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CONSTRUCTION NOTES

- Underground utilities have been plotted from available information and therefore their locations shall be considered approximate only. The verification of the location of all underground utilities, either shown or not shown on these plans, shall be the responsibility of the contractor, and shall be located prior to any grading and/or construction of improvements.
- Erosion control shall not be limited to what is shown on the plans. The contractor shall take whatever means necessary to prevent siltation from entering adjacent roadways, properties, and ditches. Such control might include channeling runoff into sediment basins, channeling runoff into areas where an extra row of straw bales are used. A silt fence might be considered, if necessary.
- The sediment control plan should be implemented before grading begins. No graded area is to remain bare without being seeded and mulched. When deemed necessary, positive slopes should be provided to prevent soil from damaging adjacent properties and silting up all storm drainage.
- No area shall be cleared without permission of the developer.
- Owner/Developer assumes full responsibility as to the performance of the grading operation and assurance that all properties and City, County and State roads will be adequately protected.
- Soil preparation and re-vegetation shall be performed according to St. Charles County requirements.
- Where natural vegetation is removed during grading, vegetation shall be re-established in such a density as to prevent erosion. Permanent type grasses shall be established as soon as possible or during the next seeding period after grading has been completed.
- Site preparation includes the clearance of all stumps, trees, bushes, and weeds, the grubbing and removal of roots and other surface obstructions from the site, and the demolition and removal of any man-made structures. The unsuitable material shall be properly disposed of off-site. Topsoil and grass seed fill areas shall be thoroughly disc'd prior to the placement of any fill. The Soils Engineer shall approve the discing operation.
- Compaction equipment shall consist of tamping rollers, pneumatic-tired rollers, vibratory rollers or high speed tandem type drum rollers acceptable to the Soils Engineer. The rollers shall be designed so as to avoid the creation of a layered fill without proper blending of successive fill layers.
- The Soils Engineer shall observe and test the placement of the fill to verify that specifications are met. A series of fill density tests will be determined on each lift of fill. Interim reports showing fill quality will be made to the Owner at regular intervals.
- The Soils Engineer shall notify the Contractor of rejections of a lift of fill or portion thereof. The Contractor shall rework the rejected portion of fill and obtain notification from the Soils Engineer of its acceptance prior to the placement of additional fill.
- All Areas to receive fill shall be scarified to a depth of not less than 6 inches and then compacted to at least 85 percent of the maximum density as determined by the Modified AASHTO T-100 Compaction Test (ASTM-D1557). Natural slopes steeper than 1 vertical to 5 horizontal to receive fill shall have horizontal benches cut into the slopes before the placement of any fill. The width and height to be determined by the Soils Engineer. The fill shall be loosely placed in horizontal layers not exceeding 8 inches in thickness and compacted in accordance with the specifications given below. The Soils Engineer shall be responsible for determining the acceptability of soils placed. Any unacceptable soils placed shall be removed at the Contractor's expense.
- The sequence of operation in the fill area will be: fill, compact, verify acceptable soil density, and repetition of the sequence. The acceptable moisture contents during the filling operation are those at which satisfactory dry densities can be obtained. The acceptable moisture contents during the filling operation in the remaining areas are from 2% to 8% above the optimum moisture content.
- The surface of the fill shall be finished so that it will not impound water; if at the end of a days work it would appear that there may be rain prior to the next working day, the surface shall be finished smooth. If the surface has been finished smooth for any reason, it shall be scarified before proceeding with the placement of succeeding lifts. Fill shall not be placed on frozen ground, nor shall filling operations continue when the temperature is such as to permit the layer.
- All low places whether on site or off site should be graded to allow drainage. This may be accomplished with temporary ditches. Any off site drainage easements shall be acquired before off site grading is to begin.
- All cut and fill slopes should be a maximum of 3:1 slope (3:1) after grading.
- All fill including filled places under proposed storm and sanitary sewer lines and paved areas including trench backfills within and off the road right-of-way shall be compacted to 90% of maximum density as determined by the Modified AASHTO T-100 Compaction Test (ASTM D1557). All lifts shall be verified by a Soils Engineer with grading and backfilling operations. The compacted fill shall be free of rutting and shall be non-yielding and non-pumping during proof rolling and compaction.
- Fill placed within proposed roadway easement shall be compacted to 90% M.O.D. Proctor and be 2% below to 6% above optimum moisture content.
- Soft soil in the bottom and banks of any existing or former pond site should be removed, spread out and permitted to dry sufficiently to be used as fill. None of this material should be placed in proposed right-of-way locations or on storm sewer locations.
- Any wells and/or springs which may exist on this property should be located and sealed in a manner acceptable to St. Charles County and the Missouri Department of Natural Resources.

STATEMENT OF STATE PLANE COORDINATE: STATE PLANE COORDINATES WERE DETERMINED ON MARCH 3, 2015 USING SPECTRE PRECISION NAD83 EPOCH 35 FROM THE PROJECT SITE TO A CONTIGUOUS SURVEYING REFERENCE STATION (COORS) WITH AN ID OF NOS HAVING PUBLISHED MISSOURI STATE PLANE (EAST ZONE) COORDINATE VALUES OF NORTH (Y) 302840.24 METERS AND EAST (X) = 253367.36 METERS. WE REPRESENT HERON THAT THESE STATE PLANE COORDINATES MEET THE ACCURACY STANDARDS FOR PROPERTY BOUNDARY SURVEYS (DCSR 30-2 AND 20 CSR 30-16, EFFECTIVE AT THE DATE OF THIS SURVEY) AS AN "URBAN PROPERTY" RELATIVE TO STATION NOS.

AVERAGE COMBINED GRID FACTOR = 0.999913777
(1 METER = 3.28083333 FEET)
THE ROTATIONAL DIFFERENCE FROM THE DEED BEARINGS SHOWN TO THE STATE PLANE BEARINGS IS COUNTERCLOCKWISE 0'12"51"

A SET OF CONSTRUCTION PLANS FOR
OAK BLUFF ESTATES
A TRACT OF LAND BEING PART OF
FRACTIONAL SECTION 32,
TOWNSHIP 47 NORTH, RANGE 2 EAST,
ST. CHARLES COUNTY, MISSOURI



CITY OF LAKE ST. LOUIS - PUBLIC WORKS GENERAL NOTES

- All improvements constructed herein shall comply with all City Ordinances.
- If an area of greater than one acre is disturbed, a land disturbance permit is required prior to commencing excavation operation. Provide a copy of approval from the Department of Natural Resources to the Public Works Department.
- Erosion and sediment control shall be the responsibility of the contractor. Additional erosion and sediment control may be required as directed by the City Engineer. (Ordinance 440.040 D.)
- When grading operations are completed or suspended vegetation in sufficient density to provide effective erosion control must be reestablished within 30 days. (Ordinance 40.050 D.) Seed type, density requirements, and fertilizer requirements can be found in Section 60.20.2 in the Design Criteria for the Preparation of Improvement Plans by St. Charles County, MO.
- All mud, material and debris from construction site to be kept off of City maintained streets. (Ordinance 440.060)
- All water main construction including valves, sleeves, meters, hydrants and fittings must conform to Public Water Supply District #2 design standards.
- All sanitary sewer construction must conform to Public Water Supply District #2 Standards and Specifications.
- All street and sidewalk construction is to be per the latest St. Louis County Standard Specifications for Highway Construction, current addition.
- Flowable fill backfill shall be used for all backfill on sewer trenches that are under City Streets, from the top of the bedding material (6" above the pipe) to the surface, or to within one foot of grade in landscaped areas.
- Earth backfill (meeting MSD Standards) may be used outside of paved areas, from the top of the bedding material (6" above the pipe) to the surface. Earth backfill should be placed in a maximum of 8 inch loose lifts, and shall be mechanically compacted to a minimum density equal to that of the adjacent, undisturbed soil.
- All storm sewer construction is to be per the Metropolitan St. Louis Sewer District (MSD) Standard Construction Specifications for Sewers and Drainage Facilities, 2009.
- Except under streets, utility trenches may be jetted. All jetting shall be performed with a probe route on no greater than 7.5 foot centers with the jetting probe centered over and parallel with the direction of the pipe. Trench widths greater than 10 feet will require multiple probes every 7.5 foot centers. Trench backfill depth less than 8 feet in depth shall be probed to a depth extending to half of the trench backfill, but not less than 3 feet. Trench backfill greater than 8 feet in depth shall be probed to half the depth of the trench backfill, but no greater than 8 feet. Jetting shall be performed from the low surface topography point and proceed toward the high point, and from the bottom of the trench backfill towards the surface. The flooding of each jetting probe shall be started slowly allowing slow saturation of the soil. Water is not to be allowed to flow away from the ditch without first saturating the trench. Contractor shall identify the locations of the surface bridging (the tendency for the upper backfill crust to arch over the trench rather than collapse and consolidate during the jetting process). The Contractor shall break down the bridged areas using an appropriate method such as the wheels or bucket of a backhoe. When the surface crust is collapsed, the void shall be backfilled with the same material within the slusher/pitted area shall be compacted such that no further surface subsidence occurs.
- All pipe joints and joints on new structures shall use City approved rubber compression type joints. Water stops are required at all points of connection not using rubber compression joints such as connections to existing structures.
- Concrete covers on structures will not be allowed. Only cast iron covers are permitted.
- All storm design is to conform to the City of Lake Saint Louis design requirements.
- It shall be the responsibility of the contractor/developer to provide traffic control per the latest edition of the Manual of Uniform Traffic Control Devices.
- Final Grades shall not exceed a 3:1 Slope (33%).
- Transverse underdrains (shallow perforated pipe in a filter fabric sleeve bedded in clean rock) shall be provided at and connected to all stormsewer structure. Underdrains shall traverse the entire pavement width at each stormsewer street crossing.

PROJECT BENCHMARK

ST. CHARLES COUNTY BENCHMARK - SC-18A
PUBLISHED ELEV = 594.52
COLLECTED ELEV = 594.34

DESCRIPTION: THE STATION IS 58.6 FEET NORTHEAST OF THE EAST LEG OF A HIGHWAY SIGN, 51 FEET EAST OF THE EDGE OF PAVEMENT, 18.5 FEET SOUTHEAST OF THE EAST LEG OF A "LAKE ST. LOUIS" SIGN AND 1.0 FEET WEST OF A CARBONITE WITNESS POST.

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MISSOURI ONE-CALL SYSTEM, INC.

DEVELOPMENT NOTES:

- Site Address: Cedar Creek Ct, Lake St. Louis, MO 63367
- Owner Information: OBP Realty LLC, 3415 Hampton Ave, St. Louis, MO 63139
- Developer Information: Jerry Melinsky, Dutchman Homes, LLC, 2507 Highway K, Ofallon, MO 63368
- Area of Tract: 19.03 Acres
- Present Zoning: SRI Single Family
- Proposed Use: Single Family Residential
- Dimensional Requirements: Front setback: 35 Feet, Side setback: 8 Feet, Rear setback: 30 Feet or 20% of lot depth, whichever is greater, Max building height: 2 stories or 35 Feet
- Easements shall be provided as follows: Roadway and Utility Easement along all Road Frontages: 15 Feet, Side Yard Utility Easements: 7.5 Feet, Rear Yard Utility Easements: 15 Feet
- Property served by the following: Water: Public Water Supply District No. 2, Sewer: Public Water Supply District No. 2, Telephone: Centurylink, Gas: Loclede Gas, Electric: Culvre River Electric Cooperative, Lake St. Louis Fire Protection District, Wertzville School District
- The basis of bearings is the northern line of the record plat of "Crimson Oaks Plat Two" a subdivision recorded in plat book 40 page 392 of the St. Charles County Recorder of Deeds Office.
- According to the FIRM Flood Insurance Rate Map 29183C0215 F Dated March 17, 2003, a portion of this development is located in Zone AE, areas determined to be inundated by the 100-year flood, and a portion of this area is determined to be floodway.
- Stormwater Detention shall be provided per City of Lake St. Louis Standards.
- All streets shall be constructed per City of Lake St. Louis Standards. The road serving the new lots will be "private" and will be maintained by the Homeowners Association to be established.
- All proposed utilities shall be located underground.
- This development shall comply with City of Lake St. Louis Tree Preservation Requirements.
- Tree Preservation Calculations: Existing Canopy: 19.03 Acres, Canopy Removed: 11.93 Acres, Developed Canopy: 7.10 Acres, Canopy Preserved: 37%
- One street tree, selected from City's list of approved trees and sized as required by current ordinance at the time of installation, shall be planted by developer (or builder, as appropriate), for every forty (40) linear feet of curbing, along all streets internal and adjacent to development.
2,400 ft x 1 tree / 40 ft = 60 street trees to be installed
- The Cur-dee-soe island shall be landscaped pursuant to landscape plan submitted by developer and approved by City's Arboreal/Horticulturalist; landscaping in cur-dee-soe island shall be maintained by Homeowners Association to be established.
- Parking shall be prohibited in the cur-dee-soe.
- The developer shall prepare Indentures or Declaration of Covenants and Restrictions for approval by City Attorney prior to recording of Plat creating lots. Indentures or Declaration of Covenants and Restrictions shall provide for maintenance by Homeowners Association of private road, stormwater collection system, monument entrance sign, common ground and detention basin, and cur-dee-soe landscaping.
- Street Lights shall be installed as directed by City of Lake Saint Louis.
- The Architecture Review Board (ARB) of the City of Lake Saint Louis shall review and approve all proposed new residential and accessory use construction in the subdivision.
- The developer shall post semi-permanent sign, a minimum of nine (9) square feet in size, near the entrance to the subdivision stating that the street in the subdivision will be private and will be maintained by the subdivision's homeowners' association. The size, location and construction of the sign and the message on the sign will be approved by the City Development Administrator prior to installation. The sign will be maintained by the developer through substantial buildout of the subdivision (eighty percent (80%) of the lots in the subdivision have homes with roofed certificates of occupancy).

SYMBOL LEGEND

× FOUND CROSS	⊠ ELECTRIC BOX	⊠ CABLE TV BOX
○ FOUND IRON PIPE	⊠ ELECTRIC METER	⊠ LIGHT STANDARD
⊠ SET IRON ROD	⊠ POWER POLE	⊠ CLEAN OUT
⊠ BENCHMARK	⊠ GUY WIRE	⊠ SANITARY MANHOLE (EXISTING)
⊠ TRAFFIC SIGNAL BOX	⊠ GAS METER	⊠ STORM SEWER MANHOLE (EXISTING)
⊠ PHONE BOX	⊠ GAS VALVE	⊠ STORM SEWER DRAIN (EXISTING)
⊠ UTILITY MANHOLE	⊠ WATER METER	⊠ GRATE INLET (EXISTING)
⊠ BOLLARD	⊠ WATER VALVE	⊠ AREA INLET (EXISTING)
⊠ MAILBOX	⊠ HYDRANT	⊠ GENERAL SURFACE DRAINAGE
⊠ SIGN	⊠ WATER SHUT OFF	⊠ EXISTING CONTOUR
⊠ POST	⊠ SPRINKLER HEAD	⊠ TREE LINE
⊠ EXISTING SHRUB	⊠ IRRIGATION VALVE BOX	⊠ SAN. SEWER (EXISTING)
⊠ EXISTING DECIDUOUS TREE	⊠ WELL	⊠ STORM DRAIN (EXISTING)
⊠ EXISTING EVERGREEN TREE	⊠ TEST HOLE	

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OAK BLUFF ESTATES
CONSTRUCTION PLANS
TITLE SHEET

STATE OF MISSOURI
 TODD DYER
 E 140019006
 REGISTERED PROFESSIONAL ENGINEER

Date: Dec 11, 2015
 Todd Dyer
 License No. MO-2000150008
 Civil Engineer

PROJECT NUMBER: 14-0546
 DATE: 12/01/15
 DRAWN BY: MJP

1 OF 23

UNDERGROUND UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE INFORMATION AND THEREFORE THEIR LOCATIONS SHALL BE CONSIDERED APPROXIMATE ONLY. THE VERIFICATION OF THE LOCATION OF ALL UNDERGROUND UTILITIES, EITHER SHOWN OR NOT SHOWN ON THESE PLANS, SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR, AND SHALL BE LOCATED PRIOR TO ANY GRADING AND/OR CONSTRUCTION OF IMPROVEMENTS.

PUBLIC WATER SUPPLY DISTRICT NO. 2 GENERAL NOTES:

Article I. GENERAL REQUIREMENTS

The following requirements apply to all Articles of these specifications. Additional requirements may be necessary for each individual section and are noted within the general requirements. Additional requirements may be set forth by the District Engineer. Design, installation, and maintenance of Improvements shall be in accordance with the latest version of the District's "GUIDELINES FOR WATER DISTRIBUTION SYSTEM AND SANITARY SEWER COLLECTION SYSTEM IMPROVEMENTS". All improvements shall be designed in accordance with MoNR under Title 10 CSR 20.8-120 and 130, these specifications and any other applicable federal, state, and local requirements. In cases where project specific specifications are approved by the District Engineer the project specifications shall govern.

Failure to comply with these specifications, the "GUIDELINES FOR WATER DISTRIBUTION SYSTEM AND SANITARY SEWER COLLECTION SYSTEM IMPROVEMENTS", or any other applicable documents may result in rejection of the Improvements by the District.

Section 1.01 Standards and Conformances

Materials

Where references are made to standards such as AWWA, ANSI, ASTM, etc., it shall be understood that such references are made to the latest revisions of such standards. All materials used at any location in the Sewer System shall meet the requirements set forth under this specification. When requested by the District, Contractors shall furnish affidavits from their suppliers certifying that materials conform to stated standards before being incorporated in the work.

Where materials are specified by brand name and model, followed by the words "or approved equal", the information concerning an "approved equal" product must be submitted to the District and a written statement of approval by the District or its assigned representative must be issued before such material may be used. In all cases, approval of such alternate products shall be at the sole discretion of the District or its assigned representative.

Installation

The work covered in this specification shall consist of furnishing all specified materials with all necessary equipment, machinery, tools, labor, and performing all work required to install and/or construct the sewer system Improvements with all directives or modifications to these specifications, all to be complete, in place, accepted, and ready for use.

Inspection, Tests, and Acceptance or Rejection of Defective Work

District staff or its representatives, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for District's acceptance of materials or equipment to be incorporated in the work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the work. Specific testing requirements can be found in each Article of these specifications.

If any work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without concurrence of District staff or its representatives, Contractor shall, if requested by District staff, uncover such work for observation. Uncovering work shall be at Contractor's expense.

Promptly after receipt of written notice from the District or its representatives of defective work, Contractor shall correct all defective work, whether or not fabricated, installed, or completed, or, if the work has been rejected by the District, remove it from the Project and replace it with work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

Field changes shall be made only with the specific permission of the District Engineer.

Section 1.02 Contractor Qualifications

To demonstrate Contractor's qualifications to perform the Work, within five (5) days of the District's request, the Contractor shall submit written evidence such as financial data, previous experience, present commitments, and three (3) projects performed within the past three (3) years, relating to construction of sanitary sewer collection system Improvements of a similar diameter, material, and scope, with project references and contacts.

Section 1.03 Site Work and Preparation

Prior to starting the Improvements as required, the Contractor shall notify the District a minimum of one (1) week prior to the start of construction. After doing so, the Contractor shall clear the route of all trees, shrubs, and other objects or materials which may directly interfere with the construction. All trees, shrubs, bushes, etc., which will not interfere with the construction shall be protected from damage.

Work preparations shall include having all necessary materials and equipment at the site in working condition, and an adequate labor force at the site and completely instructed and prepared to perform the work to completion. The Contractor shall notify all utility companies of organizations of work and shall request field markings of their respective facility locations prior to starting any work.

Section 1.04 Drainage

The Contractor shall control the grading in the vicinity of the pipe trenches so that the surface of the ground will be properly sloped to prevent water from running into the excavated areas, where possible. Any water or other liquid wastes which accumulate in the excavated areas shall be promptly removed.

Section 1.05 Obstructions of Sewer Main

Where Improvements, such as but not limited to retaining walls, tie-backs, and storm sewers greater than 24", are to be built over the sewer main, the main shall be placed in casing pipe as specified in Section 1.09. The determination of what will require the main to be placed in a casing pipe is at the discretion of the District Engineer.

Section 1.06 Separation of Water Main, Sewers, and Other Utilities

Sewers shall be laid at least 10 feet horizontally from any existing or proposed water main or other utilities. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten foot separation, deviations may be made on a case by case basis, if supported by data from the Engineer and approved by the District Engineer and MoNR. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shell located on one side of the sewer and in other cases, at such elevation that the bottom of the water main is at least 18 inches above the top of the sewer.

Sewers crossing water mains shall be laid to provide a minimum vertical clear distance of 18 inches between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer.

Separation between sewers and all other utilities shall be a minimum of 2 feet horizontally and 18 inches vertically, or as required by the District Engineer.

Section 1.07 Quality and Handling of Materials

All materials used for each Improvements project shall be new. Damaged or unused pipe, fittings, and accessories of whatever nature shall be rejected and removed from the site immediately.

All pipe and other accessories, shall be unloaded, stored, re-handled, and installed by methods in such a manner as to insure their final location in a sound and undamaged condition conforming in all respects to specified requirements. Under no circumstances shall pipe or other accessories be dropped to the ground or otherwise subjected to possible damage from impact or shock. Such materials shall be loaded by lifting with machine, hoist, or by skidding. Pipe handled on skidways shall not be skidded or rolled against other pipe.

Under all circumstances, all materials for use shall be handled in a workman-like manner using the necessary manpower and equipment to perform the task in accordance with the manufacturer's recommendations.

Proper equipment, tools, facilities, and methods satisfactory to the District, shall be provided and used by the Contractor for the safe handling of all materials. Under no circumstances shall any materials be dropped or dumped into the trench.

All open ends of pipe, fittings, etc., shall be carefully sealed with appropriately sized mechanical joint plugs or caps at the end of each day's work to prevent entrance of animals, water, and other foreign matter. Mechanical joint plugs or caps and the appropriate gasket and gasket gasket shall be utilized for sealing.

Section 1.08 Work Adjacent to and/or Crossing Rights-of-Way

All work to be performed within the road right-of-way limits shall be performed in strict accordance with the road authority's requirements. The Contractor shall obtain the necessary permits for all work prior to starting any construction. All permits must be displayed as required with two (2) copies provided to the District.

The Contractor shall comply with all standards of the latest version of the Manual on Uniform Traffic Control Devices as published by the Federal Highway Administration and any additional requirements set forth by the road authority.

The crossings shall be machine bored with simultaneous installation of the encasement. Encasement will be required for all gravity systems. Encasement will only be required for force mains if required by the governing roadway authority or District Engineer. All joints of the encasement tube shall be welded as specified and the encasement tube shall extend to the required dimensions.

Following completion of the machine bored crossing, the ends of the pipe casing shall be sealed and oil bore pill or other required excavation shall be suitably backfilled to grade.

Section 1.09 Casing Pipes

Materials

Where sewer pipes cross road right-of-way, or where required by the roadway authority or District Engineer, all pipes shall be installed in casing pipes, which shall be steel pipe with a minimum wall thickness of 1/4", ungalvanized or coated, and shall have a minimum diameter as shown below. All sewers in casing pipes shall be restrained joint pipe and the ends of casing pipes shall be sealed with preformed seals and/or other material approved by the District Engineer.

DI Carrier Pipe	Welded Steel Casing Pipe	Casing Pipe Thickness
6"	18"	0.25"
8"	20"	0.25"
12"	24"	0.375"
16"	30"	0.375"
20"	30"	0.375"
24"	36"	0.375"
30"	42"	0.375"
36"	54"	0.5"
42"	60"	0.5"

Wherever sewers are installed in casing pipes, the pipe shall be supported with "RAQ" type spacers or approved equal.

Installation

The spacers shall be carefully installed on the carrier pipe before it is installed in the casing pipe at 6' intervals, or 3 spacers per 20' length of pipe. (See Detail H)

Section 1.10 Creek Crossings

Where sewer mains cross creeks, all piping shall be restrained joint piping with a minimum of 42 inches of cover. If the grades are such that the cover is less than 42 inches, the carrier pipe shall be in a casing pipe as specified in Section 1.09.

Any required U.S. Army Corps of Engineers permits must be acquired by the Developer with two (2) copies provided to the District. All requirements of such permits must be met by the Contractor.

Aerial crossings will be considered and reviewed on a case by case basis.

Section 1.11 Staking

Staking shall be completed before the start of and during construction. Staking shall be provided by the Developer's Engineer or Land Surveyor and shall be completed by or directly supervised by a Professional Land Surveyor licensed in the state of Missouri. All staking and survey shall be performed using US State Plane 1983, zone Missouri East 2401, datum NAD83, with altitude measured from mean sea level and units of feet.

The adjacent property lines, easement lines or road right of way lines shall be staked with lot or clearly marked at a minimum spacing of 100 feet. The witness laths for the sewer stakes shall have the station and the cut clearly marked on them. Stakes shall consist of 2" x 2" hubs with 1" x 2" witness laths.

For specific requirements for staking of gravity mains and force mains see Section 2.08 and Section 3.08 of these specifications.

Section 1.12 Granular Material

Where required per these Specifications, Granular Material shall be 3/4" minus crushed limestone and screenings and shall be compacted to 95% per Standard Proctor Test Method (ASTM D698). The Contractor shall provide at the Contractor's cost independent third party compaction testing by a testing firm agreeable to the District.

Section 1.13 Trench Excavation and Backfilling

Trenches for sewers and force mains shall have a minimum width of 18" or the pipe O.D. plus 12 inches (whichever is greater), and a maximum width of the pipe O.D. plus 24 inches.

For PVC pipe, the trench depth shall be excavated 6" deeper than the proposed bottom of the pipe to allow for 6" of Granular Material bedding. The PVC pipe shall also have the Granular Material placed to a level 5" above the top of the pipe with care taken to fill all void spaces beneath the pipe. The Granular Material shall be placed as shown on Detail A of these specifications.

For ductile iron pipe, if the trench bottom is stable and suitable earth, the pipe may be placed on the earth trench bottom. If the trench bottom contains frozen material, debris or other deleterious material, the trench shall be excavated 6" or more deeper than the proposed pipe bottom and backfilled to the desired grade with Granular Material. For all pipe, bell holes in the trench bottom shall be provided to allow full contact of the pipe with the trench bottom.

Backfill for all pipes under roadways or parking lots shall consist of Granular Material carefully placed to avoid future settlement from 6" above the top of the pipe to the finished grade or as specified by the governing road authority.

In other areas, the backfill may be soil meeting ASTM D2487 soil classification groups GW, GP, GM, SW, SP, SM, GC, SC, ML, MH, CL, and CH free of large stones, debris, waste, frozen materials, vegetation and other deleterious matter.

The liquid limit and plasticity index shall not exceed 45 and 25, respectively, for the silt and clay materials.

Backfill of all pipe shall be well compacted by mechanical means. Any completed areas that show settlement shall be promptly re-backfilled with compacted clean earth, as specified above, or compacted Granular Material as required for the initial backfill.

Section 1.14 Pipe Installation

Laying of the pipe shall commence immediately after the excavation is started, and the Contractor shall use every possible means to keep the completed pipe installation orderly behind the trenching. The District may stop the trenching if it appears that the trench is open too far in advance of the pipe laying operation. The Contractor may lay pipe in the best manner adapted to securing speed and good results. The Contractor shall have the necessary equipment and tools available for making the joints for the specific materials being used.

Generally the maximum slope of sewers shall not be greater than 10%, but if a steeper slope is needed, provisions shall be made to prevent the pipe from moving down the slope in a manner approved by the District Engineer. Sewers shall not be deeper than one building to a 1:1 ratio for depths less than 5 feet and 1:1.5 for depths from 5 to 10 feet. The deflections of sewers at any manhole shall not exceed 90 degrees.

Section 1.15 Buried Below Top

Materials

Warning tape shall be installed with all sewers. The materials to be installed for this purpose shall consist of three (3) inch wide tape made of bonded layer plastic with a metallic foil core. Tape splices shall be knotted to prevent tensile pressure on the splice.

The metallic tape shall be colored green and shall bear an imprint identifying the line below, such as, "Caution Sewer Main Buried Below".

Installation

The Contractor shall furnish all materials. The three (3) inch wide tape shall be installed 18" above the sewer main, following the trench backfill progresses. The tape material shall be installed in accordance with the manufacturer's recommendations. The tape is to be placed in a manner such that trench backfill settlement will not place an excessive tensile stress on the material.

Section 1.16 Site Cleanup and Restoration

After work is completed, the site of all Improvements shall be cleared of all construction material and other debris. The entire work area shall be left in an orderly and acceptable condition.

Grading shall provide proper drainage and all installation sites shall be left in a neat, clean and acceptable condition. All walkways, driveways, roads, streets, etc. shall be cleaned and replaced to their original condition.

For all Improvements in easements the site shall be restored to a condition equal to or better than it's condition before the work was started.

All Best Management Practices shall be according to the appropriate local, state, or federal authorities' requirements.

Section 1.17 As-Built Drawings

As work progresses, the Contractor shall note all lengths of pipe installed, flow lines of all manholes, locations of all manholes, air relief valve vaults, and service connections and record all dimensions necessary to locate all sewer system facilities.

At the completion of the project, and prior to acceptance by the District, the Contractor shall furnish the copy of plans where all "as-built" dimensions and notes are endorsed. The plans must be clean and legible with regard to all notes made thereon.

See Section 2.10 and Section 5.02 of these specifications for additional requirements for gravity sewer and lift station as-builts.

Requirements for the number of copies and format required can be found in the latest version of the District's "GUIDELINES FOR WATER DISTRIBUTION SYSTEM AND SANITARY SEWER COLLECTION SYSTEM IMPROVEMENTS".

Section 1.18 Field Inspection

After all work and testing is complete a final inspection shall be made by a District representative and all manholes, valves, and cleanouts shall be plumb and be to proper grade and all cleanup work must be satisfactorily completed. The work shall be accepted only after completion of the final inspection. Any defects found in the final inspection shall be promptly corrected by the Contractor.

PUBLIC WATER SUPPLY DISTRICT NO. 2 SEWER NOTES:

Section 2.01 Pipe and Fittings

Materials - General

For gravity collection systems shall be PVC pipe with a standard dimension ratio (SDR) of 26 for sewers less than 20 feet deep, and for sewers from 20 feet to 30 feet deep the pipe shall be SDR 21 PVC pipe unless directed otherwise by the District Engineer. Sewers deeper than 30 feet will not be allowed except where specifically authorized by the District.

Materials - PVC Pipe

PVC pipe and fittings shall conform to ASTM D3034 "Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings". The pipe shall be furnished in 20' length lengths. The pipe shall be made and joined with integral bell and spigot rubber gasketed joints. Each integral bell joint shall consist of a formed bell complete with a single rubber gasket. Gaskets shall conform to ASTM F477 and meet ASTM D3212 Specifications. The pipe shall be made of PVC having a cell classification as defined in ASTM D1784 B or 12454 C cell classifications.

Restrained joint PVC pipe, couplings, and fittings utilizing precision-machined grooves and meeting the requirements of this section may be approved by the District Engineer on a case by case basis.

Materials - Ductile Iron Pipe

Ductile iron pipe shall only be used in special circumstances and as directed by the District Engineer. Ductile iron pipe and fittings shall conform to ASTM A746 and be seal coated with a protective coating. Protective coatings shall be "Narmac Series 431 Parma-Shield or approved equal. The joints of pipe shall be push on joints with rubber gaskets conforming to AWWA C-110. In general, ductile iron pipe shall be pressure class 250.

Fittings shall have mechanical joints conforming to AWWA C-110 and be sealed coated with the same protective coating as pipe specified above.

All ductile iron pipe and fittings shall have polywrap in accordance with AWWA C-105 and be installed per AWWA C-600.

For all carrier pipe placed in casing pipe under roads or highways, where used for creek or ditch crossings or at any location requiring vertical fittings, the pipe shall be mechanically restrained ductile iron, pressure class 350.

Installation

All pipe spigot ends shall be visibly marked to fully "make-up" the joint. With the exception of field cut pipe, all "make-up" marks shall be placed on the pipe of the factory. Field cut pipe shall be marked for full joint depth prior to insertion.

Gravity sewer pipe shall be laid straight to line and grade and carefully controlled by means of the stakes provided, as specified in Section 2.08, and a laser or other approved method by the District.

Section 2.02 Manholes

Materials

All manholes shall be concentric manholes constructed of reinforced concrete sections in accordance with ASTM C478 and as shown on Detail B of these specifications.

Calcium aluminum silicate cement shall be used for all manholes and the concrete shall have a minimum 30 day compressive strength of 4,000 PSI. Manholes shall have a minimum inside diameter of 48" and have pre-cast manhole bases. Manhole invert channels shall be formed with 4,000 PSI concrete.

Manhole steps shall have a minimum width of 14 inches and be steel reinforced corrosion resistant polypropylene plastic.

Installation

All manholes shall be installed as shown in the details of these specifications and at the locations and to the grades shown on the plans. The maximum spacing between manholes shall be 500 feet and, where possible, manholes shall be located on side property lines. After the bottom section of each manhole has been installed, the invert shall be stepped with smooth curves of as large a radius as the size of manhole and pipes permit. The floor of all manholes shall be smooth and slope to the channels therein.

After the manhole has been fully installed, all lifting holes shall be filled with non-shrink grout and the outside of the manhole shall be sealed as called for in Section 2.3. Care shall be taken to ensure that the flow line grade and finished grades are accurately established as shown on the plans.

Backfilling of the manholes shall be done carefully to ensure that no movement of the manhole occurs. Compaction shall be performed around manholes to 95% per Standard Proctor Test (ASTM D698).

All elevation differences of two (2)' feet or more where the pipe enters the manhole shall require an outside drop manhole (See Detail C).

Manhole steps shall be firmly embedded in the manhole walls. Steps shall extend 4.5" from the wall and be aligned so they are not directly over any pipes. Steps shall be spaced at 18" and not more than 24" from the finished grade and the bottom of the manhole.

Section 2.03 Manhole Liners and Sels

Materials

Manhole sections shall be joined with flexible butyl rubber mastic or bitumen mastic in compliance with ASTM C950. The minimum width of sealant strips shall be 1 inch.

Manholes shall be sealed on the outside with a two-part urethane modified asphalt applied to provide a dry film thickness of 20 mils. All exterior joints shall be sealed with a pressure sensitive sealing tape conforming to ASTM C877. The tape shall be 3/8" Thick as manufactured by Pipeline Seal & Insulator, Inc. or approved equal.

All pipe openings through manhole walls shall be sealed with a resilient connector in accordance with ASTM D923. The connector shall provide a flexible and watertight seal between the pipe and manhole opening.

Where a forceman discharges into a manhole, the interior of that manhole and the next two manholes downstream shall be sealed with an epoxy liner. Manholes further down the line may require an epoxy liner at the discretion of the District Engineer. The epoxy liner shall be made up of at least 90% solids by volume.

Installation

Two solid strips of mastic, as described above, shall be used between manhole sections with joints at 180 degrees apart.

Installation of exterior joint seals, resilient connectors, and epoxy liners shall be per the manufacturer's instructions.

Section 2.04 Manhole Frames and Covers

Materials

Manhole frames and covers shall be gray iron conforming to ASTM A48. The surfaces shall be machined to provide even seating and shall be coated with coal tar pitch varnish. The minimum clear opening in manhole access openings shall be 27".

All manhole covers shall be solid gasketed covers with a pick hole for opening. The cover shall utilize a ball and socket hinge for ease of opening and be lockable. The cover shall include a "Hold-Open" arm and have the ability to be completely removed for replacement and safe access. Manhole covers where traffic loads are possible shall have a minimum weight of 145 pounds. Where there is no possibility of traffic load, manhole covers shall have a weight of not less than 85 pounds.

Manhole frames shall be 7" in height and have a sealant material, as described in Section 2.03, between the frame and cone section or adjustment rings. Manhole frames for all manholes shall weigh a minimum of 230 pounds.

Installation

Prior to placing the manhole frame and cover, any debris shall be cleaned from the cone section and frame. The manhole frames and covers shall sit flush with grade and shall conform to any slope of the ground or pavement.

Section 2.05 Adjustment Rings and Chimney Sels

Materials

Grade adjustment rings shall be reinforced concrete only and have dimensions of 26.5" opening, 8" width, and a minimum height of 2".

If grade rings are used a chimney seal shall be used to provide a watertight seal from the frame to the cone section. The seal shall be a pressure sensitive tape conforming to ASTM C877. The tape shall be 3/8" Thick as manufactured by Pipeline Seal & Insulator, Inc. or approved equal.

Installation

Between each grade ring that is used mastic shall be placed as described under Section 2.03. A maximum of 12" of grade adjustment rings will be allowed. If the grade adjustment is 6" or less no more than one grade ring shall be used. Cutting of grade rings is not permitted.

Chimney seals shall be installed per the manufacturer's instructions.

Section 2.06 Drop Manholes

When a pipe entering a manhole is over 2' above the pipe exiting the manhole an outside drop shall be installed (See Detail C). Inside drops will only be allowed on a case by case basis as directed by the District Engineer.

Section 2.07 Gravity Service Connections

Gravity service connections shall be made in accordance with the District's sewer service connection policy as described in detail on the District's website at www.water-district-2.com.

Section 2.08 Staking

In addition to the General Requirements for Staking, stakes shall be placed for each manhole and for each proposed fitting for service eyes. Flow lines shall be indicated on the stakes.

Section 2.09 Testing

Testing shall include:

a. A mandrel test of all gravity sewers using a mandrel with a diameter that has a diameter 95% of the inside pipe diameter. If the mandrel test fails on any section of pipe, that section of pipe shall be uncovered and replaced. No expansion devices will be allowed to "force" the pipe that is deformed back into round. Any string lines used to forward testing shall be removed after the testing is completed.

b. An air pressure test of all gravity sewers performed to a pressure of 5 PSI with no observed drop in pressure during a test period of 5 minutes.

c. A vacuum test, according to ASTM C1244, of all manholes for a period of one minute and the vacuum shall be 10 inches of mercury and may not drop below 8 inches of mercury at the end of the one minute test.

Section 2.10 As-Built Drawings

At the completion of the project, and prior to acceptance by the District, gravity systems shall be surveyed and as-built drawings shall be sealed by a Professional Land Surveyor registered in the state of Missouri. The as-builts shall include flow lines, pipe inverts, and manhole rim elevations.

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OAK BLUFF ESTATES
 CONSTRUCTION PLANS
 P. W.S.I.D. NO.2 NOTES
 PROJECT NUMBER: 14-0546
 DATE: 1/21/15
 DRAWN BY: MLP
 2 OF 23

PUBLIC WATER SUPPLY DISTRICT NO. 2 FORCE MAIN NOTES:

Section 3.01 Pipe and Fittings

Materials - General

For 12" or smaller diameter sewer force mains PVC pipe shall be used. Ductile iron pipe and fittings may be required for sewer force mains with diameters 12" or larger at the discretion of the District Engineer.

Materials - PVC Pipe

PVC pipe shall be class 200, with a standard dimension ratio (SDR) of 21. Pipe for use under this heading shall be manufactured from clean, virgin, NSF, approved Type I, Grade 1, 1120 PVC conforming to A.S.T.M. specification D2241. The pipe shall be pressure rated for a hydrostatic working pressure of 200 PSI at 73.4 degrees F. The pipe shall also conform to the following:

- a. **Hydrostatic Integrity:** The pipe shall withstand without failure, a pressure of 420 PSI for at least 1,000 hours at 73.4 degrees F, in accordance with A.S.T.M. Specification 1505. The pipe shall withstand without failure, a pressure of 830 PSI applied in 60 to 90 seconds.
- b. **Wall Flattening Test:** A 2 inch wide section of pipe shall be flattened in less than one minute, to 100% without showing evidence of shattering or splitting at 73.4° F.
- c. **Pipe Wall Thickness:** Rigid plastic pipe shall be manufactured to provide a minimum pipe wall and bell or coupling thickness in accordance with the following schedule:

Minimum Wall Thickness (inches)

ID Size (inches)	Bore	Bell
2"	0.113	0.146
4"	0.214	0.258
6"	0.316	0.376
8"	0.410	0.481
10"	0.511	0.607
12"	0.606	0.735

d. **Concentricity:** The outer diameter of the pipe shall be concentric within .003 of an inch.

All PVC pipe shall be joined by means of a rubber ring slip joint. Cement weld or glued joints will not be permitted. The slip joint shall be formed by a bell joint which shall be an integral and homogeneous part of the pipe formed by extrusion, with a ring groove for seating the rubber ring gasket. "Ultra Blue" or other PVC with any thickness less than stated above will not be allowed. Also, C-900 PVC pipe shall not be allowed.

Restrained joint PVC pipe, couplings, and fittings utilizing precision-machined grooves and meeting the requirements of this section may be approved by the District Engineer, under an order by case basis.

Materials - Ductile Iron Pipe

Ductile iron pipe shall only be used in special circumstances and as directed by the District Engineer. Ductile iron pipe shall conform to ASTM A746 and be seal coated with a protective coating. Protective coatings shall be Innoco Series 431 Penna-Shield or approved equal. The joints of pipe shall be push on joints with rubber gaskets conforming to AWWA C-111. In general, ductile iron pipe shall be pressure class 250.

All ductile iron pipe and fittings shall have polywrap in accordance with AWWA C-105 and be installed per AWWA C-600.

For all carrier pipe placed in existing pipe crossing road right-of-ways, where used for creek or ditch crossings or at any location requiring vertical fittings, the pipe shall be mechanically restrained ductile iron, pressure Class 350.

Installation

Force mains shall be laid straight to line and grade with major deflections to be made by appropriate bends. The grades for force mains shall be established from the cuts shown on the stakes and shall be such that at least 42", but no more than 72" of cover is provided and provisions are made to clear other utilities or obstructions.

All pipe spigot ends shall be visibly marked to fully "make-up" the joint. With the exception of field cut pipe, all "make-up" marks shall be placed on the pipe at the factory. Field cut pipe shall be marked for full joint depth prior to installation.

Cutting of pipe for closure pieces with installation of valves or fittings, or for any other reason, shall be done in a neat and workman-like manner without damage to the pipe or fittings. The cutting operation shall leave a smooth cut end at right angles to the longitudinal axis of the pipe. The exterior surface of the cut end shall be beveled, and the interior surface shall be reamed or filed free of all rough edges and protrusions. All pipe cutting shall be done by saw or mechanical pipe cutters of an approved type.

Upon completion of the cutting and trimming operation, the pipe end or ends shall be marked for "make-up" depth. Prior to insertion, the pipe shall be thoroughly cleaned of all foreign materials, including filing and cutting debris.

Section 3.02 Fittings and Fitting Restraint

For restraint of unbalanced thrust for fittings larger than 12", either conventional thrust blocking or mechanical restraints may be used.

Ductile iron pipe restraints for fittings may be designed using restrained joints in the pipe and fittings. However if such restraints are provided, calculations signed and sealed by a Missouri Registered Professional Engineer shall be provided.

Concrete for thrust blocking shall be ready mix concrete, composed of Portland cement, sand and gravel with not more than six (6) gallons of water per sack of cement. The concrete shall be a 5-1/2 sack mix with 28 day minimum compressive strength of 3,000 PSI.

All fittings shall be ductile iron, Class 350, conforming to ASTM A746. The fittings shall have mechanical joints conforming to AWWA C-111 and be seal coated with a protective coating as specified for Ductile Iron Pipe in Section 2.01. If restraints are being used in a ductile iron restraint system, U.S. Pipe TR FLEX, American Flex Ring, or Griffin Snap-Lock restrained joint pipe and fittings or approved equal shall be allowed. Megalug type joint restraints shall only be allowed with mechanical joint fittings.

Installation

All horizontal fittings 12" and smaller shall be thrust blocked with poured concrete as shown in Detail E of these specifications. Thrust blocking for fittings larger than 12" shall be designed and detailed by Engineer.

Forms shall be provided to avoid concrete encasement of any part of mechanical joints. All form material shall be removed from the trench prior to backfilling. Pre-cast concrete block supports shall be used for all fittings installed.

Section 3.03 Valves

Valves shall be mechanical joint plug valves with adjustable gear driven operators rated for buried service. Plug valves shall be of the non-lubricating, eccentric type and shall be designed for a working pressure of 150 psi. Valves shall provide tight shut-off at rated pressure. The valve shall have a round port design.

The valve body shall be ductile iron ASTM A-536, Grade 65-45-12 with welded in overlay of 95 percent nickel alloy content, on all surfaces contacting the face of the plug. The valve shall be internally and externally coated with an epoxy coating.

The valve plug shall be ductile iron ASTM A-536, Grade 65-45-12 with Buna N resilient seating surface to mate with the body seat.

The plug valve shall be furnished with permanently lubricated sleeve type bearings conforming to AWWA C517. Bearings shall be of sintered oil impregnated type 316 stainless steel ASTM A-743 Grade CF-8M or Inconel ASTM B-127.

Valve shaft seals shall be of the "U" cup type in accordance with AWWA C517.

Seals shall be self-adjusting and re-posable without moving the bonnet from the valve.

Valves shall also include a cast iron valve box with the lid stamped sewer.

Section 3.04 Force Main Service Connections

Service connections to force mains shall be made in accordance with the District's sewer service connection policy as described in detail on the District's website at www.waterdistrict2.com.

Section 3.05 Air Release Valves

Materials

Air release valves shall have a reinforced nylon body with stainless steel inner-working parts and be 2" A.R.L. "Scar" Short Version D-023 or approved equal. All air release valves shall be installed in a flat bottom 72" diameter manhole. The piping for the air release valve and all fittings including the saddle shall be stainless steel. Refer to Detail G for additional information.

Installation

Air relief valves shall be provided on force mains at all high points and as indicated on the plans. The valves shall be installed on the top of the pipe and shall have a 2" stainless steel globe valve between the force main and the air relief valve. The air relief valves shall be attached to the sides of the manhole with stainless steel straps attached to the sides of the manhole to prevent movement of the valve during operation.

Section 3.06 Cleanouts

Cleanouts shall be installed to provide a means for flushing force mains. Cleanouts shall be installed as shown on the plans, as approved by the District, or as Directed by the District Engineer. At a minimum cleanouts shall be installed at terminating ends of the force main, at points where there is a change in direction 45° or greater, or every 1,000 feet. Refer to Detail F for further requirements.

Section 3.07 Tracer Wire

Materials

On all force mains there shall be installed a tracer wire which shall be a single insulated No. 12 copper wire, THHN or THWN, gasoline and oil resistant. The insulated wire shall be furnished in rolls of not less than 500 feet. Where splices are required, splices shall be made with 3M splice kits or approved equal.

Installation

The Contractor shall furnish all materials. The No. 12 insulated wire shall be placed along the top of the force main and taped in place with duct tape or electrical tape at a maximum of 6' intervals. Permanent access points shall be provided through manholes, valve boxes, clean outs or other approved means at the ends of the tracer wire.

For ductile iron pipe the locator wire shall be placed outside the polyethylene encasement. Caution must be exercised in the initial backfilling not to move or damage the locator wire.

The wire shall be brought up the outside of each access point from each direction and then both wires are to be threaded into the access point through the 1/2" diameter hole near the top in the initial installation.

The two wires shall be spliced inside the access point with a standard plastic or rubberized wire connector. After testing for continuity, the splices inside the box shall be made with a 3M splice kits or approved equal. Where splices become necessary outside of valve boxes, the splices shall be made initially with a 3M splice kit or approved equal.

All tracer wire boxes shall be tested for continuity as called for in Section 3.08.

Section 3.08 Staking

Stakes shall be placed at intervals not to exceed 100 feet along the force main and at all fittings, cleanouts, and air release valves.

Section 3.09 Testing

Testing of force mains shall include:

- a. Force mains shall be pressure tested (at the highest point in the project) at a pressure of 150 PSI for a period of 2 hours with a maximum of not more than 2 PSI drop in pressure.
- b. The tracer wire on all force mains shall be tested by the Contractor for continuity in the presence of a District representative. If the test is satisfactory, all splices shall be made permanent by means of 3-M splice kits or approved equal. If the tests fail in a section, the Contractor shall find and repair any failure in the locator wire.

PUBLIC WATER SUPPLY DISTRICT NO. 2 LIFT STATION NOTES:

Section 4.01 General

Materials

Lift stations shall consist of a wet well, submersible pumps, dry valve vault, control panel and other related accessories. The lift stations shall conform to MoDNR Design Guide per 10 CSR 20.8.130. Design calculations of maximum flow shall be submitted with detailed specifications and flows shall be determined in accordance with the requirements of MoDNR Design Guide per 10 CSR 10.8.120. All lift stations shall contain at least two (2) pumps, each with 100% design capacity.

Installation

The work covered by this Article of the specifications, shall consist of furnishing all specified materials with all necessary equipment, machinery, tools, and labor, and performing all work required to install and/or construct the sewer lift stations with all directives or modifications and these specifications, all to be complete, in place, accepted, and ready for use. Failure to comply with these specifications will result in the rejection of the work by the District. All work shall be in accordance with MoDNR Rules under Title 10 CSR 20.8-120 and 130.

Section 4.02 Wet Well

Materials

The wet well shall consist of a circular basin, minimum 5 feet in diameter and minimum 10 feet in depth. The wet well shall be constructed of reinforced concrete and have walls designed to withstand the external air loadings when the wet well is empty. The wet well shall have a reinforced concrete bottom and top with access hatch.

A 6" ductile iron suction pipe shall run inside the wet well for a bypass suction line. It shall extend above the wet well with a 90° fitting with a 6" stainless steel mild steel end and groove fitting. Stainless steel pipe supports shall be placed along the line.

The base of the wet well shall be grouted with grout specified in Section 4.02.

All pipe openings through the wet well walls shall be sealed with a resilient connector in accordance with ASTM C923. The connector shall provide a flexible and watertight seal between the pipe and wall opening.

The wet well shall contain stainless steel guide rails for the installation and removal of the pumps.

All exterior joints shall be sealed with a heat shrinkable joint wrap conforming to AHS/AWWA C-216. The wrap shall be Fiber-Wrap Water Infiltration Sealing System as manufactured by Pipeline Seal and Insulation, Inc. or approved equal. All sealed joints are to be inspected by District personnel prior to backfilling.

The pump bases shall be as specified by the pump manufacturer and have minimum 4" ductile iron (Class 350) discharge pipes, which run through the valve vault.

There shall be provided stainless steel lifting chains and floats for control of the pumps as called for in Article V and as recommended by the pump manufacturer. Floats shall be provided for the control of the pumps and alarms.

The wet well shall have a 3" minimum diameter Type 304 stainless steel air vent extending through the top slab with a 180 degree turn. All vents shall have a charcoal filter at the end of the vent pipe. The filter shall be such that the filter material may be replaced without replacing the vent filter piping.

There shall be a stainless steel or aluminum trash basket located at the inlet pipe with a stainless steel lifting chain to provide for periodic removal and cleaning.

Access to the wet well shall be through an aluminum hatch, rated for a 300 pound load, Holiday R25 or approved equal. The hatch shall be complete with hinges and flush locking mechanism, upper guide holder and level sensor cable holder. Doors shall open and automatically lock with stainless steel "hold open" arm with aluminum release handles.

Wet wells shall contain a form of fall protection around the access hatch meeting OSHA standards. Due to the varying conditions for the wet well and site layout fall protection will likely be unique to each individual lift station. Fall protection shall be proposed with each design and approved in at the discretion of the District Engineer. Manhole steps shall have a minimum width of 14 inches and be steel reinforced corrosion resistant polypropylene plastic.

Installation

The wet well shall be constructed as detailed on the plans, as approved by the District, and per these specifications. The base of the wet well shall be grouted on the inside at a 1:1 slope to prevent the accumulation of solids or as specified by the District.

All access frames and covers shall be properly set and installed as recommended by the manufacturer.

The bypass pump suction line shall be securely fastened with stainless steel pipe supports at a maximum of 10' on center. The line shall extend 2'-6" above the top of the wet well. See Detail I for more information.

The stainless steel guide rails shall be securely fastened at the top opening of the wet well, with a stainless steel bracket, to allow the pumps to accurately mate with the pump bases which shall be secured to the bottom with stainless steel bolts. Floats shall be located such that they are not affected by brooming flow.

Vent filters shall be installed directly on the end of the vent pipe per the manufacturer's instructions.

The top elevation of the wet well shall be 12" higher than the surrounding ground and the grades around the wet well shall be such that all runoff will be diverted away from the top. The hatch frame and cover shall be flush with the top of the concrete.

Steps shall be embedded 4.5" from the wall of the wet well at 16" vertical spacing and shall be no more than 24" from the top and bottom of the wet well. Steps shall not be placed directly above any pipes.

The joint wrap and resilient connectors shall be installed per the manufacturer's recommendations.

Section 4.03 Pumps and Motors

Materials

The pump and motor units shall be the submersible type to deliver the design flow through minimum 4" discharge force mains. The pumps shall be capable of passing spheres of at least 3" in diameter and shall be driven by 3 phase, 460 volt, and 60 Hz. motors. The units shall be as manufactured by Flygt, Fairbanks Morse, and ABS or approved equal. Grinder pumps shall not be allowed.

Major pump components shall be gray cast iron, Class 30, with smooth surfaces devoid of blowholes or other irregularities. Thermal sensors shall be used to monitor stator temperatures and specialized relays/sensors shall be applied to the control panel manufacturer prior to panel construction. Impellers shall be of gray cast iron, Class 30, dynamically balanced, single or double shrouded non-clogging design, with stainless steel shafts, and be capable of handling solids, fibrous materials, heavy sludge, and be capable of passing a solid 3" diameter sphere.

Installation

The pump and motor units shall be carefully installed as recommended by the manufacturer and the seals between pumps and pump bases must mate as intended. The pump and motor units shall be properly wired and field checked to see that they can be easily removed and replaced by means of the lifting chains and do not bind on the guide rails. Actual pump tests may be required by placing water in the wet well and timing the withdrawal rates.

The discharge connection elbows shall be permanently installed in the wet well and the pumps shall be automatically connected to the discharge connection when lowered into place and shall be easily removed for inspection or service by means of stainless steel lifting chains. There shall be no need for personnel to enter the wet well.

Section 4.04 Valve Vault

Materials

The valve vault for each lift station shall be pre-cast or cast in place reinforced concrete.

Access to the valve vault shall be through an aluminum hatch, rated for a 300 pound load, Holiday S2R or approved equal. The hatch shall be complete with hinges and flush locking mechanism, upper guide holder and level sensor cable holder. Doors shall open and automatically lock with stainless steel "hold open" arm with aluminum release handles.

Steps shall have a minimum width of 14 inches and be steel reinforced corrosion resistant polypropylene plastic.

The valve vault shall contain two 4" (min.) discharge lines from the pumps and each line shall have a horizontal swing check valve with an outside rotating arm indicator and a gate valve with a hand wheel operator.

The base of the valve vault shall be grouted with grout specified in Section 4.02.

All piping and all fittings shall be flanged ductile iron and all piping shall be properly supported. In one of the discharge lines there shall be a tee and valve and a male "cam lock" connection for emergency pumping to a tank truck, immediately beyond the valve vault. There shall be one 90 degree bend to bring the piping to a tee and then to the force main with a plug valve, as specified in Section 3.03, immediately beyond the tee, with a valve box for operation from the ground surface. There shall be provided a minimum 2" schedule 40 PVC drain pipe from the valve vault to the wet well.

All pipe openings through the walls of the vault shall be sealed with a resilient connector in accordance with ASTM C923. The connector shall provide a flexible and watertight seal between the pipe and wall opening.

Installation

The valve vault shall be constructed as detailed on the plans, as approved by the District, and per these specifications. The floor of the valve vault shall be grouted to provide a slope of 1% to the drain line.

All resilient connectors shall be installed per the manufacturer's recommendations.

Section 4.05 Magnetic Flow Meter

Materials

A magnetic flow meter shall be supplied with a separate signal converter for all lift stations. Meter vaults shall be a meter pit or reinforced concrete vault as determined by the size of the meter required and as directed by the District.

The magnetic flow meter body shall be rated for direct bury, full submersion, and shall be flanged. The meter body shall be carbon steel with ANSI 150 pound flanges and a corrosion coating rated for submerged conditions. The valve body liner shall be hard rubber and shall be rated for full vacuum service.

The electrodes shall be type-super smooth, polished with self-cleaning finish and non-stick shroud. They shall be constructed of 316L stainless steel equipment. The meter body shall include 316 stainless grounding rings. The cable connection ports shall be 3/4" NPT male and rated for submersion.

The signal converter shall be installed in a separate enclosure. The converter shall have one digital output and shall have current output with HART communication.

Schedule 80 PVC conduits shall be used for all wiring from the meter vault to the signal converter enclosure.

Installation

Flow meters shall be supplied in a vault as specified above in the discharge line beyond the valve vault. All power and signal wiring shall be per manufacturers requirements.

Section 4.06 Storage and Capacity

The station shall have additional storage capacity to handle flows during peak demand periods, during a power failure or other malfunction, of at least two hours. This excess capacity may be in the wet well if possible, or may be an external concrete storage tank, designed to flow back into the wet well upon correction of the lift station malfunction or power failure and is at the discretion of the District Engineer.

In some circumstances on site generators or quick connects for portable generators, per District details, will be required and is at the discretion of the District Engineer.

Materials

All joints and pipe openings in the external concrete storage tanks shall be lined and sealed using approved liners and seals as stated in Section 2.03.

Installation

Storage structures shall be installed per the approved plans and specifications or as directed by the District Engineer. All seals and liners shall be installed per the manufacturer's recommendations.

Section 4.07 Piping and Valving

Materials

All piping in the wet well and the valve vault shall be ductile iron pipe, class 350 in accordance with AWWA C-151. Valving shall be as specified in Section 3.03 of these specifications. Provisions shall be made for the removal and replacement of all piping, valves and fittings.

All bolts used inside the wet well and valve vault shall be stainless steel.

The force mains between the wet well and valve vault shall be inside schedule 40 PVC coating pipes which shall be 4" larger in diameter than the force mains and which shall be properly sealed on each end. A resilient connector conforming to ASTM C923 shall be used between the well opening and the coating pipe. Between the coating pipe and the carrier pipe shall be grouted with non-shrink, non-metallic, non-corrosive cement based grout conforming to ASTM C1107.

Installation

Piping shall be installed as shown on the plans, as approved by the District, and in accordance with Article III

Section 4.08 Pavement

Materials

Paving shall be provided for the access road and for all areas inside the fence and shall consist of a sub-base of 6" of Granular Material and the finished pavement shall be constructed with 4" of asphaltic concrete or 6" fiber mesh concrete.

Installation

Paving shall be to a smooth grade and sloped to provide proper drainage, especially away from the lift station facilities. The paved area shall be 10' in width and a paved turn around area shall be provided.

Section 4.09 Entrance Road Barriers

Materials

There shall be provided two 36" high barrier posts. Vinyl clad schedule 40 steel pipe of the entrance road to the lift station and the gates shall be painted yellow. There shall also be provided a 5/16" diameter galvanized chain locked on one end and attached to the other, run between the posts. For safety purposes, a 4" x 12" reflective plate shall be attached to the chain at the center of the span.

Installation

The barriers shall be installed as shown on the plans as approved by the District.

Section 4.10 Fencing

Materials

Fencing around the lift station, including the wet well, valve vault and control panel, shall consist of a 6" high chain link fence with a barbed wire security top and a 12" wide entrance gate. Wire fabric for the fence shall be a vinyl clad chain link fence fabric and wire shall be No. 11 gauge woven into a 2" mesh. The barbed wire top shall consist of three strands of No. 12-1/2 gauge line steel with No. 14 gauge barbs spaced at approximately 5" centers. Posts shall be vinyl clad schedule 40 pipe and post shall be equipped with suitable tops. All fencing must conform to local ordinances.

Posts shall be sized and set as follows:

TYPE	DIAMETER	DEPTH
Top Rails and Braces	1-1/4" Min	2.27 lbs.
Line Posts and Gate Frame	1-1/2" Min	2.72 lbs.
End Corner or Pull Post	2" Min.	5.79 lbs.

CONCRETE BASES

TYPE	DIAMETER	DEPTH
Line Post	12"	3'-6"
End Corner Gate	18"	4"
Pull Post	18"	4"

Installation

The fencing shall be installed as shown on the plans, as approved by the District. Poles shall be set in 30" deep concrete bases so that the pole bottom rests 6" higher than the concrete base bottom. Horizontal support bars shall be installed half way between the top rail and the ground. A #7 tension wire shall be installed at the bottom of the fencing fabric and stretched taut so as not to allow the bottom of the fencing fabric to be lifted away from the fencing poles and/or the ground. Double twisted steel ties shall be used to fasten the fencing fabric to the poles.

Section 4.11 Testing

Testing shall consist of introducing water into the wet well to ensure that the pumps operate as proposed and all controls and alarms shall be operated in the presence of a District representative to demonstrate that they operate as intended. All alarm conditions shall be simulated and the dialer or SCADA shall be programmed and shown to operate as intended.

Lockage testing as specified by the Engineer and approved by the District Engineer shall be completed by the Contractor for the wet well, storage chamber, and valve vault.

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PUBLIC WATER SUPPLY DISTRICT NO. 2 LIFT STATION CONTROL SYSTEM AND ELECTRICAL NOTES:

Section 5.01 General

Major Equipment and Services

- Pump Control Panel with Moosod-L RTU, antenna, including all software programming, start-up, and training, per the following specifications.
- The SCADA "site" shall be added to the existing SCADA PLC/computer network by an authorized Motorola Moosod Value Added Reseller (VAR) and by an authorized Intelution Systems Integrator familiar with the existing Intelution computer network.

The Contractor shall provide and install all hardware, software, labor, materials, and equipment required to provide a complete control panel with the District's Supervisory Control and Data Acquisition system (SCADA), in strict accordance with the requirements of these specifications.

The electrical and control system shall be as specified and shall all be installed in accordance with the National Electrical Code. The complete system shall be provided and installed by a single supplier.

The Contractor shall contact the local power supplier and install all lines to the control panel, including metering in accordance with their requirements. The electric meter shall be installed as close to the lift station as allowed by the power utility.

The control panel shall be located from 3 feet to 8 feet from the wet well and installed per the plans, as approved by the District, and as called for in these specifications.

Section 5.02 Quality Assurance

- (1) **Equipment Qualifications**
SCADA telemetry units shall be Motorola Moosod/Moosod-L as specified elsewhere. Motorola Moosod equipment shall be made an integral part of the control panel being manufactured by the systems integrator. Alternatives to the Motorola Moosod equipment shall not be accepted.
- (2) **Manufacturer's Qualifications**
It is the intent of these specifications that all motor control and control components be supplied by a single supplier. Controls shall not be assembled on site. System supplier shall be a UL 508 certified facility and shall be regularly engaged in the manufacture of industrial water industry. The system specified herein shall be the product of a manufacturer having at least ten years experience in the construction of such control equipment.
The control panel and SCADA system integration shall be the responsibility of a single manufacturer/supplier, hereafter designated as the Systems Integrator. All aspects of the system including fabrication, programming, start-up, and training shall be by one entity. Sub-letting of work shall not be accepted. The Systems Integrator shall provide a fully complete system operating in a satisfactory manner.
All Moosod programming and system start-up shall be performed by the Systems Integrator. The Systems Integrator shall be an authorized Motorola Moosod Value Added Reseller (VAR), proof of which shall be submitted with the bid documents, if required by the Engineer/Owner.
All Intelution programming and system start-up shall be performed by the Systems Integrator. The Systems Integrator shall be an authorized Intelution Systems Integrator familiar with Intelution SCADA system equipment.
The Systems Integrator/Motorola Moosod VAR/Intelution SI shall have offices located within 100 miles of the District's office to facilitate timely system support. The Systems Integrator shall employ at least two (2) full time field service technicians, and two (2) full time programming technicians.
- (3) **Submittals**
Complete submittals shall be provided to the Engineer/Owner for review and approval prior to purchasing of equipment or equipment fabrication. Submittal data shall include the following:
A. Drawings
A master wiring diagram for the control panel(s) shall be submitted for Engineer's review and approval before beginning construction. This diagram shall be drawn in standard ladder logic format. All ladder rungs shall be numbered in the left hand margin, and all relay contacts referenced to these numbers in the right hand margin. Each electrical node in the control schematic shall have a different wire number. A bill of materials and a layout drawing of the enclosure door/inner bracket components shall appear on this drawing with a listing of nomenclature pertaining to the components. Submittal drawings may be on 11" x 17" paper.
B. Product Data
Included in the submittal package shall be data sheets of all equipment used in the control panel, as listed in the bill of materials.

- (4) **As-Built**
Complete as-built drawings shall be provided to the Engineer/Owner upon project completion. As-built data shall be on full-size 24" x 36" paper. Five (5) sets of an electronic copy in PDF shall be provided. An additional full-size as-built drawing shall be placed in the control panel.
A waterproof reduced copy of the master "as built" wiring diagram shall be laminated in clear plastic and permanently fastened to the inside of the panel door.
- (5) **Start-up**
Provide on-site start-up of supplied equipment.
- (6) **Training**
An on-site training program shall be provided to employees as selected by the District. The objective of the training is to provide a common working knowledge concerning the operation of the system. Training shall include one (1) two-hour training session provided at the completion of start-up.

Warranty
System warranty shall be for a period of 1 year commencing upon successful completion of start-up. Warranty includes parts and labor for all equipment/software/services provided. Warranty excludes surge/transient damage.

Section 5.03 Operation

- (1) **Demand**
Basic operation of the pumps shall be as a pump-down, load/log, common off system with high level alarm. Panel shall accommodate connection of floats, with the following functionality:
High Level Log Demand
Load Demand Stop
- (2) **Control**
Each pump shall have a "Hand-Off-Auto" selector switch.
Hand: Pump shall be demanded and shall run continuously until the selector switch is turned to Off or Auto.
Off: Pump shall not be demanded.
Auto: Pump shall be controlled by the floats in the wet well. A demand for each pump shall be delayed through adjustable time delay relays with a range of .1 - 10 seconds. Initially, the time delay for the first pump demand shall be set at 8 seconds, with required additional pump demand time delays being staggered 5 seconds apart. Operation of the log pump(s) shall not be dependent on the load demand float.
- (3) **Alarms**
The alarm system shall operate individual pilot lights as described under Section 5.04, and a common general alarm for the external red light upon the following faults:
(1) **High Wet Well Level**
A contact closure from the high level float shall indicate a high level alarm condition. This alarm shall automatically reset.
(2) **Pump Fail (No Pressure)**
A time delay shall begin when the pump is demanded. If the pump pressure switch does not indicate pressure prior to the time expiring, a "No Flow" alarm shall exist. This alarm shall latch and prevent the pump from running. Alarm annunciation shall remain on until manually reset.
(3) **Pump Seal Fail**
A pump seal failure shall be annunciated only by the individual pilot light. This alarm shall not stop the pump from running.

Section 5.04 Equipment

- Pump control panels shall meet the following specifications:
- (1) **Enclosure**
Enclosure shall be NEMA 3R construction modified with a drip shield to have a NEMA 3R rating, and shall have a swing-in inner door and separate sub-panel. A

standard NEMA 3R enclosure shall not be acceptable. Enclosure shall be constructed from 12 gauge 304 stainless steel with a #4 finish. All hardware on exterior of panel shall be stainless steel. Exterior door shall be held shut with a padlock. 3-point door latch shall be Austin #4B-5655SX, or equal. The padlock is to be provided by the owner. Inner door shall be held shut with latch, Enka wing knob #1000-U78 and cam #1000-S0, or equal. All doors shall be mounted to the enclosure with continuous hinges. Exterior door shall be gasketed to provide a watertight seal to the enclosure. Sub-panel and inner door shall be 12 gauge mild steel primed and painted white. All control switches, pushbuttons, exposed line meters, and indicator lights shall be mounted on or through the inner door. All panel wiring and equipment layout shall be performed per N.E.I.C. and shall be subject to inspection. A minimum of 6" additional D.I.N. rail shall be provided for future mounting expansion.

All panels and panel doors shall be bonded to earth ground. Hinges shall not be considered as an adequate grounding path.

- (2) **Power Distribution Block**
Provide a main power distribution block sized for incoming power to the panel. Each pole of the block shall be supplied with a clear cover for operator protection. Power distribution block shall be Gould 63000, 67000, or 69000 series or approved equal, as required.
- (3) **Surge Suppressor**
Provide a silicon oxide varistor surge/lightning suppressor connected to the power distribution block and sized for incoming voltage. Minimum ratings shall be 60,000 amps, 1500 Joules. Suppressor shall be Delta LA series, or approved equal.
- (4) **Phase Monitor**
Where three-phase motors are controlled, provide a plug-in style phase monitor designed to monitor phase loss, under voltage, and phase sequence with a SPD contact to interrupt all control power in the event of phase loss. Phase monitor shall be supplied with fused protection of the three phase sensing circuit. Phase monitor shall be Diversified Electronics SLA series, Syncrom model #250A, or approved equal. Fuse holder shall be three-pole Gould USMJ series, or approved equal. Fuses shall be fast-acting Gould A1M series, or approved equal.

If a phase converter is being used to provide three phase power, a current monitor and controls shall be installed to provide protection against phase imbalance damaging the motors. An alarm should exist for when the motor is stopped due to a possible phase imbalance.

- (5) **Circuit Breakers**
Provide individual properly sized, thermal-magnetic circuit breaker for each load served. Combination circuit breaker and overload mechanism shall not be allowed. Circuit breakers for motors and other loads shall have a minimum rating of 10,000 AIC (230 vac breakers) or 14,000 AIC (480 vac breakers).
Provide individual, properly sized, thermal-magnetic circuit breaker for each of the following:
(A) Transformer
(B) Each motor load
(C) TVSS (where a TVSS is present)

Provide 1-pole, properly sized circuit breakers for the following loads:
(A) Panel receptacle/condensation heater/service light.
(B) Generator battery charger (at stations where a generator is present)
(C) Generator jacket heater (at stations where a generator is present)
(D) Control circuit
(E) 120 vac power filter
(F) Telemetry unit
(G) Power Transfer Switch (at stations where a generator is present)
(H) Generator Connections (at stations where a generator is present)

- (6) **Contactor/Overload Relay**
A magnetic, across the line, horsepower/current rated motor contactor with ambient temperature compensated overload relay shall be provided for each motor load served. Contactor shall be Cutler-Hammer CE 15 Series, ABB Series A, or approved equal. Overload relay shall be Cutler-Hammer #C316, ABB Series TA, or approved equal.
- (7) **Solid State Starter**
Pumps 20 HP and larger shall be provided with a reduced voltage solid state starter with overload relay and across-the-line bypass contactor for each motor load served. Solid state starter shall be Cutler-Hammer IT series with the side surge protector, ABB PSS series, or approved equal.
- (8) **Transformer**
If 120 volt, single phase is not available, a minimum 2KVA dry-type transformer shall be supplied with primary and secondary short circuit protection. Control power shall be 120 volt. Control circuit shall be connected so that a power outage of any duration does not require manual re-rat of system.
- (9) **Fuse Holders and Fuses**
Provide a fuse holder and fuse for the control circuit, minimum rating 5 amps (ampacity not to exceed relay contact rating). Fuse holders for control fuses shall be finger safe with neon light indication for a blown fuse. Control fuses, fuse holders shall be Gould IJCM J series, Enclose, or approved equal.
- (10) **Terminal Blocks**
Numbered terminal blocks shall be supplied for all field terminations. Current capacity of terminal strips shall be equal to the load served. Terminal blocks shall be suitable for minimum 12 AWG wire of not less than 300 volts. Terminal blocks for control interface shall be Enclose model 115116.07, or approved equal.
- (11) **Interior Service Light**
Provide an interior fluorescent service light w/ safety lens fastened to the top of the enclosure with two-position "Off-On" selector knob to control. Incandescent light shall not be acceptable. Light shall be mounted without penetrating the panel outer skin with screws or fasteners.
- (12) **Entry Switch**
An entry switch shall be mounted in the panel, which shall close a contact wired to the telemetry unit when the exterior door of the enclosure is not closed. Switch shall be Microswitch #1ACC, or equal.
- (13) **Receptacle**
Provide a 15-amp G.F.I. duplex receptacle connected to a separate circuit breaker, as described elsewhere, and mounted on the control panel inner door.
- (14) **Condensation Heater**
Provide a 100 watt, 120 vac silicone rubber self-adhesive condensation heater mounted on a flange with integral 40 degree thermostat. Heater shall be Netow #020100C1-EV11B, or approved equal.
- (15) **Control Systems**
Control systems utilizing microprocessor technology shall have power conditioning for incoming power to these pieces of equipment. The telemetry unit shall be protected by this surge suppressor. The power conditioning equipment shall be Amber Industries model AI-10PA-CM (* = Amp rating).
- (16) **Relays**
Provide an automatic electronic alternator for alternating pump operation on successive automatic cycles. Relay shall incorporate LED position indicators and a toggle switch to select pump #1 or pump #2 as the load pump, or to allow automatic alternation. Alternator shall be Diversified Electronics ARB series or approved equal.
- (17) **Relays**
Relays shall be general purpose plug-in relays with standard mounting configurations. The relays shall have the number of poles as shown on the drawings with neon indicating alarm and test button integral to each relay. Relay contact ratings shall be minimum 5 amp.
- (18) **Time Delay Relays**
Time delay relays shall be coil or D.I.P. switch selectable, and shall have contact ratings of not less than 10 amps. Switch settings shall be labeled on the relay. Time delay relays shall be Diversified Electronics TB series, or approved equal.
- (19) **Selector Switches**
Selector switches shall be 30 mm all light type with lever operators and 10 amp contacts. Knob operators shall not be accepted. Contact blocks shall be provided as required and shall be rated for a nominal voltage of 500 vac and 10 amps. Control switches shall be Cutler-Hammer Series E34 or equal. Control blocks shall be Cutler-Hammer type 10250T. Provide selector switches for the following functions (per pump where applicable):
Pump Hand-Off-Auto Three-position
- (20) **Pilot Lights**
Pilot lights shall be push-to-test, oil-light industrial units utilizing 120 volt bulbs (unless otherwise specified). Lenses shall be colored as shown on the drawings. Control panel lights shall be modular construction as manufactured by Cutler Hammer E34RPB or approved equal. Contact blocks shall be Cutler-Hammer type 10250T or approved equal. LED type lights shall not be acceptable. Provide pilot lights for the following functions (per pump where applicable):
(A) High Level Red
(B) Pump Run Green
(C) Pump Fail Red
(D) Pump Seal Fail Amber

- (21) **Pushbuttons**
Pushbuttons shall be oil-light industrial units. Contact blocks shall be provided as required and shall be rated for a nominal voltage of 500 vac and 10 amps. Control panel pushbuttons shall be modular construction as manufactured by Cutler Hammer Series E34 or approved equal. Provide push-buttons for the following functions:
(A) Alarm horn silence
(B) Pump Fail Reset
(22) **Floated Time Meters**
Provide an elapsed time meter for each pump controlled. Meter shall be 6-digit, non-resettable, reading in hours and tenths of hours. Elapsed time meter shall be Fourth Dimension, or approved equal.
- (23) **Seal Fail Relay**
Provide a conductance actuated moisture sensing relay for each submersible pump controlled in a standby mode. Specialized relay/assembly, if required by the pump manufacturer, shall be supplied to the panel manufacturer by the pump manufacturer prior to panel construction. Seal Fail Relay shall be Diversified Electronics, Syrac, or approved equal.
- (24) **Alarm Light**
Provide a red strobe light mounted to the top, exterior of the enclosure. Minimum ratings shall be 1.5 Joules of 70 flashes per minute. The strobe light shall be fully sealed to prevent water from entering the enclosure and be attached by mounting screws from inside the enclosure to prevent tampering.
- (25) **Alarm Diode**
Provide a 4-channel automatic alarm diode mounted in the control panel. Diode shall be Microtel, or as approved by the District. Diode shall be mounted on a 15" x 15" space. The diode shall be configured by the District.

The following alarms shall be wired to terminal blocks in the control panel, and then connected to the diode:
(A) Wet Well High Level
(B) Pump #1 Fail
(C) Pump #2 Fail
(D) Power Failure

- (26) **Ground Bus/Jugs**
Provide a ground lug sized for incoming power ground near the power distribution block. Provide a ground lug sized for pump ground near pump power wire terminations. Provide a ground bus for control equipment grounding, minimum 6 termination points.
- (27) **Corrosion Inhibitor**
Provide a corrosion inhibitor mounted inside the control panel. Corrosion inhibitor shall be Hoffman #A-HCI-92, or approved equal.
- (28) **Power Distribution Wiring**
Power distribution wiring on the line side of panel fuses or circuit breakers shall be sized for the load served, minimum 12 AWG. Control wiring shall be minimum #16 gauge S3 type stranded wire for internal control panel circuits. All control wires shall be run in a conduit or raceway corresponding to the master wiring diagram with alp-sleeve or heat-shrink tube wire markers. Wrap-on or adhesive wire markers shall not be allowed. 120 vac wiring (except for neutrals) shall have red insulation. 120 vac neutral wiring shall have white insulation. 50 vac or less shall have yellow insulation. 12/24 vac wiring shall have blue insulation.
- (29) **Nameplates**
Provide adhesive backed printed nameplates for all internal devices such as contactors, circuit breakers, and relays. Provide engraved phenolic nameplates, black letters on white background, for door-mounted devices such as selector switches, push-buttons, circuit breaker toggles, and pilot lights. Nameplates shall be secured firmly to the panel.

Inspection, Tests, and Acceptance or Rejection of Defective Work
District staff or its representatives, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

Section 5.05 Telemetry Equipment/Services

- (1) **Telemetry Unit**
Each pump station shall have a Moosod-L RTU conforming to the District's existing system. A full Moosod-L may be required on certain individual pump station locations, and will be requested if required when the pump station plans are submitted for review, indicating size of Moosod and number and quantity of equipment. All hardware components of the RTU shall be supplied, installed, and programmed as an integral component of the control panel. The equipment shall be configured to operate on the District's operating frequency. The District utilizes a Motorola Moosod Control Station Transceiver for interrogation and acknowledgment of alarms.
The following telemetry equipment shall be supplied in the control panel, unless otherwise indicated:
(1) Moosod-L with 5 watt convolution radio, Motorola
(1) Mixed I/O Card (2 A), 8 DI, 2 DO, Motorola #V436 OR 16 DI Card, Motorola #V115
(1) Replace 1.2 AH battery with 3 AH battery, Motorola #V328 (1) Coaxial Surge Arrestor, Polyphaser #38-050AHC-C2-NE. The following telemetry equipment shall be supplied loose or installed by the electrical contractor:
(1) Antenna: Decible #D8230-L, Comcolec #V3313A-E, or approved equal
(1) Antenna Pole: Galvanized Heavy wall conduit mounted to electrical rack (4) Coaxial cable: Type RG213JL, Belden #8287, or equal, quality and length as required (1) Coaxial connector: RF Industries #FRN-1002-15 (Male), #FRN-1024-1 (Female), or equal, as required.
(1) Cold Shrink: 3M #8425-7 and #8426-9 (or as required for coaxial cable size)

Status Connections

- Status connections shall be as follows:
Discrete Point 1 Intrusion
Discrete Point 2 Pump #1 Run
Discrete Point 3 Pump #2 Run
Discrete Point 4 Pump #3 Started Fault
Discrete Point 5 Pump #2 Start/Fault
Discrete Point 6 Wet Well High Level
Discrete Point 7 Phase Fault
Discrete Point 8 Generator Run

Software Programming/Start-up Services

All Moosod/SCADA computer programming and start-up services shall be included and completed in the control panel communications. All information in the communications as specified to the central Moosod, and that the information is displayed in the computer control and other SCADA network computers.
All Moosod programming and system start-up shall be performed by an authorized Motorola Moosod Value Added Reseller (VAR) familiar with the District's Moosod SCADA system. The SCADA "site" shall be programmed in the District's SCADA computer network by an authorized Intelution Systems Integrator familiar with the District's Intelution computer. The Motorola VAR/Intelution SI shall have offices located within 100 miles of the District office to facilitate timely system support. Systems Integrator shall be Electric Controls Company, Inc., 2355 Mercurite Drive, St. Louis, MO 63144, Ph. 314-845-2400, or approved equal.

Radio Frequency License Coordination

A licensed UHF frequency, with each site listed on the license is required. It shall be the responsibility of the Owner to obtain/updates the radio frequency license(s) necessary for the installation and successful operation of the SCADA system.

Section 5.06 Control Panel Electrical Rack

An electrical equipment rack, as shown on drawings, shall be supplied by the manufacturer of the control panel for installation by the electrical Contractor. The equipment rack shall be constructed of double-bolt Inlustrum™ hot dipped galvanized material with required conduit connecting meter bases, fused disconnect switch, control panel, seal fittings, and FRP (fiberglass reinforced plastic) junction box. If a lightning arrester for the control panel is specified elsewhere in the control panel specifications, it may be mounted on the exterior of the disconnect switch, in lieu of the control panel, if desired.
All wiring between components on the electrical rack shall be run in galvanized heavy wall conduit, minimum 1/2" diameter. All conduits shall be sealed to prevent gases from entering into the control panel.
All wire shall be not less than 12 AWG stranded type THHN/THWN, except control wiring, which may be 14 or 16 AWG stranded type THHN/THWN. All wiring shall be color coded by wire insulation, or colored tape on each end of the wire.

Section 5.07 Junction Box

Provide a fiberglass junction box for installation in valve vault. Junction box shall have sub-panel and terminal blocks for each connection.

PUBLIC WATER SUPPLY DISTRICT NO. 2 WATER MAIN NOTES:

Section 1.07 Quality and Handling of Materials

All materials used for each improvements project shall be new. Damaged or unbound pipe, fittings, and accessories of whatever nature shall be rejected and removed from the site immediately.
All pipe, fittings, valves and other accessories, shall be unloaded, stored, rehandled, and installed by methods in such a manner as to ensure their final location is a sound and undamaged condition, conforming in all respects to specified requirements. Under no circumstances shall pipe, fittings, valves, or other accessories, be dropped to the ground, or otherwise subjected to possible damage from impact or shock. Such materials shall be loaded by lifting with machine or hoist, or by sliding. Pipe handled on skidways shall not be skidded or rolled against other pipe.
Under all circumstances, all materials for use shall be handled in a workman-like manner, using the necessary manpower and equipment to perform the task in accordance with the manufacturer's recommendations.
Proper equipment, tools, facilities, and methods satisfactory to the District, shall be provided and used by the Contractor for the safe handling of all materials. Fittings, valves, and other accessories shall be carefully lowered into the trench or excavation, piece by piece, to protect coatings and linings. Under no circumstances shall any materials be dropped or dumped into the trench. All joints shall be made as specified in Section 2.01. Each piece of pipe and all fittings, valves, etc. shall be checked and cleared of debris prior to being put in place. All gaskets shall be checked and cleaned of oil, grease, dirt, etc. before being inserted. All bolted joints shall be checked for operation and bolt tightness prior to installation.
All open ends of pipe, fittings, etc., shall be carefully sealed with appropriately sized mechanical joint plugs at the end of each day's work to prevent entrance of animals, water, or any foreign matter. Mechanical joint plugs or caps and the appropriate gasket and gland packs shall be utilized for sealing.

Section 1.08 Work Adjacent to and/or Crossing Rights-of-Way

All work to be performed within the road right-of-way limits shall be performed in strict accordance with the road authority's requirements. The Contractor shall obtain the necessary permits for all work prior to starting any construction. All permits must be displayed as required with two (2) copies provided to the District.
The Contractor shall comply with all standards of the latest version of the Manual on Uniform Traffic Control Devices as published by the Federal Highway Administration and any additional requirements set forth by the road authority.
The crossings shall be machine bored with simultaneous installation of the enclosure. Boring without the concurrent installation of the enclosure tube will not be permitted. In addition, water, air, or debris shall not be allowed to enter the enclosure. An extra man crossing a road right of way shall be constructed in accordance with all permit requirements provided by the road authority.
Following completion of the machine bored crossing, the ends of the pipe coatings shall be sealed and all of bore pit or other required excavation shall be suitably backfilled to grade. For requirements for the carrier pipe and casing pipe crossing road rights-of-ways see Section 2.01 and Section 2.06, respectively.

Section 1.09 Creek Crossings

Where water main cross creek, all piping shall be restrained joint piping as specified in Section 2.01. Restrained joints and fittings, as specified in Section 2.02, shall be installed in certain cases, as determined by the District Engineer, steel casing pipe may be required as outlined in Section 2.08 of these Specifications. The determination of what constitutes a creek and the necessity for steel casing pipe shall be made by the District Engineer.

Section 1.10 Staking

Staking shall be provided before the start of and during construction. Staking shall be completed by the Developer's Engineer or land surveyor and shall be completed by directly employed or a professional and surveyor licensed in the State of Missouri. All staking and survey shall be performed using US State Plane 1983, zone Missouri East 2401, datum NAD83, with altitude measured from mean sea level and units of feet.
Stakes shall be placed to indicate the road right of way or the limits of the easements at a maximum spacing of 100 feet. The stakes shall be placed along the centerline of the proposed water main or at a fixed offset of intervals not to exceed 100 feet. Stakes shall be placed for all fittings, valves, fire hydrants and other appurtenances. All stakes shall be clearly marked to identify items such as valves, basins, or fire hydrants, as well as centerline, station, offset, easement, etc. For valves, fire hydrants and temporary blowoff assemblies, the stakes shall have the final grade noted on them such that all valve boxes, fire hydrants and blowoff assemblies can be set to the proper height to accommodate the final grading.
Cuts shall be marked on the laths placed as stakes. The cuts shall show the distance from the existing ground surface to the outside bottom of the water main.
Section 1.11 Granular Material
Where required per these Specifications, Granular Material shall be 3/4" minus crushed limestone and screenings and shall be compacted to 95% per Standard Proctor Test method (ASTM D698). The Contractor shall provide at the Contractor's cost independent third party composition (testing by a testing firm agreeable to the District).

Section 1.12 Trench Excavation and Backfill

Trenches for water mains shall have a minimum width of the pipe O.D. plus 12 inches. The finished cover over water mains shall be a minimum of 3'-6" and a maximum of 6'-0".
For PVC pipe, the trench depth shall be excavated 6" deeper than the proposed bottom of the pipe to allow for 6" of Granular Material bedding. The PVC pipe shall also have the Granular Material placed to a level 6" above the top of the pipe with care taken to fill all void spaces beneath the pipe. The Granular Material shall be placed as shown on Detail A of these specifications.
For ductile iron pipe, if the trench bottom is stable and suitable earth, the pipe may be placed on the earth trench bottom. If the trench bottom contains stones larger than 2" in any length or silt rock, the trench shall be excavated 6" deeper than the proposed pipe bottom and 6" of Granular Material bedding shall be placed before the pipe is laid. The ductile iron pipe shall then have compacted backfill of clean earth or Granular Material placed to a level 6" above the top of the pipe.
If the trench bottom contains frozen material, excessive moisture, debris or other deleterious material, the trench shall be excavated 6" or more deeper than the proposed pipe bottom and backfilled to the desired grade with Granular Material. For all pipe, bell holes in the trench bottom shall be provided to allow full contact of the pipe with the trench bottom.
Backfill of all pipes under roadways or parking lots shall consist of Granular Material carefully placed to avoid future settlement from 6" above the top of the pipe to the finished grade or as specified by the governing road authority.
In other areas, for pipes 12" and smaller, the backfill shall be soil meeting ASTM D2487 soil classification groups GW, GP, SW, SP, GM, GC, SM, SC, ML, and CL free of stones larger than 6" in any length, debris, waste, frozen materials, vegetation and other deleterious matter.
For pipes larger than 12" not under roadways or parking lots, the backfill shall be soil meeting ASTM D2487 soil classification groups GW, GP, SW, SP, GM, GC, SM, and SC free of stones larger than 6" in any length, debris, waste, frozen materials, vegetation and other deleterious matter.
The liquid limit and plasticity index shall not exceed 45 and 25, respectively, for the fill and clay materials.
Backfill of all pipe shall be well compacted by mechanical means. Any completed areas that show settlement shall be promptly re-backfilled with compacted clean earth, as specified above, or compacted Granular Material as required for the initial backfill.

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 PROJECT NUMBER: J4-0516
 DATE: 12/01/15
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4 OF 23

PUBLIC WATER SUPPLY DISTRICT NO. 2 WATER MAIN NOTES
CONTINUED

Section 1.1.3 Site Clean Up and Restoration
After work is completed, the site of all improvements shall be cleared of all construction material and other debris. The entire work area shall be left in an orderly and acceptable condition.

Grading shall provide proper drainage and all installation sites shall be left in a neat, clean and acceptable condition. All setbacks, driveways, roads, streets, etc. shall be cleared and replaced to their original condition. All water mains shall be left with the proper amount of cover as stated in Section 1.1.2.

All improvements in easements the site shall be restored to a condition equal to, or better than, its condition before the work was started.

All Best Management Practices shall be according to the appropriate local, state or federal authorities' requirements.

Section 1.1.4 As-Built Drawings
Refer to the District's latest version of "GUIDELINES FOR WATER DISTRIBUTION SYSTEM AND SANITARY SEWER COLLECTION SYSTEM IMPROVEMENTS" for as-built drawing requirements.

Article II WATER MAIN
Section 2.01 Pipe and Fittings
Materials - General
All pipe for water mains shall be 4" (inch) in diameter or larger and shall be PVC or ductile iron as specified further in this Section. Gaskets shall be made of NBR rubber. For water main located within petroleum contaminated soils Nitrite gaskets shall be used.

Materials - PVC Pipes
PVC pipe shall be class 200, with a standard dimension ratio (SDR) of 21. Pipe for use under this heading shall be manufactured from clear, virgin, NSF approved Type I Grade I, 1120 P.V.C. conforming to A.S.T.M. specification D2241. The pipe shall be pressure rated for a hydrostatic working pressure of 200 PSI at 73.4 degrees F. The pipe shall also conform to the following:

- a. Hydrostatic Integrity: The pipe shall withstand without failure, a pressure of 420 PSI for at least 1,000 hours at 73.4 degrees F. in accordance with A.S.T.M. Specification 1598. The pipe shall withstand without failure, a pressure of 830 PSI applied in 60 to 90 seconds.
- b. Visual Flattening Test: A 2 inch wide section of pipe shall be flattened in less than one minute, to 100% without showing evidence of shattering or splitting at 73.4 degrees F.
- c. Pipe Wall Thickness: Rigid plastic pipe shall be manufactured to provide a minimum pipe wall and bell or coupling thickness in accordance with the following schedules:

Ø Size (Inches)	Barrel	Bell
2"	0.113	0.146
4"	0.214	0.258
6"	0.316	0.379
8"	0.419	0.481
10"	0.521	0.607
12"	0.608	0.735

d. Concentricity: The outer diameter of the pipe shall be concentric within .003 of an inch.

All PVC pipe shall be joined by means of a rubber ring slip joint. Cement weld or glued joints will not be permitted. The slip joint shall be formed by a bell joint which shall be an integral and homogeneous part of the pipe formed by extrusion, with a ring groove for sealing the rubber ring gasket. Ultra Blue pipe or other PVC with any thickness less than stated above will not be allowed. Also, C-900 PVC pipe will not be allowed.

Restrained joint PVC pipe, couplings, and fittings utilizing precision-machined grooves and meeting the requirements of this section may be approved by the District Engineer on a case by case basis.

Materials - Ductile Iron Pipes
Ductile iron pipe shall conform to AWWA C-151 and be cement lined and seal coated in accordance with AWWA C-104. The joints shall be push on type with rubber gaskets conforming to AWWA C-111. In general, ductile iron pipe shall be pressure Class 250.

For all carrier pipe crossing road right-of-ways, where used for creek, ditch crossings or at any location requiring vertical fittings, the pipe shall be mechanically restrained ductile iron, pressure Class 350 as specified in Section 2.02.

Installation
In general the grade or slopes where new water mains are to be installed shall not exceed 10%. Where grades are in excess of 10% but not greater than 25%, restrained joint ductile iron pipe and fittings as specified herein shall be used. Additionally, vertical changes in direction shall be accomplished with the use of restrained joint ductile iron pipe and fittings as needed.

Laying of the pipe shall commence immediately after the excavation is started, and the Contractor shall use every possible means to keep the completed pipe installation closely behind the trenching. The District may stop the trenching if it appears that the trench is open too far in advance of the pipe laying operation. The Contractor may lay pipe in the best manner adapted to securing speed and good results. The Contractor shall have the necessary equipment and tools available for making the joints for the specific materials being used.

All pipe spigot ends shall be visibly marked to fully "make-up" the joint. With exception of field cut pipe, all "make-up" marks shall be placed on the pipe at the factory. Field cut pipe shall be marked for full joint depth prior to insertion.

Cutting of pipe for closure pieces with installation of valves or fittings, or for any other reason, shall be done in a neat and workman-like manner without damage to the pipe or fittings. The cutting operation shall leave a smooth cut and at right angles to the longitudinal axis of the pipe. The exterior surface of the cut end shall be beveled, and the interior surface shall be reamed or filed free of all rough edges and protrusions. All pipe cutting shall be done by saw or mechanical pipe cutters of an approved type.

Upon completion of the cutting and trimming operation, the pipe end or ends shall be marked for "make-up" depth. Prior to insertion, the pipe shall be thoroughly cleaned of all foreign materials, including fling and cutting debris.

Pipe lines are intended to be laid straight. Deflections of fittings and of ductile iron joints will be allowed when necessary but shall not exceed 2-1/2 degrees or 10" per 20' pipe length at any one joint. Bending of PVC will be allowed only when absolutely necessary and shall be done by hand tools to avoid damage to the pipe. Bending of PVC pipe shall not exceed the following limitations:

Pipe Size	Degree of Bend	Deflection per 20' Min. Radius
4"	3.5 degrees	15"
6"	2.5 degrees	11"
8"	2.0 degrees	8.5"
12"	1.0 degree	5.0"

Section 2.02 Fittings and Fitting Restraint
Materials
For restraint of unbalanced thrust for fittings larger than 12", conventional thrust blocking may be used with a design based on a pressure of 200 PSI and a passive soil resistance of 2,000 PSF.

Ductile iron pipe restraints for fittings may be designed using restrained joints in the pipe and fittings. However if such restraints are provided, calculations signed and sealed by a Missouri Registered Professional Engineer shall be provided.

Concrete for thrust blocking shall be ready mix concrete, composed of Portland cement, sand and gravel with not more than six (6) gallons of water per sack of cement. The concrete shall be a 5-1/2 sack mix with 28 day minimum compressive strength of 3,000 PSI.

All fittings shall be ductile iron, Class 350, conforming to AWWA C-153. The fittings shall be push on joint or mechanical joints conforming to AWWA C-104. If restraints are being used in a ductile iron restraint system, U.S. Pipe TR FLEX, American Flex Ring, or Griffin Snap-Lock restrained joint pipe and fittings approved equal shall be allowed. Metal type joint restraints shall only be allowed with mechanical joint fittings.

Installation
All horizontal mechanical joint fittings 12" and smaller such as tees, bands and plugs (except for fire hydrants) shall be thrust blocked with poured concrete as shown in Detail C of these Specifications. Thrust blocking for fittings larger than 12" shall be designed and detailed by Engineer.

Forms shall be provided to avoid concrete encasement of any part of mechanical joints. All form material shall be removed from the trench prior to backfilling. Pre-cast concrete block supports shall be used for all fittings installed.

Section 2.03 Polyethylene Encasement
Materials
Polyethylene encasement shall be applied to underground installations of ductile iron pipe, fittings, valves and other appurtenances.
Polyethylene film shall be manufactured of virgin polyethylene material conforming to AWWA C105 "Standard for Polyethylene Encasement for Ductile Iron Pipe Systems."
Installation
The Contractor shall furnish all materials and install the polyethylene encasement as specified and in accordance with AWWA C-600. The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material but is not intended to be a completely airtight and watertight enclosure. Overlaps shall be secured by the use of adhesive tape, plastic string, or any other material capable of holding the polyethylene encasement in place until backfilling operations are completed.

Polyethylene encasement shall be installed per the manufacturer's recommendations. Where encountered, the Contractor shall provide openings for branches, service tees, blow-offs, air valves, and similar appurtenances by making an X-shaped cut in the polyethylene and temporarily taping back the film. After the appurtenance is installed, the block shall be securely taped at the appurtenance and the cut repaired with tape as well as any other damaged areas in the polyethylene.
Where polyethylene-wrapped pipe joins an adjacent pipe that is not wrapped, the Contractor shall extend the polyethylene wrap to cover the adjacent pipe for a distance of at least two (2) feet. The end shall be secured with circumferential turns of tape.

The Contractor shall use the same backfill material as that specified in Section 1.12 for pipe without polyethylene wrapping, exercising care to prevent damage to the polyethylene wrapping when placing backfill. Backfill material shall be free from cinders, refuse, boulders, rocks, stones, or other materials that could damage the polyethylene.

Section 2.04 Buried Below Top
Materials
Warning tape shall be installed with all water mains. The materials to be installed for this purpose shall consist of three (3) inch wide vinyl or plastic with an unbroken continuous metallic foil core. Tape splices shall be knotted to prevent tensile pressure on the splice.
The metallic tape shall be colored blue and shall bear an imprint identifying the line below, such as "Caution Water Main Buried Below".

Installation
The Contractor shall furnish all materials. The three (3) inch wide tape shall be installed 18" above the water main locations as the trench backfill progresses. The tape material shall be installed in accordance with the manufacturer's recommendations. The tape is to be placed in a manner such that trench backfill settlement will not place an excessive tensile stress on the material.

Section 2.05 Tracer Wire
Materials
For all water mains a locator wire shall be provided and shall be a single insulated No. 12 copper wire, THHN or THWN, gasoline and oil resistant. The insulated wire shall be furnished in rolls of not less than 500 feet. Where splices are required, all splices shall be made with JM splice kits or approved equal.

Installation
The Contractor shall furnish all materials. The No. 12 insulated wire shall be placed along the top of the water main and taped in place with duct tape or electrical tape at a maximum of 6' intervals. All tracer wire shall be tested for continuity as called for in Section 4.06.
For ductile iron pipe the locator wire shall be placed outside the polyethylene encasement. Caution must be exercised in the initial backfilling not to move or damage the locator wire.

The wire shall be brought up the outside of each valve box from each direction and then both wires are to be threaded into the valve box through the 3/4" diameter hole near the top in the initial installation.

The two wires shall be spliced inside the valve box with a standard plastic or rubberized wire connector. After testing for continuity, the splices inside the box shall be made with JM splice kits or approved equal. Where splices become necessary outside of valve boxes, the splices shall be made initially with a JM splice kit or approved equal.

Where water mains dead end with a cap installed for a future extension, a 6" long steel "T post" extending 3" into the ground, with 3" exposed shall be provided. In these cases the locator wire shall be brought up out of the ground and securely wrapped around the "T post" and secured with electrical tape.

Section 2.06 Casing Pipes
Materials
Casing pipes for right-of-way crossings shall be welded steel pipe with a minimum wall thickness of 1/4", unpainted or coated, and shall have a minimum diameter as shown below and the ends of casing pipes shall be sealed with pre-formed seals or other material approved by the District. Casing pipes shall be sized and have wall thicknesses as shown in the table below.

Ø Carrier Pipe	Welded Steel Casing Pipe	Casing Pipe Thickness
6"	16"	0.25"
8"	20"	0.25"
12"	24"	0.375"
16"	30"	0.375"
20"	36"	0.375"
24"	38"	0.375"
30"	42"	0.375"
36"	54"	0.5"
42"	60"	0.5"

Wherever water mains are installed in casing pipes, the pipe shall be supported with "RACI" type spacers or approved equal.
Carrier pipe shall be as specified in Section 2.01.

Installation
The spacers shall be carefully installed on the carrier pipe, at 6' intervals or 1 spacers per 20' length of pipe, before it is installed in the casing pipe.

Section 2.07 Water Service Connections
Water service connections shall be made in accordance with the District's water service connection policy as described in detail on the District's website at www.msnw.org/infoc2008.

Article III WATER DISTRIBUTION SYSTEM COMPONENTS
Section 3.01 Valves
Materials - General
Valves for 12" pipe and smaller shall be gate valves. Valves for 16" pipe and larger shall be butterfly valves. All valve components shall be certified in accordance with ANSI/ASCE #1 and be UL listed and FM approved.
All bolts shall be stainless steel.
The valves shall open counterclockwise and have the maker's initials, pressure rating, and year in wide manufactured cast on the body.

All buried valves shall be provided with a Burfite type valve box, Tyler 582-S or 584-S, or approved equal. The tops of the valve boxes shall be designed with grooves to accommodate a valve box adjusting foot as provided in the tops of the above referenced Tyler valve boxes. The valve boxes shall be furnished complete with extension pieces necessary and the top of the box shall be flush with the finished grade or pavement surface. All valve boxes shall have a 3/8-inch diameter hole drilled 3-inches from the top to accommodate the water main trace wires. Like shall be stamped "Water".
Materials - Gate Valves
All gate valves shall be ductile iron or cast iron, resilient wedge valves, with non rising stems, 2" operating nuts, push-on joint, mechanical joint, or flange joint, and epoxy coated bodies and be manufactured in accordance with AWWA Standard C-509. The wall thickness for ductile iron valves shall meet or exceed AWWA Standard C-153.

The valves shall be designed to withstand a working pressure of 250 PSI on either side of the valve. The valves shall be American Flow Control Model AFC-2500, U.S. Pipe Mueller 250, and Mueller A-2360 or approved equal.

Valves intended for buried service shall have 2" square operating nuts suitable for use in a standard valve box as stated herein.

Materials - Butterfly Valves
Butterfly valves shall conform to AWWA C-504 for Class 150B butterfly valves. All butterfly valves shall have a working pressure of 200 PSI.
Butterfly valves shall have cast iron or ductile iron bodies, be designed for buried service, have push-on joint or mechanical joint ends and have side mounted 2" square operating nuts suitable for use in a standard valve box as stated herein.

Discs shall be offset to provide an uninterrupted 360° sealing edge and shall be ductile iron per ASTM A536 Grade 65-12. The disc seating edge shall be clad 316 stainless steel. Sprayed mating seating surfaces are not acceptable. The disc shall be securely attached to the valve shaft utilizing a field removable/inplace 316 stainless steel torque screw on sizes 6" - 12" or a tangential pin locked in place with a set screw on sizes above 12".

Valve boxes shall be set plumb and north or ground line shall be stamped around the box to maintain the plumb position and the lid or cover to correspond with finished grade based on the "height" indicated on the stakes for the valves.

In general, valves shall be provided at intervals of not greater than 500 feet. Additionally, at all tee intersections, a minimum of two (2) valves shall be provided and shall be oriented as directed by the District.

Section 3.02 Tapping Sleeves and Valves
Materials
All tapping sleeves for 12" and smaller pipe shall be stainless steel with stainless steel flanges. The tapping sleeves shall be Power Seal No. 3490 AS, Smith Blair 865 or JOM 432, or approved equal, with class 125 ANSI B-16.1 flanges on the outlets. For pipes larger than 12", the tapping sleeves shall be ductile iron, split mechanical joint type.

Tapping valves shall be designed for leak tight attachment to the tapping sleeve and tapping machine, shall have mechanical joint by flanged joint ends and shall otherwise conform to Section 3.01. All tapping valves shall have a valve box conforming to Section 3.01.

When dissimilar metals are used for the tapping sleeve and valve a dielectric flange insulation kit shall be used. The kits shall consist of a full-faced neoprene and phenolic gasket with full-length insulating sleeves and slugs insulating washers. The gasket material shall consist of neoprene sheets, factory applied to both sides of a laminated sheet of aluminum. The operating temperature of the gasket shall be from -85°F to 175°F. The full-length sleeve shall be 1/32-inch thick phenolic and the insulating washers shall be 1/8-inch thick high strength phenolic.

The tapping sleeves shall be carefully installed on existing pipe with tightening of bolts done carefully to avoid stresses on the existing water mains. Particular care shall be used to follow the bolt tightening sequence as recommended by the manufacturer.

The tapping valve shall then be attached to the tapping sleeve with support blocks provided as shown for valves in Detail D. If the tapping sleeve and valve are dissimilar sheet of aluminum. The operating temperature of the gasket shall be from -85°F to 175°F. The full-length sleeve shall be 1/32-inch thick phenolic and the insulating washers shall be 1/8-inch thick high strength phenolic.

Prior to the top being made, with the tapping valve closed, the assembly shall be air tested to a pressure of 150 PSI, using the port provided on the tapping sleeve. After the top is completed, the "coupon" removed shall be given to the District's representative for examination. When the top is complete, concrete thrust blocking with the same dimensions as for a tee of the same size shall be poured behind the tapping sleeve and the pit to be temporarily backfilled, before pipe laying continues, a mechanical joint pipe shall be installed in the outlet of the tapping valve to prevent dirt or debris from entering the valve.

The valves shafts shall be type 304 stainless steel. Valve seats shall be self-compensating V-type packing with a minimum of four sealing rings. One piece molded shaft seals and O-ring shaft seals will not be allowed.

The seats shall be of Buna-N for water and shall be milled in and vulcanized to the valve bodies. The seats shall contain integral shaft seals projecting the valve bearings and packing from any line diebits. Seats vulcanized to cartridge inserts in the valve bodies and seats on the discs are not allowed. Valve shaft bearings shall be nonmetallic and permanently lubricated.

The exterior and interior of metallic surfaces of each valve shall be shop painted per AWWA C504. The interior of the bodies shall have a full rubber lining suspended to the valve bodies.
Each valve operator shall be sized to operate the valve at the rated working conditions of the valve. Each valve shall be assembled, adjusted, and tested as a unit per AWWA C504, by the valve manufacturer. The test pressure for leakage tests shall be 225 PSI.

Installation
Prior to installation, all valves shall be checked for bolt tightness and operation. All foreign matter, dirt, and debris shall be removed from inside the valve body. The valve gate and guide shall be cleaned free of grease and dirt. After thoroughly cleaning and checking the valve for operation, the valve gate shall be opened, and the valve shall be installed in place. All valves shall have pre-cast concrete block supports, the same as for fittings as shown on Detail D of these Specifications.

Section 3.03 Fire Hydrants
Materials
Fire hydrants shall have a 5-1/4" valve opening, one 4-1/2" steamer nozzle and two 2-1/2" hose nozzles and a 6" mechanical joint shoe and conform to AWWA C-502. The fire hydrants shall be Mueller Super Centurian 250, American Daring No. B-84-B, Kennedy RBID, or approved equal.
Post or flush type hydrants shall have one or two 2-1/2" hose nozzles, a 2-1/8" main valve opening, and a mechanical joint shoe. The post or flush type hydrants shall be Mueller A-811 or approved equal.

All hydrants shall be delivered to the site coated with a black bituminous coating for the portions to be underground and a primer and yellow finish coat for the portions to be exposed. The types of paint and coating shall be as recommended by the fire hydrant manufacturer.
All hydrants shall receive a final paint coat in the field. Exposed barrels and tops shall be chrome yellow. All hydrant cap threads shall be field-lubricated with an approved, food-grade grease. The hydrants shall have a minimum "bury" of four (4) feet unless the depth of the main requires a deeper "bury".

Installation
Fire hydrants shall be installed where shown on the plans and as shown on Detail B of these Specifications. Care shall be taken to set the hydrant plumb and the 4-1/2" pumper nozzle shall face the street. Care shall also be exercised to set the fire hydrants hydrostatic. After installation and backfill, the exposed barrel and top shall be given a finish coat of "Chrome yellow" paint. The operating nuts on the top of fire hydrant shall not be painted.
In general, fire hydrants will not require thrust blocks when they are restrained by "Anchor Locks" or "Isogrip" follow-up glands as shown on Detail B of these Specifications. However, if they are installed as a dead end, or thrust block, same as for a 6" x 6" tee they shall be provided to restrain the fire hydrant and core shall be taken out to encase the drain hole in the fire hydrant.

Section 3.04 Air Release Devices
Materials
For high points of water mains, air release valves shall be provided and such valves shall be Combination Air Valves for Waterworks Service in accordance with AWWA C512. The valves shall be in concrete vaults, 72" in diameter, with cover, air vent, isolation valve and pressure gauges as approved by the District Engineer. Combination Air Valves shall be A.R.I. Model D-040-C, Combination Air Valve (Bank) or approved equal.
Installation
Where there are pronounced high spots in water mains 8" and smaller, fire hydrants shall be located at said high spots. For high spots in water mains larger than 8", automatic air release valves shall be provided as specified hereinbefore. All automatic air release devices are to be permanent and constructed per Detail G.

Section 4.01 Disinfection
Disinfection shall be accomplished by placing sufficient hypochlorite granules (HTH) in each section of pipe or injection of a hypochlorite solution to achieve a chlorine residual in the pipelines, upon initial filling, of 50 mg/L (PPM). HTH tablets will not be allowed.
Following completion of the pipeline, it shall be slowly filled with water and a sample will be taken immediately and the chlorine residual must be 50 mg/L or greater. The solution shall be allowed to stand for 24 hours and a sample shall then be taken. The chlorine residual after 24 hours shall be 10 mg/L or greater. If the piping shows insufficient chlorine residuals in either test, the piping shall be re-chlorinated by the injection of a hypochlorite solution until satisfactory results are achieved.

All disinfection shall be completed by the Contractor. Only the testing to determine the chlorine residual shall be completed by the District.

Section 4.02 Pressure Testing
Immediately following disinfection, the piping shall be pumped to a pressure (at the highest point in the project) of 150 PSI or higher where the working pressure is higher than 150 PSI as determined by the District.
In such cases, the test pressure shall be 50 psi greater than the working pressure and no pressure tests shall be conducted. The first test shall be with the fire hydrant auxiliary valves open and be to 150 PSI. The second test shall be with the fire hydrant auxiliary valves closed and be to the higher pressure as directed by the District.

All pumping equipment and pressure gauges shall be provided by the contractor. After achieving the test pressure, the piping shall be left closed for a period of two (2) hours. At the end of this time the pressure drop shall not exceed 2 PSI.
In addition, if the pressure appears, in the judgment of the District's representative, to be continuing to drop, the test shall be continued for another two (2) hours and if any further drop occurs, the test shall be considered a failure. If the pressure test fails, the contractor will be required to find and correct the source of the leakage. If this requires draining of the pipeline, when the leakage is corrected, the piping must be re-disinfected and the pressure tested again until satisfactory results are achieved.

De-chlorination will be performed by the Contractor prior to any chlorinated waters being released into the environment. Complete de-chlorination must be achieved.

Section 4.03 Leakage Testing
Testing for leakage shall be performed on all water mains. At the completion of the pressure test, the water main shall be re-pressurized to the test pressure by pumping potable water into the main. The volume of water required to re-pressurize the main shall be measured. All mains shall meet leakage standards per AWWA C500. The maximum allowable leakage rate shall be calculated using the following equation:

$$L = \frac{SD(P)(L)(S) + 148.000}{P}$$

Where: L = allowable leakage, in gallons per hour; S = length of pipe in feet; section, in feet; D = pipe diameter, in inches; P = average test pressure, psi.

If the volume of water put back into the main exceeds the maximum allowable leakage, as calculated by the equation above, the Contractor will be required to find and correct the source of the leakage. If this requires draining of the pipeline, when the leakage is corrected, the piping must be re-disinfected and the leakage test shall be performed again until satisfactory results are achieved. The testing requirements for pressure and duration shall be the same as those for the pressure test.

De-chlorination will be performed by the Contractor prior to any chlorinated waters being released into the environment. Complete de-chlorination must be achieved.

Section 4.04 Flushing
After satisfactory disinfection is achieved, all piping shall be thoroughly flushed until all water discharged is visibly clear. A final chlorine residual test will then be taken and the chlorine residual must be between 0.5 - 2.0 mg/L. If the residual is too high, additional flushing shall be done until the desired residual is obtained. If the residual is too low, the entire disinfection and flushing procedure shall be repeated until the desired results are achieved. Complete de-chlorination of discharged water shall be performed by the Contractor.

Section 4.05 Bacteriological Testing
After satisfactory disinfection and pressure testing, a sample shall be taken by the Contractor in the presence of a District representative and submitted to a laboratory approved by the MDNR and the District for bacteriological analysis. After 24 hours, a second sample shall be taken in a like manner and submitted for analysis. The two samples must be found to be "safe" by the testing laboratory, and copies of the test results must be supplied to the District. If the samples are not found to be "safe" further flushing and/or disinfection as directed by the District shall be conducted by the Contractor until "safe" samples on two consecutive days are achieved. Following successful bacteriological testing and a determination by the District that the samples are "safe", the mains may be placed into service.
If mains are not placed into service within 90 days samples must be retaken.

Section 4.06 Final Inspection and Trooper Wire Testing
After all work is completed and all disinfection, pressure testing, flushing and bacteriological testing is complete, the Contractor shall conduct a locator wire test between all sections of the wire in the presence of a District representative. If the test is satisfactory, all splices in valve boxes shall be made permanent by means of 3-M splice kits or approved equal. If the tests fail in a section, the Contractor must find and repair any failure in the locator wire.

A final inspection shall be made by a District representative and all valves and hydrants shall be plumb and be to proper grade and all cleanup work must be satisfactorily completed. The work shall be accepted only after completion of the final inspection. Any defects found in the final inspection shall be promptly corrected by the Contractor.

APPENDIX A
All Construction shall conform to the following taken from the "Design Guide for Community Water Systems" (effective August 25, 2003) as published by the MDNR and as partially reproduced below. As MDNR's requirements change in the future, the latest edition of their rules will apply.

8.6 Separation of Water Mains, Sanitary Sewers and Combined Sewers
8.6.1 General
The following factors should be considered in providing adequate separation:
a. Materials and type of joints for water and sewer pipes;
b. Soil conditions;
c. Service and branch connections into the water main and sewer line;
d. Compensating variations in the horizontal and vertical separations;
e. Space for repair and alterations of water and sewer pipes; and
f. Off-setting of water mains around manholes.

8.6.2 Parallel installation
Water mains shall be laid at least ten feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten-foot separation, the department may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer and on either case, at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. In areas where the recommended separation cannot be obtained, either the waterline or the sewer line shall be constructed of mechanical joint pipe or cased in a continuous casing.

8.6.3 Crossings
Water mains crossing sewers shall be laid to provide a minimum vertical clear distance of 18 inches between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer. At crossings, the full length of water pipe shall be located so both joints will be as far from the sewer as possible but in no case less than ten feet. Special structural support for the water and sewer pipes may be required in areas where the recommended separations cannot be obtained either the waterline or the sewer line shall be constructed of mechanical joint pipe or cased in a continuous casing that extends no less than ten feet on both sides of the crossing.

8.6.4 Exception
Any variance from the specified separation distances in paragraphs 8.6.2 and 8.6.3 must be submitted to the department for approval.

8.6.5 Force mains
There shall be at least a ten-foot horizontal separation between water mains and sanitary sewer force mains and they shall be in separate branches. In areas where these separations cannot be obtained, either the waterline or the sewer line shall be cased in a continuous casing.

8.6.6 Sewer manholes
No waterline shall be located closer than ten feet to any part of a sanitary or combined sewer manhole.

8.6.7 Disposal facilities
No waterline shall be located closer than 25 feet to any on-site wastewater disposal facility, agricultural waste disposal facility, or landfill.

APPENDIX B
All Construction shall conform to the following taken from the "Design Guide for Community Water Systems" (effective August 25, 2003) as published by the Missouri Department of Natural Resources and as partially reproduced below. As MDNR's requirements change in the future, the latest edition of their rules will apply.

8.7 Surface Water Crossings
Surface water crossings, whether over or under water, present special problems. The department shall be consulted before final plans are prepared. Positive joints shall be required in waterways and wet weather streams.

8.7.1 Above-water crossings
The pipe shall be adequately supported and anchored, protected from damage and trespass and accessible for repair or replacement.

8.7.2 Underwater crossings
a. Flowing streams
A minimum cover of four feet shall be provided over the pipe. When crossing water courses are greater than 15 feet in width, the following shall be provided:
1. The pipe shall be of special construction, having flexible watertight joints. Steel or ductile iron ball-joint river pipe shall be used for open cut crossings. Restrained joint pipe may be used for open cut crossings, provided it is encased in a welded steel casing. Restrained joint pipe shall be used for bored crossings.
2. Valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair; the valves shall be easily accessible and should not be subject to flooding.
3. Permanent logs shall be provided on each side of the valve with a small meter to determine leakage and for sampling purposes.
4. The stream crossing pipe or casing shall extend at least 15 feet beyond the upper edge of the stream channel on each side of the stream.

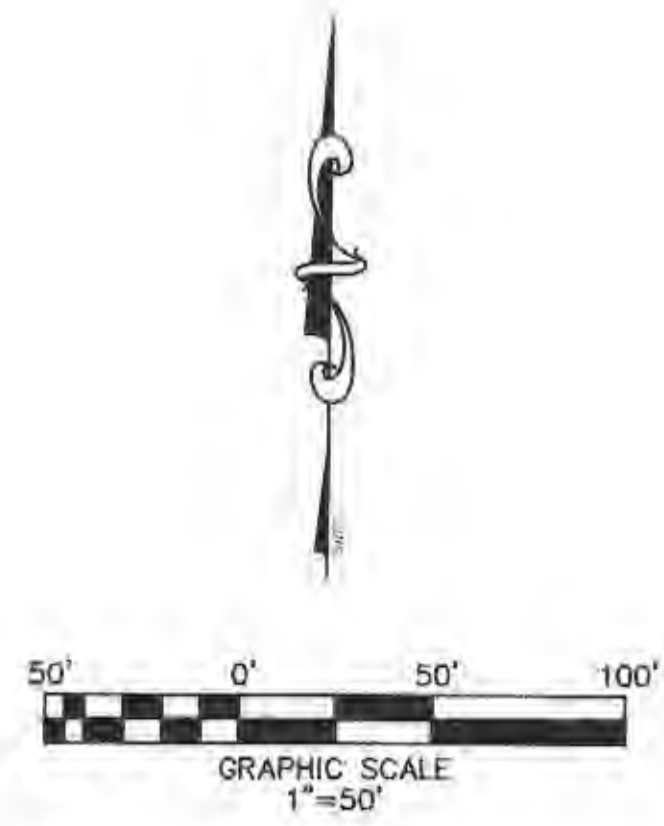
b. Intermittent flowing streams
1. Restrained joint pipe shall be used for all stream crossings.
2. The pipe shall extend at least 15 feet beyond the upper edge of the stream channel on each side of the stream.

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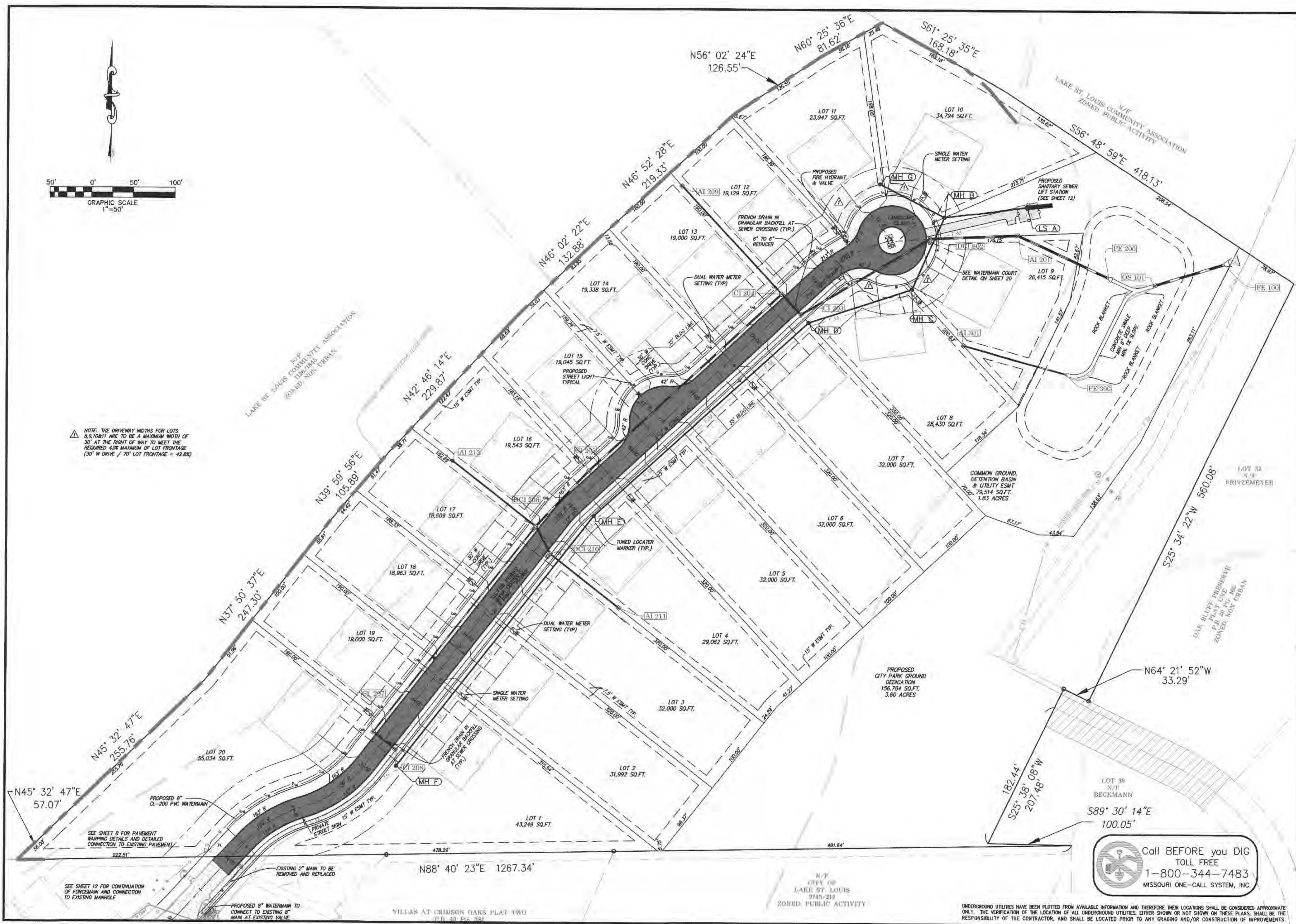
OAK BLUFF ESTATES
CONSTRUCTION PLANS
P.W.S.D. NO.2 NOTES

PROJECT NUMBER: 14-031946
DATE: 12/19/15
DRAWN BY: MLP

5 OF 23



NOTE: THE DRIVEWAY WIDTHS FOR LOTS 8, 9, 10 & 11 ARE TO BE A MAXIMUM WIDTH OF 30' AT THE RIGHT OF WAY TO MEET THE REQUIRED 4.5% MAXIMUM OF LOT FRONTAGE (30' W DRIVE / 70' LOT FRONTAGE = 42.8%)



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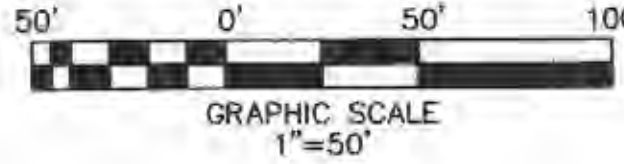
OAK BLUFF ESTATES
CONSTRUCTION PLANS
 FLAT PLAN

PROJECT NUMBER: 14-0546
 DATE: 12/01/15
 DRAWN BY: MJF

6 OF 23

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- NOTE:
1. THE PROPOSED GRADING ON LOTS 8 - 12 MUST BE CERTIFIED BY A SOILS ENGINEER THAT THE SLOPES AND SOILS ARE STABLE. BENCHES MUST BE CUT INTO THE SLOPE BEFORE GRADING OPERATIONS BEGIN SO THAT BACKFILL SOILS WILL NOT SLIDE DOWN THE SLOPE. A CERTIFIED SOILS ENGINEER SHALL BE PRESENT AT THE TIME OF GRADING.
 2. THE PROPOSED BUILDINGS ON LOTS 3 AND 4 SHALL HAVE EXTENDED FOUNDATION WALLS. THE FOUNDATION WALLS SHALL BE EXTENDED TO A DEPTH SO THAT THE FOUNDATION BEARING PLAN IS BELOW THE SEWER TRENCH.
 3. ALL STORM SEWER STREET CROSSINGS AND CUL-DE-SAC ISLAND TO HAVE TRAVERSE UNDER DRAIN INSTALLED. SEE DETAIL ON SHEET 3.
 4. THE REAR YARD SWALES SHALL HAVE A MINIMUM OF 1 FOOT OF FREEBOARD ABOVE THE DESIGN FLOW.
 5. LOTS 3 AND 4 SHALL HAVE AN EXTENDED FOUNDATION WALL ON THE SIDE FRONTING THE STORM SEWER RUN D2210 TO ADJ1. DEPTH OF FOUNDATIONS SHALL BE DETERMINED ON FINAL CONSTRUCTION PLAN DRAWINGS.
 6. REAR YARD SWALES SHALL BE SODED.

GRADING QUANTITIES:
 67,300 C.Y. CUT
 67,950 C.Y. FILL (includes 15.0% shrinkage)
 650 C.Y. FILL

The above yardage is an approximation only, NOT FOR BIDDING PURPOSES. Contractors shall verify quantities prior to construction.



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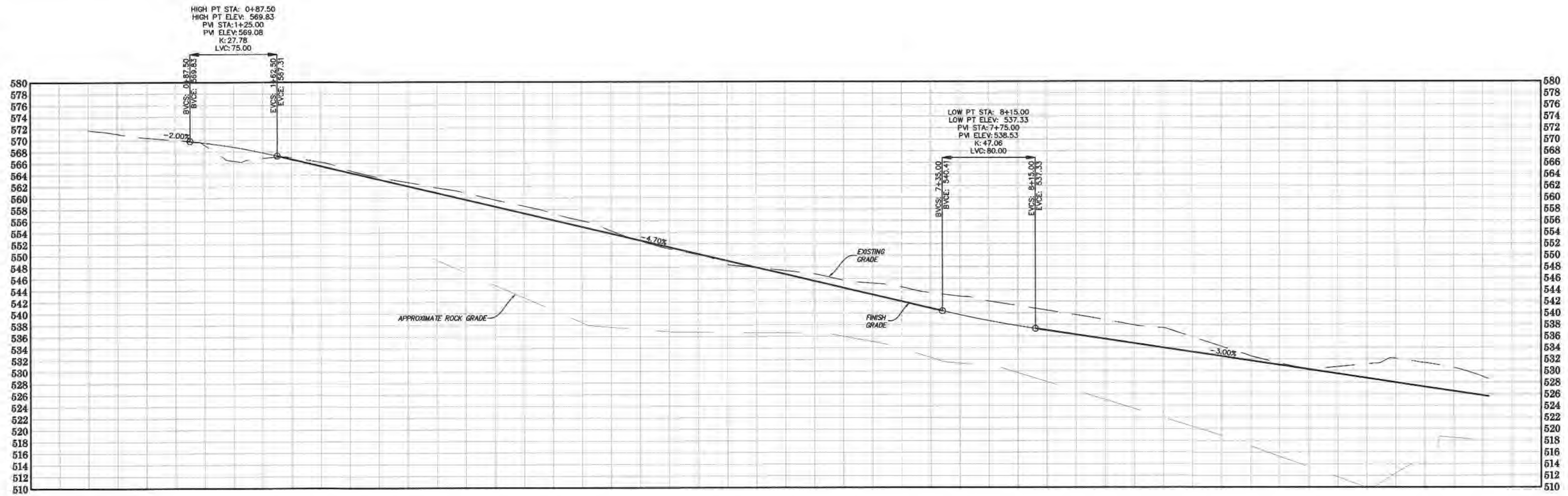
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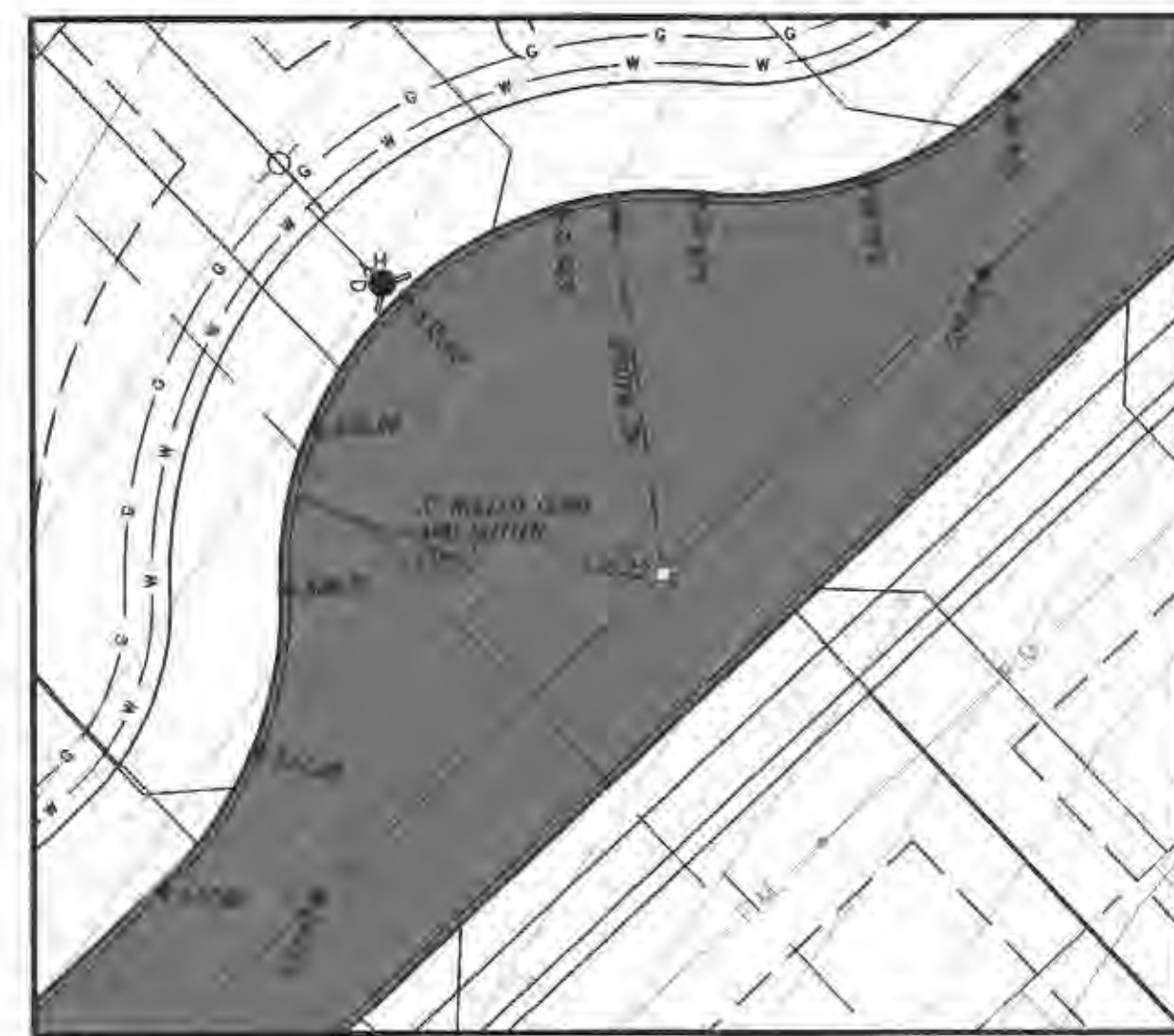
OAK BLUFF ESTATES
 CONSTRUCTION PLANS
 GRADING PLAN

PROJECT NUMBER: 14-0546
 DATE: 12/1/15
 DRAWN BY: MLP

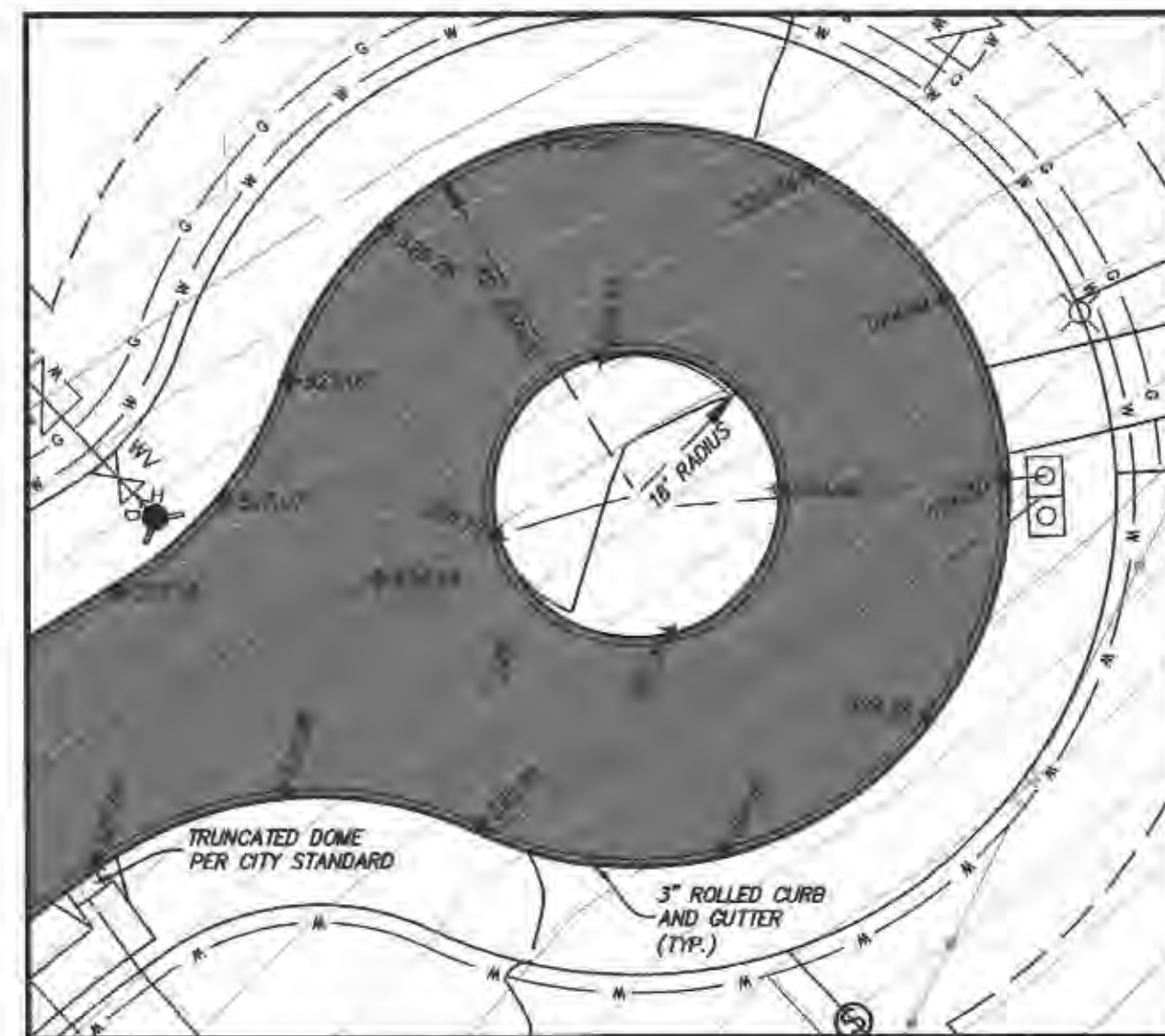
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HORIZ. 1"=50'
SCALE:



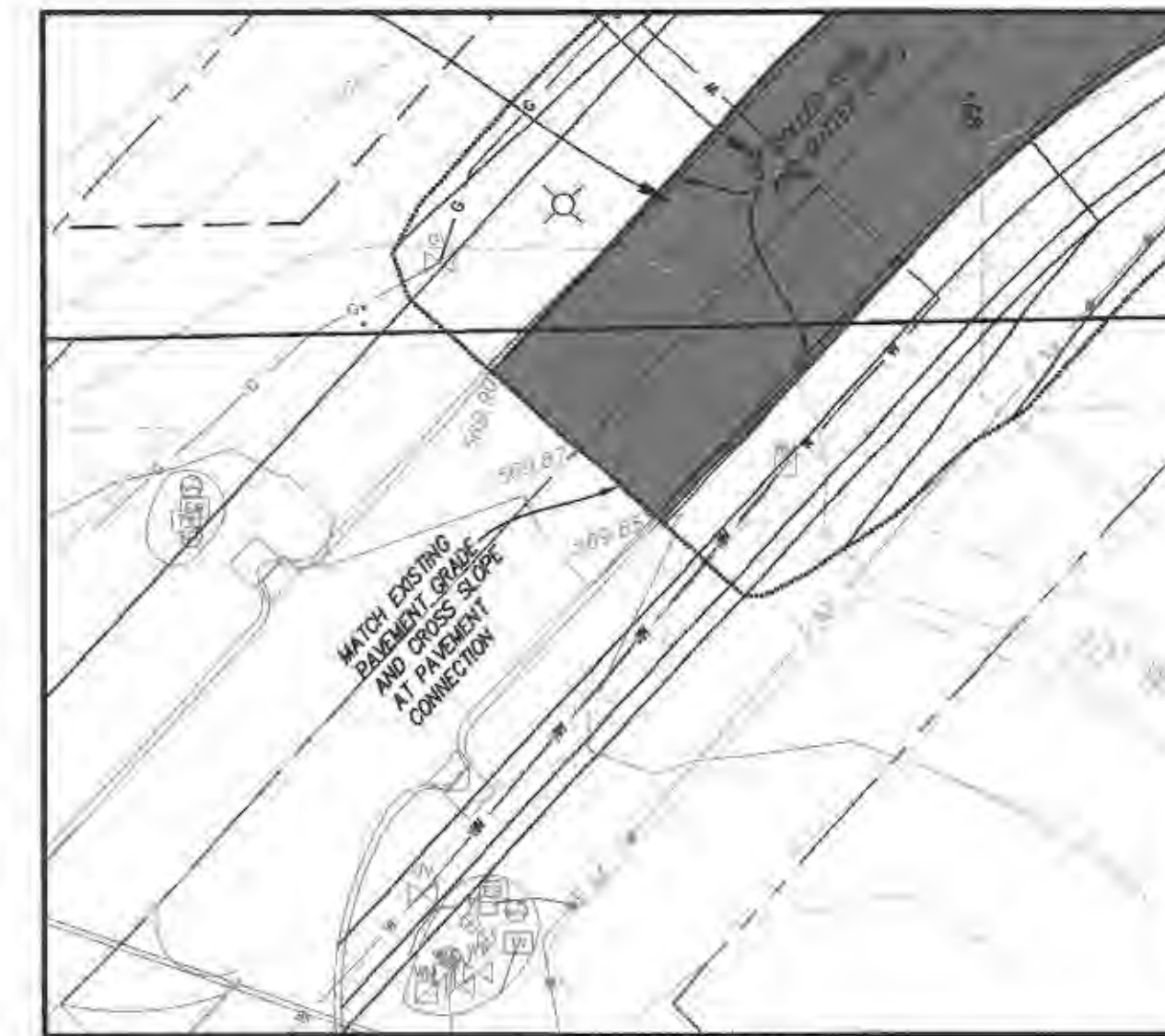
571.7	570.4	569.2	569.85	568.9	567.87	566.2	565.85	563.6	563.20	561.7	560.85	559.8	558.50	557.1	556.15	554.3	553.80	551.2	551.45	548.4	548.10	547.4	546.75	545.7	544.40	544.5	542.05	542.9	539.75	541.3	537.80	538.7	536.88	537.9	534.78	535.9	533.28	532.6	531.78	530.2	530.28	531.2	528.78	531.4	527.28	529.0	525.78
-0+50	0+00	0+50	1+00	1+50	2+00	2+50	3+00	3+50	4+00	4+50	5+00	5+50	6+00	6+50	7+00	7+50	8+00	8+50	9+00	9+50	10+00	10+50	11+00	11+50	12+00	12+50																					



WARPING DETAIL - EYE BROW CUL-DE-SAC
* ALL SPOTS ARE TO TOP OF PAVEMENT ELEVATION



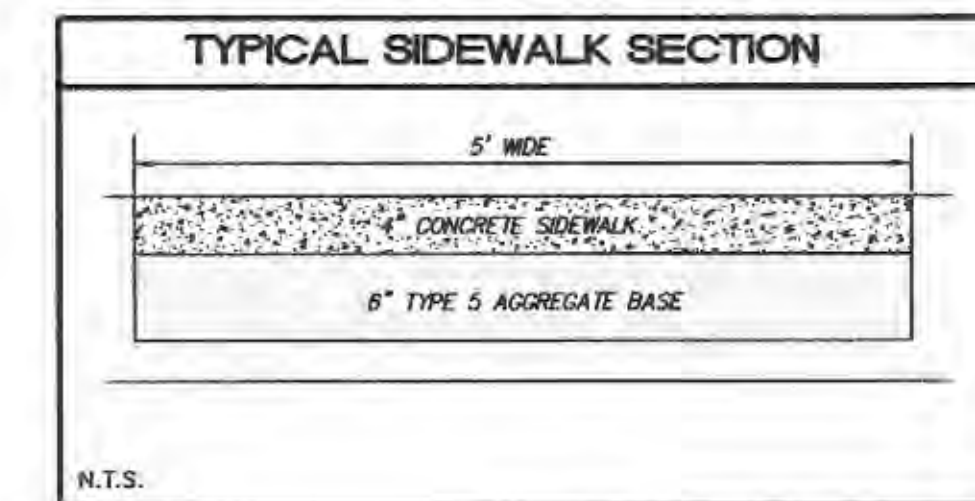
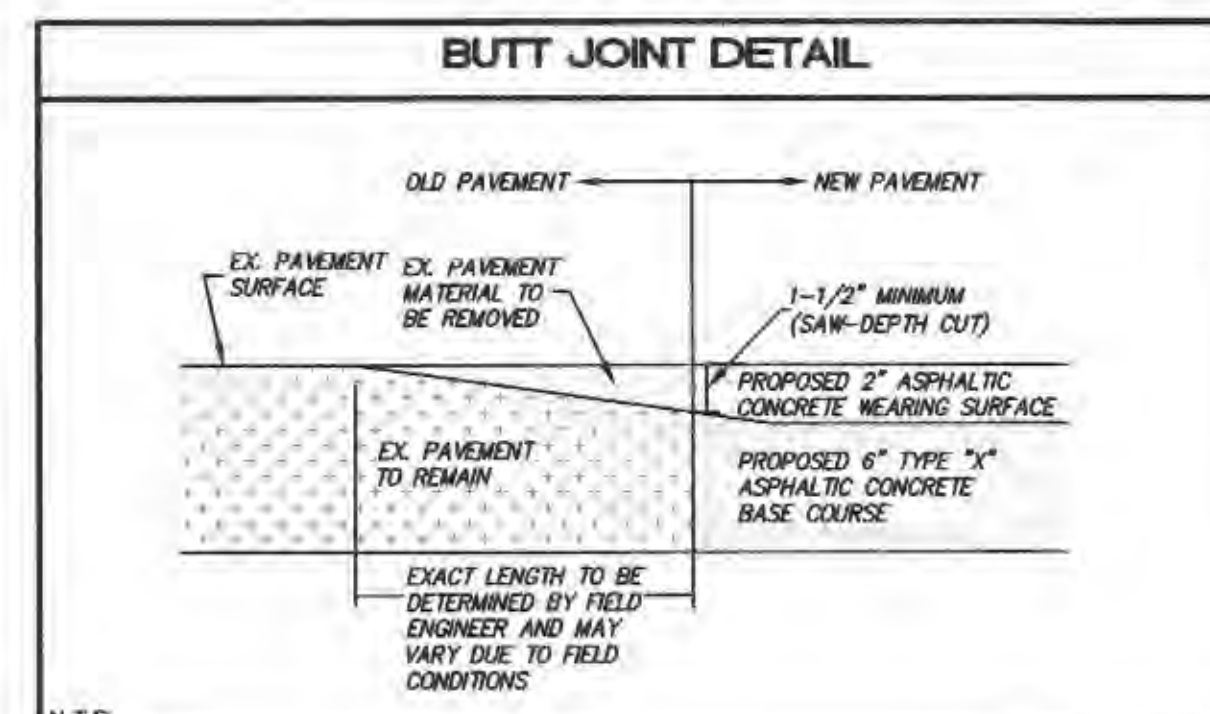
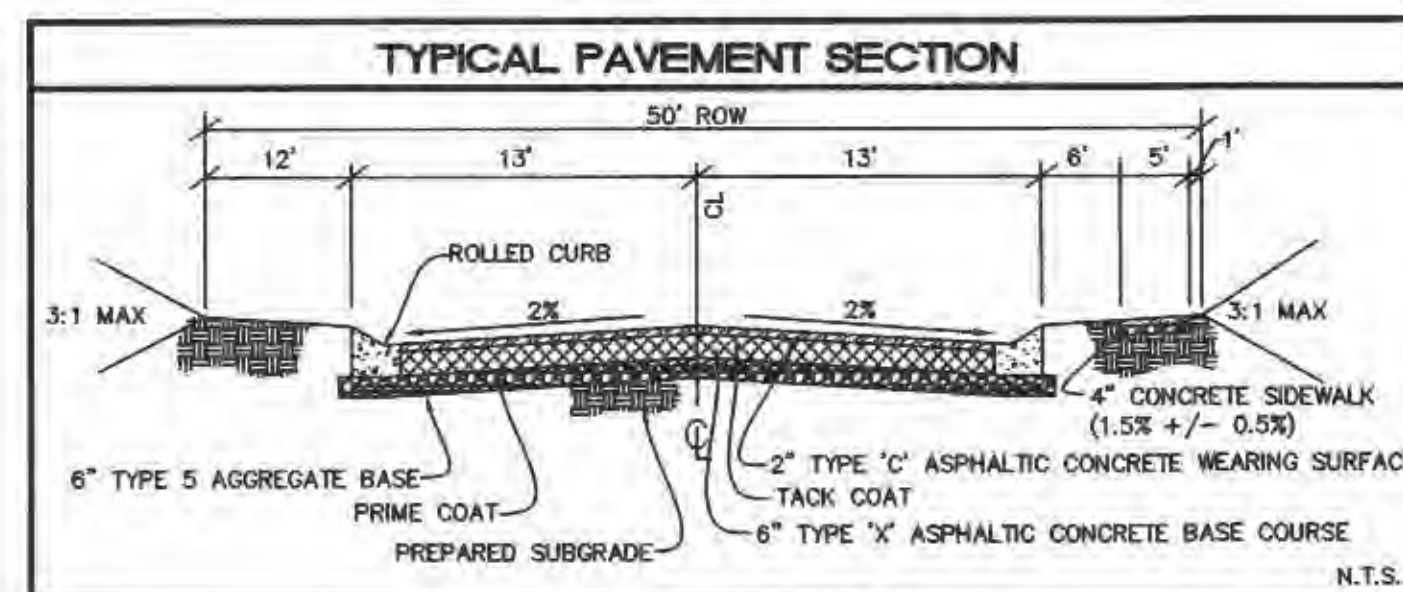
WARPING DETAIL - CUL-DE-SAC
* ALL SPOTS ARE TO TOP OF PAVEMENT ELEVATION



WARPING DETAIL - HEADER CONNECTION
* ALL SPOTS ARE TO TOP OF PAVEMENT ELEVATION

PAVEMENT SECTION

- OPTION 1:
2" MODOT BP-1 ASPHALTIC CONCRETE WEARING SURFACE
6" MODOT ASPHALTIC CONCRETE BASE COURSE
6" TYPE 5 AGGREGATE BASE
- OPTION 2:
7" PORTLAND CEMENT CONCRETE
6" TYPE 5 AGGREGATE BASE



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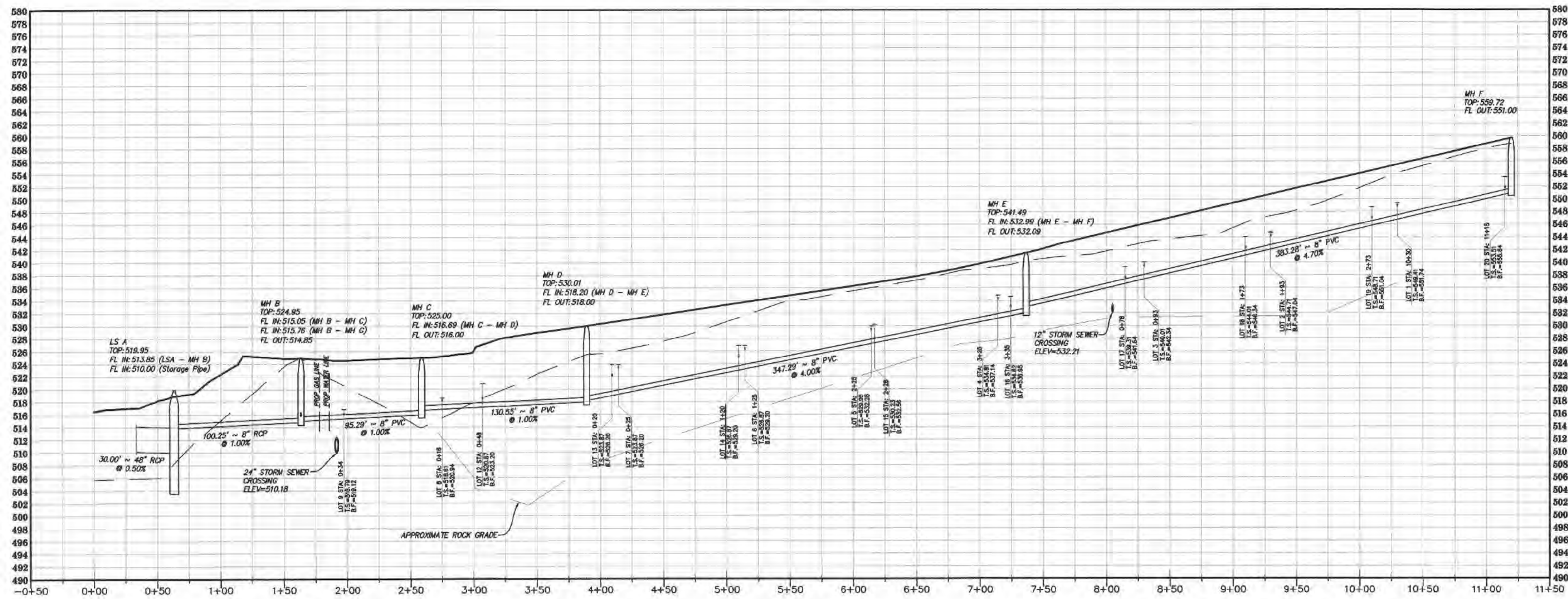
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STREET PROFILE & WARPING DETAILS

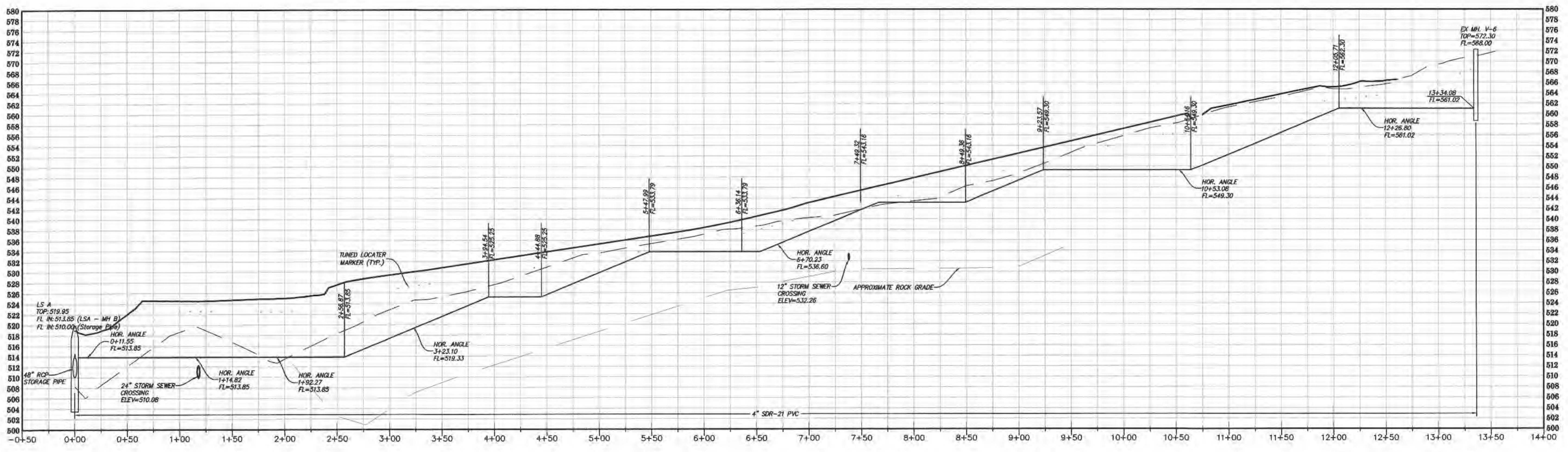
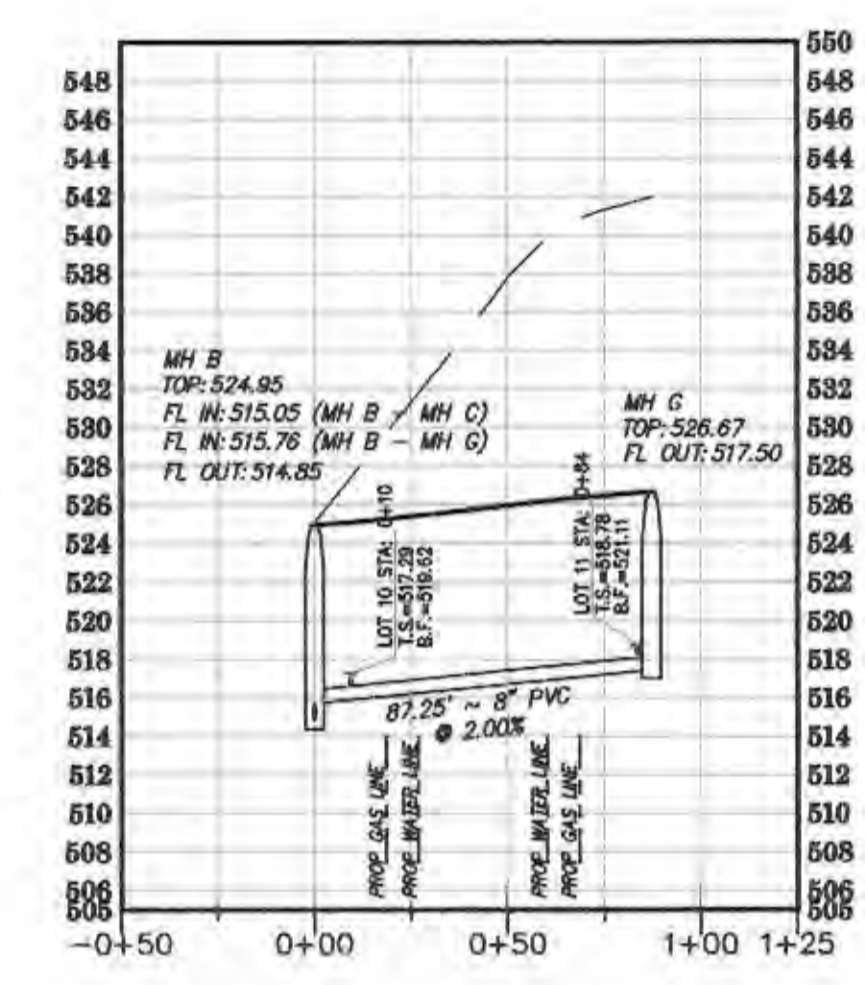
PROJECT NUMBER: 14-0546

DATE: 12/10/15

DRAWN BY: MLF



VERT.
1"=10'
HORIZ.
1"=50'
SCALE:



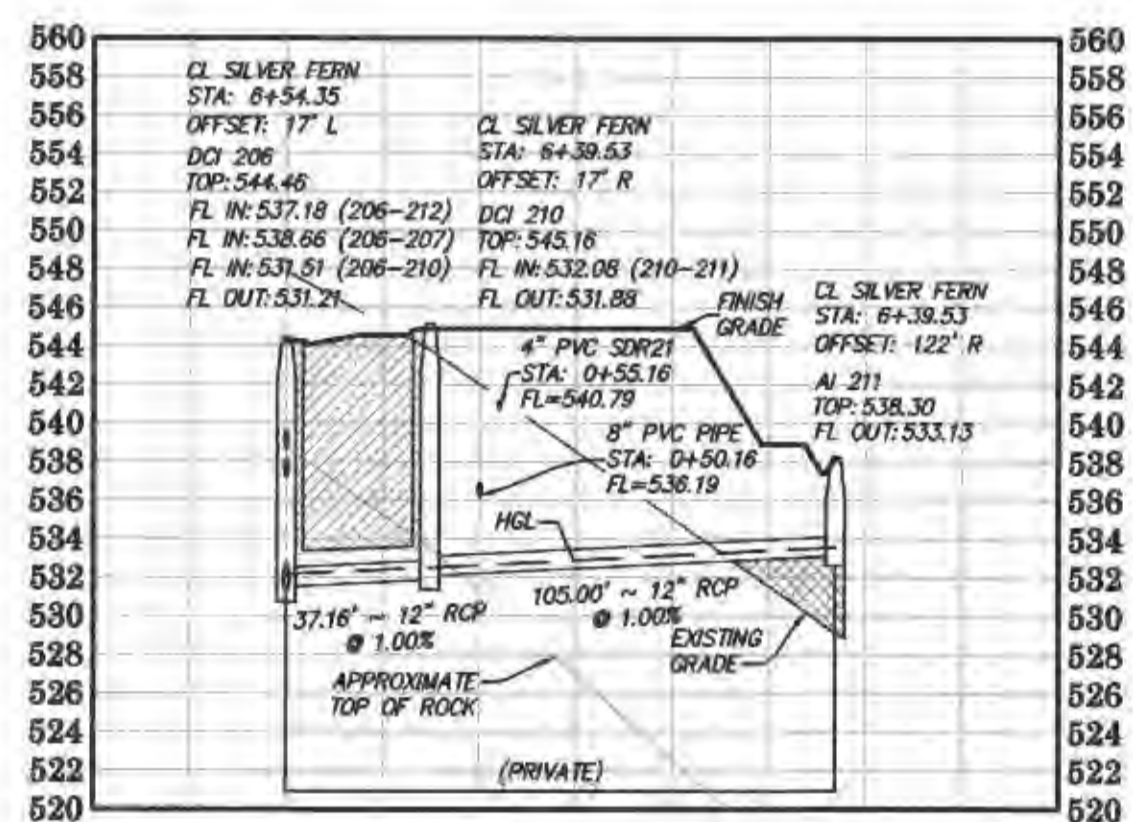
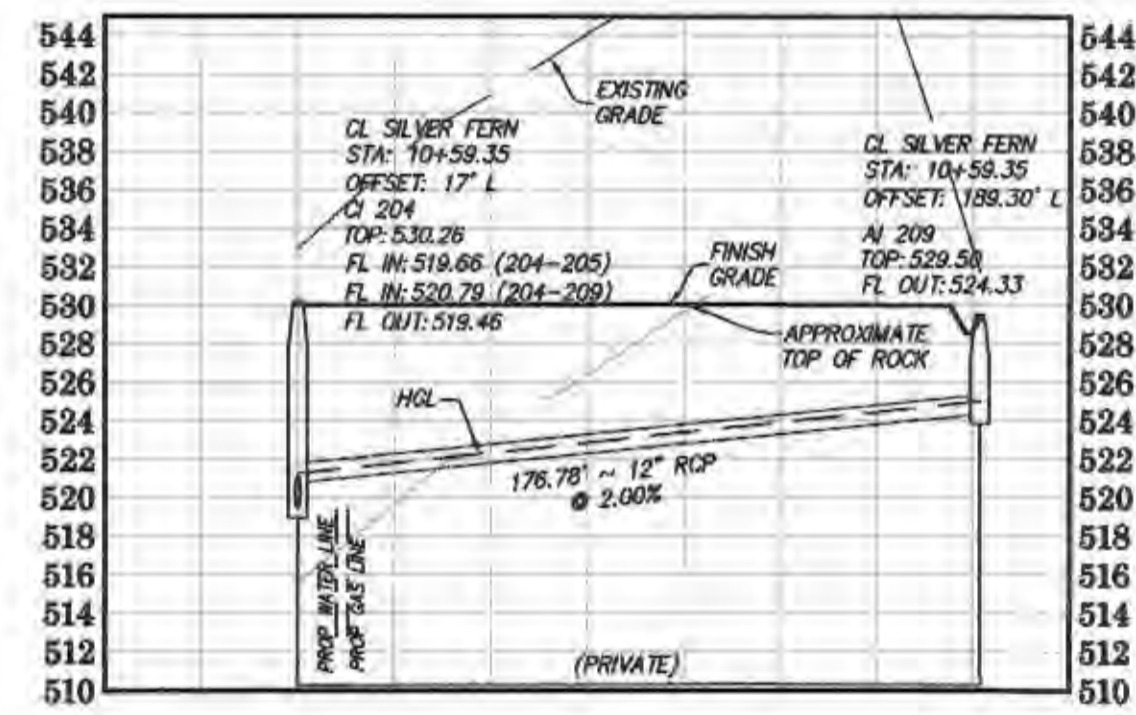
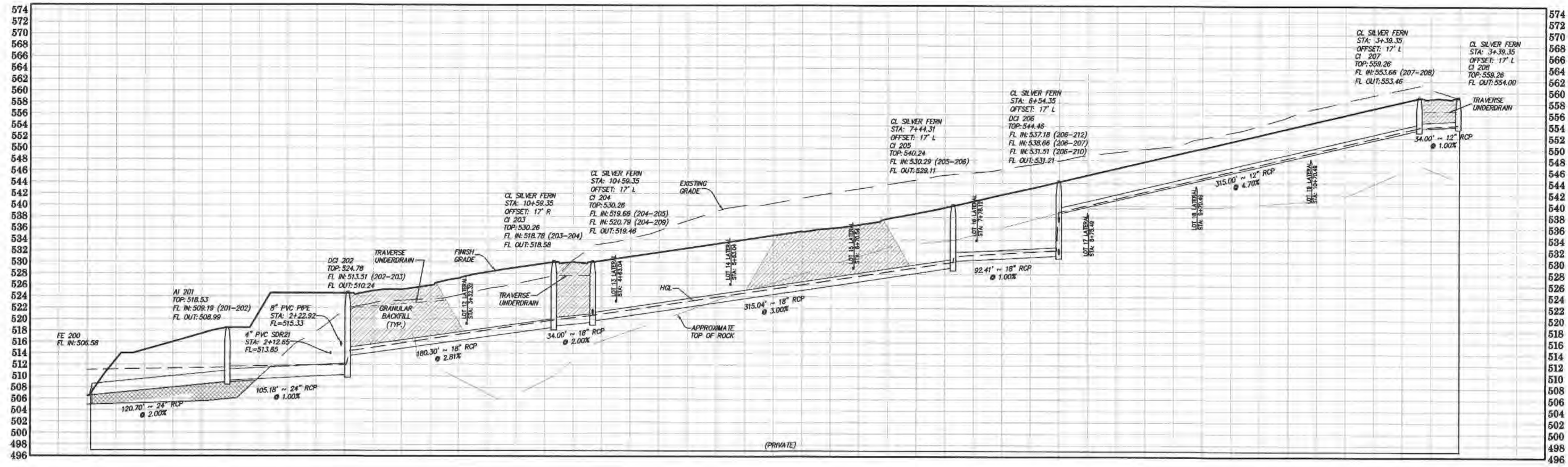
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OAK BLUFF ESTATES
CONSTRUCTION PLANS
SANITARY SEWER PROFILES

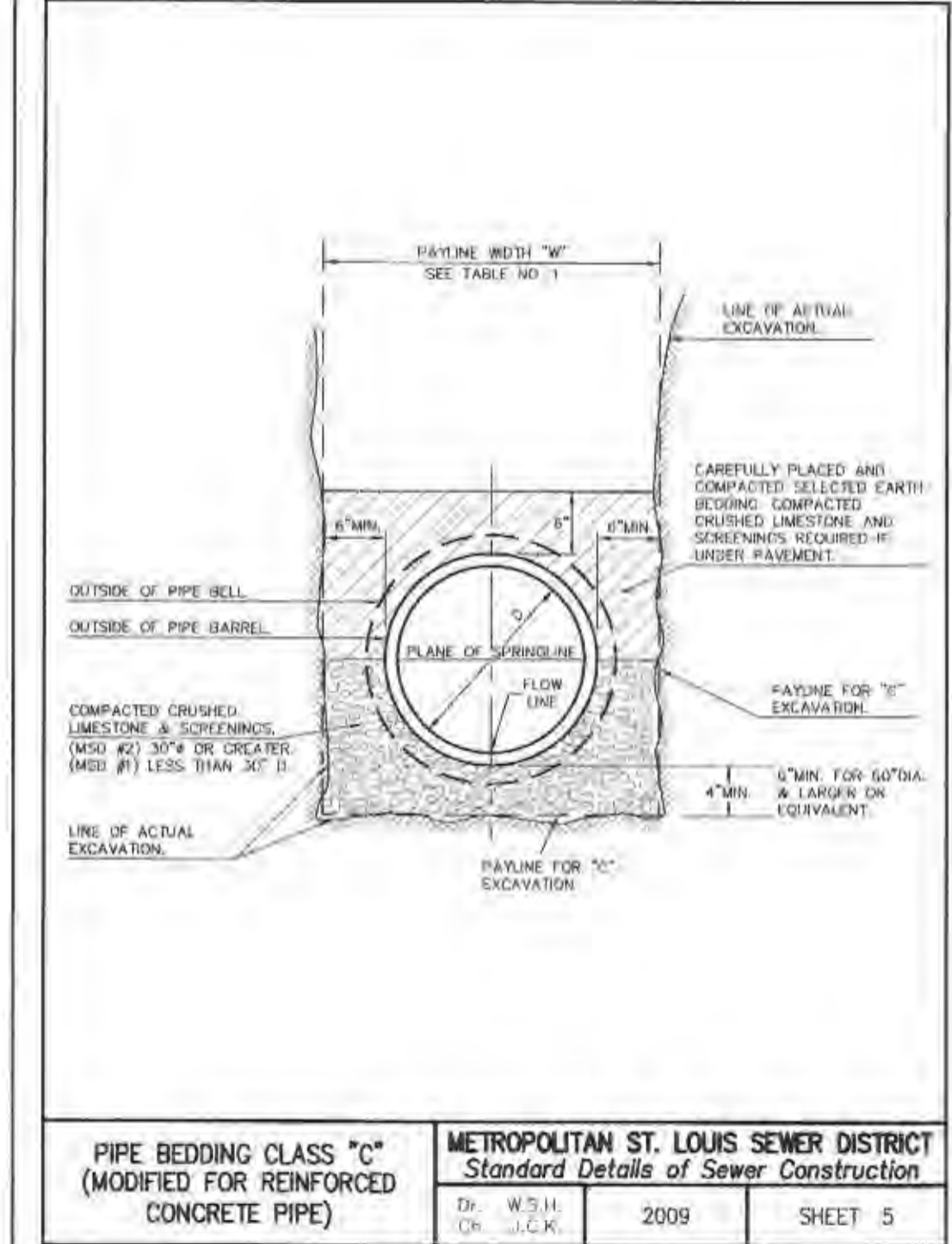
PROJECT NUMBER: 14-0546
DATE: 12/10/15
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ROUND PIPE				HORIZONTAL ELLIPTICAL PIPE			
INSIDE DIAMETER OF PIPE (INCHES)	"W" PAYLINE WIDTH OF TRENCH (INCHES)	"M" PAYLINE WIDTH OF TRENCH (FEET)	PAY-VOLUMES CU. FT. PER FT.	INSIDE DIMENSIONS SP. PIPE (INCHES)	"W" PAYLINE WIDTH OF TRENCH (INCHES)	"M" PAYLINE WIDTH OF TRENCH (FEET)	PAY VOLUMES CU. FT. PER FT.
4	30	2.50	5.28				
6	30	2.50	3.98				
8	30	2.50	3.07				
10	30	2.50	4.08				
12	30	2.50	4.25				
15	36	3.00	5.55				
18	36	3.00	5.77	14 x 23	41	3.42	5.94
21	39	3.25	6.61				
24	42	3.50	7.39	19 x 30	49	4.06	7.68
27	45	3.75	8.16	22 x 34	57	4.45	8.61
30	48	4.00	9.36	24 x 38	58	4.83	9.70
33	51	4.25	10.53	27 x 42	62	5.17	10.71
36	54	4.50	11.43	28 x 45	66	5.50	11.72
39	57	4.75	12.43	29 x 48	71	5.82	12.74
42	60	5.00	13.38	30 x 51	76	6.15	13.75
45	63	5.25	14.33	31 x 54	81	6.47	14.76
48	66	5.50	15.27	32 x 57	86	6.79	15.77
51	69	5.75	16.22	33 x 60	91	7.11	16.78
54	72	6.00	17.16	34 x 63	96	7.43	17.79
57	75	6.25	18.11	35 x 66	101	7.75	18.80
60	78	6.50	19.05	36 x 69	106	8.07	19.81
63	81	6.75	19.99	37 x 72	111	8.39	20.82
66	84	7.00	20.93	38 x 75	116	8.71	21.83
69	87	7.25	21.87	39 x 78	121	9.03	22.84
72	90	7.50	22.81	40 x 81	126	9.35	23.85
75	93	7.75	23.75	41 x 84	131	9.67	24.86
78	96	8.00	24.69	42 x 87	136	9.99	25.87
81	99	8.25	25.63	43 x 90	141	10.31	26.88
84	102	8.50	26.57	44 x 93	146	10.63	27.89
87	105	8.75	27.51	45 x 96	151	10.95	28.90
90	108	9.00	28.45	46 x 99	156	11.27	29.91
93	111	9.25	29.39	47 x 102	161	11.59	30.92
96	114	9.50	30.33	48 x 105	166	11.91	31.93
99	117	9.75	31.27	49 x 108	171	12.23	32.94
102	120	10.00	32.21	50 x 111	176	12.55	33.95
105	123	10.25	33.15	51 x 114	181	12.87	34.96
108	126	10.50	34.09	52 x 117	186	13.19	35.97
111	129	10.75	35.03	53 x 120	191	13.51	36.98
114	132	11.00	35.97	54 x 123	196	13.83	37.99
117	135	11.25	36.91	55 x 126	201	14.15	39.00
120	138	11.50	37.85	56 x 129	206	14.47	40.01
123	141	11.75	38.79	57 x 132	211	14.79	41.02
126	144	12.00	39.73	58 x 135	216	15.11	42.03
129	147	12.25	40.67	59 x 138	221	15.43	43.04
132	150	12.50	41.61	60 x 141	226	15.75	44.05
135	153	12.75	42.55	61 x 144	231	16.07	45.06
138	156	13.00	43.49	62 x 147	236	16.39	46.07
141	159	13.25	44.43	63 x 150	241	16.71	47.08

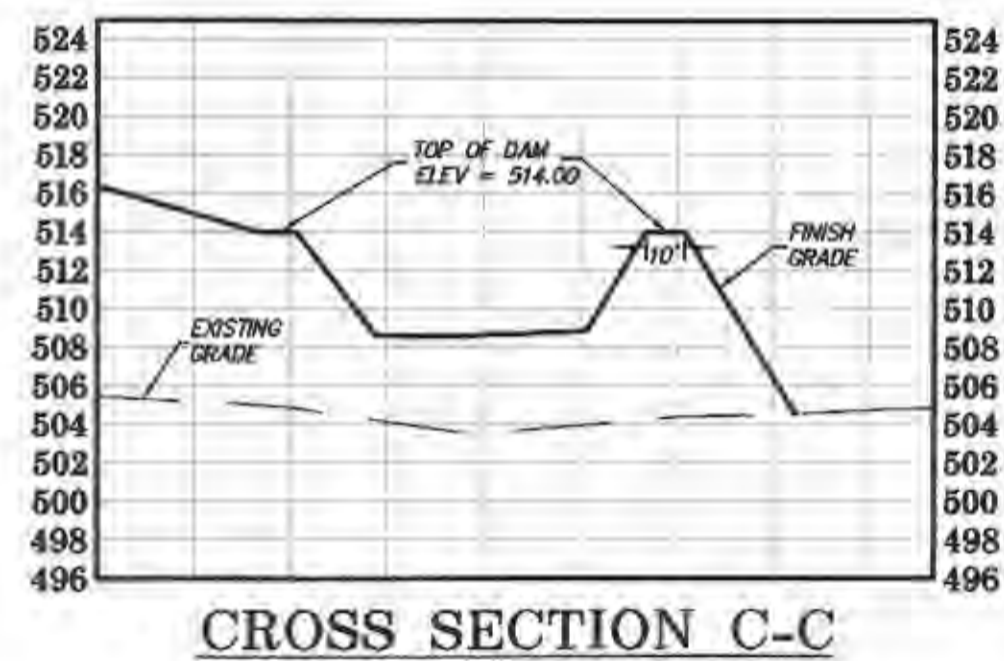
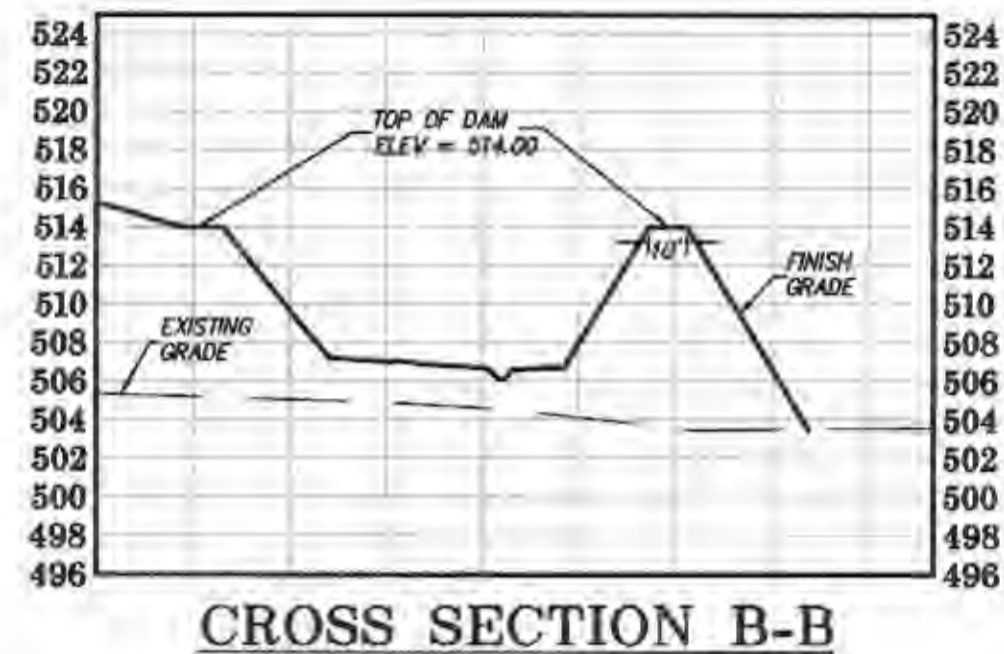
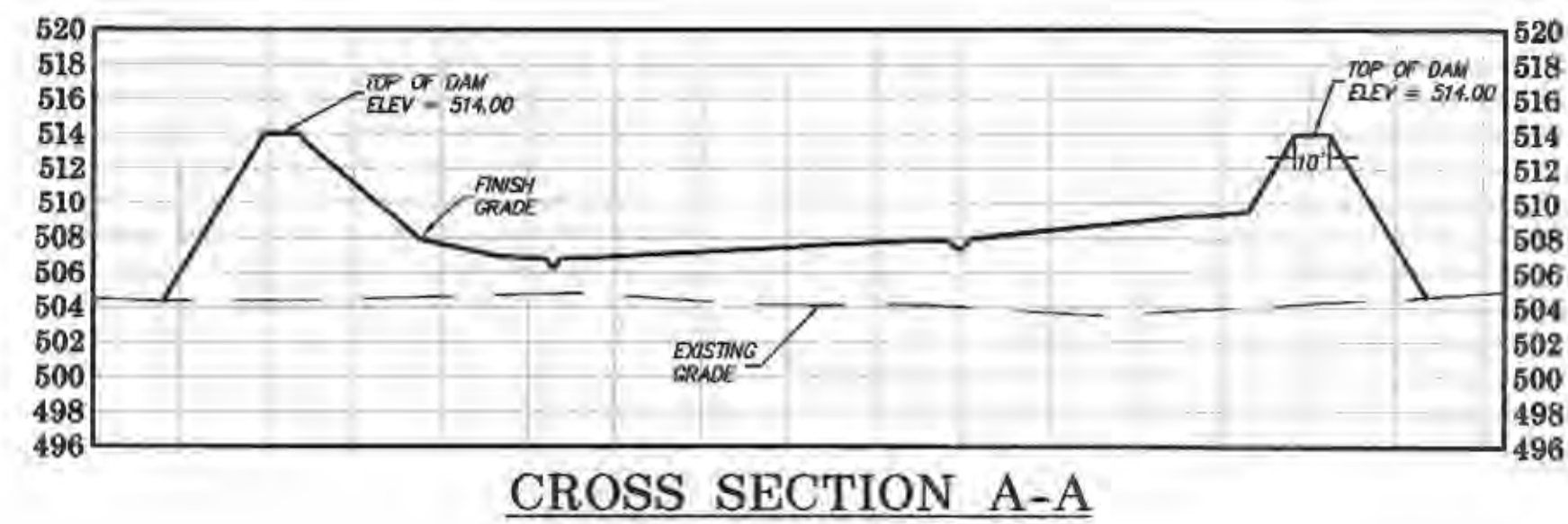


NOTE:
 1. All storm sewers shall be reinforced A.S.T.M. C-76, Class III minimum, unless otherwise shown on the plans.
 2. All storm sewer pipe in the roadway easement shall be reinforced concrete pipe (A.S.T.M. C-76, Class III minimum).

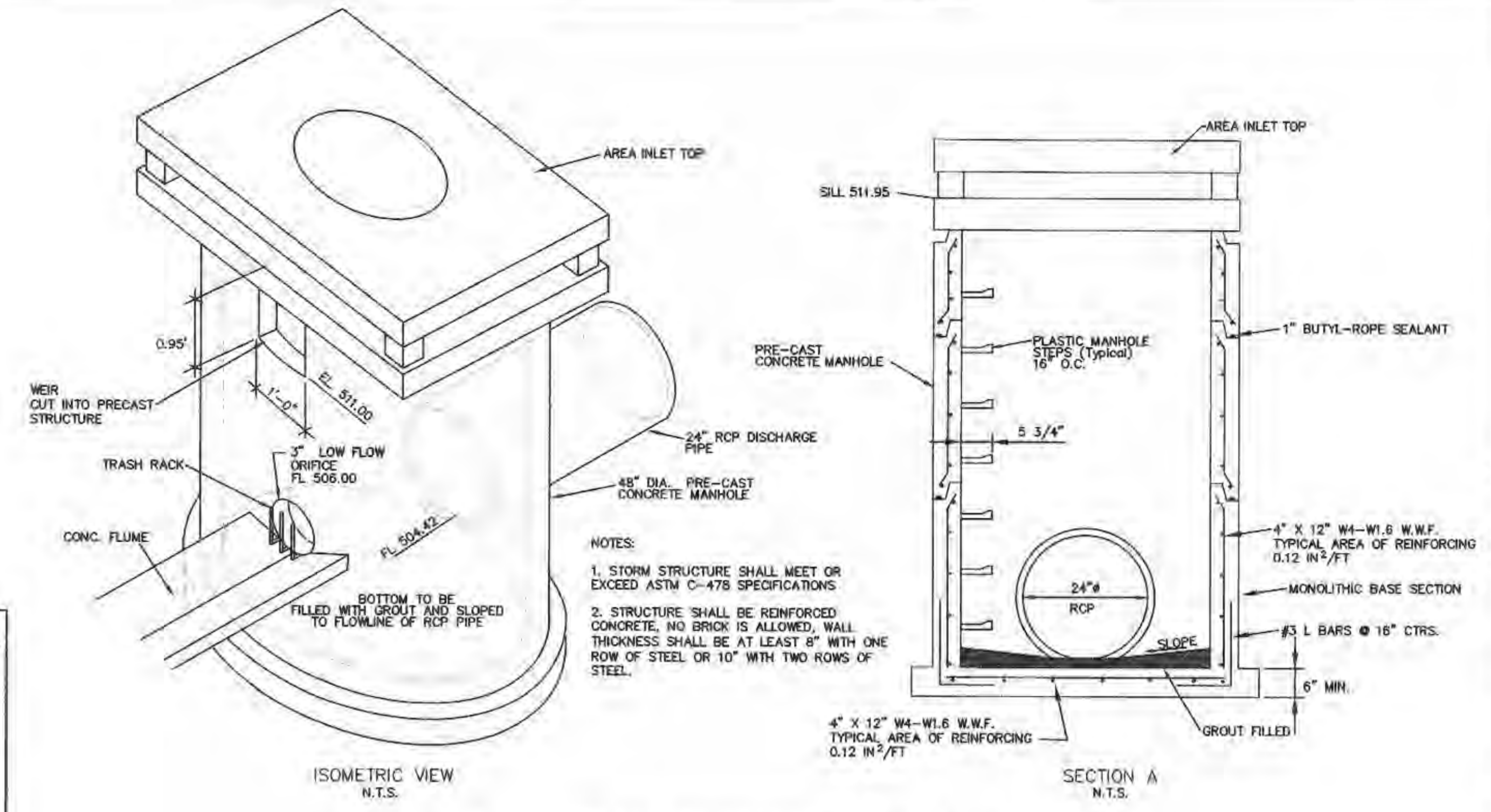
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OAK BLUFF ESTATES
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 STORM SEWER PROFILES

PROJECT NUMBER: 14-0546
 DATE: 1/21/15
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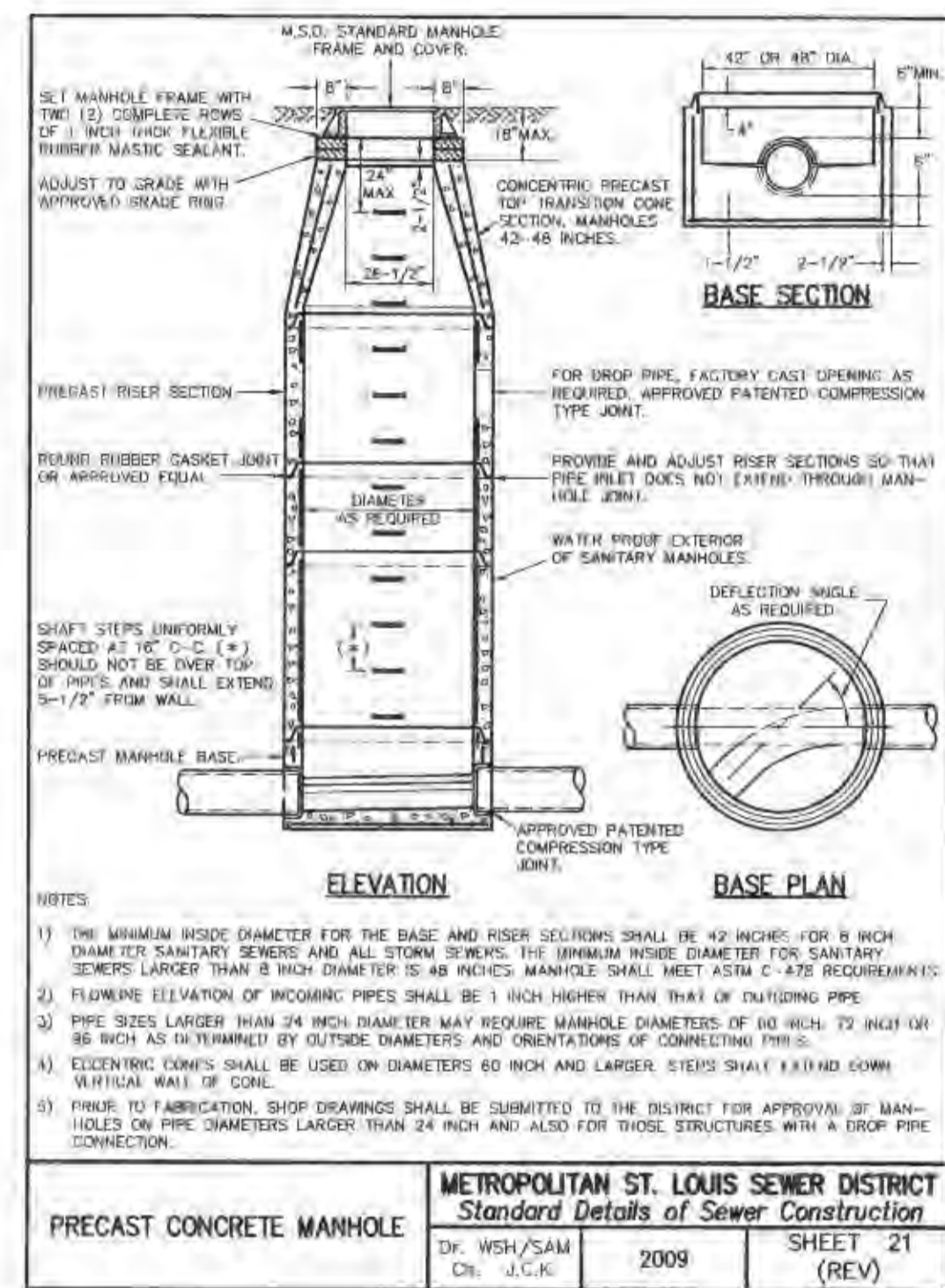


VERT. 1"=10'
HORIZ. 1"=50'
SCALE

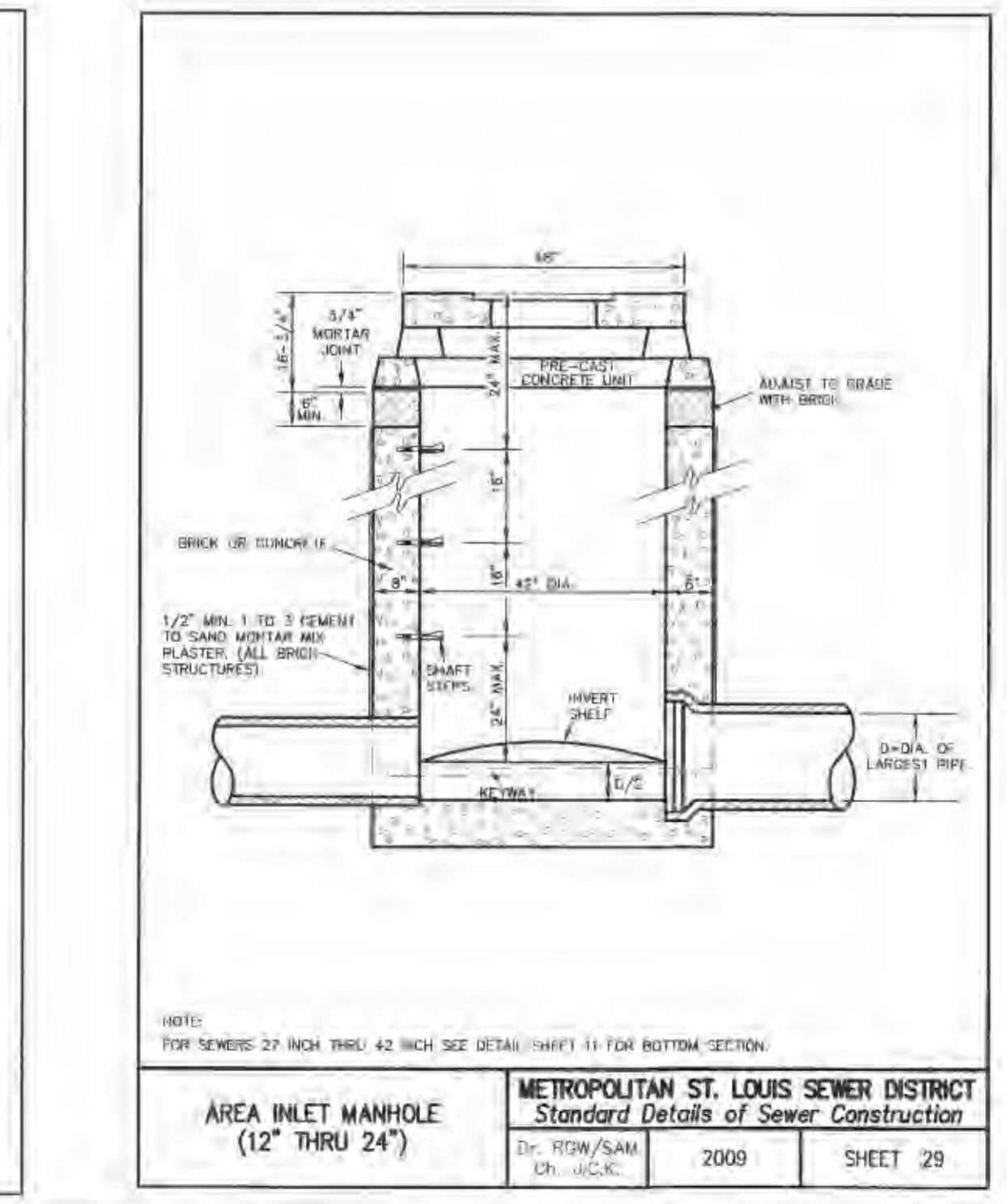
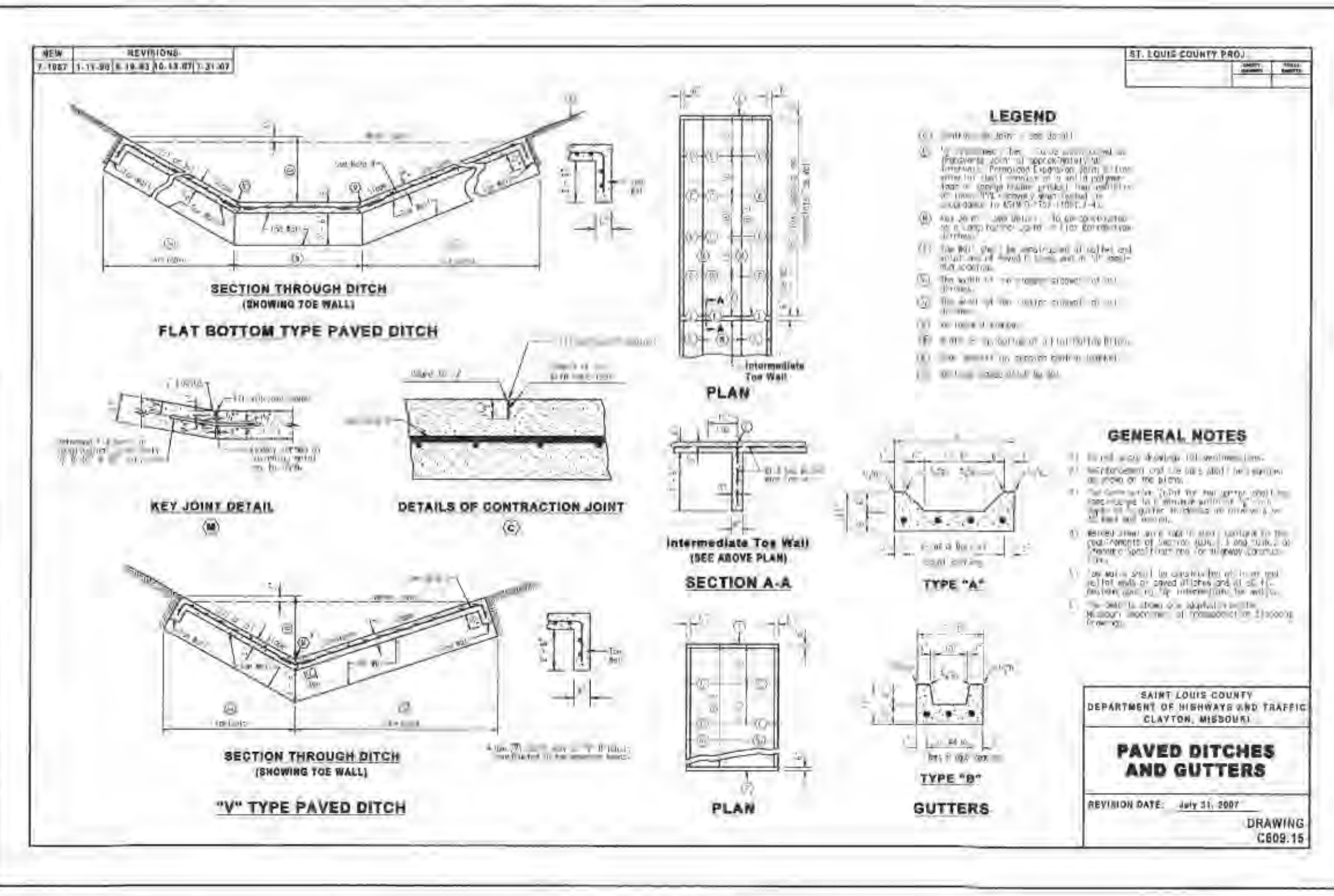


DETENTION STRUCTURE DETAIL

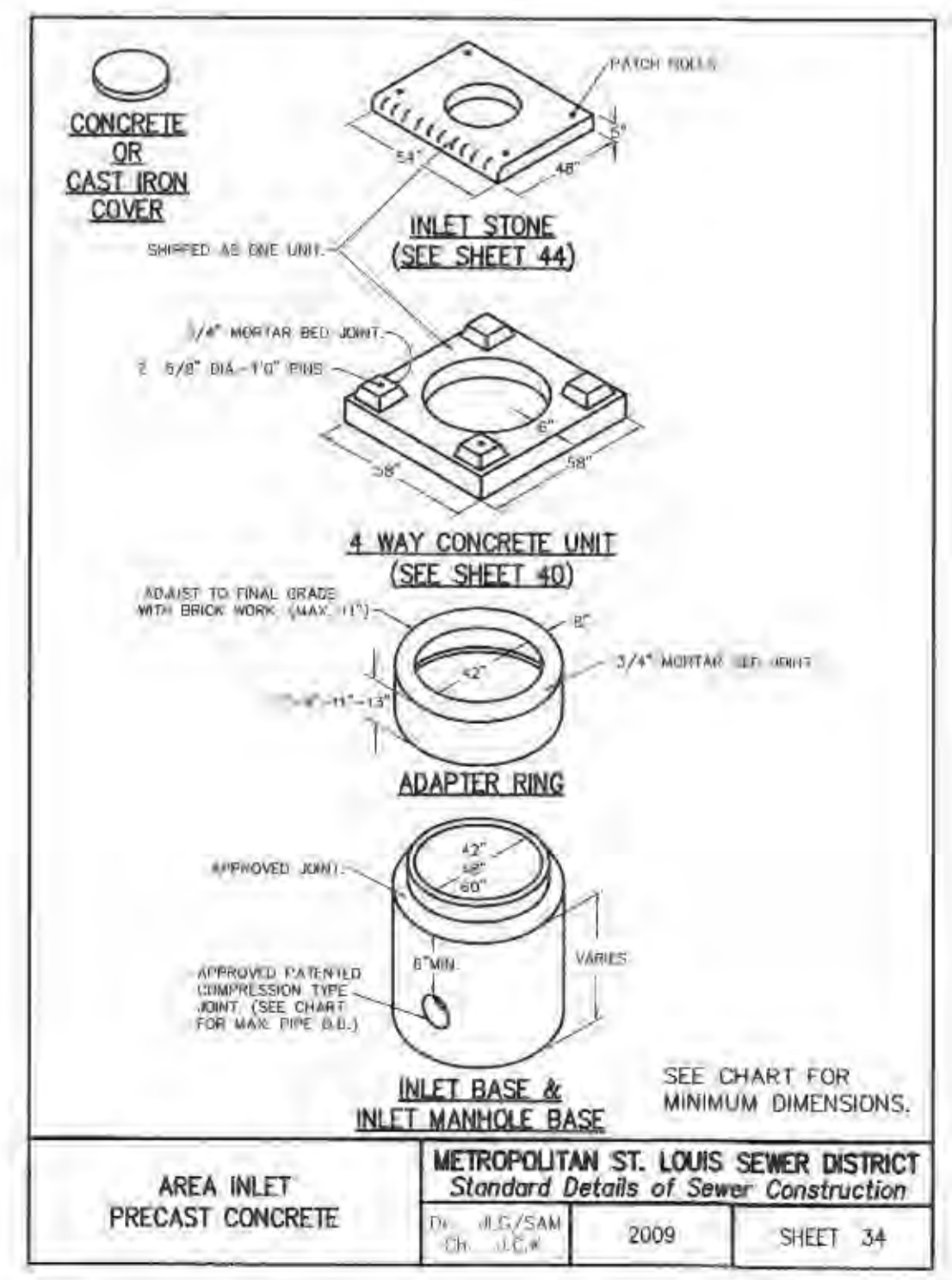
- All Storm Sewer Details will be by M.S.D. Standards and Specifications.
- Brick construction shall not be used for manholes or inlets.
- Concrete covers on structures will not be allowed. Only cast iron covers are permitted.



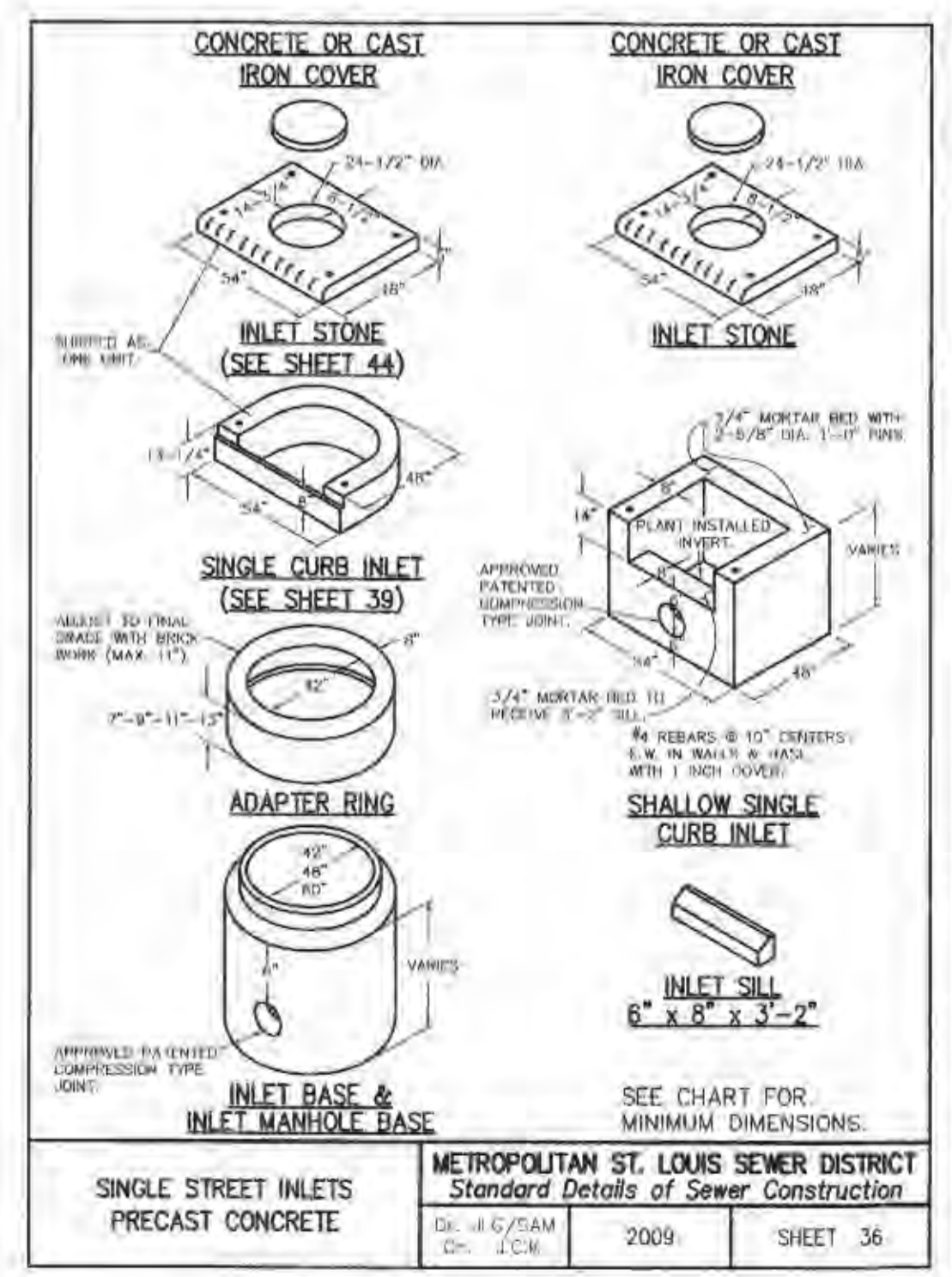
PRECAST CONCRETE MANHOLE	METROPOLITAN ST. LOUIS SEWER DISTRICT Standard Details of Sewer Construction
Dr. WSH/SAM Ch. J.C.K.	2009 SHEET 21 (REV)



AREA INLET MANHOLE (12" THRU 24")	METROPOLITAN ST. LOUIS SEWER DISTRICT Standard Details of Sewer Construction
Dr. RW/SAM Ch. J.C.K.	2009 SHEET 29



AREA INLET PRECAST CONCRETE	METROPOLITAN ST. LOUIS SEWER DISTRICT Standard Details of Sewer Construction
Dr. H.G./SAM Ch. J.C.K.	2009 SHEET 34

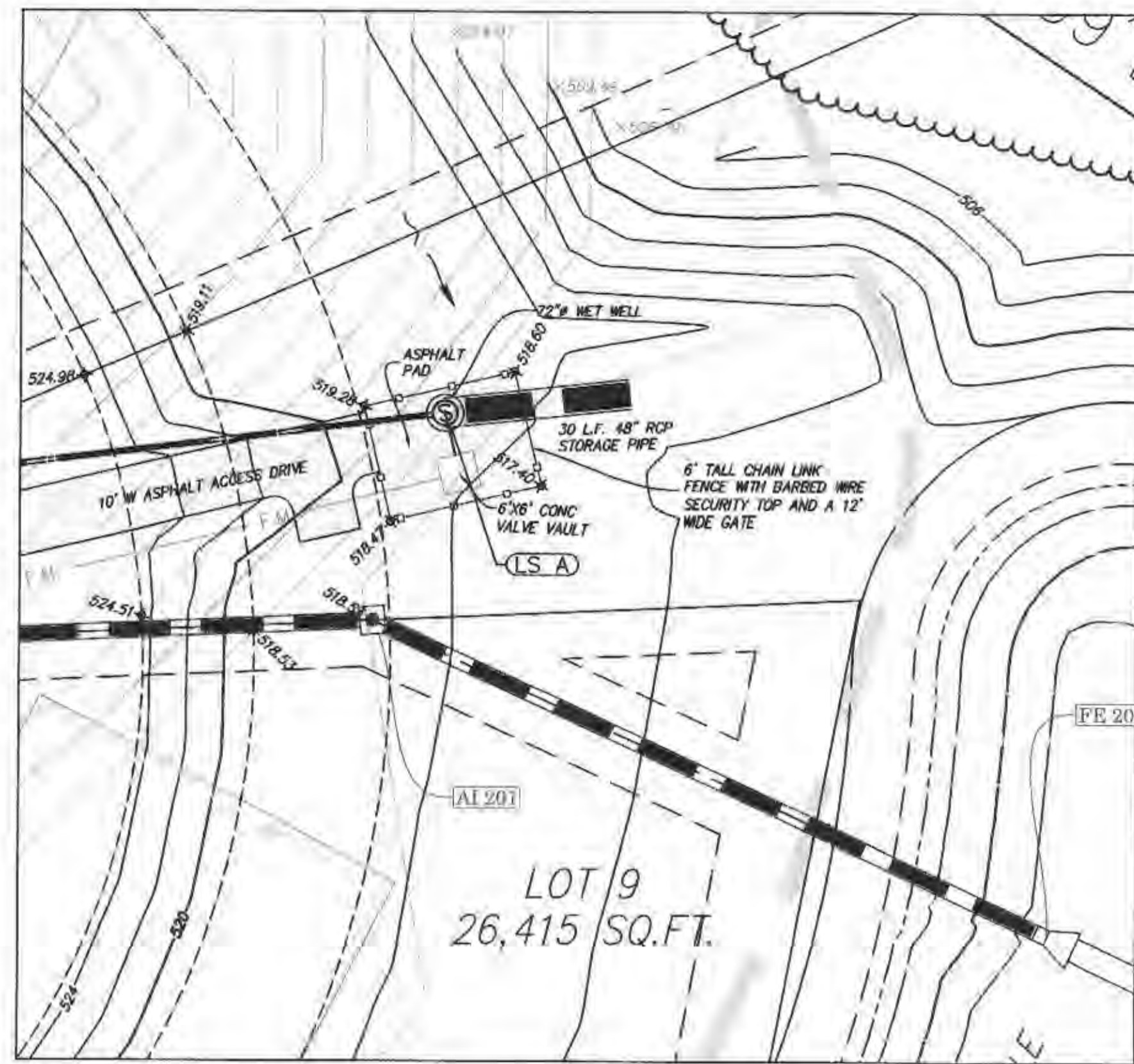


SINGLE STREET INLETS PRECAST CONCRETE	METROPOLITAN ST. LOUIS SEWER DISTRICT Standard Details of Sewer Construction
Dr. H.G./SAM Ch. J.C.K.	2009 SHEET 36

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OAK BLUFF ESTATES
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 BASIN X-SECTIONS & OUTFALL DETAIL

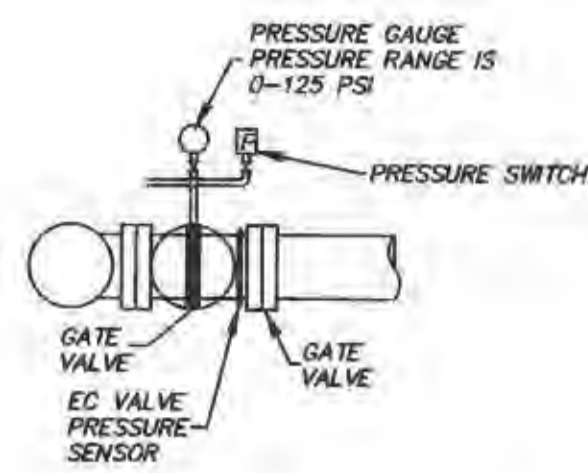
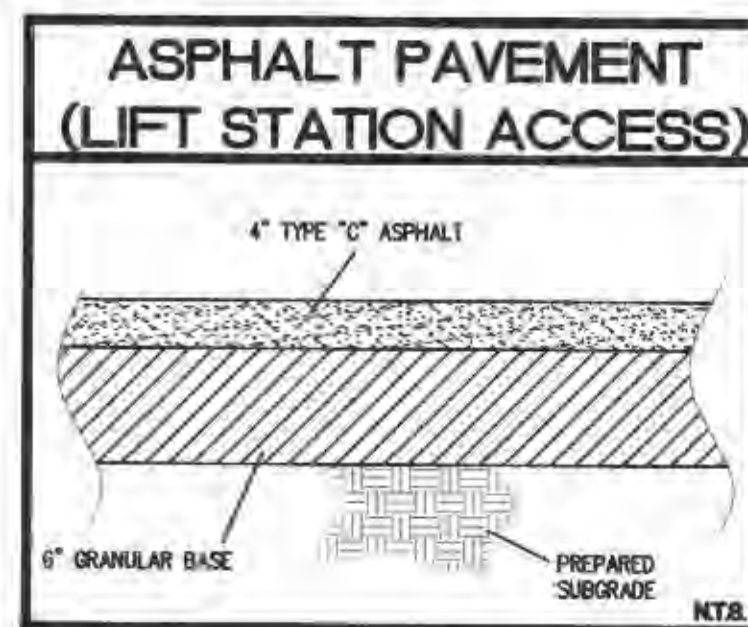
PROJECT NUMBER: 14-0596
DATE: 12/10/15
DRAWN BY: MLP



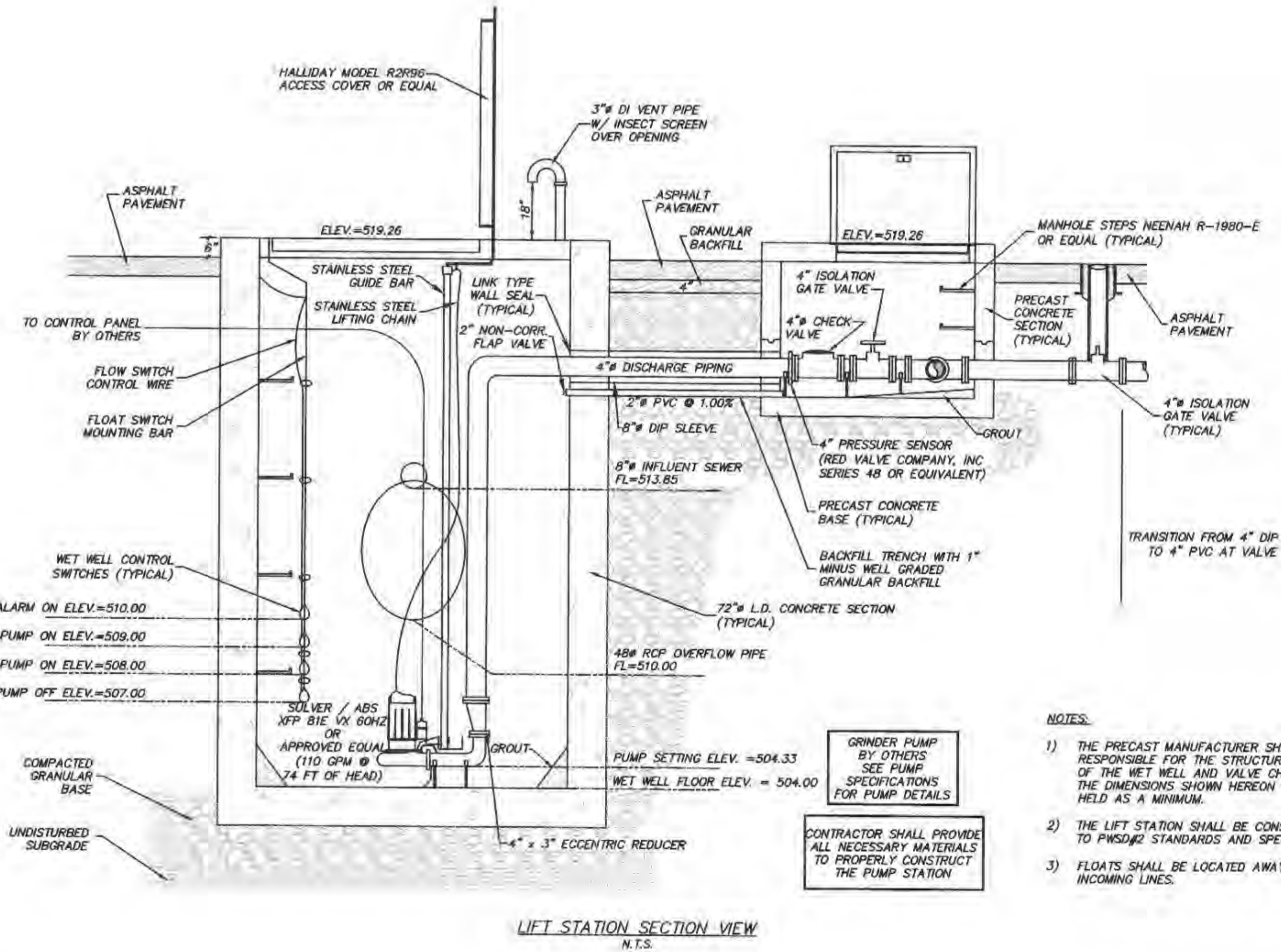
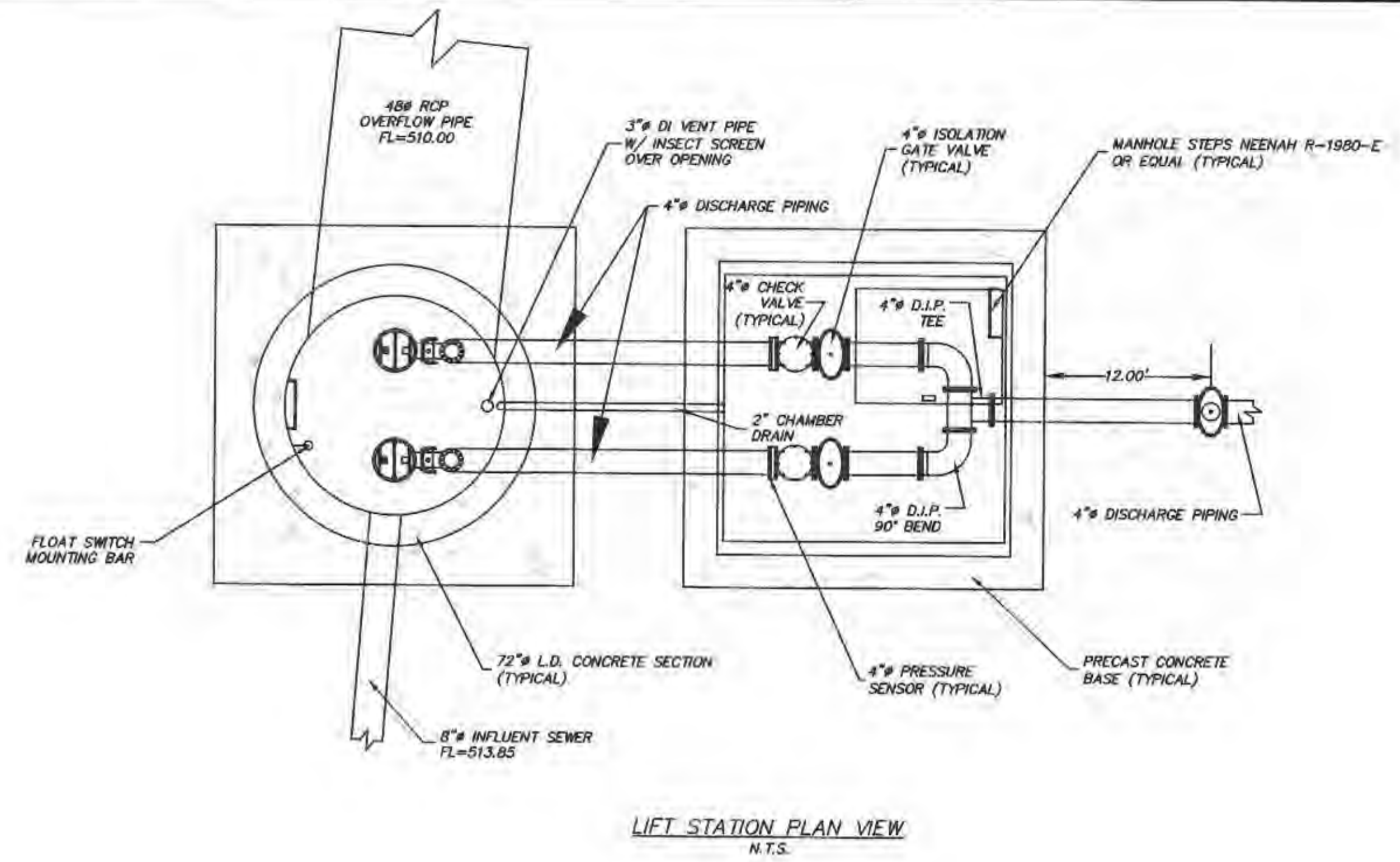
SANITARY LIFT STATION DETAIL
SCALE: 1"=20'



FORCE MAIN CONNECTION TO EXISTING MANHOLE
SCALE: 1"=20'



TYPICAL PRESSURE SENSOR & GAUGE DETAIL
N.T.S.

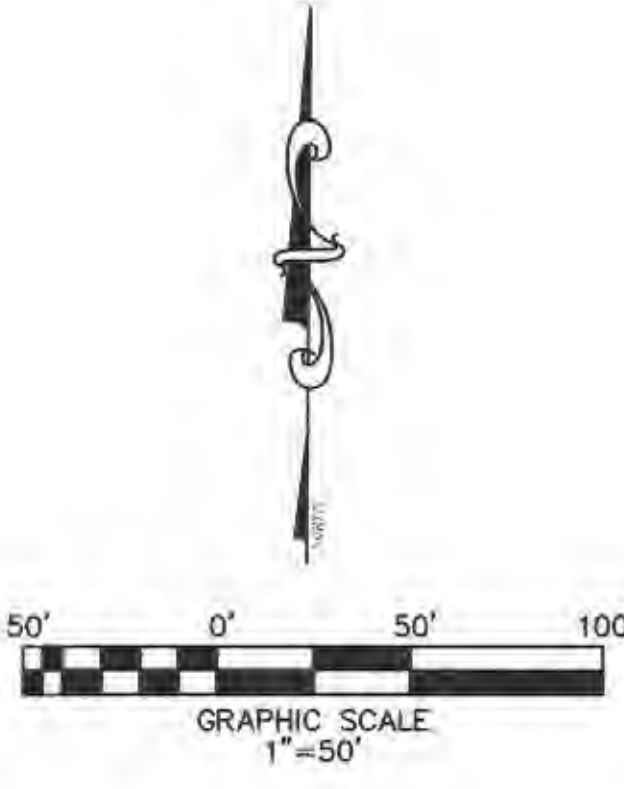
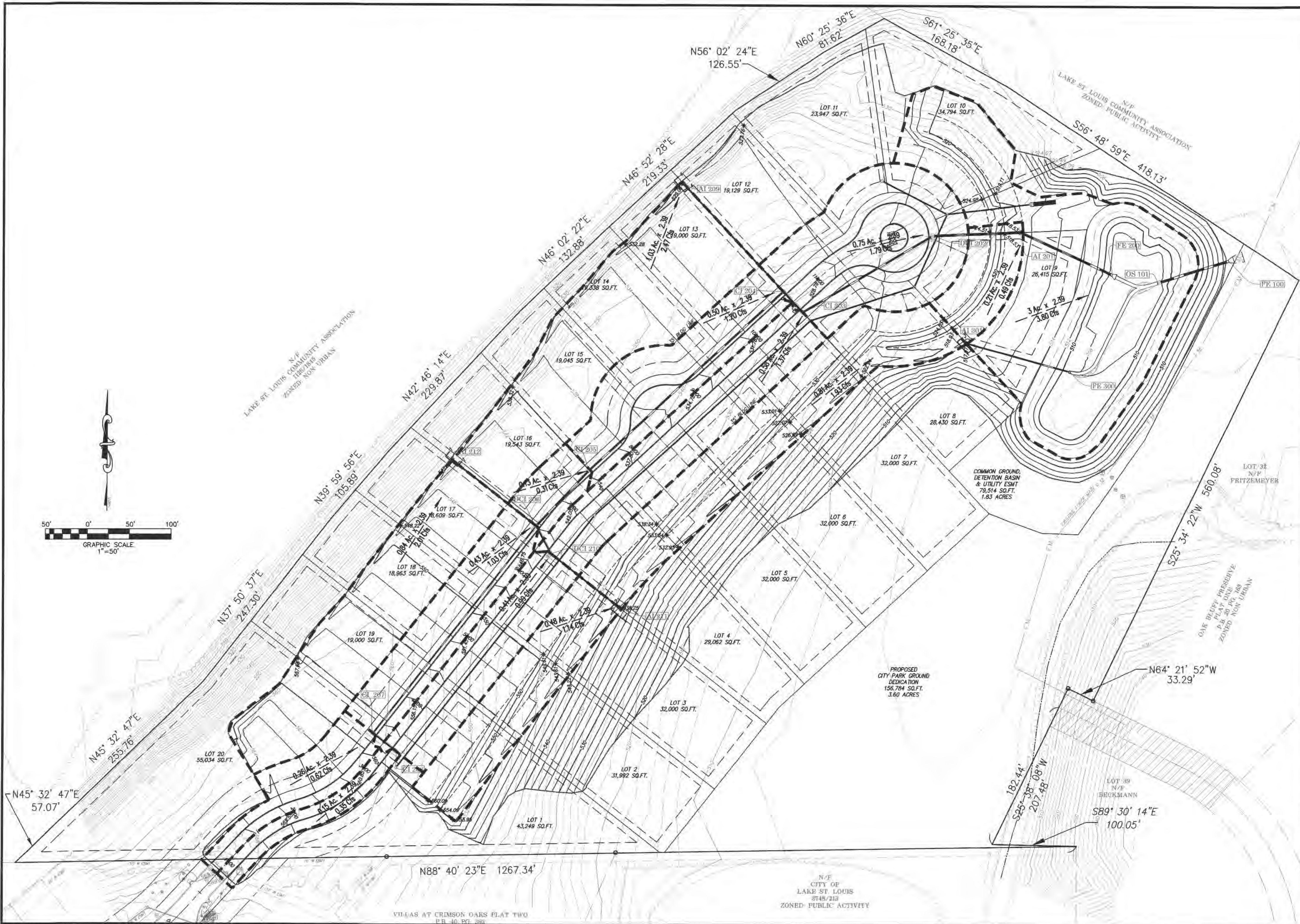


- NOTES:**
- 1) THE PRECAST MANUFACTURER SHALL BE RESPONSIBLE FOR THE STRUCTURAL DESIGN OF THE WET WELL AND VALVE CHAMBER. THE DIMENSIONS SHOWN HEREON SHALL BE HELD AS A MINIMUM.
 - 2) THE LIFT STATION SHALL BE CONSTRUCTED TO PWSö STANDARDS AND SPECIFICATIONS.
 - 3) FLOATS SHALL BE LOCATED AWAY FROM INCOMING LINES.

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OAK BLUFF ESTATES
CONSTRUCTION PLANS
LIFT STATION PLAN & DETAILS

PROJECT NUMBER: 14-0546
DATE: 12/01/15
DRAWN BY: MLP



N/W
LAKE ST. LOUIS COMMUNITY ASSOCIATION
TRAILER
ZONED: NON URBAN

N/W
LAKE ST. LOUIS COMMUNITY ASSOCIATION
ZONED: PUBLIC ACTIVITY

OAK BLUFF PRESERVE
P.P. 20 AC. 168
ZONED: NON URBAN

N/E
CITY OF
LAKE ST. LOUIS
2745/213
ZONED: PUBLIC ACTIVITY

VILLAS AT CRIMSON OAKS PLAY TWO
P.L. 10 PG. 2002

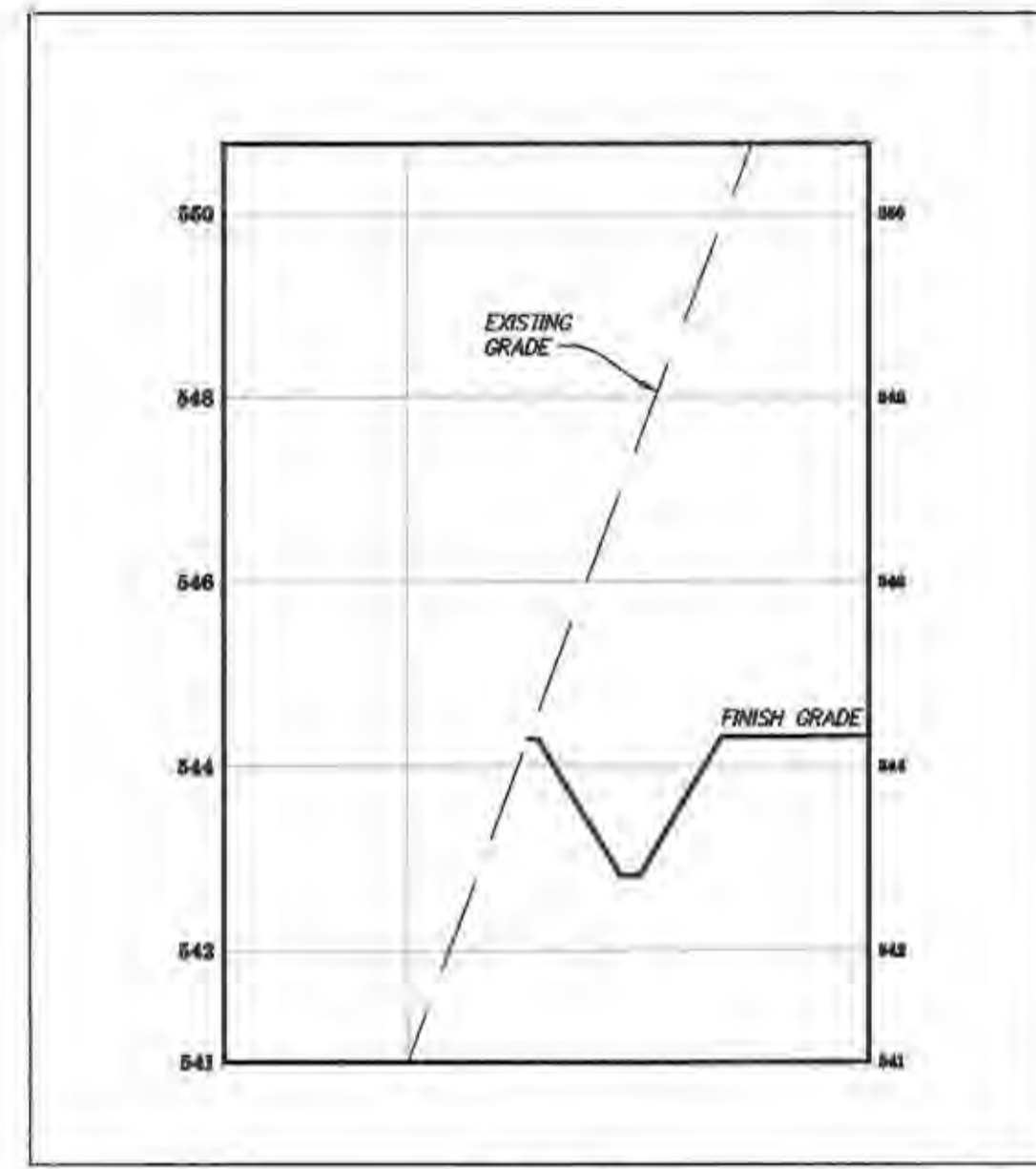
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OAK BLUFF ESTATES
CONSTRUCTION PLANS
DRAINAGE AREA MAP

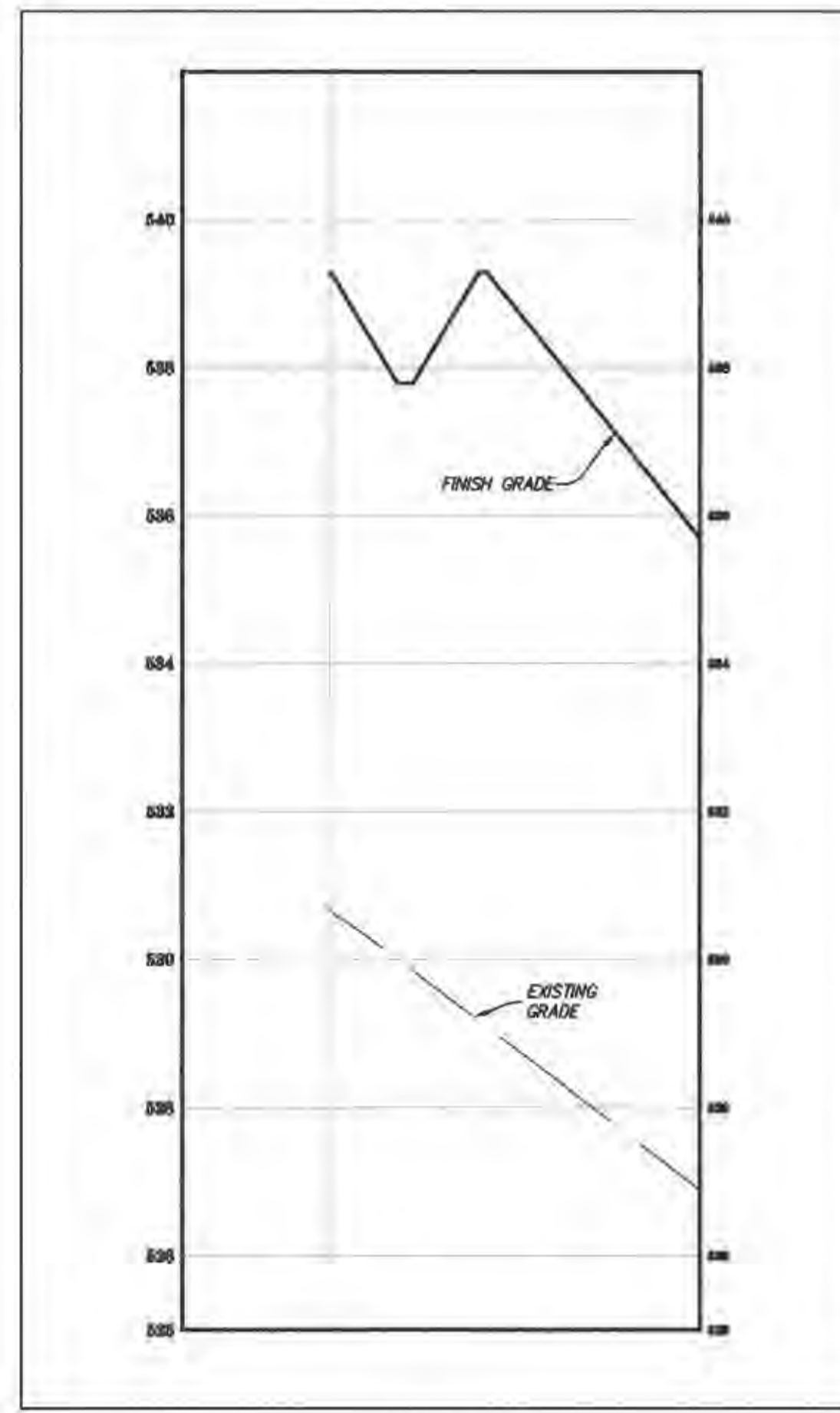
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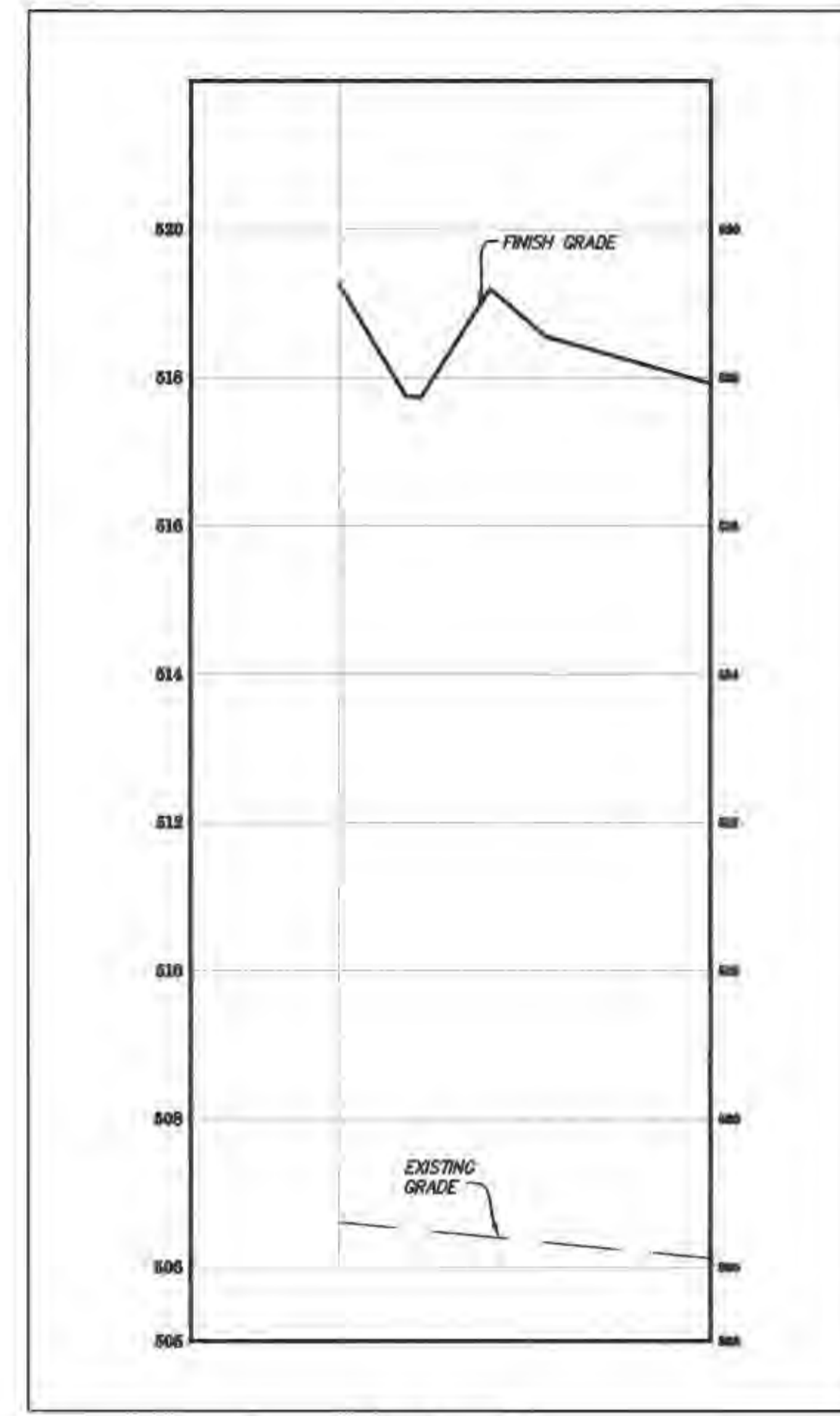
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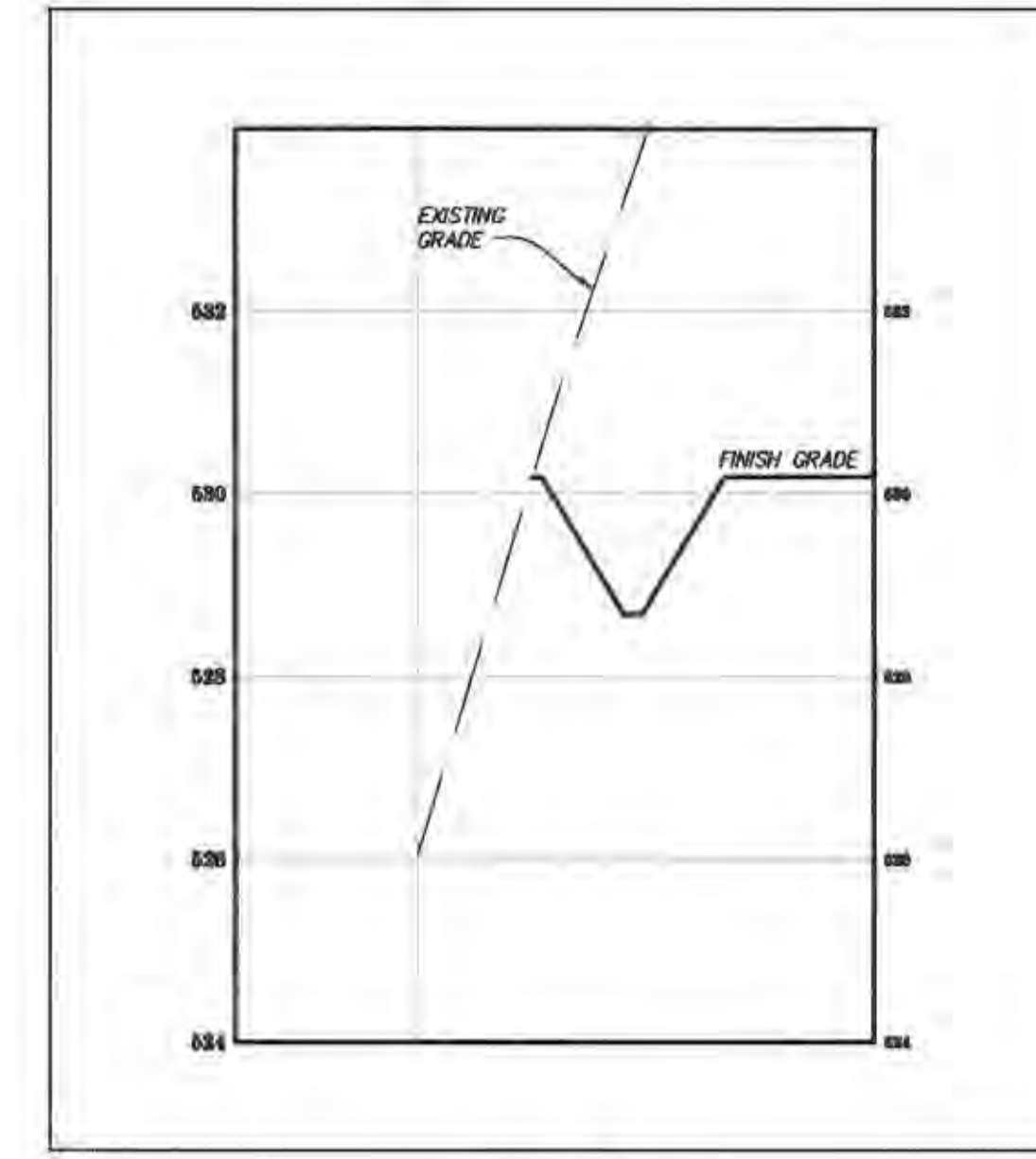
SECTION 1



SECTION 2



SECTION 3



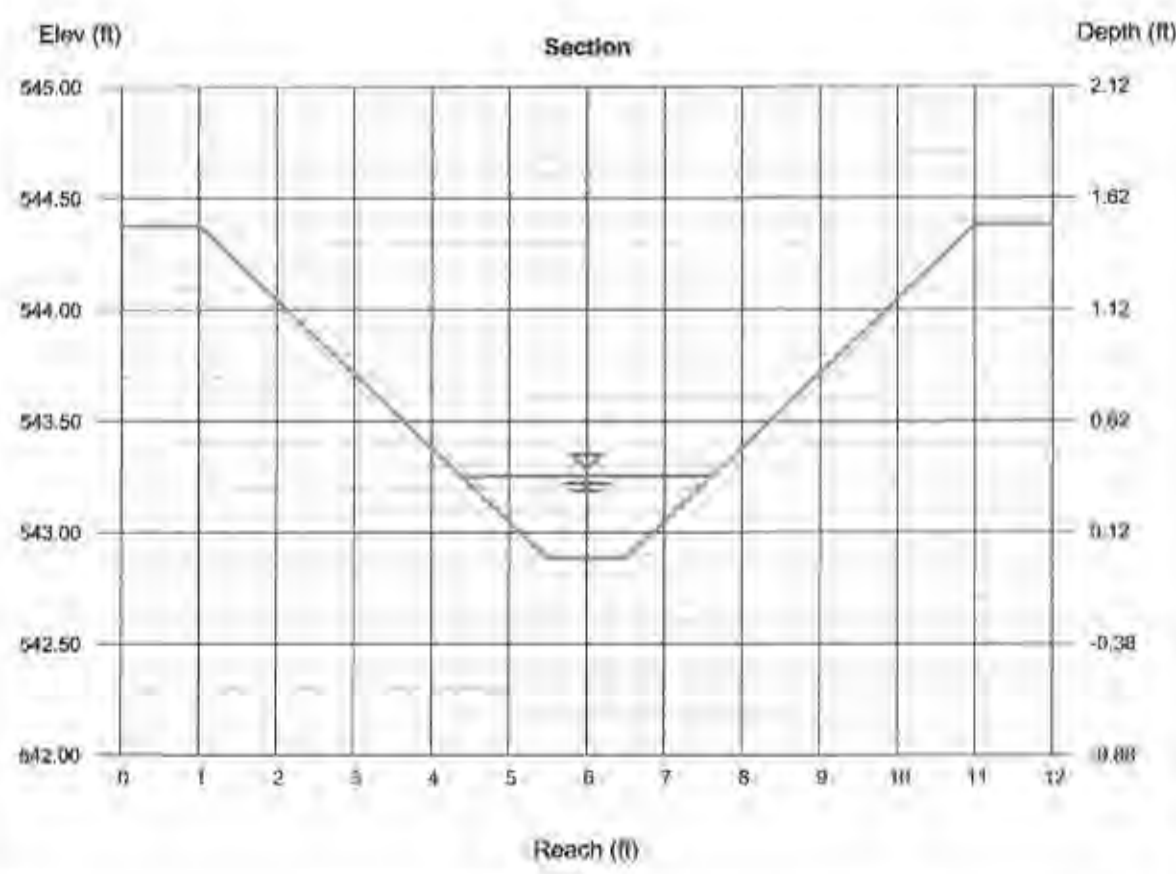
SECTION 4

Channel Report

Hydroflow Express Extension for AutoCAD® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 6 2011

Rear Yard Swale - Section 1 (15-year, 20 minute event)

Trapezoidal	Highlighted	
Bottom Width (ft) = 1.00	Depth (ft) = 0.37	
Side Slopes (z:1) = 3.00, 3.00	Q (cfs) = 2.010	
Total Depth (ft) = 1.50	Area (sqft) = 0.78	
Invert Elev (ft) = 542.88	Velocity (ft/s) = 2.57	
Slope (%) = 4.70	Wetted Perim (ft) = 3.34	
N-Value = 0.045	Crit Depth, Yc (ft) = 0.36	
	Top Width (ft) = 3.22	
	EGL (ft) = 0.47	
Calculations		
Compute by:	Known Q	
Known Q (cfs) = 2.01		

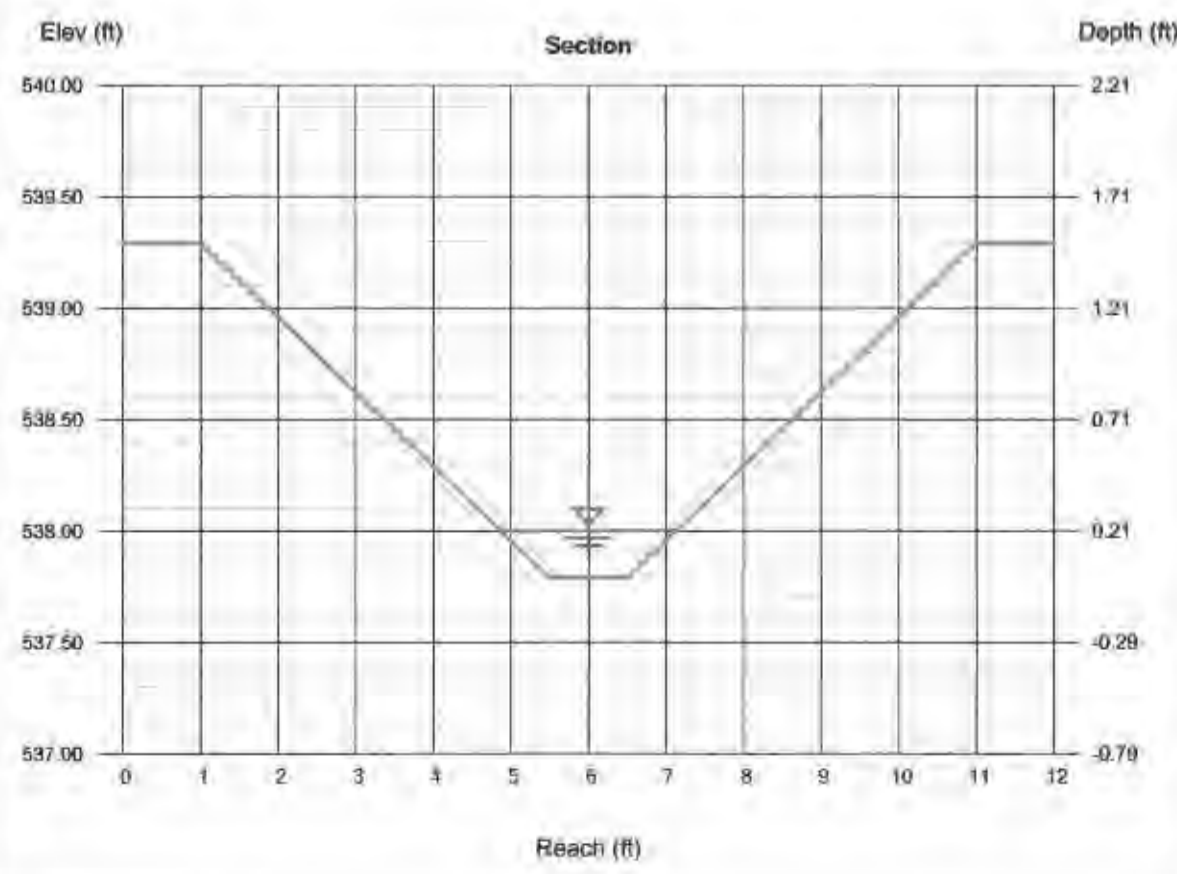


Channel Report

Hydroflow Express Extension for AutoCAD® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 6 2011

Rear Yard Swale - Section 2 (15-year, 20 minute event)

Trapezoidal	Highlighted	
Bottom Width (ft) = 1.00	Depth (ft) = 0.21	
Side Slopes (z:1) = 3.00, 3.00	Q (cfs) = 1.140	
Total Depth (ft) = 1.50	Area (sqft) = 0.34	
Invert Elev (ft) = 537.79	Velocity (ft/s) = 3.33	
Slope (%) = 4.70	Wetted Perim (ft) = 2.33	
N-Value = 0.025	Crit Depth, Yc (ft) = 0.27	
	Top Width (ft) = 2.26	
	EGL (ft) = 0.38	
Calculations		
Compute by:	Known Q	
Known Q (cfs) = 1.14		

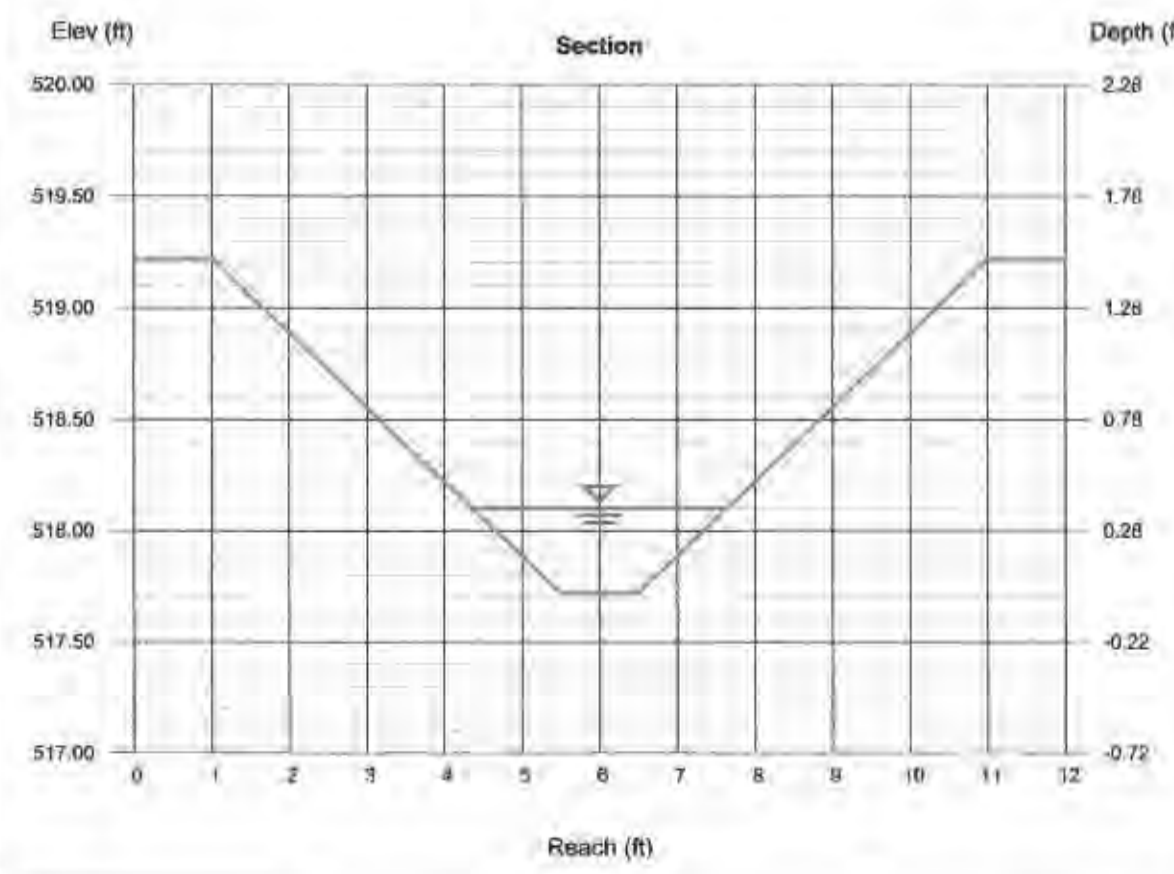


Channel Report

Hydroflow Express Extension for AutoCAD® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 6 2011

Rear Yard Swale - Section 3 (15-year, 20 minute event)

Trapezoidal	Highlighted	
Bottom Width (ft) = 1.00	Depth (ft) = 0.38	
Side Slopes (z:1) = 3.00, 3.00	Q (cfs) = 1.930	
Total Depth (ft) = 1.50	Area (sqft) = 0.81	
Invert Elev (ft) = 517.72	Velocity (ft/s) = 2.37	
Slope (%) = 3.70	Wetted Perim (ft) = 3.40	
N-Value = 0.045	Crit Depth, Yc (ft) = 0.35	
	Top Width (ft) = 3.28	
	EGL (ft) = 0.47	
Calculations		
Compute by:	Known Q	
Known Q (cfs) = 1.93		

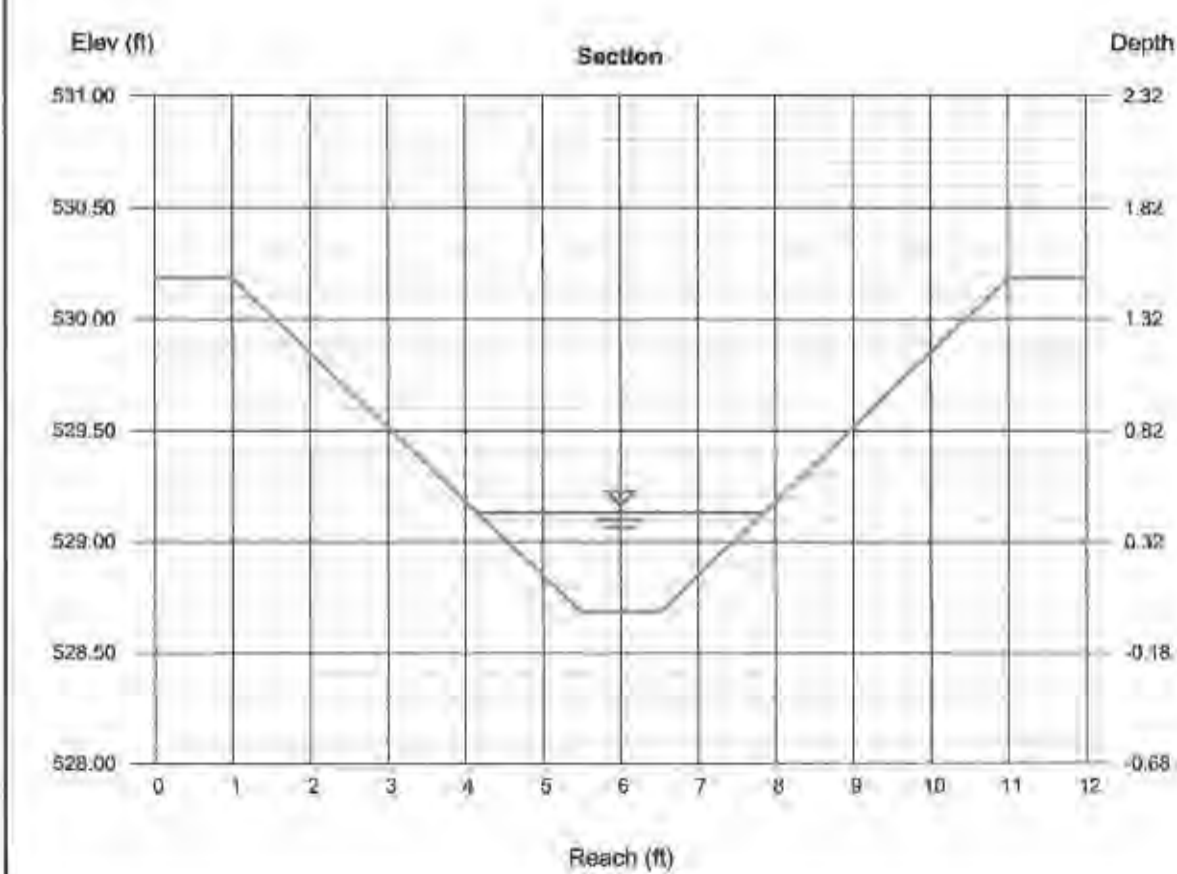


Channel Report

Hydroflow Express Extension for AutoCAD® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 6 2011

Rear Yard Swale - Section 4 (15-year, 20 minute event)

Trapezoidal	Highlighted	
Bottom Width (ft) = 1.00	Depth (ft) = 0.45	
Side Slopes (z:1) = 3.00, 3.00	Q (cfs) = 2.470	
Total Depth (ft) = 1.50	Area (sqft) = 1.08	
Invert Elev (ft) = 528.68	Velocity (ft/s) = 2.34	
Slope (%) = 3.00	Wetted Perim (ft) = 3.85	
N-Value = 0.045	Crit Depth, Yc (ft) = 0.40	
	Top Width (ft) = 3.70	
	EGL (ft) = 0.53	
Calculations		
Compute by:	Known Q	
Known Q (cfs) = 2.47		



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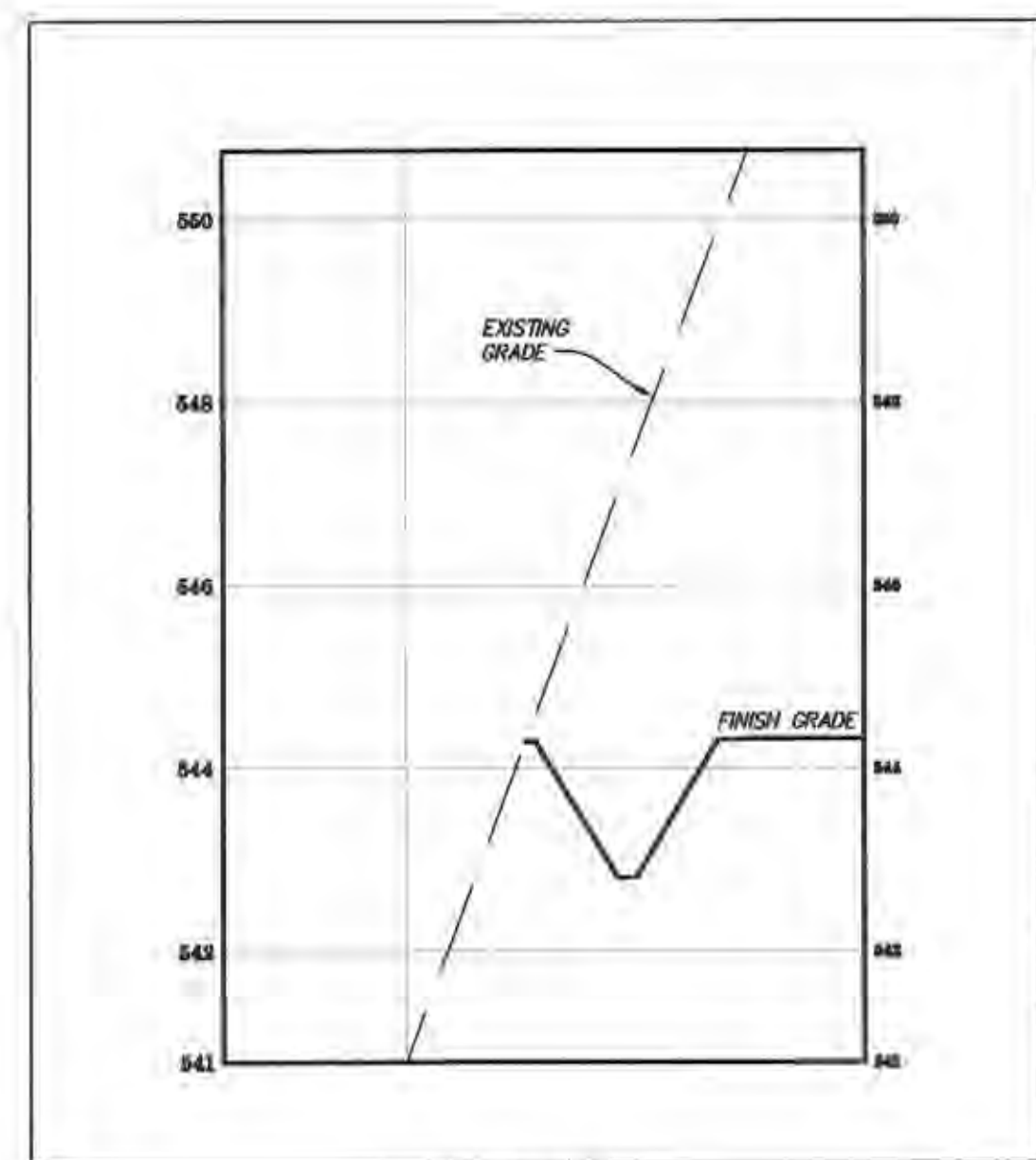
OAK BLUFF ESTATES
CONSTRUCTION PLANS
REAR YARD SWALE CROSS SECTIONS

PROJECT NUMBER: 14-0545

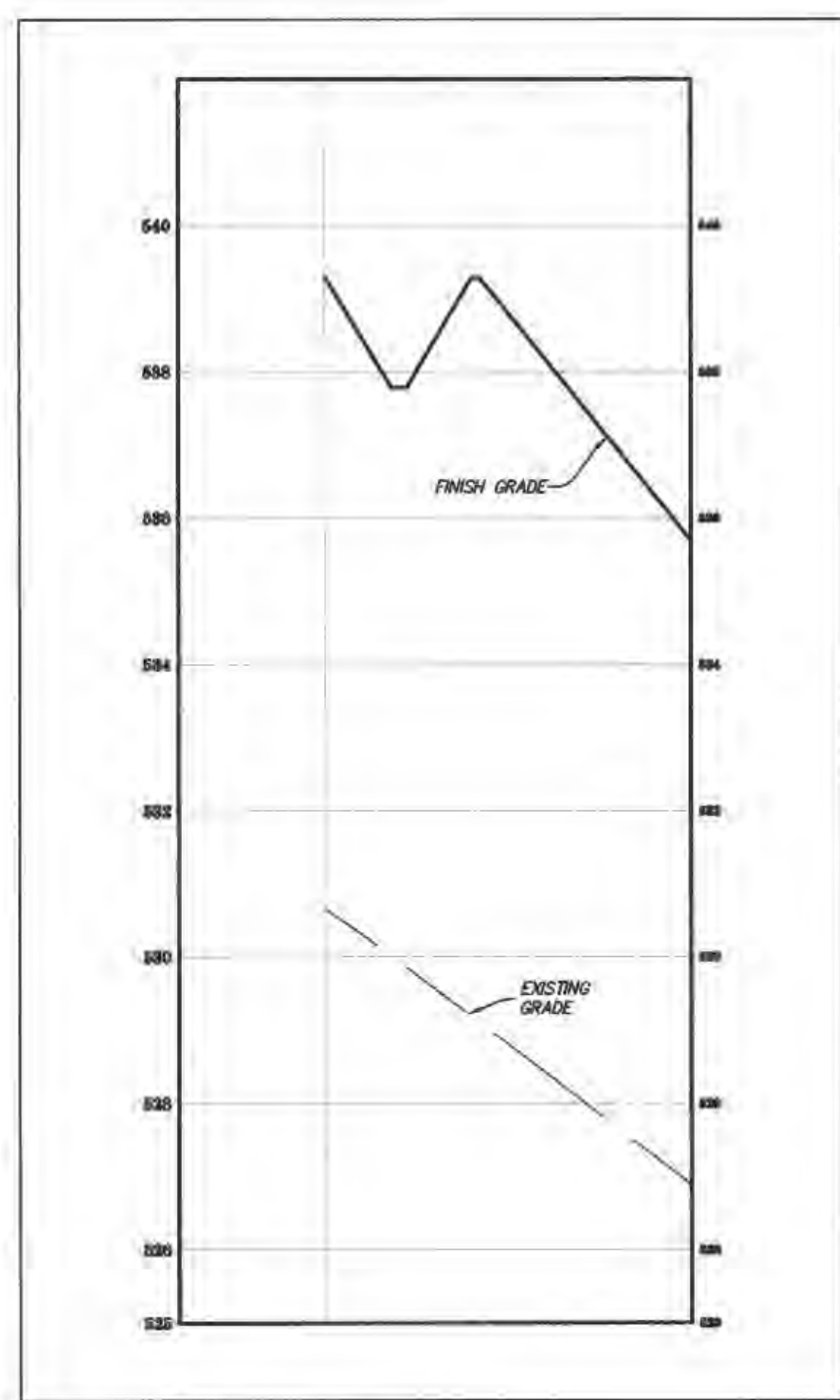
DATE: 12/10/11

DRAWN BY: MLF

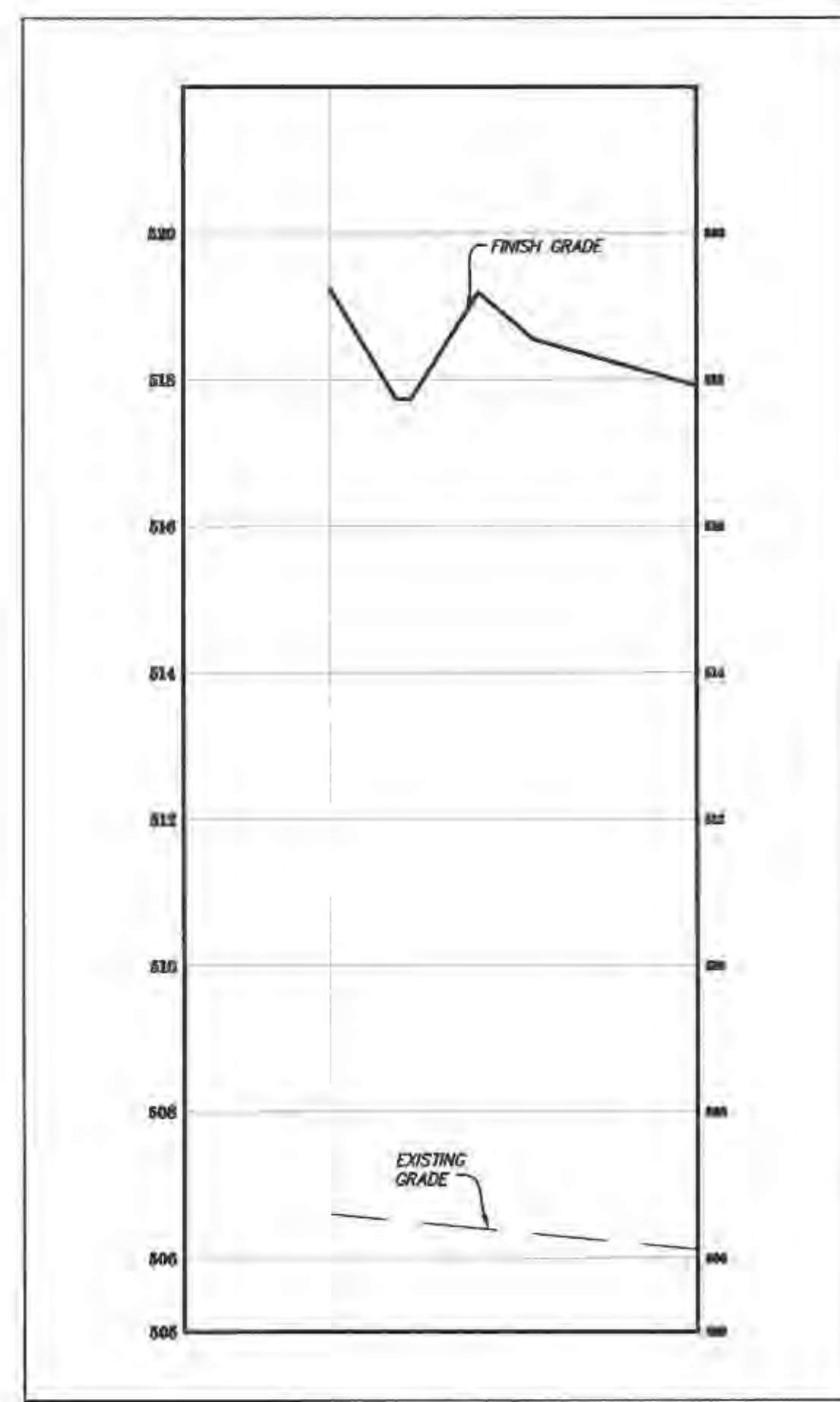
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SCALE:



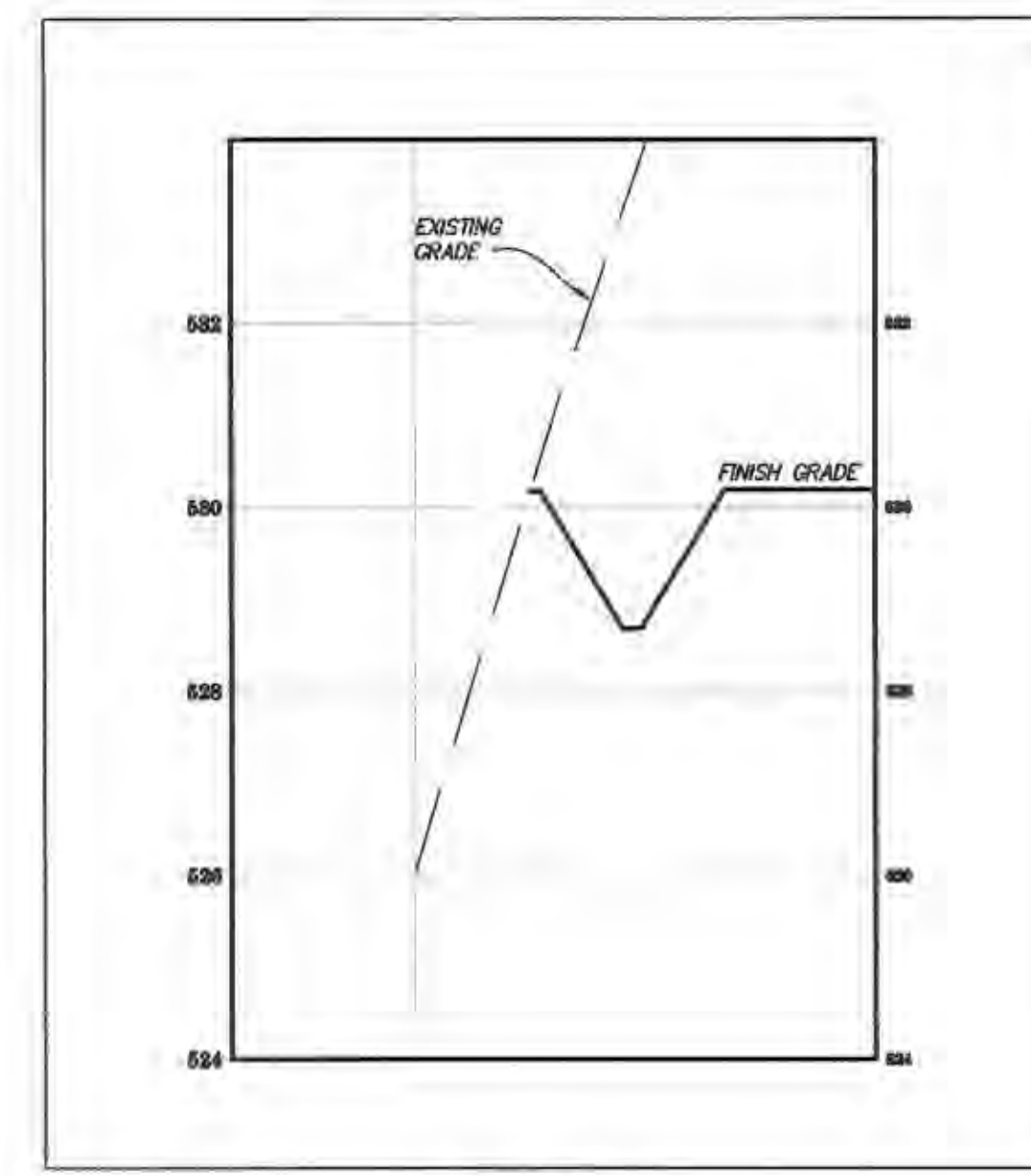
SECTION 1



SECTION 2



SECTION 3



SECTION 4

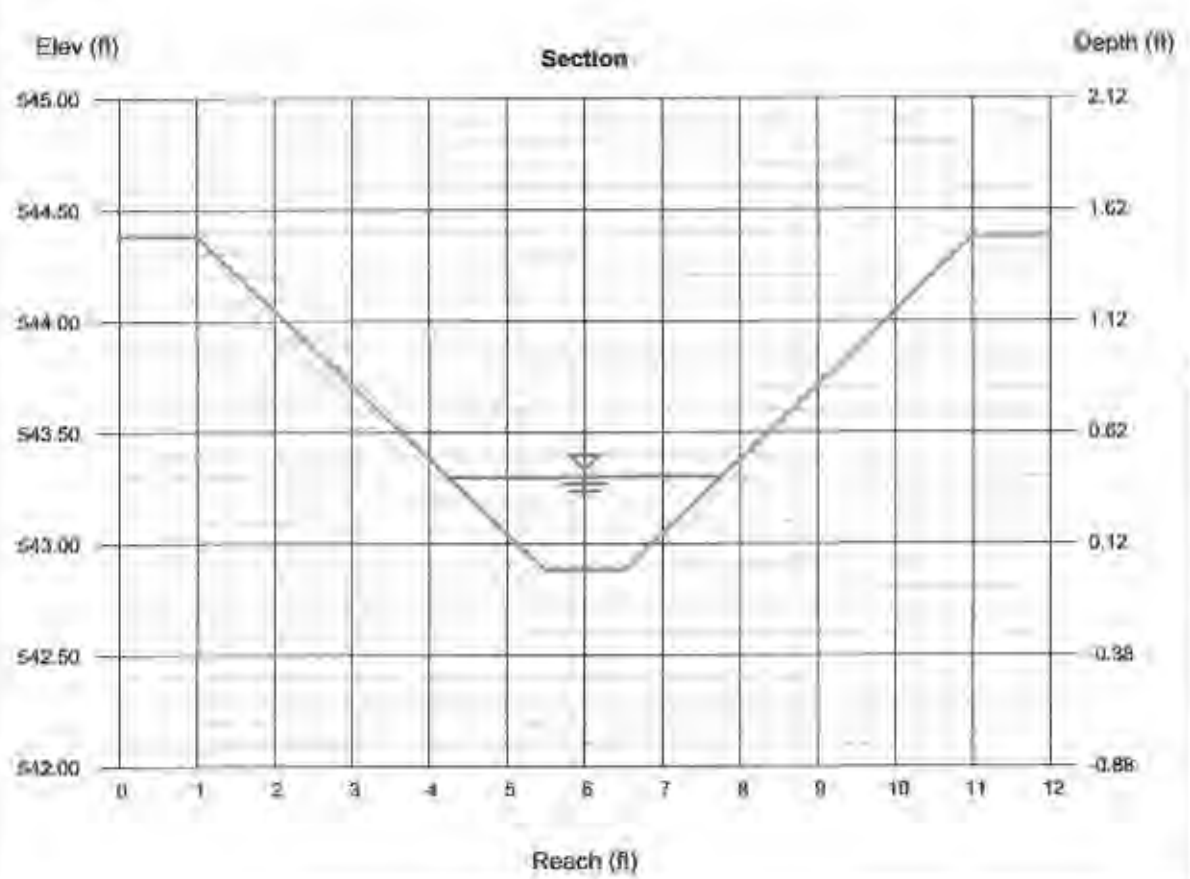
Channel Report

Hydraulics Express Extension for Autodesk AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 8 2015

Rear Yard Swale Section 1 (100-year, 20 minute event)

Trapezoidal		Highlighted	
Bottom Width (ft)	= 1.00	Depth (ft)	= 0.42
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 2.700
Total Depth (ft)	= 1.50	Area (sqft)	= 0.95
Invert Elev (ft)	= 542.88	Velocity (ft/s)	= 2.84
Slope (%)	= 4.70	Wetted Perim (ft)	= 3.86
N-Value	= 0.045	Crit Depth, Yc (ft)	= 0.42
		Top Width (ft)	= 3.52
		EGL (ft)	= 0.55

Calculations
Compute by: Known Q
Known Q (cfs) = 2.70



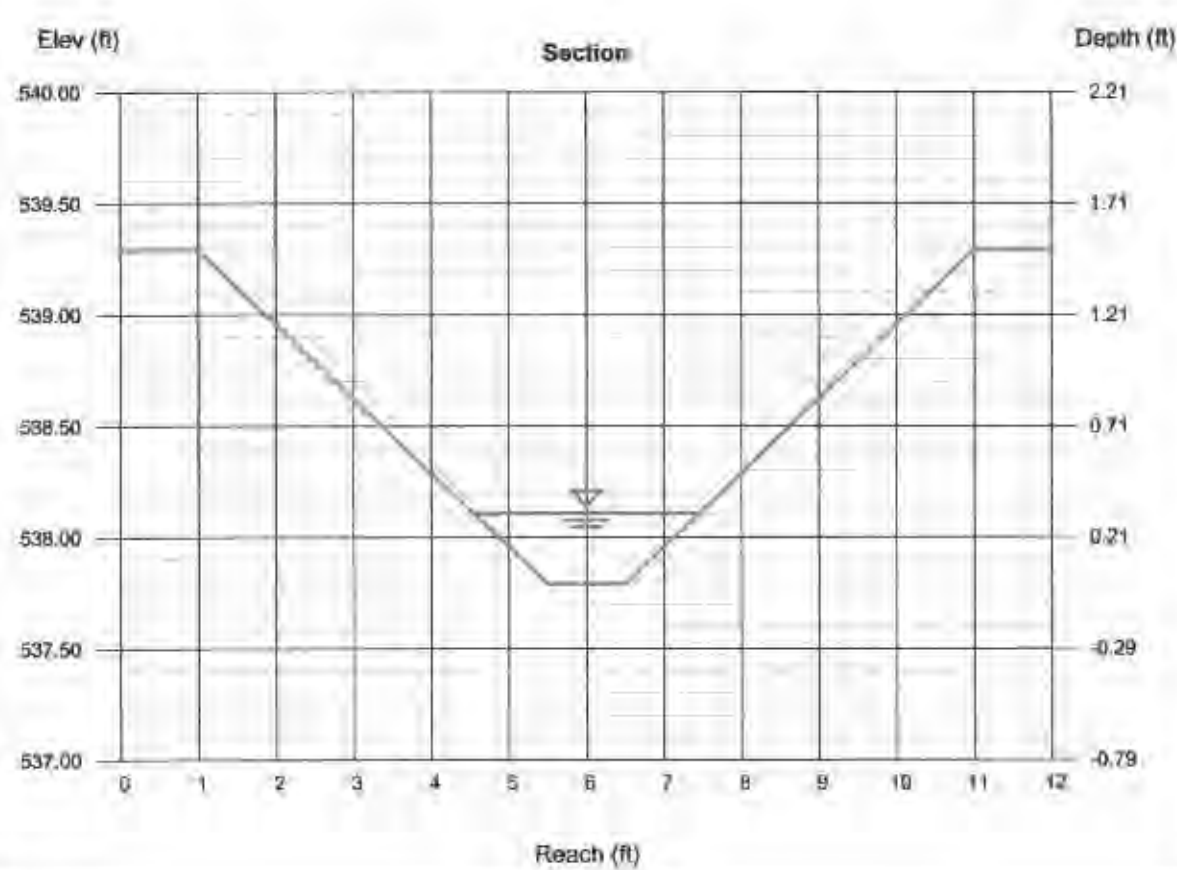
Channel Report

Hydraulics Express Extension for Autodesk AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 8 2015

Rear Yard Swale Section 2 (100-year, 20 minute event)

Trapezoidal		Highlighted	
Bottom Width (ft)	= 1.00	Depth (ft)	= 0.32
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 1.550
Total Depth (ft)	= 1.30	Area (sqft)	= 0.63
Invert Elev (ft)	= 537.79	Velocity (ft/s)	= 2.47
Slope (%)	= 4.70	Wetted Perim (ft)	= 3.02
N-Value	= 0.045	Crit Depth, Yc (ft)	= 0.31
		Top Width (ft)	= 2.92
		EGL (ft)	= 0.41

Calculations
Compute by: Known Q
Known Q (cfs) = 1.55



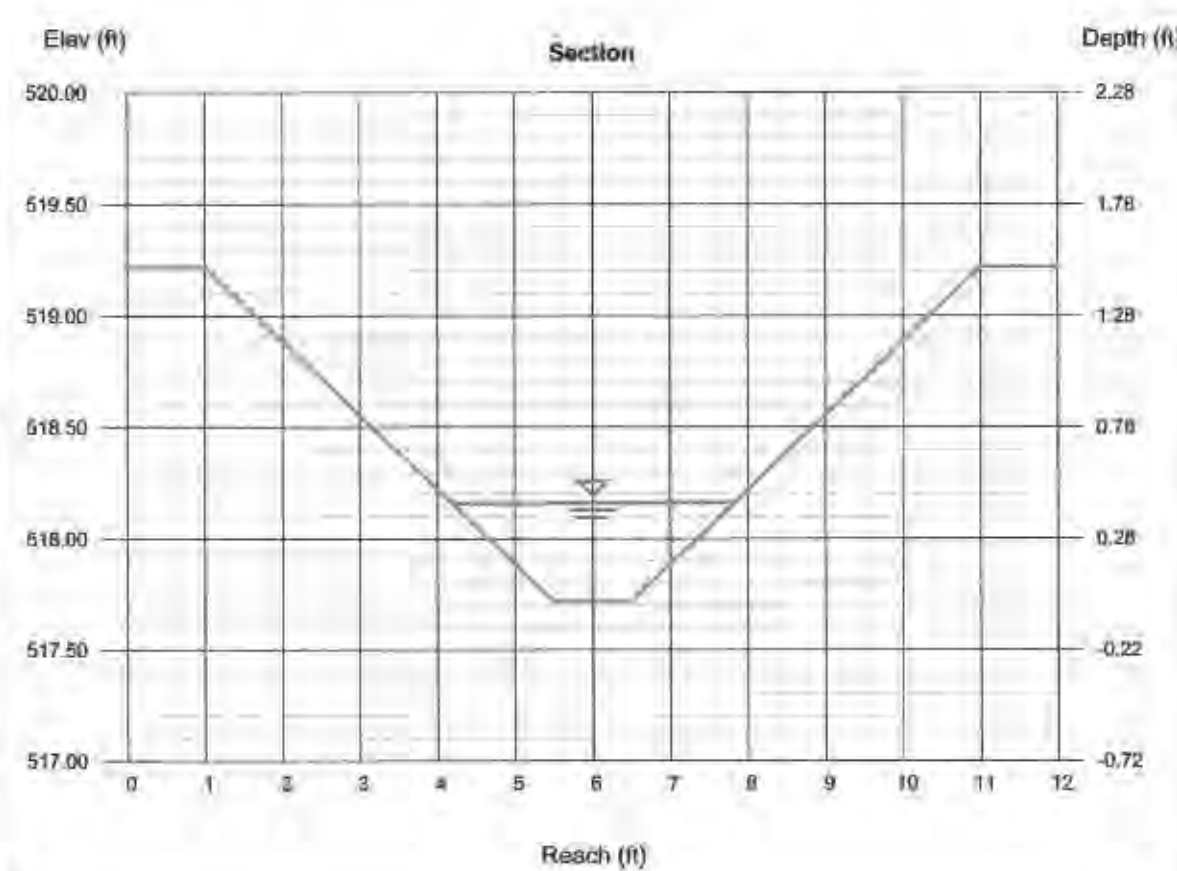
Channel Report

Hydraulics Express Extension for Autodesk AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 8 2015

Rear Yard Swale - Section 3 (100-year, 20 minute event)

Trapezoidal		Highlighted	
Bottom Width (ft)	= 1.00	Depth (ft)	= 0.44
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 2.810
Total Depth (ft)	= 1.50	Area (sqft)	= 1.02
Invert Elev (ft)	= 517.72	Velocity (ft/s)	= 2.56
Slope (%)	= 3.70	Wetted Perim (ft)	= 3.78
N-Value	= 0.045	Crit Depth, Yc (ft)	= 0.41
		Top Width (ft)	= 3.84
		EGL (ft)	= 0.54

Calculations
Compute by: Known Q
Known Q (cfs) = 2.81



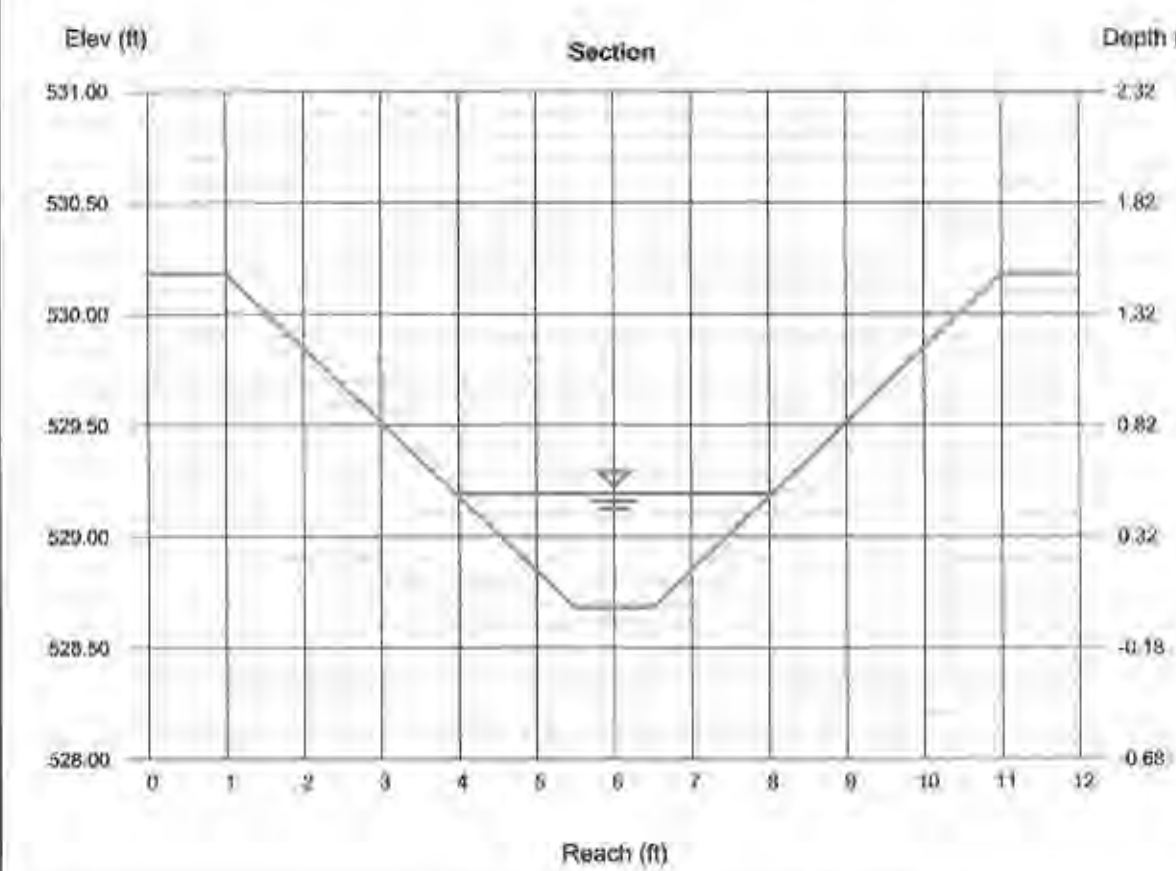
Channel Report

Hydraulics Express Extension for Autodesk AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 8 2015

Rear Yard Swale - Section 4 (100-year, 20 minute event)

Trapezoidal		Highlighted	
Bottom Width (ft)	= 1.00	Depth (ft)	= 0.51
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 3.320
Total Depth (ft)	= 1.50	Area (sqft)	= 1.29
Invert Elev (ft)	= 529.65	Velocity (ft/s)	= 2.57
Slope (%)	= 3.00	Wetted Perim (ft)	= 4.23
N-Value	= 0.045	Crit Depth, Yc (ft)	= 0.46
		Top Width (ft)	= 4.06
		EGL (ft)	= 0.51

Calculations
Compute by: Known Q
Known Q (cfs) = 3.32

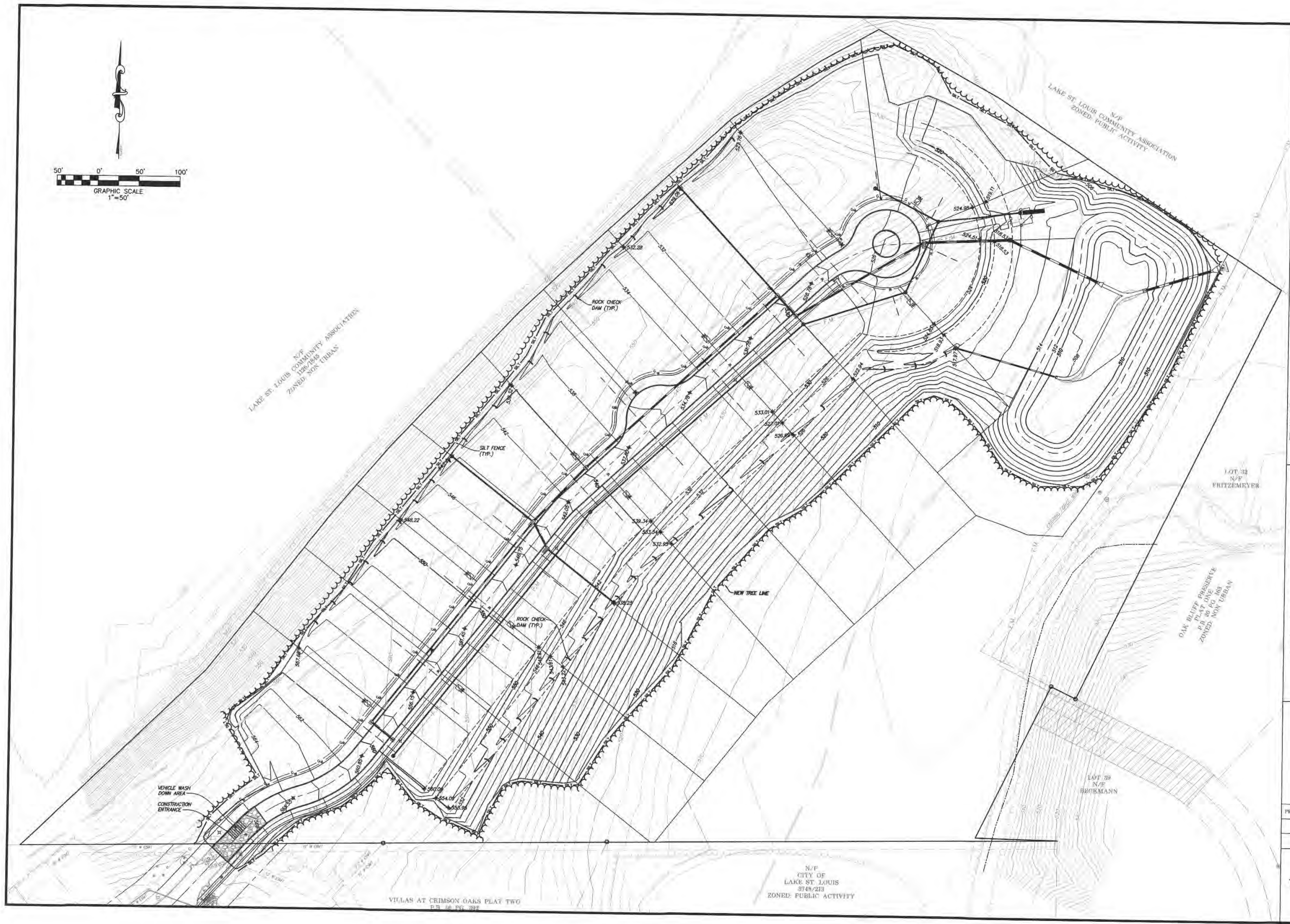
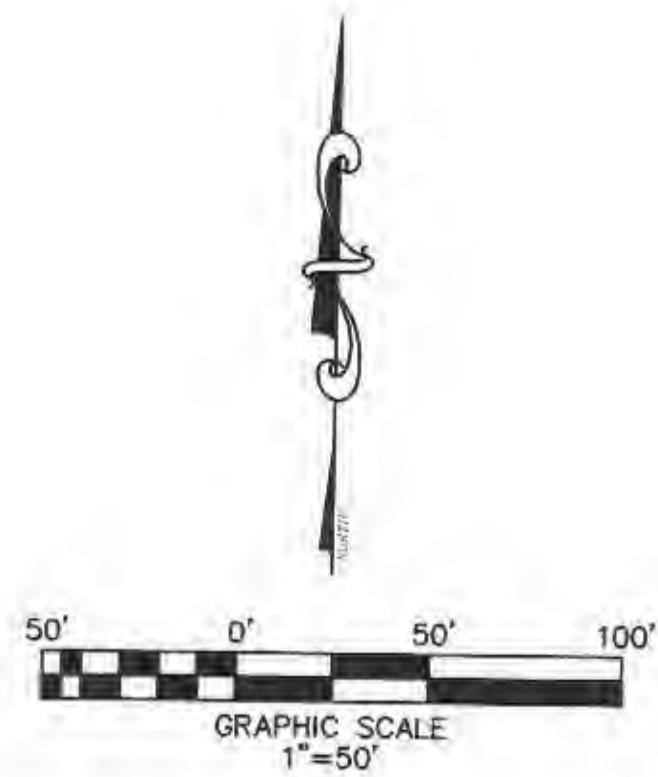


REAR YARD SWALE SUMMARY				
	Section 1	Section 2	Section 3	Section 4
100-YR HW	543.30	538.11	518.16	529.19
Low Sill	543.45	543.64	519.12	529.70
Freeboard	0.15	5.53	0.96	0.51

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OAK BLUFF ESTATES
CONSTRUCTION PLANS
REAR YARD SWALE CROSS SECTIONS

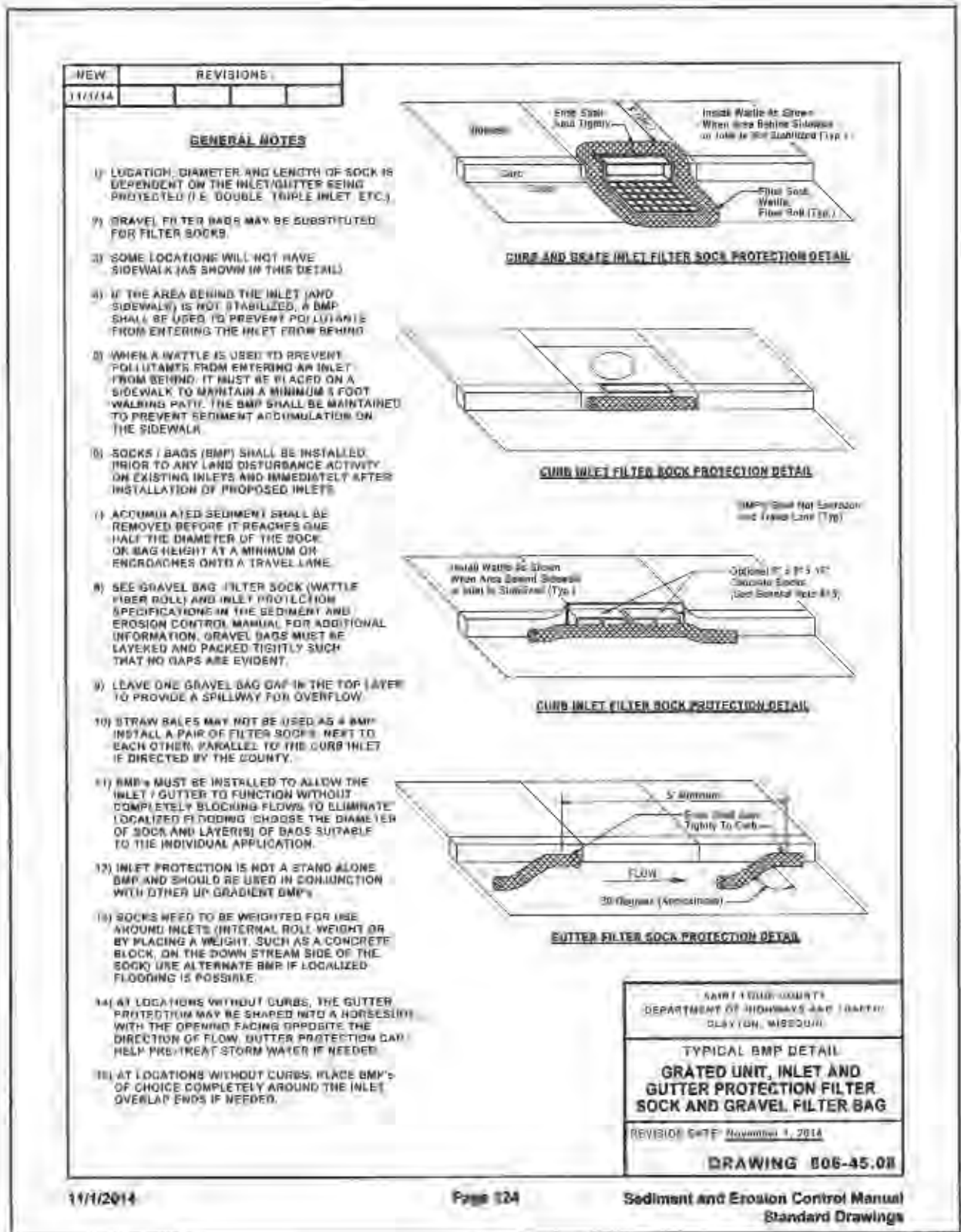
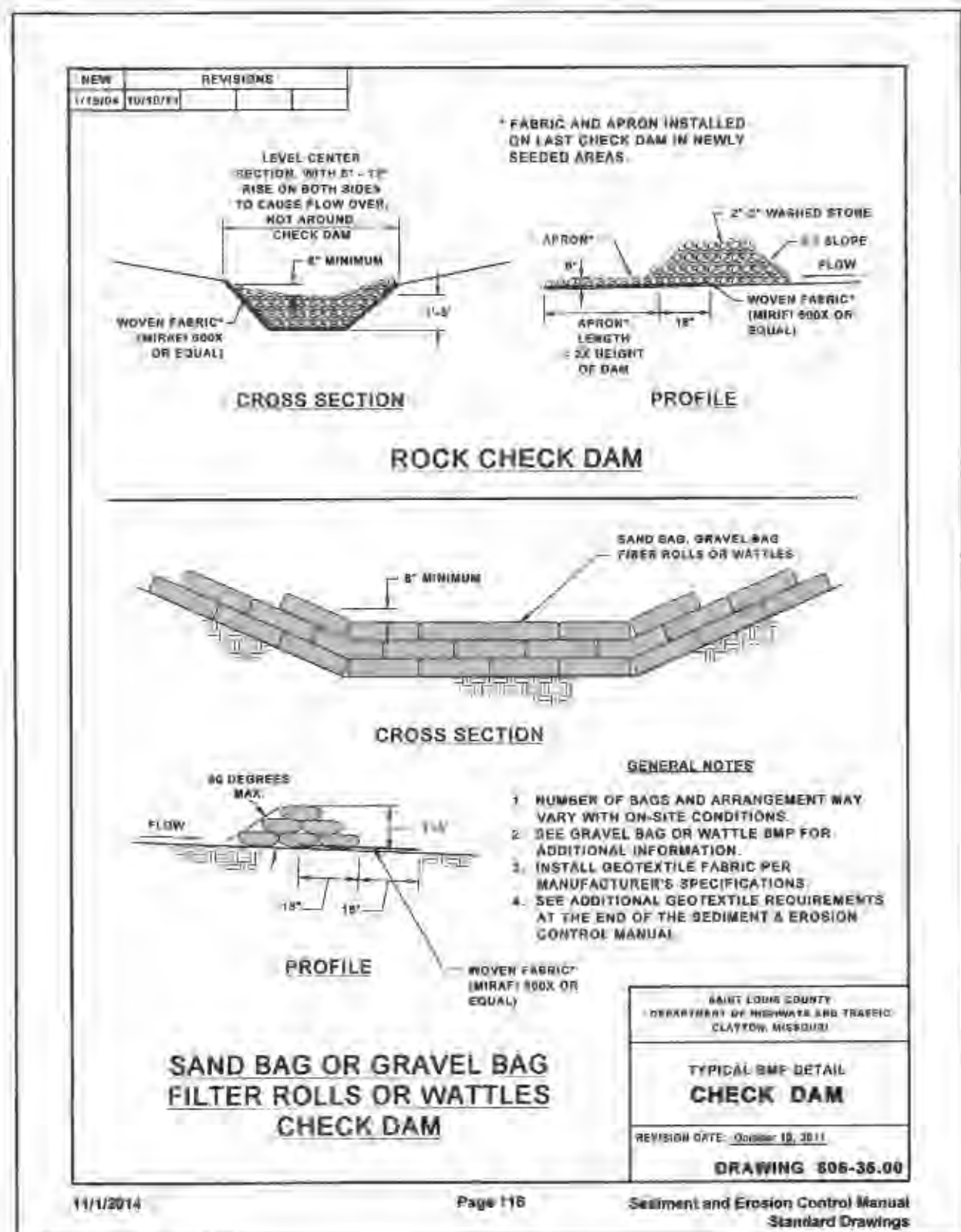
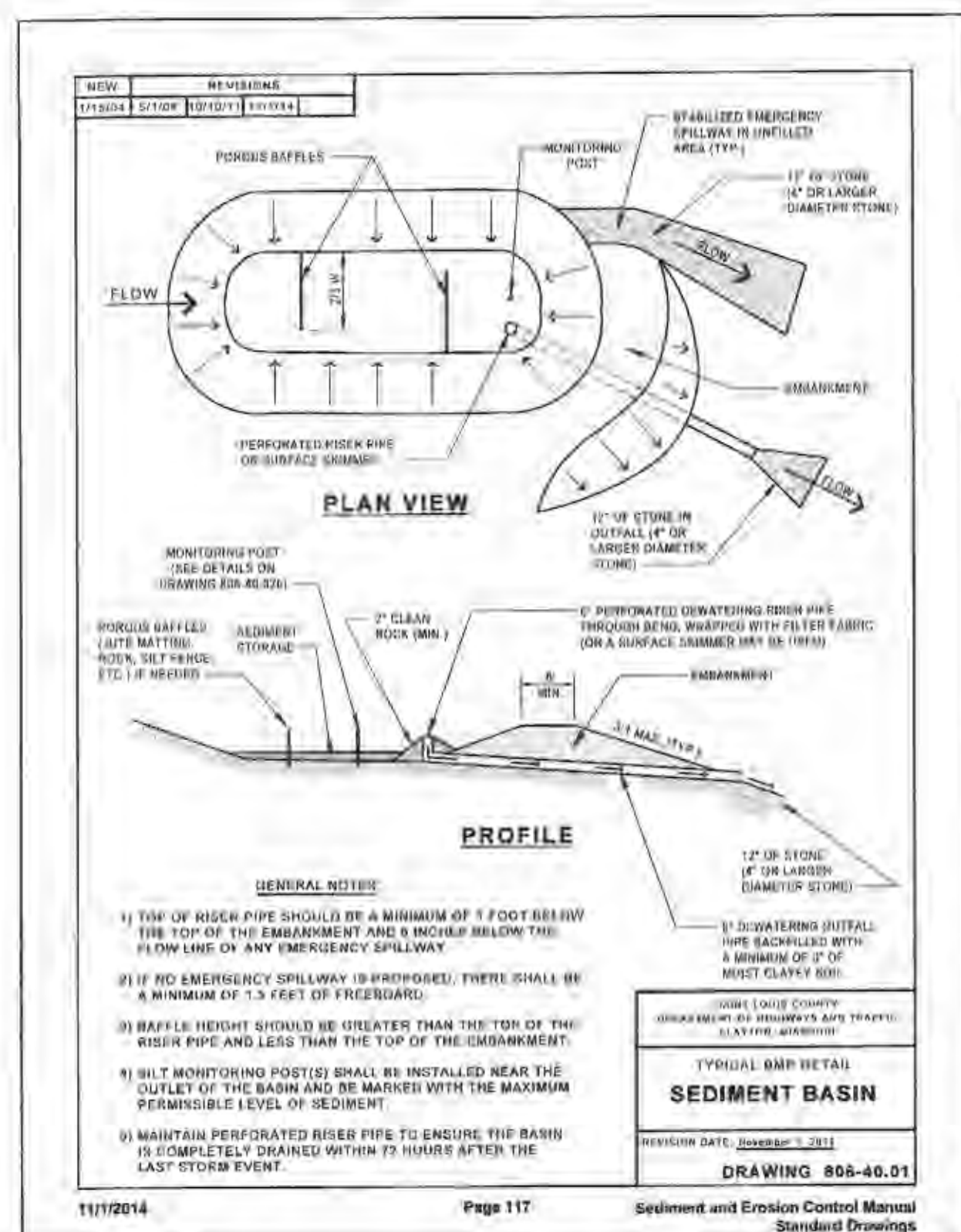
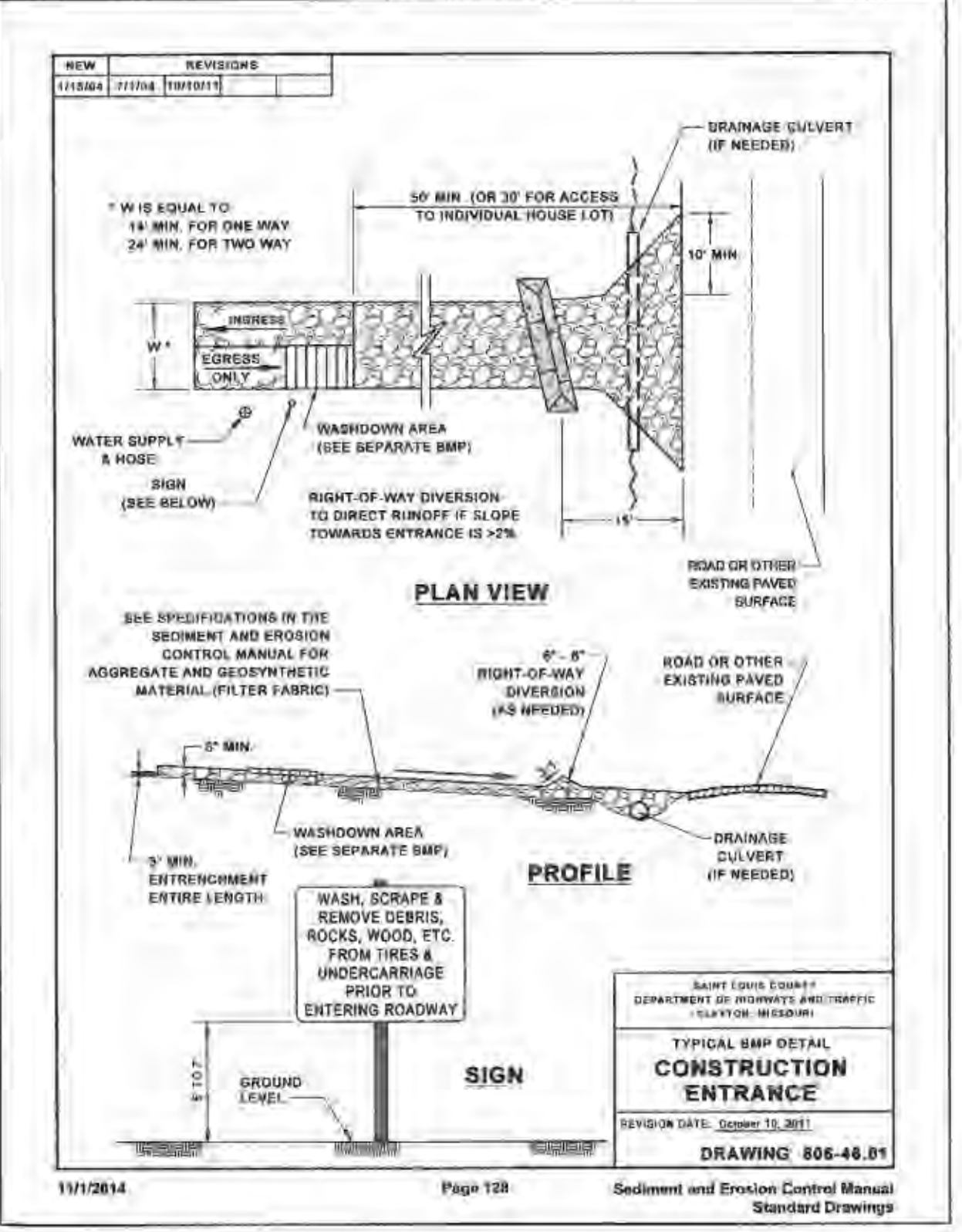
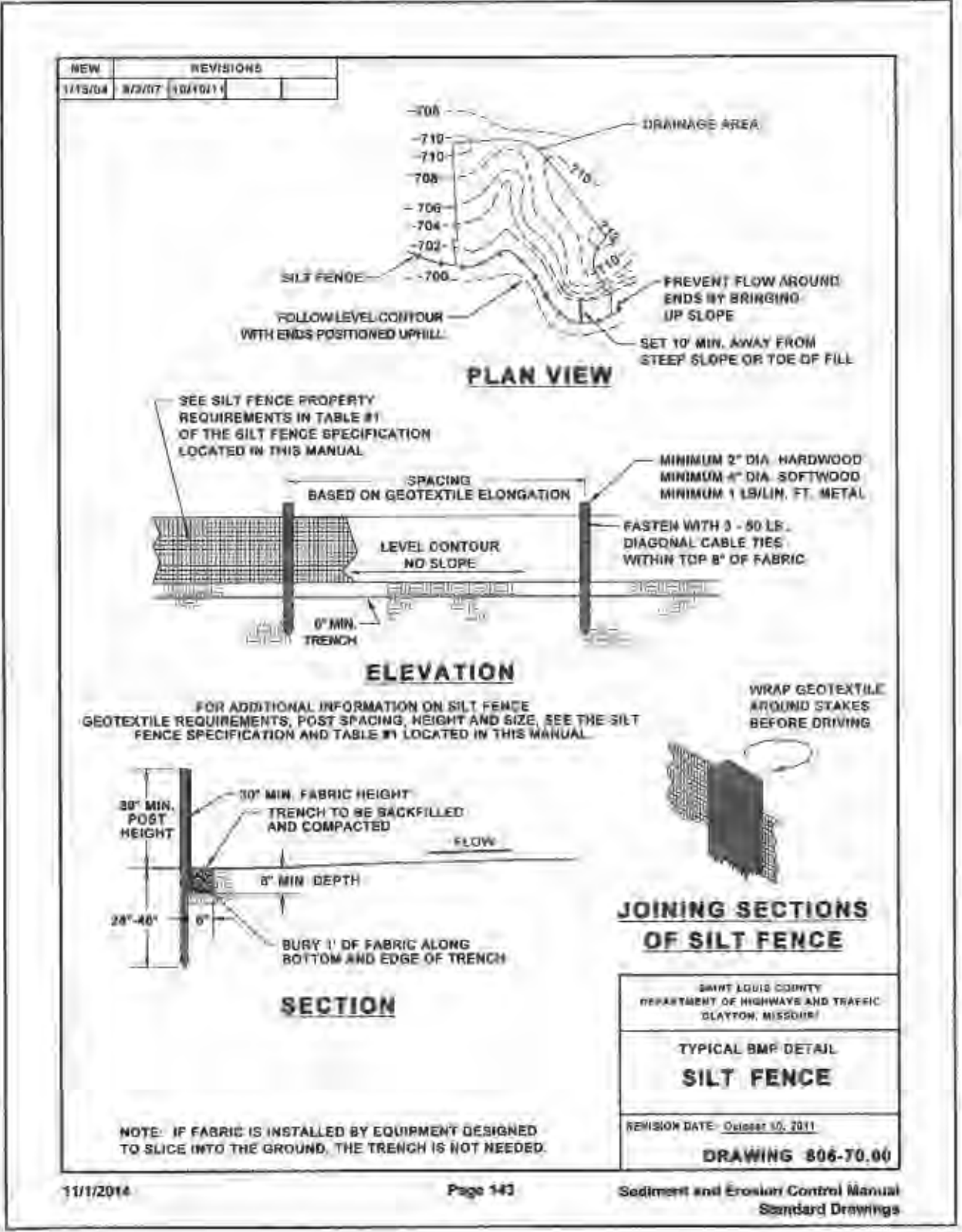
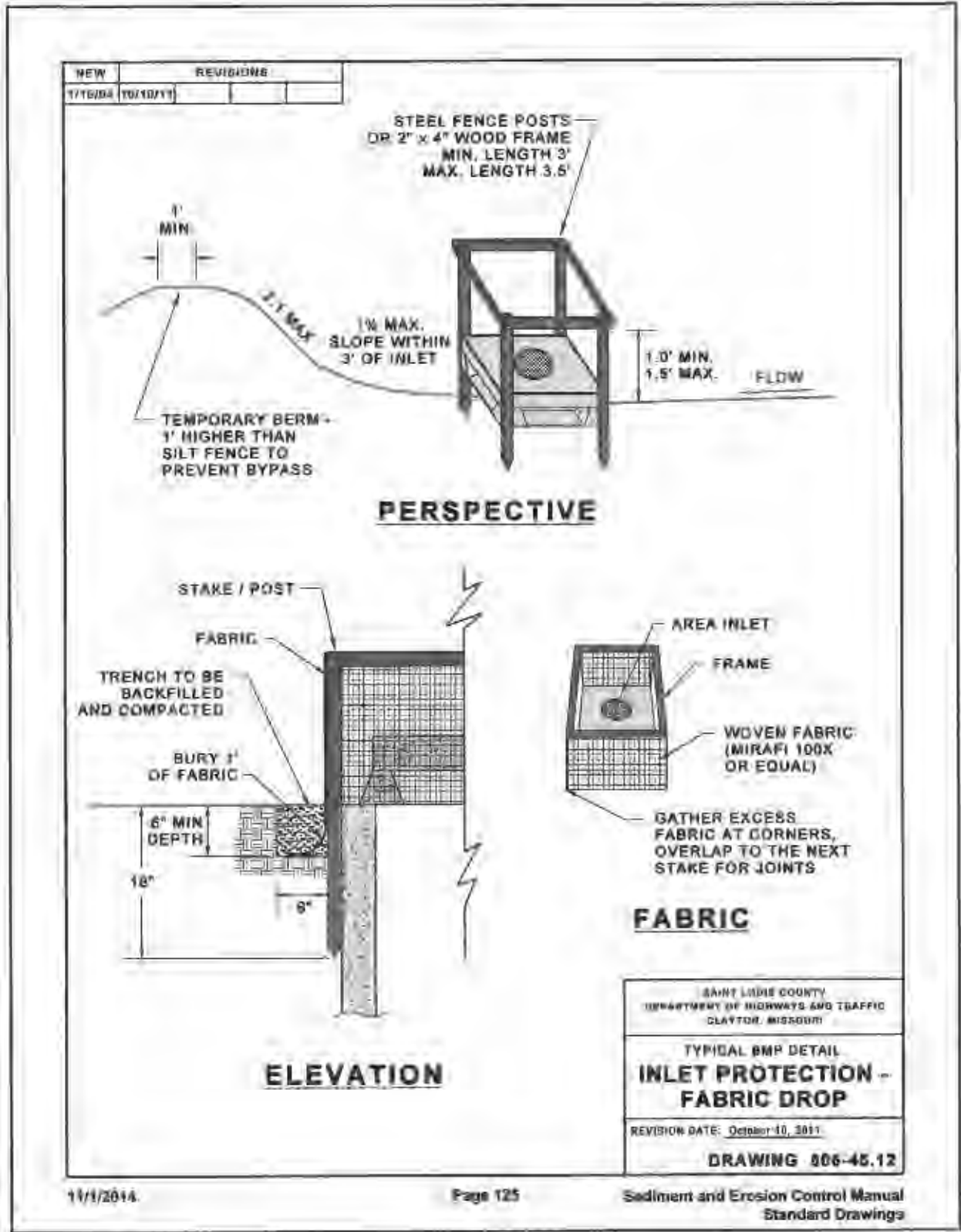
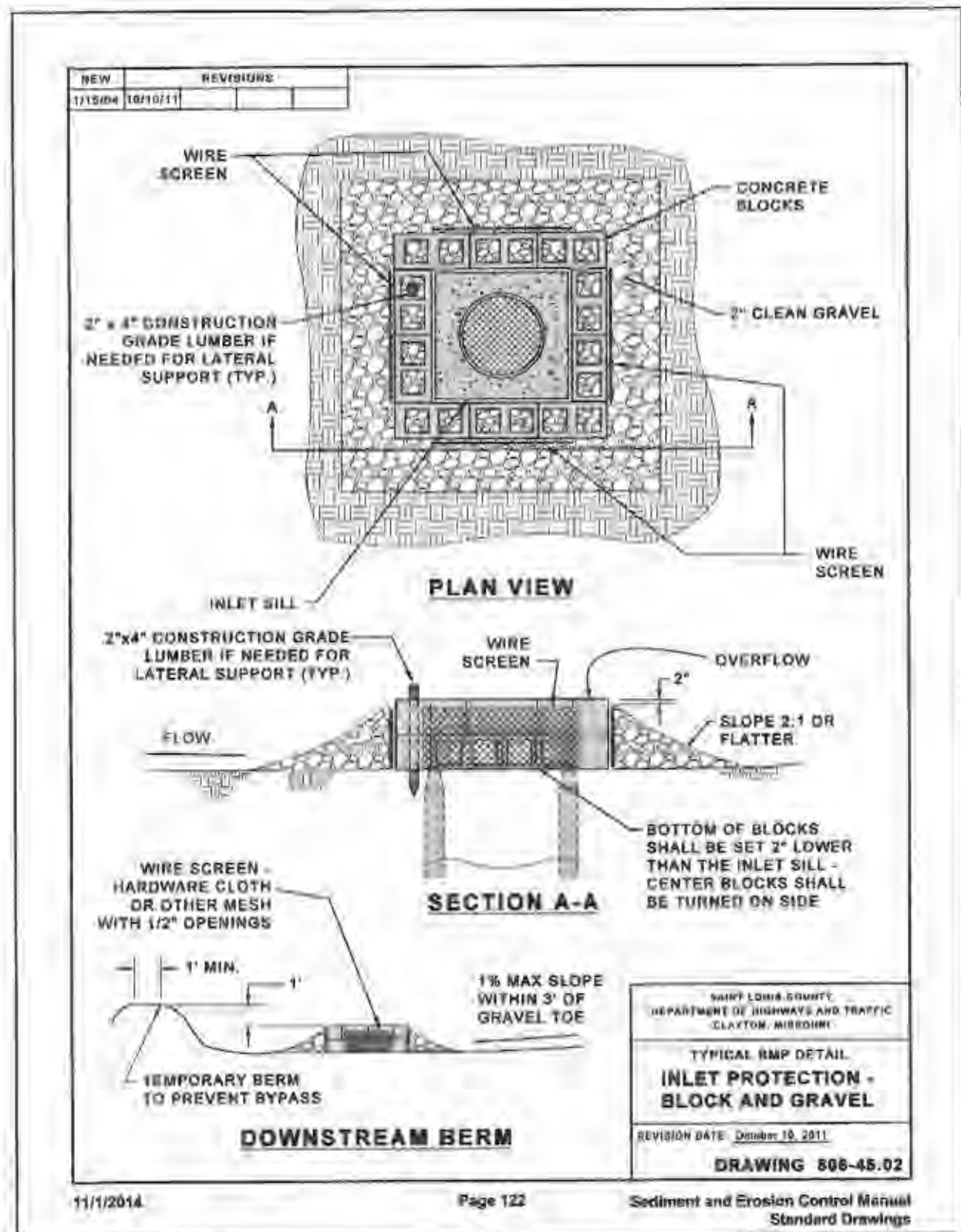
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OAK BLUFF ESTATES
CONSTRUCTION PLANS
 STORMWATER POLLUTION PREVENTION PLAN

PROJECT NUMBER: 14-0546
 DATE: 12/01/15
 DRAWN BY: MLP



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OAK BLUFF ESTATES
CONSTRUCTION PLANS
SWPPP DETAILS

PROJECT NUMBER: 14-0546
DATE: 12/10/15
DRAWN BY: MLF

TABLE 1: BASE SEEDING RATES - POUNDS PURE LIVE SEED PER ACRE

Species	Base Rate (100%)	Erpion Control Rating	Wildlife Habitat Rating	Wet Soil Tolerance Rating	Drought Tolerance Rating
Cool Season Legumes:					
Birdfoot Trefoil	5.0	Fair	Fair	Low	Medium
Alfalfa Clover	5.2	Good	Good	High	Low
Ladino Clover	3.0	Good	Fair	Medium	Low
Red Clover	8.0	Fair	Fair	None	Low
Kura Clover	7.0	Fair	Fair	None	Low
Alfalfa	7.5	Fair	Excellent	None	High
Warm Season Legumes:					
Common Lespedeza ¹⁾	7.5	Poor	Excellent	Low	High
Illinois Hornedlark ²⁾	3.5	Fair	Excellent	None	Medium
Partridge Pea ²⁾	26.8	Fair	Excellent	None	Medium
Purple Prairieclover ³⁾	5.8	Poor	Good	None	High
Blowhard Butterfly ⁴⁾	6.1	Poor	Good	None	High
Shoney Ticklerfall ⁵⁾	10.0	Fair	Excellent	None	High
Cool Season Grasses:					
Timothy ⁶⁾	15.3	Good	Excellent	Low	Medium
Virginia Wildrye ⁶⁾	15.0	Good	Excellent	Medium	Medium
Kentucky Bluegrass	3.2	Good	Good	Low	Low
Ordnancegrass	6.2	Fair	Excellent	None	Medium
Perennial Ryegrass	7.3	Poor	Good	None	Low
Woolly	1.7	Good	Good	Medium	Low
Red Canarygrass	4.8	Excellent	Poor	High	Medium
Smooth Brome	4.0	Excellent	Fair	Low	Medium
Tall Fescue	10.0	Excellent	Poor	Low	High
Timothy	3.1	Good	Excellent	Low	Low
Warm Season Grasses:					
Distalragras	2.1	Excellent	Poor	Low-Medium	High
Big Bluestem ⁷⁾	4.0	Fair	Good	Medium	High
Fluoranthus ⁸⁾	2.9	Good	Poor	None	High
Carolina Ostragal ⁹⁾	2.2	Fair	Good	None	High
Eastern Ostragal ⁹⁾	4.0	Poor	Good	Medium	Medium
Indiangrass ⁹⁾	7.5	Fair	Excellent	Low	Medium
Little Bluestem ⁹⁾	6.4	Good	Excellent	None	High
Silvets Grass ⁹⁾	7.5	Good	Excellent	None	Medium
Southern Crabgrass ⁹⁾	3.2	Fair	Poor	Low	Low
Switchgrass ⁹⁾	4.7	Good	Good	Medium	Medium
Warm Season Forbs:					
Corydalis ¹⁰⁾	3.6	Fair	Good	None	Medium
Pink Purple Creeper ¹⁰⁾	16.4	Poor	Fair	None	Medium
Blue Eye Falx ¹⁰⁾	11.3	Poor	Fair	None	High
Wild Bergamot ¹⁰⁾	1.4	Fair	Fair	High	Low
Yarrow ¹⁰⁾	4.4	Fair	Fair	Medium	High

¹⁾ These species are annual species; plant in the dormant or spring planting periods to allow seedbed to occur. Refer to Table 2, page 7 for planting dates. Check to make sure that the use of these species meets the local environmental conditions and any program requirements prior to planting in the seed mixture.
²⁾ Acceptable cultivars or locally adapted seeds of native species grown in (origin) Missouri or adjacent states (KS, OK, AR, TN, KY, IL, IN, WI, MI) will be planted. Refer to Table 2 of this specification for a listing of acceptable cultivars.

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July 2012

TABLE 2: NATIVE GRASS SPECIES, CULTIVARS OR SELECTIONS FOR USE IN MISSOURI

Plant Species	Cultivar	Area of Use ¹⁾	States of Collection
Native Cool Season Grasses			
Virginia Wildrye	Clover River O'Ma Ha	Statewide North Missouri	Eastern Missouri East and Northeast Nebraska
Native Warm Season Grasses			
Big Bluestem ²⁾	Keokuk 02-70 Eze Pawnee	Statewide Statewide Statewide North Missouri	Western Iowa Southern Missouri, Southern Illinois, Northern Arkansas, and Eastern Oklahoma Eastern Kansas North Central Kansas and South Central Nebraska
Little Bluestem	Charm Albino Cinaron Comper	Statewide Statewide South Missouri, sandy area only North Missouri	North Central Nebraska Eastern Kansas Southwestern Kansas and Oklahoma Pennsylv North Central Kansas and South Central Nebraska
Eastern Gamagrass	Osage Poc PMK-24	Statewide Statewide Statewide	Missouri and Southern Illinois Kansas and Oklahoma Kansas and Oklahoma
Sideoats Grass	Burns El Reno Firstway	North Missouri Statewide Statewide	North Central Nebraska Central Oklahoma North Central Nebraska
Indiangrass	Blaney Osage Cheyenne	Statewide Statewide Statewide	Southern Illinois Eastern and Central Kansas and Oklahoma Western Oklahoma
Switchgrass	Nebraska 54 Cove-to-Rock Blackwell Alamo Kendro	North Missouri Statewide Statewide Louisiana Sites - South Missouri Lowland Sites - Statewide	Southern Illinois North Central Oklahoma South Central Texas East Central Oklahoma
Native Warm Season Legumes and Forbs	Patridge Trailblazer Nebraska 28	North Missouri North Missouri North Missouri	North Central and South Central Nebraska Selection from Pathfinder North Central Nebraska

¹⁾ North Missouri is all counties north of Bates, Henry, Benton, Morgan, Monticau, Cole, Osage, Gasconade, Franklin, and St. Louis Counties. South Missouri is all counties including and south of those listed.

4) Mixture Adjustment Factor - The amount of seed needed will vary based on the percentage of each species in the desired mix that is planned and applied to the site. Use the current form JS-AGRON-25 to calculate the amount of seed needed to apply the minimum seed to meet the practice criteria. Each conservation practice requires a different minimum amount of seed due to the different conservation purposes. Declare the desired percentage for each species in the mix for calculating seed needs; mixture percentages will total 100 percent.

An example of the seeding rate calculations for Practice, Method, and Mixture Adjustment Factors follows the formula:

$$\text{Base Rate (Table 1)} \times \text{Practice (\%)} \times \text{Method (\%)} \times \text{Mixture (\%)} = \text{Seeding Rate (PLS)}$$

NRCS MOFOTG
July 2012

Table 3: Site Preparation, Seedbed Preparation, and Seed Placement

Seeding Situation	Site Preparation	Seedbed Preparation	Seed Placement
Broadcast seeding legumes and forbs in the dormant seeding period (for more information on establishing forbs, see Native Forbs Information Sheet IS-10643F)	Remove some of the residue/cover prior to planting. This may be accomplished by grazing, haying, or prescribed burning.	None	Broadcast without rolling before or after seed placement
No till drilling or planting Complete Revegetation	When planting a no till seeding into heavy crop residue, remove some of the residue cover prior to planting. This may be accomplished by herbicides, grazing, haying, shredding, or prescribed burning. If chemical burn-down of existing perennial vegetation will be used apply chemicals in split applications at least 1 month apart. Split applications like summer/fall and spring/summer give in seeding work best. If chemical burn-down of annual crops/weeds will be used 1 application may be used.		Plant the seed mixture with a grassland drill, grain drill, or seeder/spreader at the proper depth. Drills shall be capable of properly metering and placing the seed and kind of seed being planted. Desired seeding depth shall be between 1/2" and 1 1/4" for all species except eastern gamagrass which will be planted to a depth of 1 to 1 1/2 inches. Set the drill or seeder at shallower depths (1/8 inch) for smaller seeds or planting on heavier soils. Plant large seeds at the deeper depth (1 1/4 inch) or when planting on sandy soil.
No till drilling or planting Intersowing grasses or forbs and legumes into existing vegetation	When no-tilling into existing vegetation to improve diversity or reduce the stand, remove some of the residue/cover prior to planting. This may be accomplished by grazing, haying, shredding, prescribed burning or herbicides. If chemical burn-down of existing cover will be used, 1 application will be used to weaken the existing stand and reduce competition.		Spread the seed on the soil surface in any manner that will insure even distribution of seed to the entire area. Rolling or packing after spreading the seed will be required for any broadcast seedings that occur outside of the dormant seeding period.
Broadcast seeding into a tilled seedbed	Depending on prior land use, existing cover and active growth herbicides, prescribed burning, grazing, close mowing or some combination of these treatments will be used to weaken the existing stand, control weedy species and/or prevent seed production during the growing season prior to seeding. Timing of herbicide applications shall be based on the growth stage of the target species being controlled. Adequate time for decomposition of root crowns should be provided to insure good seed to soil contact at planting.	Prepare a seedbed, incorporate lime and fertilizer. Rolling or packing before broadcasting seed will be required for all broadcast seedings that occur outside of the dormant seeding period. All slopes must be smooth and free of gullies and/or rills.	Plant the seed mixture with a grassland drill, grain drill, seeder/spreader, or sprayer at the proper depth. Drills shall be capable of properly metering and placing the seed and kind of seed being planted. Desired seeding depth shall be between 1/2" and 1 1/4" for all species except eastern gamagrass which will be planted to a depth of 1 to 1 1/2 inches. Set the drill or seeder at shallower depths (1/8 inch) for smaller seeds or planting on heavier soils. Plant large seeds at the deeper depth (1 1/4 inch) or when planting on sandy soil.
No till drilling, starting, striping into a tilled seedbed			
Critical area plantings on steep slopes (4:1 or steeper)	All slopes must be smooth and free of rills and/or gullies	None	Broadcast seed without rolling before or after seed placement

NRCS MOFOTG
July 2012

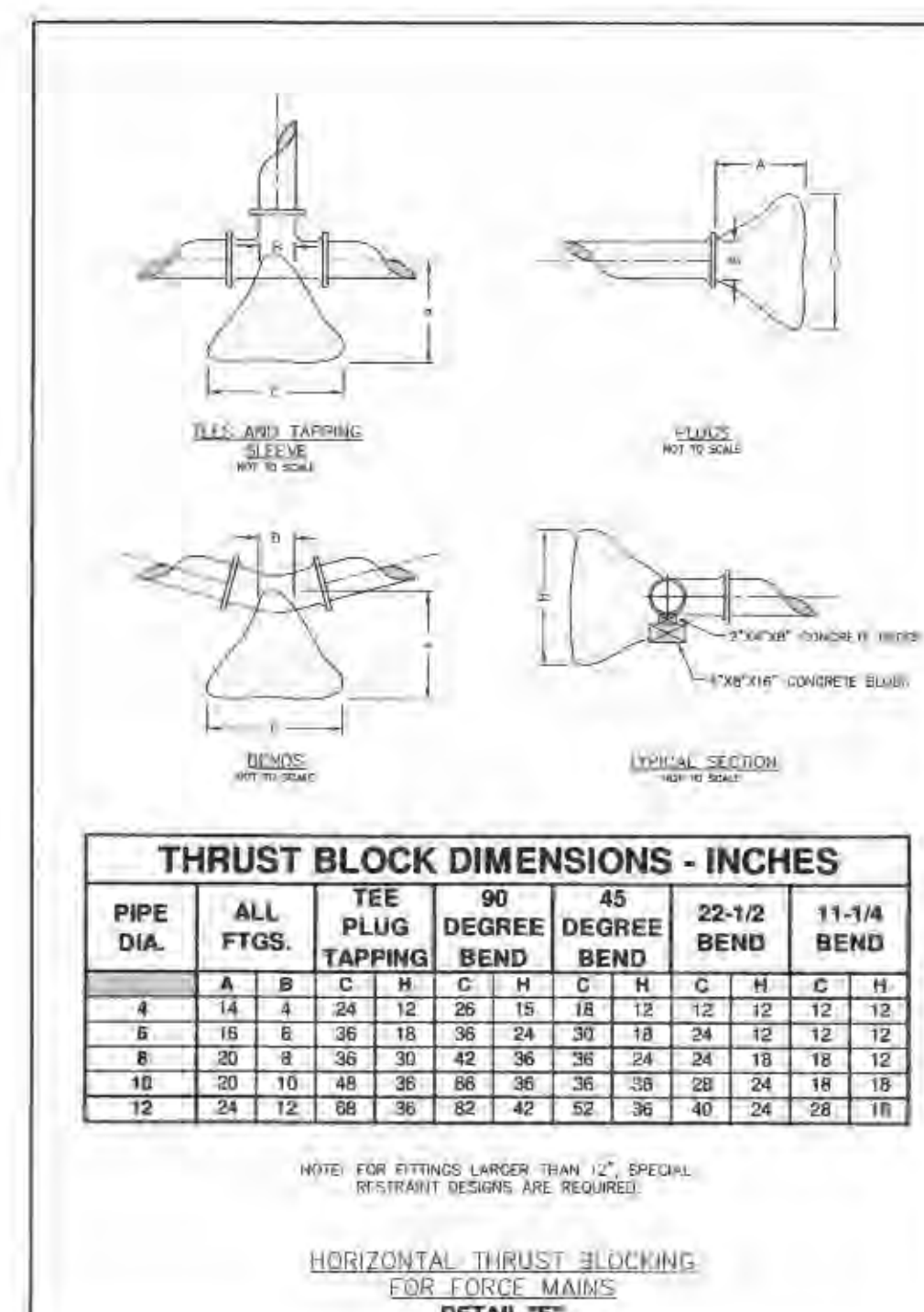
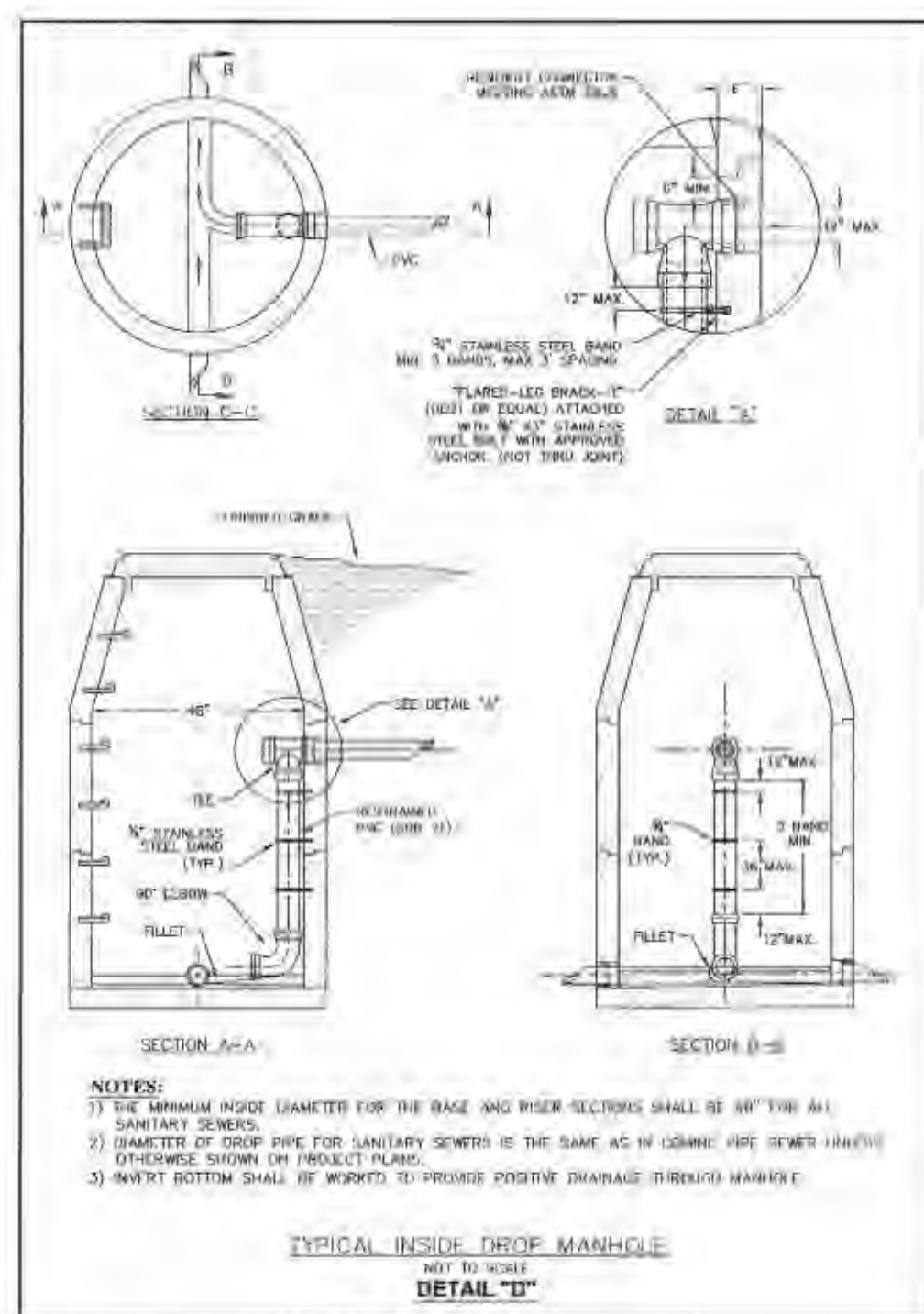
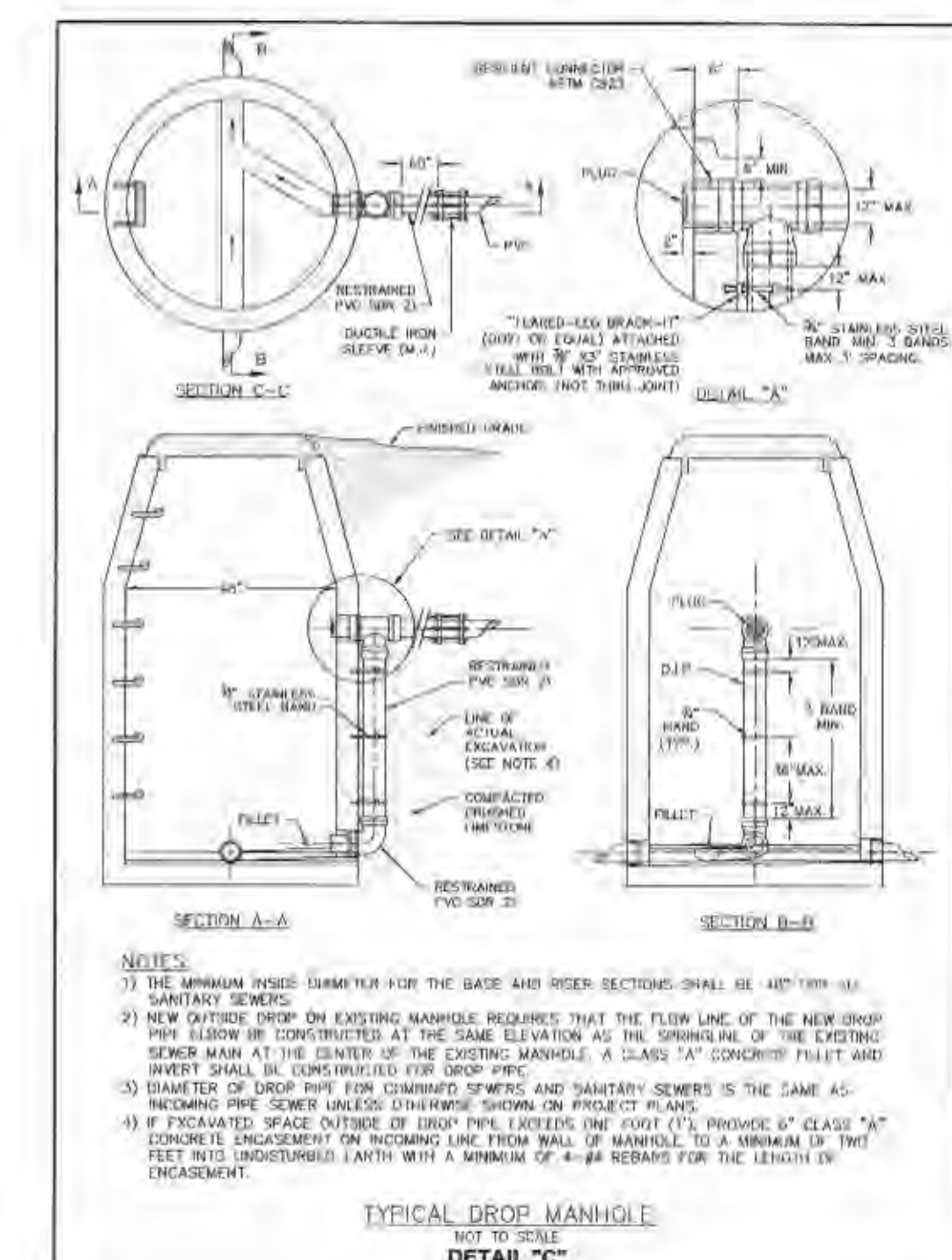
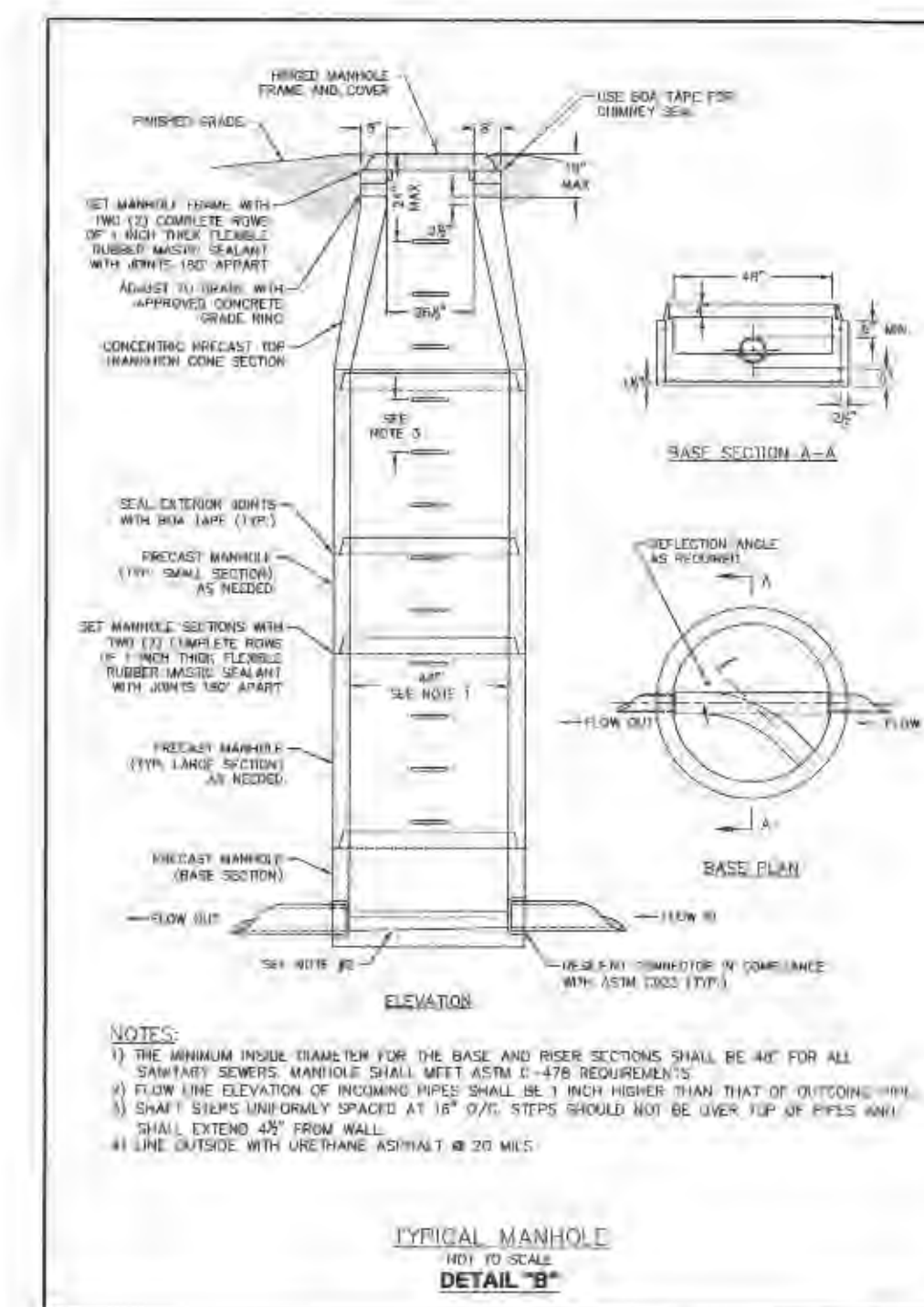
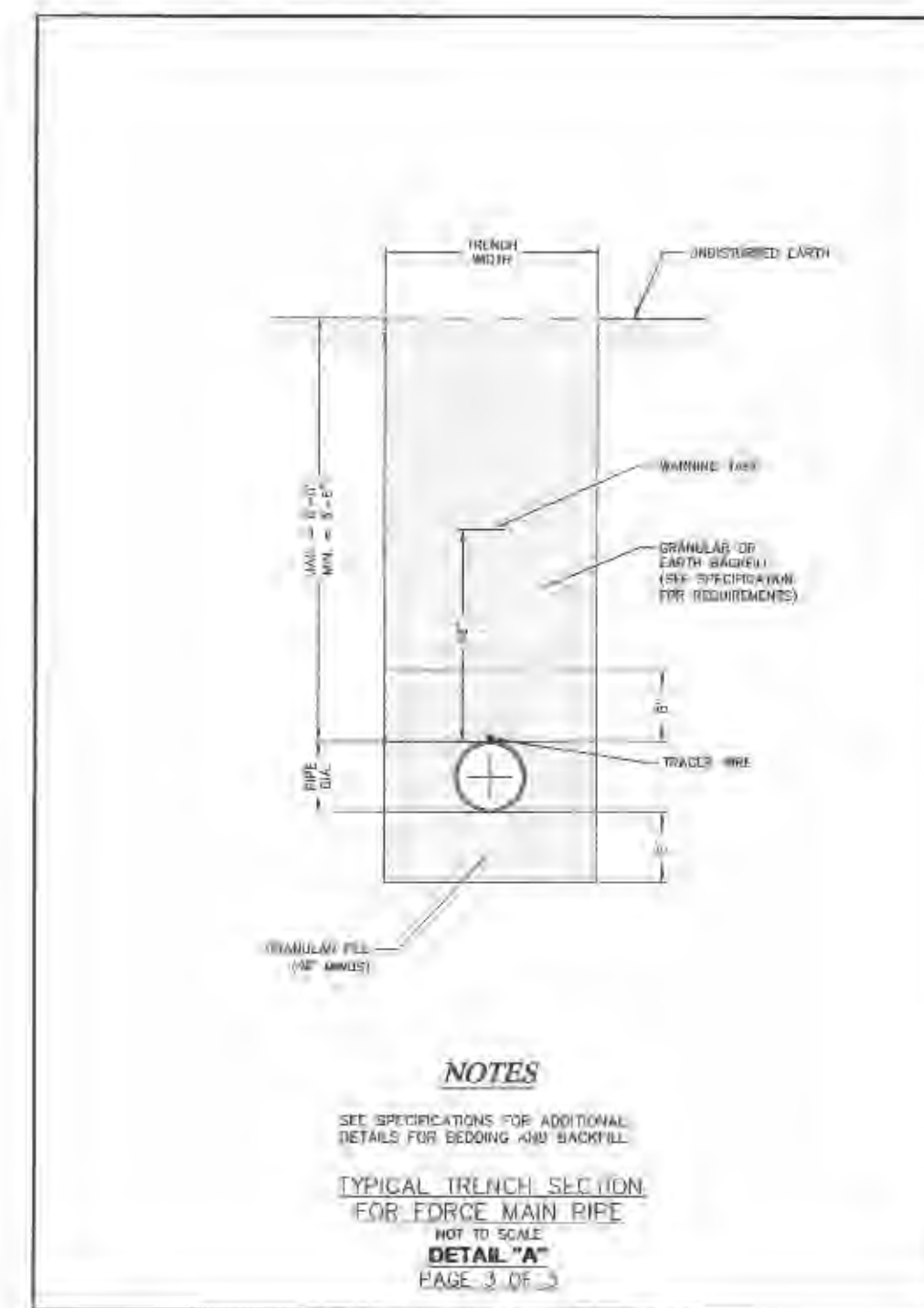
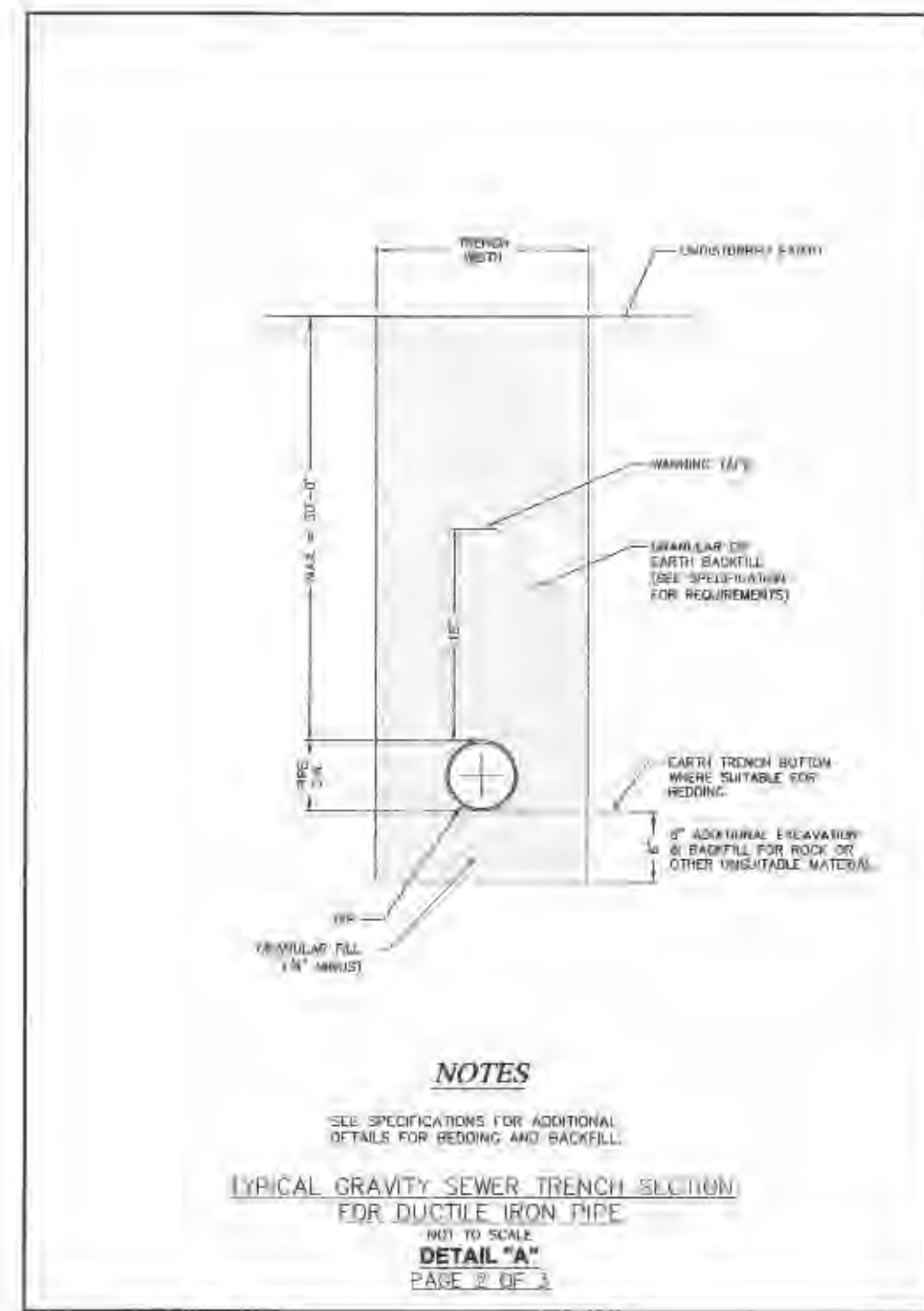
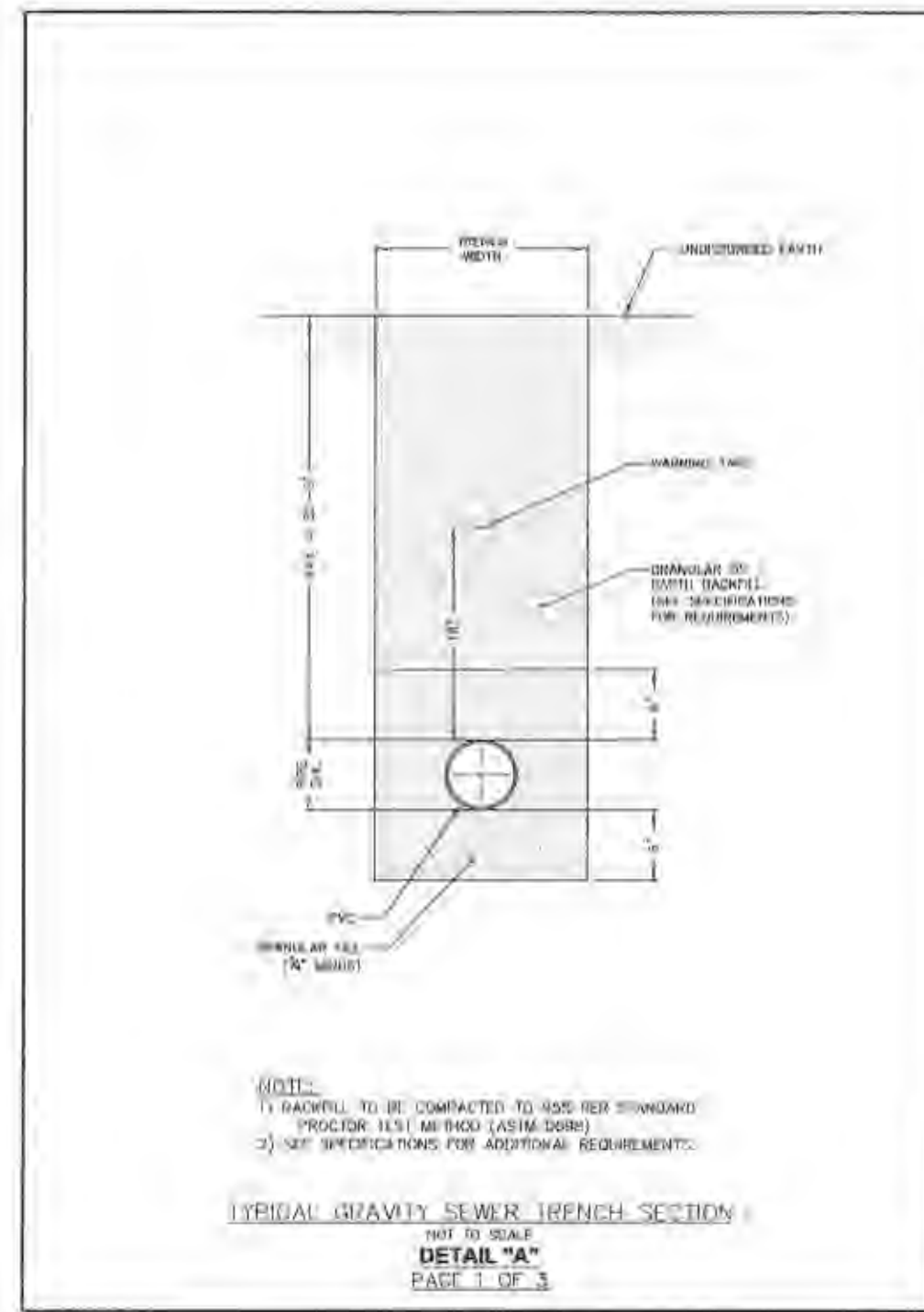
TABLE 4: PLANTING DATES¹⁾

Plantings with a dominance of:	Spring Planting Period ²⁾	Summer or Fall Planting Period	Dormant Season Planting Period ³⁾
Cool Season Grasses and Legumes in Northern Missouri ⁴⁾ Acceptable Dates Optimal Dates	Mar 16 - May 31 Mar 16 - Apr 30	Aug 01 - Oct 15 ⁵⁾ Aug 16 - Sep 15	Dec 01 - Mar 15
Cool Season Grasses and Legumes in Southern Missouri ⁴⁾ Acceptable Dates Optimal Dates	Mar 01 - May 15 Mar 01 - Apr 15	Aug 16 - Oct 15 ⁵⁾ Sep 01 - Sep 30	Dec 16 - Feb 29
Warm Season Grasses, Legumes, and Forbs in Northern Missouri ⁴⁾ Acceptable Dates Optimal Dates	Mar 16 - Jun 30 Apr 16 - Jun 15		Nov 16 - Mar 15
Warm Season Grasses, Legumes, and Forbs in Southern Missouri ⁴⁾ Acceptable Dates Optimal Dates	Mar 01 - Jun 15 Apr 01 - May 31		Dec 01 - Feb 29

¹⁾ Planting dates are based on plant suitability zones. Northern Missouri is all counties north of Bates, Henry, Benton, Morgan, Monticau, Cole, Osage, Gasconade, Franklin, and St. Louis Counties. Southern Missouri is all counties including and south of those listed.
²⁾ Mixtures containing annual species (common lespedeza, partridge pea, or southern crabgrass) will be planted only in the dormant or spring planting periods. All herbaceous seedings under the 643 standard must be planted in the dormant period.
³⁾ Mixtures containing legume species will be planted by September 15 in Northern Missouri and September 30 in Southern Missouri.

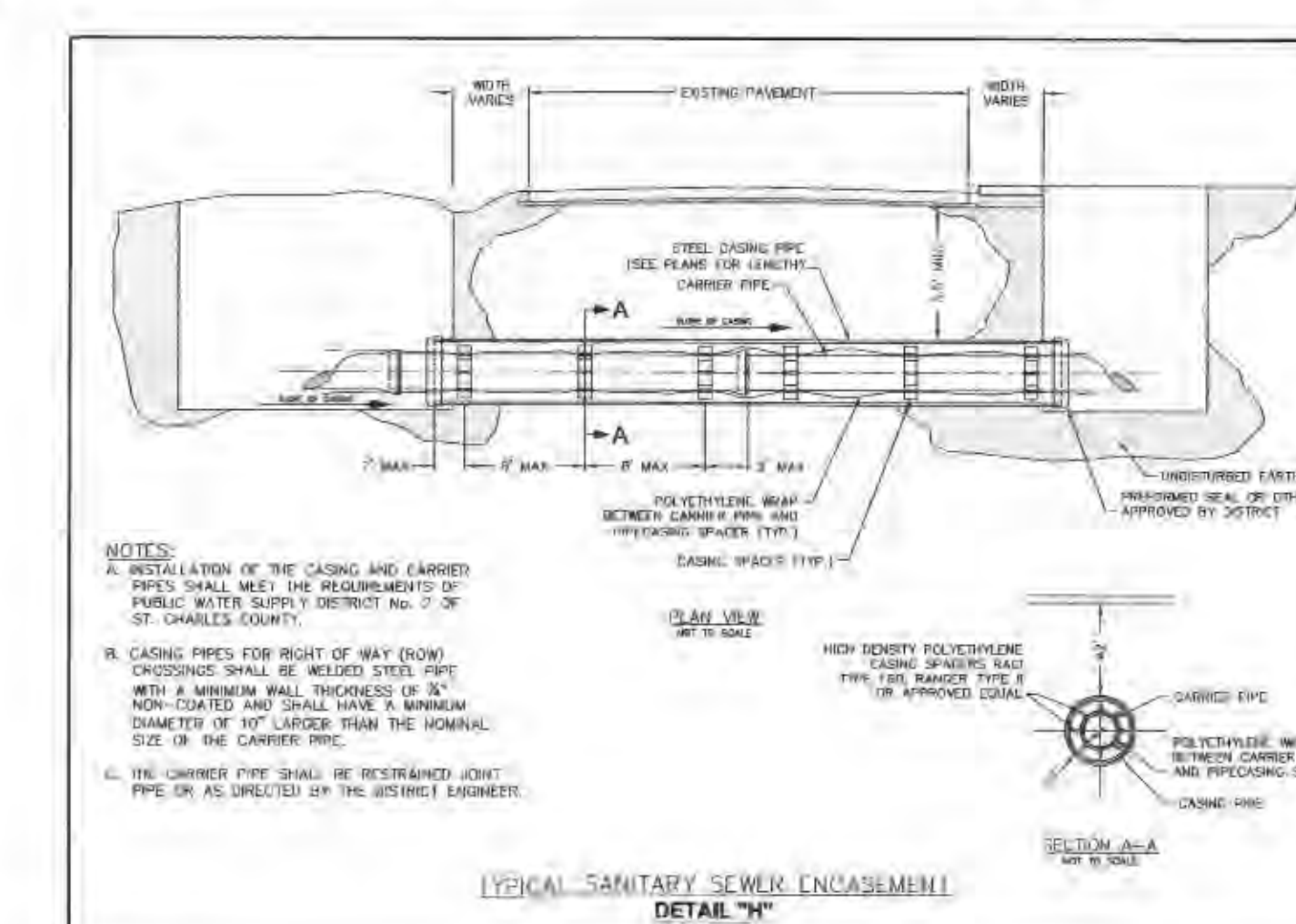
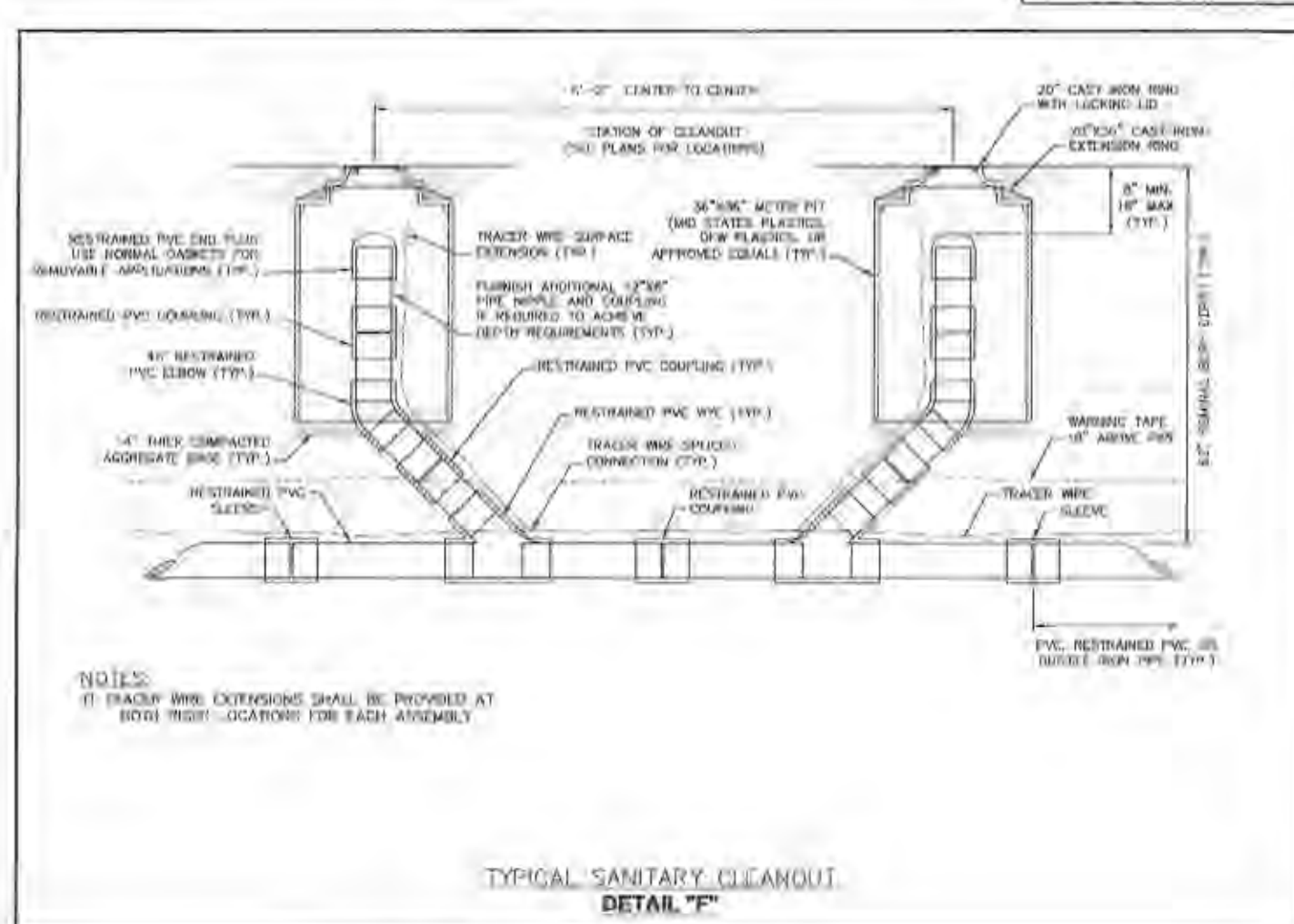
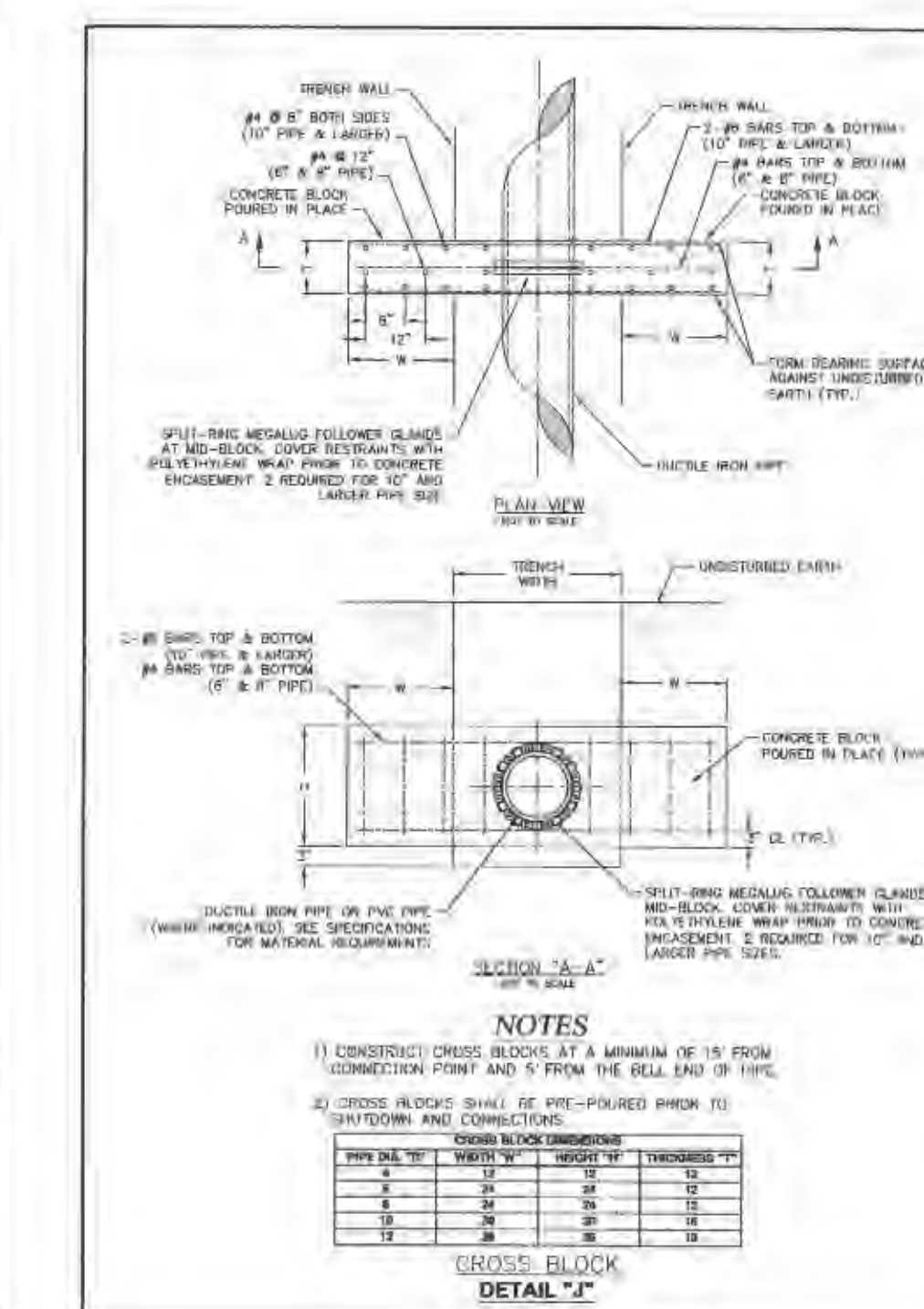
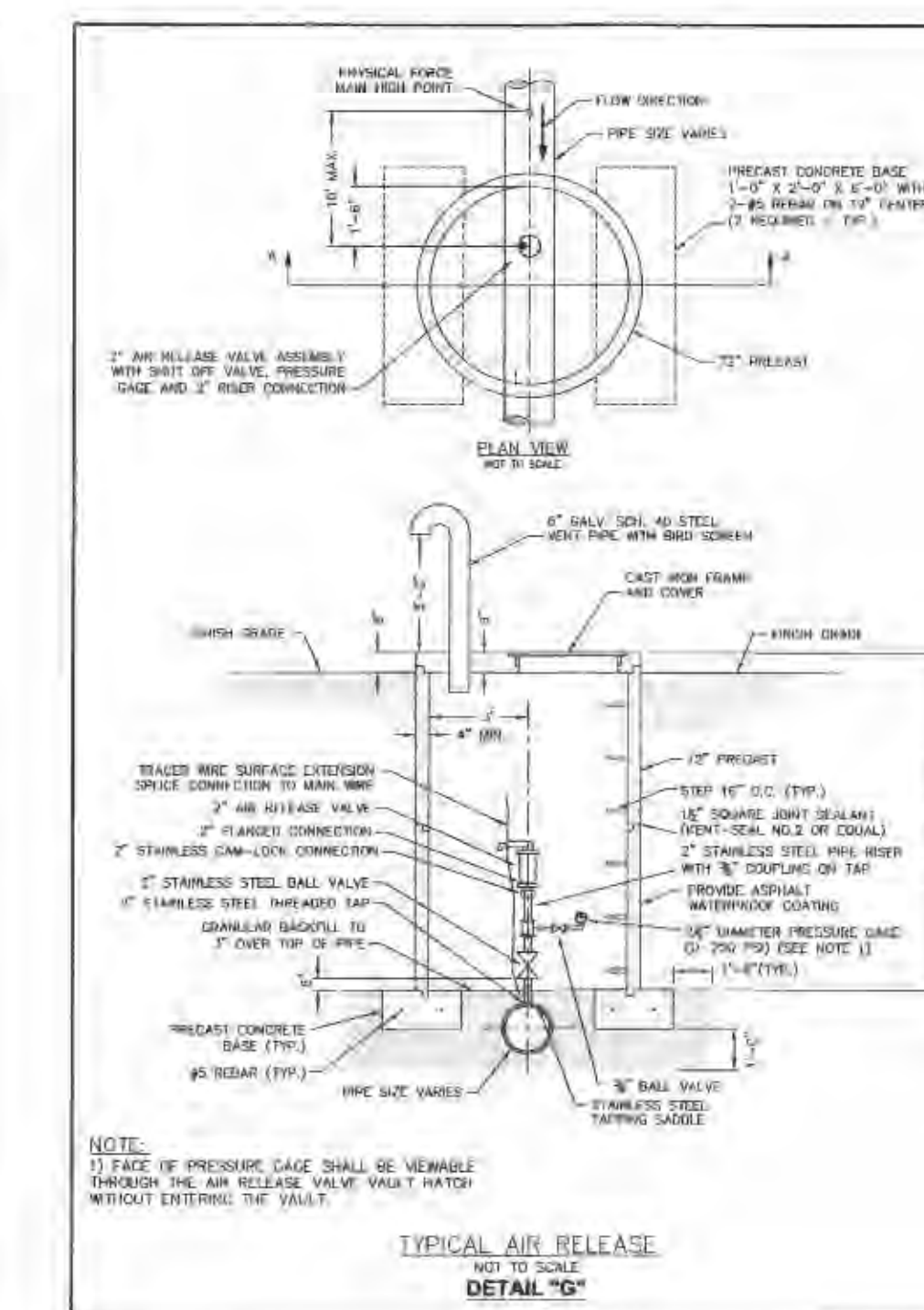
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 SWPPP DETAILS



THRUST BLOCK DIMENSIONS - INCHES

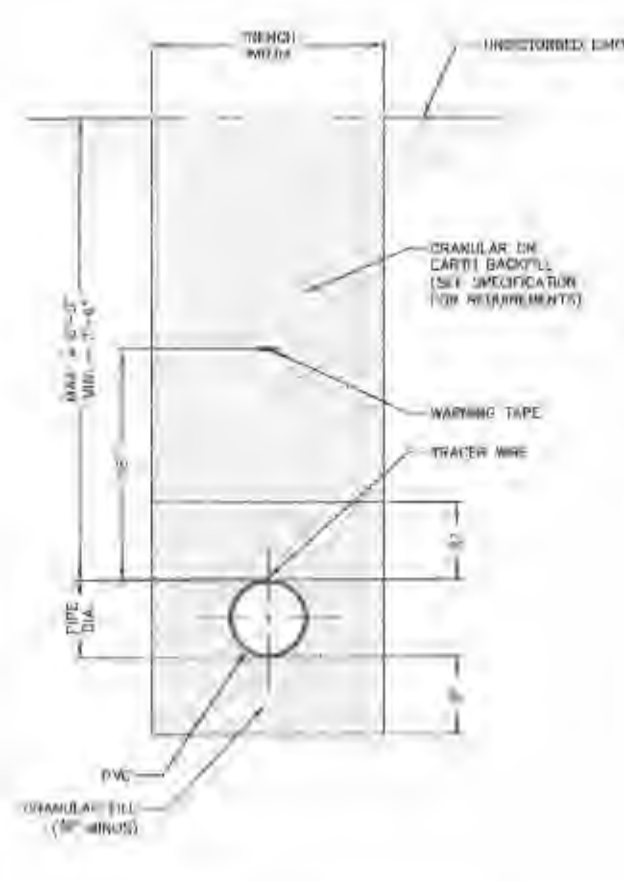
PIPE DIA.	ALL FTGS.			90 DEGREE BEND			45 DEGREE BEND			22-1/2 DEGREE BEND			11-1/4 DEGREE BEND		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
4	14	4	24	12	26	15	18	12	12	12	12	12	12	12	12
6	16	6	36	16	36	24	30	18	24	12	12	12	12	12	12
8	20	8	36	30	42	36	36	24	24	18	18	12	12	12	12
10	20	10	48	36	66	36	36	28	28	24	18	18	12	12	12
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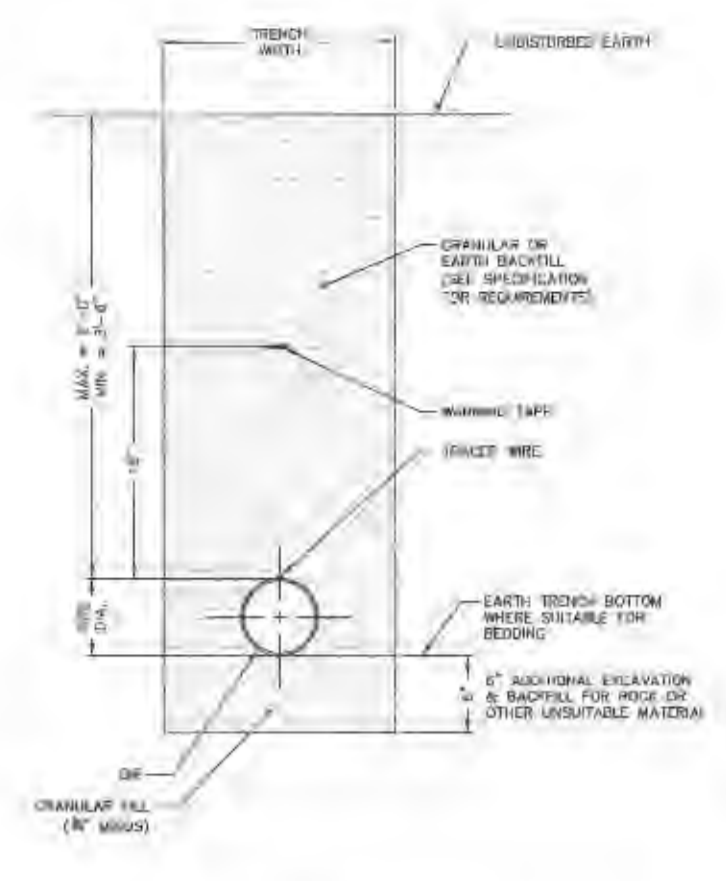
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CONSTRUCTION PLANS
SANITARY SEWER DETAILS

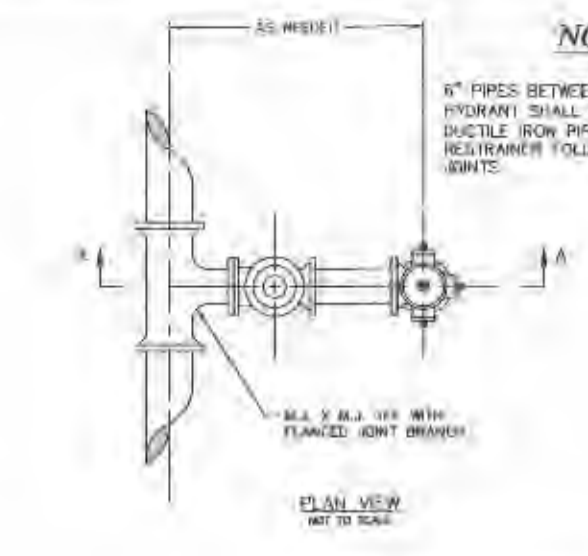
PROJECT NUMBER: 14-0546
DATE: 12/10/15
DRAWN BY: MUF



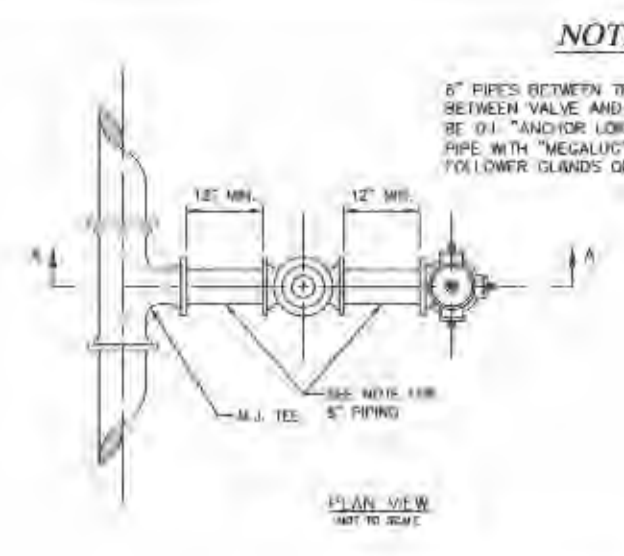
NOTES
 1) SEE SPECIFICATIONS FOR APPROVAL DETAILS FOR BEDDING AND BACKFILL.
TYPICAL TRENCH SECTION FOR PVC PIPE
 DETAIL "A"
 PAGE 1 OF 2



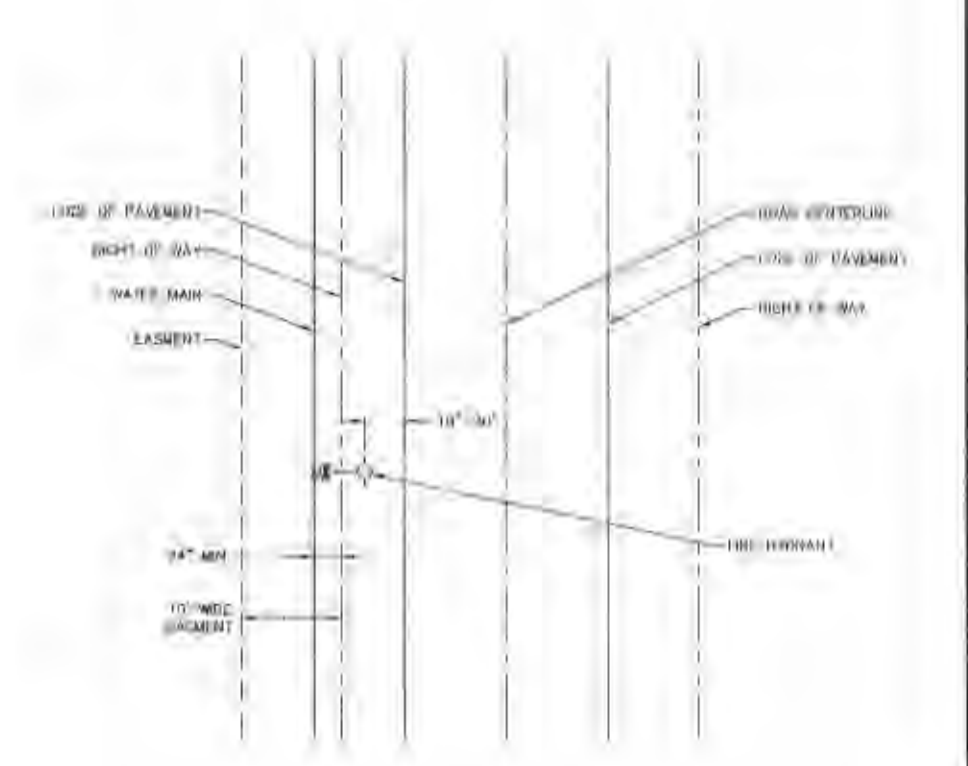
NOTES
 1) POLYWRAP REQUIRED FOR DUCTILE IRON PIPE.
 2) SEE SPECIFICATIONS FOR ADDITIONAL DETAILS FOR BEDDING AND BACKFILL.
TYPICAL TRENCH SECTION FOR DUCTILE IRON PIPE
 DETAIL "A"
 PAGE 2 OF 3



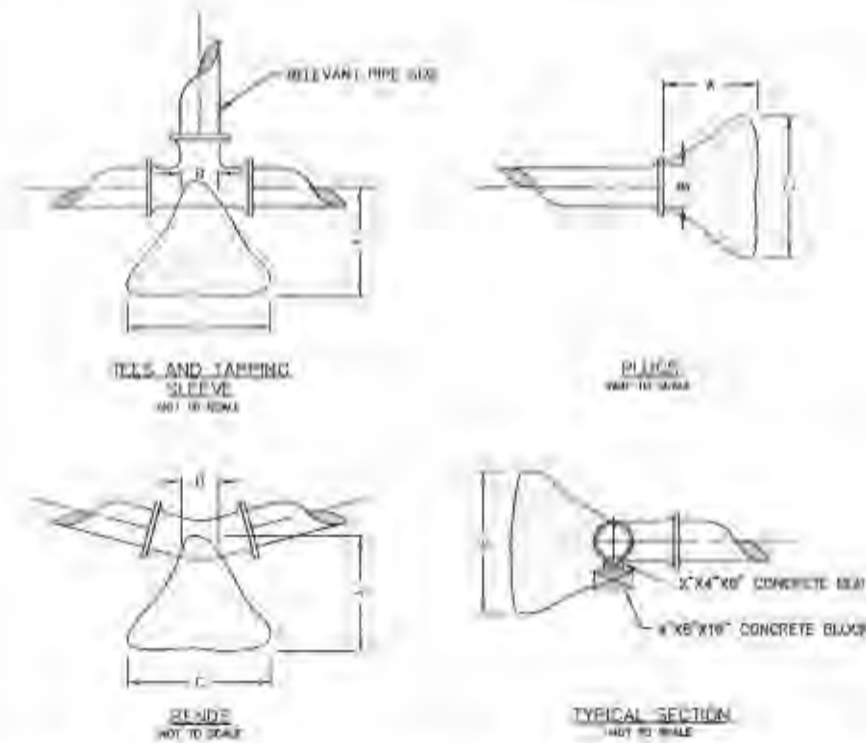
NOTES
 1" PIPES BETWEEN VALVE AND FIRE HYDRANT SHALL BE 2" THICKNESS LISTS OF DUCTILE IRON PIPE WITH METALLIC FOLLOWER TIGHTER BANDS OF ALL JOINTS.
FIRE HYDRANT DETAIL
 DETAIL "B"
 PAGE 1 OF 3



NOTES
 1" PIPES BETWEEN VALVE AND FIRE HYDRANT SHALL BE 2" THICKNESS LISTS OF DUCTILE IRON PIPE WITH METALLIC FOLLOWER TIGHTER BANDS OF ALL JOINTS.
FIRE HYDRANT DETAIL
 DETAIL "B"
 PAGE 2 OF 3



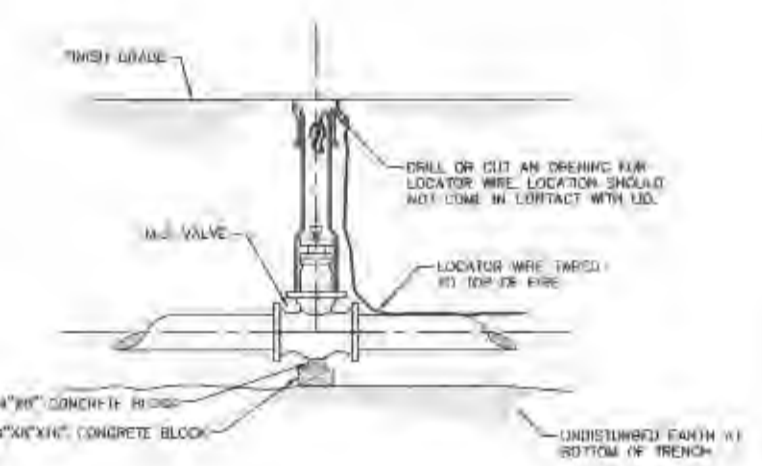
FIRE HYDRANT DETAIL
 DETAIL "B"
 PAGE 3 OF 3



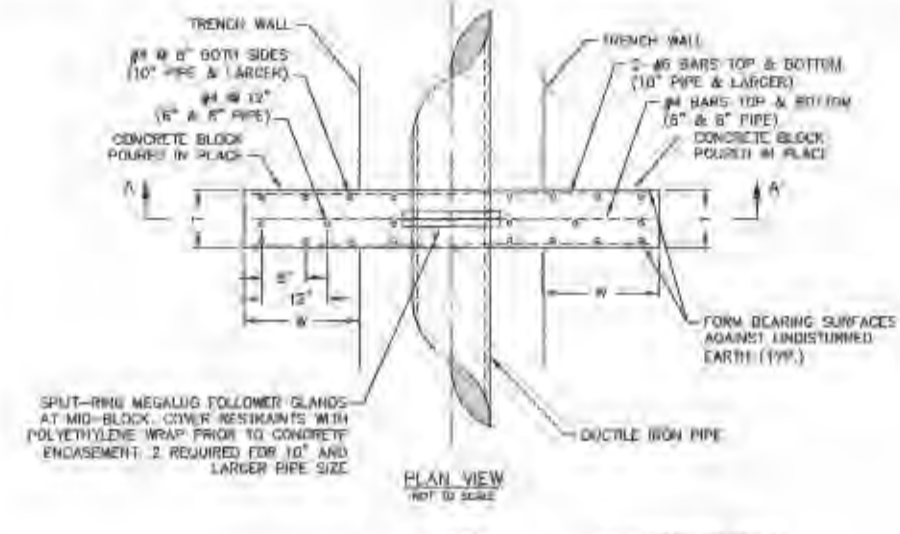
THRUST BLOCK DIMENSIONS - 22-INCHES

PIPE DIA.	ALL FTGS.		TEE PLUG TAPPING		90 DEGREE BEND		45 DEGREE BEND		22-1/2 BEND		11-1/4 BEND	
	A	B	C	H	C	H	C	H	C	H	C	H
4	14	4	24	12	26	15	18	12	12	12	12	12
6	16	6	36	18	38	24	30	18	24	12	12	12
8	20	8	36	30	42	36	36	24	24	18	18	12
10	25	10	48	36	60	36	36	28	28	24	18	18
12	34	12	66	36	82	42	36	40	24	28	18	18

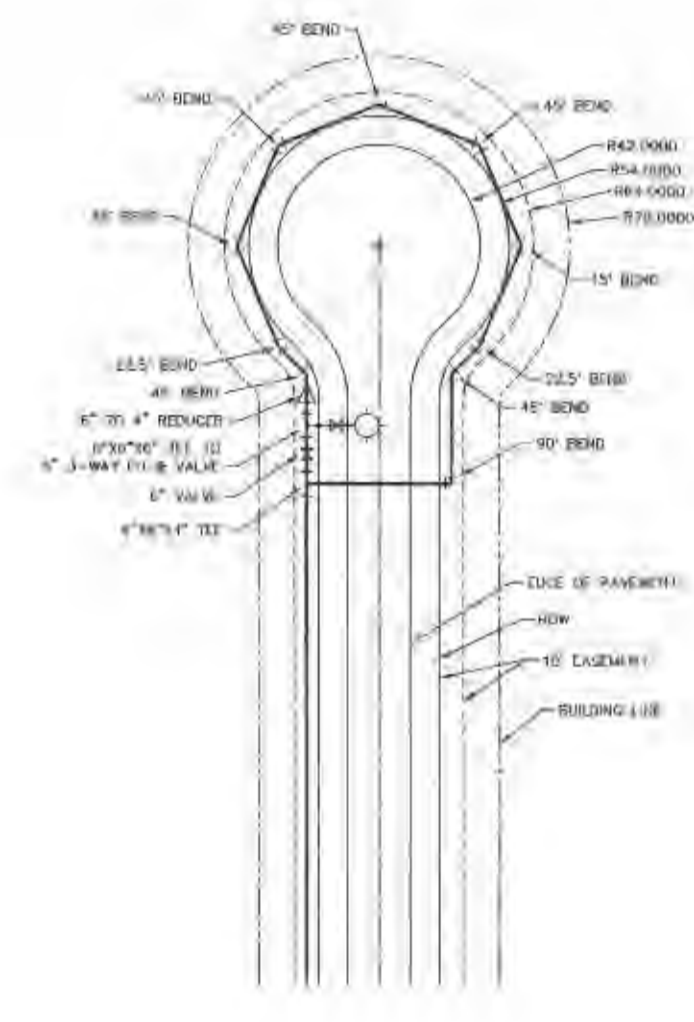
NOTE
 FOR TAPPING LARGER THAN 1" SPECIAL REQUIREMENTS APPLY.
HORIZONTAL THRUST BLOCKING
 DETAIL "C"



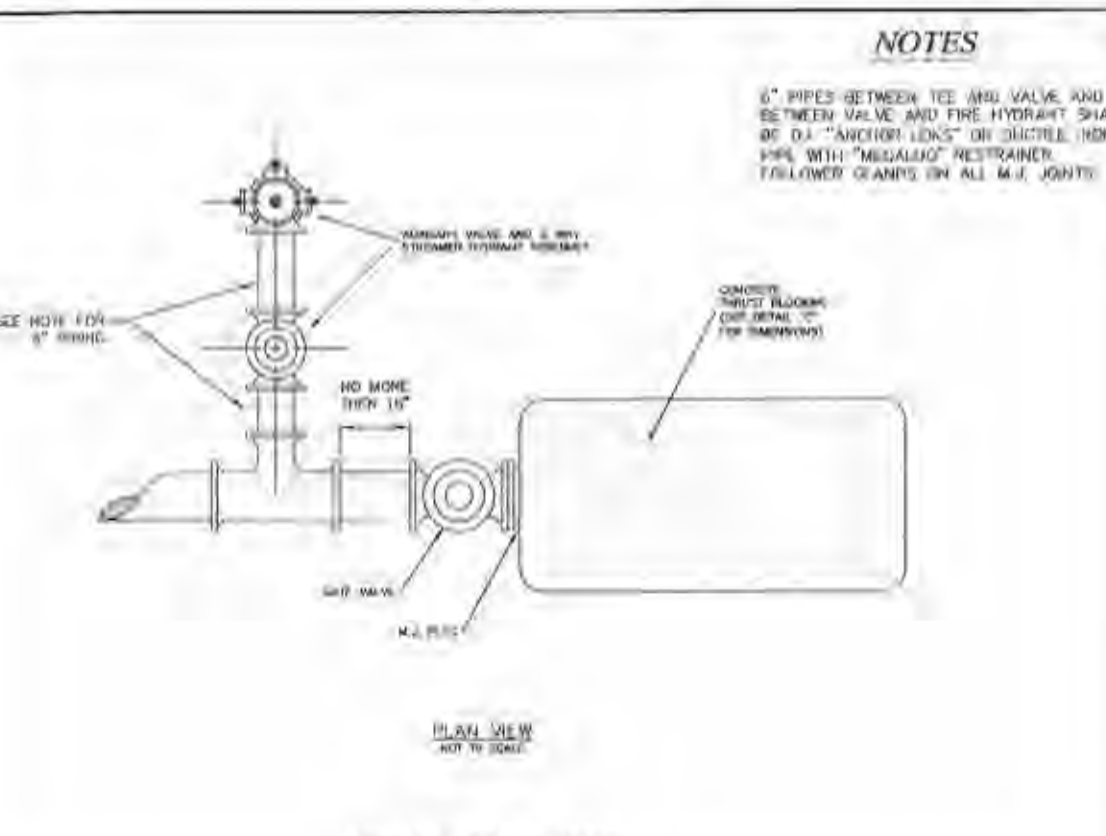
GATE VALVE DETAIL
 DETAIL "D"



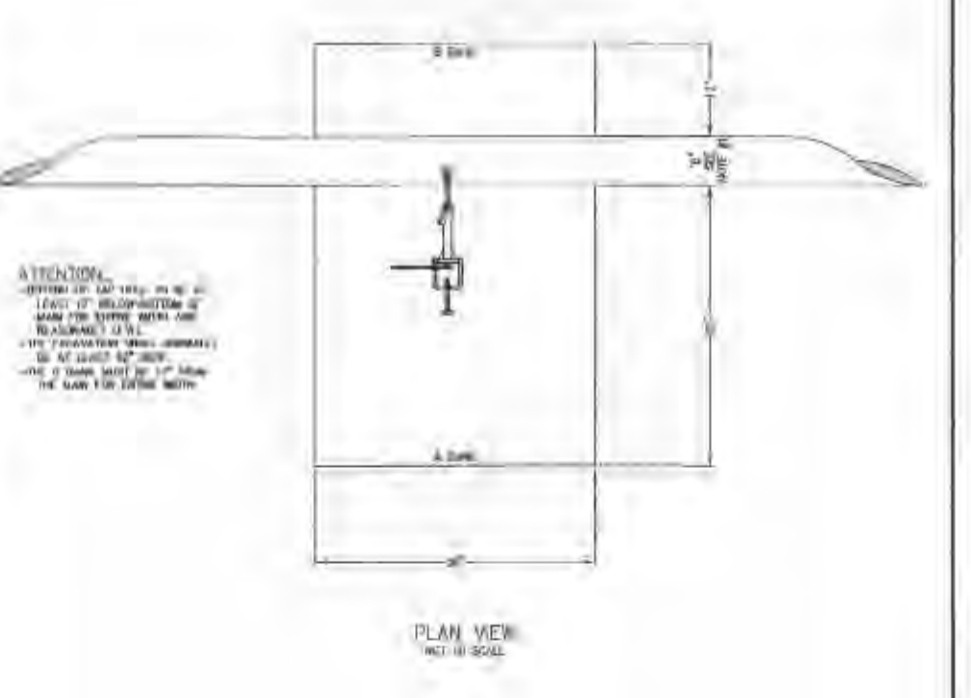
CROSS BLOCK DETAIL
 DETAIL "E"



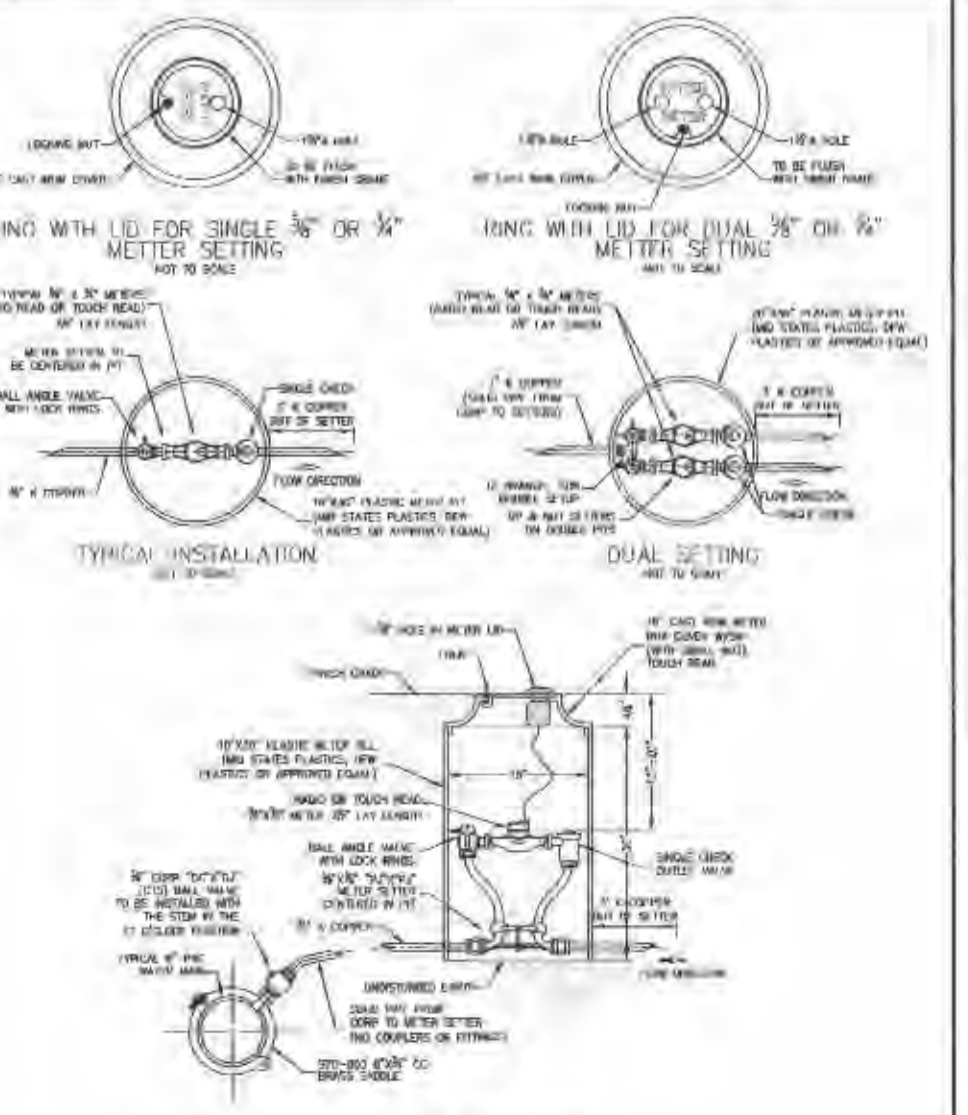
SMALL COURT DETAIL
 DETAIL "F"
 PAGE 1 OF 2



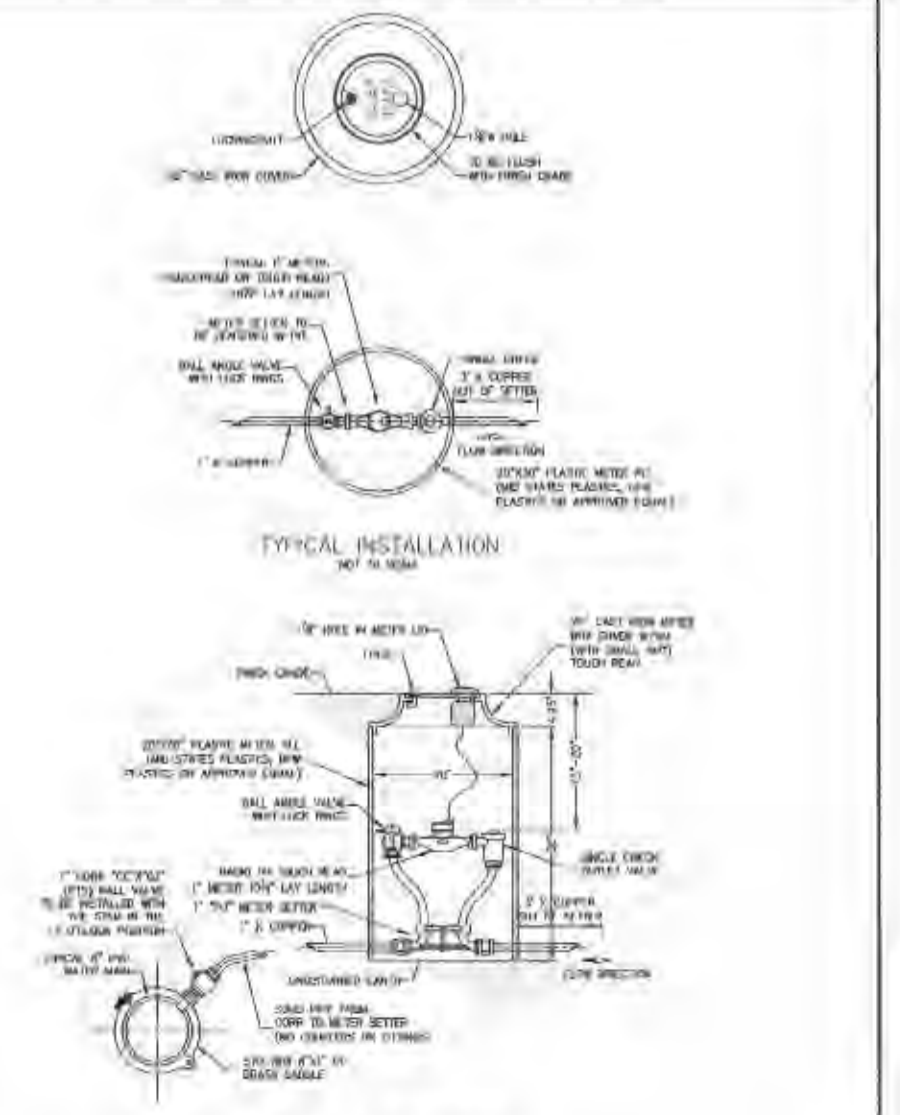
TYPICAL WATER MAIN TERMINATION DETAIL
 DETAIL "G"



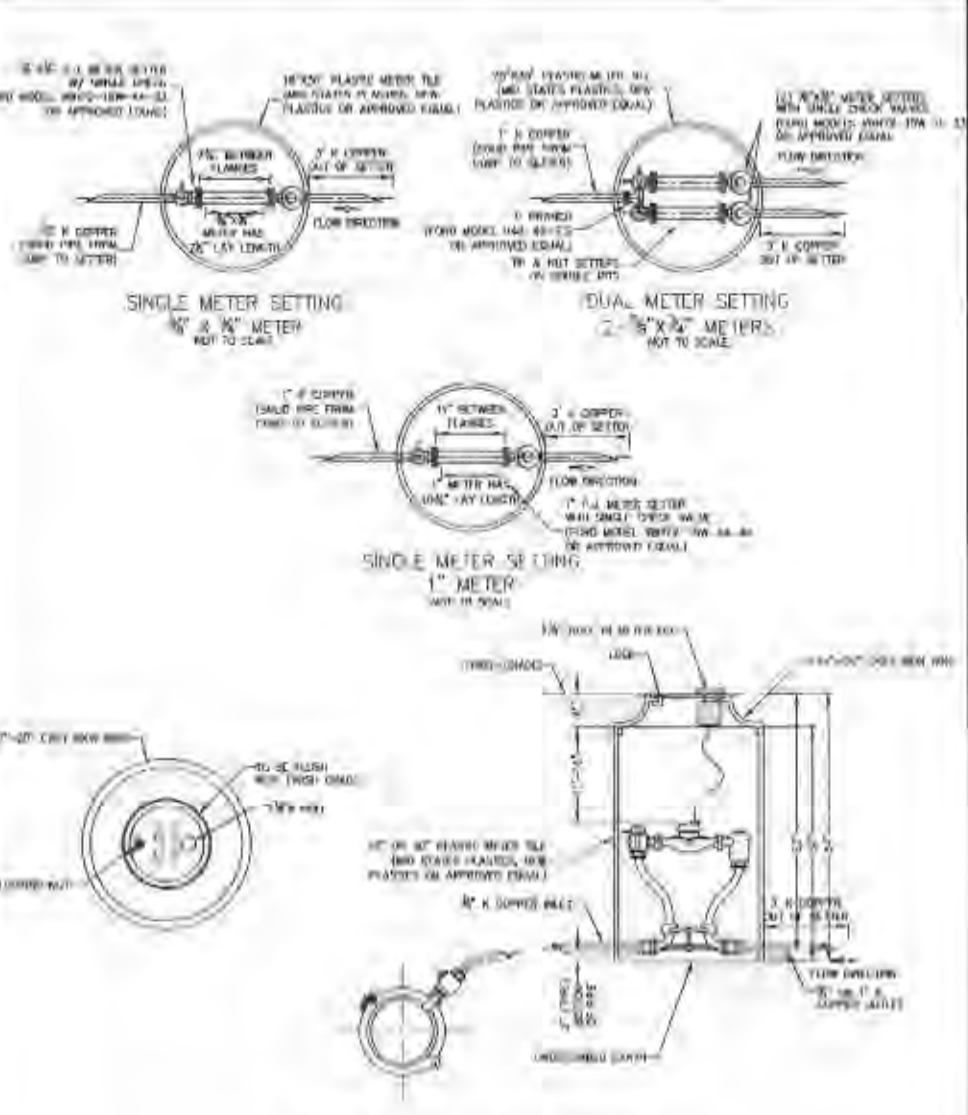
TYPICAL 1/2" SERVICE CORRECTIVE TAP HOLE DIMENSIONS
 DETAIL "A"
 PUBLIC WATER SUPPLY DISTRICT #2 OF SAINT CHARLES COUNTY



TYPICAL 1/2" RESIDENTIAL WATER SERVICE
 DETAIL "C"
 PUBLIC WATER SUPPLY DISTRICT #2 OF SAINT CHARLES COUNTY



TYPICAL 1" RESIDENTIAL WATER SERVICE
 DETAIL "D"
 PUBLIC WATER SUPPLY DISTRICT #2 OF SAINT CHARLES COUNTY

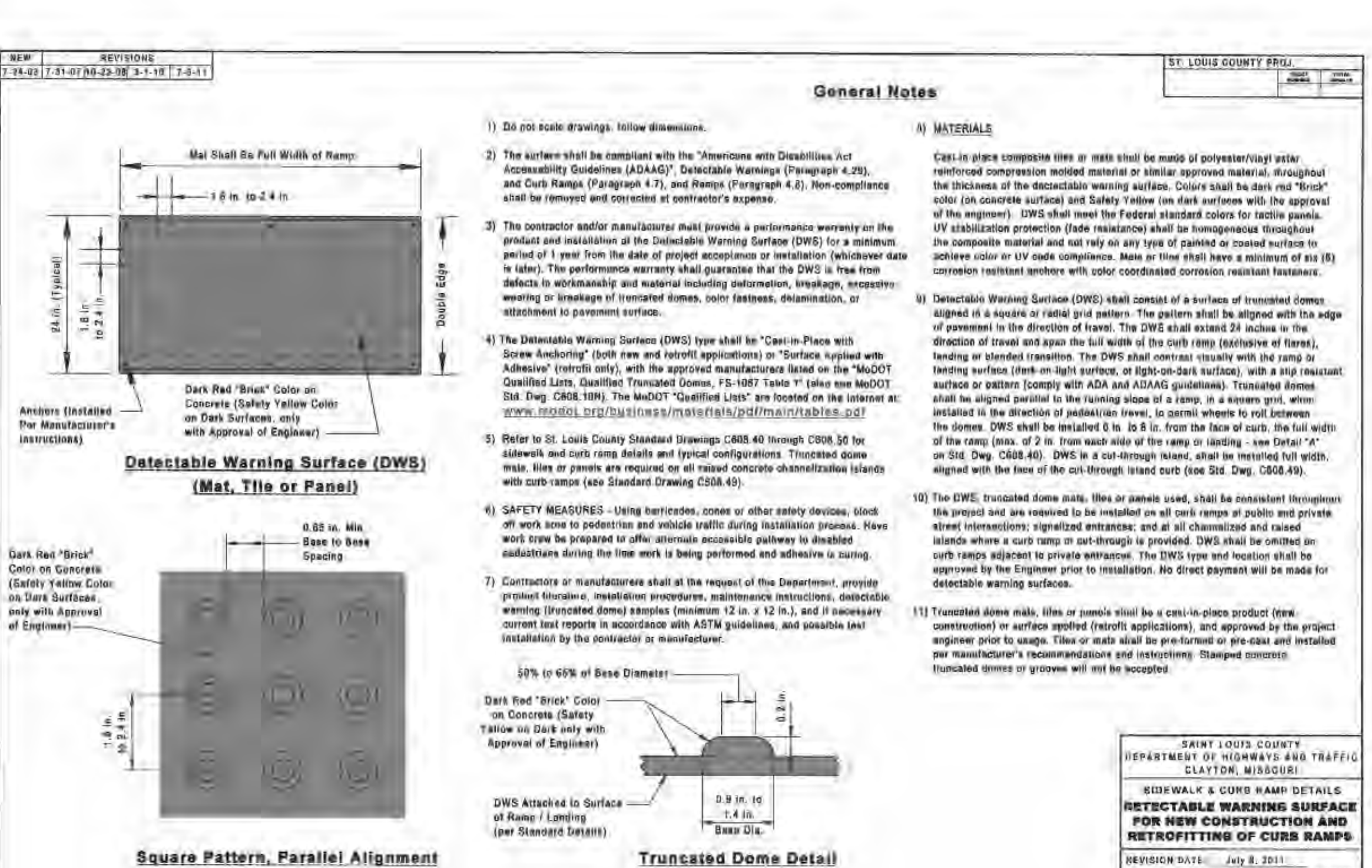
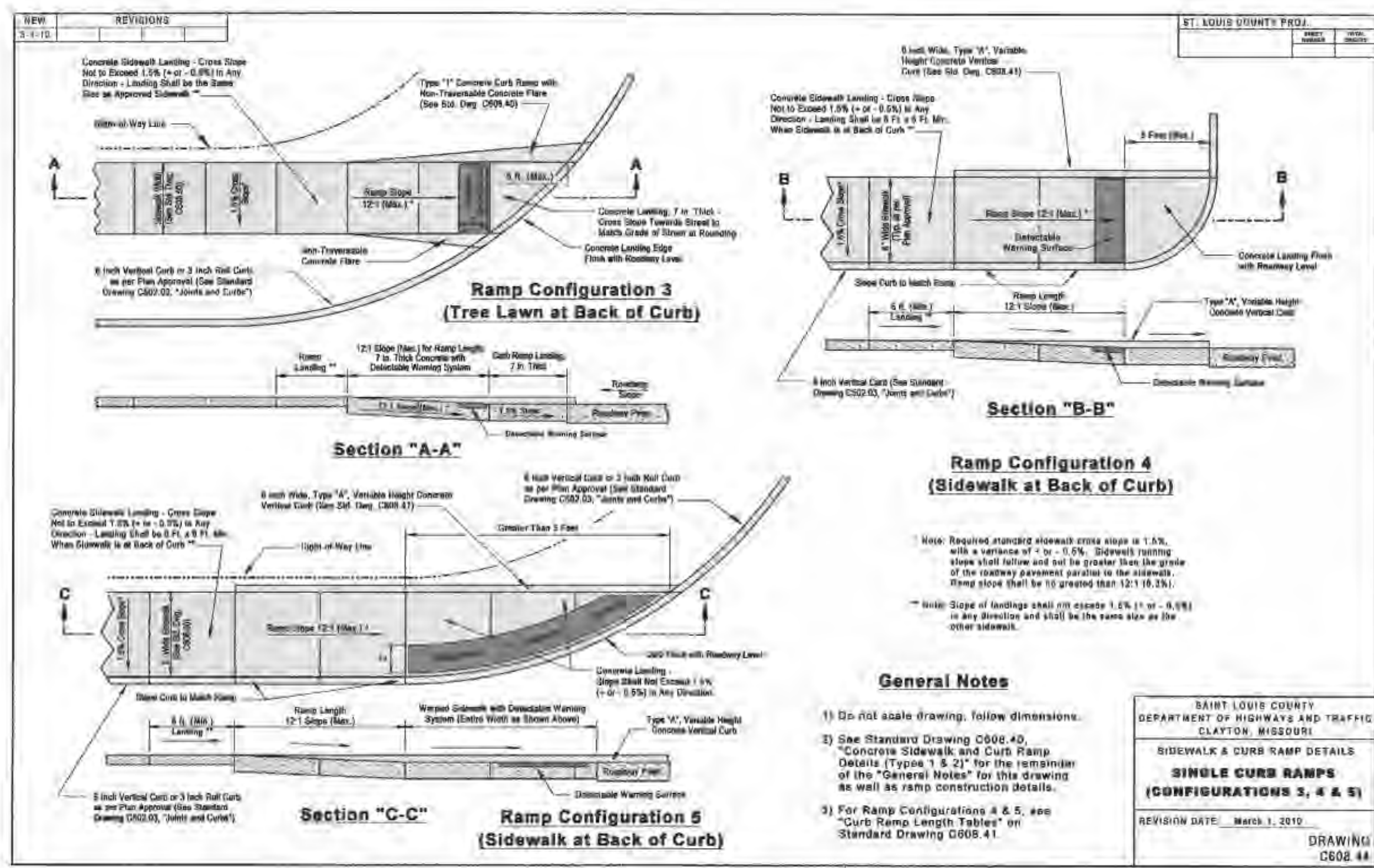
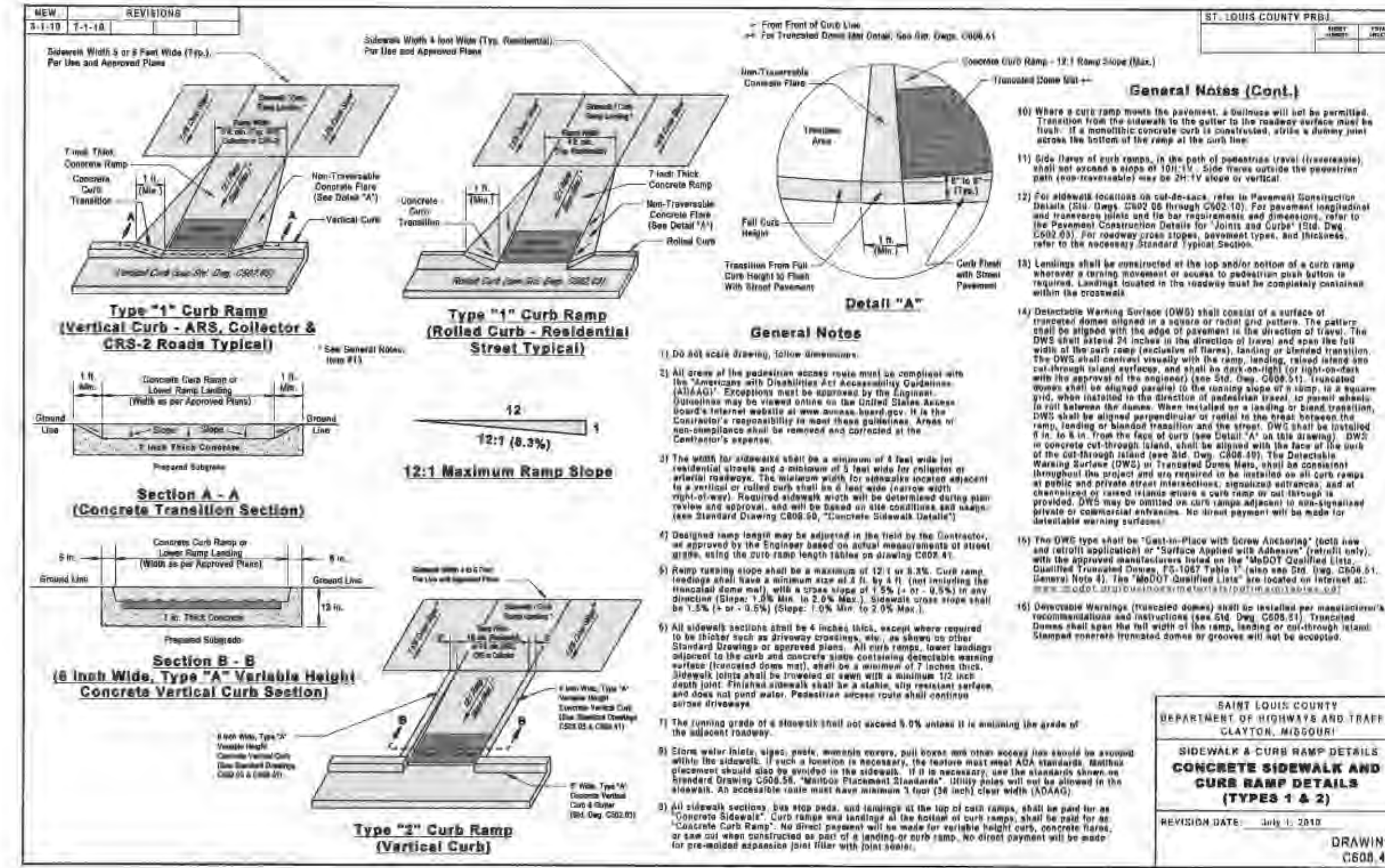
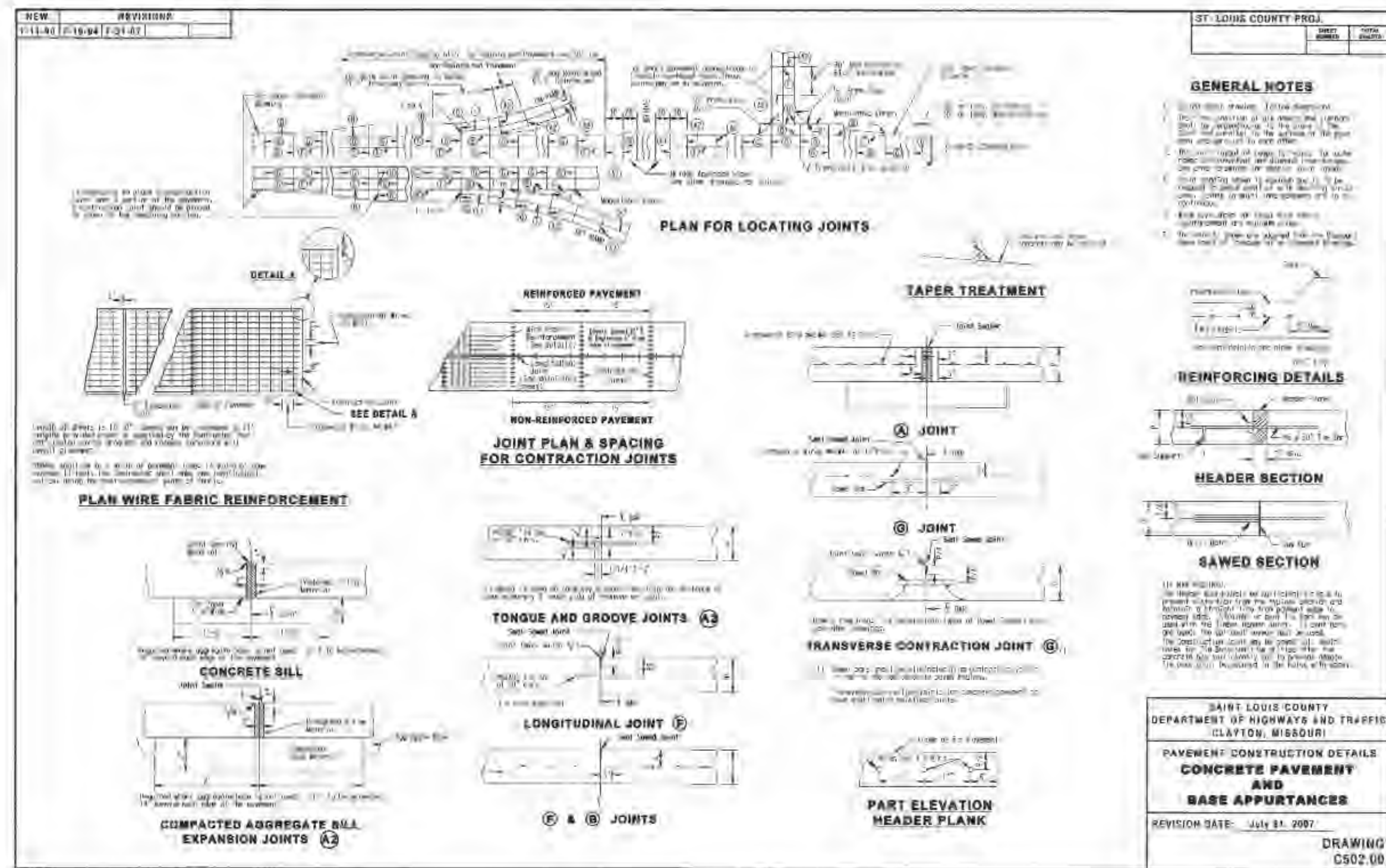


TYPICAL PLASTIC P1 SERVICE FOR MODERATE TO COLD CLIMATES
 DETAIL "D"
 PUBLIC WATER SUPPLY DISTRICT #2 OF SAINT CHARLES COUNTY

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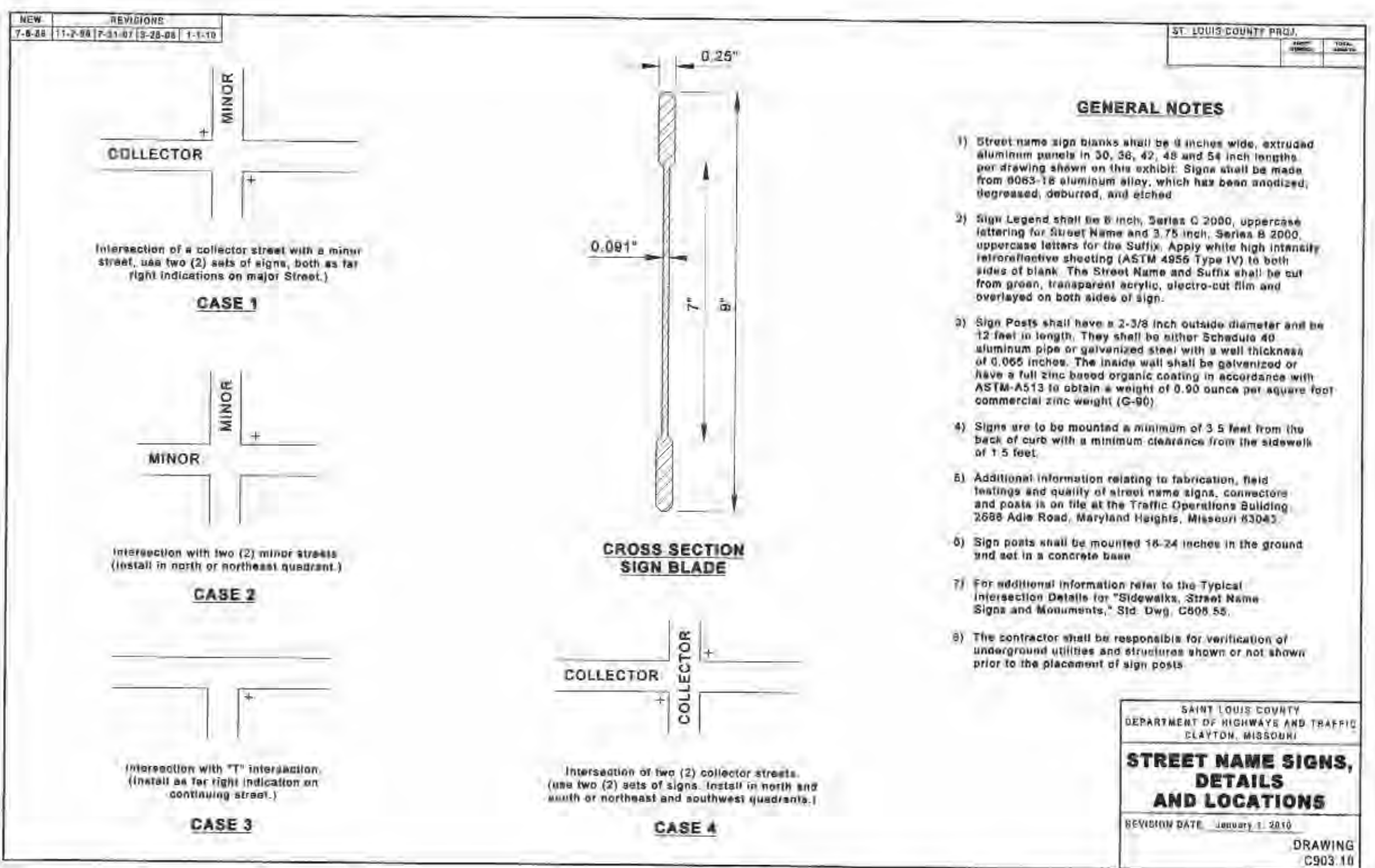
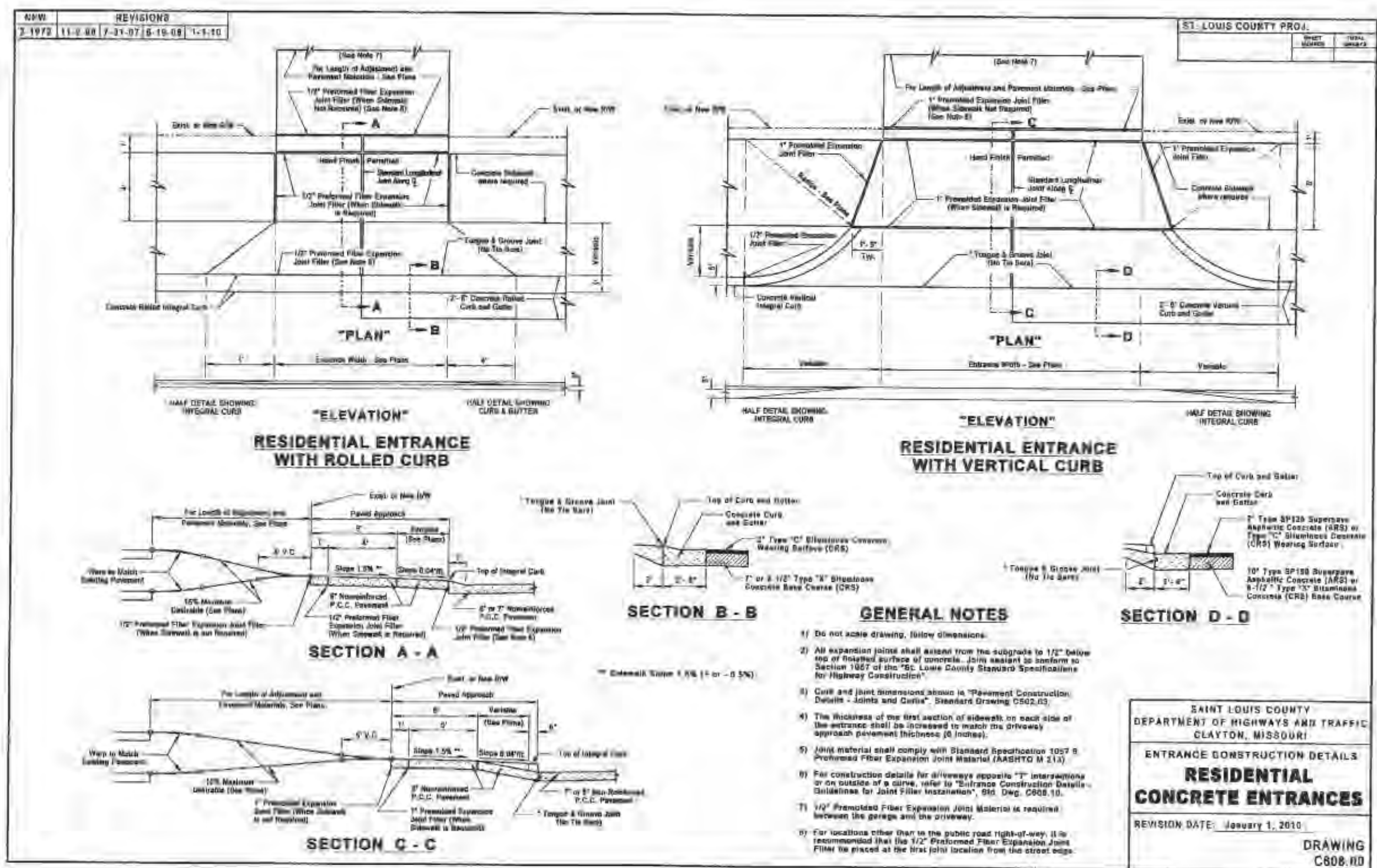
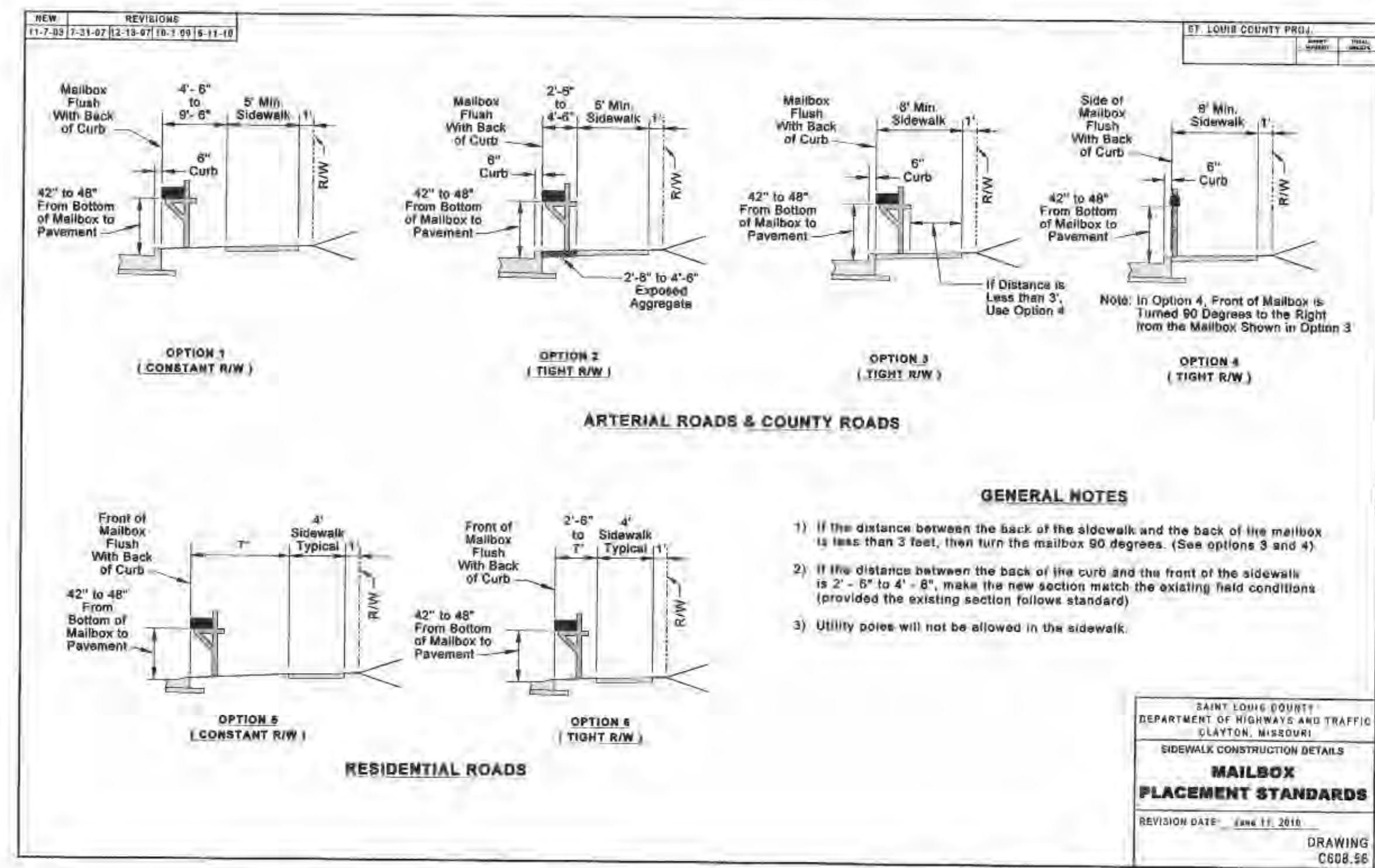
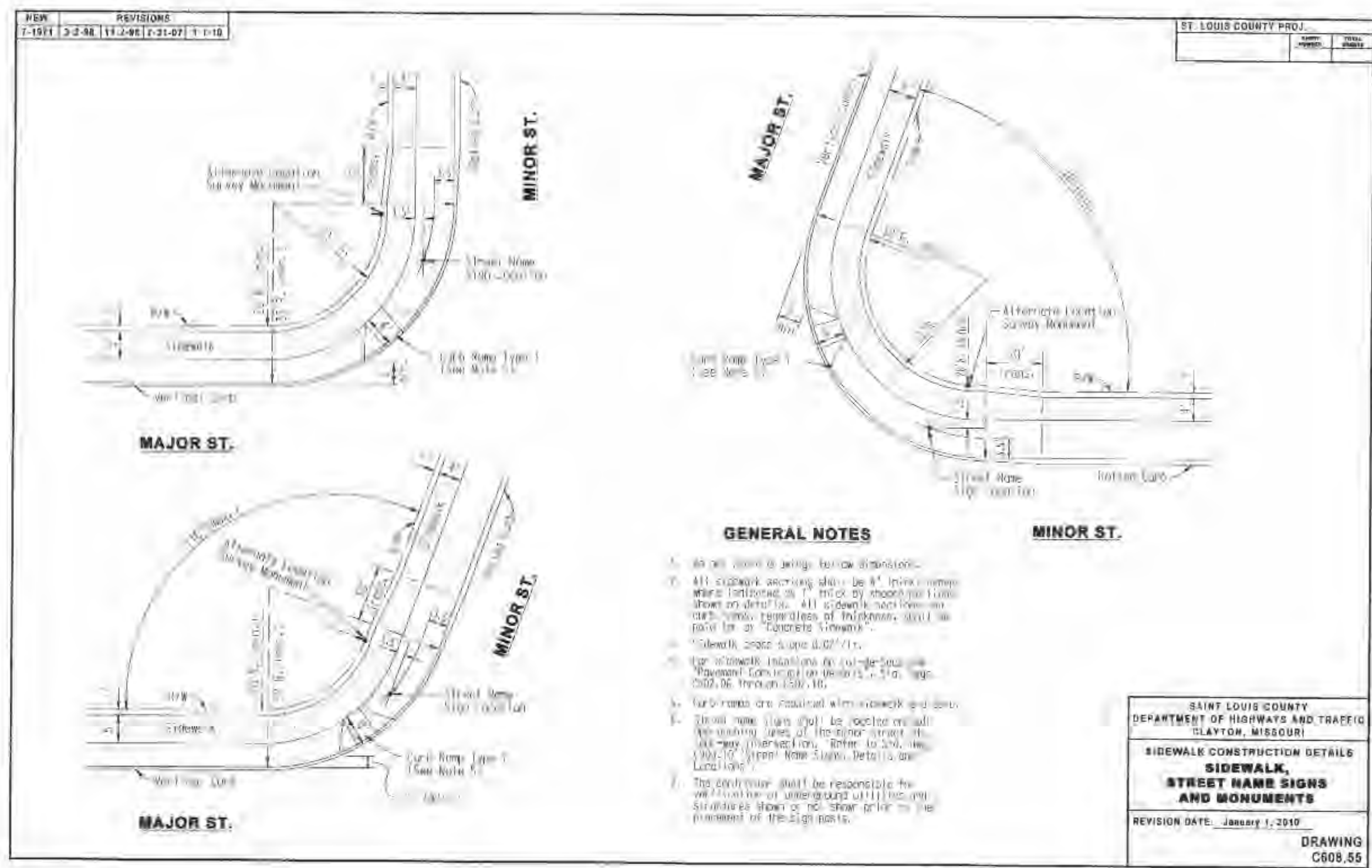
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CONSTRUCTION DETAILS

PROJECT NUMBER: 14-05-46
DATE: 1/21/15
DRAWN BY: MLT