SECTION 02221

UNCLASSIFIED EXCAVATION FOR UTILITIES

PART1 GENERAL

1.1 The work called for by this section shall consist of clearing and grubbing, loosening, loading, removing, and disposing of, in the specified manner, all wet and dry materials (including rock) encountered that must be removed for construction purposes; furnishing, placing, and maintaining all sheeting, shoring, bracing, and timbering necessary for the proper protection and safety of the work, the workmen, the public, and adjacent property and improvements; the dewatering of trenches and other excavations; the preparation of satisfactory pipe beds; the backfilling and tamping trenches, foundations, and other structures; the preparation of fills and embankments; the removal of unsuitable material from outside the normal limits of excavation and, where ordered by the engineer, their replacement with suitable materials; and all other grading or excavation work incidental to or necessary for the work. This work shall be performed as specified below.

1.2 Rock encountered that cannot be removed by normal trenching equipment, such as a trackhoe, will be removed by the owner.

1.3 Owner shall also locate by survey, centerline of where pipe is to be installed and location of each manhole. Contractor is responsible for continued verification of correct installation locations and proper depths and slopes of pipe and manholes.

1.4 Owner shall provide all pipe, manholes and stone necessary for completion of this work.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 PREPARATION OF THE SITE

A. Before starting construction, remove from the work site all vegetable growth (except as hereinafter excluded), debris, and/or other objectionable matter as well as any buildings and/or other structures that the indicate are to be removed. Dispose of this refuse material in a manner acceptable to the engineer.

B. In certain areas it may be desirable for existing trees, shrubs, or other vegetation on the site to be preserved for the permanent landscape. Such vegetation may be shown on the Drawings, specifically listed in the specifications, marked on the site, or identified by the engineer. In no case damage or remove such growth without written permission from the Owner.

C. If the area to be excavated is occupied by trees, brush, or other vegetable growth, clear such growth and grub the excavated area, and remove all large roots to a depth of not less than 2 feet below the bottom of the proposed construction. Dispose of the growth removed in a manner satisfactory to the engineer. Fill all holes

or cavities created during this work that extend below the subgrade elevation with suitable material, and compact to the same density as the surrounding material.

D. Trees, cultivated shrubs, etc., that are situated within public riqht-of-way and/or construction easements through private property but not directly within the excavation area shall remain undisturbed unless it is necessary to remove them so that the work can be performed safely and unless their removal is specifically ordered by the engineer. Take special precautions to protect and preserve such growth throughout all stages of the construction.

E. Preparation of the site shall be considered an integral part of the excavation and no separate payment shall be allowed.

3.2 UNSUITABLE MATERIALS

A. Wherever muck, quicksand, soft clay, swampy ground, or other material unsuitable for foundations, subgrade, or backfilling is encountered, remove it and continue excavation until suitable material is encountered. The material removed shall be disposed of in the manner described below. Then refill the areas excavated for this reason with 1 inch to 2 inches crushed stone up to the level of the lines, grades, and/or cross sections shown on the Drawings. The top 6 inches of this refill shall be No. 67 (TDOT) crushed stone for bedding.

3.3 ROCKS AND BOULDERS

A. Any material that is encountered within the limits of the required excavation that cannot be removed except by drilling and/or blasting, including rock, boulders, masonry, hard pan, chert, shale, street and sidewalk pavements, and/or similar materials, shall be removed by owner.

B. Excavate rock over the horizontal limits of excavation and to a depth of not less than 6 inches below the outside bottom of pipe up to 30 inches in diameter and not less than 12 inches below the outside bottom of larger pipes if rock extends to such depth. Then backfill the space below grade with No. 67 (TOOT) crushed stone or other approved material, tamp to the proper grade, and make ready for construction. For monolithic concrete sewers or culverts and for structures, excavate rock to the outside bottom of the structure or sewer.

3.4 DISPOSAL OF MATERIALS

A. Whenever practicable, all materials removed by excavation that are suitable for backfilling pipe trenches or for other purposes shown on the Drawings or directed by the engineer shall be used for these purposes. Any materials not so used shall be considered waste materials and disposed of on site.

B. Waste materials may be deposited in spoil areas at locations approved by the engineer. Do not leave in unsightly piles but instead spread in uniform layers, neatly level, and shape to drain.

C. Once any part of the work is completed, properly dispose of all surplus or unused materials (including waste materials) left within the construction limits of that work. Leave the surface of the work in a neat and workmanlike condition, as described below.

3.5 EXCAVATION FOR TRENCHES, MANHOLES, AND STRUCTURES

A. Unclassified excavation for pipelines shall consist of the excavation necessary for the construction of water, sewer, and other pipes and their appurtenances (including manholes, inlets, outlets, headwalls, collars, concrete saddles, and pipe protection) that are called for by the Drawings. It shall include clearing and grubbing where necessary, backfilling and tamping pipe trenches and around structures, and disposing of waste materials, all of which shall conform to the applicable provisions set forth elsewhere in these specifications.

B. The Contractor may, if he chooses, use a motor powered trenching machine. If he does, however, he shall be fully responsible for the preservation or repair of existing utilities .

. C. Unless the construction of lines by tunneling, jacking, or boring is called for by the Drawings or specifically authorized by the engineer, make excavation for pipelines in open cut and true to the lines and grades shown on the Drawings or established by the engineer on the ground. Cut the banks of trenches between vertical parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes (or, if sheeting is used, between the inside faces of that sheeting) shall vary with the size of the pipe to be installed, but shall not be more than the distance determined by the following formula: 4/3d + 15 inches, where "d" represents the internal diameter of the pipe in inches. When approved in writing by the engineer, the banks of trenches from the ground surface down to a depth not closer than 1 foot above the top of the pipe may be excavated to nonvertical and nonparallel planes, provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the formula given above. Any cut made in excess of the formula *4/3d* + 15 inches shall be at the expense of the Contractor and may be cause for the engineer to require that stronger pipe and/or a higher class of bedding be used at no cost to the Owner.

D. Provide a minimum of 6 inches of No. 67 (TDOT) crushed stone for bedding of pipe.

E. Excavate bell holes for bell and spigot pipe at proper intervals so that the barrel of the pipe will rest for its entire length upon the bottom of the trench. Bell holes shall be large enough to permit proper jointing of the pipe. Do not excavate bell holes more than 2 joints ahead of pipe laying.

F. Excavation for manholes, inlets, and other incidental structures shall not be greater in horizontal area than that required to allow a 2 foot clearance between the outer surface of the structure and the walls of the adjacent excavation or of the sheeting used to protect it. The bottom of the excavation shall be true to the required shape and elevation shown on the Drawings. No earth backfilling will be permitted under manholes, inlets, headwalls, or similar structures

G. Do not excavate pipe trenches more than 200 feet ahead of the pipe laying, and perform all work so as to cause the least possible inconvenience to the public. Construct temporary bridges or crossings when and where the engineer deems necessary to maintain vehicular or pedestrian traffic.

H. In all cases where materials are deposited along open trenches, place them so that in the event of rain or surcharge loading from such deposits no damage will result to the work and/or to adjacent property.

I. Excavation for manholes and other structures may be performed with nonvertical banks except beneath pavements or adjoining existing improvements. Do not permit the horizontal area of the excavation to exceed that required to allow a 2 foot clearance between the outer surface of the structure and the banks of the excavation or the sheeting used to protect the embankments. The bottom of the excavation shall be true to the required shape and elevation shown on the Drawings.

3.6 SHEETING, SHORING, AND BRACING

A. Take special care to avoid damage wherever excavation is being done. SuffiCiently sheet, shore, and brace the sides of all excavations to prevent slides, cave-ins, settlement, or movement of the banks and to maintain the specified trench widths. Use solid sheets in wet, saturated, or flowing ground. All sheeting, shoring, and bracing shall have enough strength and rigidity to withstand the pressures exerted, to keep the walls of the excavation properly in place, and to protect all persons and property from injury or damage. Separate payment will not be made for sheeting, shoring, and bracing, which are considered an incidental part of the excavation work.

B. Wherever employees may be exposed to moving ground or cave-ins, shore and lay back exposed earth excavation surfaces more than 5 feet high to a stable slope, or else provide some equivalent means of protection. Effectively protect trenches less than 5 feet deep when examination of the ground indicates hazardous ground movement may be expected. Guard the walls and faces of all excavations in which employees are exposed to danger from moving ground by a shoring system, sloping of the ground, or some equivalent protection.

C. Comply with all OSHA standards in determining where and in what manner sheeting, shoring, and bracing are to be done. The sheeting, shoring, and bracing system shall be designed by a professional engineer licensed in the State of Tennessee and shall be subject to approval by the engineer. However, such approval does not relieve the Contractor of the sole responsibility for the safety of all employees, the effectiveness of the system, and any damages or injuries resulting from the lack or inadequacy of sheeting, shoring, and bracing.

D. Where excavations are made adjacent to existing buildings or structures or in paved streets or alleys, take particular care to sheet, shore, and brace the sides of the excavation so as to prevent any undermining of or settlement beneath such structures or pavement. Underpin adjacent structures wherever necessary, with the approval of the engineer.

E. Do not leave sheeting, shoring, or bracing materials in place unless this is called for by the Drawings, ordered by the engineer, or deemed necessary or advisable for the safety or protection of the new or existing work or features. Remove these materials in such a manner that the new structure or any existing structures or property, whether public or private, will not be endangered or damaged and that cave-ins and slides are avoided.

F. Fill and compact all holes and voids left in the work by the removal of sheeting, shoring, or bracing as specified herein.

G. The Contractor may use a trench box, which is a prefabricated movable trench shield composed of steel plates welded to a heavy steel frame. The trench box shall be designed to provide protection equal to or greater than that of an appropriate shoring system.

3.7 THE DEWATERING OF EXCAVATION

A. Provide and keep in operation enough suitable pumping equipment whenever necessary or whenever directed to do so by the engineer. Give special attention to excavations for those structures that, prior to proper backfilling, are subject to flotation from hydrostatic uplift.

3.8 BORROW EXCAVATION

A. Whenever the backfill of excavated areas or the placement of embankments requires more material than is available from authorized excavations, or whenever the backfill material from such excavations is unsuitable, then obtain additional material from other sources. This may require the opening of borrow pits at points accessible to the work. In such cases, make suitable arrangements with the property owner and pay all incidental costs, including any royalties, for the use of the borrowed material. Before a borrow pit is opened, the quality and suitability of its material shall be approved by the engineer. All state and local regulation concerning borrow pits, drainage and erosion control shall be strictly followed.

B. Excavate borrow pits in such a way that the remaining surfaces and slopes are reasonably smooth and that adequate drainage is provided over the entire area. Construct drainage ditches wherever necessary to provide outlets for water to the nearest natural channel, thus preventing the formation of pools in the pit area. Leave the sides of borrow pit cuts at a maximum slope of 2: 1 unless otherwise directed by the engineer.

C. Properly clear and grub borrow pits, and remove all objectionable matter from the borrow pit material before placing it in the backfill.

D. The taking of materials from borrow pits for use in the construction of backfill, fills, or embankments shall be considered an incidental part of the work; no separate payment shall be made for this.

3.9 BACKFILLING

A. Begin backfilling after the line construction is completed and then inspected and approved by the engineer. On each side of the line, from the bottom of barrel to 1 foot above the top of the pipe, the backfill material shall consist either of fine, loose earth like sandy soil or loam or of granular material that is free from clods, vegetable matter, debris, stone, and/or other objectionable materials and that has a size of no more than 2 inches. Place this backfill simultaneously on either side of the pipe in even layers that before compaction are no more than 6 inches deep. Thoroughly and completely tamp each layer into place before placing additional layers. When shown on the Drawings, this backfill shall, at locations beneath or closely adjacent to pavement, consist of No. 67 (TDOT) crushed stone.

B. If plastic sewer pipe is used, install No. 67 (TDOT) crushed stone in a 6 inch envelope on all sides of the pipe. Then add the remaining backfill up to 1 foot above the top of the pipe as described in the previous paragraph.

C. From 1 foot above the pipe upward, the backfill material may contain broken stones that make up approximately 3/4 of the backfill's total volume. However, if this type of backfill is used, there must be enough spalls and earth materials to fill all voids

completely. The maximum dimension of individual stones in such backfill shall not exceed 6 inches, and the backfill material shall be placed and spread in even layers not more than 12 inches deep. At locations beneath or closely adjacent to pavement or at locations of improvements subject to damage by displacement, tamp and thoroughly compact the backfill in layers that, before compaction, are 6 inches deep. In other areas, the backfill for the upper portion of the trenches may be placed without tamping but shall be compacted to a density equivalent to that of adjacent earth material as determined by laboratory tests. Use special care to prevent the operation of backfilling equipment from causing any damage to the pipe.

D. If earth material for backfill is, in the opinion of the engineer, too dry to allow thorough compaction, then add enough water so that the backfill can be properly compacted. Do not place earth material that the engineer considers too wet or otherwise unsuitable.

E. Wherever excavation has been made within easements across private property, the top 1 foot of backfill material shall consist of fine loose earth free from large clods, vegetable matter, debris, stone, and/or other objectionable materials.

F. Wherever trenches have been cut across or along existing pavement, temporarily pave the backfill of such trenches by placing Class A, Grade D, crushed stone as the top 12 inches of the backfill. Maintain this temporary pavement either until the permanent pavement is restored or until the project is accepted by the Owner. On heavy traveled roadways, cold mix or leveling course binder 2 inches thick shall be installed and maintained until permanent pavement is installed.

G. Conduct backfilling around manholes, inlets, outfalls, and/or structures in the same manner as specified above for pipelines except that even greater care is necessary to prevent damage to the utility structure.

H. Wherever pipes have diameters of 15 inches or less, do not use power operated tampers to tamp that portion of the backfill around the pipe within 1 foot above the pipe.

I. Perform backfilling so as not to disturb or injure any pipe and/or structure against which the backfill is being placed. If any pipe or structure is damaged and/or displaced during backfilling, open up the backfill and make whatever repairs are necessary, whenever directed to do so by the engineer.

J. Backfilling and clean-up operations shall closely follow pipe laying; failure to comply with this provision will result in the engineer's requiring that the Contractor's other activities be suspended until backfilling and clean-up operations catch up with pipe laying.

K. Compaction Requirements: Under buildings and 2 times the depth of pipe beyond, and under roads and 2 times the depth beyond the shoulder, compact to 95 percent maximum density in accordance with ASTM 0698. In all other locations, compact to 90 percent maximum density.

3.10 MAINTENANCE

A. Maintain trench backfill at the approximate level of the original ground surface by periodically adding backfill material wherever necessary and whenever directed to do so by the engineer. Continue such maintenance until final acceptance of the project, or until the engineer issues a written release.

SECTION 02721

STORM SEWER

PART 1 GENERAL

1.1 SUMMARY

A. The work covered by this section shall consist of furnishing all labor, and equipment, for laying and jointing storm sewer pipe and fittings, and installation of manholes, and other structures incidental to the construction of storm sewers as shown on the drawings. All pipe and manholes and stone necessary for the completion of this project shall be furnished by the owner. Bidder shall hold the proper licenses for bidding and contracting for utility work as required by Tennessee State Law.

1.2 RELATED SECTIONS

A. Section 02221 - Unclassified Excavation for Utilities

PART 2 PRODUCTS

2.1 GENERAL

A. The diameter of pipe culverts, storm drains and manholes are shown on the project drawings.

2.2 SEWER PIPE MATERIALS

A. Reinforced Concrete Pipe (RCP): All concrete sewer pipe with an internal diameter of 12 inches or less shall be extra strength sewer pipe conforming to ASTM C14. All concrete pipe with an internal diameter of 15 inches or more shall be Class III (unless otherwise noted on plans) reinforced concrete pipe conforming to ASTM C76. Horizontal elliptical shall conform to C-507 Class HE-II, HE-III, or HE-IV as specified on the drawings.

2.3 STORM PIPE ACCESSORIES

A. Joint Materials:

1. Butyl Mastic Joints or Rubber Gasket for RCP: "Soil-Tight" joints for RCP and manholes shall be accomplished by using a butyl mastic sealant or a rubber gasket in the joint as provided by the owner. RCP: The bell and spigot or the tongue and groove of the pipe has been manufactured and prepared for the type of joint selected. The rubber gaskets meet the requirements of ASTM C443.

2.4 STRUCTURES AND APPURTENANCES

A. Manholes are precast concrete and are provided by the owner for installation. They meet ASTM C478.

B. Manholes are provided with transitioning risers and cones and rubber pipe manhole connections meeting ASTM C913.

PART 3 EXECUTION

3.1 PIPELINE CONSTRUCTION

A. Carefully protect all existing sewers, water lines, gas lines, sidewalks, curbs, gutters, pavements, electric lines, or other utilities or structures in the vicinity of the work from damage at all times.

B. Before constructing or placing joints, ensure that the methods employed conform to the specifications and will provide a watertight joint, and further that the workmen intended for use on this phase of the work are thoroughly familiar and experienced with the type of joint proposed.

C. Before placing sewer pipe in position in the trench, carefully prepare the bottom and sides of the trench, and install any necessary bracing and sheeting as provided in Section 02221, Unclassified Excavation for Utilities.

D. Tightly stretch a mason's line or wire above the ground level, parallel to and directly above the axis of the pipe to be installed; this line is to be supported at intervals of no more than 50 feet on sewers being laid on a grade of 2 or more and not exceeding 25 feet for grades of less than 2. Determine the exact line and grade for each section of pipe by measuring down from this line to the invert of the pipe in place. Accurately place each pipe to the exact line and grade called for on the drawings. Furnish all labor and materials necessary for erecting batter boards. The use of laser beams will be allowed.

E. Do not allow water to run or stand in the trench while pipe laying is in progress, before the joint has completely set, or before the trench has been backfilled. Do not at any time open up more trench than the available pumping facilities are able to dewater.

F. Correct trench bottoms found to be unsuitable for foundations after pipe laying operations have been started, and bring them to exact line and grade with compacted earth as necessary.

G. Carefully inspect each piece of pipe and special fitting before it is placed, and lay no defective pipe in the trench.

H. When Bell and Spigot pipe is utilized bell holes shall be excavated and be large enough to allow ample room for the pipe joints to be properly made. Cut bell holes out not more than 10 joints ahead of the pipe laying. Carefully grade the bottom of the trench between bell holes so that each pipe barrel will rest on a solid foundation for its entire length. Lay each pipe joint so as to form a close concentric joint with adjoining pipe and to avoid sudden offsets or inequalities in the flow line.

I. (For watertight installations only) After the joints have been completed, they shall be inspected, tested, and accepted by the Engineer before they can be covered. The Contractor shall immediately repair any leaks or defects discovered at any time after completion of the work. Take up any pipe that has been disturbed after joints were formed; clean and remake the joints; and relay the pipe at the Contractor's expense. Carefully protect all pipe in place from damage until backfill operations are completed.

J. Required trench widths, bedding materials, structural backfill materials, and compaction requirements for trench backfill and structural backfill for the various piping products called for in the plan documents are set forth on the project drawing detail sheet in Section 02221, Unclassified Excavation for Utilities.

K. Do not begin the backfilling of trenches until the pipe in place has been inspected and approved by the Engineer.

L. As the work progresses, thoroughly clean the interior of all pipe in place. On small pipe, keep a swab or drag in the pipeline, and pull forward past each joint immediately after it has been made. After laying each line of pipe, carefully inspect it, and remove all earth, trash, rags, and other foreign matter from its interior.

3.2 JOINT CONSTRUCTION

A. Rubber "0" Ring and Profile Joints (For Watertight Installations with RCP): Rubber gaskets and the method of joint construction shall form a flexible watertight seal and shall be in strict compliance with the manufacturer's directions and requirements.

Adequately lubricate the gaskets with lubricant provided for this purpose. Pipe joints shall be adequately and thoroughly homed until gasket has seated.

3.3 WYES AND TEES

A. Install wyes and tee branches in the sewer line as shown on the drawings and/or at such other locations as may be designated by the Engineer. If such branches are not to be used immediately, close them with manufacturer approved stoppers.

3.4 CONNECTIONS

A. Make connections to all existing sewer lines as shown on the Plans or as directed by the Engineer. Make connections either by removing a section of the sewer from the existing line and inserting in the space a wye branch of the proper size or by constructing a manhole, junction box, regulator chamber, or other structure as shown on the Plans.

B. Make connections to existing manholes or inlets by cutting a hole in the wall of the existing structure, inserting a length of pipe into the hole, filling around the pipe with concrete or mortar, and troweling the inside and outside surfaces of the joint to a neat finish. Shape or reshape the bottoms of manholes as necessary to fit the invert of the sewer pipe.

3.5 PIPE PROTECTION

A. If pipe sewer has less than 1 foot of cover when completed, provide concrete protection as shown on the drawings or required by the Engineer. Place the protection in accordance with the Plans. CMP and HDPE installations must meet minimum cover as specified in Trench Details .

3.6 INSTALLATION OF STRUCTURES AND APPURTENANCES

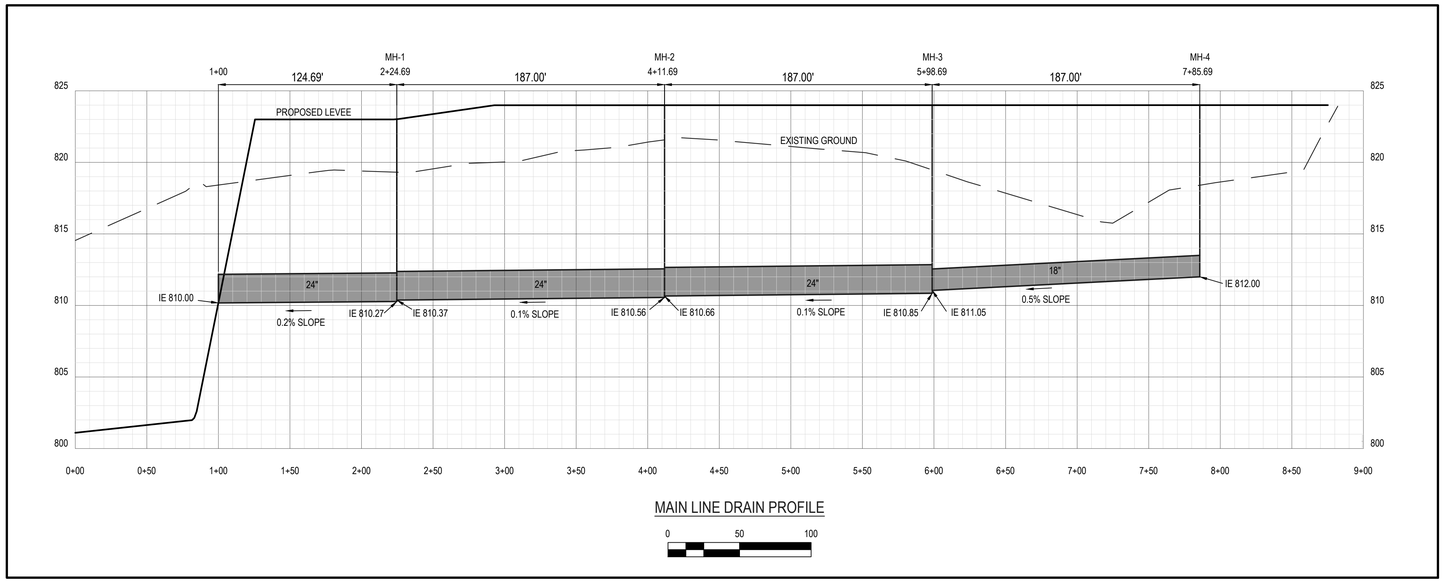
A. Construct inlets to the sizes, shapes, and dimensions shown on the drawings or as directed by the Engineer to meet special conditions

3.7 CLEANUP

A. After completing each section of sewer line, remove all debris and construction materials and equipment from the site of the work, grade and smooth over the surface on both sides of the line, and leave the entire right-ot-way in a clean, neat, and serviceable condition.

B. The interior of catch basins, area drains, and manholes shall be cleaned of debris and excess material, the grating or cover placed, and all unused material, equipment, tools, and debris removed from the area.

END OF SECTION



MAIN LINE DRAIN PROFILE

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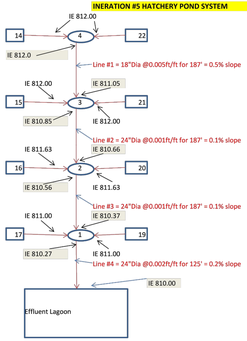

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MAIN LINE DRAIN TO EFFLUENT POND

MH	TO	MH	LINE #	PIPE DIA (INCHES)	PIPE LNG (FT)	SLOPE (FT/FT)	SLOPE %	FALL (FT)	FULL FLOW CAP (CFS)	CUM POND FLOW (CFS)
4	to	3	1	18"	187 ft	0.005	0.5	0.95 ft	7.43	7.12
3	to	2	2	24"	187 ft	0.001	0.1	0.19 ft	7.2	14.24
2	to	1	3	24"	187 ft	0.001	0.1	0.19 ft	7.2	21.36
1	to	EL	4	24"	125 ft	0.002	0.2	0.27 ft	10.1	28.5

22 = Typical Hatchery Pond #. 15" diameter drain pipe flowing full @ 1.6% slope =6.5cfs.

4 = Typical MH #

IE = Invert Elev of Pipe

NOTES - Each pond cap.= 2,000,000 gallons. To fully drain with 15" pipe@1.6% slope= 12 hrs to drain 1 pond @6.56cfs.
24 " drain pipe max. capacity = 7.2cfs. Site can only drain 2 ponds per day maximum.

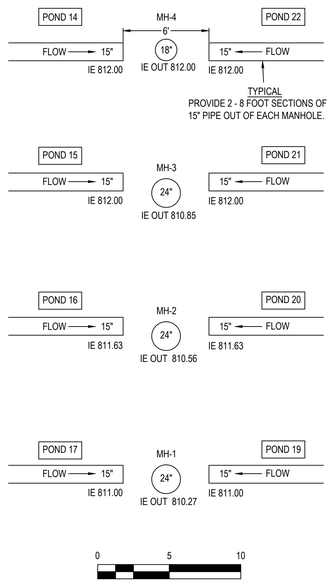
POND DRAINS TO MH'S

DRAINS PONDS	TO	MH	PIPE DIA (INCHES)	PIPE IE ELEV AT KETTLE	PIPE IE ELEV AT MH	PIPE LNG (FT)	SLOPE (FT/FT)	SLOPE %	FALL (FT)
14 & 22	to	4	15"	812.23	812.00	14.2	0.016	1.6	0.23
15 & 21	to	3	15"	812.23	812.00	14.2	0.016	1.6	0.23
16 & 20	to	2	15"	812.23	811.63	14.2	0.042	4.2	0.60
17 & 19	to	1	15"	811.23	811.00	14.2	0.016	1.6	0.23

14 = Typical Hatchery Pond #

4 = Typical MH #. 6 FT diameter MH's.

IE = Invert Elev of Pipe



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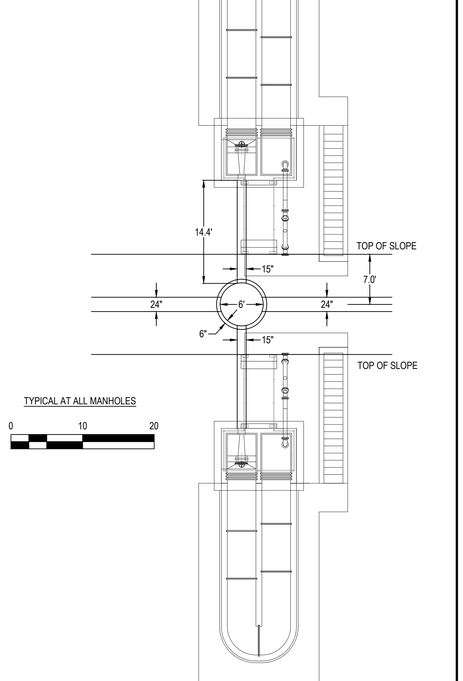
SECTION AT EACH MANHOLE



TYPICAL AT ALL MANHOLES

0 10 20

REVISIONS

TENNESSEE WILDLIFE RESOURCES AGENCY
Engineering Division
P.O. Box 40747
Nashville, TN 37204

NORMANDY HATCHERY EXPANSION
MAIN LINE DRAIN PROFILE

DRAWN BY
SM

CHECKED BY
DH

DATE
7-14-15

SCALE

JOB NUMBER
13-001

SHEET

C-1.7

1 OF 1 SHEETS