

SECTION 329200.19 – SEEDING AND MULCHING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Placing topsoil.
- B. Permanent seeding, hydro seeding, mulching and fertilizing.

1.2 RELATED SECTIONS

- A. Section 312316.13 – Trenching: Rough grading over cut.
- B. Section 313500 – Slope Protection and Erosion Control: Erosion control. Temporary seeding and mulching.

1.3 REFERENCES

- A. FS O-F-241 – Fertilizers, Mixed, Commercial.
- B. Lawn Mixture

1. Kentucky Bluegrass (<i>Poa pratensis</i>)	3 lb./ 1000 ft ²
2. Creeping Red Fescue (<i>Festuca rubra</i>)	3 lb./ 1000 ft ²
3. Annual Ryegrass (<i>Lolium multiflorum</i>)	2 lb / 1000 ft ²
4. Perennial Ryegrass, turf type (<i>Lolium perenne</i>)	2 lb / 1000 ft ²

- C. General Notes and any other related specifications.

1.4 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quack grass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambs quarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nut grass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.5 SUBMITTALS AT PROJECT CLOSEOUT

- A. Section 017839 – Closeout Submittals: Procedures for submittals.
- B. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.6 QUALITY ASSURANCE

- A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.7 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture.

1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Section 410100 – Operation and Maintenance Processing and Handling Equipment: Transport, handle, store, and protect products.
- B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
- C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.9 MAINTENANCE SERVICE

- A. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition for two cuttings.

PART 2 - PRODUCTS

2.1 SEED MIXTURE

- A. Seed Mixture: ODOT; Item 659.09; Lawn Mixture

2.2 SOIL MATERIALS

- A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; pH value of minimum 5.4 and maximum 7.0.

2.3 ACCESSORIES

- A. Mulching Material:
 - 1. Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

2. Hemlock species wood cellulose fiber, dust or chip form, free of growth or germination inhibiting ingredients.
- B. Fertilizer: FS O-F-241, Type I, Grade A; recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated in analysis.
- C. Water: Clean, fresh and free of substances or matter, which could inhibit vigorous growth of grass.
- D. Erosion Fabric: Jute matting, open weave.
- E. Stakes: Softwood lumber, chisel pointed.
- F. String: Inorganic fiber.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this section.
- B. Soils must include enough fine-grained material to hold at least a moderate amount of available moisture.
- C. The soil must be free from material that is toxic or otherwise harmful to plant growth.
- D. Soils which do not meet the above minimum conditions shall receive topsoil to a depth of 4 inches.

3.2 SITE PREPARATION

- A. Subsoiler, plow, or other implement shall be used to reduce soil compaction and allow maximum infiltration. (Maximizing infiltration will help control both runoff rate and water quality.) Subsoiling should be done when the soil moisture is low enough to allow the soil to crack or fracture. Subsoiling shall not be done on slip-prone areas where soil preparation should be limited to what is necessary for establishing vegetation.
- B. The site shall be graded as needed to permit the use of conventional equipment for seedbed preparation and seeding.
- C. Topsoil shall be applied where needed to establish vegetation.

3.3 PLACING TOPSOIL

- A. Prior to applying topsoil, the topsoil should be pulverized.
- B. To ensure bonding, grade the subsoil and roughen the top 3-4 in. by disking.

- C. Do not apply when site is wet, muddy, or frozen, because it makes spreading difficult, causes compaction problems, and inhibits bonding with subsoil.
- D. Apply topsoil evenly to a depth of at least 4 inches and compact slightly to improve contact with subsoil.
- E. After spreading, grade and stabilize with seeding or appropriate vegetation.

3.4 SEEDBED PREPARATION

- A. Lime—Agricultural ground limestone shall be applied to acid soil as recommended by a soil test. In lieu of a soil test, lime shall be applied at the rate of 100 pounds per 1,000-sq. ft. or 2 tons per acre.
- B. Fertilizer—Fertilizer shall be applied as recommended by a soil test. In place of a soil test, fertilizer shall be applied at a rate of 25 pounds per 1,000-sq. ft. or 1000 pounds per acre of a 10-10-10 or 12-12-12 analyses.
- C. The lime and fertilizer shall be worked into the soil with a disk harrow, spring-tooth harrow, or other suitable field implement to a depth of 3 inches. On sloping land, the soil shall be worked on the contour.

3.5 SEEDING DATES AND SOIL CONDITIONS

- A. Seeding should be done March 1 to May 31 or August 1 to September 30. If seeding occurs outside of the above-specified dates, additional mulch and irrigation may be required to ensure a minimum of 80% germination. Tillage for seedbed preparation should be done when the soil is dry enough to crumble and not form ribbons when compressed by hand. For winter seeding, refer to dormant seeding.

3.6 SEEDING

- A. Apply seed at a rate of 3 lbs per 1000 sq ft evenly in two intersecting directions. Rake in lightly.
- B. Do not seed areas in excess of that which can be mulched on same day.
- C. Planting Season: April to September.
- D. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- E. Immediately following seeding, apply mulch as required herein. Maintain clear of shrubs and trees
- F. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches.

3.7 SEED PROTECTION

- A. Identify seeded areas with stakes and string around area periphery.
- B. Cover seeded slopes where grade is 1:3 or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.
- C. Lay fabric smoothly on surface, bury top end of each section in 6-inch (150 mm) deep excavated topsoil trench. Provide 12-inch (300 mm) overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.
- D. Secure outside edges and overlaps at 36-inch (900 mm) intervals with stakes.
- E. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
- F. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches (150 mm).

3.8 DORMANT SEEDINGS

- A. Seedings should not be made from October 1 through November 20. During this period, the seeds are likely to germinate but probably will not be able to survive the winter.
- B. The following methods may be used for "Dormant Seeding":
 1. From October 1 through November 20, prepare the seedbed, add the required amounts of lime and fertilizer, then mulch and anchor. After November 20, and before March 15, broadcast the selected seed mixture. Increase the seeding rates by 50% for this type of seeding.
 2. From November 20 through March 15, when soil conditions permit, prepare the seedbed, lime and fertilize, apply the selected seed mixture, mulch and anchor. Increase the seeding rates by 50% for this type of seeding.
 3. Apply seed uniformly with a cyclone seeder, drill, cultipacker seeder, or hydro-seeder (slurry may include seed and fertilizer) on a firm, moist seedbed.
 4. Where feasible, except when a cultipacker type seeder is used, the seedbed should be firmed following seeding operations with a cultipacker, roller, or light drag. On sloping land, seeding operations should be on the contour where feasible.

3.9 MULCHING

- A. Mulch material shall be applied immediately after seeding. Dormant seeding shall also be mulched. 100% of the ground surface shall be covered with an approved material.
- B. Application rates:
 1. Straw—If straw is used it shall be unrotted small-grain straw applied at the rate of 2 tons per acre or 90 pounds (two to three bales) per 1,000-sq. ft. The mulch shall be spread uniformly by hand or mechanically applied so the soil surface is covered. For uniform distribution of hand-spread mulch, divide area into approximately 1,000-sq.-ft. sections and spread two 45-lb. bales of straw in each section.

2. Hydroseeders—If wood cellulose fiber is used, it shall be applied at 2,000 lb./ac. or 46 lb./1,000 sq. ft.
3. Other—Other acceptable mulches include rolled erosion control mattings or blankets applied according to manufacturer's recommendations or wood chips applied at 6 tons per acre.

3.10 MAINTENANCE

- A. Expect emergence within 4 to 28 days after seeding, with legumes typically following grasses. Check permanent seedlings within 4 to 6 weeks after planting. Growth should indicate:
 1. Vigorous seedlings;
 2. Uniform ground surface coverage with at least 30% growth density;
 3. Uniformity with legumes and grasses well intermixed;
 4. Green, not yellow, leaves. Perennials should remain green throughout the summer, at least at the plant bases.
- B. Permanent seeding shall not be considered established for at least one full year from the time of planting. Inspect the seeding for soil erosion or plant loss during this first year. Repair bare and sparse areas. Fill gullies. Re-fertilize, re-seed, and re-mulch if required. Consider no-till planting. A minimum of 70% growth density, based on a visual inspection, must exist for an adequate permanent vegetative planting.
- C. If stand is inadequate or plant cover is patchy, identify the cause of failure and take corrective action: choice of plant materials, lime and fertilizer quantities, poor seedbed preparation, or weather. If vegetation fails to grow, have the soil tested to determine whether pH is in the correct range or nutrient deficiency is a problem.
- D. Depending on stand conditions, repair with complete seedbed preparation, then over-seed or re-seed.
- E. If it is the wrong time of year to plant desired species, over-seed with small grain cover crop to thicken the stand until timing is right to plant perennials or use temporary seeding.
- F. Satisfactory establishment may require re-fertilizing the stand in the second growing season.
- G. Consider mowing after plants reach a height of 6 to 8 inches. Mow grasses tall, at least 3 inches in height and minimizes compaction during the mowing process. Vegetation on structural practices such as embankments and grass-lined channels need to be mowed only to prevent woody plants from invading the stand.

END OF SECTION 329200.19

SECTION 331113 – WATERLINE CONSTRUCTION

PART 1 - GENERAL

1.1 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the Work of this Section, including but not limited to Division 1, General Requirements.

1.2 DESCRIPTION OF WORK

- A. Water line piping, valves, and appurtenances.
- B. Water line testing and disinfection.

1.3 QUALITY ASSURANCE

- A. General: All materials shall be free from defects impairing strength and durability and be of the best quality for the purposes specified or shown on the Drawings. It shall have structural properties sufficient to solely sustain or withstand strain and stresses to which it is normally subjected and be true to detail.
- B. Manufacturer's Qualifications
 - 1. Provide piping and appurtenances that are standard products in regular production by manufacturers whose products have proven reliable in similar service for at least two years.
 - 2. Provide piping and appurtenances of the same type from a single manufacturer.
- C. The Contractor shall be responsible for making all field measurements prior to installation of his work. Any deviations in measurements between the field conditions and the Drawings shall be immediately reported to the Engineer.
- D. Testing
 - 1. Manufacturer's certified test results as defined for the type of pipe shall be stamped approved by the Contractor and forwarded to the Engineer as a Reference Submittal. No pipe shall be installed which does not meet the requirements of these Specifications.
 - 2. All pipe, joints, and fittings shall be pressure tested as required by this Specification for the type of pipe. The Contractor shall notify the Engineer and Owner, in writing, at least 48 hours prior to performing the tests.

1.4 SUBMITTALS

- A. Provide technical submittals in accordance with Section 017800, Submittals, demonstrating piping and accessories conform completely to the requirements of this Section.

- B. Product Data
 - 1. Catalog cut sheets and description of all items.
 - 2. Construction materials.
 - 3. Standard diameters, wall thickness and other pertinent dimensions of all sizes of piping and accessories.
- C. Testing: Copies of all field test reports.

1.5 HANDLING, DELIVERY, AND STORAGE

- A. General
 - 1. Handling, delivery, and storage shall be in accordance with Section 410100 of the Project Manual and the manufacturer's recommendations.
 - 2. In no case shall the pipe or appurtenance be dumped, dropped, or thrown.
 - 3. Interior of piping shall be completely free of dirt and foreign matter.

PART 2 - PRODUCTS

2.1 DUCTILE IRON PIPE

- A. Ductile iron pipe shall conform to AWWA C151 with wall thickness provided in accordance with AWWA C150 for the depth of cover shown on the Drawings using a minimum rated working pressure of 350 psi and Laying Condition 4; minimum Pressure Class 350, unless otherwise shown or specified.
- B. Pipe shall have standard asphaltic coating on the exterior
- C. Pipe shall have a standard thickness cement mortar lining in accordance with ANSI/AWWA C104/A21.4.
- D. The class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacturer's mark, country where cast, year in which the pipe was produced, and the letters "DI" or "Ductile" shall be cast or stamped on the pipe.
- E. Push-on and mechanical joint ends shall conform to AWWA C110 with gaskets conforming to AWWA C111.
- F. Flange joints shall conform to AWWA C110 with gaskets and bolts conforming to AWWA C110, Appendix A.
- G. Restrained joints for push-on joint piping shall be the equal of TR Flex by U.S. Pipe and Foundry Co., Flex-Ring by American Cast Iron Pipe Co., or Tyton Joint with Field Lok Gasket instant joint restraint by U.S. Pipe and Foundry Co.

- H. Restrained joints for mechanical joint piping shall be the equal of Megalug by EBBA Iron, Inc.; MJ Gripper Gland by U.S. Pipe and Foundry Co.; or Lok-Fast Joint by American Cast Iron Pipe Co.

2.2 D.I. FITTINGS AND ACCESSORIES

- A. All fittings shall be ductile iron unless otherwise specified. Fittings shall have mechanical joints unless otherwise noted. Ductile iron standard fittings shall conform to AWWA C110 and compact fittings shall conform to AWWA C153. Pressure rating shall be 250 unless otherwise noted.
- B. All lining and coating for fittings shall be as specified for ductile iron pipe.
- C. Fittings shall be as manufactured by U.S. Pipe and Foundry Co., American Cast Iron Pipe Co., Clow Corp. or approved equal.
- D. Mechanical and push-on joint fittings shall conform to AWWA C111/ANSI 21.11.
- E. Flange joint fittings shall conform to AWWA C110 with gaskets and bolts conforming to AWWA C110, Appendix A.
- F. Long radius elbows, reducing elbows, reducing-on-the-run tees, side outlets, eccentric reducers and laterals supplied as flanged fittings shall conform to ANSI B16.1.
- G. All flanged joint fittings shall be furnished with 1/8 inch thick rubber gaskets. The bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in American Standard for Wrench Head Bolts and Nuts and Wrench Openings (ANSI B18.2). Material for bolts and nuts shall conform to ASTM A307 Grade B.
- H. Anchor pipe and fittings shall consist of plain end MJ pipe fittings furnished with integral fixed or split rotatable ring follower glands. A mechanical joint anchoring tee may be substituted for a mechanical joint tee with anchoring piece.

2.3 GATE VALVES

- A. All gate valves installed under this contract shall be resilient wedge gate valves and shall be of the same class as the pipe on which they are installed. Valves shall have joint ends compatible with type of pipe used, non-rising stems, 2" square operating nut and shall open "left".
- B. Approved Manufacturers: US Pipe & Foundry, Mueller Co., or Kennedy Valve Mfg. Co. or approved equal.
- C. Valves shall conform to AWWA C509 and shall incorporate an iron body, bronze-mounted, and parallel seat. Valve seals shall be O-ring type in lieu of a stuffing box. Valve stems shall be manganese bronze, non-rising type.
- D. Gate valves 4-inch and larger shall be cast iron with bronze gate rings.

- E. All gate valves 2 1/2" and smaller shall be of an Engineer approved manufacture and suitable for the service required. All valves shall have openings through the body of the same circular area as that of the pipe to which they are attached. All valves shall be designed to take the full unbalanced pressure upon either face.
- F. Except as otherwise stated or indicated upon the plans, underground valves shall be fitted with standard, two-inch square operating nut. All valves in interior or above ground piping shall be fitted with hand wheels and shall have flanged or screwed ends depending upon the size of pipe with which they are being used, or as shown on the plans. Underground valves will be provided with boxes, covers and operating nuts extended to grade. All underground valves shall have cast iron bodies.
- G. All hand-operated gate valves shall open by turning counter clockwise (left). The direction of opening shall be indicated by an arrow on hand wheels and on operating nuts.
- H. All submerged valves shall be furnished with "o" ring packing.
- I. All gate valves shall be designed for a minimum working pressure equivalent to that of the connecting pipe.
- J. The valve body and bonnet shall be coated with fusion bonded epoxy, interior and exterior, in accordance with AWWA C550. The coating material shall comply with NSF Standard 61.
- K. All valves shall have the manufacturer's name, pressure rating and year of manufacture cast into the body.

2.4 CONCRETE BLOCKING

- A. Concrete blocking will be placed at all tees, bends, and valve locations unless otherwise noted. Blocking shall be placed in accordance with the details shown in the Drawings.
- B. Concrete shall be ready mix concrete with a minimum compressive strength of 2,500 psi at 28 days.

2.5 VALVE BOXES

- A. Valve boxes shall be supplied for all buried valves.
- B. The assembly shall consist of three (3) pieces and a cover. The cover shall be marked "Water". The valve box shall be screw-type, cast iron with 5-1/4-inch shaft. A round base that will enclose the valve bonnet shall be furnished with 6-inch and 8-inch valves. An oval base shall be supplied with valves larger than 8-inches.
- C. The valve box shall be supported at the base on concrete blocking to stabilize the assembly.

PART 3 - EXECUTION

3.1 EXECUTION

- A. Size, Type and Joining: All materials shall conform to the size and type shown on the drawings or called for in the specification. In joining two dissimilar types of pipe, standard fittings shall be used when available. In the event fittings are not available, the method of joining shall be selected by the Contractor and submitted for review by the Engineer.

- B. Installation Standards: Except where noted or specified, all underground waterline shall be laid in accordance with AWWA C600 or AWWA C605 for ductile iron or PVC pipe, respectively. All clearances and separations between water lines and sewer lines shall be in accordance with OEPA guidelines.

- C. General Excavation:
 - 1. Contractor shall do all excavation, undercutting, dewatering and backfilling necessary for work under this contract unless otherwise noted.
 - 2. Work shall conform to other sections of Division 2 except where modified by this section.
 - 3. The width of trench below the top of the pipe shall not exceed the nominal diameter of the pipe plus 2 feet for all pipelines.
 - 4. Where the maximum trench width is exceeded, the pipe shall be placed in a concrete cradle or a stronger pipe shall be used as necessary. If the maximum trench width is exceeded for any reason other than by request of the Engineer, the concrete cradle or the stronger pipe shall be placed at the Contractor's expense.
 - 5. Excavation shall include all necessary clearing of excavated areas, tree removal, all grubbing, all wet, dry, fill and rock excavation, the removal of pavement and all incidental work thereto.
 - 6. Contractor shall excavate whatever materials are encountered as required to place the pipe and appurtenances at the elevations noted.
 - 7. The trench shall be constructed in accordance with Section 312316.13 – Trench Excavation, Bedding and Backfill.
 - 8. Excavations at the crossing of all underground utility services in place shall be as narrow as practicable.
 - 9. Unless otherwise noted, all existing underground services shall be protected from damage and maintained in service at their original location and grade during the process of the work. Any damage to underground services shall be replaced or repaired at no cost to the Owner or to the owner of the service. The present underground services shown on the drawings are located in accordance with available data. Encountering these services at a different location or encountering services not shown shall not release the Contractor from the previous stated conditions.
 - 10. Any service connections encountered which are to be removed shall be cut off at the limits of the excavation and capped in accordance with the requirements of owners of such connections.
 - 11. Excavated material that is unsuitable or not required for filling shall be wasted.
 - 12. Materials to be used for fill and suitable for this purpose shall be deposited where required, except that no fill shall be placed where trenches for sewers, water lines or other services will be located until after the trench work is completed.

13. Contractor shall provide adequate shoring, sheet piling and bracing to prevent earth from caving or washing into the excavation, and shall do all shoring and underpinning necessary to properly support adjacent or adjoining structures. All shoring, sheet piling and underpinning must be maintained until permanent support is provided.

D. Laying Pipe:

1. Piping shall be installed in accordance with the manufacturer's published instructions, modified only as may be directed herein or by the Engineer. All pipe installations shall comply with applicable paragraphs contained as part of these construction specifications.
2. Pipe Bury Depth - normal laying depth shall be 48" of cover depth minimum regardless of pipe diameter. Where rock is encountered, the minimum cover over top of the pipe shall be 48". Where rock is encountered on the trench bottom at the normal laying depth, a minimum of 6 inches of granular bedding shall be required.
3. All piping shall be assembled in accordance with the layout shown on the plans with only such modifications as may be necessary to conform to the final detail dimensions or location of existing water mains, hydrants, existing utilities, tanks, valve vaults, booster stations, valves, county roads, highway and stream crossings, etc. In crossing under ditches and streams the minimum depth of the trench required for the project shall be maintained. Standard fittings shall be used if required to depress the pipe but in no case shall the approach to the crossing be laid at a steeper angle than forty-five (45) degrees with the horizontal.
4. All pipe installed under this contract shall be installed in accordance with the applicable sections of AWWA C600 or AWWA C605 for ductile iron and PVC pipe, respectively. Type B laying conditions shall be maintained for both ductile iron and PVC installations. Trench width at the top of the pipe shall not exceed the pipe diameter plus 2 feet unless approved by the Engineer. Minimum trench width shall be 1 foot greater than the maximum outside pipe diameter. Pipe shall be laid directly on a bedded trench bottom containing coupling or bell joint holes with trench shaped to provide continuous contact with the pipe between coupling or bell joint holes as recommended by the pipe manufacturer or as directed by the Engineer.
5. If, in the course of construction, ground water is encountered, the Contractor shall reduce the water level to the invert of the main or bottom of the structure. The Contractor shall maintain this dewatered condition until the area around the structure has been backfilled to existing grade. No pipe shall be laid in water, or when the trench conditions or the weather is unsuitable for such work, except by permission of the Engineer. At times when pipe installation is not in progress, the open ends of the pipe shall be closed by approved means and no trench water shall be permitted to enter the pipe. It shall be borne in mind that precautions must be taken to prevent empty pipe from floating, should the trench become flooded before backfilling has been completed.
6. Prior installation the interior of each piece of pipe and each fitting shall be inspected and any dirt and debris shall be removed. Swabbing may be required. After installation, inspect again and remove any accumulated dirt and debris.

7. Each piece of pipe shall be lowered into trench and installed separately. All pieces of pipe shall be laid in the trench so that it is firmly supported on the bedding material throughout its length.
8. As shown on the plans, or as directed by the Engineer, the Contractor shall provide concrete anchors or thrust blocks (against undisturbed earth), joint harness, and concrete encasement where required. This work shall be included in the unit prices bid for installing pipe, fittings, and appurtenances.
9. Pieces of pipe or fitting which are known to be defective shall not be laid or placed. Any defective piece of pipe or fitting discovered after the piping is laid shall be removed and replaced with satisfactory pipe or fitting. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe. Cuts shall be made with proper tools for cutting the pipe. In the event the pipe is damaged as a result of the pipe being cut, the affected joint shall be rejected.
10. Bed the pipe as indicated and specified in Section 312316.13.
11. Material used for backfilling trenches over the pipe shall be free from any rock or debris that may be a potential source of damage to the pipe. Where material originally excavated from the trench is deemed unsuitable, the contractor shall obtain other suitable material for use as backfill.
12. Contractor shall provide, operate and maintain all pumps or other equipment necessary to drain and keep all excavation pits and trenches and the entire subgrade area free from water under any circumstances that may arise.
13. All trees, shrubs and improved areas outside of the excavation shall be protected from damage.
14. Where indicated water line shall be installed with tracer wire.
15. Pipe must be kept clean of mortar, cement, clay, sand or other material. Prior to installation the interior of each piece of pipe and each fitting shall be inspected and any dirt and debris shall be removed. Swabbing may be required. After installation, the pipe and fittings shall be inspected again and any accumulated dirt and debris removed.

E. Restrained Joints:

1. Except where noted or indicated, all bends, caps, plugs, tees and other fittings shall be restrained with flexible restrained joints. In addition, restrained joints shall be utilized for a minimum of one joint or 20 feet, whichever is greater, to each side of the fitting. Restrained joints shall be provided regardless of the use of concrete thrust blocking.
2. Mechanical joints for ductile iron pipe shall be restrained by Megalug 1100 or 1100SD Series by EBAA Iron Sales, Inc., a comparable product manufactured by Star Pipe Products, or an equal restraining system.
3. Ductile iron push-on joint pipe shall be restrained by Lok-Ring Joint by American Ductile Iron Pipe, TRFLEX by U.S. Pipe, or equal.
4. Joints in AWWA C900/C905 PVC pipe shall be restrained by Megalug 2800 Series by EBAA Iron Sales, Inc., a comparable product manufactured by Star Pipe Products, or an equal restraining system.
5. Joints between AWWA C900/C905 PVC pipe and mechanical joint ductile iron fittings shall be restrained by Megalug 2000PV Series by EBAA Iron Sales, Inc., a

comparable product manufactured by Star Pipe Products, or an equal restraining system.

3.2 TESTING

- A. All testing must be witnessed by the Engineer. Non-witnessed testing will not be accepted. Contractor shall provide engineer with 48-hour notice prior to commencing with testing.
- B. The Contractor shall make all valves tight under their working pressure after they have been installed and before they are placed in operation. Any defective parts shall be replaced at the Contractor's expense.
- C. All valves shall be pressure tested in conjunction with their adjoining piping.
- D. All water lines shall be disinfection tested in accordance with AWWA C 651.
- E. Pressure Testing:
 - 1. A hydrostatic test as required in applicable sections of AWWA C600 or AWWA C605 for ductile iron or PVC pipe, respectively, shall be applied to the whole or individually isolated sections of the water lines and hydrant leads.
 - 2. The test pressure shall be maintained at 150 psi or one and a half times the working pressure (whichever is greater), in any section being tested. The duration of each pressure test shall be at least 2 hours.
 - 3. The Contractor shall furnish and Owner verifies gauges for the test. Furthermore, the Contractor shall furnish all materials, make all taps required and furnish a pump, piping, all other equipment and all assistance necessary for conducting the tests. Gauges provided by the Contractor shall only be used for potable water or be new.
 - 4. Before applying the specified pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made by the Contractor at points of highest elevation or as required. Taps shall be of the sizes as shown on the drawings, or as directed by the Engineer.
- F. Leakage Testing:
 - 1. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.
 - 2. No pipe installation will be accepted until this leakage (evaluated on a pressure basis of 150 psi) is less than 1.99 U.S. gallons per hour per 100 joints of 12-inch nominal diameter pipe and corrected for the other sizes of pipe as provided in the AWWA Specification.
- G. Any testing performed against existing valves shall be at the Contractor's risk and in strict compliance with the requirements of the Owner. If unable to achieve the required test, the Contractor shall disconnect from the existing valve, plug the line and retest until satisfactory results are obtained. Any damage caused to existing facilities shall be repaired at the Contractor's expense.

3.3 DISINFECTION

- A. After satisfactory hydrostatic testing, the completed pipe shall be chlorinated in accordance with AWWA C651, latest edition. All labor, material, and equipment including chlorination taps and blow-off taps necessary to complete the work shall be furnished and paid for by the Contractor. Taps shall include tapping valves, sufficient tubing or pipe to extend outside the trench, and operable valve above ground. Blow-offs shall be installed as required. The time and section of line to be chlorinated shall be approved by the Engineer.
- B. Upon completing the chlorination and the subsequent flushing of the line, the Contractor shall take the necessary water samples from the pipe for testing by an approved laboratory. Engineer must be present to witness the samples being taken. Testing shall be performed in accordance with Ohio Environmental Protection Agency rules and regulations, copies of which are available from the Ohio Environmental Protection Agency. A certified copy of the test results shall be sent to the Owner. The cost of testing shall be borne by the Contractor.

3.4 CONNECTIONS

- A. Contractor is responsible for connecting to existing pipe where indicated in the Drawings.
- B. Expose and determine the type and diameter of existing pipe and ensure that the proper fittings gaskets necessary for interface are available in advance of initiating work on the connection.
- C. The Contractor shall be responsible for the valving off the existing main, flushing, and bleeding air from the existing line once the connection is made. The existing line shall not be valved off until the Contractor has all necessary equipment and materials at the site to make the proper connection. All work shall be performed in coordination with the Owner.

3.5 VALVE TESTING

- A. The Contractor shall make all valves tight under their working pressure after they have been installed and before they are placed in operation. Any defective parts shall be replaced at the Contractor's expense.
- B. All valves shall be pressure tested in conjunction with their adjoining piping.

3.6 VALVE INSTALLATION AND STORAGE

- A. The valves and appurtenances shall be installed in accordance with the installation manual furnished by the valve manufacturer. Extreme care shall be used in the handling, storage and installation of these valves to prevent damage or distortion of the equipment and to insure proper performance.
- B. Repair or service parts for one of each type and size of valve and hydrant supplied shall be furnished and stored as directed by the Owner.

C. The equipment shall include, in general, the following items:

1. Special tools required for maintenance or operation of valves.
2. Gaskets, rings, seals, packing, lubricants, bolts, washers, operation manuals, drawings, etc., required to maintain valves in proper operating service.

END OF SECTION 331113

SECTION 332100 - WATER SUPPLY WELLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Cable-tool water supply wells.
 - 2. Submersible well pumps.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. PA: Polyamide (nylon) plastic.
- C. PE: Polyethylene plastic.
- D. PP: Polypropylene plastic.
- E. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

- A. Minimum Tested Water Supply Well Performance Capacity: 700 gallons per minute based on OEPA criteria.

1.5 SUBMITTALS

- A. Product Data: Submit certified performance curves and rated capacities of selected well pump and furnished specialties and accessories for each type and size of well pump indicated.
- B. Shop Drawings: Show layout and connections for well pumps.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
 - 2. Setting Drawings: Include templates and directions for installing foundation bolts, anchor bolts, and other anchorages.
 - 3. Project Record Documents: Record the following data for each water supply well:

- a. Casings: Material, diameter, thickness, weight per foot of length, and depth below grade.
- b. Screen: Material, construction, diameter, and opening size.
- c. Pumping Test: Static water level, maximum safe yield, and drawdown at maximum yield.
- d. Log: Formation log indicating strata encountered.
- e. Alignment: Certification that well is aligned and plumb within specified tolerances.

1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports, including the following:
 1. Substrata formations.
 2. Water-bearing formations.
 3. Water levels.
 4. Laboratory water analysis.
 5. Well-screen analysis.
 6. Performance test data.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each well pump to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Well Driller Qualifications: An experienced water supply well driller licensed in the jurisdiction where Project is located.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with AWWA A100 for water supply wells.

1.9 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of water service.
 2. Do not proceed with interruption of water service without Owner's written permission.
- B. Well Drilling Water: Provide temporary water and piping for drilling purposes. Provide necessary piping for water supply. Potable water shall be used for drilling purposes. Surface water shall not be used for drilling purposes. If necessary, the potable water shall be treated for drilling purposes in accordance with the drilling mud manufacturer recommendations.

1.10 WARRANTY

- A. Products and installation will be free of defects in workmanship for a period of one (1) year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WELL CASINGS – STEEL CASING

- A. Defective, visibly damaged, or reject pipe shall not be used as casing or liner pipe for wells.
- B. Casing shall extend continuously either to the top of the aquifer, or to the top of the non-water bearing consolidated formations above an aquifer, and shall have a minimum length of 25'.
- C. Welded steel pipe or tubing used as permanent well casing or liners shall meet the following.
1. Casing shall be new pipe or tubing that has a minimum wall thickness in accordance with the following table:

Nominal Pipe Size (inch)	Minimum Wall Thickness (inch)
< 8	0.188
8	0.322
10	0.365
12-20	0.375
> 20	0.500

2. Casing shall be manufactured in compliance ASTM A53/A53M or ASTM A589;
3. Casing shall have ANSI/NSF 61 certification for use in a public water system well;
4. Casing shall be greater than minimum wall thickness and weight when required either to withstand the stresses of installation, grouting and operation, or corrosion;

5. Casing shall be equipped with a drive shoe when driven;
6. Casing shall be legibly marked on each length, by the manufacturer, with all of the following information:
 - a. Name of the manufacturer;
 - b. Kind of pipe (continuous welded, electric resistance welded or seamless);
 - c. Weight or schedule;
 - d. Nominal or outside diameter;
 - e. Specification number;
 - f. Heat or lot number;
 - g. A certification mark that verifies compliance with standard ANSI/NSF 61 certification for use in a public water system well;
7. Casing shall be structurally sound, watertight throughout its length with casing joints or couplings.
 - a. Thermoplastic spline lock joints may be installed and need not meet standards ASTM F480 or ANSI/NSF 14.
 - b. Thermoplastic couplings shall be legibly marked as applicable with the nominal well casing pipe coupling size, type of plastic, designation of compliance with standards ASTM F480 and ANSI/NSF 14, and the manufacturer's name or trademark.
8. A thermoplastic pipe casing shall not be installed where potential or known contaminants may degrade or permeate plastic.
9. Casing shall not be driven.

D. Well Seals: Casing cap, with holes for piping and cables, that fits into top of casing and is removable, waterproof, and vermin proof.

2.2 GROUT

- A. Cement: ASTM C 150, Type II.
- B. Aggregates: ASTM C 33, fine and coarse grades.
- C. Water: Potable.
- D. Grout shall be bentonite and have ANSI/NSF 60 certification. Grout shall not contain bentonite drilling mud or cuttings.
- E. Admixtures shall not be used.

2.3 WATER WELL SCREENS

- A. Screen Material: Wire wound, fabricated of ASTM A 666, Type 304 stainless steel.
 1. The screen design shall be designated "Hi-Flow".
 2. The screen shall provide sufficient column and collapse strength to withstand installation and borehole pressures.
 3. Screen joints between screen sections and blank casing shall be welded, or threaded and coupled.

4. Screen installation using telescoping methods shall be attached either directly to the bottom of the casing or to a packer.
5. Maximum Entering Velocity: 0.1 fps.

2.4 PACK MATERIALS

- A. Coarse, uniformly graded filter sand and/or fine gravel shall be utilized. Crushed limestone shall not be used.
- B. Selection of material should be based on the formation particle size determined via the drilling process.

2.5 SUBMERSIBLE WELL PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Goulds Water Technology (Xylem)
 2. Or equal.
- B. Description: Submersible, vertical-turbine well pump complying with HI 2.1-2.2 and HI 2.3; with the following features:
 1. Impeller Material: Silicon bronze.
 2. Motor: Capable of continuous operation under water, with protected submersible power cable.
 3. Column Pipe: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends and cast-iron or steel threaded couplings.
 4. Discharge Piping: AWWA C115. Include NSF listing mark "NSF pw."
- C. Capacities and Characteristics:
 1. Capacity: 700 gpm
 2. Total Discharge Head: 100 ft
 3. Discharge Size: 8"
 4. Speed: 3500 rpm
 5. Motor Horsepower: 25
 6. Volts: 480
 7. Phases: 3
 8. Hertz: 60

2.6 MOTORS

- A. General requirements for motors are as follows:
 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 2. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in electrical Sections.

PART 3 - EXECUTION

3.1 PREPARATION

A. Area Well Data: Review well logs, operating and test analyses.

1. Well No. 4 – ODNR Well Log No. 978914
2. Well No. 5 – ODNR Well Log No. 978915
3. Test Hole – ODNR Well Log No. 9965003

3.2 INSTALLATION

- A. Construct well using cable-tool method unless an alternate method is agreed to by Owner.
- B. Take samples of substrata formation at 10-foot intervals and at changes in formation throughout entire depth of each water supply well. Carefully preserve samples on-site in glass jars properly labeled for identification.
- C. Excavate for mud pit or provide aboveground structure, acceptable to authorities having jurisdiction, to allow settlement of cuttings and circulation of drill fluids back to well without discharging to on-site waterways.
- D. Enlarge pilot hole and install permanent casing, screen, and grout. Install first section of casing with hardened steel driving shoe of an OD slightly larger than casing couplings if threaded couplings are used.
- E. Set casing and liners round, plumb, and true to line.
- F. Join casing pipe as follows:
1. Ream ends of pipe and remove burrs.
 2. Remove scale, slag, dirt, and debris from inside and outside casing before installation.
 3. Cut bevel in ends of casing pipe and make threaded joints.
 4. Clean and make solvent-cemented joints.
- G. Mix grout in proportions of 1 cu. ft. or a 94-lb sack of cement with 5 to 6 gal. of water. Bentonite clay may be added in amounts of 3 to 5 lb/cu. ft. for a 94-lb sack of cement. If bentonite clay is added, water may be increased to 6.5 gal./cu. ft. of cement.
- H. Place grout continuously, from bottom to top surface, to ensure filling of annular space in one operation. Do not perform other operations in well within 72 hours after grouting of casing. Annular space shall be completely filled with grout from the bottom of the annular space, upward to the ground surface in accordance with OAC 3745-9-07 Well Grouting for Construction or Closure.
- I. Provide permanent casing with temporary well cap. Install with top of casing at elevation noted on drawings to provide protection from 100-yr flood.

- J. Develop well to maximum yield per foot of drawdown.
 - 1. Extract maximum practical quantity of sand, drill fluid, and other fine materials from water-bearing formation.
 - 2. Avoid settlement and disturbance of strata above water-bearing formation.
 - 3. Do not disturb sealing around well casings.
 - 4. Continue developing wells until water contains no more than 2 ppm of sand by weight when pumped at maximum testing rate.
 - 5. The permanent pump (where specified to be supplied as a part of the project) shall not be used to develop the well without the Owner's consent.

- K. Install submersible well pumps according to HI 2.1-2.4 and provide access for periodic maintenance.
 - 1. Before lowering permanent pump into well, lower a dummy pump that is slightly longer and wider than permanent pump to determine that permanent pump can be installed. Correct alignment problems.
 - 2. Before lowering permanent pump into well, start pump to verify correct rotation.
 - 3. Securely tighten discharge piping joints.
 - 4. Locate line-shaft well pump near well bottom; locate motor above grade. Install driver plate to correctly align motor and pump.
 - 5. Connect motor to submersible pump and locate near well bottom.
 - a. Connect power cable while connection points are dry and undamaged.
 - b. Do not damage power cable during installation; use cable clamps that do not have sharp edges.
 - c. Install water-sealed surface plate that will support pump and piping.

3.3 CONNECTIONS

- A. Piping installation requirements are as outlined in the specifications. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Ground equipment according to electrical specifications and requirements.
- C. Connect wiring according to electrical specifications and requirements.

3.4 FIELD QUALITY CONTROL

- A. Test Preparation: Clean water supply wells of foreign substances. Swab casings using alkalis, if necessary, to remove foreign substances.
- B. Perform tests and inspections and prepare test reports.
- C. Tests and Inspections:
 - 1. Plumbness and Alignment Testing: Comply with AWWA A100. The maximum allowable horizontal deviation of a public water system well from vertical shall not exceed two thirds of the smallest inside diameter of that part of the well being tested per one hundred feet of depth.

2. Furnish samples of water-bearing formation to testing laboratory and well-screen manufacturer for mechanical sieve analysis.
3. Prepare reports on static level of ground water, level of water for various pumping rates, and depth to water-bearing strata.
4. Performance Test Preparation: Start well pump and adjust controls and pressure setting. Replace damaged and malfunctioning controls and equipment.
5. Performance Testing: Conduct final pumping tests after wells have been constructed, cleaned, and tested for plumbness and alignment.
 - a. Arrange to conduct tests, with 48 hours' advance notice, after test pump and auxiliary equipment have been installed. Note water-level elevations referred to for each assigned datum in wells.
 - b. Provide discharge piping to conduct water to locations where disposal will not create a nuisance or endanger adjacent property. Comply with requirements of authorities having jurisdiction.
 - c. Provide and maintain equipment of adequate size and type for measuring flow of water, such as weir box, orifice, or water meter.
 - d. Measure elevation to water level in wells.
 - e. Perform two bailer or air-ejection tests to determine expected yield. Test at depths with sufficient quantity of water to satisfy desired yields.
 - f. Test Pump: Variable capacity test pump with capacity equal to maximum expected yields at pressure equal to drawdown in wells, plus losses in pump columns and discharge pipes.
 - g. Start and adjust test pumps and equipment to required pumping rates.
 - h. The pumping test shall consist of two separate activities, a step test and a constant rate test. The step test shall be completed first. Upon completion of the step test, the well shall be allowed to "rest", permitting the aquifer to recover toward the static water level observed prior to initiation of the step test. The constant rate test shall not be initiated until the static water level has recovered 90 percent of the drawdown observed during the step test.
 - i. A step test with at least three progressively increasing pumping rates shall be conducted. The rates utilized in conducting the step test shall be 0.5 times the proposed pump design rate, the proposed pump design rate and 1.5 times the proposed pump design rate unless an alternate pumping rate structure has been agreed upon in advance by the Owner and the Engineer. The duration of the step test shall be structured to allow the drawdown level within the well to stabilize at each pumping rate for a minimum of 15 minutes before the pumping rate is increased to the next rate step. Contractor shall also monitor and record the well recovery.
 - j. A constant rate pumping test shall be conducted for at least twenty-four hours either at a rate at least 1.5 times the pump design rate of 700 gpm or at a rate supported by the formation.
 - k. During the performance of the step test and constant rate test and during the recovery period thereafter, the Contractor shall record the depth of water present within the existing observation well (and within any existing production wells) located at the project site. The information obtained shall be conveyed to the Owner and the Engineer as a part of the well pumping test report.

1. The datum utilized for the development of the well log(s) and pumping test report shall be approved by the Owner and/or Engineer. Contractor shall prepare a pumping test report that includes the following:

- 1) Date and times of starting through ending of pumping test;
- 2) Pumping rate and pump setting depth;
- 3) Water level measurements from the well of the static water level and drawdown to the nearest 0.1 foot, as measured from an identified datum. Water level measurements shall be at the following time intervals:

Time after Pump Test Started (min)	Time interval between measurements (min)
0-15	1
15-60	5
60-120	10
120-180	20
180-300	30
300-1,440	60

- 4) Specific capacity;
- 5) Graphic evaluation on semi logarithmic graph paper by plotting the drawdown measurements on the arithmetic scale and time on the logarithmic scale;
- 6) Water level measurements immediately after termination of the constant rate pump test for a period of time until the water level is essentially unchanged at time intervals of five minutes for the first hour and every thirty minutes thereafter.

D. Water Analysis Testing:

1. Engage a qualified testing agency to make bacteriological, physical, and chemical analyses of water from each finished well and report the results. Make analyses according to requirements of authorities having jurisdiction and as outlined in OAC 3745-9-09-C.
2. Analyze water sample from each finished well for bacteriological, physical, and chemical quality and report the results. Make analyses according to requirements of authorities having jurisdiction.
3. Reports detailing the completed testing shall be submitted to the Owner, the Engineer and to the OEPA in accordance with the provisions of the OAC.

3.5 CLEANING

- A. Disinfect water supply wells according to AWWA A100 and AWWA C654 before testing well pumps.
- B. Follow water supply well disinfection procedures required by authorities having jurisdiction before testing well pumps.

3.6 PROTECTION

- A. Water Quality Protection: Prevent well contamination, including undesirable physical and chemical characteristics.
- B. Ensure that mud pit will not leak or overflow into streams or wetlands. When well is accepted, remove mud and solids in mud pit from Project site and restore site to finished grade.
- C. Provide casings, seals, sterilizing agents, and other materials to eliminate contamination; shut off contaminated water.
- D. Exercise care to prevent breakdown or collapse of strata overlaying that from which water is to be drawn.
- E. Protect water supply wells to prevent tampering and introducing foreign matter. Retain temporary well cap until installation is complete.

3.7 WELL LOG

- A. Contractor shall be responsible for recording a well log at the time the well is drilled with the Ohio Department of Natural Resources (ODNR).
- B. A copy of the properly filed ODNR well log shall be provided to the Owner and the Engineer.

END OF SECTION 332100