SITEWORK SPECIFICATIONS

FOR

COTTAGES AT GENERATION VILLAGE
WILLARD, MISSOURI

Prepared For:

COTTAGES AT GENERATION VILLAGE, LP

3556 S. CULPEPPER CIRCLE, SUITE 4

SPRINGFIELD, MISSOURI 65804

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PROJECT:

Project Name: Cottages at Generation Village
Location: Willard, Missouri

CIVIL ENGINEERING CONSULTANT OF RECORD:

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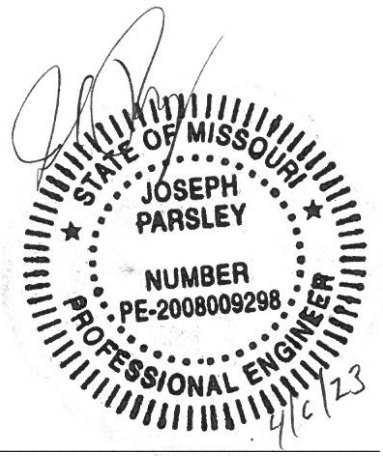

Civil Engineering Consultant of Record Date

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SECTION 02230 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cleaning site of debris, grass, trees, and other plant life in preparation for site or building earthwork.
   2. Protection of existing structures, trees, or vegetation indicated on the Construction Drawings to remain.

B. Related Requirements:
   1. Section 02220 – Site Demolition: Demolition and removal of structures, paving, utilities and other improvements. [SECTION NOT USED]
   2. Section 02300 – Earthwork: Stripping and removal of topsoil.
   3. Section 02370 - Erosion And Sedimentation Control (Including SWPPP)

1.2 ENVIRONMENTAL REQUIREMENTS

A. Construct temporary erosion and sediment control systems as shown on Construction Drawings and as directed by the "Storm Water Pollution Prevention Plan" (SWPPP) to protect adjacent properties and water resources from erosion and sedimentation.

B. In event that sitework on this project will disturb one or more acres, starting work shall be strictly governed by the sequence of construction as specified in Section 02370 and SWPPP site maps. Contractor shall not begin construction without "National Pollution Discharge Elimination System" (NPDES) permit governing discharge of storm water from site for entire construction period. NPDES permit requires SWPPP to be in place during construction.

C. Clearing and grubbing shall commence in the proper sequence as specified in Section 02370 and on the SWPPP site map.

D. Contractor shall conduct storm water management practices in accordance with the project SWPPP and applicable NPDES permit and shall enforce action taken or imposed by Federal or State agencies, including cost of fines, construction delays, and remedial actions resulting from Contractor's failure to comply with provisions of NPDES permit.

1.3 PROJECT CONDITIONS

A. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as reasonably practical.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify existing plant life that is to remain and verify clearing limits are clearly tagged, identified, and marked in such manner as to ensure their protection throughout construction operations.

3.2 PROTECTION

A. Locate, identify, and protect existing utilities that are to remain.

B. Protect trees, plant growth, and features designated to remain as part of final landscaping.

C. Conduct operations with minimum interference to public or private accesses and facilities. Maintain ingress and egress at all times and clean or sweep roadways daily as required by SWPPP or governing authority. Dust control shall be provided with sprinkling systems or equipment provided by Contractor.

D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by a licensed land surveyor and replaced, as necessary, in kind.

E. Provide traffic control as required, in accordance with the US Department of Transportation's "Manual on Uniform Traffic Control Devices" and applicable state highway department requirements.

3.3 EQUIPMENT

A. Material shall be transported to and from the project site using well-maintained and operating vehicles. Transporting vehicles operating on site shall stay on designated haul roads and shall not endanger improvements by rutting, over-loading, or pumping.

3.4 CLEARING

A. Clear areas required for access to site and execution of work.

B. Unless otherwise indicated on Construction Drawings, remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction. Removal includes digging out stumps and roots. Depressions caused by clearing and grubbing operations shall be filled to subgrade elevation to avoid ponding of water. Satisfactory fill material shall be placed in accordance with Section 02300.

C. Remove grass, trees, plant life, stumps, and other construction debris from site to dump site that is suitable for handling such material according to state laws and regulations.

D. Cut heavy growths of grass from areas before stripping and topsoil removal and remove cuttings with remainder of cleared vegetative material.

END OF SECTION

SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavation, filling, and backfilling for structures, pavement, and outparcels.
2. Trenching and backfilling for utilities.
3. Dewatering.
4. Boring under crossings.

B. Related Requirements:
1. Section 02318 - Rock Excavation.
2. Section 02340 - Soil Stabilization.
3. Section 02370 - Erosion Control and Sedimentation. Temporary and permanent erosion control.
4. Section 02375 - Stone Protection. Rip-rap stone for slope protection.
5. 02900 – Planting.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM)
1. ASTM D422 - Particle Size Analysis of Soil.
2. ASTM D698 - Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN.m/m^3)).
3. ASTM D1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 Kn.m/m^3)).
4. ASTM D2487 - Classification of Soils for Engineering Purposes (Unified Soil Classification System).
5. ASTM D2488 - Description and Identification of Soils (Visual-Manual Procedures).
6. ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
7. ASTM D6938 – In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

C. American Association of State Highway and Transportation Officials (AASHTO)
1. AASHTO T 88 - Particle Size Analysis of Soils.

D. Missouri Department of Transportation (MoDOT):
1. Standard Specifications for Highway Construction, Latest Edition.

E. National Fire Protection Association (NFPA)
1. NFPA 70 - National Electrical Code.

F. American Water Works Association (AWWA)
1. AWWA C200 - Standard for Steel Water Pipe - 6 In. (150 mm) and Larger.
2. AWWA C206 - Field Welding Of Steel Water Pipe.

1.3 DEFINITIONS

A. Satisfactory Materials: Materials meeting the following requirements are satisfactory.
1. Low plasticity material with a maximum particle size less than 3 inches and having a liquid limit less than 45 and plasticity index less than 25 shall be considered satisfactory for fill placement in all areas and elevations.

2. On-site high plasticity fat clay soils with a liquid limit less than 75 and plasticity index less than 45 shall be considered satisfactory for fill placement at elevations 2 feet or greater below final subgrade elevation in structural areas or all elevations in non-structural areas.
3. Satisfactory materials shall be free of rock or gravel larger than allowed for fill or backfill material as specified hereinafter or as shown on the drawings.
4. Satisfactory materials shall contain no debris, waste, frozen materials, vegetation, and other deleterious matter.

B. Unsatisfactory Materials: Materials which do not comply with the requirements for satisfactory materials are unsatisfactory.
1. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory materials which contains root and other organic matter or frozen material. The owner shall be notified of any contaminated materials.
2. Unsatisfactory materials also include satisfactory materials not maintained allowable moisture content range at time of compaction as specified in Section 3.13. below.

1.4 SUBMITTALS

A. Upon request, submit 30-pound sample of each type of off-site fill material that is to be used at the site in airtight containers to the independent testing laboratory or submit gradation and certification of aggregate material that is to be used at the site to the owner for review.

B. Submit gradation and certification of aggregate material that is to be used for trench bedding, haunching, and initial and final backfill for all utility and storm sewer installations to the CEC for review.

C. Submit name of each material supplier and specific type and source of each material. Change in source throughout project requires approval of Owner.

D. Submit Dewatering Plans upon request by Owner.

E. Shop drawings or details pertaining to excavating and filling are not required unless otherwise shown on the Drawings or if contrary procedures to Construction Documents are proposed.

F. Shop drawings or details pertaining to site utilities are not required unless required by regulatory authorities or unless uses of materials, methods, equipment, or procedures that are contrary to The Drawings or Specifications are proposed. Do not perform work until Owner has accepted required shop drawings.

G. Contact utility companies and determine if additional easements will be required to complete project. Provide written confirmation of the status of all easements to Owner at time of Preconstruction Conference or no later than 90 days prior to project possession date.

PART 2 - PRODUCTS

2.1 SOIL AND ROCK MATERIALS

A. Fill and Backfill. Satisfactory materials excavated from the site.

B. Imported Fill Material: Satisfactory material provided from offsite borrow areas when sufficient satisfactory materials are not available from required excavations.

C. Trench Backfill: ASTM D2321-11 unless otherwise specified or shown on the drawings. An open-graded material meeting the requirements of ASTM D2321-11 may be used only if the material is wrapped in an approved filter or drainage fabric (See Section 2.2.B. below) and with written permission from the CEC.

D. Bedding: Aggregate Type as indicated on the plans or naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; an open-graded material meeting the requirements of ASTM

D2321-11 may be used only if the material is wrapped in an approved filter or drainage fabric (See Section 2.2.B. below) and with written permission from the CEC.

E. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2- inch sieve and 0 to 5 percent passing a No.8 sieve. Drainage fill, where required, shall be wrapped in an approved filter or drainage fabric (See Section 2.2.B. below).

F. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No.4 sieve. Filter material, where required, shall be wrapped in an approved filter or drainage fabric (See Section 2.2.B. below).

G. Topsoil: Topsoil shall consist of stripping material excavated from the site. Topsoil shall consist of organic surficial soil found in depth of not more than 6-inches. Topsoil shall be as further defined in Section 02900 – Planting.

2.2 APPURTENANT MATERIALS

A. Stabilization fabrics and geogrids: As specified in Section 02340.

B. Filter and drainage fabrics: As specified in Section 02340.

C. Steel Casing Pipe: Comply with AWWA C200 minimum grade B, size, and wall thickness as indicated on The Drawings.

D. Trench Utility Locator Tape: Heavy duty 6" wide underground warning tape. Tape shall be made from polyethylene material, 3.5 mils thick, with a minimum tensile strength of 1,750 psi. Place the tape at one-half the minimum depth of cover for the utility line or a maximum of 3 feet, whichever is the less, but never above the top of subgrade. Color of tape shall be determined by as follows:
1. Natural Gas or Propane – Yellow.
2. Electric – Red.
3. Telephone – Orange.
4. Water – Blue.
5. Sanitary Sewer – Green.

2.3 EQUIPMENT

A. Transport off-site materials to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

2.4 SOURCE QUALITY CONTROL

A. Laboratory testing of materials proposed for use in the project shall be by the Contractor. The Contractor shall provide samples of material obtained off-site to owner upon request.

B. Perform California Bearing Ratio (CBR) tests in areas to receive pavement for each type of material that is imported from off-site. CBR value shall be equal to or above pavement design subgrade CBR value indicated on Construction Drawings.

C. Following tests shall be performed on each type of on-site or imported soil material used as compacted fill:
1. Moisture and Density Relationship: ASTM D698.
2. Mechanical Analysis: AASHTO T88 or ASTM D422.
3. Plasticity Index: ASTM D4318.

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify required lines, levels, contours, datum, elevations, and grades necessary for construction as shown on the drawings.

B. Notify utility companies to remove or relocate public utilities that are in conflict with proposed improvements.

C. Protect plant life, lawns, fences, existing structures, sidewalks, paving, and curbs, unless otherwise noted on the drawings from excavating equipment and vehicular traffic.

D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

E. Remove from site, material encountered in grading operations that is unsatisfactory material or undesirable for backfilling, subgrade, or foundation purposes. Dispose of in manner satisfactory to Owner and local governing agencies. Backfill areas with layers of satisfactory material and compact as specified herein.

F. Prior to placing fill in low areas, such as previously existing creeks, ponds, or lakes, perform following procedures:
   1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use adequate pump to obtain the same results.
   2. After drainage of low area is complete, remove muck, mud, debris, and other unsatisfactory material by using acceptable equipment and methods that will keep natural soils underlying low area dry and undisturbed.
   3. All muck, mud, and other materials removed from low areas shall be dried on-site by spreading in thin layers for observation. Material shall be inspected and, if found to be satisfactory for use as fill material, shall be incorporated into lowest elevation of site filling operation, but not under building subgrade or within 5'-0" of perimeter of building subgrade, paving or other structural areas. If, after observation, material is found to be unsatisfactory, it shall be removed from site.

G. Locate and identify utilities that have previously been installed and protect from damage.

H. Locate and identify existing utilities that are to remain and protect from damage.

I. Maintain in operating condition existing utilities, previously installed utilities, and drainage systems encountered in utility installation. Repair surface or subsurface improvements shown on the Drawings.

J. Verify location, size, elevation, and other pertinent data required making connections to existing utilities and drainage systems as indicated on the Drawings.

K. Over excavate and properly prepare areas of subgrade that are not capable of supporting proposed systems. Stabilize these areas by using acceptable geotextile fabrics or aggregate material placed and compacted as specified in Section 02340.

3.2 DEWATERING

A. General:
   1. Dewatering activities shall conform to applicable provisions in 02370.
   2. Provide dewatering systems as required for excavations.
   3. Design and provide dewatering system using accepted and professional methods consistent with current industry practice to eliminate water entering the excavation under hydrostatic head from the bottom or sides. Design system to prevent differential hydrostatic head, which would result in floating out soil particles in a manner, termed as a “quick” or “boiling” condition. System shall not be dependent solely upon sumps or pumping water from within the excavation where differential head would result in a quick condition, which would continue to worsen the integrity of the excavation’s stability.
   4. Provide dewatering system of sufficient size and capacity to prevent ground and surface water flow into the excavation and to allow Work to be installed in a dry condition.

5. Control, by acceptable means, all water regardless of source. Contractor shall be responsible for disposal of the water.
6. Control groundwater in a manner that preserves strength of foundation soils, does not cause instability or raveling of excavation slopes, and does not result in damage to existing structures. Where necessary, lower water level in advance of excavation utilizing wells, wellpoints, jet educators, or similar positive methods. The water level as measured by piezometers shall be maintained a minimum of 3 feet below prevailing excavation level.
7. Commence dewatering prior to any appearance of water in excavation and continue until Work is complete to the extent that no damage results from hydrostatic pressure, flotation, or other causes.
8. Open pumping with sumps and ditches will be allowed provided it does not result in boils, loss of fines, softening of the ground, or instability of slopes.
9. Install wells or wellpoints, if required, with suitable screens and filters so that continuous pumping of fines does not occur. Arrange discharge to facilitate collection of samples by the Owner. During normal pumping and upon development of wells, levels of fine sand or silt in the discharge water shall not exceed 5 ppm. Install sand tester on discharge of each pump during testing to verify that levels are not exceeded.
10. Control grading around excavations to prevent surface water from flowing into excavation areas.
11. No additional payment will be made for any supplemental measures to control seepage, groundwater, or artesian head.

B. Design:
1. Designate and obtain the services of a qualified dewatering specialist to provide dewatering plan as may be necessary to complete the Work.
2. Contractor shall be responsible for the accuracy of the drawings, design data, and operational records required.
3. Contractor shall be responsible for the design, installation, operation, maintenance, and any failure of any component of the system.

C. Damages:
1. Contractor shall be responsible for and shall repair any damage to work in place, other contractor's equipment, utilities, residences, highways, roads, railroads, private and municipal well systems, adjacent structures, natural resources, habitat, existing wells, and the excavation. Contractor responsibility shall also include, damage to the bottom due to heave and including but not limited to, removal and pumping out of the excavated area that may result from Contractor's negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system.
2. Remove subgrade materials rendered unsatisfactory by excessive wetting and replace with approved backfill material at no additional cost to the Owner.

D. Maintaining Excavation in Dewatering Condition:
1. Dewatering shall be a continuous operation. Interruptions due to power outages or any other reason will not be permitted.
2. Continuously maintain excavation in a dry condition with positive dewatering methods during preparation of subgrade, installation of pipe, and construction of structures until the critical period of construction or backfill is completed to prevent damage of subgrade support, piping, structure, side slopes, or adjacent facilities from flotation or other hydrostatic pressure imbalance.
3. Provide standby equipment on site, installed, wired, and available for immediate operation if required to maintain dewatering on a continuous basis in the event any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damaged structures and foundation soils at no additional cost to Owner.
4. System maintenance shall include but not be limited to 24-hour supervision by personnel skilled in the operation, maintenance, and replacement of system components and any other work required to maintain excavation in dewatered condition.

E. System Removal: Upon completion of the work, remove dewatering equipment from the site, including related temporary electrical service.

F. Wells shall be removed or cut off a minimum of 3 feet below final ground surface, capped, and abandoned in accordance with regulations by agencies having jurisdiction.

3.3 TOPSOIL EXCAVATION

A. Cut heavy growths of grass from areas before stripping and remove cuttings with remainder of cleared vegetative material.

B. Strip topsoil to a depth of not less than 6 inches from areas that are to be filled, excavated, landscaped, or re-graded to such depth that it prevents intermingling with underlying subsoil or questionable material.

C. Stockpile topsoil in storage piles in areas shown on The Drawings or where directed by Owner. Construct storage piles to freely drain surface water. Cover storage piles as required to prevent windblown dust. Dispose of unsuitable topsoil as specified for waste material, unless otherwise specified by Owner. Remove excess topsoil from site unless specifically noted otherwise on the Drawings.

3.4 GENERAL EXCAVATION

A. Classification of Excavation: The Contractor shall assure himself by site investigation or other necessary means that he is familiar with the type, quantity, quality, and character of excavation work to be performed. Excavation shall be considered unclassified excavation, except as indicated in the Contract Documents.

B. When performing grading operations during periods of wet weather, provide adequate dewatering, drainage and ground water management to control moisture of soils.

C. Shore, brace, and drain excavations as necessary to maintain excavation as safe, secure, and free of water at all times.

D. Excavate building areas to line and grade as shown on the Drawings being careful not to over excavate beyond elevations needed for building subgrades.

E. Place satisfactory excavated material into project fill areas.

F. Unsatisfactory excavated material shall be disposed of in manner and location that is acceptable to Owner and local governing agencies.

G. Perform excavation using capable, well-maintained equipment and methods acceptable to Owner and local governing agencies.

H. All pipes that penetrate levees, including permanent outlet control devices and temporary discharge pipes from sedimentation ponds, shall be constructed in conjunction with fill placement to ensure these drainage devices are properly placed and the surrounding backfill is adequately tied to the basin levee. Trenching of levees is not permitted. All materials in the levee, including bedding materials for the discharge devices, shall be low permeability, cohesive soils. Soil exhibiting high shrink/swell potential or containing greater than 5% organics shall not be used.

3.5 ROCK EXCAVATION

A. Rock excavation is specified in Section 02318.

3.6 TRENCHING EXCAVATION FOR UTILITIES

A. Contact local utility companies before excavation begins. Dig trench at proper width and depth for laying pipe, conduit, or cable. Cut trench banks vertical, if possible, and remove stones from bottom of trench as necessary to avoid point-bearing. Over-excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous and uniform bedding. Replace over-excavation with satisfactory material and dispose of unsatisfactory material.

B. Trench excavation sidewalls shall be sloped, shored, sheeted, braced, or otherwise supported by means of sufficient strength to protect workmen in accordance with applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to exit ladder or steps shall not be greater than 25 feet in trenches 4 feet or deeper.

C. Perform trench excavation as indicated on the Drawings for specified depths. During excavation, stockpile materials suitable for backfilling in orderly manner far enough from bank of trench to avoid overloading, slides, or cave-ins.

D. Remove excavated materials not required or not satisfactory as backfill or embankments and waste off-site or at on-site locations approved by the Owner and in accordance with governing regulations. Dispose of structures discovered during excavation as specified in Section 02220.

E. Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches and other excavations as specified.

F. Open cut excavation with trenching machine or backhoe. Where machines other than ladder or wheel-type trenching machines are used, do not use clods for backfill.

G. Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on bedding material at every point along entire length except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.

H. Trench width below top of pipe shall not be less than 12 inches nor more than 18 inches wider than outside surface of pipe or conduit that is to be installed to designated elevations and grades. Other trench width for pipe, conduit, or cable shall be least practical width that will allow for proper compaction of trench backfill.

I. Trench depth requirements measured from finished grade or paved surface shall meet the following requirements or applicable codes and ordinances, whichever is more stringent:
   1. Water Mains: 30 inches to top of pipe barrel or 6 inches below frost line, established by local building official, whichever is deeper.
   2. Sanitary Sewer: Elevations and grades as indicated on the drawings and as specified in Section 02535.
   3. Storm Sewer: Elevations and grades as indicated on the Drawings.
   4. Electrical Conduits: 24 inches minimum to top of conduit or as required by NEC 300-5, NEC 710-36 codes, or local utility company requirements, whichever is deeper.
   5. TV Conduits: 18 inches minimum to top of conduit or as required by local utility company, whichever is deeper.
   6. Telephone Conduits: 18 inches minimum to top of conduit, or as required by local utility company, whichever is deeper.
   7. Gas Mains and Service: 30 inches minimum to top of pipe, or as required by local utility company, whichever is deeper.

   The above noted depths are minimum requirements. Except where specific elevations and grades are indicated on the drawings, the contractor shall increase the depth as necessary, upon approval of the respective utility company, to ensure minimum clearances and separations are maintained.

3.7 SUBGRADE PREPARATION

A. Scarification and Compaction: Areas exposed by excavation or stripping and on which subgrade preparations are to be performed shall be scarified to minimum depth of 8 inches and compacted as specified hereinafter.

B. Proofrolling: Subgrades shall be proofrolled to detect areas of insufficient compaction and soft pocket, or areas of excess yielding. Proofrolling shall be accomplished by making minimum of two complete passes with fully-loaded tandem-axle dump truck with a minimum weight of 20 tons, or approved equal, in each of two perpendicular directions. Limit vehicle speed to three mph. Areas of failure such as soft spots, unsatisfactory soils, and areas of excessive pumping or rutting shall be excavated and re-compacted as specified herein. Continual

failure areas shall be stabilized in accordance with Section 02340 at no additional cost to Owner. Subgrade exposed longer than 48 hours or on which precipitation has occurred shall be re-proofrolled. Document proofrolling procedure, specific locations, deficiencies, and corrective measures for review by Owner upon request.

C. Hand Auger Probing: In small areas where proof rolling is not practical, hand auger probing may be necessary in lieu of proofrolling to ensure the subgrade soils are well compacted, stable, and unyielding prior to placing fill or constructing improvements above those soils. Hand auger probing in these areas shall consist of shallow hand auger borings to penetrate any disturbed portions of the subgrade and then using DCP testing, steel probe testing or other testing procedures, as approved by the owner, necessary to ensure the subgrade is stable and unyielding prior to placing new stone base and pavements. Retesting of the subgrade will be required if the new stone base and pavements are not placed within the time limits outlined in the specifications or if the subgrade is subjected to unfavorable weather conditions.

3.8 FILLING

A. Fill areas to contours and elevations shown on the Drawings with materials deemed satisfactory.

B. Place fills in continuous lifts specified herein.

C. Fill within proposed building subgrade, paving subgrade, and other structural areas shall not contain rock or stone greater than 3 inches in any dimension.

D. Fill materials used in preparation of subgrade shall be placed in lifts or layers not to exceed 8 inches loose measure and compacted as specified hereinafter.

E. Material imported from off-site shall have CBR value equal to or above pavement design subgrade CBR value indicated on The Drawings.

F. Building area subgrade pad shall be that portion of site directly beneath and 5 feet beyond building and appurtenances, including limits of future building expansion areas as shown on the Drawings.

3.9 ROCK FILL

A. Rock fill is not permitted.

3.10 PIPE BEDDING

A. Excavate trenches for pipe or conduit to 4 inches below bottom of pipe and to the width as specified herein. Place 4 inches of bedding material, compact in bottom of trench, and shape to conform to lower portion of pipe barrel.

B. Place geotextile fabric as specified on the Drawings and in accordance with Section 02340.

3.11 TRENCH BACKFILLING

A. Materials used for trench backfill shall comply with requirements as specified herein.

B. Backfill and compact in accordance with fill and compaction requirements in ASTM D2321 unless otherwise shown on the drawings.

C. Do not backfill trenches until required tests are performed and utility systems comply with and are accepted by applicable governing authorities.

D. Backfill trenches to contours and elevations shown on the Drawings.

E. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

F. All trenches in non-pavement areas shall be capped with 12" of low plasticity cohesive fill to reduce the infiltration and conveyance of surface water through the trench backfill. It will be permissible to reduce the thickness of the cap in small isolated areas where the 12" thickness is not achievable due to design grades and/or utility burial depths. A 9" thick cap may be utilized in these areas.

G. All trenches that extend into the building pad and are sloped toward the building shall have a "plug" of 5 feet in length consisting of low plasticity cohesive fill or with lean concrete/flowable fill.

3.12 BORINGS AND CASINGS UNDER ROADS, HIGHWAYS, AND RAILROAD CROSSINGS

A. When indicated by the Drawings, street, road, highway, or railroad crossings for utility mains installed by jacking and boring method shall be in accordance with area specifications and governing authorities.

B. Excavation of approach pits and trenches within right-of-way of street, road, highway, or railroad shall be of sufficient distance from paving or railroad tracks to permit traffic to pass without interference. Tamp backfill for approach pits and trenches within right-of-way in layers not greater than 6-inches thick for entire length and depth of trench or pit. Compact backfill to 95 percent of maximum density in accordance with ASTM D698, obtained at optimum moisture as determined by AASHTO T180. Mechanical tampers may be used after cover of 6 inches has been obtained over top of barrel of pipe.

C. Accomplish boring operation using commercial type boring rig. Bore hole to proper alignment and grade. Bore hole shall be within 2 inches of same diameter as largest outside joint diameter of pipe installed. Install pipe in hole immediately after bore has been made and in no instance shall hole be left unattended while open.

D. In event subsurface operations result in failure or damage to pavement or railroad tracks within 1 year of construction, make necessary repairs to pavement or railroad tracks. If paving cracks on either side of pipe line or is otherwise disturbed or broken due to construction operations, repair or replace disturbed or broken area.

E. Clean, prime, and line interior and exterior of casing pipe with two coats of asphalt coating in accordance with and governing authorities.

F. Butt weld steel casing. Welds shall be full penetration single butt-welds in accordance with AWWA C206.

G. Install casing and utility pipe with end seals, vent pipe, and other special equipment in accordance with area specifications and governing authorities.

3.13 COMPACTION

A. Compact as follows:

Material Tested	Proctor Type	Min % Dry Density	Placement Moisture Content Range	Frequency of Testing
Structural Lean Clay Fill (Cohesive)	Standard	95%	-1 to +3%	1 per 2,500 SF of fill placed per lift
Structural Fat Clay Fill (Cohesive)	Standard	95%	0 to +3%	1 per 2,500 SF of fill placed per lift
Structural Fill (Granular)	Standard	95%	-2 to +2%	1 per 2,500 SF of fill placed per lift
Random Fill (Non-Load Bearing)	Standard	90%	-3 to +3%	1 per 6,000 SF of fill placed per lift
Utility Trench Backfill	Standard	95%	-1 to +2%	1 per 150 lineal foot per lift

B. Maintain moisture content as specified in the above table.

C. Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.

D. Corrective Measures for Non-Complying Compaction: Remove and recompact deficient areas until proper compaction is obtained. Continual failure areas shall be stabilized in accordance with Section 02340 at no additional cost to Owner.

3.14 MAINTENANCE OF SUBGRADE

A. Verify finished subgrades to ensure proper elevation and conditions for construction above subgrade.

B. Protect subgrade from excessive wheel loading during construction, including concrete trucks, dump trucks, and other construction equipment.

C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of material with CBR equal to or better than that specified on the drawings. Surface of subgrade after compaction shall be firm, uniform, smooth, stable, and true to grade and cross-section.

D. Construct temporary ditches and perform such grading as necessary to maintain positive drainage away from subgrade at all times.

3.15 BORROW AND SPOIL SITES

A. Comply with NPDES and local erosion control permitting requirements for any and all on-site and off-site, disturbed spoil and borrow areas. Upon completion of spoil or borrow operations, clean up spoil or borrow areas in a neat and reasonable manner to the satisfaction of Owner or off-site property owner, if applicable.

3.16 FINISH GRADING

A. Check grading of building subgrades by string line from grade stakes (blue tops) set at not more than 50-foot centers. Allowable tolerance shall be plus or minus 0.10 feet from plan grade. Provide engineering and field staking as necessary for verification of lines, grades, and elevations.

B. Grade areas where finish grade elevations or contours are indicated on the Drawings, other than paved areas and buildings, including excavated areas, filled and transition areas, and landscaped areas. Graded areas shall be uniform and smooth, free from rock, debris, or irregular surface changes. Ground surfaces shall vary uniformly between indicated elevations. Grade finished ditches to allow for proper drainage without ponding and in manner that will minimize erosion potential. For topsoil, sodding, and seeding requirements refer to Section 02900.

C. Correct settled and eroded areas within 1 year after date of completion at no additional expense to Owner. Bring grades to proper elevation.

3.17 FIELD QUALITY CONTROL / TESTING AND INSPECTION (T & I)

A. Field quality control shall be the responsibility of the Contractor. Except for below specified mandatory testing, field quality control testing and inspection shall be at the discretion of the Contractor as necessary to assure compliance with Contract requirements.

B. Testing and inspection shall be performed continuously throughout the duration of earthwork activities.

C. Work shall be performed by a properly trained and certified inspector. Report of testing and inspection results shall be made upon the completion of testing.

D. Classification of Materials: Perform test for classification of materials used and encountered during construction in accordance with ASTM D2488 and ASTM D2487.

E. Laboratory Testing Of Materials: Perform laboratory testing of materials (Proctor, Sieve Analysis, Atterberg Limits, Consolidation Test, etc.) as specified.

F. Proofrolling: Document and explain proofrolling inspection procedures and results in the laboratory inspection report.

G. Field Density Tests
   1. Building Subgrade Areas, Including 5'-0" Outside of Exterior Building Lines: In cut areas, not less than one compaction test for every 2,500 sq. ft and at locations along all continuous wall footings with intervals not exceeding 100 feet and at each column spread footing. In fill areas, same rate of testing for each 8-inch lift, measured loose and at locations along continuous wall footings with intervals not exceeding 100 feet and at each column spread footing.
      a. Density tests on top of building subgrade shall be performed within 48 hours prior to placement of overlying materials. If inclement weather occurs after testing, retest prior to placement of overlying materials.
   2. Paving Areas and other Areas of Construction Exclusive of Building Subgrade:
      a. In cut areas, not less than one compaction test for every 5,000 sq. ft. In fill areas, same rate of testing for each 8-inch lift, measured loose.
      b. Utility Trench Backfill: Intervals not exceeding 200-feet of trench for first and every other 8-inch lift of compacted trench backfill.
   3. Test Method: In-place nuclear density, ASTM D6938.

H. Observation and Inspection:
   1. Observe all subgrades/excavation bases below footings and slabs and verify design bearing capacity is achieved as required.
   2. Observe and document presence of groundwater within excavations.

END OF SECTION

SECTION 02318 (31 2316) - ROCK EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removal including, drilling, blasting, and protection of rock excavation.

B. Related Requirements:
   1. Section 02230 – Site Clearing. Clearing of trees, brush, and vegitation prior to excavation.
   2. Section 02300 – Earthwork: Excavation, filling, and compaction of earth materials and rock fill.

1.2 [RESERVED]

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. National Fire Protection Association (NFPA)
   1. NFPA495 - Code for Manufacturing, Transportation, Storage, And Use of Explosive Material

C. United States Department of Interior, Bureau of Mines
   1. Seismic Effects of Blasting

D. Occupational Safety & Health Administration (OSHA)
   1. 29CFR1910.109 - Explosives and Blasting Agents

1.4 DEFINITIONS

A. Rock Excavation: Removal of igneous, metamorphic, or sedimentary rock or stone, boulders over two cubic yards in volume in open areas and one cubic yard in volume in trenches; and masonry, concrete, or solid frozen soil that cannot be removed by rippers or other mechanical methods and, therefore, requires drilling and blasting.
   1. The excavation and disposal of all "Rock Excavation" that is indicated by the Soils Report shall be considered unclassified excavation and shall be included with site work grading as part of the lump sum base bid.
   2. If "Rock Excavation" is required that is not indicated by the Soils Report, the Wal-Mart Construction Manager shall be notified prior to such rock excavation, and he must then visit the site and verify the necessity for excess "Rock Excavation," determine an estimated quantity and provide the Contractor written approval to proceed. In the event the estimated quantity is exceeded, the Wal-Mart Construction Manager shall again be notified to establish a revised estimated quantity and authorize the Contractor to proceed. Payment for the authorized work shall be by a Change Order to the Contract.

B. Trenches: Excavations having vertical sides whose depths exceed its width, made for storm water drainage, sanitary sewer, water, and gas pipes, electric, communications, and steam conduits, and related uses.

1.5 SUBMITTALS

A. Submit Blasting Plan prior to any blasting and Monitoring Reports to the Owner and Governing Agencies for review.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA495, Bureau of Mines Seismic Effects of Blasting, and OSHA 29CFR1910.109 as applicable.

B. Comply with all applicable laws, rules, ordinances and regulations of the Federal, State and local regulatory authorities and insurers that govern the licensing, transportation, storage, handling, use, and disposition of explosives.

C. Prior to rock excavation, obtain and pay for all powder and blasting permits and licenses from regulatory agencies.

D. If blasting is required or undertaken, the responsible Subcontractor shall be licensed in the State and shall possess a current blasting license issued by the appropriate regulatory authority and be permitted for the transportation of explosives if required.

E. In case of conflict between regulations or between regulations and Specifications, the Contractor shall comply with the strictest applicable codes, regulations or Specifications.

1.7 SITE CONDITIONS

A. Environmental Requirements: Determine environmental effects associated with proposed work and safeguard those concerns as regulated by law and local governing agencies by reasonable and practical methods.

B. Existing Conditions: The Contractor shall be responsible for any and all damage and/or injury from the use of explosives. The Contractor shall save and hold harmless the Owner, Architect and Engineer from any and all claims from the use of explosives. Removal of materials of any nature by blasting shall be done in such a manner and at such times as to avoid damage affecting integrity of existing construction and damage to new or existing dwellings, structures and water wells in or adjacent to the area of the work. It shall be the Contractor's responsibility to determine the method of operation to ensure desired results and integrity of completed work. All damage caused by the Contractor's blasting operations shall be repaired to the full satisfaction of the Owner at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Explosives, detonator/delay device, and blast mat materials shall be type recommended by explosive supplier and shall comply with requirements specified herein.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify site conditions and note subsurface conditions affecting work of this section.

B. Identify required lines, levels, and elevations that will determine extent of proposed removals.

3.2 ROCK EXCAVATION

A. Cut rock to form level bearing at bottom of footing and trench excavations. Remove shaled layers to provide sound and unshattered base for footings or foundations. Contractor shall consider reuse of excavated materials on site in accordance with Section 02300. If material cannot be utilized on site, dispose of material offsite.

B. If placed in embankments, perform rock excavation in manner that will produce material of such size as in accordance with Section 02300. Remove rock to allow for construction and/or installation of the site and building improvements as indicated on Construction Drawings. Remove loose or shattered rock, overhanging ledges and boulders which might dislodge.

C. Use lean concrete or suitable materials as directed by registered geotechnical engineer to replace rock overblast or over excavation in building and expansion area to facilitate placement of utilities and foundations systems.

3.3 ROCK BLASTING

A. General

1. The drilling and blasting methods and programs shall be those necessary to accomplish any and all rock excavation required for completion of the improvements shown on the Construction Drawings in accordance with the procedures specified herein. Do not use explosives as a primary means of transporting material outside the excavated prism.
2. Blasting work shall be performed only with necessary permits from all regulatory authorities and after completion of the preblast survey. Blasting work shall take place only after persons in the vicinity have been notified and have reached positions of safety. Take appropriate precautions to prevent all persons from entering the blasting area. Use methods and programs that will prevent damage to, but not limited to, adjacent dwellings, structures, public domain, natural resources, habitat, existing wells and landscape features and that will minimize the scattering of rock, stumps or other debris. All affected roadways shall be inspected, cleared, and opened to traffic within 1 hour of completed blasting or as required by governing authorities.
3. Complete all blasting with experienced powdermen licensed to use explosives in the State.
4. Conduct blasting at such hours so as not to disrupt surrounding residences and businesses, and in accordance with Federal, state and local regulations and/or ordinances with regard to noise.
5. Take all precautions necessary to warn and/or protect any individuals exposed to his operations prior to any blasting. Blasting mats or other approved flyrock protection shall be employed as necessary to protect areas adjacent to blasting.
6. Develop and maintain records covering pertinent data on the location, depth and area of the blast, the diameter, spacing, depth, overdepth, pattern, amount, distribution and powder factor for the explosives used per hole and per blast; the sequence and pattern delays, and description and purpose of special methods. Provide a copy of the records to the Owner upon the Owner's request. Receipt and acceptance by the Owner of blasting data will not relieve the Contractor of responsibility to produce satisfactory results as set forth in these specifications. Drilling and blasting shall be done only to the depth, amount and at such locations, with explosives of such quantity, distribution, and density that will not produce unsafe or damage rock surfaces or damage rock beyond the prescribed excavation limits. The Contractor shall be responsible for the cost of removal of overblast and also for the cost of placement and compaction of suitable replacement fill where overblast removal is required or occurs.
7. When a drilling and blasting program results in damage to the excavation or unacceptable peak particle velocity or frequency values as specified herein, the Contractor will be required to devise and employ revised methods that will prevent such damage or unacceptable ground motions at no cost to the Owner. The revisions may include special methods such as presplit and zone blasting, shallow lifts, reduction in size of individual blasts, small diameter blast holes, closely spaced blast holes, reduction of explosives, greater distribution of explosives by use of decking and primacord or variation in density of explosives and chemical or mechanical splitting of the rock.

B. Explosives

1. Take special precautions for proper use of explosives to prevent harm to human life and damage to surface structures, utility lines, or other subsurface structures.
2. Store, handle, and employ explosives in accordance with Federal, state and local regulations, or, in the absence of such, in accordance with the provisions of the NFPA and OSHA.

C. Blasting Vibration And Limit Criteria

1. The amount of vibration, frequency and overpressure generated by blasting shall not exceed regulatory statutes or directives established by State, local or other authorities. In no case shall the maximum Peak Particle Velocity (PPV) exceed the limits indicated on Figure B-1, Appendix B, of the United States Bureau of Mines Report of Investigations, RI 8507, 1980 or latest edition.
2. The peak airblast overpressure measured at the location of the nearest occupied, aboveground structure (considering wind direction) shall not exceed 0.014 psi.

D. Preblast Survey

1. General:
    a. Conduct a preblast survey prior to initiating blasting work. Preblast survey shall be performed by a registered Professional Engineer or specialized consultant licensed in the State of the work covered under this contract and specialized in conducting preblast surveys.

b. The preconstruction/preblast survey shall consist of documenting conditions of all existing dwellings and structures located within a minimum of 500 feet of the limits of all work requiring rock blasting prior to commencement of blasting or further if required by Federal, state or local regulations.

c. The purpose of the preblast survey is to determine the conditions of existing dwellings, structures and water supply wells and document any pre-existing defects and other physical factors that could reasonably be affected by the blasting. Structures such as dams, ponds, pipelines, cables and transmission lines, cisterns, structures of historical significance, and/or structures with unusually costly or vulnerable contents shall be included. The preblast survey shall also note the nature and sensitivity of livestock that may be affected by the blasting.

2. Examination of and Preparation for Survey:

a. The Contractor shall contact the property owners (or their legal representative) of properties within a minimum of 500 feet of the limits of all blasting work in order to obtain permission to conduct a survey of their property. If the property owner does not grant the Contractor permission to conduct the survey, the Contractor shall contact the property owner a second time by registered mail/return receipt requested. The second request for permission to conduct the survey shall include a description of the survey to be performed and the purpose of the survey. At least 72 hours prior to start of blasting work, notify the appropriate local regulatory authority of any property owners who refuse access for the preconstruction survey.

b. Notify the property owners at least 48 hours prior to conducting the preblast survey. After completion of the survey, two copies of the preblast report shall be submitted to the appropriate local regulatory authority for their reference if required. Additionally, one copy shall be kept on file at the location of the project and one copy provided to the Owner upon request.

3. Method:

a. The preblast survey shall include a detailed examination of the interior and exterior of structures located within a minimum of 500 feet of the limits of blasting work. Color photographs, videotapes, and written descriptions shall be taken as required to document the condition of areas within the limits of the survey area. Particular note shall be made of evident structural faults or deficiencies, or recent repairs.

b. The preblast survey shall also include an assessment of water supply wells located within a minimum 500 feet of the limits of all blasting work. This assessment shall include the following items:

1) Information regarding the date of construction of the well, depth, method of construction, yield, water quality and any other existing available data will be requested from each well owner and/or the installer, provided the installer is known.

2) A short duration pump test shall be performed on each well utilizing the existing pump that services each well. The pump shall be activated, the volume of water measured and the drawdown in the well measured for a 1-hour or less period until approximate steady state conditions are achieved. The data obtained from these measurements shall be used to estimate the approximate yield of each well.

3) Upon completion of the above-described short duration pump test, obtain a groundwater sample from the well and submit to a State certified water quality laboratory. Laboratory shall analyze sample for iron, manganese, total dissolved solids, turbidity and total coliform.

4. Survey Report:

a. The Contractor shall prepare a written report summarizing the results of the preblast survey. The final written report shall be signed and sealed by the Contractor's qualified inspector. The report shall contain the following:

1) Location and description of each property
2) Descriptions of the conditions of the on-site elements
3) Summary of the visual inspection
4) Color photographs, sketches, and videotape with vocal summary
5) All data developed from the water supply well assessment

b. Provide videotapes to include supplemental information, as required. Pictorial documentation shall be of professional quality and shall be provided with a scale, where practicable. Clearly label pictorial documentation with an identification number, name of the project and the Engineer or qualified person conducting the survey, name of the property owner, date the picture or video tape was taken, and sufficient information to determine the location of the area in question.

c. The Contractor's inspector shall immediately report in writing to the Contractor any findings that, in his opinion, indicate that any structure or well will be adversely affected by the required construction and blasting.

d. If, during the course of construction and blasting, the Contractor is requested by an adjacent property owner to view alleged damage to property, the Contractor shall give written notice to the Owner prior to the Contractor's visit to the adjacent owners property.

E. Blast Monitoring:

1. Contractor shall perform seismic blast monitoring in accordance with State and local regulations.
2. Contractor shall provide monitoring of blasting vibrations and over-pressures to allow evaluation of compliance with the specified vibration/over-pressures to criteria. As a minimum, the Contractor will monitor each blast as follows:
   a. Monitor vibrations at the exterior walls of all structures within 500 feet of each blast location.
   b. If no structures are located within 500 feet of the blast location, monitor vibrations at three equally spaced radial points located a minimum of 500 feet from the blast locations.
   c. Monitor over-pressures for all structures within a minimum 500 feet of the blast.
3. If requested by the Owner, report vibration/overpressure-monitoring results to the Owner within two hours of blasting. Monitoring performed by the Contractor does not relieve the Contractor of responsibility for control of vibration and overpressure during blasting operations.

3.4 ROCK CUT FACE EXCAVATION

A. The slope of the soil above the top of any permanently exposed rock cut face shall be no steeper than 3(H):1(V) unless otherwise noted on the Construction Drawings. Slope of the rock face shall meet the requirements below.

TYPE OF ROCK	SLOPE (Horizontal to Vertical)
Solid limestone or sandstone	1:1.2
Interbedded limestone, sandstone or shale	1:1.25
Layered shale (no hard rock)	1:1.5

B. Benches of at least ten feet in width at a maximum of twenty feet in elevation intervals or as noted on the Construction Drawings. The benches shall serve to provide rock traps and divert water from the rock face.

3.5 ROCK TRAP

A. Locate rock traps at the base of permanently exposed rock slopes and construct as indicated in the Construction Documents or Blasting Plan.

3.6 OVEREXCAVATION AND BACKFILL

A. Over excavation which is required to remove unsuitable natural undisturbed bedrock weakened by weathering or other cause not inflicted by the Contractor shall be immediately reported to the Owner and performed as directed by the Owner, and the theoretical lines and grades will be adjusted accordingly. Material outside the excavation limits which are disturbed due to the fault or negligence of the Contractor or due to his failure to exercise sound construction practices, shall be either replaced by the Contractor with suitable materials (earth or concrete), or bolted, or both as directed, at no cost to the Owner.

END OF SECTION

SECTION 02340 - SOIL STABILIZATION

PART 1 GENERAL

1.1 SUMMARY

It is anticipated that areas of the site will require subgrade stabilization. These areas are to be identified in the field by proving methods such as proof rolling, as further described in Section 02300 – Earthwork. Areas that do not exhibit the necessary stability are required to be stabilized as needed to provide adequate support for the intended improvements. Approved options for stabilizing these areas are presented herein. The means and methods, as well as the implementation of the stabilization, are the responsibility of the contractor. The CEC is not to provide recommendations or approval for the method of the stabilization. If the initial method selected by the contractor does not produce an acceptable subgrade for the subsequent improvements, it shall be the contractor's responsibility to modify and/or replace the original method as may be needed to achieve an acceptable result. Costs for all subgrade stabilization, including both initial and subsequent repairs as may be needed, are to be included in the base bid and no additional compensation will be provided.

A. Section Includes:
   1. Excavation, treatment, and backfilling of subgrade for lime, cement, fly ash, or bridge lift stabilization.
   2. Geotextile fabric and geogrid for stabilization of subgrade.

B. Related Requirements:
   1. Section 02300 - Earthwork

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
   1. ASTM C150 - Portland Cement.
   2. ASTM C618 - Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.
   3. ASTM C977 - Quicklime and Hydrated Lime for Soil Stabilization.
   4. ASTM D1633 - Compressive Strength of Molded Soil-Cement Cylinders.

C. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO M216 - Lime for Soil Stabilization.

D. National Lime Association (NLA):
   1. NLA Bulletin 326 - Lime Stabilization Construction Manual.

E. Missouri Department of Transportation (MoDOT):
   1. Standard Specifications for Highway Construction, Latest Edition.

F. Occupational Safety and Health Administration (OSHA):
   1. OSHA 01926.1153 Respirable Crystalline Silica.

1.3 ENVIRONMENTAL REQUIREMENTS

A. Do not install mixed materials in wind in excess of 10 mph or when temperature is below 40 degrees Fahrenheit.

B. Minimize dust emissions or provide equipment that suppresses dust.

C. Dispose of construction waste in accordance with the applicable local, state, and federal requirements.

1.4 SUBMITTALS

A. Submit gradation and certification of material that is to be used to the owner for review.

B. Submit name of each materials supplier and specific type and source of each material. Obtain approval of Owner prior to change in source.

C. Submit mix designs, materials mix ratio, detailed descriptions of the proposed procedures and equipment to be used, documentation of projects successfully completed within the last five (5) years and laboratory test data to the Civil Engineering Consultant of Record 4 weeks prior to beginning stabilization activities. Certify materials and mix ratios will achieve the specified requirements as indicated in the Construction Documents or as specified by state and local agencies for soil stabilization if not stated in the Construction Documents.

D. Submit approved mix designs, materials mix ratio, and laboratory test data to the owner prior to commencing stabilization activities.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide products from one of the following manufacturers as specified in the Materials paragraph below:
1. TenCate Geosynthetics North America (Mirafi), Pendergrass, GA., (706) 693-2226, www.tencate.com
2. Hanes Geo Components (WEBTEC), Winston Salem, NC. (336) 747-1600, www.hanesgeo.com
3. Tensar International Corp., Atlanta, GA. (888) 828-5126, www.tensarcorp.com
4. Thrace-LINQ Inc., Summerville, SC (843) 873-5800, www.thracelinq.com
5. DuPont (Typar). Summerville, SC (843) 832-6860, www.typargeo.com
6. Synteen Technical Fabrics, Lancaster, SC (800) 796-8336, www.synteen.com

2.2 MATERIALS

A. Soil Treatment Materials:
1. Hydrated Lime: ASTM C977 or AASHTO M216.
2. Portland Cement: ASTM C150, Type I.
3. Fly Ash: ASTM C618.

B. Aggregate:
1. Coarse Aggregate: Crushed carbonate, crushed gravel, crushed air-cooled slag, granulated slag, a mixture of crushed and granulated slag, or other types of suitable material meeting the following gradation requirements:

Sieve Size	Percent Passing
2 inches	100
1 inch	70-100
3/4 inch	50-90
No. 4	30-60
No. 30	7-30
No. 200	0-5

2. Fine Aggregate: Sand – Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter meeting the following gradation requirements:

Sieve Size	Percent Passing
No. 4	90-100
No. 50	7-40
No. 200	0-5

C. Subsoil: Existing to be reused.

D. Bridge Lift Material: Surge stone, granular fill, or shot rock fill.

2.3 ACCESSORIES

A. Curing Seal: Asphalt Emulsion Primer.

B. Geotextile Fabric for Stabilization: Provide one of the following:
1. Mirafi HP 370 or HP 570, by TenCate.
2. SF40 or SF65, by DuPont.
3. GTF-200 or 300, by Thrace-LINQ.
4. TerraTex HD, by Hanes.

C. Geogrid for Stabilization: Provide one of the following:
1. Biaxial Geogrid Type 1 (formerly BX 1100), by Tensar.
2. Biaxial Geogrid Type 2 (formerly BX 1200), by Tensar.
3. Mirafi BXG 11, by TenCate.
4. Mirafi BXG 12, by TenCate.
5. SF 11, by Synteen.
6. SF 12, by Synteen

PART 3 EXECUTION

3.1 PREPARATION

A. Obtain approval of mix design before proceeding with placement.

B. Start stabilization only when weather and soil conditions are favorable for successful application of proposed material.

C. Proofroll subgrade to identify areas in need of stabilization.

D. Contractor shall assume all responsibility for proper mix design. Contractor shall perform necessary soil tests to confirm soluble sulfates are not present within soil matrix prior to using any material containing calcium due to possibility of sulfate induced heave. If a product containing calcium is utilized and soil heave issues arise either during or after construction it shall be the responsibility of the Contractor to remediate affected areas in accordance with the owner’s requirements.

3.2 EQUIPMENT

A. Perform operations using suitable, well maintained equipment capable of excavating subsoil, mixing and placing materials, wetting, consolidating, and compacting of material.

3.3 EXCAVATION

A. Excavate subsoil to depth sufficient to accommodate soil stabilization.

B. Remove lumped subsoil, boulders, and rock that interfere with achieving uniform subsoil conditions.

C. Do not excavate within normal 45 degree bearing splay of any foundation.

D. Notify owner of unexpected subsurface conditions. Discontinue affected work in area until notified to resume work.

E. Correct areas over-excavated in accordance with Section 02300.

F. Remove excess excavated material from site.

3.4 GEOTEXTILE FABRIC AND/OR GEOGRID

A. Place geotextile fabric and/or geogrid over subsoil surface, lap edges and ends in accordance with manufacturer's recommendations in those areas that are shown on Construction Drawings or in those areas that need additional stabilization prior to placement of base course. Bridge lift sections may require the use of geotextile fabric and/or geogrid for stabilization prior to placement of fill.

B. Place geotextile fabric and/or geogrid in accordance with manufacturer's recommendations.

3.5 SOIL TREATMENT AND BACKFILLING

A. Lime Stabilized Subgrade: Where indicated on Construction Drawings or as required after continual failure, treat prepared subgrade with hydrated lime in accordance with state highway department specifications.

B. Cement Stabilized Subgrade: Where indicated on Construction Drawings or as required after continual failure, treat prepared subgrade with Portland cement in accordance with state highway department specifications.

C. Fly Ash Stabilized Subgrade: Where indicated on Construction Drawings or as required after continual failure, treat prepared subgrade with fly ash in accordance with state highway department specifications.

D. Bridge Lifts: Where indicated on Construction Drawings or as required after continual failure, treat prepared subgrade by application of a bridge lift. Bridging over existing soils shall be acceptable only when approved in writing by the Owner. Place geotextile fabric or geogrid over existing soils to be bridged. The geotextile fabric or geogrid selected shall be appropriate for the bridge lift material being placed. Place bridge lift over geotextile fabric or geogrid. Surge stone and shot rock will be approved by the Owner's representative on a submittal basis. The Owner and the Owner's representative shall have sole discretion as to the acceptability of all submittals. Bridge lifts within the building pad area will not be accepted.

E. Backfill and compaction of treated subsoil shall be in accordance with Sections 02300.

F. Maintain optimum moisture of mixed materials to attain required stabilization and compaction.

G. Finish subgrade surface in accordance with Section 02300.

H. Remove surplus mix materials from site.

3.6 CURING

A. Immediately following compaction of mix, seal top surface with curing seal.

B. Do not permit traffic for 72 hours after sealing top surface.

3.7 FIELD QUALITY CONTROL / TESTING AND INSPECTION (T&I)

A. Field quality control shall be the responsibility of the Contractor. Field quality control testing and inspection shall be at the discretion of the Contractor (except for specified mandatory testing listed below) as necessary to assure compliance with Contract requirements.

B. Unconfined compression tests on lime, fly ash, or Portland cement treated mixture shall be conducted in accordance with ASTM D1633. Mold three specimens for each mix design submitted by the Contractor to verify mix design meets the specified requirements. Cure each specimen at a constant moisture content and temperature for 28 days. Test for unconfined compressive strength and compare to the specified design strength. Perform test minimum of three weeks prior to proposed stabilization activities.

C. Field Density: Field in-place density shall be determined as specified in Section 02300.

END OF SECTION

SECTION 02370 – EROSION AND SEDIMENTATION CONTROL (INCLUDING SWPPP)

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes
   1. Installation of temporary and permanent erosion and sedimentation control systems.
   2. Installation of temporary and permanent slope protection systems.
   3. Stormwater Pollution Prevention Plan (SWPPP).

B. Related Sections
   1. Stormwater Pollution Prevention Plan
   2. Construction Drawings (“Site Maps”)
   3. Construction Stormwater Details

1.2 ENVIRONMENTAL REQUIREMENTS

A. Protect adjacent properties, any identified endangered or threatened species and/or critical habitat, any identified cultural or historic resources, and receiving water resources from erosion and sediment damage until final stabilization is achieved. All stormwater controls and systems must be installed & functioning as designed and free of accumulated sediment and debris before final project approval.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Seed, sod, and ground covers for the establishment of vegetation.

B. All erosion control products sediment control devices or materials for non-stormwater BMPs as specified herein and on the Construction Drawings.

C. Rolled erosion control products according to Erosion Control Technology Council (ECTC) standard specifications.

D. Temporary mulches such as loose straw, wood cellulose, or agricultural silage.

E. Rip-Rap (stone protection).

F. Temporary and permanent outfall structures as specified on the drawings.

PART 3 – EXECUTION

3.1 PREPARATION

A. Review the drawings and Stormwater Pollution Prevention Plan.

B. Conduct stormwater pre-construction meeting with Site Contractor, all ground-disturbing Sub-contractors, and state or local agency personnel.

C. Revise SWPPP as necessary to address potential pollution from site identified after issuance of the SWPPP at no additional cost to owner.

3.2 EROSION AND SEDIMENTATION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

A. Place erosion and sediment control systems in accordance with the drawings and Stormwater Pollution Prevention Plan or as may be dictated by site conditions in order to maintain the intent of the specifications and permits.

B. The Stormwater Pollution Prevention Plan and Site Maps shall be corrected or modified as site conditions change. Contractor must obtain approval from Developer's Engineer prior to modifying or substituting Best Management Practices. Changes during construction shall be noted in the Stormwater Pollution Prevention Plan and posted on the drawings (Site Maps).

C. Owner has authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations and to direct Contractor to provide immediate permanent or temporary pollution control measures.

D. Maintain erosion and sedimentation control systems as dictated by site conditions, indicated in the construction documents, or as directed by governing authorities or Owner to control sediment until final stabilization. Contractor shall respond to maintenance or additional work ordered by Owner or governing authorities immediately, but in no case, within not more than 48 hours at no additional cost to the Owner.

E. Contractor shall incorporate permanent erosion control features, paving, permanent slope stabilization, and vegetation into project at earliest practical time to minimize need for temporary controls.

F. Permanently seed and mulch cut and fill slopes as construction proceeds to extent considered desirable and practical.

G. Unless required within a shorter timeframe by the applicable General Permit for Stormwater Discharges Associated with Construction Activity, disturbed areas that will not be graded or actively worked for a period of 14 days or more, shall be temporarily stabilized as work progresses with vegetation or other acceptable means unless otherwise specified in the Contract Documents. In the event it is not practical to seed areas, slopes must be stabilized with mulch and tackifier, bonded fiber matrix, netting, blankets or other means to reduce the erosive potential of the area.

END OF SECTION

STORMWATER POLLUTION PREVENTION PLAN

FOR

CONSTRUCTION ACTIVITIES

AT

Cottages at Generation Village
Willard, Missouri

Prepared for:

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This SECTION 02370 specification has been sealed and signed by a registered Professional Engineer as part of the overall project Civil Engineering Specification.

I. INTRODUCTION

This SWPPP has been prepared for major activities associated with the construction of:

Cottages at Generation Village

This SWPPP, including the applicable General Permit, includes the elements necessary to comply with the General Permit for construction activities administered by the U.S. Environmental Protection Agency (EPA) under the National Pollutant Discharge Elimination System (NPDES) program and all local governing agency requirements. This SWPPP must be implemented at the start of construction.

Construction phase pollutant sources anticipated at the site are disturbed (bare) soil, vehicle fuels and lubricants, chemicals and coatings associated with site or building construction and pavement installation, construction-generated litter and debris, and building materials. Without adequate control there is a potential for each type of pollutant to be transported by stormwater.

Project construction will consist primarily of site grading, paving, storm drainage, water supply, sewage collection, road work, utilities, etc. located within the permitted project area.

A. Purpose

A major goal of pollution prevention efforts during project construction is to control soil and pollutants that originate on the site and prevent them from flowing to surface waters. The purpose of this SWPPP is to provide guidelines for achieving that goal. A successful pollution prevention program also relies upon careful inspection and adjustments during the construction process in order to enhance its effectiveness.

B. Scope

This SWPPP must be implemented before construction begins on the site. It primarily addresses the impact of storm rainfall and runoff on areas of the ground surface disturbed during the construction process. In addition, there are recommendations for controlling other sources of pollution that could accompany the major construction activities. Applicability of this SWPPP will terminate when disturbed areas are stabilized, permanent erosion and sedimentation controls are installed, temporary erosion and sedimentation controls are removed, construction activities covered herein have ceased, and a completed Notice of Termination (NOT) is transmitted to the governing agency.

Forms which are necessary for implementing the SWPPP are included herein.

The General Permit for Stormwater Discharges Associated with Construction Activities prohibits most non-stormwater discharges during the construction phase. Refer to the General Permit for allowable non-stormwater discharges that occur during construction on this project.

Best Management Practices (BMPs) must be implemented for the above allowable discharges for the duration of the permit. Each non-stormwater discharge should be noted in the SWPPP and have proper erosion and sedimentation controls in place with the possible exception of discharges from firefighting activities.

The techniques described in this SWPPP focus on providing control of pollutant discharges with practical approaches that utilize readily available expertise, material, and equipment.

The Owner/Developer referred to in this SWPPP is Cottages at Generation Village, LP. The Primary Operator is Hamilton Builders, LLC. The General Contractor shall construct the site development improvements while working under contract with the Developer.

II. PROJECT DESCRIPTION

Described within the Site Maps are the major construction activities that are the subject of this SWPPP. Also included in the sequence are BMP installation activities that must take place prior to construction activities.

NOTE: Down slope protective measures must always be in place before soil is disturbed. Activities are presented in the order (sequence) they are expected to be completed.

All activities and timeframes (beginning and ending dates) shall be noted on the Site Map and the "Record of Stabilization and Construction Activity Dates" form found in Appendix J of this SWPPP. The sequence of construction is listed on the Site Maps.

The actual schedule for implementing pollutant control measures will be determined by project construction progress and recorded by the General Contractor on the Soil Erosion/Sedimentation Control Operation Time Schedule on the Erosion and Sedimentation Control plans (Site Maps). Down slope protective measures must always be in place before soil is disturbed.

III. SITE DESCRIPTION

Included as parts of this SWPPP are the project Construction Drawings. Refer to the Construction Drawings for detailed site information.

A. Site Location

- Location: Southeast corner of intersection of Hughes Road and Megan Lane in Willard, Missouri
- Latitude: 37°17'00" N (37.283333° N)
- Longitude: 93°24'15" W (93.404167° W)
- A vicinity map is included in Appendix B.

B. Site Topography

- Lowest elevation on project site: 1187'
- Highest elevation on project site: 1205'
- Percent slope variation: Existing slopes across the site generally range from 5% to 33%.
- Vegetation: All existing vegetative areas removed from this site during construction will be replaced with impervious area or re-vegetated upon the completion of grading activities.

C. Rainfall Information

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Average Rainfall in inches	2.54	2.40	3.51	4.71	5.56	4.47	3.85	3.59	4.31	3.60	3.56	2.61

- The total average annual rainfall for the project area is: 44.71 inches
- The design rain event for this project is: Erosion prevention and sediment controls for this project are designed to control the runoff generated by the 2 year, 24 hour rain event.
- General Contractor shall maintain a rain gauge and daily rainfall records at the site, or use a reference site for a record of daily amount of precipitation.

D. Site Soils

- Soil type and texture: Per the project Geotechnical Report, soils across the site generally consist of fat clays overlaying weeathered chert.
- Average depth to ground water: Groundwater was encountered in one soil boring advanced as part of the project Geotechnical Exploration at a depth of 17 feet while drilling and 10 feet upon completion of drilling.

E. Total Site Area, Area to be Disturbed, and Runoff Coefficient

- The project site contains: 10 acres
- The area to be disturbed on the project site: 9.97 acres
- Run-Off Coefficient
    - Pre-Development CN: 74
    - Post-Development CN: 88

F. Receiving Surface Waters

- Receiving waters: Unnamed Tributary of Rainer Branch
- Distance to named receiving waters: Rainer Branch is approximately 1.25 miles west of the project site.
- Receiving water quality: Rainer Branch is not listed in the 2022 Missouri 303(d) List of Impaired Waterboies.
- 100-year floodplain: The project site is shown to be within "Other Areas" (Zone X), areas determined to be outside the 0.2% annual chance floodplain per FEMA's Flood Insurance Rate Map (FIRM) 29077C0192E with an effective date of December 17, 2010.

IV. STORMWATER POLLUTION PREVENTION MEASURES AND CONTROLS

A variety of stormwater pollutant controls are recommended for this project. Some controls are intended to function temporarily and will be used as needed for pollutant control during the construction period. These include temporary sediment barriers and permanent storm retention ponds (which can also function as temporary sediment basins). Permanent stabilization will be accomplished in all disturbed areas by covering the soil with pavement, building foundation, vegetation, or other forms of soil stabilization.

A. Erosion and Sediment Controls

1. Minimization of Disturbed Areas

Note to General Contractor: Owner has authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations and to direct General Contractor to provide immediate permanent or temporary pollution control measures

2. Soil Stabilization

The purpose of soil stabilization is to prevent soil from eroding and leaving the site. In the natural condition, soil is stabilized by native vegetation. The primary technique to be used at this project for stabilizing site soils will be to provide a protective cover of grass, pavement, or building structure.

a.) **Temporary Seeding –** All denuded areas that will be inactive for 14 days or more, must be stabilized temporarily with the use of hydro-mulch with a slurry of bonded fiber matrix at a rate of 3000#/acre. Stockpiles and diversion ditches/berms must be stabilized to prevent erosion and dust issues.

Temporary stabilization method specified on the plans is based on climate specific conditions.

b.) **Permanent Seeding, Sod or Mulching –** All areas at final grade must be covered with sod 14 days after completion of work in that area. At the completion of ground-disturbing activities the entire site must have permanent stabilization per planting plan, in all areas not covered by hardscape (pavement, buildings, etc.).

Consideration is given to climate conditions, soil type and native vegetation when designing the final landscaping plan. Note: Crushed/decomposed granite or other non-vegetative cover may be an acceptable final cover in arid climates.

To minimize the potential for erosion and maximize seed germination & growth, the General Contractor must evaluate the short and long-term local forecast prior to applying permanent seed or sod.

3. Structural Controls

Stormwater run-off for this project will be handled by the use of structural controls such as inlet filters, sedimentation/erosion control eels. Locations for and details of structural controls can be found on the sheets titled Erosion and Sedimentation Control Plan/Site Map – Phases I through II, and Erosion Control Details. In case there are questions regarding stormwater run-off, the Contractor shall refer to the General Permit for requirements.

a) **Sedimentation Basins – BMP Not Used –** Temporary sedimentation basins are depressions constructed downslope of construction activity and located such that stormwater runoff from upland areas of less than 100 acres are diverted through the basin. Sediment basins shall be constructed as directed by the SWPPP and shall be constructed as part of the initial Phase I BMPs whenever practical. An overflow pipe is incorporated at the outlet to discharge flow from the basin. Temporary and/or permanent discharge devices for use in sedimentation basins shall be constructed with fill placement to endure these devices are properly placed and the surrounding backfill is adequately tied to the basin levee. All materials in the levee, including bedding materials for the discharge devices, shall be low permeability, cohesive soil. Soil exhibiting high shrink/swell potential or containing greater than 5% organics shall not be used. A marker signifying the need for cleanout of each basin must be provided at the elevation shown on the Erosion Control Details provided in the Site Development Plans for this project.

b) **Sedimentation Traps – BMP Not Used –** Temporary sedimentation traps are depressions constructed down slope of construction activity and located such that stormwater runoff from upland areas of less than 5 acres are diverted through the trap. Sedimentation traps shall be constructed as indicated by the SWPPP and shall be constructed as part of the initial BMPs whenever practical. An overflow weir is incorporated at the outlet to discharge flow from the trap. Sedimentation traps shall be phased with the earthwork activity where practical.

c) **Sedimentation/Silt Fence –** Silt fence is a synthetic permeable woven or non-woven geotextile fabric incorporating metal support stakes at intervals sufficient to support the fence (5-feet maximum distance between posts), water, and sediment retained by the fence. The fence is designed to retain sediment-laden stormwater and allow settlement of suspended soils before the stormwater flows through the fabric and discharges from the site. Silt fence shall be located on the contour to capture overland, low-velocity sheet flows and is typically installed with a wire fence backing for additional support. Wire fence backing is required unless the silt fence is installed using the slicing method as the slicing method ensures the silt fence fabric is anchored securely in the ground.

Install silt fence at a fairly level grade along the contour with the ends curved uphill to provide sufficient upstream storage volume for the anticipated runoff. Drainage areas shall not exceed ½ acre per 100 feet of wire-reinforced silt fence for slopes less than 2 percent.

d) **Construction Exit –** All access points from the public street into the construction site shall include a construction exit composed of course stone to the dimensions shown on the Construction Drawings detail sheet. The rough texture of the stone helps to remove clumps of soil adhering to the construction vehicle tires through the action of vibration and jarring over the rough surface and the friction of the stone matrix against soils attached to vehicle tires.

In addition to the stone at the construction exit, it may be necessary to install devices such as pipes (cattle guard) to increase the vibration and jarring. It may also be necessary to install a wheel wash system. If this is done, a sedimentation trap control must be installed to treat the wash water before it discharges from the site.

All site access must be confined to the construction exit(s). Barricade to prevent use, any locations other than the construction exit(s) where vehicles or equipment may access the site. Use jersey barriers, construction fencing/drums, etc. near construction exit(s) to prevent traffic by-pass or short circuiting.

e) **Storm Sewer Inlet Protection –** Curb and grated inlets are protected from the intrusion of sediment through a variety of measures as shown on the details included in the Construction drawings. The primary mechanism is to place controls in the path of flow sufficient to slow the sediment-laden water to allow settlement of suspended soils before discharging into the storm sewer. It is possible that as construction progresses from storm sewer installation through to paving that the inlet protection devices will change.

Note to General Contractor: All inlet protection devices create ponding of stormwater that can result in flooding or by-pass conditions.

f) **Check Dams – BMP Not Used –** Defined channels subject to concentrated flows in larger quantities and higher velocities may be protected with rock or other manufactured device (Geo-ridge for example) that can be used as a check dam. The dams impound sediment-laden water and allow for settlement of suspended soil before the stormwater flows over and through the device. Dams shall be placed along the water course at linear intervals in which the elevation of the bottom of the upper most check dam is at the same elevation as the top of the check dam immediately below it. This will allow the most ponding capacity and will not increase the velocity of the water flowing along the channel.

Location and spacing of check dams are shown on the Site Maps. Check dams are composed of crushed stone or rip rap or of other manufactured devices. See the detail sheet within the Construction Drawings for the types of dams to be used on this site.

g) **Diversion Ditch/Berm – BMP Not Used –** Diversion ditches (swales) and berms (dikes) are constructed as shown on the Site Maps at locations within the construction site to intercept overland flow and direct or divert flow to a sediment basin or other point where discharge can be controlled. Ditches are excavated in the surface soils with the spoils from the excavation typically placed along the downstream edge of the ditch to provide additional capacity. Berms are built up on the surface soils and compacted to create a stable diversion.

B. Other Pollutant Controls

This section includes the controls of pollutants other than sediment and additional requirements of the General Permit. In general, litter, construction debris, and construction chemicals exposed to stormwater shall be picked up prior to anticipated storm events or before being carried off of the site by wind (e.g., forecasted by local weather reports), or otherwise prevented from becoming a pollutant source for stormwater discharges (e.g., screening outfalls, daily pickup, etc.).

1. Dust Control

Construction traffic must enter and exit the site at the stabilized construction exit. The purpose is to trap dust and mud that would otherwise be carried beyond the permitted project area by construction traffic. Large areas of soil that are denuded of vegetation and have no protection from particles being picked up and carried by wind should be protected with a temporary cover or kept under control with water or other soil adhering products to limit wind transported particles exiting the site perimeter.

Water trucks or other dust control agents will be used as needed during construction to minimize dust generated on the site. Tackifiers may be used to hold soil in place and prevent dust. Manufacturer recommendations for application locations and rates must be used for dust control applications. Dust control must be provided by the General Contractor to a degree that is in compliance with applicable local and state dust control regulations.

2. Dewatering

Verify discharges from dewatering activities are allowed non-stormwater discharges under the General Permit. Obtain a dewatering permit according to state and local regulations, if discharges from dewatering activities are not allowed under the General Permit. Discharges from dewatering operations must be directed through an appropriate pollution prevention/treatment measure, such as a pump discharge filter bag, sediment trap or sediment basin prior to being discharged from the site or into a water body of the State. Under no circumstances are discharges from dewatering

operations to be discharged directly into streams, rivers, lakes or other areas beyond the permitted project area. Likewise, discharges into storm sewer systems that do not drain to a suitable on-site treatment facility, such as a basin, are also prohibited. Discharges from dewatering operations must also be conducted in a manner sufficient to prevent erosion from the discharge runoff.

Use best management practices when dewatering. Place intake hose on a flotation or similar device and do not pump directly from the bottom of the basin, trench, etc. Always pump through a sediment control BMP and dewater within the permitted limits of disturbance to ensure discharge criteria are achieved. Do not discharge on a slope greater than three percent or within 20' of a surface water body. Dewatering should not occur during or immediately after precipitation events, but exceptions will be evaluated on case by case basis.

3. Solid Waste Disposal

No solid materials, including building materials, are allowed to be discharged from the site with stormwater. All solid waste, including disposable materials incidental to the major construction activities, must be collected and placed in containers. The containers will be emptied when 95% full, or as necessary, by a certified trash disposal service and hauled away from the site. Covers for the containers will be provided as necessary to meet state and local requirements. Construct covers as practicable, or required, to prevent stormwater contact and pollutant discharges from solid waste receptacles. The location of solid waste receptacles shall be shown on the Site Maps.

Substances that have the potential for polluting surface and/or groundwater must be controlled by whatever means necessary in order to ensure that they do not discharge from the site. As an example, special care must be exercised during equipment fueling and servicing operations. If a spill occurs, it must be contained and disposed of so that it will not flow from the site or enter groundwater, even if this requires removal, treatment, and disposal of soil. In this regard, potentially polluting substances should be handled in a manner consistent with the impact they represent.

4. Sanitary Facilities

All personnel involved with construction activities must comply with state and local sanitary or septic system regulations. Temporary sanitary facilities will be provided at the site throughout the construction phase. They must be utilized by all construction personnel and will be serviced by a commercial operator. The location of sanitary facilities shall be shown on the Site Maps. Portable toilets must be securely anchored and are not allowed within 30' of inlets or permitted limit of disturbance or within 50' of a water of the State.

5. Non-Stormwater Discharges

Non-stormwater components of site discharges must be clean water. Water used for construction which discharges from the site must originate from a public water supply or private well approved by the State Health Department. Water used for construction that does not originate from an approved public supply must not discharge from the site. It can be retained in the ponds until it infiltrates and evaporates. Other non-stormwater discharges would include ground water. Only uncontaminated ground water can be discharged from the site, as allowed by and in accordance with applicable local ground water dewatering permits/regulations. When non-stormwater is discharged from the site, it must be done in a manner such that it does not cause erosion of the soil during discharge.

Process water such as power washing and concrete cutting must be collected for treatment and disposal. It is not to be flushed into the site storm drain system.

6. Concrete Waste from Concrete Ready-Mix Trucks

Discharge of excess or waste concrete and/or wash water from concrete trucks will be allowed on the construction site, but only in approved aboveground portable concrete washout containers. There will be no specifically designated lined and diked areas prepared to prevent contact between the concrete and/or wash water and stormwater that will be discharged from the site. The General Contractor shall eliminate or minimize the number of seams in the liner.

Alternatively, waste concrete can be placed into forms to make rip rap or other useful concrete products. The cured residue from the concrete washout diked areas shall be disposed in

accordance with applicable state and federal regulations. This jobsite superintendent is responsible for assuring that these procedures are followed. The location of concrete washout areas shall be shown on the Site Maps. Follow all applicable environmental regulations for concrete wash out pits.

7. Masons' Area

Contractor shall identify masons' area on the site and indicate location on the Site Map. To the extent practical, all masonry tools, material, including sand and sacked cement or mortar materials, and equipment shall be located within the area identified. Runoff control, such as berms or diversion ditches, silt fence, straw wattles, or other means of containment shall be provided to prevent the migration of stormwater pollutants in runoff from the masons' area. Receptacles for debris and trash disposal shall also be provided.

8. Fuel Tanks

Temporary on-site fuel tanks for construction vehicles shall meet all state and federal regulations. Tanks shall have approved spill containment with the capacity required by the applicable regulations. From NFPA 30: All tanks shall be provided with secondary containment (i.e. containment external to and separate from primary containment). Secondary containment shall be constructed of materials of sufficient thickness, density, and composition so as not to be structurally weakened as a result of contact with the fuel stored and capable of containing discharged fuel for a period of time equal to or longer than the maximum anticipated time sufficient to allow recovery of discharged fuel. It shall be capable of containing 110% of the volume of the primary tank if a single tank is used, or in the case of multiple tanks, 150% of the largest tank or 10% of the aggregate, whichever is larger.

The tanks shall be in sound condition free of rust or other damage which might compromise containment. Fuel storage areas will meet all EPA, OSHA and other regulatory requirements for signage, fire extinguisher, etc. Hoses, valves, fittings, caps, filler nozzles, and associated hardware shall be maintained in proper working condition at all times. The location of fuel tanks shall be shown on the Site Maps and shall be located to minimize exposure to weather and surface water drainage features.

A Spill Prevention, Control and Countermeasure (SPCC) Plan must be developed if aboveground oil storage *capacity* at the construction site exceeds 1,320-gallons or as specified by state. Containers with a storage capacity of 55-gallons or less are not included when calculating site storage capacity. The General Contractor shall work with the CEC to develop and implement a SPCC Plan in accordance with the Oil Pollution Prevention regulation at Title 40 of the Code of Federal Regulations, Part 112, (40 CFR 112).

9. Hazardous Material Management and Spill Reporting Plan

Any hazardous or potentially hazardous material that is brought onto the construction site will be handled properly in order to reduce the potential for stormwater pollution. All materials used on this construction site will be properly stored, handled, dispensed and disposed of following all applicable label directions. Flammable and combustible liquids will be stored and handled according to 29 CFR 1926.152. Only approved containers and portable tanks shall be used for storage and handling of flammable and combustible liquids.

Material Safety Data Sheets (MSDS) information will be kept on site for any and all applicable materials.

In the event of an accidental spill, immediate action will be undertaken by the General Contractor to contain and remove the spilled material. All hazardous materials, including contaminated soil and liquid concrete waste, will be disposed of by the Contractor in the manner specified by federal, state and local regulations and by the manufacturer of such products. As soon as possible, the spill will be reported to the appropriate agencies. As required under the provisions of the Clean Water Act, any spill or discharge entering waters of the United States will be properly reported. The General Contractor will prepare a written record of any spill and associated clean-up activities of petroleum products or hazardous materials in excess of 1 gallon or reportable quantities, whichever is less. The General Contractor will provide notice to Developer immediately upon identification of a reportable spill.

Any spills of petroleum products or hazardous materials in excess of Reportable Quantities as defined by EPA or the state or local agency regulations, shall be immediately reported to the EPA National Response Center (1-800-424-8802) and applicable local and state agencies.

In order to minimize the potential for a spill of petroleum product or hazardous materials to come in contact with stormwater, the following steps will be implemented:

a) All materials with hazardous properties (such as pesticides, petroleum products, fertilizers, detergents, construction chemicals, acids, paints, paint solvents, additives for soil stabilization, concrete, curing compounds and additives, etc.) will be stored in a secure location, under cover and in appropriate, tightly sealed containers, when not in use.

b) The minimum practical quantity of all such materials will be kept on the job site and scheduled for delivery as close to time of use as practical.

c) A spill control and containment kit (containing for example, absorbent material such as kitty litter or sawdust, acid neutralizing agent, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided on the construction site and location(s) shown on Site Maps.

d) All of the product in a container will be used before the container is disposed of. All such containers will be triple rinsed, with water prior to disposal. The rinse water used in these containers will be disposed of in a manner in compliance with state and federal regulations and will not be allowed to mix with stormwater discharges.

e) All products will be stored in and used from the original container with the original product label.

f) All products will be used in strict compliance with instructions on the product label.

g) The disposal of excess or used products will be in strict compliance with instructions on the products label.

10. Long-Term Pollutant Controls

Stormwater pollutant control measures installed during construction, that will also provide stormwater management benefits after construction, include vegetative areas. An O&M Manual is not required by governing regulations to be a part of the SWPPP. There are no state post-construction storm water management requirements for the site.

C. "Best Management Practices" (BMPs)

Owner has authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations and to direct the General Contractor to provide immediate permanent or temporary pollution control measures.

During the construction phase, the General Contractor shall implement the following measures:

1) Materials resulting from clearing and grubbing or excavation operations shall be stockpiled up slope from adequate sedimentation controls. Materials removed to sites beyond the permitted project area shall be protected with appropriate controls and properly permitted and otherwise comply with applicable laws, all in accordance with this SWPPP, including Section V below.

2) The General Contractor shall designate areas on the Site Maps for equipment cleaning, maintenance, and repair. The General Contractor and subcontractors shall utilize such designated areas. Cleaning, maintenance, and repair areas shall be protected by a temporary perimeter berm, shall not occur within 150 feet of any waterway, water body or wetland, and in areas located as far as practical from storm sewer inlets.

3) Use of detergents for large scale washing is prohibited (i.e. vehicles, buildings, pavement surfaces, etc.).

4) Chemicals. Paints, solvents, fertilizers, and other toxic materials must be stored in waterproof containers. Except during application, the containers, the contents must be kept in trucks or within storage facilities. Runoff containing such material must be collected, removed from the site, treated, and disposed of at an approved solid waste and chemical disposal facility.

5) Clearing and grubbing shall be held to a minimum necessary for grading and equipment operations. Construction must follow the sequencing specified on the plans and in the SWPPP to minimize the exposure time of graded or denuded areas

V. APPROVED STATE AND LOCAL PLANS

In addition to this SWPPP, construction activities associated with this project must comply with any guidelines set forth by local regulatory agencies.

VI. INSPECTIONS AND SYSTEM MAINTENANCE

Between the time this SWPPP is implemented and final Notice of Termination has been submitted, all disturbed areas, outfall points, and pollutant controls must be inspected at least once every 14 days and within 24 hours of the end of a storm event of 0.25 inches or greater. The purpose of site inspections is to assess performance of pollutant controls. The inspections will be conducted by the General Contractor's Site Superintendent. Based on these inspections, the General Contractor will decide whether it is necessary to modify this SWPPP, add or relocate controls, or revise or implement additional Best management Practices in order to prevent pollutants from leaving the site via stormwater runoff. The General Contractor has the duty to cause pollutant control measures to be repaired, modified, supplemented, or take additional steps as necessary in order to achieve effective pollutant control. Note: If a BMP is covered by snow, mark the BMP as not applicable and document the reason the BMP cannot be inspected on the daily report.

Examples of specific items to evaluate during site inspections are listed below. This list is not intended to be comprehensive. During each inspection, the inspector must evaluate overall pollutant control system performance as well as particular details of individual system components. Additional factors should be considered as appropriate to the circumstances. The General Contractor is responsible for measuring and recording site-specific rainfall amounts.

Refer to Section IV.10. of the General Permit for additional requirements related to inspections.

A. Construction Exit and Track Out

Locations where vehicles enter and exit the site must be inspected for evidence of sediment tracking beyond the permitted project area. A stabilized construction exit shall be constructed where vehicles enter and exit. Exits shall be maintained or supplemented with additional rock as necessary to prevent the release of sediment from vehicles leaving the site. Any sediment deposited on the roadway shall be swept as necessary throughout the day or at the end of every day and disposed of in an appropriate manner. Sediment shall **NOT** be washed into storm sewer systems.

B. Erosion Control Devices

Rolled erosion control products (nets, blankets, turf reinforcement mats) and marginally vegetated areas (areas not meeting required vegetative densities for final stabilization) must be inspected daily. Rilling, rutting and other signs of erosion indicate the erosion control device is not functioning properly and additional erosion control devices are warranted.

C. Sediment Control Devices

Sediment barriers, traps and basins must be inspected and they must be cleaned out at such time as their original capacity has been reduced by 50 percent. All material excavated from behind sediment barriers or in traps and basins shall be incorporated into on-site soils or spread out on an upland portion of the site and

stabilized. To minimize the potential for sediment releases from the project site perimeter control devices shall be inspected with consideration given to changing up-gradient conditions.

D. Material Storage Areas

Material storage areas should be located to minimize exposure to weather. Inspections shall evaluate disturbed areas and areas used for storing materials that are exposed to rainfall for evidence of, or the potential for, pollutants entering the drainage system or discharging from the site. If necessary, the materials must be covered or original covers must be repaired or supplemented. Also, protective berms must be constructed, if needed, in order to contain runoff from material storage areas. All state and local regulations pertaining to material storage areas will be adhered to.

E. Vegetation

Consideration must be given to anticipated climate and seasonal conditions when specifying and planting seed. Seed shall be free of weedy species and appropriate for site soils and regional climate. Seed and mulch per the construction drawings immediately after topsoil is applied and final grade is reached. Grassed areas shall be inspected to confirm that a healthy stand of grass is maintained.
Per the State General Permit, final site stabilization is achieved once all soil disturbing activities at the site have been completed, and one of the following criteria is met:

a. A uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a uniform density of at least 70 percent of the (preferably) native vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures and all slopes and channels have been permanently stabilized against erosion, or
b. Equivalent permanent stabilization measures (such as the use of riprap, permanent geotextiles, hardened surface materials including concrete, asphalt, gabion baskets, or Reno mattresses) have been employed.

Vegetated areas must be watered, fertilized, and reseeded as needed to achieve this requirement. The vegetative density must be maintained through project completion to be considered stabilized. Areas protected by erosion control blankets are not permanently stabilized until the applicable General Permit requirement for final vegetative density is achieved. Rip-rap, mulch, gravel, decomposed granite or other equivalent permanent stabilization measures may be employed in lieu of vegetation based on site-specific conditions and governing authority approval.

F. Discharge Points

All discharge points must be inspected to determine whether erosion and sediment control measures are effective in preventing discharge of sediment from the site or impacts to receiving waters.

G. Special Project Areas

Contractor is responsible for obtaining SWPPP related permits for any areas outside of the permitted project area.

The Inspection Report Form must identify all deficiencies, any corrections, whether they are identified during the current inspection or have occurred since the previous inspection, and any additional comments. Based on inspection results, any modification necessary to increase effectiveness of this SWPPP to an acceptable level must be made immediately but no longer than within 48 hours of the inspection. The inspection reports must be complete and additional information should be included if needed to fully describe a situation. An important aspect of the inspection report must identify whether the site was in compliance with the SWPPP at the time of inspection and specifically identify all incidents of non-compliance.

A responsible corporate officer must sign a letter delegating the site superintendent as the authorized position for conducting the required inspections. Inspection reports must include an original, authorized signature and date of the inspection. Inspection reports must be retained by the General Contractor as an integral part of this SWPPP for at least five years from the date of submission of the Notice of Termination of permit coverage.

Ultimately, it is the responsibility of the General Contractor to assure the adequacy of site pollutant discharge controls. Actual physical site conditions or contractor practices could make it necessary to install more structural controls than are shown on the plans. For example, localized concentrations of runoff could make it necessary to install additional sediment barriers. Assessing the need for additional controls and implementing them or adjusting existing controls will be a continuing aspect of this SWPPP until the site achieves final stabilization. Any modifications, additions or deletions of sediment control devices that may alter the hydraulic design of the site or are

located in areas of potential high flow (basins, traps, check dams, diversions. etc.) must be approved by the Engineer through the request for information process (RFI).

APPENDIX A

CONTACT LIST

CONTACT LIST

Contacts for: **Cottages at Generation Village**

Primary Operator: **Hamilton Builders, LLC**

Responsible for coordinating oversight of storm water compliance by owner/developer and its Responsible Contractors at each site.

Owner's Construction Manager:

Name: _____

Phone: _____

Responsible for conducting twice weekly inspections, conducting the final site inspection after verifying final stabilization and overseeing compliance with all applicable permits, the Clean Water Act, and the site SWPPP.

Responsible Contractor's Compliance Officer: Name: _____

Company: _____

Phone: _____

Responsible for the supervision or completion of construction at a site and able to adequately identify and implement storm water sediment and erosion control practices and effectively instruct employees and contractors in the implementation of such practices.

Project Superintendent(s): Name: _____

Company: _____

Phone (office): _____

Phone (mobile): _____

Responsible for overseeing activities and work at a site; has the authority to direct employees and contractors to undertake actions to comply with all applicable permits, the Clean Water Act, and the site's SWPPP.

Note to General Contractors: Date this form each time contact information is added or updated. Do not erase information from this form. If information is incorrect or outdated, line through incorrect / outdated information and write in correct / new information. If contact information changes more than once create a new updated Contact List, date, and place on top of old Contact List to be kept onsite.

APPENDIX B

VICINITY MAP

USGS QUADRANGLE MAP
SCALE=1"=2000'

APPENDIX C

NOTICE OF INTENT

[NOI TO BE INSERTED ONCE COMPLETED]

APPENDIX D

CONSTRUCTION SITE NOTICE

MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

STORMWATER DISCHARGES FROM THIS LAND DISTURBANCE SITE ARE AUTHORIZED BY THE MISSOURI STATE OPERATING PERMIT NUMBER:

_____

ANYONE WITH QUESTIONS OR CONCERNS ABOUT STORMWATER DISCHARGES FROM THIS SITE, PLEASE CONTACT THE MISSOURI DEPARTMENT OF NATURAL RESOURCES AT

1-800-361-4827

02370-23

APPENDIX E

GENERAL PERMIT

STATE OF MISSOURI

DEPARTMENT OF NATURAL RESOURCES

MISSOURI CLEAN WATER COMMISSION

MISSOURI STATE OPERATING PERMIT

In compliance with the Missouri Clean Water Law (Chapter 644 RSMo, hereinafter, the Law) and the Federal Water Pollution Control Act (Public Law 92-500, 92nd Congress) as amended,

Permit No.:	MO-RAxxxxx
Owner:	< name >
Address:	< address >
Continuing Authority:	< name, or Same as above >
Address:	< address, or Same as above >
Facility Name:	< name >
Facility Address:	< physical address >
Legal Description:	¼, ¼, ¼, Sec. xx, TxxN, RxxW, < county > County
UTM Coordinates:	X = , Y =
Receiving Stream:	< receiving stream > < (C, P, L1, L2, L3) >
First Classified Stream and ID:	< 1st classified stream > <(C, P, etc.)> <(WBID #number)>
USGS Basin and Sub-watershed No.:	< (USGS HUC12 #) >

is authorized to discharge from the facility described herein, in accordance with the effluent limitations, benchmarks, and monitoring requirements as set forth herein.

FACILITY DESCRIPTION

All Outfalls

Construction or land disturbance activity (e.g., clearing, grubbing, excavating, grading, filling, and other activities that result in the destruction of the root zone and/or land disturbance activity that is reasonably certain to cause pollution to waters of the state).

This permit authorizes only stormwater and certain non-stormwater discharges under the Missouri Clean Water Law and the National Pollutant Discharge Elimination System; it does not apply to other regulated areas.

February 8, 2022
Effective Date

February 7, 2027
Expiration Date

Chris Wieberg
Chris Wieberg, Director, Water Protection Program

I. APPLICABILITY

A. Permit Coverage and Authorized Discharges

1. This Missouri State Operating Permit (permit) authorizes the discharge of stormwater and certain non-stormwater discharges from land disturbance sites that disturb one or more acres, or disturb less than one acre when part of a larger common plan of development or sale that will disturb a cumulative total of one or more acres over the life of the project. A permit must be issued before any disturbance of root zone of the existing vegetation or other land disturbance activities may begin.

2. If an individual or developer proposes to improve a lot for development or sale that is less than an acre and part of a common plan of development or sale, a permit is required. If an individual proposes to develop a lot to reside on themselves, the development is not considered part of the larger common plan of development or sale and does not require a permit unless the lot is an acre or more [10 CSR 20-6.200 (1)(B)6.]. See table below.

Permit Requirements for a Common Promotional Plan

	Land Disturbance Permit Required?	
	Less than one acre (< 1 acre)	One acre or more (≥ 1 acre)
Land disturbance by a developer (or a contractor working on their behalf), regardless of type of development (initial, commercial, residential)	Yes, if part of a larger common plan of development or sale with cumulative disturbance of one or more acres including individual residential lots in order to improve the lot for sale	Yes
Land disturbance by an individual to reside on themselves (or a contractor working on their behalf)	No	Yes

This general permit also authorizes the discharge of stormwater and certain non-stormwater discharges from smaller projects where the Missouri Department of Natural Resources (Department) has exercised its discretion to require a permit [10 CSR 20-6.200 (1)(B)].

A Missouri State Operating Permit (MORA, MOR100, or site specific) that specifically identifies the project must be issued before any site vegetation is removed (disturbance of the root zone) or the site disturbed [10 CSR 20-6.200 (1)(A)].

Any persons who operate, use, or maintain a land disturbance activity (owner/operator) which is subject to permitting requirements for stormwater discharges from land disturbance activities, who disturbs land prior to permit issuance from the Department is in violation of both State [10 CSR 20-6.200 (1)(A)] and Federal regulations.

The owner/operator and continuing authority of this permit are responsible for compliance with this permit [10 CSR 20-6.200 (3)(B)].

The primary operator(s) of a land disturbance site is any party associated with the project who either: 1) has operational control over construction plans, including the ability to make modifications to those plans; or 2) has day-to-day operational control of those activities at a project that are necessary to ensure compliance with the permit conditions. This may be the General Contractor, Project Manager, or similar role.

3. This permit authorizes stormwater discharges from land disturbance support activities (e.g., equipment staging yards, material storage areas, excavated material disposal areas, borrow areas, concrete, or asphalt batch plants) provided appropriate stormwater controls are designed, installed, and maintained and the following conditions are met and addressed in the Stormwater Pollution Prevention Plan (SWPPP):
   (a) The support activity is directly related to the construction site required to have permit coverage for stormwater discharges;
   (b) The support activity is not a commercial operation or serve multiple unrelated construction sites;
   (c) The support activity does not continue to operate beyond the completion of the construction activity at the project it supports;
   (d) Sediment and erosion controls are implemented in accordance with the conditions of this permit; and
   (e) The support activity is strictly stormwater discharges. Support activities which discharge process water shall apply for separate coverage, such as a concrete batch plant discharging process water shall be covered under a MOG49.

The permittee is responsible for compliance with this permit for any construction support activity.

4. This permit authorizes non-stormwater discharges from the following activities provided that these discharges are treated by appropriate Best Management Practices (BMPs) where applicable and addressed in the permittee's specific SWPPP required by this general permit:
   (a) Discharges from emergency fire-fighting activities;
   (b) De-chlorinated fire hydrant flushing;
   (c) Uncontaminated water line flushing;
   (d) Uncontaminated condensate from air conditioning or compressor condensate;
   (e) Landscape watering;
   (f) Uncontaminated, non-turbid discharges of ground water or spring water;
   (g) Foundation or footing drains where flows are not contaminated with process materials;
   (h) Water used to control dust; and
   (i) Pavement wash waters, provided spills or leaks of toxic or hazardous substances have not occurred (unless all spill material has been removed) and where soaps, solvents, and detergents are not used. Directing pavement wash waters directly into any water of the state, storm inlet, or stormwater conveyance, unless the conveyance is connected to an effective control, is prohibited.

5. Sites that have contaminated soils that will be disturbed by the land disturbance activity, or where such materials are brought to the site to use as fill or borrow, shall notify the Department's Water Protection Program for approval before applying for coverage under this permit. The Department reserves the right to revoke or deny coverage under this general permit; a site-specific permit may be required to cover such activities.

B. Permit Restrictions

1. Any non-stormwater discharges other than those explicitly authorized in Part I APPLICABILTY, Condition A.3 are prohibited under this permit.

2. This permit does not authorize the discharge of process wastewaters, treated or otherwise, including water used to wash machinery, equipment, buildings, or wastewater from washout of concrete.

3. For sites operating within the watershed of any Outstanding National Resource Water (which includes the Ozark National Riverways and the National Wild and Scenic Rivers System), sites that discharge to an Outstanding State Resource Water, or facilities located within the watershed of an impaired water as designated in the 305(b) report, including the 303(d) list, with an impairment for sediment:
   (a) This permit authorizes stormwater discharge so long as no degradation of water quality occurs due to discharges from the permitted facility per 10 CSR 20-7.031(3)(C) and as long as the facility is 1,000 or more feet away from the Outstanding National or State Resource Water or a water of the state with an impairment for sediment.
   (b) A site with a discharge found to be causing degradation or contributing to an impairment by discharging a pollutant of concern, during an inspection or through complaint investigations, may be required to become a no discharge facility or obtain a site-specific permit with more stringent monitoring and SWPPP requirements.
   (c) For sites within 1,000 feet of Outstanding National or State Resource Water or a water of the state with an impairment for sediment, the site shall operate as a no-discharge facility as defined in 10 CSR 20-6.015(1)(B)7, and discharges from dewatering of sedimentation basins is prohibited.

4. This general permit does not authorize the placement of fill materials in flood plains, placement of fill into any floodway, the obstruction of stream flow, or changing the channel of a defined drainage course. This general permit addresses only the quality of the stormwater runoff and the minimization of off-site migration of sediments and other water contaminants.

5. This permit does not allow stream channel or wetland alterations unless approved by Section 404 of the federal Clean Water Act (CWA) permitting authorities. Land disturbance activities may not begin in waters of the United States until any required Section 404 permit and Section 401 certification have been obtained.

6. This operating permit does not affect, remove, or replace any requirement of the National Environmental Policy Act; the Endangered Species Act; the National Historic Preservation Act; the Comprehensive Environmental Response, Compensation and Liability Act; the Resource Conservation and Recovery Act; or any other relevant acts. Determination of applicability to the above mentioned acts is the responsibility of the permittee. Additionally, this permit does not establish terms and conditions for runoff resulting from silvicultural activities listed in Section 402(l)(3)(a) of the Clean Water Act.

7. Compliance with all requirements in this permit does not supersede any requirement for obtaining project approval from an established local authority nor remove liability for compliance with county and other local ordinances.

8. The Department may require any facility or site authorized by a general permit to apply for a site-specific permit [10 CSR 20-6.010(13)(C)]. Cases where a site-specific permit may be required include, but are not limited to, the following:
   (a) The discharge(s) is a significant contributor of a pollutant(s) which impairs the designated uses or general criteria of the receiving stream;
   (b) The discharger is not in compliance with the conditions of the general permit;
   (c) A Total Maximum Daily Load (TMDL) containing requirements applicable to the discharge(s) is approved; or
   (d) Materials or contaminants exist at the site, or are brought to the site to use as fill or borrow, which may necessitate special controls or permit limits not otherwise considered under this general permit, such as contaminated soils from federal clean-up sites. This general permit may be authorized when additional contaminant controls are proposed by the applicant and the proposal is accepted by the Department in written correspondence.

9. If a facility or site covered under a current general permit desires to apply for a site-specific permit, the facility or site may do so by contacting the Department for application requirements and procedures.

10. Any discharges not expressly authorized in this permit and not clearly disclosed in the permit application cannot become authorized or shielded from liability under CWA section 402(k) or Section 644.051.16, RSMo, by disclosure to EPA, state, or local authorities after issuance of this permit via any means, including any other permit applications, funding applications, the SWPPP, discharge monitoring reporting, or during an inspection. Discharges at the facility not expressly authorized by this permit must be covered by another permit, be exempt from permitting, or be authorized through some other method.

11. In the event that a State of Emergency is declared, either by the State or Federal government, and as a result an emergency-related project requires land disturbance activity that requires a permit, the owner/operator of the project may begin work prior to permit issuance so long as they implement sediment and erosion controls in compliance with the master general permit conditions contained herein. The owner/operator is not exempt from permitting and shall apply for the land disturbance permit as soon as practicable but no later than seven calendar days after starting work. The Department may determine that other emergencies, considered on a case-by-case basis, are applicable. Contact the Department to determine if non-state of emergencies are applicable.

II. EXEMPTIONS FROM PERMIT REQUIREMENTS

1. Facilities that discharge all stormwater runoff directly to a combined sewer system (as defined in 40 CFR 122.26 and 40 CFR 35.2005) connecting to a publicly owned treatment works which has consented to receive such a discharge are exempt from Department stormwater permit requirements.

2. Land disturbance activities that disturb less than one (1) acre of total land area which are not part of a common plan of sale where water quality standards are not exceeded are exempt from Department stormwater permit requirements. Land disturbance activity on an individual residential building lot is not considered as part of the overall subdivision unless the activity is by the developer to improve the lot for sale.

3. Oil and gas related activities as listed in 40 CFR 122.26(a)(2)(ii) where water quality standards are not exceeded are exempt from Department stormwater permit requirements.

4. Linear, strip, or ribbon construction or maintenance operations meeting one (1) of the following criteria are exempt from Department stormwater permit requirements:
   (a) Grading of existing dirt or gravel roads which does not increase the runoff coefficient and the addition of an impermeable surface over an existing dirt or gravel road;
   (b) Cleaning or routine maintenance of roadside ditches, sewers, waterlines, pipelines, utility lines, or similar facilities;
   (c) Trenches two (2) feet in width or less; or
   (d) Emergency repair or replacement of existing facilities as long as BMPs are employed during the emergency repair.

III. REQUIREMENTS

1. The permittee shall post a public notification sign at the main entrance to the site with the specific MORA permit number. The public notification sign must be visible from the public road that provides access to the site's main entrance. An alternate location is acceptable provided the public can see it and it is noted in the SWPPP. The public notification sign must remain posted at the site until the permit has been terminated. The sign is provided at the end of this permit.

2. The permittee shall be responsible for notifying the land owner and each contractor or entity (including utility crews and city employees or their agents) who will perform work at the site of the existence of the SWPPP and what actions or precautions shall be taken while on-site to minimize the potential for erosion and the potential for damaging any BMP. The permittee is responsible for any damage a subcontractor may do to established BMPs and any subsequent water quality violation resulting from the damage.

3. Ensure the design, installation, and maintenance of effective erosion and sediment controls to minimize the discharge of pollutants. At a minimum, such controls must be designed, installed, and maintained to:
   (a) Control stormwater volume, velocity, and peak flow rates within the site to minimize soil erosion;
   (b) Control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion and scour;
   (c) Minimize the amount of exposed soil during construction activity;
   (d) Minimize the disturbance of steep slopes;
   (e) Minimize sediment discharges from the site. Address factors such as:
      1) the amount, frequency, intensity, and duration of precipitation;
      2) the nature of resulting stormwater runoff;
      3) expected flow from impervious surfaces, slopes, and drainage features; and
      4) soil characteristics, including the range of soil particle size expected to be present on the site;
   (f) Provide and maintain natural buffers around surface waters as detailed in Part V. BMP REQUIREMENTS Condition 7, direct stormwater to vegetated areas to increase sediment removal and maximize stormwater infiltration and filtering, unless infeasible;
   (g) Minimize soil compaction and preserve topsoil where practicable; and
   (h) Capture or treat a 2-year, 24-hour storm event.

4. A 2-year, 24-hour storm event shall be determined for the project location using the National Oceanic and Atmospheric Administration's National Weather Service Atlas 14 which can be located at https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html.
   (a) As an alternative to utilizing NOAA Atlas 14 for site specific data to determine the 2-year, 24-hour storm event the conservative default value can be used based on the map provided by the Department in the Factsheet portion of this permit. The permittee may choose which source to use for the site specific data.

5. BMPs for land disturbance [10 CSR 20-6.200(1)(D)2] are a schedule of activities, practices, or procedures that reduces the amount of soil available for transport or a device that reduces the amount of suspended solids in runoff before discharge to waters of the state. The term BMPs are also used to describe the sediment and erosion controls and other activities used to prevent stormwater pollution. BMPs are divided into two main categories: structural or non-structural; and they are also classified as temporary or permanent.

6. Installation of BMPs necessary to prevent soil erosion and sedimentation at the downgradient project boundary (e.g. buffers, perimeter controls, exit point controls, storm drain inlet protection) must be complete prior to the start of all phases of construction. By the time construction activity in any given portion of the site begins, downgradient BMPs must be installed and operational to control discharges from the initial site clearing, grading, excavating, and other earth-disturbing activities. Additional BMPs shall be installed as necessary throughout the life of the project. Following the installation of these initial BMPs, all BMPs needed to control discharges shall be installed and made operational prior to subsequent earth disturbing activities.

7. Temporary BMPs may be added and removed as necessary with updates to the SWPPP as specified in the requirements below.

8. All BMPs shall be maintained and remain in effective operating condition during the entire duration of the project, with repairs made within the timeframes specified elsewhere in this permit, until final stabilization has been achieved.
   (a) Ensure BMPs are protected from activities that would reduce their effectiveness.
   (b) Remove any sediment per the BMP manufacturer's instructions or before it has accumulated to one-half of the above-ground height of any BMP that collects sediment (i.e. silt fences, sediment traps, etc.)
   (c) The project is considered to achieve final stabilization when Part V. BMP REQUIREMENTS, Condition 13 is met.

9. Minimize sediment trackout from the site and sediment transport onto roadways.
   (a) Restrict vehicle traffic to designated exit points.
   (b) Use appropriate stabilization techniques or BMPs at all points that exit onto paved roads or areas outside of the site.
   (c) Use additional controls to remove sediment from vehicle and equipment tires prior to exit from facility where necessary.
   (d) Any sediment or debris that is tracked out past the exit pad or is deposited on a roadway after a precipitation event shall be removed the shorter of either daily or before a rain event. Remove the track-out sediment by sweeping, shoveling, or vacuuming these surfaces, or by using other similarly effective means of sediment removal. Sediment or debris tracked out

on pavement or other impervious surfaces shall not be disposed of into any stormwater conveyance, storm drain inlet, or water of the state.

(e) Stormwater inlets susceptible to receiving sediment or other pollutants from the permitted land disturbance site shall have curb inlet protection. This may include inlets off the active area where track out from vehicles and equipment could impact the stormwater runoff to those inlets.

10. Concrete washout facilities shall be used to contain concrete waste from the activities onsite, unless the washout of trucks and equipment is managed properly at an offsite location.
The washout facility shall be managed to prevent solid and/or liquid waste from entering waters of the state by the following:
(a) Direct the wash water into leak-proof containers or pits designed so that no overflows can occur due to inadequate sizing or precipitation;
(b) Locate washout activities a minimum of 50 feet from waters of the state, stormwater inlets and/or stormwater conveyances;
(c) Washout facilities shall be cleaned, or new facilities must be constructed and ready for use, once the washout is 75% full;
(d) Designate the washout area(s) and conduct such activities only in these areas.
(e) Ensure contractors are aware of the location, such as by marking the area(s) on the map or signage visible to the truck and/or equipment operators.

11. Good housekeeping practices shall be maintained at all times to keep waste from entering waters of the state.
(a) Provide solid and hazardous waste management practices, including providing trash containers, regular site cleanup for proper disposal of solid waste such as scrap building material, product/material shipping waste, food/beverage containers, spent structural BMPs;
(b) Provide containers and methods for proper disposal of waste paints, solvents, and cleaning compounds.
(c) Manage sanitary waste. Portable toilets shall be positioned so that they are secure and will not be tipped or knocked over and so that they are located away from waters of the state and stormwater inlets and stormwater conveyances.
(d) Ensure the storage of construction materials be kept away from drainage courses, stormwater conveyances, storm drain inlets, and low areas.

12. All fueling facilities present shall at all times adhere to applicable federal and state regulations concerning underground storage, above ground storage, and dispensers.

13. Any hazardous wastes that are generated onsite shall be managed, stored, and transported according to the provisions of the Missouri Hazardous Waste Laws and Regulations.

14. Store all paints, solvents, petroleum products, petroleum waste products, and storage containers (such as drums, cans, or cartons) so they are not exposed to stormwater or provide other prescribed BMPs such as plastic lids and/or portable spill pans to prevent the commingling of stormwater with container contents. Commingled water may not be discharged under this permit. Provide spill prevention, control, and countermeasures to contain the spill. Any containment system used to implement this requirement shall be constructed of materials compatible with the substances contained and shall prevent the contamination of groundwater.

15. Implement measures intended to prevent the spillage or loss of fluids, oil, grease, fuel, etc. from vehicles and equipment to thereby prevent the contamination of stormwater from these substances. This may include prevention measures such as, but not limited to, utilizing drip pans under vehicles and equipment stored outdoors, covering fueling areas, using dry clean-up methods, use of absorbents, and cleaning pavement surfaces to remove oil and grease.

16. Spills, Overflows, and Other Unauthorized Discharges.
(a) Any spill, overflow, or other discharge not specifically authorized in the permit above are unauthorized.
(b) Should an unauthorized discharge cause or permit any contaminants to discharge or enter waters of the state, the unauthorized discharge must be reported to the appropriate Regional Office as soon as practicable but no more than 24 hours after the discovery of the discharge. If the spill or overflow needs to be reported after normal business hours or on the weekend, the facility must call the Department's Environmental Emergency Response hotline at (573) 634-2436. Leaving a message on a Department staff member voice-mail does not satisfy this reporting requirement.
(c) A record of all spills shall be retained with the SWPPP and made available to the Department upon request.
(d) Other spills not reaching waters of the state must be cleaned up as soon as possible to prevent entrainment in stormwater but are not required to be reported to the Department.

17. The full implementation of this operating permit shall constitute compliance with all applicable federal and state statutes and regulations in accordance with RSMo 644.051.16 and the CWA §402(k); however, this permit may be reopened and modified or alternatively revoked and reissued to comply with any applicable effluent standard or limitation issued or approved under Clean Water Act §§ 301(b)(2)(C) and (D), 304(b)(2), and 307(a)(2) if the effluent standard or limitation so issued or approved contains different conditions or is otherwise more stringent than any effluent limitation in the permit or controls any pollutant not limited

in the permit. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, termination, notice of planned changes, or anticipated non-compliance does not stay any permit condition.

IV. STORMWATER POLLUTION PREVENTION PLAN (SWPPP) MANAGEMENT REQUIREMENTS

1. The primary requirement of this permit is the development and implementation of a SWPPP which incorporates site specific practices to best minimize the soil exposure, soil erosion, and the discharge of pollutants, including solids.

   The purpose of the SWPPP is to ensure the design, implementation, management, and maintenance of BMPs in order to prevent sediment and other pollutants in stormwater discharges associated with the land disturbance activities [40 CFR 122.44 (k)(4)] from entering waters of the state above established general and narrative criteria, compliance with Missouri Water Quality Standards; and compliance with the terms and conditions of this general permit.
   (a) **The SWPPP must be developed and implemented prior to conducting any land disturbance activities and must be specific to the land disturbance activities at the site.**
   (b) The permittee shall fully implement the provisions of the SWPPP required under this permit as a condition of this general permit throughout the term of the land disturbance project. Failure to develop, implement, and maintain a SWPPP may lead to immediate enforcement action.
   (c) The SWPPP is a living document and shall be updated any time site conditions warrant adjustments to the project or BMPs.
   (d) Either an electronic copy or a paper copy of the SWPPP, and any required reports, must be accessible to anyone on-site at all times when land disturbance operations are in process or other operational activities that may affect the maintenance or integrity of the BMP structures and made available as specified under Part VIII. STANDARD PERMIT CONDITIONS, Condition 1 of this permit. The SWPPP shall be readily available upon request and should not be sent to the Department unless specifically requested

2. A SWPPP must be developed, implemented, and maintained at the site or electronically accessible by on-site personnel. Failure to implement and maintain the BMPs chosen, which can be revised and updated, is a permit violation. The chosen BMPs will be the most reasonable and cost effective while also ensuring the highest quality water discharged attainable for the facility. Facilities with established SWPPPs and BMPs shall evaluate BMPs on a regular basis and change the BMPs as needed if there are BMP deficiencies.

3. The SWPPP must:
   (a) List and describe the location of all outfalls;
   (b) List any allowable non-stormwater discharges occurring on site and where these discharges occur;
   (c) Incorporate required practices identified below;
   (d) Incorporate sediment and erosion control practices specific to site conditions;
   (e) Discuss whether or not a 404 Permit is required for the project;
   (f) Discuss whether the discharges are in the watershed of Outstanding National or State Resource Water or in the watershed of a water impaired for sediment.
   (g) Name the person(s) responsible for inspection, operation, and maintenance of BMPs. The SWPPP shall list the names and describe the role of all owners/primary operators (such as general contractor, project manager) responsible for environmental or sediment and erosion control at the land disturbance site.

4. The SWPPP briefly must describe the nature of the land disturbance activity, including:
   (a) The function of the project (e.g., low density residential, shopping mall, highway, etc.);
   (b) The intended sequence and timing of activities that disturb the soils at the site;
   (c) Estimates of the total area expected to be disturbed by excavation, grading, or other land disturbance support activities including off-site borrow and fill areas;
   (d) If within the boundaries of a regulated Municipal Separate Storm Sewer System (MS4s), list the name of the regulated MS4.

5. In order to identify the site, the SWPPP shall include site information including size in acres. The SWPPP shall have sufficient information to be of practical use to contractors and site construction workers to guide the installation and maintenance of BMPs.

6. The function of the SWPPP and the BMPs listed therein is to prevent or minimize pollution to waters of the state. A deficiency of a BMP means it was not effective in preventing or minimizing pollution of waters of the state.

   The permittee shall select, install, use, operate and maintain appropriate BMPs for the permitted site. The following manuals are acceptable resources for the selection of appropriate BMPs:

Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites, (Document number EPA 833-R-06-004) published by the United States Environmental Protection Agency (USEPA) in May 2007. This manual as well as other information, including examples of construction SWPPPs, is available at the USEPA internet site at https://www.epa.gov/sites/production/files/2015-10/documents/sw_swppp_guide.pdf; and https://www.epa.gov/npdes/developing-stormwater-pollution-prevention-plan-swppp.

The latest version of *Protecting Water Quality: A field guide to erosion, sediment and stormwater best management practices for development sites in Missouri,* published by the Department. This manual is available at: https://dnr.mo.gov/document-search/protecting-water-quality-field-guide.

The permittee is not limited to the use of these guidance manuals. Other guidance publications may be used to select appropriate BMPs. However, all BMPs must be described and justified in the SWPPP. Although the use of these manuals or other resources is recommended and may be used for BMP selection, they do not supersede the conditions of this permit. They may be used to inform in the decision making process for BMP selection but they are not themselves part of the permit conditions.

The permittee may retain the SWPPP, inspection reports, and all other associated documents (including a copy of this permit) electronically pursuant to RSMo 432.255. The documents must be made available to all interested persons in either paper or electronic format as required by this permit and the permittee must remit a copy (electronic or otherwise) of the SWPPP and inspection reports to the Department upon request.

7. The SWPPP must contain a legible site map, multiple maps if necessary, identifying:
   (a) Site boundaries of the property;
   (b) Locations of all waters of the state (including wetlands) within the site and half a mile downstream of the site's outfalls;
   (c) Location of all outfalls;
   (d) Direction(s) of stormwater flow (use arrows) and approximate slopes before and after grading activities;
   (e) Areas of soil disturbance and areas that will not be disturbed (or a statement that all areas of the site will be disturbed unless otherwise noted);
   (f) Location of structural and non-structural BMPs, including natural buffer areas, identified in the SWPPP;
   (g) Locations where stabilization practices are expected to occur;
   (h) Locations of on-site and off-site material, waste, borrow or equipment storage areas and stockpiles;
   (i) Designated points where vehicles will exit the site;
   (j) Location of stormwater inlets and conveyances including ditches, pipes, man-made conduits, and swales; and
   (k) Areas where final stabilization has been achieved.

8. An individual shall be designated by the permittee as the environmental lead. This environmental lead shall have knowledge in erosion, sediment, and stormwater control principles, knowledge of the permit, and the site's SWPPP. The environmental lead shall ensure all personnel and contractors understand any requirements of this permit may be affected by the work they are doing. The environmental lead or designated inspector(s) knowledgeable in erosion, sediment, and stormwater control principles shall inspect all structures that function to prevent or minimize pollution of waters of the state.

9. Throughout coverage under this permit, the permittee shall amend and update the SWPPP as appropriate during the term of the land disturbance activity. All SWPPP modifications shall be signed and dated. The permittee shall amend the SWPPP to incorporate any significant site condition changes which impact the nature and condition of stormwater discharges. At a minimum, these changes include whenever the:
   (a) Location, design, operation, or maintenance of BMPs is changed;
   (b) Design of the construction project is changed that could significantly affect the quality of the stormwater discharges;
   (c) Permittee's inspections indicate deficiencies in the SWPPP or any BMP;
   (d) Department notifies the permittee in writing of deficiencies in the SWPPP;
   (e) SWPPP is determined to be ineffective in minimizing or controlling erosion and sedimentation (e.g., there is visual evidence of excessive site erosion or sediment deposits in streams, lakes, or downstream waterways, sediment or other wastes offsite); and/or
   (f) Department determines violations of water quality standards may occur or have occurred.

10. Site Inspections: The environmental lead, or a designated inspector, shall conduct regularly scheduled inspections. These inspections shall be conducted by a qualified person, one who is responsible for environmental matters at the site, or a person trained by and directly supervised by the person responsible for environmental matters at the site. Site inspections shall include, at a minimum, the following:
   (a) For disturbed areas that have not achieved final stabilization, all installed BMPs and other pollution control measures shall be inspected to ensure they are properly installed, appear to be operational, and are working as intended to minimize the

discharge of pollutants.

(b) For areas on site that have achieved either temporary or final stabilization, while at the same time active construction continues on other areas, ensure that all stabilization measures are properly installed, appear to be operational, and are working as intended to minimize the discharge of pollutants.
(c) Inspect all material, waste, borrow, and equipment storage, and maintenance areas that are covered by this permit. Inspect for conditions that could lead to spills, leaks, or other accumulations of pollutants on the site.
(d) Inspect all areas where stormwater typically flows within the site, including drainage ways designed to divert, convey, and/or treat stormwater.
(e) All stormwater outfalls shall be inspected for evidence of erosion, sediment deposition, or impacts to the receiving stream. If a discharge is occurring during an inspection, the inspector must observe and document the visual quality of the discharge, and take note of the characteristics of the stormwater discharge, including turbidity, color; odor; floating, settled, or suspended solids; foam; oil sheen; and other indicators of stormwater pollutants.
(f) When practicable the receiving stream shall also be inspected for a minimum of 50 feet downstream of the outfall.
(g) The perimeter of the site shall be inspected for evidence of BMP failure to ensure concentrated flow does not develop a new outfall.
(h) The SWPPP must explain how the environmental lead will be notified when stormwater runoff occurs.

11. Inspection Frequency: All BMPs must be inspected in accordance to one of the schedules listed below. The inspection frequency shall be documented in the SWPPP, and any changes to the frequency of inspections, including switching between the options listed below, must be documented on the inspection form:
    (a) At least once every seven (7) calendar days and within 48 hours after any storm event equal to or greater than a 2-year, 24-hour storm has ceased during a normal work day or within 72 hours if the rain event ceases during a non-work day such as a weekend or holiday; or
    (b) Once every 14 calendar days and within 24 hours of the occurrence of a storm event of 0.25 inches of precipitation or greater, or the occurrence of runoff from snowmelt. To determine if a storm event of 0.25 inches or greater has occurred on the site, the permittee shall either keep a properly maintained rain gauge on site, or obtain the storm event information from a weather station near the site location.
        1) Inspections are only required during the project's normal working hours.
        2) An inspection must be conducted within 24 hours of a storm event which has produced 0.25 inches. The inspection shall be conducted within 24 hours of the event end, or within 72 hours if the rain event ceases during a non-work day such as a weekend or holiday.
        3) If it is elected to inspect every 14 calendar days and there is a storm event at the site that continues for multiple days, and each day of the storm produces 0.25 inches or more of rain, the permittee shall conduct an inspection within 24 hours of the end of the storm or within 72 hours if the rain event ceases during a non-work day such as a weekend or holiday.
    (c) For any portion of the site that discharges within the watershed of an Outstanding National or State Resource Water or a water impaired for sediment, inspections shall be inspected once every seven (7) calendar days and within 24 hours of the occurrence of a storm event of 0.25 inches or greater, or when the occurrence of runoff flow from frozen or snowmelt is sufficient to cause a discharge.
    (d) Areas on-site that have achieved stabilization, while at the same time active construction continues on other areas, may reduce inspection frequency to monthly, for those stabilized areas, if the following conditions exist:
        1) For areas where disturbed portions have undergone temporary stabilization, inspections shall occur at least once a month while stabilized and when re-disturbed shall follow either frequency outlined in (a),(b), or (c) above.
        2) Areas on-site that have achieved final stabilization must be inspected at least once per month until the permit is terminated.
    (e) If construction activities are suspended due to frozen conditions, the permittee may temporarily reduce site inspections to monthly until thawing conditions begin to occur if all of the following are met:
        1) Land disturbances have been suspended; and
        2) All disturbed areas of the site have been stabilized in accordance with Part V. BMP REQUIREMENTS, Condition 13.
        3) The change shall be noted in the SWPPP.
    (f) Any basin dewatering shall be inspected daily when discharge is occurring. The discharge shall be observed and dewatering activities shall be ceased immediately if the receiving stream is being impacted. These inspections shall be noted on a log or on the inspection report.

    If weather conditions or other issues prevent correction of BMPs within seven calendar days, the reasons for the delay must be documented (including pictures) and there must be a narrative explaining why the work cannot be accomplished within the seven day time period. The documentation must be filed with the regular inspection reports. The corrections shall be made as soon as weather conditions or other issues allow.

12. Site Inspection Reports: A log of each inspection and/or copy of the inspection report shall be kept readily accessible and must be made available upon request by the Department. Electronic logs are acceptable as long as reports can be provided within 24

hours. If inspection reports are kept off-site, the SWPPP must indicate where they are stored. The inspection report shall be signed by the environmental lead or designated inspector (electronically or otherwise).

(a) The inspection report is to include the following minimum information:
   1) Inspector's name and title.
   2) Date and time of inspection.
   3) Observations relative to the effectiveness of the BMPs and stabilization measures. The following must be documented:
      a. Whether BMPs are installed, operational, and working as intended;
      b. Whether any new or modified stormwater controls are needed;
      c. Facilities examined for conditions that could lead to spill or leak;
      d. Outfalls examined for visual signs of erosion or sedimentation at outfalls. Excessive erosion or sedimentation may be due to BMP failure or insufficiency. Response to observations should be addressed in the inspection report.
   4) Corrective actions taken or necessary to correct the observed problem.
   5) Listing of areas where land disturbance operations have permanently or temporarily stopped.

13. Any structural or maintenance deficiencies for BMPs or stabilization measures shall be documented and corrected as soon as possible but no more than seven (7) calendar days after the inspection.
   (a) Corrective action documentation shall be stored with the associated site inspection report.
   (b) Immediately take all reasonable steps to address the condition, including cleaning up any contaminated surfaces so the material will not discharge in subsequent storm events.
   (c) If weather conditions or other issues prevent correction of BMPs within seven calendar days, the reasons for the delay must be documented (this may include pictures) and there must be a narrative explaining why the work cannot be accomplished within the seven day time period. The permittee shall correct the problem as soon as weather conditions or issues allow.
   (d) Corrective actions may be required by the Department. The permittee must comply with any corrective actions required by the Department as a result of permit violations found during an inspection.

V. BMP REQUIREMENTS

1. The information, practices, and BMP requirements in this section shall be implemented on site and, where noted, provided for in the SWPPP.

2. Existing vegetation and trees shall be preserved where practicable. The permittee is encouraged to preserve topsoil where practicable. Trees designated for preservation should have a protective barrier outside of the dripline, or the area directly located under the outer reaches of the tree's branches.

3. The permittee shall select appropriate BMPs for use at the site and list them in the SWPPP. When selecting effective BMPs, the permittee shall consider stormwater volume and velocity and shall incorporate more than one BMP and sequential treatment devices where the use of a single BMP is ineffective to prevent or minimize sediment or other pollutants from leaving the site. Permittee should consider a schedule for performing erosion control measures when selecting BMPs.

4. The SWPPP shall include a description of both structural and non-structural BMPs that will be used at the site.
   (a) The SWPPP shall provide the following general information for each BMP which will be used one or more times at the site:
      1) Physical description of the BMP;
      2) Site conditions that must be met for effective use of the BMP;
      3) BMP installation/construction procedures, including typical drawings; and
      4) Operation and maintenance procedures and schedules for the BMP.
   (b) The SWPPP shall provide the following information for each specific instance where a BMP is to be installed:
      1) Whether the BMP is temporary or permanent;
      2) When the BMP will be installed in relation to each phase of the land disturbance procedures to complete the project; and
      3) Site conditions that must be met before removal of the BMP if the BMP is not a permanent BMP.

5. Structural BMP Installation: The permittee shall ensure all BMPs are properly installed and operational at the locations and relative times specified in the SWPPP.
   (a) Perimeter control BMPs for runoff from disturbed areas shall be installed or existing vegetative areas marked for preservation before general site clearing is started. Note this requirement does not apply to earth disturbances related to initial site clearing and establishing entry, exit, or access of the site, which may require that stormwater controls be installed immediately after the earth disturbance.
   (b) For phased projects, BMPs shall be properly installed as necessary prior to construction activities.
   (c) Stormwater discharges which leave the site from disturbed areas shall pass through an appropriate impediment to sediment movement such as a sedimentation basin, sediment traps (including vegetative buffers), or silt fences prior to leaving the land

disturbance site.
(d) A drainage course change shall be clearly marked on a site map and described in the SWPPP.
(e) If vegetative stabilization measures are being implemented, stabilization efforts are considered "installed" when all activities necessary to seed or plant the area are completed. Vegetative stabilization is not considered "operational" until the vegetation is established.

6. Install sediment controls along any perimeter areas of the site that are downgradient from any exposed soil or other disturbed areas. Prevent stormwater from circumventing the edge of the perimeter control. For sites where perimeter controls are infeasible, other practices shall be implemented to minimize discharges to perimeter areas of the site.

7. For surface waters of the state, defined in Section 644.016.1(27) RSMo, located on or adjacent to the site, the permittee must maintain a riparian buffer or structural equivalent in accordance with at least one of the following options. The selection and location must be described in the SWPPP.
   (a) Provide and maintain a 50-foot undisturbed natural buffer; or
   (b) Provide and maintain an undisturbed natural buffer that is less than 50 feet and is supplemented by erosion and sediment controls that achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer; or
   (c) If infeasible to provide and maintain an undisturbed natural buffer of any size, implement erosion and sediment controls to achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.
   (d) The permittee is not required to comply with (a), (b), or (c) above if one or more of the following exceptions apply and documentation is provided in the SWPPP:
      1) If there is no discharge of stormwater to waters of the state through the area between the disturbed portions of the site and waters of the state located within 50 feet of the site. This includes situations where the permittee has implemented permanent control measures that will prevent such discharges, such as a berm or other barrier.
      2) Where no natural buffer exists due to preexisting development disturbances that occurred prior to the initiation of planning for the current development of the site.
         a. Where some natural buffer exists but portions of the area within 50 feet of the waters of the state are occupied by preexisting development disturbances the permittee is required to comply with (a), (b), or (c) above.
      3) For linear projects where site constraints make it infeasible to implement a buffer or equivalent provided the permittee limit disturbances within 50 feet of any waters of the state and/or the permittee provides supplemental erosion and sediment controls to treat stormwater discharges from earth disturbances within 50 feet of the water of the state. The permittee must also document in the SWPPP the rationale for why it is infeasible for the permittee to implement (a), (b), or (c) and describe any buffer width retained and supplemental BMPs installed.
   (e) Where the permittee is retaining a buffer of any size, the buffer should be measured perpendicularly from any of the following points, whichever is further landward from the water:
      1) The ordinary high water mark of the water body, defined as the line on the shore established by fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, and/or the presence of litter and debris; or
      2) The edge of the stream or river bank, bluff, or cliff, whichever is applicable.

8. Slopes for disturbed areas must be identified in the SWPPP. A site map or maps defining the sloped areas for all phases of the project must be included in the SWPPP. The disturbance of steep slopes shall be minimized.

9. Manage stockpiles or land clearing debris piles composed, in whole or in part, of sediment and/or soil.
   (a) Locate the piles outside of any natural buffers zones, established under the condition above, and away from any stormwater conveyances, drain inlets, and areas where stormwater flow is concentrated;
   (b) Install a sediment barrier along all downgradient perimeter areas;
   (c) Prevent stormwater flows from causing erosion of stockpiles, for example, by diverting flows around them.
   (d) For piles that will be unused for 14 or more days, provide cover with appropriate temporary stabilization in accordance with Part V. BMP REQUIREMENTS, Condition 13.
   (e) Rinsing, sweeping, or otherwise placing any soil, sediment, debris, or stockpiled product which has accumulated on pavement or other impervious surfaces into any stormwater conveyance, storm drain inlet, or water of the state is prohibited.

10. The site shall include BMPs for pollution prevention measures and shall be noted in the SWPPP. At minimum such measures must be designed, installed, implemented, and maintained to:
   (a) Minimize the discharge of pollutants from equipment and vehicle rinsing; no detergents, additives, or soaps of any kind shall be used. Rinse waters must be treated in a sediment basin or alternative control that provides equivalent or better treatment prior to discharge;
   (b) Minimize the exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste, and other materials present on the site to precipitation and to stormwater;
   (c) Minimize the discharge of pollutants from spills and leaks and implement chemical spill and leak prevention and response

procedures, including, but not limited to, the installation of containment berms and use of drip pans at petroleum product and liquid storage tanks and containers; and

(d) Prevent discharges from causing or contributing to an exceedance of water quality standards including general criteria.

11. Sedimentation Basins: The SWPPP shall include a sedimentation basin for each drainage area with ten or more acres disturbed at one time.
    (a) The sedimentation basin shall be sized, at a minimum, to treat a local 2-year, 24-hour storm.
    (b) Sediment basins shall not be constructed in any waters of the state or natural buffer zones.
    (c) Discharges from dewatering activities shall be managed by appropriate controls. The SWPPP shall include a description of any anticipated dewatering methods and specific BMPs designed to treat dewatering water.
        1) Appropriate controls include, but are not limited to, sediment socks, dewatering tanks, tube settlers, weir tanks, filtration systems (e.g. bag or sand filters), and passive treatment systems that are designed to remove or retain sediment.
        2) Erosion controls and velocity dissipation devices (e.g. check dams, riprap, and vegetated buffers) to prevent erosion at inlets, outlets, and discharge points shall be utilized.
        3) Water with an oil sheen shall not be discharged and shall be marked in SWPPP.
        4) Visible floating solids and foam shall not be discharged.
    (d) Until final stabilization has been achieved, sediment basins and impoundments shall utilize outlet structures or floating skimmers that withdraw water from the surface when discharging.
        1) Under frozen conditions, it may be considered infeasible to withdraw water from the surface and an exception can be made for that specific period as long as discharges that may contain sediment and other pollutants are managed by appropriate controls. If determined infeasible due to frozen conditions, documentation must be provided in the SWPPP to support the determination, including the specific conditions or time period when this exception applies.
    (e) Accumulated sediment shall not exceed 25% of total volume or as prescribed in the design, whichever is less. Note in the SWPPP the locations for disposal of the material removed from sediment basins.
    (f) Prevent discharges to the receiving stream causing visual turbidity. For the purposes of this permit, visual turbidity refers to a sediment plume or other cloudiness in the water caused by sediment that can be identified by an observer.
    (g) The SWPPP shall require the basin be maintained until final stabilization of the disturbed area served by the basin.

    Where use of a sediment basin is infeasible, the SWPPP shall evaluate and specify other similarly effective BMPs to be employed to control erosion and sediment. These similarly effective BMPs shall be selected from appropriate BMP guidance documents authorized by this permit. The BMPs must provide equivalent water quality protection to achieve compliance with this permit. The SWPPP shall require both temporary and permanent sedimentation basins to have a stabilized spillway to minimize the potential for erosion of the spillway or basin embankment.

12. Soil disturbing activities on site that have ceased either temporarily or permanently shall initiate stabilization immediately in accordance with the options below. For soil disturbing activities that have been temporarily ceased on any portion of the site and will not resume for a period exceeding 14 calendar days:
    (a) The permittee shall construct BMPs to establish interim stabilization; and
    (b) Stabilization must be initiated immediately and completed within 14 calendar days.
    (c) For soil disturbing activities that have been permanently ceased on any portion of the site, final stabilization of disturbed areas must be initiated immediately and completed within 14 calendar days.
        1) Extension to the 14-day completion period for temporary and final stabilization may be made due to weather and equipment malfunctions. In these circumstances, the justification for the extension to the 14 day shall be documented in the SWPPP. The discontinuation or continuation of the extension may be determined by review of the Department staff when on site.
    (d) Until stabilization is complete, interim sediment control shall consist of well-established and maintained BMPs that are reasonably certain to protect waters of the state from sediment pollution over an extended period of time. This may require adding more BMPs to an area than is normally used during daily operations. The types of BMPs used must be suited to the area disturbed, taking into account the number of acres exposed and the steepness of the slopes. If the slope of the area is greater than 3:1 (three feet horizontal to one foot vertical) or if the slope is greater than 3% and greater than 150 feet in length, then the permittee shall establish interim stabilization within seven days of ceasing operations on that part of the site. The following activities would constitute the immediate initiation of stabilization:
        1) Prepping the soil for vegetative or non-vegetative stabilization as long as seeding, planting, and/or installation of non-vegetative stabilization products takes place as soon as practicable;
        2) Applying mulch or other non-vegetative product to the exposed areas;
        3) Seeding or planting the exposed areas;
        4) Finalizing arrangements to have stabilization product fully installed in compliance with the deadlines for completing stabilization.
    (e) If vegetative stabilization measures are being implemented, stabilization is considered "installed" when all activities necessary to seed or plant the area are completed. Installed does not mean established.

(f) If non-vegetative stabilization measures are being implemented, stabilization is considered "installed" when all such measures are implemented or applied.
1) Non-vegetative stabilization shall prevent erosion and shall be chosen for site conditions, such as slope and flow of stormwater.
(g) Final stabilization is not considered achieved until vegetation has grown and established to meet the requirements below.

13. Prior to removal of BMPs, ceasing site inspections, and requesting termination of the permit, final stabilization must be achieved. Final stabilization shall be achieved as soon as possible once land disturbance activities have ceased. Document in the SWPPP the type of stabilization and the date final stabilization is achieved.
(a) The project is considered to have achieved final stabilization when perennial vegetation (excluding volunteer vegetation), pavement, buildings, or structures using permanent materials (i.e. riprap, gravel, etc.) cover all areas that have been disturbed. With respect to areas that have been vegetated, vegetation must be at least 70% coverage of 100% of the vegetated areas on site. Vegetation must be evenly distributed.
(b) Disturbed areas on agricultural land are considered to have achieved final stabilization when they are restored to their preconstruction agricultural use. If former agricultural land is changing to non-agricultural use, this is no longer considered agricultural land and shall follow condition (a).
(c) If the intended function of a specific area of the site necessitates that it remain disturbed, final stabilization is considered achieved if all of the following are met:
1) Only the minimum area needed remains disturbed (i.e. dirt access roads, motocross tracks, utility pole pads, areas being used for storage of vehicles, equipment, materials). Other areas must meet the criteria above.
2) Permanent structural BMPs (rock checks, berms, grading, etc.) or non-vegetative stabilization measures are implemented and designed to prevent sediment and other pollutants from entering waters of the state.
3) Inspection requirements in Part IV. SWPPP MANAGEMENT REQUIREMENT, Condition 11 are met and documented in the SWPPP.
(d) Winter weather and frozen conditions do not excuse any of the above final stabilization requirements. If vegetation is required for stabilization the permittee must maintain BMPs throughout winter weather and frozen conditions until thawing and vegetation meets final stabilization criteria above. Document stabilization attempts during frozen conditions in the SWPPP. Consider future freezing when removing vegetation and plan with temporary stabilization techniques before the ground becomes frozen.

VI. PERMIT TERMINATION

1. Until the permittee terminates coverage under this permit, the permittee must comply with all conditions in the permit, including continuation of site inspections and public notification signage posted. To terminate permit coverage, the permittee must submit to the appropriate Regional Office a complete and accurate Request for Termination of Operating Permit which certifies that the site meets the following requirements:
(a) For any areas that (1) were disturbed during construction, (2) are not covered over by permanent structures, and (3) over which the permittee had control during the construction activities, the requirements for final vegetative or non-vegetative stabilization in Part V BMP REQUIREMENTS, Condition 13;
(b) The permittee has removed and properly disposed of all construction materials, waste, and waste handling devices and has removed all equipment and vehicles that were used during construction, unless intended for long-term use following termination of permit coverage;
(c) The permittee has removed all temporary BMPs that were installed and maintained during construction, except those that are intended for long-term use following termination of permit coverage or those that are biodegradable; and
(d) The permittee has removed all potential pollutants and pollutant-generating activities associated with construction, unless needed for long-term use following termination of permit coverage.

The Department may request photographs that clearly document compliance with termination requirements.

2. The permit may be terminated if;
(a) There has been a transfer of control of all areas of the site for which the current permittee is responsible under this permit to another operator, and that operator has obtained coverage under this permit; or
(b) Coverage under an individual or alternative general NPDES permit, with land disturbance conditions, has been obtained.

VII. SAMPLING REQUIREMENTS

The permittee is not required to sample stormwater under this permit. The Department may require sampling and reporting as a result of illegal discharges, compliance issues related to water quality concerns or BMP effectiveness, or evidence of off-site

impacts from activities at the site. If such an action is needed, the Department will specify in writing the sampling requirements, including such information as location and extent. If the permittee refuses to perform sampling when required, the Department may terminate the general permit and require the facility to obtain a site-specific permit with sampling requirements.

VIII. STANDARD PERMIT CONDITIONS

1. Records: The permittee shall retain copies of this general permit, the SWPPP and all amendments for the site named in the State Operating Permit, results of any monitoring and analysis, and all site inspection records required by this general permit.
   (a) The records shall be accessible during normal business hours and retained for a period of at least three (3) years from the date of termination.
   (b) The permittee shall provide a copy (electronic or otherwise) of the SWPPP to the Department, USEPA, or any local agency or government representative if they request a copy in the performance of their official duties within 24 hours of the request (or next working day), unless given more time by the representative.
   (c) The permittee shall provide a copy of the SWPPP to those who are responsible for installation, operation, or maintenance of any BMP. The permittee, their representative, and/or the contractor(s) responsible for installation, operation and maintenance of the BMPs shall have a current copy of the SWPPP with them when on the project site.

2. Land Ownership and Change of Ownership: Federal and Missouri stormwater regulations [10 CSR 20-6.200(1) (B)] require a stormwater permit and erosion control measures for all land disturbances of one or more acres. These regulations also require a permit for land disturbance sites less than one acre if the lot is part of a larger common plan of development or sale.
   (a) If the permittee sells any portion of the permitted site to a developer for commercial, industrial, or residential use, this land remains a part of the common sale and the new owner must obtain a permit prior to conducting any land disturbance activity. Therefore, the original permittee must amend the SWPPP to show that the property has been sold and, therefore, no longer under the original permit coverage.
   (b) Property of any size which is part of a larger common plan of development where the property has achieved final stabilization and the original permit terminated will require application of a new land disturbance permit for any future land disturbance activity unless the activity is by an individual residential building lot owner on a site less than one acre.
   (c) If a portion of a larger common plan of development is sold to an individual for the purpose of building his or her own private residence, a permit is required if the disturbed portion of the land sold is equal to or greater than one acre. No permit is required, however, for less than one acre of land disturbed on the portion sold.

3. Permit Transfer: This permit may not be transferred to a new owner in any fashion except by submitting an Application for Transfer of Operating Permit signed by the seller and buyer of the site along with the appropriate modification fee. In some cases, revocation and reissuance may be necessary. Facilities that undergo transfers of ownership without notice to the Department are considered to be operating without a permit.

4. Termination: This permit may be terminated when the project has achieved final stabilization, defined in Part VI. PERMIT TERMINATION.
   (a) In order to terminate the permit, the permittee shall notify the Department by submitting the form Request for Termination of Operating Permit Form MO 780-2814. The form should be submitted to the appropriate Regional Office or through an approved electronic system if it should become available.
   (b) The Cover Page (Certificate Page) of the Master General Permit for Land Disturbance specifies the "effective date" and the "expiration date" of the Master General Permit. The "issued date" along with the "expiration date" will appear on the State Operating Permit issued to the applicant. **This permit does not continue administratively beyond the expiration date.**

5. Duty to Reapply: If the project or development completion date will be after the expiration date of this general permit, then the permittee must reapply to the Department for a new permit. This permit may be applied for and issued electronically in accordance with Section 644.051.10, RSMo.
   (a) Due to the nature of the electronic permitting system, a period of time may be granted at the discretion of the Department in order to apply for a new permit after the new version is effective. Applicants must maintain appropriate best management practices and inspections during the discretionary period.

6. Duty to Comply: The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Missouri Clean Water Law and Federal Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

7. Modification, Revocation, and Reopening:
   (a) If at any time the Department determines that the quality of waters of the state may be better protected by reopening this permit, or revoking this permit and requiring the owner/operator of the permitted site to apply for a site-specific permit, the Department may revoke a general permit and require any person to obtain such an operating permit as authorized by 10

CSR20-6.010(13) and 10 CSR 20-6.200(1)(B).

(b) If this permit is reopened, modified, or revoked pursuant to this Section, the permittee retains all rights under Chapter 536 and 644 Revised Statutes of Missouri upon the Department's reissuance of the permit as well as all other forms of administrative, judicial, and equitable relief available under law.

8. Other Information: Where the permittee becomes aware that it failed to submit any relevant facts in a permit application or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information.

9. Duty to Provide Information: The permittee shall furnish to the Department, within 24 hours unless explicitly granted more time in writing, any information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The permittee shall also furnish to the Department upon request, copies of records required to be kept by this permit.

10. Inspection and Entry: The permittee shall allow the Department, or an authorized representative (including an authorized contractor acting as a representative of the Department), upon presentation of credentials and other documents as may be required by law, to:
    (a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted or where records must be kept under the conditions of the permit;
    (b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
    (c) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
    (d) Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Federal Clean Water Act or Missouri Clean Water Law, any substances or parameters at any location.

11. Signatory Requirement:
    (a) All permit applications, reports required by the permit, or information requested by the Department shall be signed and certified. (See 40 CFR 122.22 and 10 CSR 20-6.010)
    (b) The Federal Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit (including monitoring reports or reports of compliance or non-compliance) shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than six (6) months per violation, or by both.
    (c) The Missouri Clean Water Law provides that any person who knowingly makes any false statement, representation or certification in any application, record, report, plan, or other document filed or required to be maintained pursuant to sections 644.006 to 644.141 shall, upon conviction, be punished by a fine of not more than ten thousand dollars, or by imprisonment for not more than six months, or by both.

12. Property Rights: This permit does not convey any property rights of any sort or any exclusive privilege.

13. Notice of Right to Appeal: If you were adversely affected by this decision, you may be entitled to pursue an appeal before the administrative hearing commission (AHC) pursuant to Sections 621.250 and 644.051.6 RSMo. To appeal, you must file a petition with the AHC within thirty days after the date this decision was mailed or the date it was delivered, whichever date was earlier. If any such petition is sent by registered mail or certified mail, it will be deemed filed on the date it is mailed; if it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is received by the AHC. Any appeal should be directed to:

Administrative Hearing Commission
U.S. Post Office Building, Third Floor
131 West High Street, P.O. Box 1557
Jefferson City, MO 65102-1557
Phone: 573-751-2422
Fax: 573-751-5018
Website: https://ahc.mo.gov

MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

STORMWATER DISCHARGES FROM THIS LAND DISTURBANCE SITE ARE AUTHORIZED BY THE MISSOURI STATE OPERATING PERMIT NUMBER:

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ANYONE WITH QUESTIONS OR CONCERNS ABOUT STORMWATER DISCHARGES FROM THIS SITE, PLEASE CONTACT THE MISSOURI DEPARTMENT OF NATURAL RESOURCES AT

1-800-361-4827

MISSOURI DEPARTMENT OF NATURAL RESOURCES
FACT SHEET FOR MASTER GENERAL PERMIT
MO-RAXXXXX

The Federal Water Pollution Control Act [Clean Water Act (CWA)] Section 402 of Public Law 92-500 (as amended) established the National Pollution Discharge Elimination System (NPDES) permit program. This program regulates the discharge of pollutants from point sources into the waters of the United States and the release of stormwater from certain point sources. All such discharges are unlawful without a permit (Section 301 of the CWA). After a permit is obtained, a discharge not in compliance with all permit terms and conditions is unlawful. Missouri State Operating Permits (permit) are issued by the Missouri Department of Natural Resources (Department) under an approved program operated in accordance with federal and state laws (Federal CWA and Missouri Clean Water Law Section 644 as amended). Permits are issued for a period of five (5) years unless otherwise specified.

Per 40 CFR 124.56, 40 CFR 124.8, and 10 CSR 20-6.020(1)(A)2, a Fact Sheet shall be prepared to give pertinent information regarding the applicable regulations, rationale for the development of effluent limitations and conditions, and the public participation process for the permit. A Fact Sheet is not an enforceable part of an MSOP.

DEFINITIONS FOR THE PURPOSES OF THIS PERMIT:

Common Promotional Plan: A plan undertaken by one (1) or more persons to offer lots for sale or lease; where land is offered for sale by a person or group of persons acting in concert, and the land is contiguous or is known, designated, or advertised as a common unit or by a common name or similar names, the land is presumed, without regard to the number of lots covered by each individual offering, as being offered for sale or lease as part of a common promotional plan.

Dewatering: The act of draining rainwater and/or groundwater from basins, building foundations, vaults, and trenches.

Effective Operating Condition: For the purposes of this permit, a stormwater control is kept in effective operating condition if it has been implemented and maintained in such a manner that it is working as designed to minimize pollutant discharges.

Emergency-Related Project: A project initiated in response to a public emergency (e.g. earthquakes, extreme flooding conditions, tornado, disruptions in essential public services, pandemic) for which the related work requires immediate authorization to avoid imminent endangerment to human health/safety or the environment or to reestablish essential public services.

Exposed Soils: For the purposes of this permit, soils that as a result of earth-disturbing activities are left open to the elements.

Immediately: For the purposes of this permit, immediately should be defined as within 24 hours.

Impervious Surface: For the purpose of this permit, any land surface with a low or no capacity for soil infiltration including, but not limited to, pavement, sidewalks, parking areas and driveways, packed gravel or soil, or rooftops.

Infeasible: Infeasible means not technologically possible or not economically practicable and achievable in light of best industry practices.

Install or Installation: When used in connection with stormwater controls, to connect or set in position stormwater controls to make them operational.

Land Disturbance Site or Site: The land or water area where land disturbance activities will occur and where stormwater controls will be installed and maintained. The land disturbance site includes construction support activities, which may be located at a different part of the property from where the primary land disturbance activity will take place or on a different piece of property altogether. Off-site borrow areas directly and exclusively related to the land disturbance activity are part of the site and must be permitted.

Larger Common Plan of Development or Sale: A continuous area where multiple separate and distinct construction activities are occurring under one plan, including any offsite borrow areas that are directly and exclusively related to the land disturbance activity. Off-site borrow areas utilized for multiple different land disturbance projects are considered their own entity and are not part of the larger common plan of development or sale. See definition of Common Promotional Plan to understand what a 'common plan' is.

Minimize: To reduce and/or eliminate to the extent achievable using stormwater controls that are technologically available and economically practicable and achievable in light of best industry practices.

Non-structural BMP: Institutional, educational, or pollution prevention practices designed to limit the amount of stormwater runoff or pollutants that are generated in the landscape. Examples of non-structural BMPs include picking up trash and debris, sweeping up nearby sidewalks and streets, maintaining equipment, and training site staff on stormwater control practices.

Operational: for the purposes of this permit, stormwater controls are made "operational" when they have been installed and implemented, are functioning as designed, and are properly maintained.

Ordinary High Water Mark: The line on the shore established by fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, and/or the presence of litter and debris.

Outfall: For the purposes of this permit, outfalls are locations where stormwater exits the site property, including pipes, ditches, swales, channels, or other conduits that transport stormwater discharges associated with the construction activity.

Peripheral: For the purposes of this permit, peripheral should be defined as the outermost boundary of the area that will be disturbed.

Permanently: For the purposes of this permit, permanently is defined as any activity that has been ceased without any intentions of future disturbance.

Pollution Prevention Controls (or Measures): Stormwater controls designed to reduce or eliminate the addition of pollutants to construction site discharges through analysis of pollutant sources, implementation of proper handling/disposal practices, employee education, and other actions.

Qualified Person (inspections): A person knowledgeable in the principles and practice of erosion and sediment controls and pollution prevention who possesses the appropriate skills and training to assess conditions at the construction site that could impact stormwater quality and the appropriate skills and training to assess the effectiveness of any stormwater controls selected and installed to meet the requirements of this permit.

Stormwater Control (also referred to as sediment/erosion controls): refers to any temporary or permanent BMP or other method used to prevent or reduce the discharge of pollutants to waters of the state.

Structural BMP: Physical sediment/erosion controls working individually or as a group (treatment train) appropriate to the source, location, and area climate for the pollutant to be controlled. Examples of structural BMPs include silt fences, sedimentation ponds, erosion control blankets, and seeding.

Temporary Stabilization: A condition where exposed soils or disturbed areas are provided temporary vegetation and/or non-vegetative protective cover to prevent erosion and sediment loss. Temporary stabilization may include temporary seeding, geotextiles, mulches, and other techniques to reduce or eliminate erosion until either final stabilization can be achieved or until further construction activities take place to re-disturb this area.

Treatment Train: A multi-BMP approach to managing the stormwater volume and velocity and often includes erosion prevention and sediment control practices often applied when the use of a single BMP is inadequate in preventing the erosion and transport of sediment. A good option to utilize as a corrective action.

Volunteer Vegetation: A volunteer plant is a plant that grows on its own, rather than being deliberately planted for stabilization purposes. Volunteers often grow from seeds that float in on the wind, are dropped by birds, or are inadvertently mixed into soils. Commonly, volunteer vegetation is referred to as 'weeds'. This does not meet the requirements for final stabilization.

Waters of the State: Section 644.016.1(27) RSMo. defines waters of the state as, "All waters within the jurisdiction of this state, including all rivers, streams, lakes and other bodies of surface and subsurface water lying within or forming a part of the boundaries of the state which are not entirely confined and located completely upon lands owned, leased or otherwise controlled by a single person or by two or more persons jointly or as tenants in common."

EXAMPLES OF TYPES; BUT NOT LIMITED TO'S:

Building materials and building products typically present at constructions sites: Asphalt sealants, copper flashing, roofing materials, adhesives, concrete admixtures, and gravel and mulch stockpiles

Construction and domestic (solid) waste: Packaging materials, scrap construction materials, masonry products, timber, pipe and electrical cuttings, plastics, Styrofoam, concrete, demolition debris, and other trash or building materials.

Hazardous or toxic waste that may be present at construction sites: Caulks, sealants, fluorescent light ballasts (mercury), solvents, petroleum-based products, wood preservatives, additives, curing compounds, and acids.

Pollutant-generating activities: Paving operations; concrete, paint, and stucco washout and waste disposal; solid waste storage and

disposal; and dewatering activities.

Types of pollutants typically found at constructions sites: Sediment; nutrients; heavy metals; pesticides and herbicides; oil and grease; bacteria and viruses; trash, debris, and solids; treatment polymers; and any other toxic chemicals.

BMPs for Erosion Control: Temporary/permanent seeding, hydroseeding, mulch and hydromulch, erosion control blankets, dust control, sodding, slope protection, and preservation of existing vegetation.

BMPs for Sediment Control: Fabric drop inlet protection, excavated drop inlet protection, block and gravel inlet protection, domed inlet protection, inlet bag or insert, silt fence, temporary diversion, right-of-way/diversion bar, temporary slope drain, subsurface drain, rock outlets, berms, filter socks, transition mats, temporary sediment trap, energy dissipaters, rock check dam, ditch checks, wattles, straw bale barrier, vegetative buffer strip, sediment basin, particle curtains, frog logs, and dispersion fields.

ePermitting for Land Disturbance

In order to apply for the states MO-RA land disturbance permit you will need to utilize the Department's online ePermitting system. In order to access this, you will need to register an account with the Missouri Gateway for Environmental Management (MoGEM). The following user guides will assist you with this process.

MoGEM Website:**https://dnr.mo.gov/data-e-services/missouri-gateway-environmental-management-mogem**
ePermitting Website: https://dnr.mo.gov/data-e-services/water/electronic-permitting-epermitting
How to Register: https://dnr.mo.gov/document-search/registering-new-user-account-within-missouri-gateway-environmental-management-mogem-portal
ePermitting User Guides: (found on ePermitting website)
- How to Add a Facility: https://dnr.mo.gov/document-search/epermitting-chapter-2-home-facility-search-associate-new-facility
- How to Apply for a Permit: https://dnr.mo.gov/document-search/epermitting-chapter-3-create-new-permit.

Part I – Basic Permit Information

Facility Type:	Industrial Stormwater; Land Disturbance
Facility SIC Code(s):	1629
Facility Description:	Construction or land disturbance activity (e.g., clearing, grubbing, excavating, grading, filling, and other activities that result in the destruction of the root zone and/or land disturbance activity that is reasonably certain to cause pollution to waters of the state).

This permit establishes a SWPPP requirement for pollutants of concern from all facilities covered under this permit. 10 CSR 20-6.200(7) specifies "general permits shall contain BMP requirements and/or monitoring and reporting requirements to keep the stormwater from becoming contaminated".

Land disturbance activities include clearing, grubbing, excavating, grading, filling and other activities that result in the destruction of the root zone and/or other activities that are reasonably certain to cause pollution to waters of the state.

A Missouri State Operating Permit for land disturbance permit is required for construction disturbance activities of one or more acres, or for construction activities that disturb less than one acre when they are part of a larger common plan of development or sale that will disturb a cumulative total of one or more acres over the life of the project per 10CSR 20-6.200(1)(D)28.

The primary requirement of a land disturbance permit is the development of a SWPPP which incorporates site-specific BMPs to minimize soil exposure, soil erosion, and the discharge of pollutants. The SWPPP ensures the design, implementation, management and maintenance of BMPs in order to prevent sediment and other pollutants from leaving the site.

When it precipitates, stormwater washes over the loose soil on a construction site and various other materials and products being stored outside. As stormwater flows over the site, it can pick up pollutants like sediment, debris, and chemicals from the loose soil and transport them to nearby storm sewer systems or directly into rivers, lakes, or coastal waters. The Missouri Department of Natural Resources is responsible for ensuring that construction site operators have the proper stormwater controls in place so that construction can proceed in a way that protects your community's clean water and the surrounding environment. One way the department helps protect water quality is by issuing land disturbance permits.

Local conditions are not considered when developing conditions for a general permit. A facility may apply for a site-specific permit if they desire a review of site-specific conditions.

CHANGES TO THE RENEWAL OF THIS PERMIT INCLUDE:
While drafting this permit for renewal, the Department hosted three public meetings held on January 27, February 17, and March 9, 2021, which allowed stakeholders to voice concerns about conditions within the permit and submit comments during the period of initial stakeholder involvement. These concerns were taken into consideration when drafting the permit. In addition to these meetings, the Department also held an informal review period for stakeholders to review the draft prior to the 30 day public comment period.

- Updated language throughout the permit to current permit language used by the Department and EPA.
- Added language for emergency related projects.
- Clarified conditions which were ambiguous.
- Reorganized sections/conditions for logical progression.
- Authorized permit transfers and some modifications.
- Sections added for termination procedures, discharges to special streams, and procedures for concrete washout.

PART II – RECEIVING STREAM INFORMATION

APPLICABLE DESIGNATIONS OF WATERS OF THE STATE:
Per Missouri Effluent Regulations (10 CSR 20-7.015), the waters of the state are divided into seven (7) categories. This permit applies to facilities discharging to the following water body categories:

- ✓ Missouri or Mississippi River [10 CSR 20-7.015(2)]
- ✓ Lakes or Reservoirs [10 CSR 20-7.015(3)]
- ✓ Losing Streams [10 CSR 20-7.015(4)]
- ✓ Metropolitan No-Discharge Streams [10 CSR 20-7.015(5)]
- ✓ Special Streams [10 CSR 20-7.015(6)]
- ✓ Subsurface Waters [10 CSR 20-7.015(7)]
- ✓ All Other Waters [10 CSR 20-7.015(8)]

Missouri Water Quality Standards (10 CSR 20-7.031) defines the Clean Water Commission water quality objectives in terms of "water uses to be maintained and the criteria to protect those uses." The receiving stream and/or 1st classified receiving stream's designated water uses shall be maintained in accordance with 10 CSR 20-7.031(24). A general permit does not take into consideration site-specific conditions.

MIXING CONSIDERATIONS:
This permit applies to receiving streams of varying low flow conditions. Therefore, the effluent limitations must be based on the smallest low flow streams considered, which includes waters without designated uses. As such, no mixing is allowed [10 CSR 20-7.031(5)(A)4.B.(I)(a)]. No Zone of Initial Dilution is allowed. [10 CSR 20-7.031(5)(A)4.B.(I)(b)].

RECEIVING STREAM MONITORING REQUIREMENTS:
There are no receiving water monitoring requirements recommended at this time.

PART III – RATIONALE AND DERIVATION OF EFFLUENT LIMITATIONS & PERMIT CONDITIONS

305(B) REPORT, 303(d) LIST, & TOTAL MAXIMUM DAILY LOAD (TMDL):
Section 305(b) of the Federal CWA requires each state identify waters not meeting Water Quality Standards and for which adequate water pollution controls have not been required. Water Quality Standards protect such beneficial uses of water as whole body contact, maintaining fish and other aquatic life, and providing drinking water for people, livestock, and wildlife. The 303(d) report, which includes the 303(d) list, helps state and federal agencies keep track of waters which are impaired but not addressed by normal water pollution control programs.

A TMDL is a calculation of the maximum amount of a given pollutant a body of water can absorb before its water quality is affected. If a water body is determined to be impaired as listed on the 303(d) list, then a watershed management plan will be developed which shall include the TMDL calculation. For facilities with an existing general permit before a TMDL is written on their receiving stream, the Department will evaluate the permit and may require any facility authorized by this general permit to apply for and obtain a site-specific operating permit.

ANTI-BACKSLIDING:
A provision in the Federal Regulations [CWA Section 303(d)(4); CWA Section 402(c); 40 CFR Part 122.44(I)] requires a reissued permit to be as stringent as the previous permit with some exceptions.

✓ Not Applicable: All effluent limitations in this permit are at least as protective as those previously established.

ANTIDEGRADATION:
Antidegradation policies ensure protection of water quality for a particular water body on a pollutant by pollutant basis to ensure Water Quality Standards are maintained to support beneficial uses such as fish and wildlife propagation and recreation on and in the water. This also includes special protection of waters designated as an Outstanding National Resource Water or Outstanding State Resource Water [10 CSR 20-7.031(3)(C)]. Antidegradation policies are adopted to minimize adverse effects on water.

The Department has determined the best avenue forward for implementing the Antidegradation requirements into general stormwater permits is by requiring the appropriate development and maintenance of a SWPPP. The SWPPP must identify all reasonable and effective BMPs, taking into account environmental impacts and costs. This analysis must document why no discharge or no exposure options are not feasible at the facility. This selection and documentation of appropriate control measures will then serve as the analysis of alternatives and fulfill the requirements of the Antidegradation Rule and Implementation Procedure 10 CSR 20-7.031(3) and 10 CSR 20-7.015(9)(A)5.

Any facility seeking coverage under this permit which undergoes expansion or discharges a new pollutant of concern must update their SWPPP and select reasonable and cost effective new BMPs. New facilities seeking coverage under this permit are required to develop a SWPPP including this analysis and documentation of appropriate BMPs. Renewal of coverage for a facility requires a review of the SWPPP to ensure the selected BMPs continue to be appropriate.
✓ Applicable; the facility must review and maintain stormwater BMPs as appropriate.

BENCHMARKS:
When a permitted feature or outfall consists of only stormwater, a benchmark may be implemented at the discretion of the permit writer. Benchmarks require the facility to monitor and, if necessary, replace and update stormwater control measures. Benchmark concentrations are not effluent limitations. A benchmark exceedance, therefore, is not a permit violation; however, failure to take corrective action is a violation of the permit. Benchmark monitoring data is used to determine the overall effectiveness of control measures and to assist the permittee in knowing when additional corrective actions may be necessary to comply with the limitations of the permit.
✓ Not applicable; this facility has stormwater-only outfalls and does not contain numeric benchmarks.

BEST MANAGEMENT PRACTICES:
Minimum site-wide BMPs are established in this permit to ensure all permittees are managing their sites equally to protect waters of the state from certain activities which could cause negative effects in receiving water bodies. If the minimum BMPs are not followed, the facility may violate general criteria [10 CSR 20-7.031(4)]. Statutes are applicable to all permitted facilities in the state; therefore, pollutants cannot be released unless in accordance with RSMo 644.011 and 644.016 (17).

During a short time period, construction sites can contribute more sediment to streams than can be deposited naturally during several decades. The resulting siltation and contribution of other pollutants from construction sites can cause physical, chemical, and biological harm to Missouri's waters. Land disturbance activities, such as clearing and grading the land surface, increases the potential for sediment discharges.

The previous version of this permit contained the majority of the BMPs required in this permit and were found to protect water quality. Additional BMPs were added to improve protections with language taken from the EPA's Construction General Permit.

Language was added for track out to clarify and to combine with the roadway conditions in the previous permit. Preventing sediment from entering roadway inlets will protect water quality. Requirements were added for concrete wash out management. This is a common activity on construction sites which had not been address in the previous permit. Containment of the wash out water will protect waters of the state. This language was adopted from the EPAs Construction General Permit.

This renewal requires certain operators be listed in the SWPPP, this was added to ensure all responsible parties are known to the staff on site in the event there is an environmental issue that needs attention.

Inspection conditions were added to clarify what parts of the site to inspect. By inspecting areas prone to pollution, such as material storage, or location where pollutants are like to leave the site, such as the outfall, there is increased protections to water quality by stopping pollutants before leaving the site, or correcting an issue quickly.

Inspection frequencies were reduced for areas where stabilization has been achieved. It was the permit writer's judgement that stabilized areas do not require inspections at the same frequency as active areas of a site as the stabilization is a BMP to reduce sediment loss. Additional inspections are required for sediment basin dewatering activities during times of dewatering. These activities open the possibility for high volumes of sediment to be discharged into the receiving waters. By inspecting the discharge, the waters shall be better protected. Language was added to add the temporary reduction of inspections for areas that have frozen ground.

Condition was added for stockpile management to add clarity for operators on site. Migration of soil or product from mis-managed piles can enter waters of the state and cause water quality violations. Conditions were added to sediment basin dewater to increase the protection of receiving waters by increasing controls to retain sediment and keep it out of the discharged water.

Language was added to include National and State Resource Waters with added protections. Language for this was taken from the template for Missouri General Permits. These requirements also include waters with impairments for sediment, the pollutant of concern under this permit. Extra protections in these special stream requirements were added to clarify the discharges must be stormwater only.

Language was added to include the encouragement of preserving vegetation, trees, and soil. Clearing reduces the natural uptake of water and nutrients by vegetation and excessive grading can smooth the ground surface, increasing amount and velocity of runoff. Vegetation inhibits erosion as the roots hold the topsoil in place, while leaves protect the surface against rain. Once the vegetative cover is gone, erosion is accelerated. The longer the exposed area is subject to erosive forces, the more severe the effect. Clarification was added to define voluntary vegetation and to explain that these shallow rooted short-lived vegetation is not allowed as permanent stabilization.

CHANGES IN DISCHARGES OF TOXIC POLLUTANT:
This special condition reiterates the federal rules found in 40 CFR 122.44(f) and 122.42(a)(1). In these rules, the facility is required to report changes in amounts of toxic substances discharged. Toxic substances are defined in 40 CFR 122.2 as "…any pollutant listed as toxic under section 307(a)(1) or, in the case of "sludge use or disposal practices," any pollutant identified in regulations implementing section 405(d) of the CWA." Section 307 of the clean water act then refers to those parameters found in 40 CFR 401.15. The permittee should also consider any other toxic pollutant in the discharge as reportable under this condition.

DOMESTIC WASTEWATER, SLUDGE, AND BIOSOLIDS:
Domestic wastewater is defined as wastewater (i.e., human sewage) originating primarily from the sanitary conveyances of bathrooms and kitchens. Domestic wastewater excludes stormwater, animal waste, process waste, and other similar waste.

✓ Not applicable; this permit does not authorize discharge of domestic waste, sludge, or biosolids. This includes discharges to onsite lagoons. If a facility has an onsite lagoon, they may need to obtain a separate general or site specific permit to cover discharges or land application from this structure.

Sewage sludge is solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works; including but not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment process; and material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screening generated during preliminary treatment of domestic sewage in a treatment works. Biosolids are solid materials resulting from domestic wastewater treatment meeting federal and state criteria for productive use (i.e. fertilizer) and after having pathogens removed.

✓ Not applicable; this permit does not authorize discharge or land application of biosolids or sludge. A separate permit must be obtained for these activities, either general or site specific.

EFFLUENT LIMITATION GUIDELINE:
Effluent Limitation Guidelines, or ELGs, are found at 40 CFR 400-499. These are limitations established by the EPA based on the SIC code and the type of work a facility is conducting. Most ELGs are for process wastewater and some address stormwater. All are technology based limitations which must be met by the applicable facility at all times.

✓ The industries covered under this permit have an associated Effluent Limit Guideline (ELG) which is applicable to the stormwater discharges in this permit and is applied under 40 CFR 125.3(a).

ELECTRONIC DISCHARGE MONITORING REPORT (EDMR) SUBMISSION SYSTEM:
The U.S. Environmental Protection Agency (EPA) promulgated a final rule on October 22, 2015, to modernize Clean Water Act reporting for municipalities, industries, and other facilities by converting to an electronic data reporting system. The final rule requires regulated entities and state and federal regulators to use information technology to electronically report data required by the National Pollutant Discharge Elimination System (NPDES) permit program instead of filing paper reports. To comply with the federal rule, the Department is requiring all permittees to begin submitting discharge monitoring data and reports online.

✓ Not applicable; this permit has no limits to report.

GENERAL CRITERIA CONSIDERATIONS:
In accordance with 40 CFR 122.44(d)(1), effluent limitations shall be placed into permits for pollutants determined to cause, have reasonable potential to cause, or to contribute to, an excursion above any water quality standard, including narrative water quality criteria. In order to comply with this regulation, the permit writer has completed a reasonable potential determination on whether discharges have reasonable potential to cause or contribute to an excursion of the general criteria listed in 10 CSR 20-7.031(4). In instances where reasonable potential exists, the permit includes limitations within the permit to address the reasonable potential. In

discharges where reasonable potential does not exist, the permit may include monitoring to later determine the discharge's potential to impact the narrative criteria. Additionally, RSMo 644.076.1, as well as Standard Permit Conditions Part VIII of this permit state it shall be unlawful for any person to cause or allow any discharge of water contaminants from any water contaminant or point source located in Missouri in violation of sections 644.006 to 644.141 of the Missouri Clean Water Law or any standard, rule, or regulation promulgated by the commission.

LAND APPLICATION:
Land application, or surficial dispersion of wastewater and/or sludge, is performed by facilities to maintain a basin as no-discharge. Requirements for these types of operations are found in 10 CSR 20-6.015; authority to regulate these activities is from RSMo 644.026.
✓ Not applicable; this permit does not authorize operation of a surficial land application system to disperse wastewater or sludge.

LAND DISTURBANCE:
Land disturbance, sometimes called construction activities, are actions which cause disturbance of the root layer or soil; these include clearing, grading, and excavating of the land. 40 CFR 122.26(b)(14) and 10 CSR 20-6.200(3) requires permit coverage for these activities. Coverage is not required for facilities when only providing maintenance of original line and grade, hydraulic capacity, or to continue the original purpose of the facility.
✓ Applicable; this permit provides coverage for land disturbance activities. These activities have SWPPP requirements and may be combined with the standard site SWPPP. Land disturbance BMPs should be designed to control the expected peak discharges. The University of Missouri has design storm events for the 25 year 24 hour storm; these can be found at: http://ag3.agebb.missouri.edu/design_storm/comparison_reports/20191117_25yr_24hr_comparison_table.htm; to calculate peak discharges, the website https://www.lmnoeng.com/Hydrology/rational.php has the rational equation to calculate expected discharge volume from the peak storm events.

NUTRIENT MONITORING:
Nutrient monitoring is required for facilities characteristically or expected to discharge nutrients (nitrogenous compounds and/or phosphorus) when the design flow is equal to or greater than 0.1 MGD per 10 CSR 20-7.015(9)(D)8.
✓ This is a stormwater only permit; therefore, it is not subject to provisions found in 10 CSR 20-7.015 per 10 CSR 20-7.015(1)(C).

OIL/WATER SEPARATORS:
Oil water separator (OWS) tank systems are frequently found at industrial sites where process water and stormwater may contain oils and greases, oily wastewaters, or other immiscible liquids requiring separation. Food industry discharges typically require pretreatment prior to discharge to municipally owned treatment works. Per 10 CSR 26-2.010(2)(B), all oil water separator tanks must be operated according to manufacturer's specifications and authorized in NPDES permits per 10 CSR 26-2.010(2) or may be regulated as a petroleum tank.
✓ Not applicable; this permit does not authorize the operation of OWS. The facility must obtain a separate permit to cover operation of and discharge from these devices.

OPERATOR CERTIFICATION REQUIREMENTS:
As per 10 CSR 20-6.010(8) Terms and Conditions of a Permit, permittees shall operate and maintain facilities to comply with the Missouri Clean Water Law and applicable permit conditions and regulations. Operators or supervisors of operations at regulated wastewater treatment facilities shall be certified in accordance with [10 CSR 20-9.020(2)] and any other applicable state law or regulation.
✓ Not applicable; the facilities covered under this permit are not required to have a certified operator.

PERMIT SHIELD:
The permit shield provision of the Clean Water Act (Section 402(k)) and Missouri Clean Water Law (644.051.16 RSMo) provides that when a permit holder is in compliance with its NPDES permit or MSOP, they are effectively in compliance with certain sections of the Clean Water Act and equivalent sections of the Missouri Clean Water Law. In general, the permit shield is a legal defense against certain enforcement actions but is only available when the facility is in compliance with its permit and satisfies other specific conditions, including having completely disclosed all discharges and all facility processes and activities to the Department at time of application. It is the facility's responsibility to ensure that all potential pollutants, waste streams, discharges, and activities, as well as wastewater land application, storage, and treatment areas, are all fully disclosed to the Department at the time of application or during the draft permit review process. Subsequent requests for authorization to discharge additional pollutants or expanded or newly disclosed flows, or for authorization for previously unpermitted and undisclosed activities or discharges, will likely require permit modification or may require the facility be covered under a site specific permit.

PRETREATMENT PROGRAM:
This permit does not regulate pretreatment requirements for facilities discharging to an accepting permitted wastewater treatment facility. If applicable, the receiving entity (the publicly owned treatment works - POTW) must ensure compliance with any effluent limitation guidelines for pretreatment listed in 40 CFR Subchapter N per 10 CSR 20-6.100. Pretreatment regulations per RSMo 644.016 are limitations on the introduction of pollutants or water contaminants into publicly owned treatment works or facilities.

✓ Not Applicable; the facilities covered under this permit are not required to meet pretreatment requirements under an ELG.

PUBLIC NOTICE OF COVERAGE FOR AN INDIVIDUAL FACILITY:
Public Notice of reissuance of coverage is not required unless the facility is a specific type of facility as defined in 10 CSR 20-6.200(1). The need for an individual public notification process shall be determined and identified in the permit [10 CSR 20-6.020(1)(C)5.].

✓ Not applicable; public notice is not required for coverage under this permit to individual facilities. The MGP is public noticed in lieu of individual permit PN requirements.

REASONABLE POTENTIAL ANALYSIS (RPA):
Federal regulation 40 CFR Part 122.44(d)(1)(i) requires effluent limitations for all pollutants which are or may be discharged at a level which will cause or have the reasonable potential to cause or contribute to an in-stream excursion above narrative or numeric water quality standard. In accordance with 40 CFR Part 122.44(d)(iii) if the permit writer determines any given pollutant has the reasonable potential to cause or contribute to an in-stream excursion above the water quality standard, the permit must contain effluent limits for the pollutant.

✓ The permit writer reviewed industry materials, available past inspections, and other documents and research to evaluate general and narrative water quality reasonable potential for this permit. Permit writers also use the Department's permit writer's manual, the EPA's permit writer's manual (https://www.epa.gov/npdes/npdes-permit-writers-manual), program policies, and best professional judgment. For each parameter in each permit, the permit writer carefully considers all applicable information regarding technology based effluent limitations, effluent limitation guidelines, and water quality standards. Best professional judgment is based on the experience of the permit writer, cohorts in the Department and resources at the EPA, research, and maintaining continuity of permits if necessary. For stormwater permits, the permit writer is required per 10 CSR 6.200(6)(B)2 to consider: A. application and other information supplied by the permittee; B. effluent guidelines; C. best professional judgment of the permit writer; D. water quality; and E. BMPs.

SCHEDULE OF COMPLIANCE (SOC):
Per § 644.051, RSMo, a permit may be issued with a Schedule of Compliance (SOC) to provide time for a facility to come into compliance with new state or federal effluent regulations, water quality standards, or other requirements. Such a schedule is not allowed if the facility is already in compliance with the new requirement or if prohibited by other statute or regulation. An SOC includes an enforceable sequence of interim requirements (e.g. actions, operations, or milestone events) leading to compliance with the Missouri Clean Water Law, its implementing regulations, and/or the terms and conditions of an operating permit. *See also* Section 502(17) of the Clean Water Act, and 40 CFR 122.2. For new effluent limitations, the permit may include interim monitoring for the specific parameter to demonstrate the facility is not already in compliance with the new requirement. Per 40 CFR 122.47(a)(1) and 10 CSR 20-7.031(11), compliance must occur as soon as possible. If the permit provides a schedule for meeting new water quality based effluent limits, an SOC must include an enforceable, final effluent limitation in the permit even if the SOC extends beyond the life of the permit.

✓ Not Applicable: This permit does not contain a SOC.

SETBACKS:
Setbacks, sometimes called separation distances, are common elements of permits and are established to provide a margin of safety in order to protect the receiving water and other features from accidents, spills, unusual events, etc. Specific separation distances are included in 10 CSR 20-8 for minimum design standards of wastewater structures. While wastewater is considered separately from stormwater under this permit, the guides and Chapter 8 distances may remain relevant to requirements under this permit if deemed appropriate by the permittee.

✓ Discharge to the watersheds of a Metropolitan No-Discharge Stream (10 CSR 20-7.031 Table F) is authorized by this permit if the discharges are in compliance with 10 CSR 20-7.015(5) and 10 CSR 20-7.031(7). Discharges to these watersheds are authorized for uncontaminated stormwater discharges only.

✓ This permit authorizes stormwater discharges which are located in a way to allow water to be released into sinkholes, caves, fissures, or other openings in the ground which could drain into aquifers (except losing streams) per 10 CSR 20-7.015(7). It is the best professional judgment of the permit writer to allow discharges to losing streams as the effluent is stormwater only.

✓ This permit authorizes stormwater discharge in the watersheds of Outstanding state Resource Waters (OSRW); Outstanding National Resources Waters (ONRW), which includes the Ozark National Riverways and the National Wild and Scenic Rivers System; and impaired waters as designated in the 305(b) report, including the 303(d), list so long as no degradation of water quality occurs in the OSRW and ONRW due to discharges from the permitted facility per 10 CSR 20-7.015(6)(B) and 10 CSR 20-7.031(3)(C).
Additionally, if the facility is found to be causing degradation or contributing to an impairment by discharging a pollutant of concern during an inspection or through complaint investigations, they will be required to become a no discharge facility or obtain a site specific permit with more stringent monitoring and SWPPP requirements. Missouri's impaired waters can be found at https://dnr.mo.gov/water/what-were-doing/water-planning/quality-standards-impaired-waters-total-maximum-daily-loads/impaired-waters. Sites within 1000 feet of a OSRW, ONRW, or water impaired for sediment must operate as a no-discharge facility. These additional protections are borrowed from the USEPA 2021 draft Construction General Permit.

SLUDGE – DOMESTIC BIOSOLIDS:
Biosolids are solid materials resulting from domestic wastewater treatment meeting federal and state criteria for beneficial use (i.e. fertilizer). Sewage sludge is solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works; including, but not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment process; and material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screening generated during preliminary treatment of domestic sewage in a treatment works.
✓ This permit does not authorize discharge or land application of biosolids. Sludge/biosolids is not generated by this industry.

SLUDGE – INDUSTRIAL:
Industrial sludge is solid, semi-solid, or liquid residue generated during the treatment of industrial process wastewater in a treatment works; including, but not limited to, scum or solids removed in primary, secondary, or advanced wastewater treatment process; scum and solids filtered from water supplies and backwashed; and a material derived from industrial sludge.
✓ Not applicable; sludge is not generated by this industry.

SPILL REPORTING:
Any emergency involving a hazardous substance must be reported to the Department's 24 hour Environmental Emergency Response hotline at (573) 634-2436 at the earliest practicable moment after discovery. The Department may require the submittal of a written report detailing measures taken to clean up a spill. These reporting requirements apply when the spill results in chemicals or materials leaving the permitted property or reaching waters of the state. This requirement is in addition to the noncompliance reporting requirement found in Standard Conditions Part I. https://dnr.mo.gov/waste-recycling/investigations-cleanups/environmental-emergency-response.

Underground and above ground storage devices for petroleum products, vegetable oils, and animal fats may be subject to control under federal Spill Prevention, Control, and Countermeasure Regulation and are expected to be managed under those provisions, if applicable. Substances regulated by federal law under the Resource Conservation and Recovery Act (RCRA) or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) which are transported, stored, or used for maintenance, cleaning or repair shall be managed according to the provisions of RCRA and CERCLA.

STORMWATER POLLUTION PREVENTION PLAN (SWPPP):
In accordance with 40 CFR 122.44(k), BMPs must be used to control or abate the discharge of pollutants when: 1) Authorized under section 304(e) of the Clean Water Act (CWA) for the control of toxic pollutants and hazardous substances from ancillary industrial activities; 2) Authorized under section 402(p) of the CWA for the control of stormwater discharges; 3) Numeric effluent limitations are infeasible; or 4) the practices are reasonably necessary to achieve effluent limitations and standards or to carry out the purposes and intent of the CWA. In accordance with the EPA's *Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites,* (Document number EPA 833-R-06-004) published by the EPA in 2007 https://www.epa.gov/sites/production/files/2015-10/documents/sw_swppp_guide.pdf, BMPs are measures or practices used to reduce the amount of pollution entering waters of the state from a permitted facility. BMPs may take the form of a process, activity, or physical structure. Additionally, in accordance with the Stormwater Management, a SWPPP is a series of steps and activities to 1) identify sources of pollution or contamination, and 2) select and carry out actions which prevent or control the pollution of storm water discharges. Additional information can be found in *Stormwater Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices* (EPA 832-R-92-006; September 1992).

A SWPPP must be prepared if the SIC code for the facility is found in 40 CFR 122.26(b)(14) and/or 10 CSR 20-6.200(2). A SWPPP may be required of other facilities where stormwater has been identified as necessitating better management. The purpose of a SWPPP is to comply with all applicable stormwater regulations by creating an adaptive management plan to control and mitigate stream pollution from stormwater runoff. Developing a SWPPP provides opportunities to employ appropriate BMPs to minimize the risk of pollutants being discharged during storm events. The following paragraph outlines the general steps the permittee should take to determine which BMPs will work to achieve the benchmark values or limits in the permit. This section is not intended to be all encompassing or restrict the use of any physical BMP or operational and maintenance procedure assisting in pollution control. Additional steps or revisions to the SWPPP may be required to meet the requirements of the permit.

Areas which should be included in the SWPPP are identified in 40 CFR 122.26(b)(14). Once the potential sources of stormwater pollution have been identified, a plan should be formulated to best control the amount of pollutant being released and discharged by each activity or source. This should include, but is not limited to, minimizing exposure to stormwater, good housekeeping measures, proper facility and equipment maintenance, spill prevention and response, vehicle traffic control, and proper materials handling. Once a plan has been developed, the facility will employ the control measures determined to be adequate to prevent pollution from entering waters of the state. The facility will conduct inspections of the BMPs to ensure they are working properly and re-evaluate any BMP not achieving compliance with permitting requirements. For example if the BMP being employed is deficient in controlling

stormwater pollution, corrective action should be taken to repair, improve, or replace the failing BMP. If failures do occur, continue this trial and error process until appropriate BMPs have been established.

The EPA has developed factsheets on the pollutants of concern for specific industries along with the BMPs to control and minimize stormwater (https://www.epa.gov/npdes/stormwater-discharges-industrial-activities). Along with EPA's factsheets, the International Stormwater BMP database (https://bmpdatabase.org/) may provide guidance on BMPs appropriate for specific industries.

For new, altered, or expanded stormwater discharges, the SWPPP shall identify reasonable and effective BMPs while accounting for environmental impacts of varying control methods. The antidegradation analysis must document why no discharge or no exposure options are not feasible. The selection and documentation of appropriate control measures shall serve as an alternative analysis of technology and fulfill the requirements of antidegradation [10 CSR 20-7.031(3)].

Alternative analysis evaluation of the BMPs is a structured evaluation of BMPs which are reasonable and cost effective. The alternative analysis evaluation should include practices designed to be: 1) non-degrading; 2) less degrading; or 3) degrading water quality. The glossary of the *Antidegradation Implementation Procedure* defines these three terms. The chosen BMP will be the most reasonable and effective management strategy while ensuring the highest statutory and regulatory requirements are achieved and the highest quality water attainable for the facility is discharged. The alternative analysis evaluation must demonstrate why "no discharge" or "no exposure" is not a feasible alternative at the facility. This structured analysis of BMPs serves as the antidegradation review, fulfilling the requirements of 10 CSR 20-7.031(3) Water Quality Standards and *Antidegradation Implementation Procedure*, Section II.B.

✓ Applicable: A SWPPP shall be developed and implemented for each site and shall incorporate required practices identified by the Department with jurisdiction, incorporate control practices specific to site conditions, and provide for maintenance and adherence to the plan.

UNDERGROUND INJECTION CONTROL (UIC):

The UIC program for all classes of wells in the State of Missouri is administered by the Missouri Department of Natural Resources and approved by EPA pursuant to section 1422 and 1425 of the Safe Drinking Water Act (SDWA) and 40 CFR 147 Subpart AA. Injection wells are classified based on the liquids which are being injected. Class I wells are hazardous waste wells which are banned by RSMo 577.155; Class II wells are established for oil and natural gas production; Class III wells are used to inject fluids to extract minerals; Class IV wells are also banned by Missouri in RSMo 577.155; Class V wells are shallow injection wells; some examples are heat pump wells and groundwater remediation wells. Domestic wastewater being disposed of sub-surface is also considered a Class V well. In accordance with 40 CFR 144.82, construction, operation, maintenance, conversion, plugging, or closure of injection wells shall not cause movement of fluids containing any contaminant into Underground Sources of Drinking Water (USDW) if the presence of any contaminant may cause a violation of drinking water standards or groundwater standards under 10 CSR 20-7.031 or other health-based standards or may otherwise adversely affect human health. If the Department finds the injection activity may endanger USDWs, the Department may require closure of the injection wells or other actions listed in 40 CFR 144.12(c), (d), or (e). In accordance with 40 CFR 144.26, the permittee shall submit a Class V Well Inventory Form for each active or new underground injection well drilled, or when the status of a well changes, to the Missouri Department of Natural Resources, Geological Survey Program, P.O. Box 250, Rolla, Missouri 65402. Single family residential septic systems and non-residential septic systems used solely for sanitary waste and having the capacity to serve fewer than 20 persons a day are excluded from the UIC requirements (40 CFR 144.81(9)).

✓ Not applicable; this permit does not authorize subsurface wastewater systems or other underground injection. These activities must be assessed under an application for a site specific permit. Certain discharges of stormwater into sinkholes may qualify as UIC. It is important the permittee evaluate all stormwater basins, even those holding water; as sinkholes have varying seepage rates. This permit does not allow stormwater discharges into sinkholes. The facility must ensure sinkholes are avoided in the construction process. The State's online mapping resource https://modnr.maps.arcgis.com/apps/webappviewer/index.html?id=87ebef4af15d438ca658ce0b2bbc862e has a sinkhole layer.

VARIANCE:

Per the Missouri Clean Water Law Section 644.061.4, variances shall be granted for such period of time and under such terms and conditions as shall be specified by the commission in its order. The variance may be extended by affirmative action of the commission. In no event shall the variance be granted for a period of time greater than is reasonably necessary for complying with the Missouri Clean Water Law Section 644.006 to 644.141 or any standard, rule, or regulation promulgated pursuant to Missouri Clean Water Law Section 644.006 to 644.141.

✓ Not Applicable: This permit is not drafted under premises of a petition for variance.

WASTELOAD ALLOCATIONS (WLA) FOR LIMITATIONS:

Per 10 CSR 20-2.010(78), the amount of pollutant each discharger is allowed by the Department to release into a given stream after the Department has determined total amount of pollutant which may be discharged into the stream without endangering its water quality. Water quality based maximum daily and average monthly effluent limitations were calculated using methods and procedures outlined in USEPA's Technical Support Document For Water Quality-based Toxics Control (TSD) (EPA/505/2-90-001).

✓ Not applicable; water quality limitations were not applied in this permit.

WATER QUALITY STANDARDS:
Per 10 CSR 20-7.031(4), General Criteria shall be applicable to all waters of the state at all times, including mixing zones. Additionally, 40 CFR 122.44(d)(1) directs the Department to include in each NPDES permit conditions to achieve water quality established under Section 303 of the CWA, including state narrative criteria for water quality.

WHOLE EFFLUENT TOXICITY (WET) TEST:
Per 10 CSR 20-7.031(1)(FF), a toxicity test conducted under specified laboratory conditions on specific indicator organism; and per 40 CFR 122.2, the aggregate toxic effect of an effluent measured directly by a toxicity test. A WET test is a quantifiable method of determining if a discharge from a facility may be causing toxicity to aquatic life by itself, in combination with, or through synergistic responses when mixed with receiving water.
✓ Not applicable: At this time, permittees are not required to conduct a WET test. This permit is for stormwater only.

PART IV – EFFLUENT LIMITATIONS DETERMINATION

EPA Construction General Permit (CGP)
The CGP was used to research and support best professional judgment decisions made in establishing technology-based conditions for this general permit which are consistent with national standards. The permit writer determined the standards established by the CGP are achievable and consistent with federal regulations. Additionally, the conditions reflecting the best practicable technology currently available are utilized to implement the ELG.

In this general permit, technology-based effluent conditions are established through the SWPPP and BMP requirements. Effective BMPs should be designed on a site-specific basis. The implementation of inspections provides a tool for each facility to evaluate the effectiveness of BMPs to ensure protection of water quality. Any flow through an outfall is considered a discharge. Future permit action due to permit modification may contain new operating permit terms and conditions which supersede the terms and conditions, including effluent limitations, of this operating permit.

PART V–REPORTING REQUIREMENTS

SAMPLING:
The permittee is not required to sample stormwater under this permit. The Department may require sampling and reporting as a result of illegal discharges, compliance issues related to water quality concerns or BMP effectiveness, or evidence of off-site impacts from activities at the facility. If such an action is needed, the Department will specify in writing the sampling requirements, including such information as location and extent. If the permittee refuses to perform sampling when required, the Department may terminate the general permit and require the facility to obtain a site-specific permit with sampling requirements.

REPORTING:
There are no reporting requirements for MO-RAxxxxx land disturbance permits. Land disturbance information is best reviewed on an as requested basis and this permit established documents requirements that allow the Department to request and receive needed documentation prior to, during, or after site inspections.

PART VI – RAINFALL VALUES FOR MISSOURI & SURFACE WATER BUFFER ZONES

Knowledge of the 2-year, 24-hour storm event is used in this permit for two main reasons:

1) The design, installation, and maintenance of effective erosion and sediment controls to minimize the discharge of pollutants. These erosion and sediment controls must be designed to capture or treat a 2-year, 24-hour storm event. This includes BMPs and, depending on the acreage of the drainage area, sediment basins.

2) If the seven-day inspection frequency is utilized, an inspection must occur within 48 hours after any storm event equal to or greater than a 2-year, 24 hour storm has ceased.

A 2-year, 24-hour storm event may be determined in two different ways. For site-specific 2-year, 24-hour storm event information utilize the National Oceanic and Atmospheric Administration's National Weather Service Atlas 14 (NOAA Atlas 14) which is located at https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html. This is the most accurate and preferred method for determining the 2-year, 24-hour storm event. In general, this will be the least stringent method. For more information visit; https://www.weather.gov/media/owp/oh/hdsc/docs/Atlas14_Volume8.pdf.

As an alternative to NOAA Atlas 14, a default value may be utilized. The map below provided by the Department represent the most conservative, protective values for default values applicable to Missouri. In general, this will be the most stringent method. This map is based on Technical Paper No. 40 (TP-40). TP-40 provides a map of the continental U.S. for the 2-year, 24-hour storm event. See map below for default values.

Map 1: Default Values for 2-Year, 24-Hour Storm Event for Design of Sediment and Erosion Controls

Legend: Northern Counties (blue): 3.5 inches
Southern Counties (grey): 4 inches

Surface Water Buffer Zones: In order to design controls that match the sediment removal efficiency of a 50-foot buffer, you first need to know what this efficiency is for your site. The sediment removal efficiencies of natural buffers vary according to a number of site-specific factors, including precipitation, soil type, land cover, slope length, width, steepness, and the types of erosion and sediment controls used to reduce the discharge of sediment prior to the buffer. For additional information; https://www.epa.gov/sites/default/files/2017-02/documents/2017_cgp_final_appendix_g_-_buffer_reqs_508.pdf

PART VII – ADMINISTRATIVE REQUIREMENTS

On the basis of preliminary staff review and applicable standards and regulations, the Department, as administrative agent for the Missouri Clean Water Commission, proposes to issue a permit(s) subject to certain effluent limitations, schedules, and special conditions contained herein and within the permit. The proposed determinations are tentative pending public comment.

PUBLIC MEETING:
The Department hosted three public meetings for this permit. The meetings were held on January 27, February 17, and March 9, 2021.

PUBLIC NOTICE:
The Department shall give public notice when a draft permit has been prepared and its issuance is pending. Additionally, public notice will be issued if a public hearing is to be held because of a significant degree of interest or because of water quality concerns related to a draft permit. No public notice is required when a request for a permit modification or termination is denied; however, the requester and facility must be notified of the denial in writing.

The Department must give public notice of a pending permit or of a new or reissued Missouri State Operating Permit. The public comment period is a length of time not less than thirty (30) days following the date of the public notice, during which interested persons may submit written comments about the proposed permit.

For persons wanting to submit comments regarding this proposed permit, please refer to the Public Notice page located at the front of this draft permit. The Public Notice page gives direction on how and where to submit appropriate comments.

- ✓ The Public Notice period for this permit was held from November 5, 2021 and ends December 6, 2021. Two letters were received during the 30 day Public Notice period. The summarized comments from the letter and the Department's responses

to the comments are below and are in reference to the Public Noticed version of this permit. The comments and responses to the Public Notice of this permit do not warrant the modification of the terms and conditions of this permit.

Letter 1:
Comment #1: Numbering on Page 3 - **there are two #2's**
Response: Thank you, this was corrected.
Comment #2: 2. … If an individual proposes to develop a lot to reside on (**themself**),
Response: This word has been added to add clarity.
Comment #3: Table on Page 3, I. Applicability Section A, #2. The second row, second column is confusing. This second part seems to imply that lots less than 1 acre but not part of a common plan would need a permit if the lot is to be sold. This seems contrary to the one or more acres required for a permit.
Response: The second part was reworded in effort to clarify. The "or if" was changed to "including" to clarify both situations are part of the common plan and would require a permit.
Comment #4: The first part of this section before the semicolon seems incomplete:
Response: The redundant wording was removed to clarify this condition.
Comment #5: There is no #3.
Response: Thank you, this was corrected.
Comment #6: Number 4. Could the impaired water also be on the 303(d) list? Impaired waters are only on the 305(b) list after they have a TMDL written. What about the streams on the 303(d) list that are waiting for a TMDL?
Response: The 303(d) list is a less-encompassing component of the all-encompassing 305(b) Report. The permit has been edited to state "designated in the 305(b) Report, including the 303(d) list," to emphasizing the 303(d) list.
Comment #7: 10. Change the word States to state
Response: This was corrected.
Comment #8: There are 2 (b)s under #1. 1(c). Part VII. should be Part VIII STANDARD PERMIT CONDITIONS
6. Replace the period with a colon after BMPs. "The permittee shall select, install, use, operate and maintain appropriate BMPs for the permitted site. The following manuals are acceptable resources for the selection of appropriate BMPs:"
Response: These corrections were made.
Comment #9: 11(b) 2 and 3. These are missing periods after the word "holiday"
Response: These corrections were made.
Comment #10: V. BMP Requirements (2) Can you define "dripline"
Response: A longer explanation of "dripline" was added to that condition for clarity.
Comment #11: 11.(c)(2) Is this missing a word after "from". In the phrase "discharge points from" ? Perhaps just remove the word "from". The phrase would read "inlets, outlets, and discharge points shall be utilized."
Response: This correction has been made.
Comment #12: Also, the addition of language related to BMPs discussed on page 5 and 6 of the fact sheet are positive additions to the permit and should help guide protection of waters of the state from sediment.
On the top of page 6 of the fact sheet, it appears there is a typo: " Migration of soil or product from mis-managed **plies"**
Response: This correction has been made.

Letter 2:
Comment #1: Define Outfalls.
Response: Outfalls are points with discharges of stormwater from areas associated with the industrial activity for which the facility is permitted; in this case construction. Discerning if certain drains which leave the site would be considered an outfall or not would be specific to each site, in addition to the specific phase of construction. Outfalls on construction sites are often not stationary. An outfall does not need to be a pipe, it can be a ditch, channel, or other conduit that discharges stormwater off the property, and there is no size constraint to outfalls. A definition has been added to the fact sheet to add clarification.
Comment #2: I. Applicability: A. Permit Coverage and Authorized Discharges – Permit numbering is off.
Response: Thank you, this has been corrected.
Comment #3: **I. Applicability: B. Permit Restrictions** – Permit numbering is off.
Response: Thank you, this has been corrected.
Comment #4: 4(c) Discharges from dewatering of sedimentation basins is prohibited. Does this mean direct dumping of dewatering material? Are dewatering controls such as sediment bags, infiltration trenches, or buffer strips allowed?
Response: The definition of no-discharge facility found in 10 CSR 20-6.015 includes the condition "To hold or irrigate, or otherwise dispose without discharge to surface or subsurface waters of the state, all process wastes and associated storm water flows except for discharges that are caused by catastrophic and chronic storm events;". Dewatering controls are allowed so long as they are operated so that the dewatered material and water is not discharged to waters of the state.
Comment #5: 4(c) references 10 CSR 20-6.15(1)B(7). Should this be 10 CSR 20-6.015(1)B(7)?
Response: This has been corrected, thank you.
Comment #6: Could the department please clarify what is meant by a "catastrophic event" referenced in this regulation? The permit design standards are for the 2-year, 24-hour storm.
Response: Catastrophic storm is defined in 10 CSR 20-6.015(1)(B)2 as "A precipitation event of twenty-four (24)-hour

duration or less that exceeds the twenty-five (25)-year, twenty-four (24)-hour storm event." A chronic storm event is defined in 10 CSR 20-6.015(1)(B)3 as "A precipitation event with a duration of more than twenty-four (24) hours that exceeds the one-in-ten (1 in 10)-year return frequency."
This information is found on the National Oceanic and Atmospheric Administration's National Weather Service Atlas 14. A link can be found in the permit part **III. REQUIREMENTS** 4.
Comment #7: IV. SWPPP Management Requirements 1. Multilevel numbering is off.
Response: This has been corrected, thank you.
Comment #8: **VIII. Standard Permit Conditions 2. Land Ownership and Change of Ownership** 2(c) – Please clarify if an individual needs a land disturbance permit for their personal residence if the portion of land sold is equal to or greater than one acre, as it states in the proposed permit, or only if they will be disturbing one acre or greater.
Response: The word 'disturbed' has been included in this portion to add clarity.

DATE OF FACT SHEET: 10/13/2021

COMPLETED BY:
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SECTION 02375 – STONE PROTECTION (RIP-RAP)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rip-rap, bedding, and filter fabric for stone slope protection.

B. Related Requirements:
   1. Section 02300 – Earthwork: Geotextile fabric

PART 2 - PRODUCTS

2.1 MATERIALS

A. Rip-Rap: Stone for rip-rap shall consist of field stone or rough unhewn quarry stone as nearly uniform in section as is practical. Stones shall be dense, resistant to action of air and water, and suitable for purpose intended. Unless otherwise specified, stones shall weigh between 50 and 150 pounds each, and at least 60 percent of stones shall weigh more than 100 pounds each.

B. Bedding Stone: Quarried and crushed angular limestone, 6-inches in depth, and with the following gradation:

Sieve Designation	% By Weight Passing Square Mesh Sieves
3”	100
1-1/2”	50-80
3/4”	20-60
No. 4	0-15
No. 200	0-5

C. Filter Fabric: Geotextile fabric shall be as specified in Section 02340 and as detailed on Construction Drawings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Start stabilization only when weather and soil conditions are favorable for successful application of proposed material.

B. Notify Owner of unexpected subsurface conditions. Discontinue affected work in area until notified to resume work.

C. Dress slopes and other areas to be protected to line and grade shown on Construction Drawings prior to placing of rip-rap. Undercut areas to receive rip-rap to elevation equal to final elevation less total depth of rip-rap to be placed before placing rip-rap.

D. Correct areas over-excavated in accordance with Section 02300.

E. Remove excess excavated material from site.

3.2 PLACEMENT

A. Place rip-rap in areas where indicated on Construction Drawings.

B. Install filter fabric and bedding stone prior to placement of rip-rap.

C. Place stones so that greater portion of weight is carried by earth and not by adjacent stones. Place stones in single layer with close joints. Upright areas of stone shall make angle of approximately 90 degrees with embankment slope. Place courses from bottom of embankment upward, with larger stones being placed in lower courses. Fill open joints with spalls. Embed stones in embankment as necessary to present uniform top surface such that variation between tops of adjacent stones shall not exceed 3 inches.

3.3 GEOTEXTILE FABRIC AND/OR GEOGRID

A. Place geotextile fabric over subsoil surface, lap edges and ends in accordance with manufacturer's recommendations and as shown on the Drawings.

END OF SECTION

SECTION 02510 - WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Site water piping and fittings including domestic potable waterline and fire protection system supply waterline, valves, and fire hydrants.

B. Related Requirements:
   1. Section 02300 – Earthwork: Trenching, backfill, and compaction for utilities.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American Society of Mechanical Engineers (ASME):
   1. ASME B 16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. ASTM International (ASTM):
   1. ASTM B88 - Seamless Copper Water Tube.
   2. ASTM D1784 - Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
   3. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series).
   4. ASTM D2564 - Poly (Vinyl Chloride) (PVC) Solvent Cement.
   5. ASTM D2672 - Poly (Vinyl Chloride) (PVC) Integrally Molded Bell Ends For Solvent - Cemented Pipe Joints.
   6. ASTM D3139 - Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
   7. ASTM F477 - Elastomeric Gaskets And Lubricant.
   8. ASTM F656 - Poly (Vinyl Chloride) (PVC) Cement Primer.

D. American Water Works Association (AWWA):
   1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
   2. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and other Liquids.
   3. AWWA C116 - Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Watersupply Service.
   4. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
   5. AWWA C153 - Ductile-Iron Compact Fittings for Water Service.
   6. AWWA C504 - Rubber-Seated Butterfly Valves.
   7. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
   8. AWWA C550 - Protective Interior Coatings for Valves And Hydrants.
   9. AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.
   10. AWWA C605 - Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
   11. AWWA C651 - Disinfecting Water Mains.
   12. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches, for Water Distribution.

1.3 SUBMITTALS

A. Furnish 1 copy of results of meter test and hydrostatic pressure test to Owner, Owners Civil Engineering Consultant (CEC), and utility company upon completion of water distribution backfilling operations.

B. Project Record Documents:

1. Disinfection report: Record the following:
   a. Type and form of disinfectant used.
   b. Date and time disinfectant injection start and time of completion.
   c. Test locations.
   d. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
   e. Date and time of flushing start and completion.
   f. Disinfectant residual after flushing in ppm for each outlet tested.
2. Bacteriological report: Record the following:
   a. Date issued, project name, testing laboratory name, address, and telephone number.
   b. Time and date of water sample collection.
   c. Name of person collecting samples.
   d. Test locations.
   e. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
   f. Coliform bacteria test results for each outlet tested.
   g. Certification that water conforms, or fails to conform, to bacterial standards.
   h. Bacteriologist's signature and authority.
3. Accurately record actual locations of piping mains, valves, connections, and top of pipe elevations.
4. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

PART 2 - PRODUCTS

2.1 PIPE

A. Pipe sizes 3-inches and smaller for installation below grade and outside building shall comply with one or combination of following:
   1. PEX: CTS SDR-9, AWWA C904
      a. Fittings: Pack joint brass connections

B. Pipe sizes 4 to 16 inches for installation below grade and outside building shall comply with one or combination of following:
   1. Polyvinyl Chloride (PVC) Water Pipe: Pipe, AWWA C900, rated DR 18 (Class 235), continually marked as required.
      a. Elastomeric gaskets and lubricant: ASTM F477 for smaller pipes.
      b. Pipe joints: Integrally molded bell ends, ASTM D3139.
      c. Fittings: EBAA Iron 2000PV MEGALUG or equivalent restraints wrapped in a 7 mil plastic coating.
      d. Blowoffs: Two pipe joints prior to the blowoff shall be restrained mechanical joints with EBAA 2000PV MEGALUG or equivalent.

2.2 VALVES

A. Gate Valves, 2-Inches and Larger:
   1. Manufacturer and Model: Mueller Resilient Wedge Gate Valves or approved equal.
   2. AWWA C509, iron body, non-rising stem with square nut, single wedge, resilient seat, flanged or mechanical joint ends, control rod, post indicator where indicated on Construction Drawings, extension box and valve key.

B. Ball Valves, 2-Inches and Smaller:
   1. Manufacturer and Model: Mueller Oriseal or approved equal.
   2. Brass body, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA compression inlet end, compression outlet with electrical ground connector, with control rod, extension box and valve key.

C. Butterfly Valves, From 2-Inch to 24-Inch: AWWA C504, Iron body, bronze disc, resilient replaceable seat, water or lug ends, infinite position lever handle.

D. Check Valves, Post Indicator Valves, And Backflow Preventers: Refer to Section 13900 - Fire Suppression.

E. Mark manufacturer's name and pressure rating on valve body.

2.3 FIRE HYDRANTS

A. Fire Hydrants: Type as required by utility company/Local Fire Department and as shown on Construction Drawings.

B. Hydrant Extensions: Fabricate in multiples of 6-inches with rod and coupling to increase barrel length.

C. Hose and Steamer Connections: Match sizes with utility company, with two hose nozzles, one pumper nozzle.

D. Finish: Apply primer and 2 coats of enamel or special coating to color as required by utility company.

2.4 ACCESSORIES

A. Thrust Blocking: Place 3,000 psi concrete to provide sufficient bearing area to transmit unbalanced thrust from bends, tees, caps, or plugs to undisturbed soil without loading undisturbed soil in excess of 2,500 pounds per square foot when water main pressure is 100 psi.

MINIMUM THRUST BLOCKING BEARING AREAS (UNLESS NOTED OTHERWISE ON CONSTRUCTION DRAWINGS)

Pipe Diameter	Tees Sq. Ft	90° Bend Sq. Ft	45° Bend Sq. Ft	22½° Bend Sq. Ft.	11¼° Bend Sq. Ft.	5 5/8 Bend Sq. Ft.	Cap/Plug Sq. Ft.
3"	1.0	1.0	1.0	1.0	1.0	1.0	1.5
4"	1.0	1.0	1.0	1.0	1.0	1.0	2.0
6"	1.5	2.0	1.0	1.0	1.0	1.0	3.0
8"	2.5	3.5	1.8	1.0	1.0	1.0	4.0
10"	4.0	5.5	2.8	1.5	1.0	1.0	6.0
12"	6.0	8.0	4.0	2.0	1.5	1.0	8.5
14"	8.0	11.0	5.5	3.0	2.0	1.5	12.0
16"	10.0	14.2	7.0	4.0	3.0	2.5	15.0
18"	21.0	21.0	12.0	6.0	4.0	3.5	24.0

B. Locked mechanical joint fittings shall be installed where vertical changes in direction are required and, if approved by Owner and governing authority, can be installed in lieu of above thrust blocking requirements.

C. Polyethylene Encasement: Single layer of two ply cross-laminated high density polyethylene encasement per AWWA C105, Section 4.1.2, Type III, Class C (Black), Grade 33, tensile strength 5,000 psi minimum, elongation 100 percent, thickness nominal 0.004 inch (4 mil).

D. Trace Wire: Magnetic detectable conductor, (#12 Copper) brightly colored plastic covering imprinted with “Water Service” in large letters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and depth are as indicated on Construction Drawings.

3.2 PREPARATION

A. Ream pipe and tube ends and remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare pipe for connections to equipment with flanges or unions.

D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.3 TRENCHING AND BEDDING

A. Excavate pipe trench and place bedding material in accordance with Section 02300.

3.4 INSTALLATION – GENERAL

A. Perform installation in accordance with utility company or municipality requirements which shall take precedence over requirements stated herein when difference exists.

3.5 INSTALLATION - PIPE AND FITTINGS

A. Maintain separation of water main from sanitary and storm sewer piping in accordance with state or local codes.

B. Install ductile iron pipe and fittings in accordance with AWWA C600.

C. Install PVC pipe and fittings in accordance with AWWA C605.

D. Ductile iron pipe and fittings shall be installed with polyethylene encasement around the pipe for the entire length of the project except where water main is within steel casing or is concrete encased. Install polyethylene encasement in accordance with AWWA C105, Method A.

E. Install pipe to allow for expansion and contraction without stressing pipe or joints or as specified by pipe manufacturer.

F. Install access fittings in accordance with local codes to permit disinfection of water system performed under this Section.

G. Connections with Existing Pipelines: Where connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions with least interference with operation of existing pipeline and in compliance with local utility company.

H. Form and place concrete for thrust blocks or other specified methods of retainage at each change of direction or end of pipe main.

I. Place pipe to depth in accordance with Section 02300.

J. Backfill trench in accordance with Section 02300.

K. Install trace wire continuous over top of non-metal pipe. Bury a minimum of 6 inches below finish grade, and above pipeline.

3.6 INSTALLATION - VALVES AND HYDRANTS

A. Install gate valves as indicated on Construction Drawings. Support valve on concrete pads with valve stem vertical and plumb. Install valve boxes in manner that will not transmit loads, stress, or shock to valve body. Center valve box over operating nut of valve vertical and plumb. Securely fit valve box together leaving cover flush with finished surface.

B. Install fire hydrant assemblies as indicated on Construction Drawings in vertical and plumb position with steamer/pumper nozzle pointed perpendicular to traffic where hydrant is adjacent to street, roadway, or parking lot drive or toward protected building unless otherwise directed by local authorities. Support hydrant assembly on concrete pad and firmly brace on side opposite inlet pipe against undisturbed soil and concrete blocking. Place minimum of

6-cubic feet of crushed stone or gravel around hydrant base and barrel after thrust blocking has cured at least 24 hours. Maintain vertical position of hydrant backfilling and compacting.

3.7 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Perform disinfection of potable lines in accordance with AWWA C651.

B. Disinfect distribution system with chlorine before acceptance for domestic operation. Chlorine dosage shall be not less than 50 parts per million. Flush lines before introduction of chlorinating materials and after contact period of not less than 24 hours. Flush with clean water after contact period until residual chlorine content is not greater than 1.0 part per million. Flush water discharged from water supply lines or hydrants shall not be allowed to discharge directly onto exposed soil or turf which could result in erosion of soil. If potential for erosion exists at discharge point, measures shall be taken to prevent erosion. Open and close valves in lines being disinfected several times during contact period. After disinfection, take water sample and bacteriological test in accordance with AWWA C651. Do not place distribution system in service until approval is obtained from local governing authorities.

C. Provide a means of neutralizing the super-chlorinated water before releasing into the environment. This may be accomplished by either a method of dechlorinization, direct release into a detention area approved by Owner, or any method acceptable to federal, state, and local codes. Direct release to open ground shall not be allowed, unless contained within an onsite detention facility with 6" permanent storage. In this case, the Contractor shall time the release to assure that no rainstorms are imminent. The intent of this condition is to allow the majority of the chlorine to evaporate into the atmosphere before a rainstorm has the opportunity to wash the residual downstream. Contractor shall not release super-chlorinated water directly into the sanitary sewer system, private or public, nor any storm drain system not directly discharging into the detention facility.

3.8 SERVICE CONNECTIONS

A. Provide water service connection in compliance with utility company requirements including reduced pressure backflow preventer (if required) and water meter with by-pass valves and sand strainer.

3.9 FIELD QUALITY CONTROL

A. Test water distribution system pipe installed below grade and outside building in accordance with the following procedures:
   1. Perform testing of pipe materials, joints, and other materials incorporated into construction of water mains and force mains to determine leakage and water tightness. In the event state or local code requires more stringent test, more stringent test shall take precedence.
   2. Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water. Hydrostatically test at 200 psi, or 50 psi in excess of the system working pressure, whichever is greater, and shall maintain that pressure at +/- 5 psi for 2 hours. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage shall be 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
   3. Provide the completed Contractor’s Material And Test Certificate For Underground Piping included at the end of this Section.

B. Prepare reports of testing activities.
   1. Contractor shall complete Material and Test Certificate for Underground Piping included at the end of this Section. Additionally, contractor shall ensure minimum requirements of applicable AHJs are also performed and recorded.
   2. Report shall include photographs taken by the contractor during testing.

C. The Design Engineer is required to provide certification that the water system has been installed as per the plans and specifications prior to final acceptance. The contractor must adhere to the following requirements in order for the Engineer to provide the required certification.
   1. Provide backfill density test results, as taken by the owner's on site testing laboratory, to the Engineer.

2. Perform required final pressure and leakage testing in accordance with the Contract Documents.
3. Provide written results of the pressure and leakage testing to the Engineer.
4. Provide written results of the bacteriological tests, from an approved laboratory and in a form approved by the state, to the Engineer.

D. Provide an as-built survey of the water system improvements, certified by a licensed surveyor, to the Engineer.

END SECTION

CONTRACTOR'S MATERIAL AND TEST CERTIFICATE FOR UNDERGROUND PIPING

<table>
<tr><td colspan="2">Store Number:
City, ST:</td><td colspan="3">Date:</td></tr>
<tr><td colspan="2">Pipe Type and Class:</td><td colspan="3">Type Joint :</td></tr>
<tr><td rowspan="2">Underground Pipes And Joints</td><td colspan="4">Pipe conforms to NFPA 13/24: □ Yes □ No
Fittings conform to NFPA 13/ 24: □ Yes □ No
If no explain :</td></tr>
<tr><td colspan="4">Joints anchored clamped, strapped, or blocked in accordance with NFPA 13/24: □ Yes □ No
If no, explain:</td></tr>
<tr><td>Test Description</td><td colspan="4"><u>Flushing</u>: Flow the required rate until water is clear and indicated by no collection of foreign material in burlap bags at outlets such as hydrants and blow-offs. Flush at flows not less than 390 gpm for 4 in. pipe, 880 gpm for 6 in. pipe, 1560 gpm for 8 in. pipe, 2440 gpm for 10 in. pipe, and 3520 gpm for 12 in. pipe. When supply cannot produce stipulated flow rates, obtain maximum available.
<u>Hydrostatic</u>: All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200 psi or 50 psi in excess of the system working pressure, whichever is greater, and shall maintain that pressure ±5 psi for 2 hours.
<u>Hydrostatic Testing Allowance</u>: Where additional water is added to the system to maintain the test pressures required by 10.10.2.2.1, the amount of water shall be measured and shall not exceed the limits of the equation in the Leakage Test section.</td></tr>
<tr><td rowspan="2">Flushing Test</td><td colspan="4">New underground piping and lead in flushed according to NFPA 13/24: □ Yes □ No
If no, explain :</td></tr>
<tr><td colspan="2">How flushing flow was obtained:
Public water □
Tank or Reservoir □
Fire pump □</td><td colspan="2">Through what type opening:
Hydrant butt □
Open pipe □</td></tr>
<tr><td>Hydrostatic Test</td><td colspan="2">All new underground piping hydrostatically tested at _____ psi for _____ hours.
If no, explain:</td><td colspan="2">Joints Covered: □ Yes □ No</td></tr>
<tr><td>Leakage Test</td><td colspan="2">$L = \frac{SD\sqrt{P}}{148,000}$

L= testing allowance, gal per hr
S= length of pipe, ft
D= nominal diameter of pipe, in.
P= Avg test pressure during hydrostatic test, psi</td><td colspan="2">$L = \frac{(\_\_\_\_\_\ ft)\times(\_\_\_\_\_\ in)\times\sqrt{(\_\_\_\_\_)}}{148,000}\ psi$

L= Allowable leakage: _____gal _____hrs
Leakage measured: _____gal _____hrs
Leakage actual< leakage allowed?
□ Yes □ No</td></tr>
<tr><td rowspan="3">Hydrants</td><td colspan="2">Number installed:</td><td>Manufacturer & Model:</td><td>All operate satisfactorily:
□ Yes □ No</td></tr>
<tr><td colspan="4">Water control valves left wide open: □ Yes □ No
If no, explain:</td></tr>
<tr><td colspan="4">Hose threads of fire department connections and hydrants compatible with AHJ: □ Yes □ No</td></tr>
<tr><td rowspan="4">Signatures</td><td colspan="4">Contractor Firm & Contact Name:</td></tr>
<tr><td colspan="2">Signature:</td><td>Title:</td><td>Date:</td></tr>
<tr><td colspan="2">AHJ Witness:</td><td colspan="2">Representing:</td></tr>
<tr><td colspan="2">Signature:</td><td>Title:</td><td>Date:</td></tr>
</table>

END OF FORM

SECTION 02535 - SANITARY SEWAGE SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sanitary sewer drainage piping, fittings, accessories, cleanouts, and bedding.
2. Connection of site sanitary sewer system to municipal sanitary sewer systems.

B. Related Requirements:
1. Section 02300 – Earthwork: Trenching, backfill, and compaction for utilities
2. Section 02536 - Sewer Manholes, Frames, and Covers

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
1. ASTM A74 - Cast Iron Soil Pipe and Fittings
2. ASTM A746 - Ductile Iron Gravity Sewer Pipe
3. ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings
4. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings
5. ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
6. ASTM D2241 - Poly (vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
7. ASTM D2657 - Heat-Joining Polyolefin pipe and Fittings
8. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
9. ASTM D3035 - Polyethylene (PE) Plastic Pipe Using Flexible Elastomeric Seals
10. ASTM D3139 - Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals
11. ASTM D3212 – Integrally Molded Bell Fittings
12. ASTM D3261 - Butt Heat Fussion Polyethylene (PE) Plastic Fittings For Polyethylene Plastic Pipe And Tubing
13. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe
14. ASTM F1417 - Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.

C. American Water Works Association (AWWA):
1. AWWA C111 - Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
2. AWWA C600 - Ductile-Iron Water Mains And Their Appurtenances
3. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In, For Water Distribution
4. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing And Fittings 1/2 Inch Through 3 Inches, For Water Distribution
5. AWWA C906 - Polyethylene (PE) Pressure Pipe And Fittings, 4 Inch Through 63 Inch, For Water Distribution

1.3 SUBMITTALS

A. Project Record Documents:
1. Accurately record actual locations of pipe runs, connections, cleanouts, and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.
3. Testing Reports for all testing as described herein.

1.4 PROJECT CONDITIONS

A. Coordinate work with termination of sanitary sewer connection outside building and connection to municipal sewer utility service.

PART 2 - PRODUCTS

2.1 SEWER PIPE, FITTINGS, AND JOINTS

A. Polyvinyl Chloride Pipe (PVC): ASTM D 3034, rated SDR 35 unless otherwise specified by the utility company. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification.
   1. Pipe joints: Integrally molded bell ends, ASTM D 3212, Table 2, with factory supplied elastomeric gaskets and lubricant.

B. Force Main:
   1. High-Density Polyethylene Pipe (HDPE): AWWA C901 and C906, ASTM D3035, SDR 11 for 150 psi pressure rating.
      a. Fittings: Molded, AWWA C901 or C906.
      b. Joints: Butt fusion, ASTM D2657, flanged gasket joints at interface
   2. Polyvinyl Chloride Pipe (PVC): For less than 4 inches in diameter, ASTM D2241 for push-on or solvent weld joints, and for pipe 4 inches in diameter and larger, AWWA C900, Class 150 with push-on joints.
      a. Joints/Fittings: Push-on, ASTM D3139 with ASTM F477 gaskets.
      b. Solvent Cement: ASTM D2564.
   3. Ductile Iron Pipe (DIP): ASTM A746, Class 50, inside nominal diameter as shown on the drawings, bell and spigot end.
      a. Ductile Iron Pipe Joint Device: AWWA C111, rubber gasket joint devices.

2.2 PIPE ACCESSORIES

A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene-ribbed gasket for positive seal.

B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps, etc.

2.3 CLEANOUTS AND MANHOLES

A. Manholes shall conform to Section 02536.

B. Lid and Frame: Provide in accordance with Section 02536. Provide traffic grade and rated covers and frames where cleanouts and manholes are within pavement, with the letters “SSCO” or “SANITARY SEWER” respectively cast into the cover.

C. Shaft Construction: Cast iron shaft of internal diameter as specified on Construction Drawings with 2500 psi concrete collar for cleanouts.

2.4 APPURTENANCES

A. Trace Wire: Magnetic detectable conductor (#12 copper), brightly colored plastic covering, imprinted with “Sanitary Sewer Service” in large letters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Construction Drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with bedding material.

B. Remove large stones or other hard matter that could damage pipe or impede consistent backfilling or compaction.

3.3 BEDDING

A. Excavate trench and place bedding material in accordance with Section 02300.

3.4 INSTALLATION - PIPE

A. Install type and class of pipe as shown on the drawings. Pipes shall be laid and maintained to the required line and grade with necessary fittings, bends, manhole risers, cleanouts and other appurtenances placed at the required locations. The pipe shall be installed with uniform bearing under the full length of the barrel of the pipe. The pipe shall be inspected for defects and cracks before being lowered into the trench. Defective, damaged or unsound pipe, or pipe that has had its grade disturbed after laying shall be taken up and replaced. Commence installation at lowest point with the bell end upgrade.

B. No pipe shall be laid in water or when trench conditions are unsuitable for work.

C. Pipe connecting to manholes or other structures shall terminate flush inside of the structure wall.

D. Joints for PVC and CISP shall be thoroughly lubricated with an approved lubricant before pipe sections are slipped together. Open ends shall be fully protected with a stopper to prevent earth or other material from entering the pipe during construction. Carefully free interior of the pipe from dirt, cement and other deleterious material as the work progresses.

E. Maintain separation of potable water main from sewer piping at crossings a minimum of 10 feet horizontal and 18 inches vertical.

F. Install HDPE piping and fittings to AWWA C901 and C906. Butt fusion welded per ASTM D3261.

G. Route pipe in straight line parallel to roads, buildings and adjacent utilities and as shown on the drawings.

H. Establish elevations of buried piping with sufficient cover as recommended by pipe manufacturer to ensure not less than 3 feet of cover, except as noted on drawings.

I. Form and place concrete for thrust blocks at each elbow of pipe force main. See construction drawing for details of construction.

J. Backfill trench in accordance with Section 02300.

K. Install trace wire continuous over top of non-metal pipe. Bury 6 inches minimum below finish grade, above pipeline.

3.5 INSTALLATION – CLEANOUTS AND MANHOLES

A. Form bottom of excavation clean and smooth to correct elevation.

B. For cleanouts, form and place cast-in-place concrete base pad with provision for sanitary sewer pipe to be installed to proper elevations.

C. For manholes, construct inverts according to the following guidelines:
   1. Invert channel shall be smooth and accurately shaped to a semicircular bottom to match with the inside of the adjacent sewer section.
   2. Invert channels and structure bottoms shall be shaped with mortar and lean concrete.
   3. Changes in size and grade of invert shall be made gradually and evenly.

4. Changes in the direction of the sewer entering branch or branches shall have a true curve of as large a radius as the manhole will permit.

D. For manholes, provide manhole rings, frame, and cover as shown on the construction drawings.

3.6 FIELD QUALITY CONTROL

A. Field quality control shall be conducted by the Contractor.

B. Pipes and joints shall not be completely backfilled until after inspection, testing, and approval by the Owner and local jurisdiction.

C. Prior to testing for leakage, the pipe trench shall be backfilled to at least the spring line of the pipe. If required to prevent pipe movement during testing, additional backfill shall be added leaving the pipe joints uncovered to permit inspection.

D. Air Pressure Exfiltration Test: Gravity systems shall be air tested between manholes at 3.5 psi for 5 minutes per ASTM F1417 for plastic pipes.
1. Each section of sewer line between successive manholes shall be tested by plugging the upper and lower ends of the line using pneumatic plugs.
2. The sewer line shall be filled to an air pressure of 4 psi and held for two minutes to allow for stabilization of the air pressure meter. After meter stabilization, the pressure shall be reduced to 3.5 psi and held for 5 minutes per ASTM F-1417 for plastic pipe.
3. The allowable net pressure drop will be 0.5 psi
4. An example Air Pressure Exfiltration Test Report is included in Appendix A. This form contains the minimum air pressure exfiltration testing and reporting standards to meet owner requirements. Contractor shall ensure minimum requirements of applicable AHJs are also performed and recorded.
5. Report shall include photographs taken by the contractor during testing.

E. Deflection Test:
1. Deflection tests shall be conducted on all plastic pipe using a mandrel with a diameter equal to 95 percent of the inside diameter of the pipe. The test shall be performed without mechanical pulling devices.
2. Allowable Deflection: Maximum allowable pipe deflection shall not exceed 5 percent of nominal inside diameter.
3. Mandrel: Mandrel, go/no-go, device shall be cylindrical in shape and constructed with either 9 or 16 evenly spaced arms or prongs. Mandrels with fewer arms will be rejected as not sufficiently accurate. Contact length of mandrel's arms shall equal or exceed nominal inside diameter of sewer to be inspected. Critical mandrel dimensions shall carry tolerance of 0.01-inch maximum. Contractor shall provide mandrel and necessary equipment for mandrel test.
4. Procedure: Mandrel shall be hand-pulled through flexible pipe sewer lines no earlier than 30 days after trench has been completely backfilled. Sections of sewer not passing mandrel shall be uncovered and rebedded, rerounded, or replaced to satisfaction of Owner or governing agency. Repaired section shall be retested.
5. An example Deflection Test Report is included in Appendix A. This form contains the minimum deflection testing and reporting standards to meet owner requirements. Contractor shall ensure minimum requirements of applicable AHJs are also performed and recorded.
6. Report shall include photographs taken by the contractor during testing.

F. Hydrostatic Test: Force main piping shall be hydrostatically tested at 150 psi in accordance with AWWA C 600.

G. Provide measuring devices, meters, water, materials, and labor for making the required tests.

H. Tests shall be conducted in the presence of the Owner or his designee. Test data shall be submitted to the Engineer for review and approval.

I. All testing shall be completed prior to placing any line in service. The contractor shall be responsible for the safety of all participates and shall follow all OSHA mandated guidelines, including those for Confined Space Entries.

J. The Design Engineer is required to provide certification that the sewer system has been installed as per the plans and specifications prior to final acceptance. The contractor must adhere to the following requirements in order for the Engineer to provide the required certification:
    1. Provide backfill density test results, as taken by the owner's on site testing laboratory, to the Engineer.
    2. Perform required final exfiltration and deflection tests in accordance with the Contract Documents.
    3. Provide written results, of all required tests, to the Engineer.

END OF SECTION

APPENDIX A

TESTING REPORT
SANITARY SEWER PIPE
AIR PRESSURE EXFILTRATION TEST

PROJECT NAME: _____

PROJECT LOCATION: _____

INSPECTOR: _____

DATE OF TESTING: _____

MANHOLE # _____ **to MANHOLE #** _____ **TYPE OF PLUGS USED:** _____

PIPE SIZE: _____ **PIPE MATERIAL:** _____ **DISTANCE BETWEEN MANHOLES:** _____

TESTING TIME (MIN): _____ **BEGINNING PRESSURE (PSI):** _____

ENDING PRESSURE (PSI): _____ **AT** _____ **MIN**

NET PRESSURE DROP: _____ **PASS or FAIL (circle one)**

MANHOLE # _____ **to MANHOLE #** _____ **TYPE OF PLUGS USED:** _____

PIPE SIZE: _____ **PIPE MATERIAL:** _____ **DISTANCE BETWEEN MANHOLES:** _____

TESTING TIME (MIN): _____ **BEGINNING PRESSURE (PSI):** _____

ENDING PRESSURE (PSI): _____ **AT** _____ **MIN**

NET PRESSURE DROP: _____ **PASS or FAIL (circle one)**

COMMENTS: _____

_____

_____

_____

SIGNATURE: _____ **DATE:** _____

TESTING REPORT SHEET ___ **OF** ___

TESTING REPORT
SANITARY SEWER PIPE
DEFLECTION TEST

PROJECT NAME: _____

PROJECT LOCATION: _____

INSPECTOR: _____

DATE OF TESTING: _____

MANHOLE # _____ **to MANHOLE #** _____ **PASS or FAIL (circle one)**

MANHOLE # _____ **to MANHOLE #** _____ **PASS or FAIL (circle one)**

MANHOLE # _____ **to MANHOLE #** _____ **PASS or FAIL (circle one)**

MANHOLE # _____ **to MANHOLE #** _____ **PASS or FAIL (circle one)**

MANHOLE # _____ **to MANHOLE #** _____ **PASS or FAIL (circle one)**

MANHOLE # _____ **to MANHOLE #** _____ **PASS or FAIL (circle one)**

MANHOLE # _____ **to MANHOLE #** _____ **PASS or FAIL (circle one)**

MANHOLE # _____ **to MANHOLE #** _____ **PASS or FAIL (circle one)**

COMMENTS: _____

_____

_____

_____

SIGNATURE: _____ **DATE:** _____

TESTING REPORT SHEET ___ OF ___

SECTION 02536 - SEWER MANHOLES, FRAMES, AND COVERS

PART 1 - GENERAL

1.1 SUMMARY

1.2 Section Includes:
1. Monolithic concrete, modular precast concrete, masonry, and precast polyethylene manhole assemblies.

1.3 Related Requirements:
1. Section 02300 - Earthwork. Excavation, backfill, and compaction
2. Section 02535- Sanitary Sewer Systems
3. Section 02630 - Storm Drainage

1.4 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
1. ASTM A48 - Gray Iron Castings.
2. ASTM C55 - Concrete Building Brick.
3. ASTM C94 - Ready Mixed Concrete.
4. ASTM C478 - Precast Reinforced Concrete Manhole Sections.
5. ASTM C990 - Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
6. ASTM D2412 - Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.

C. International Masonry Industry All-Weather Council (IMIAC):
1. Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

D. Occupational Safety and Health Administration (OSHA):
1. OSHA 01926.1153 Respirable Crystalline Silica.

E. Texas Department of Transportation (TXDOT):
1. Standard Specification for Construction and Maintenance of Highways, Streets, and Bridges, 2014 Edition.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Minimize dust emissions and provide equipment that suppresses dust when cutting concrete or masonry.

1.6 SUBMITTALS

A. Shop Drawings: Indicate reference to Construction Drawings of manhole locations, elevations, piping with sizes, locations, and elevations of penetrations.

B. Sanitary Sewer Manhole Vacuum Test Report

PART 2 - PRODUCTS

2.1 MANHOLES

A. Precast Concrete: Reinforced precast concrete barrel.
1. Manhole Sections: ASTM C478.

2. Joints and Joint Sealant: Joint between manhole barrel sections shall conform to ASTM C990 using pre-formed flexible joint sealant.
3. Pipe Connection Sealant: Joint material between manhole barrel and adjoining pipe shall be as shown on the drawings.
4. Construct manholes of precast concrete sections as required by Construction Drawings to size, shape, and depth indicated.

B. Concrete Brick: ASTM C55, Grade N Type I-moisture controlled, normal weight, of same grade, type and weight as block units, nominal modular size of 3 5/8-inches x 7 5/8-inches x 2 1/4-inches.

C. Mortar and Grout: Mortar for finishing and sealing shall be Class "C". Honeycombing less than 2-inches deep shall be repaired using Class "D" mortar.

D. Brick Transition Reinforcement: Formed steel 8-gauge wire with galvanized finish.

E. Configuration:
1. Barrel Construction: Concentric with eccentric cone top section.
2. Shape: Cylindrical.
3. Clear Inside Dimensions: 48-inches diameter minimum or as indicated on Construction Drawings.
4. Design Depth: As indicated on Construction Drawings.
5. Clear Lid Opening: 24-inches minimum
6. Pipe Entry: Provide openings as indicated on Construction Drawings.
7. Main and Lateral Pipes: Neatly cut off main and lateral pipes flush with inside of manhole or inlet where they enter structure walls. Point up irregularities and rough edges with nonshrinking grout.

F. Inverts: Shape inverts for smooth flow across structure floor as indicated on Construction Drawings. Use concrete and mortar to obtain proper grade and contour. Finish surface with fine textured wood float.

2.2 COMPONENTS

A. Lid and Frame:
1. Manufacturer: One of the following or approved equal:
a. Bass & Hays Foundry.
b. Deeter Foundry, Inc.
c. East Jordan Iron Works.
d. Neenah Foundry.
e. U.S. Foundry & Manufacturing
2. ASTM A48, Class 30B minimum, heavy duty cast iron construction, machined flat bearing surface.
3. Removable lid, closed or open as indicated on Construction Drawings, with sealing gasket.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify items specified by other Sections are properly sized and located.

B. Verify that built-in items are in proper location and ready for roughing into work.

C. Verify that the excavation for manholes is correct.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves as indicated on Construction Drawings.

3.3 PRECAST MANHOLE CONSTRUCTION

A. Place base pad to proper elevation and location and trowel top surface level for placement of manhole barrel.

B. Place manhole barrel plumb and level to correct elevations and anchor to base pad.
   1. After completion of slab foundation, lower first joint of manhole barrel into position, grooved end first, and set level and plumb on concrete base. Align and adjust to proper grade prior to placing and forming invert. Pour invert immediately after setting of first section of manhole barrel.
   2. Prior to setting subsequent manhole barrel sections, apply primer to tongue and groove ends and allow to set in accordance with manufacturer's recommendations. Place joint sealant on tongue end. Lower next section into position, and remove excess material from interior of structure. Add additional material on exterior of joint, if necessary, for completely watertight joint.

C. Set cover frames and lids level without tipping, to correct elevations. Utilize pre-cast rings or brick and mortar to achieve final rim elevation. Maximum limit, 4 courses.

3.4 FIELD QUALITY CONTROL

A. Vacuum Test: All manholes shall be vacuum tested in accordance with ASTM C1244-93, Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.
   1. Plug all manhole entrances and exits other than the manhole top access using suitably sized pneumatic or mechanical pipeline plugs and follow all manufacturer's recommendations and warnings for proper and safe installation of such plugs. Plugs should be inserted a minimum of 6" beyond manhole wall.
   2. Install the vacuum tester head assembly at the top access of manhole. (If using a "plate" style manhole tester, position the plate on the manhole ring assembly.)
   3. Attach the vacuum pump assembly to the proper connection on the test head assembly. Make sure the vacuum inlet/outlet valve is in the closed position.
   4. Following safety precautions and manufacturer's instructions, inflate sealing element to the recommended maximum inflation pressure.
   5. Start the vacuum pump and allow pre-set RPM to stabilize.
   6. Open the inlet/outlet ball valve and evacuate the manhole to 10" Hg. (approximately negative 5 psig, 0.3 bar).
   7. Close vacuum inlet/outlet ball valve and monitor vacuum for specified test period (see table). If vacuum does not drop in excess of 1" Hg., manhole is considered acceptable and the manhole passes the test. If manhole fails the test, complete necessary repairs and repeat test procedures until satisfactory results are obtained.
   8. Manholes in asphalted areas cannot be tested until subbase for asphalt has been stabilized.
   9. An example Vacuum Test Report is included in Appendix A. This form contains the minimum vacuum testing and reporting standards to meet owner requirements. Contractor shall ensure minimum requirements of applicable AHJs are also performed and recorded.
   10. Report shall include photographs taken by the contractor during testing.

Depth (ft.)	Diameter (in.)								
	30	33	36	42	48	54	60	66	72
	Times (s)								
8	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	46	51	57
16	22	24	29	34	40	46	52	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	46	55	64	72	79	89
24	33	36	42	51	59	64	78	87	97
26	36	39	46	55	64	75	85	94	105

28	39	42	49	59	69	81	91	101	113
30	42	45	53	65	74	87	98	108	121

END OF SECTION

SECTION 02630 - STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Storm sewer drainage piping, fittings, and accessories.
2. Storm drainage structures.

1.2 Related Requirements:
1. Section 02300 – Earthwork: Excavation, trenching, backfill, and compaction.
2. Section 02370 – Erosion and Sedimentation Control (Including SWPPP).
3. Section 02536 - Sewer Manholes, Frames, and Covers.

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO M 170 – Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
2. AASHTO M 190 - Bituminous Coated Corrugated Metal Culvert Pipe and Arches.
3. AASHTO M 252 - Corrugated Polyethylene Drainage Tubing, 3 to 10 Inch Diameter.
4. AASHTO M 294 - Corrugated Polyethylene Drainage Tubing, 12 to 60 Inch Diameter.
5. AASHTO M 306 - Drainage, Sewer, Utility, and Related Casting
6. AASHTO M 330 - Polypropylene Pipe, 300- to 1500-mm (12- to 60-in) Diameter

C. ASTM International (ASTM):
1. ASTM A 74 - Cast Iron Soil Pipe and Fittings.
2. ASTM A 185 - Steel welded Wire Fabric, Plain, for Concrete Reinforcement.
3. ASTM A 615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
4. ASTM A 674 – Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.
5. ASTM A 760 - Corrugated Steel Pipe, Metallic-Coated For Sewers And Drains.
6. ASTM A 796 - Structural Design Of Corrugated Steel Pipe, Pipe-Arches, And Arches For Storm And Sanitary Sewers And Other Buried Applications.
7. ASTM A 798 - Factory-Made Corrugated Steel Pipe For Sewers And Other Applications.
8. ASTM C 76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
9. ASTM C 150 - Portland Cement.
10. ASTM C 206 - Finished Hydrated Lime.
11. ASTM C 443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
12. ASTM C 564 - Rubber Gasket for Cast Iron Soil Pipe and Fittings.
13. ASTM C 924 - Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
14. ASTM C 969 - Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
15. ASTM C 1628 – Joints for Concrete Gravity Flow Sewer Pipe, Using Rubber Gaskets.
16. ASTM D 2321 - Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications
17. ASTM D 3034 - Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
18. ASTM D 3212 - Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
19. ASTM F 477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
20. ASTM F 949 - Poly (Vinyl Chloride)(PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings.
21. ASTM F 1417 - Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.
22. ASTM F 2306 - 12 to 60 Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.

23. ASTM F 2487 – Infiltration and Exfiltration Acceptance Testing of Installed Corrugated High Density Polyethylene Pipelines.
24. ASTM F 2736 - 6 to 30 in. (152 to 762 mm) Polypropylene (PP) Corrugated Single Wall Pipe and Double Wall Pipe.
25. ASTM F 2764 - 30 to 60 in. Polypropylene (PP) Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications.
26. ASTM F 2881 - 12 to 60 in. Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications

D. American Concrete Institute (ACI):
1. ACI 301 - Structural Concrete for Buildings.

E. UNI-Bell PVC Pipe Association:
1. UNI-B-6 – Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe.

1.4 SUBMITTALS

A. Project Record Documents:
1. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 PROJECT CONDITIONS

A. Coordinate work with termination of storm sewer connection outside building including connection to municipal storm sewer system.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Pipe and joint materials specified below for storm drainage shall be strictly limited to the extent shown or allowed on the drawings or as specified in Part 3 hereinafter.

B. Reinforced Concrete Pipe (RCP): ASTM C 76, Class III unless noted otherwise on Drawings.
1. Joint Material: Provide joints to the extent allowable in Part 3 Joints.
a. Rubber O-ring Gasket: ASTM C 443, ASTM C 1628.
2. Flared End Sections: ASTM C 76 or, for sections with toe wall, AASHTO M 170.

C. High Density Polyethylene Pipe (HDPE): AASHTO M 252 Type S or SP, M 294 Type S or SP, or ASTM F 2306 smooth interior/annular exterior. Use only where specifically indicated on Drawings.
1. Joint Material: As shown in table in Part 3 for the type of joint allowed.
a. Rubber Gasket: ASTM F477
b. Rubber Gasket Joints: ASTM 3212.
c. Corrugated Coupling Bands: As recommended by manufacturer.

D. Polyvinyl Chloride (PVC) Pipe: ASTM D 3034, rated SDR 35, or ASTM F 949 for Profile Pipe, continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D3034 classification. Only permitted when specifically indicated on Drawings. PVC is only permitted in pipes 15” in diameter or less.
1. Joint Material: As shown in table in Part 3 for the type of joint allowed.
a. Rubber Gasket: ASTM F477
b. Rubber Gasket Joints: ASTM 3212.

E. Spiral Rib Metal Pipe: ASTM A760 Type 1R or Type IIR. Coatings shall meet requirements of ASTM A 929 and shall be galvanized, aluminized, or bituminous coated as specified on Drawings. Use only where specifically indicated on Drawings.
1. Pipe gauge shall be as specified on construction drawings or if no gauge is given then the minimum gauges are as follows: 15” to 42” diameter round pipe – 16 gauge (0.064”), 48” to 60” round pipe – 14 gauge

(0.079”), 66” to 78” round pipe – 12 gauge (0.109”), 15” to 30” pipe arch – 16 gauge (0.064”), 36” to 42” pipe arch – 14 gauge (0.079”), and 48” to 78” pipe arch – 12 gauge (0.109”). Gauges for larger diameters shall be indicated on the drawings. Standard corrugated steel pipe (CMP or CSP) shall not be substituted for Spiral Rib Metal Pipe.

2. Acceptable manufacturers: Provide the following or approved equal:
   a. Ultra Flo or Ultra Flo II by Contech, Inc.
   b. Max Flow by Southeast Culvert, Inc.
   c. Max Flow by St. Regis Culvert, Inc.
   d. Max Flow by Thompson Culvert, Inc.
3. Joint Material: Provide joints to the extent allowable in Part 3 Joints.
   a. Semi-corrugated “Hugger” type bands and “O” ring gaskets.

F. Subdrains: Perforated, PVC or flexible corrugated HDPE pipe as specified herein of the size indicated on the drawings.

2.2 ACCESSORIES

A. Encasement for Piping: ASTM A 674. Where required for corrosion protection for underground iron pipe and fittings.
1. Material: High-density, crosslaminated polyethylene (PE) film of 0.004-inch (0.10-mm) minimum thickness.
2. Form: Sheet or tube.
3. Color: Black.

2.3 DRAINAGE STRUCTURES

A. Manholes: Conform to Section 02536.

B. Grates and Frames: Provide in accordance with details shown on Drawings or equivalent by one of the acceptable manufacturers.
1. Acceptable Manufacturers:
   a. Bass & Hays Foundry.
   b. East Jordan Iron Works.
   c. Neenah Foundry.
   d. U.S. Foundry & Manufacturing.

C. Cement Mortar used for paving inverts, filling lift holes, joints, patching and anchoring castings shall consist of one part Portland cement, type I, ASTM C 150, 1/4 part hydrated lime, ASTM C 206 and 2-1/2 parts clean, well-graded sand and water free of suspended matter, alkali, and containing no industrial or domestic waste.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over-excavation with bedding material.

B. Remove large stones or other hard matter that could damage piping or impede consistent backfilling or compaction.

C. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.3 INSTALLATION – PIPE

A. Install type of pipe shown on the drawings. Where type of pipe material is not shown or restricted on the drawings, provide only RCP. Installation provisions herein shall apply to the extent as applicable to the pipe and joints allowed.

B. Inspect pipe for defects and cracks before being lowered into the trench, piece by piece. Remove and replace defective, damaged or unsound pipe or pipe that has had its grade disturbed after laying. Protect open ends with a stopper to prevent earth or other material from entering the pipe during construction. Remove dirt, excess water, and other foreign materials from the interior of the pipe during the pipe laying progress.

C. Excavate pipe trench and place bedding material in accordance with Section 02300.

D. All pipes that penetrate levees, including permanent outlet control devices and temporary discharge pipes from sedimentation basins, shall be constructed in conjunction with fill placement to ensure these drainage devices are properly placed and the surrounding backfill is adequately tied into the basin levee. Trenching of levees is not permitted. All materials in the levee, including bedding materials for the discharge devices, shall be low permeability, cohesive soils. Soil exhibiting high shrink/swell potential or containing greater than 5% organics shall not be used. Contractor shall provide progressive pictures of the pipe installation to the CEC to document the installation. If pictures are not provided to the CEC, the pipe will need to be removed and replaced at no additional cost to Owner while being observed by the CEC.

E. Install pipe in accordance with manufacturer's written recommendations.

F. Thermoplastic Pipe: Install pipe in accordance with pipe manufacturer's installation instructions and ASTM D 2321 and as indicated on the drawings.

G. Spiral Rib Metal Pipe: Install as indicated on the drawings, as recommended by the manufacturer, and in accordance with ASTM A 798 and A 796 as they apply.

H. HDPE Pipe: Install pipe in accordance with pipe manufacturer's installation Guidelines for Culvert Storm Drainage Applications and as indicated on the drawings.

I. Install polyethylene corrosion-protection encasement around iron piping as indicated on the drawings, as recommended by the manufacturer, and in accordance with ASTM A 674.

J. Commence installation at the lowest point for each segment of the route. Lay RCP with the groove or bell end upstream.

K. Lay pipe to the required line and slope gradients with the necessary fittings, bends, manhole, risers and other appurtenances placed at the required location as noted on Drawings.

L. Do not displace or damage pipe when compacting.

M. Do not place pipe in water or when trench conditions are unsuitable for such work.

N. Joints: Construct joints as described herein and in accordance with manufacturer's installation instructions. Provide pipe joint type for silttight or watertight joint performance in accordance with the following table. Rubber gasketed joints shall conform to ASTM D 3212. The table applies only to the extent as applicable to the pipe and joint type and the joint performance as shown or specified.

Pipe and Joint Type	**Joint Performance**		
	Watertight	Silttight	Soiltight
RCP			
Rubber O-Ring Gasket	x	x	x
PP			

Rubber Gasket	x	x	x
HDPE			
Rubber Gasket	x	x	x
Corrugated Coupling Bands			x
PVC			
Rubber Gasket	x	x	x
Spiral Rib Aluminum Pipe			
Hugger Band w/ O Ring Rubber Gasket		x	x

3.4 INSTALLATION – MANHOLES, CATCH BASINS, INLETS, AND JUNCTION BOXES

A. Construct drainage structures in accordance with details shown on Drawings and in accordance with Section 02536 as applicable.

B. Precast Sections:
1. Install precast section with bases in accordance with Section 02300 and 02536 or as shown on drawings.
2. Align pipe openings to that of the pipe entering and leaving the manhole, etc. Properly Pipe with connections to manholes, etc. as shown on the drawings.

C. Invert channels shall be smooth and accurately shaped to a semicircular bottom conforming to the inside of the adjacent sewer section. Shape invert channels and structure bottoms with cement mortar. Changes in size and grade of invert shall be made gradually and evenly. Changes in direction of the sewer entering branch or branches shall have a true curve of as large a radius as the manhole will permit.

D. Frames and Covers:
1. Set frames and covers to the proper elevation. Firmly embed frames in mortar approximately 1 inch thick and align to fit the top section of the structure.
2. Limit bricks set in mortar and used to adjust the frame to finished grade to no more than four courses.
3. Adjustment rings used to make adjustments in grade shall be made with the initial ring embedded in mortar and the exterior of the rings pargeted with mortar not less than 1/2 inch thick. No adjustment made in this manner shall exceed 8 inches.

E. Construct concrete cradles as shown on the drawings and as needed when crossing over and under sewer pipe or utility lines. Concrete shall be 3,000 psi mix with a minimum thickness of 6 inches.

3.5 SUBDRAINS

A. Install subdrains in accordance with the details and at the locations shown on the drawings.

3.6 INSPECTION AND TESTING

A. General:
1. Clean, inspect, and test Strom sewer systems and culverts, upon completion or at such time as directed. The system or culvert shall have a true grade and line. Actual elevations shall be within 0.08 feet of the elevations given on the drawings.
2. After completion of the Work, or any part thereof, the job shall be tested to determine that it has been installed in accordance with the drawings and specifications. In general, the Work shall prove to be in good condition, installed in accordance with the drawings and specifications and ready for use.

B. Cleaning and Testing:
1. Visibly inspect and remove all debris and obstructions from storm pipe.
2. Test watertight joints in accordance with the requirements of jurisdictional authorities, UNI-B-6 and the following:
   a. Option: Test plastic piping according to ASTM F 1417 or ASTM F 2487.
   b. Option: Test concrete piping according to ASTM C 924 or ASTM C 969.

C. Alignment Test: After backfill has been placed and compacted to a depth not less than one foot above top of pipe, a visual inspection shall be made by flashing a light between manholes. Correct displacement or misalignment of invert.

END OF SECTION

SECTION 02715 - BASE COURSE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aggregate base for asphaltic concrete including sand/shell base and hot-mix sand asphalt base.

B. Related Requirements:
   1. Section 02300 – Earthwork: Excavation, Backfill, and Compaction for Pavement subgrade.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
   1. ASTM D698 – Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbs/ft³ (600 kN-m/m³)).
   2. ASTM D1557 – Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbs/ft³ (2,700 kN-m/m³)).
   3. ASTM D6938 – In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

C. Asphalt Institute.

D. Missouri Department of Transportation (MoDOT):
   1. Standard Specification for Highway Construction, Latest Edition.

1.3 SUBMITTALS

A. Submit materials certificate to the Owner, signed by materials producer and Contractor, certifying that materials comply with, or exceed, requirements specified herein or on the Construction Drawings.

B. Submit certification of base course materials and placement as specified in Parts 2 and 3 hereinafter.

1.4 WEATHER LIMITATIONS

A. Do not place aggregate when base surface temperature is less than 40 degrees F, nor when air temperature is below 45 degrees F. Do not place aggregate when surface is wet or frozen. Do not place aggregate when weather conditions are unfavorable otherwise.

PART 2 - PRODUCTS

2.1 BASE COURSE MATERIAL

A. Aggregate Base Course: Aggregate base course shall consist of a well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction. Base course may consist of a granular base (crushed slag, stone, or gravel, etc), sand/shell base material, or a hot-mix sand asphalt base.

B. Base course shall be as shown on the drawings, or when not shown, shall be as specified herein.

C. Aggregate base material requirements from State or other local highway agency specifications may be used for aggregate base course for roads, streets, or similar use pavements if the following conditions are met:
   1. Percentage of material by weight passing the No. 200 sieve will not exceed 10.

2. Portion of the material passing the No. 40 sieve must have a liquid limit not greater than 25 and a plasticity index not greater than 5.

D. Aggregate shall consist of clean, sound, durable particles of crushed stone, crushed slag, crushed gravel, angular sand, or other approved material. Aggregate shall be free of lumps of clay, organic matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve shall be known as coarse aggregate; that portion passing the No. 4 sieve shall be known as fine aggregate.
   1. Coarse aggregates shall be angular particles of uniform density.
   2. Fine aggregates shall be angular particles of uniform density. Fine aggregate shall consist of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.

E. Gradation: Gradation shall be in conformance with the paving section information shown on the construction drawings.

F. Hot-mix Sand Asphalt Bases: Asphalt Institute Type VI, VII, or VIII Mixes for Hot-mix Sand Asphalt Bases. Hot-Mix base shall be used only under asphaltic concrete surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall verify to the Owner in writing that the subgrade has been inspected, tested, and gradients and elevations are correct, dry, and properly prepared in accordance with Section 02300.

3.2 CONSTRUCTION

A. Perform base course construction in accordance with the applicable State standard specifications or as shown or specified.

B. Perform base course construction in a manner that will drain the surface properly and prevent runoff from adjacent areas from draining onto base course construction.

C. Compact base material to not less than 98 percent of optimum density as determined by ASTM D698 unless otherwise indicated on the Drawings.

D. Construct to thickness indicated on Construction Drawings. The minimum base thickness as shown on drawings shall be achieved throughout all pavement areas.
   1. Granular Base: Apply in lifts or layers not exceeding 8-inches, measured loose.
   2. Sand/Shell Base: Apply in lifts or layers not exceeding 4-inches, measured loose.
   3. Hot-mix Sand Asphalt Bases: Apply in lifts or layers not exceeding 3-inches, measured loose.

3.3 FIELD QUALITY CONTROL / TESTING AND INSPECTION (T&I)

A. Field quality control shall be the responsibility of the Contractor. Field quality control testing and inspection shall be at the discretion of the Contractor (except for specified mandatory testing listed below) as necessary to assure compliance with Contract requirements.

B. Mandatory Testing and Inspection:
   1. Measure base course tolerances no more than 25 ft. on center with a rod and level or stringline.
   2. Certify in writing to the Owner that base course placement is in accordance with Contract Document requirements prior to subsequent work thereon.
   3. Density: Nuclear Method, ASTM D6938. One test in each lift for each 20,000 sq. ft. of in-place base material area.
   4. Base Material Thickness: One test for each 20,000 sq. ft. of in-place base material area. All areas tested for thickness shall meet or exceed the base thickness shown on the drawings.

C. Prepare and distribute test reports to Owner.

END OF SECTION

SECTION 02740 - ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Asphalt concrete binder and surface course.

B. Related Requirements:
   1. Section 02300 - Earthwork.
   2. Section 02715 - Base Course.
   3. Section 02765 - Pavement Markings.
   4. Section 02770 - Curbs and Sidewalks.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. The Asphalt Institute (AI):
   1. MS-2 - Mix Design Methods For Asphalt Concrete And Other Hot-Mix Types.

C. Missouri Department of Transportation (MoDOT):
   1. Standard Specification for Highway Construction, Latest Edition.

D. ASTM International (ASTM):
   1. ASTM D1188 - Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.
   2. ASTM D2041 - Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
   3. ASTM D2950 - Density of Bituminous Concrete in Place by the Nuclear Methods.
   4. ASTM D2726 - Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixture.
   5. ASTM D5444 - Mechanical Size Analysis of Extracted Aggregate.

E. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO M017 - Mineral Filler for Bituminous Paving Mixtures.
   2. AASHTO M140 - Emulsified Asphalt.
   3. AASHTO M208 - Cationic Emulsified Asphalt.
   4. AASHTO M320 - Performance-Graded Asphalt Binder
   5. AASHTO M323 - Superpave Volumetric Mix Design
   6. AASHTO T164 - Quantitative Extraction of Asphalt Binder from Hot-Mix Asphalt (HMA)
   7. AASHTO T166 - Bulk Specific Gravity of Compacted Hot-Mix Asphalt Mixtures Using Saturated Surface-Dry Specimens
   8. AASHTO T209 – Theoretical Maximum Specific Gravity and Density of Hot Mix Asphalt (HMA)
   9. AASHTO T275 - Bulk Specific Gravity of Compacted Hot-Mix Asphalt Mixtures Using Paraffin-Coated Specimens
   10. AASHTO T308 - Asphalt Content of Hot-Mix Asphalt (HMA) by the Ignition Method.
   11. AASHTOT312 - Preparing and Determining the Density of Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor.
   12. AASHTO T331 - Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Automatic Vacuum Sealing Method

F. National Asphalt Pavement Association (NAPA):
   1. IS 123 – Recycling Hot-Mix Asphalt Pavements
   2. IS 128 - HMA Pavement Mix Type Selection Guide

G. Occupational Safety and Health Administration (OSHA):

1. OSHA 01926.1153 Respirable Crystalline Silica.

1.3 QUALITY ASSURANCE

A. Pre-installation Meeting: Convene a pre-installation meeting at the site at least two weeks prior to commencing work of this Section. Require attendance of parties directly affecting work of this Section, including, but not limited to, the Owner's representative, Contractor, paving sub-contractor and job foreman.
   1. Contact Owner three weeks prior to pre-installation conference to confirm schedule.
   2. Record discussions of meeting and decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. Review foreseeable methods and procedures related to paving work, including the following:
      a. Review preparation and installation procedures and coordinating and scheduling required with related work.
      b. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
      c. Tour, inspect and discuss condition of subgrade, drainage structures, and other preparatory work.
      d. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
      e. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
      f. Review paving requirements (drawings, specifications and other contract documents).
      g. Review required submittals, both completed and yet to be completed.
      h. Review required inspections, testing procedures.
      i. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
      j. Review safety precautions relating to placement of paving.

1.4 SUBMITTALS

A. Submit mix designs to the Civil Engineering Consultant of Record at least 30 days prior to beginning asphalt paving operations. Mix designs over one year old will not be accepted by Owner. Mix design submittal shall follow the format as recommended by Asphalt Institutes Manual MS-2 and include the following:
   1. Type and Name of mix.
   2. Gradation Analysis.
   3. Optimum asphalt content.
   4. Grade of asphalt binder.
   5. Volumetric properties.
   6. References to local State Highway Department Specification for each material when applicable.

B. Submit approved mix designs and laboratory test results to Owner signed by the materials producer and Contractor certifying materials and mix ratios conform to the requirements specified herein.

C. Submit certification of asphalt placement as specified in Field Quality Control.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Minimize dust emissions or provide equipment that suppresses dust.

1.6 PROJECT CONDITIONS

A. Weather Limitations:
   1. Apply tack coat when ambient or base surface temperature is above 40 F, and when temperature has been above 35 F for 12 hours immediately prior to application. Do not apply when base is wet, contains excess moisture, during rain, or when frozen.
   2. Construct asphalt concrete paving when ambient temperature is above 40 F.

B. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aggregate: Use locally available materials and gradations that meet local State Highway Department Specifications and exhibit satisfactory records of previous installations. All aggregate requirements, including those for quality, shall meet those in AASHTO M323 for the specified traffic level.

B. Asphalt Binder: Asphalt binder shall be a performance-graded (PG) binder, meeting the requirements of M 320, which is appropriate for the climate and traffic-loading conditions at the site of the paving project and in compliance with the local State Highway Department Specifications for that location, or as specified by the contract documents.
   1. Design reliability shall be 85% for the high- and low-temperature performance.
   2. The minimum required PG binder shall be that which satisfies the required design reliability using the pavement temperature data determined.

C. Tack Coat: Emulsified asphalt; AASHTO M140 or AASHTO M208, SS-1h, CSS-1, or CSS-1h, may be diluted with up to 1 part water to 1 part asphalt.

D. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with AASHTO M17, if recommended by local State Highway Department Specifications.

E. Reclaimed Asphalt Pavement (RAP): RAP may be used in amounts not to exceed 20% by wt. The mix design shall contain the percentage of RAP that is to be used in the production. Production procedures using RAP material shall conform to NAPA IS 123. Additional RAP provisions shall be as follows:
   1. Material-handling machinery shall not drive on the RAP stockpiles.
   2. RAP maximum top size aggregate introduced into the mix shall be 1-1/2 inches.
   3. Dust (fines) in the RAP, when added to the virgin aggregate, shall not exceed the requirements of the virgin mix design.
   4. Moisture content shall be monitored to assure that the material can be thoroughly dried as it is processed.
   5. Stockpiles shall be left uncovered or stored under the roof of an open-sided building.
   6. Material handling front-end loader operators shall be experienced in handing RAP materials.
   7. RAP shall be loaded in the cold feed bins in small consistent quantities without causing the material to compact in the bin.
   8. RAP shall not be held in the bin for extended periods of time, especially on hot, humid days.
   9. During production, RAP material shall not be allowed to contact open flame.

2.2 ASPHALT-AGGREGATE MIXTURE

A. Pavement mix shall be in accordance with the DOT Standard Specifications as shown on the construction plans. Reference Paving Sections detail shown on the construction plans for additional information.Superpave Mix:

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that the prepared base material has been inspected, tested, and gradients and elevations are correct, dry, and properly prepared in accordance with Section 02715.

3.2 PREPARATION

A. Proof roll prepared base material surface to check for unstable areas in accordance with Section 02300 including documentation and re-proof rolling as required. Paving work shall begin only after unsuitable areas have been corrected and are ready to receive paving.

B. Establish and maintain required lines and elevations.

C. Cover the surfaces of curbs, gutters, manholes and other structures on which the asphalt concrete mixture will be placed, with a thin, uniform coat of liquid asphalt. Where the asphalt concrete mixture will be placed against the vertical face of an existing pavement, clean the vertical face to remove foreign substances and apply a coating of liquid asphalt at a rate of approximately 0.25 gallons per square yard.

D. Density Control Strips.
1. Prior to beginning placement of asphalt, construct asphalt concrete density control strips.
2. Source and type of material, material requirements, and laydown and compaction equipment used for compaction shall be the same as that to be used in the project.
3. The subgrade or pavement layer upon which the control strip is constructed shall tested prior to construction of the control strip.
4. The control strip shall be a minimum of 250 linear feet long and one paver width wide unless approved in writing by the CEC.
5. Rolling the control strip shall continue until no appreciable increase in density is obtained by additional coverages.
6. Upon completion of rolling, the Contractor shall use a nuclear testing device to establish the mean density of the control strip. The mean density will be based on 10 tests taken at randomly selected sites within the control strip area. The nuclear gauge will be calibrated with the average of 3 cores taken from the same area. The average of the cores shall meet the specified density requirements with no individual test less than 91 percent. The calibration factor between the average nuclear density and average core density shall be applied to the Contractor's nuclear gauge for Contractor's density monitoring.

E. Equipment:
1. Equipment necessary for the paving of asphalt concrete shall be on the project prior to beginning paving operations.
2. Maintain equipment in satisfactory operating condition and correct breakdowns in manner that will not delay or be detrimental to the schedule of paving operations.

3.3 APPLICATION

A. Tack Coat:
1. Apply to contact surfaces of previously constructed asphalt concrete base courses or Portland cement concrete and surfaces abutting or projecting into asphalt concrete or into asphalt concrete pavement.
2. Apply tack coat to asphalt concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat between each lift or layer of full depth asphalt concrete and sand asphalt bases and on surface of bases where asphalt concrete paving will be constructed.
3. Apply at rate which produces a residual of asphalt cement between 0.04 and 0.06 gal per sq. yd of surface.
4. Allow drying until at proper condition to receive paving.

3.4 ASPHALT CONCRETE PLACEMENT

A. Place asphalt concrete mixture on completed, compacted underlying surface, spread, and strike off. Spread mixture at the minimum ambient temperature that will allow the required density to be achieved.

B. Whenever possible, spread pavement by finishing machine; however, inaccessible or irregular areas may be placed by hand methods. Spread hot mixture uniformly to required depth with hot shovels and rakes. After spreading, carefully smooth hot mixture to remove segregated course aggregate and rake marks. Rakes and lutes used for hand spreading shall be type designed for use on asphalt mixtures. Do not dump loads faster that they can be properly spread. Workers shall not stand on loose mixture while spreading.

C. Placement and routing of hauling and placing equipment shall be conducted in a manner to avoid tire tracking of bituminous material onto existing paved surfaces.

D. Paving Machine Placement: Apply successive lifts of asphalt concrete in transverse directions except when placing within small areas, parallel lifts may be placed when considered more practical. Joints of successive parallel lifts

shall be offset a minimum of 2 feet. Place surface course parallel to flow of traffic. Place asphalt paving in typical strips not less than 10'-0" wide. Asphalt concrete pavement, including base and surface course, shall be placed in two or more lifts as indicated on drawings. Pavement thicknesses shall be thickness shown on the drawings for each course but not less than 1-1/2 inch nor more than 3 inches for each lift.

3.5 ROLLING AND COMPACTION

A. After being spread, mixture shall be compacted by rolling as soon as it will bear the weight of rollers without undue displacement. Number, weight, types of rollers, and sequences of rolling operations shall be such that the required density and surface are consistently attained while the mixture is in workable condition.

B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

C. Breakdown Rolling: Perform breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling and repair displaced areas by loosening and filling with hot material.

D. Intermediate Rolling: Follow breakdown rolling as soon as possible while mixture is hot. Continue second rolling until mixture has been thoroughly compacted as follows:
   1. Minimum Average Density: 93 percent of theoretical maximum density according to AASHTO T209 or ASTM D2041, with no individual test less than 91 percent nor greater than 97 percent.

E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked. Any masked or marred finish surfaces shall be repaired or smoothed.

H. Compaction at Unsupported Edges of Pavements: Start the first roller pass 12-15 inches from the unsupported edge. Allow the uncompacted asphalt to act as a dike to hold the mat in place. The final pass over the uncompacted dike should not slough off if the roller is supported on the compacted mat.

3.6 JOINTS

A. General: Place each asphalt paving layer as continuous as possible to keep the number of joints to a minimum. Create joints between old and new pavement, between successive days work, and where the mixture has become cold (less than 140 degrees F). Make these joints in such a manner as to create a continuous bond between the old and new pavement construction courses.

B. Construction joints shall have same texture, density, and smoothness as other sections of asphalt concrete course.

C. Transverse Joints: If placing of material is discontinued or if material in place becomes cold, make a joint running perpendicular to the direction traveled by the paver. Before placement continues, trim the edge of the previously placed pavement to a straight line perpendicular to the paver and cut back to expose an even vertical surface for the full thickness of the course. When placement continues, position the paver on the transverse joint so that sufficient hot mixture will be spread in order to create a joint after rolling that conforms to the required smoothness. If the temperature of the previously placed pavement material drops below 140 degrees F before paving is resumed, give the exposed vertical face a thin coat of liquid asphalt just before paving is continued.

D. Longitudinal Joints: Coat longitudinal joints that are not completed before the previously laid mixture has cooled to a temperature below 140 degrees F, with liquid asphalt just before paving is continued.

3.7 FIELD QUALITY CONTROL / TESTING AND INSPECTION (T&I)

A. Field quality control shall be the responsibility of the Contractor. Field quality control testing and inspection shall be at the discretion of the Contractor (except for specified mandatory testing listed below) as necessary to assure compliance with Contract requirements.

B. Mandatory Testing:
   1. Pavement Thickness: Measure pavement thickness behind the paver at the beginning of and during pavement placing operations to assure proper thickness.
   2. Field Density Test For In-Place Materials: In-place density tests by nuclear method in accordance with ASTM D2950. Nuclear density shall be correlated with ASTM D1188 or D2726 or AASHTO T166, T275, T331 as applicable.
      a. Density tests on subgrades and aggregate base courses to be overlaid by pavements shall be performed within 48 hours prior to placement of the pavement lift. If inclement weather occurs after testing, retest prior to placement of next lift. Testing frequencies shall be as specified in Sections 02300 and 02715 respectively.

C. Areas of deficient paving, including compaction, smoothness, thickness, and asphalt mixture, shall be delineated, removed, and replaced in compliance with specifications requirements. Alternative remedial or corrective measures for repair of deficient paving may be allowed provided a plan of corrective action is submitted in the form of a Request For Information (RFI) and the plan is approved by the CEC.

D. Provide certification in writing that asphalt placement is in accordance with specification requirements.

E. Provide documentation to the Owner of proof rolling and of subgrade and aggregate base compaction testing prior to pavement placement each day in the areas to be paved including the density control strip

F. Surface Smoothness Test: In areas of obvious depressions or bumps, suspect areas of each lift shall be checked with a 10’-0” straightedge both parallel with, and at right angles to, centerline of the paved area. The variation of the surface between two contact points shall not exceed 1/4-inch.

END OF SECTION

SECTION 02751 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Preparation and placement of Portland cement concrete parking areas.
2. Preparation and placement of Portland cement concrete roads and entrances.
3. Aggregate base below slab.

B. Related Requirements:
1. Section 02300 - Earthwork: Excavation, backfill, compaction for subgrades.
2. Section 02765 - Pavement Markings.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American Concrete Institute (ACI):
1. ACI 117 - Tolerances for Concrete Construction and Materials and Commentary.
2. ACI 301 - Structural Concrete.
3. ACI 305.1- Hot Weather Concreting.
4. ACI 306.1- Cold Weather Concreting.
5. ACI 308.1 - Curing Concrete.
6. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary.

C. American Society for Testing and Materials (ASTM):
1. ASTM A 36 - Structural Steel.
2. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
3. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
4. ASTM C31 - Making and Curing Concrete Test Specimens in the Field.
5. ASTM C33 - Concrete Aggregates.
6. ASTM C 39 - Comprehensive Strength of Cylindrical Concrete Specimens.
7. ASTM C42 - Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
8. ASTM C94 - Ready-Mixed Concrete.
9. ASTM C138 - Unit Weight, Yield, and Air Content (Gravemetric) of Concrete.
10. ASTM C143 - Slump of Hydraulic Cement Concrete.
11. ASTM C150 - Portland Cement.
12. ASTM C172 - Sampling Freshly Mixed Concrete.
13. ASTM C231 - Air-Content of Freshly Mixed Concrete by the Pressure Method.
14. ASTM C260 - Air-Entraining Admixtures for Concrete.
15. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
16. ASTM C403 - Time of Setting of Concrete Mixtures by Penetration Resistance
17. ASTM C618 - Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.
18. ASTM C920 - Elastomeric Joint Sealants.
19. ASTM C989 - Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
20. ASTM C1064 - Temperature of Freshly Mixed Portland Concrete Cement.
21. ASTM C1218 - Water-Soluble Chloride in Mortar and Concrete.
22. ASTM C1602 - Mixing Water used in the Production of Hydraulic Cement Concrete.
23. ASTM D98 - Calcium Chloride
24. ASTM D 698 - Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. (2.49 Kg) Hammerand 12-in (305 mm) Drop.
25. ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous).
26. ASTM D1241 - Materials for Soil-Aggregate Subbase, Base and Surface Courses

27. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
28. ASTM D1752: Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
29. ASTM D2628 - Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
30. ASTM D3575: Standard Test Methods for Flexible Cellular Materials Made From Olefin Polymers.

D. Federal Specifications (FS):
1. FS HH-F-341 - Fillers, Expansion Joint: Bituminous (Asphalt & Tar)

E. International Code Council, Inc.:
1. International Building Code (IBC).

F. Missouri Department of Transportation (MoDOT):
~~1.~~ Standard Specification for Highway Construction, Latest Edition.

G. National Ready-Mixed Concrete Association:
1. NRMCA Inspection Standards

1.3 SUBMITTALS

A. Obtain CEC approval for Mix Design and Pavement Joint and Placement Plan prior to commencement of work.

B. Submit submittal items required within this section in a single submittal.

C. Sieve Analysis for Aggregate Base: Submit current sieve analysis report, sampled and tested within the last 60 days of submittal date, for aggregate base and choker material.

D. Concrete Batch Plant Certifications: Submit name and address of the concrete supplier's batch plant and plant certification(s) by National Ready-Mix Concrete Association and/or State Department of Transportation.

E. Mix Design:
1. Fill out and submit attached Concrete Mix Design Submittal Form.
2. Submit three copies of each proposed mix.
3. Submit separate mix design for concrete to be placed by pumping in addition to the mix design for concrete to be placed directly from the truck chute.
4. Submit mix design to the Civil Engineering Consultant of Record.
5. Include applicable information shown on the Mix Design Submittal Form and the following:
   a. Proportions of cementitious materials, fine and coarse aggregate, and water.
   b. Water-cementitious material ratio, 28-day compressive design strength, slump, and air content.
   c. Type of cement, fly ash, slag and aggregate.
   d. Aggregate gradation.
   e. Type and dosage of admixtures.
   f. Special requirements for pumping.
   g. Range of ambient temperature and humidity for which design is valid.
   h. Special characteristics of mix which require precautions in mixing, placing, or finishing techniques to achieve finished product specified.
6. Materials and methods for curing concrete.

F. Attachments to Concrete Mix Design: Submit the following as attachments to be included with the Concrete Mix Design:
1. Cementitious materials mill test reports for the following:
   a. Portland cement
   b. Fly ash
   c. Slag
2. Designation, type, quality, and source (natural or manufactured) of coarse and fine aggregate materials.
3. Sieve Analysis Reports: Provide separate sieve analysis of percentages passing for coarse and fine aggregate. Show values for each sieve size shown on the mix design form. Do not leave any line blank. Sieve

analysis sampling and testing for each aggregate source shall be conducted within 60 days of concrete submittal date.

4. Aggregate Supplier Statement:
   a. Stating if aggregate is possibly alkali-reactive based on tests or past service.
   b. Stating if aggregate can possibly cause pop-outs, "D" cracking, or other disruptions due to moisture gain, freezing, or other mechanisms, based on tests or past service.
5. Product data for the following concrete materials admixtures:
   a. Water reducing
   b. Set retarding
   c. Set accelerating
   d. Data indicating chloride ion content information for each admixture
6. Concrete compressive strength data as required by ACI 318.
7. Concrete supplier approval of mix design.
8. Chloride-Ion Content: Measured water-soluble chloride-ion content (percent by weight of cementitious materials) in accordance with ASTM C1218.
9. Time of Initial Setting: Initial setting time in accordance with ASTM C403.

G. Product Data: Submit certified laboratory test data or manufacturer's certificates and data for the items listed below certifying that materials are in conformance requirements specified herein. Submit to the Civil Engineering Consultant of Record for review and approval and within 7 calendar days after receipt of Notice-to-Proceed.
1. Portland cement concrete mix design(s)
2. Type and source of Portland cement, fly ash, and slag
3. Aggregate gradations
4. Joint back-up material
5. Soft preformed joint filler
6. Pavement joint sealant
7. Dowel bars
8. Tie bars
9. Reinforcing steel bars
10. Welded wire fabric
11. Air entraining admixtures
12. Water-reducing, set-retarding, and set-accelerating admixtures (if used)

H. Pavement Joint and Placement Plan: For projects with all-concrete parking lots, provide a placement plan identifying the items listed below.
1. Concrete truck access location.
2. Extent of placements including width, length, slab placement area and volume.
3. Locations of construction joints.
4. Location of sawn contraction joints if different from those shown on the civil drawings.

I. Delivery Tickets:
1. Copies of delivery tickets for each load of concrete delivered to site.
2. Indicate information required by ASTM C 94 on each ticket including additional information required for slabs.
3. Information on ticket shall include quantities of material batched including the amount of free water in the aggregate and the quantity of water that can be added at the site without exceeding the maximum water cementitious ratio of the approved mix design. Aggregate moisture corrections shall be based on ASTM definitions of aggregate moisture content and absorption.
4. Mix identification number on ticket shall match number on submitted and approved mix design.
5. Submit copies to Owner with each concrete delivery.

J. Installation Certification: Submit certification in writing that final placement is in accordance with specification requirements.

K. Statement of Approval of Concrete Supplier: Submit statement with information specified in Quality Assurance paragraph below.

1.4 QUALITY ASSURANCE

A. Concrete Truck Inspection:
   1. Conform to ASTM C94, NRMCA, and Department of Transportation standards in state where project is located.
   2. Perform inspections immediately before starting concreting operations.
   3. Record acceptable truck numbers.
   4. Record the identification numbers of those trucks found to be acceptable on the basis of inspections.
   5. Do not bring on site for concreting operations, any truck whose identification numbers are not recorded as acceptable. Notify Owner if non-conforming trucks are used to deliver concrete for slabs and pavements.

B. Tolerances:
   1. Conform to most stringent requirements of ACI 117 and ACI 301 except as specified herein.
   2. Thickness Tolerance – The concrete pavement thickness shall meet or exceed the design thickness. All sections not meeting the minimum design thickness (0" minus tolerance) will be unacceptable and shall be removed and replaced at no additional cost to the owner.
   3. Compressive Strength – The specified concrete pavement compressive strength is a minimum requirement. All paving not meeting the minimum compressive strength requirements will be unacceptable and shall be removed and replaced at no additional cost to the Owner.

C. Concrete Supplier Approval:
   1. The concrete supplier shall be fully approved and acceptable by the concrete subcontractor as the producer of concrete for which the subcontractor is to place and finish. Prepare Statement of Approval of Concrete Supplier stating project name, name of concrete supplier, along with the statement of approval and the signatures of the Contractor and concrete pavement subcontractor.

D. Pre-installation Meeting: Convene a pre-installation meeting at the site at least two weeks prior to commencing work of this Section. Require attendance of parties directly affecting work of this Section, including, but not limited to, the Owner's representative, Contractor, concrete sub-contractor and job foreman, concrete supplier, and base fine grading contractor.
   1. Contact Owner Thirty days prior to pre-installation conference to confirm schedule.
   2. Record discussions of meeting and decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. Review foreseeable methods and procedures related to paving work, including the following:
   3. Testing and inspection procedures.
   4. Concrete finishes and finishing.
   5. Cold- and hot-weather concreting procedures.
   6. Curing procedures.
   7. Concrete design mixture and examine procedures for ensuring quality of concrete materials.
   8. Proposed sources of concrete materials, including capabilities and location of plant that will manufacture concrete.
   9. Tour, inspect and discuss condition of subgrade, drainage structures, and other preparatory work.
   10. Requirements for protecting concrete work, including restriction of traffic during installation period and for remainder of construction period.
   11. Review and finalize construction schedule and verify availability of materials.
   12. Concrete paving requirements (drawings, specifications and other contract documents).
   13. Required submittals, both completed and yet to be completed.
   14. Weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
   15. Safety precautions relating to placement of concrete.
   16. Changes to the contract documents from recommendations or discussions at the Pre-Construction meeting shall be approved in writing by the Owner prior to implementation.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Concreting in Hot, Dry, or Windy Weather:
   1. Employ precautions to avoid cracking when the concrete rate of evaporation exceeds 0.1 pounds per square foot per hour or when any combination of concrete materials and weather conditions are favorable for the formation of plastic shrinkage cracks.
   2. Maintain an accurate reading thermometer at the job site to check temperature of concrete.
   3. Reject concrete if more than one slump adjustment, as defined in ASTM C 94, is required.

4. Do not place concrete when forms, subgrade, aggregate base, or reinforcing bars are more than 120 F or the temperature differential between the forms, aggregate base, or reinforcing bars and concrete will create conditions favorable for settlement cracks or thermal cracking.

B. Concreting in Cold Weather:
1. Conform to ACI 306.1 when temperature and other environmental conditions are as noted therein.
2. Subgrade shall be thawed to depth of 12 inches immediately before placing concrete.
3. Measure and record concrete temperature during protection period in each placement at regular time intervals, but not less than 3 times per 24 hour period.
4. Do not place slabs on subgrade or base that is more than 20°F cooler than concrete. Warm subgrade or base to decrease temperature differential to 20 F or less

1.6 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Coat forms with nonstaining type of coating that will not discolor or deface surface of concrete.

B. Aggregate Base and Choker Materials:
1. Aggregate Base Material:
a. Gradation: Conform to gradation shown on the Civil Drawings.
2. Aggregate Choker Material: Clean granular fill with less than 3% clay and/or friable particles. Use one of the following gradations:
a. ASTM 448 No. 10 with 6% to 12% passing No. 200 sieve.
b. Material meeting the following gradation:

Std. Sieve Size	% Passing
No. 4	85-100
No. 8	75-95
No. 16	55-75
No. 50	22-45
No. 100	10-30
No. 200	6-12

C. Reinforcement:
1. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A185. Furnish in flat sheets.
2. Reinforcing Bars: Deformed steel bars, ASTM A615, Grade 60.
3. Joint Dowel Bars: ASTM A615, grade 40 minimum, smooth round plain steel bars, or ASTM A36, smooth round or square plain steel bars, cut bars true to length with ends square and free of burrs.

D. Cementitious Materials:
1. Portland Cement: ASTM C150, Type I, Use only one brand throughout project.
2. Fly Ash: ASTM C 618, Class C or F. Use only one type and source throughout project.
3. Slag: ASTM C989, Grade 100 or 120. Use only one type and source throughout project.

E. Pavement Joint Materials:
1. Joint Back-up Material: Polyethylene foam, 100% closed cell
2. Soft Preformed Joint Filler: Flexible closed-cell non-extruding synthetic foam expansion joint strips.
a. Ceramar Flexibe Foam Expansion Joint, by W.R. Meadows.
b. Deck-O-Foam Expansion Joint Filler, by W.R. Meadows
3. Sealant:

a. Dow 888, by Dow Corning.
b. 301 NS by Pecora.
c. Spectrum 800 or 900 by Tremco.

F. Concrete Aggregate:
1. Conform to ASTM C33.
2. Aggregate shall contain no coal or lignite in concrete that will not be covered by soil.
3. Fine Aggregate:
a. Conform to fine aggregate grading requirements as defined in section 6.1 of ASTM C 33 unless approved by the Civil Engineer.
b. If manufactured sand is used, blend with minimum 25% natural sand unless otherwise approved by Civil Engineer.
4. Coarse Aggregate:
a. Nominal maximum coarse aggregate size shall be 1 inch for slabs ≤ 5-1/2 inch thick.
b. The nominal maximum size of an aggregate is the smallest sieve size through which the major portion of the aggregate must pass, with a minimal amount retained on the maximum sieve size. Maximum 4% shall be retained on the nominal maximum size sieve.
5. Adjust proportions of combined coarse, intermediate, and fine aggregates to provide the following particle size distribution characteristics, unless otherwise approved:
a. Coarseness Factor of 60 to 75%.
1) The Coarseness Factor (CF) is the percent of combined aggregate retained on the #8 sieve that is also retained on the 3/8" sieve.
2) The Coarseness Factor is calculated as follows:
3) CF = Aggregate retained on 3/8" sieve / Aggregate retained on #8 sieve.
b. Adjusted Workability Factor
1) The Workability Factor (WF) is the percent of combined aggregate that passes the #8 sieve.
2) The Adjusted Workability Factor (Adj-WF) is calculated as follows:
3) Adj-WF = WF+[(Cementitious Material -564 lbs.)/37.6]
4) The range of accepted Adj-WF for a given CF is as follows:
5) Adj-WF = [(11.25 - .15 CF) + 33] ± 2.5
6) Combined percent retained on any given sieve size shall not exceed 24%.
6. Gradation requirement of ASTM C33 may be waived in order to meet ranges specified.

G. Water: ASTM C 1602.

H. Air Entrainment: ASTM C260.
1. Air-Mix or AEA-92, by Euclid.
2. MasterAir VR 10, MasterAir AE 90, or MasterAir E 200 by BASF Admixtures.
3. Daravair or Darex Series, by W.R. Grace.
4. Equivalent approved products.

I. Evaporation Retardant: Water-based polymer, sprayable.
1. Euco-Bar, by Euclid
2. MasterKure ER 50 by BASF Admixtures
3. Aquafilm, by Dayton Superior.

J. Liquid Membrane Curing and Sealing Compound: ASTM C 1315, Type I, Class A or B, 25% minimum solids content, clear non-yellowing with no styrene-butadiene.
1. Water Based, VOC less than 350 g/l:
a. Super Aqua Cure, by Euclid Chemical Corp.
b. MasterKure CC 1315WB by BASF Admixtures.
2. Solvent Based (For use below 40F)
a. Super Rez-Seal, by Euclid Chemical Corp.
b. MasterKure CC 300 SB by BASF Admixtures.

2.2 CONCRETE MIX

A. Design mix shall produce normal weight concrete consisting of Portland cement, supplementary cementitious materials, aggregates, admixtures, and water to produce specified requirements.

B. Geographical Weather Exposure Classification: Geographical exposure classification shall be Severe F3 exposure.

C. Compressive Strength at 28 days, unless otherwise indicated on the Drawings:
   1. ACI Exposure Category and classification:
      a. Severe exposure: F3
   2. Compressive Strength: Strength at 28 days, unless otherwise indicated on the Drawings:
      a. Severe exposure classification: 4,000 psi.
   3. Maximum Water-Cementitious Material Ratio (Cement Quantity Includes Fly Ash or slag):
      a. Severe exposure classification: 0.45 by wt.
   4. Slump Range: Slump at the point of placement shall be 2 to 4 inches for hand placed concrete, 1-1/14 to 3 inches for machine placed (slip form) concrete. Maximum slump variance shall be 2 inches.
   5. Air Content: As shown in the table below.

D. Air Entrainment as shown below:

Nominal Maximum Size Aggregate (Inch)	Average Air Content (%)		
	Negligible	Moderate	Severe
3/8	4.5	6.0	7.5
1/2	4.0	5.5	7.0
3/4	3.5	5.0	6.0
1	3.0	4.5	6.0
1-1/2	2.5	4.5	5.5

E. Supplementary Cementitious Materials (SCM):
   1. Concrete mix shall contain SCM at the amounts specified unless other amounts are approved by the Civil Engineer. Either fly ash or ground granulated blast furnace slag (GGBFS) may be used for the SCM but shall not be used together to form a ternary mix. Use of fly ash or GGBFS in the concrete mix is mandatory.
   2. Fly Ash: Substitute fly ash for Portland cement at 15% of the total cementitious content.
      a. If used to mitigate potential aggregate reactivity, only Type F fly ash may be used and shall have the following maximum properties: 1.5% available alkali and 8.0% CaO. When a maximum of 25% replacement is used, up to 10.0% CaO is permitted.
   3. Ground Granulated Blast Furnace Slag (GGBFS): Substitute GGBFS for Portland cement at 20% of the total cementitious content.
      a. If required to mitigate potential sulfate exposure or aggregate reactivity, up to 50% substitution of Portland cement is allowed.
   4. Maintain air-entrainment at specified levels.

F. Calcium Chloride:
   1. Calcium chloride (Type L) may be used in solution form as part of the mixing water to accelerate concrete setting and early-strength development.
   2. Amount of calcium chloride added shall not be more than necessary to produce the desired results and shall not exceed 2% by weight of cement.
   3. The dosage range for the calcium chloride for the entire project shall not vary by more than 1%. Range is defined as the difference between the maximum and minimum dosages of calcium chloride for the entire project.
   4. Calcium chloride shall not be used in the following applications unless approved by the Civil Engineer:
      a. concrete containing embedded dissimilar metals or aluminum
      b. slabs supported on permanent galvanized steel forms
      c. concrete exposed to deicing chemicals
      d. prestressed or post-tension concrete
      e. concrete containing aggregates with potentially deleterious reactivity and concrete exposed to soil
      f. concrete exposed to soil or water containing sulfates.

5. Use calcium chloride in accordance with manufacturer's recommendation.
6. Chloride-ion Concentration: Maximum water-soluble chloride-ion concentrations in hardened concrete at ages from 28 to 42 days contributed from the ingredients including water, aggregates, cementitious materials, and admixtures shall not exceed the following limits unless approved by the Civil Engineer:

Type of Member	Maximum water-soluble chloride ion (Cl-) content in concrete (percent by weight of cement)
Prestressed concrete	0.06
Reinforced concrete exposed to chloride in service	0.15
Reinforced concrete that will be dry or protected from moisture in service	1.00
Other reinforced concrete construction	0.30

7. When using calcium chloride or other admixtures containing chlorides, measure water-soluble chloride-ion content (percent by weight of cement) per ASTM C 1218. Sample shall be from concrete representing the submitted mix design and maximum chloride dosage anticipated for the project.

2.3 MIXING

A. Mix concrete and deliver in accordance with ASTM C 94.

PART 3 - EXECUTION

3.1 PREPARATION

A. Proofroll prepared base material surface to check for unstable areas in accordance with Section 02300 including documentation and re-proof rolling as required. Paving work shall begin only after unsuitable areas have been corrected and are ready to receive paving.

B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.

3.2 AGGREGATE BASE PLACEMENT

A. Unless otherwise specified on the Drawings, place aggregate base as specified herein.

B. Aggregate Base:
1. Install aggregate base where shown on Drawings.
2. Compact to final thickness shown in layers not exceeding 6 inches with minimum of 2 passes per layer with vibratory compactor.
3. Compact fill to 98% of aggregate's Standard Proctor as determined by Method D of ASTM D698.
4. Leave base up to 2 inches low until just prior to concrete placement.

C. Aggregate Base Fine Grading:
1. Compact to final thickness shown with 2 passes minimum vibratory compactor to produce smooth, flat, dense surface.
2. Do not allow excess moisture in or on base at time of placing concrete.
3. Level off aggregate base top surface with a maximum 3/4" thick aggregate choker material to achieve the following:
   a. To reduce surface friction and to meet specified fine grade tolerances specified below.
   b. To level areas exposed to rain, traffic, or excavations for buried utilities.
   c. At areas where aggregate base material does not have sufficient fine particles to produce a surface that is free of exposed aggregate or surface voids greater than 3/8" in size at time of slab installation.
4. Contractor shall verify adequate fines at surface immediately prior to concrete slab placement.
5. Provide dry, smooth, flat, dense surface
6. Proof-roll 48 hrs. maximum prior to concrete placement. Depression under a fully loaded ready mix truck shall not exceed 1/2 inch.

D. Pavement Aggregate Base Fine Grade Tolerance: +0 inch, -3/4 inch with transition no greater than 3/4 inch vertically to 8 inches horizontally.

3.3 INSTALLATION

A. Form Construction
   1. Set forms to required grades and lines, rigidly braced and secured.
   2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place minimum of 24 hours after concrete placement.
   3. Check completed formwork for grade and alignment to following tolerances:
      a. Top of forms not more than 1/8-inch in 10'-0".
      b. Vertical face on longitudinal axis, not more than 1/4-inch in 10'-0".
   4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.

B. Reinforcement: Fasten reinforcing bars or welded wire fabric (if required) accurately and securely in place with suitable supports and ties. Remove from reinforcement all dirt, oil, loose mill scale, rust, and other substances that will prevent proper bonding of the concrete to the reinforcement.

C. Concrete Placement
   1. Mix and place concrete when the air temperature in the shade and away from artificial heat is a minimum of 35 degrees F and rising. Hot and cold weather concreting shall be in accordance with ACI 305.1 (hot weather) and 306.1 (cold weather).
   2. Do not place concrete until base material and forms have been checked for alignment and grade. Concrete shall not be placed around manholes or other structures until they are at required finish elevation and alignment.
   3. Place concrete using methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
   4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place construction joint.

D. Contraction and Construction Joints: Construct contraction and construction joints straight with face perpendicular to concrete surface. Construct transverse joints perpendicular to centerline, unless otherwise detailed.
   1. Contraction Joints: Provide joints at spacing of 12'-0" on centers, maximum each way. Construct control joints for depth equal to at least 1/4 of the concrete thickness, as follows:
      a. Form tooled joints in fresh concrete by grooving top with recommended tool and finishing edge with jointer.
      b. Sawed Contraction Joints:
         1) Use saws, blades, skid plates, and accessories by Soff-Cut International, Inc. or approved equal.
         2) Start cutting sawed joints as soon as concrete has hardened sufficiently to prevent raveling or dislodging of aggregates. This will typically be from 1 hour in hot weather to 4 hours in cold weather after completing finishing of slab in that joint location.
         3) Provide at least two “Soff-Cut” saws on site with blades capable of achieving the required depth of saw cut.
         4) Extend sawed joint to the slab boundaries and abutments, including columns, drains, and other penetrations in the path of a defined joint. Implement methods and timing of the saw cut beyond the limits of the Soff-Cut saw reach to provide a consistent depth of cut with minimal raveling of joint edges.
   2. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for period of more than 1/2 hour. Construct joints in accordance with details shown.

E. Isolation and Fixed Object Joints: Construct joint at locations and in accordance with details shown.

F. Pavement Joint Materials: Place joint fillers, back-up material, and sealants at locations shown and in accordance with manufacturer’s instructions.
   1. Soft Preformed Joint Fillers: Extend preformed joint fillers full-width and depth of joint, and not less than 1/2-inch or more than 1-inch below finished surface. Furnish preformed joint fillers in 1-piece lengths for full width being placed, wherever possible. Where more than 1 length is required, lace or clip preformed joint filler sections together in a single plane.

3.4 CONCRETE FINISHING

A. After initial striking off and consolidating of concrete paving, smooth surface using either a magnesium channel float or magnesium bull float.

B. Round edges of slabs and formed joints to 1/2-inch radius with edging tool. Eliminate tool marks on concrete surface.

C. After completion of straightedge / floating and when excess moisture or surface sheen has disappeared, uniformly finish surface to provide a coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to flow of traffic so as to produce regular corrugations not over 1/16 of an inch deep. Initial nonslip finishing shall be approved by the Owner.

D. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Owner.

3.5 CURING AND PROTECTION

A. Protect and cure finished concrete paving using curing compound. Cure for a period not less than 7 days.

B. Use solvent based curing compound when compound is applied below 40 F.

3.6 CLEANING AND ADJUSTING

A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

3.7 FIELD QUALITY CONTROL / TESTING AND INSPECTION (T&I)

A. Field quality control shall be the responsibility of the Contractor. Field quality control testing and inspection shall be at the discretion of the Contractor as necessary to assure compliance with Contract requirements.

B. Correction of Deficient Work:
   1. When directed by the Owner, remove and replace or repair concrete and related Work which does not conform to specified requirements including strength, tolerances, and finishes.
   2. Bear cost of corrections or delays to other work affected by, or resulting from, corrections to concrete Work.
   3. If results of compressive strength tests reveal deficiencies in concrete, meet requirements of ACI 318 and ACI 301.

END OF SECTION

CONCRETE MIX DESIGN SUBMITTAL FORM
(Section 02751 – Concrete Pavement) Date

PROJECT INFORMATION

PROJECT _____
ADDRESS _____
CITY, ST _____
GENERAL CONTRACTOR
COMPANY _____
JOBSITE PHONE _____

A. CONCRETE INFORMATION

Supplier Mix Design # _____
Design Strength (f'c) _____ psi
Water / Cementitious Ratio _____
Total Air Content _____ %
Total Est. Volume of Concrete _____ CY

Mix Developed From:
☐ Trial Mix Test Data (*attach test data*)
☐ Field Experience

Density
Wet _____ pcf Dry _____ pcf

Slump
" _____ (± 1") **WITHOUT** WR Admixture
" _____ (± 1") **WITH** WR Admixture

LEAVE BLANK FOR STAMP OF APPROVAL BY CONCRETE SUPPLIER AND ENGINEER OF RECORD

B. ADMIXTURE INFORMATION

	ASTM Designation	Product (Manufacturer/Brand)	Dosage (ounces) oz / cy	oz / cwt
Water Reducing				
Accelerating				
Retarding				
Air-Entraining				

C. MIX DESIGN

Mix Proportions (per cubic yard)

	Identification (Type, size, source, etc.)	Weight (pounds)	Density (SSD)	**Volume** (cubic feet)	% Aggregate Absorption

Cement					
Fly Ash					
Slag					
Coarse Aggregate #1					
#2					
#3					
Fine Aggregate #1					
#2					
Water					
Air Content					
	TOTALS				

Coarse & Fine Aggregate Gradation Information

Sieve Size	**% Passing Each Sieve** (All Sieve Sizes must be entered)					Combined % Passing	Combined % Retained	
	Coarse Agg. # 1	Coarse Agg. # 2	Coarse Agg. # 3	Fine Agg. # 1	Fine Agg. # 2		Cumulative	Individual
% of Vol								

Aggregate Ratios

Coarseness Factor =	$\frac{\text{Combined \% cumulative retained 3/8" sieve}}{\text{Combined \% cumulative retained \#8 sieve}}$	=		
Workability Factor =	Combined % passing #8 sieve	=		
Adj-Workability Factor =	WF + [(Cementitious Material - 564) ÷ 37.6]	=		
Allowable Adj-WF=	Adj-WF = [(11.25 - .15 CF) + 33] ± 2.5	=	Low	High

D. **ATTACHMENTS:** Include the following with this Mix Design Report.

- ☐ Portland Cement mill test reports
- ☐ Fly ash mill test reports
- ☐ Slag mill test reports
- ☐ Designation, type, quality, and source (natural or manufactured) of coarse and fine aggregate materials
- ☐ Separate aggregate gradation reports including all required sieve sizes
  - All gradation sieve report tests dated within 60 days of this report
  - Report for each coarse and fine aggregate material in mix
- ☐ Statement if possible reactivity of aggregate, based on tests or past service
- ☐ Statement if possible aggregate pop-outs or their disruptions, based on tests or past service
- ☐ Product data for the following admixtures:
  - Chloride ion data and related calculations
  - Water reducing, set retarding, set accelerating, etc.
- ☐ Measured water-soluble chloride ion content in concrete (percent by weight of cement).
- ☐ Concrete compressive strength data used for standard deviation calculations

E. CONCRETE SUPPLIER INFORMATION

Company Name	_____	Tel. #	( ) _____
Address	_____		
City, ST Zip	_____		
Technical Contact	_____	Cell #	( ) _____
		e-mail	_____
Sales Contact	_____	Cell #	( ) _____

	PRIMARY PLANT	SECONDARY PLANT
Plant Location:		
Miles from Site:		
Travel Time to Site:		
NRMCA Certified:	☐ YES ☐ NO	☐ YES ☐ NO
State DOT Certified:	☐ YES ☐ NO	☐ YES ☐ NO
Batch Mixing Type:	☐ DRY ☐ CENTRAL MIX	☐ DRY ☐ CENTRAL MIX

SECTION 02765 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Painting and marking of pavements, curbs, guard posts, and light pole bases.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American Association of State Highway and Transportation (AASHTO):
   1. AASHTO M247 - Glass Beads Used in Traffic Paints
   2. AASHTO M248 - Ready-Mixed White and Yellow Traffic Paints

C. Master Painter's Institute (MPI):
   1. MPI 32 – Traffic Marking Paint, Solvent Based.
   2. MPI 97 – Traffic Marking Paint, Latex.

D. ASTM International (ASTM):
   1. ASTM D4259 – Standard Practice for Abrading Concrete.
   2. ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness by Notched Gauges.

E. Federal Specifications (FS):
   1. FS A-A-2886 - Paint, Traffic, Solvent Based (supersedes FS TT-P-85 and FS TT-P-115, Type I)
   2. FS TT-B-1325 - Beads (Glass Spheres) Retro-Reflective
   3. FS TT-P-1952 - Paint, Traffic And Airfield Marking, Waterborne

F. The Society for Protective Coatings (SSPC):
   1. SSPC-SP13 – Surface Preparation of Concrete.

1.3 ENVIRONMENTAL REQUIREMENTS

A. Minimize dust emissions and provide equipment that suppresses dust.

B. Dispose of construction waste in accordance with applicable local, state, and federal requirements.

1.4 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Paint shall be waterborne or solvent borne, colors as shown or specified herein. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

B. Waterborne Paint: Paints shall conform to FS TT-P-1952.

C. Solvent Borne Paint: Paint shall conform to FS A-A-2886 or AASHTO M248. Paint shall be non-bleeding, quick-drying, and alkyd petroleum base paint suitable for traffic-bearing surface and be mixed in accordance with manufacturer's instructions before application for colors White, Yellow, Blue, and Red.

D. Glass Beads: AASHTO M 247, Type 1 or FS TT-B-1325, Type 1, Gradation A.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the work area and correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Sweep and clean surface to eliminate loose material and dust.

B. Where existing pavement markings are indicated on Construction Drawings to be removed or would interfere with adhesion of new paint, a motorized abrasive device shall be used to remove the markings. Equipment employed shall not damage existing paving or create surfaces hazardous to vehicle or pedestrian traffic. Within public rights-of-way, appropriate governing authority shall approve method of marking removal.

C. New pavement surfaces shall be allowed to cure for not less than 30 days before application of marking materials.

3.3 CLEANING EXISTING PAVEMENT MARKINGS

A. Remove existing pavement markings which are in good condition but interfere or conflict with the newly applied marking patterns. Deteriorated or obscured markings that are not misleading or confusing or do not interfere with the adhesion of the new marking material do not require removal. Conduct sodium bicarbonate (soda) blasting in such a manner that the finished pavement surface is not damaged or left in a pattern that is misleading or confusing. Use a water mist spray system recommended by the manufacturer for dust suppression when pavement preparation includes soda blasting.

3.4 APPLICATION

A. Apply two coats of same color of paint as specified below, at manufacturer's recommended rate, without addition of thinner, with maximum of 100 square feet per gallon or as required to provide a minimum wet film thickness of 15 mils and dry film thickness of 7 ½ mils per coat. Paint shall be applied for a total dry film thickness of 15 mils. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs and crosswalks, use straightedge to ensure uniform, clean, and straight stripe.

B. Install pavement markings according to manufacturer's recommended procedures for the specified material.

C. Following items shall be painted with colors noted below unless noted otherwise on Construction Drawings:
1. Pedestrian Crosswalks: White
2. Exterior Sidewalk Curbs and Guard posts: Yellow
3. Fire Lanes: Red or per local code
4. Lane Striping where separating traffic moving in opposite directions: Yellow
5. Lane Striping where separating traffic moving in the same direction: White
6. ADA Symbols: Blue or per local code
7. ADA parking space markings as shown on the drawings.
8. Parking Stall Striping: Yellow

D. Apply glass beads at pedestrian crosswalk striping and at lane striping and arrows at driveways connecting to public streets. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

3.5 FIELD QUALITY CONTROL

A. Field quality control shall be the responsibility of the Contractor. Field quality control testing and inspection shall be at the discretion of the Contractor as necessary to assure compliance with Contract requirements.

3.6 CLEANING

A. Waste materials shall be removed at the end of each workday. Upon completion of the work, all containers and debris shall be removed from the site. Paint spots upon adjacent surfaces shall be carefully removed by approved procedures that will not damage the surfaces and the entire job left clean and acceptable.

END OF SECTION

SECTION 02770 - CURBS AND SIDEWALKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Portland cement concrete curbs, gutters, and sidewalks except sidewalks adjacent to building.

B. Related Requirements:
   1. Section 02300 - Earthwork: Preparation of subgrades.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American Concrete Institute (ACI):
   1. ACI 305R - Hot Weather Concreting
   2. ACI 306R - Cold Weather Concreting
   3. ACI 306.1 - Standard Specifications for Cold Weather Concreting.
   4. ACI 308 - Standard Specifications for Curing Concrete

C. ASTM International (ASTM):
   1. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
   2. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.
   3. ASTM C31 - Making and Curing Concrete Test Specimens in the Field.
   4. ASTM C39 - Comprehensive Strength of Cylindrical Concrete Specimens.
   5. ASTM C42 - Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   6. ASTM C94 - Ready-Mixed Concrete.
   7. ASTM C138 - Test Method for Unit Weight, Yield, and Air Content (Gravemetric) of Concrete.
   8. ASTM C143 - Slump of Hydraulic Cement Concrete.
   9. ASTM C231 - Air-Content of Freshly Mixed Concrete by the Pressure Method.
   10. ASTM C172 - Sampling Freshly Mixed Concrete.
   11. ASTM C173 - Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
   12. ASTM C260 - Air-Entraining Admixtures for Concrete.
   13. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
   14. ASTM C618 - Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.
   15. ASTM C989 - Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
   16. ASTM C1064 - Temperature of Freshly Mixed Portland Concrete Cement.
   17. ASTM C1218 - Water-Soluble Chloride in Mortar and Concrete.
   18. ASTM D98 - Calcium Chloride.
   19. ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous).
   20. ASTM D1190 - Concrete Joint Sealer, Hot Poured, Elastic Type.
   21. ASTM D1751 - Performed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
   22. ASTM D2628 - Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

D. Federal Specifications (FS):
   1. FS HH-F-341 - Fillers, Expansion Joint: Bituminous (Asphalt & Tar)

E. Missouri Department of Transportation (MoDOT)::
   1. Standard Specification for Highway Construction, Laest Edition.

1.3 SUBMITTALS

A. Mix Design:

1. Fill out and submit attached Concrete Mix Design Submittal Form.
2. Submit three copies of each proposed mix.
3. Submit separate mix design for concrete to be placed by pumping in addition to the mix design for concrete to be placed directly from the truck chute.
4. Submit mix design to the Civil Engineering Consultant of Record.
5. Include applicable information shown on the Mix Design Submittal Form and the following:
    a. Proportions of cementitious materials, fine and coarse aggregate, and water.
    b. Water-cementitious material ratio, 28-day compressive design strength, slump, and air content.
    c. Type of cement, fly ash, slag and aggregate.
    d. Aggregate gradation.
    e. Type and dosage of admixtures.
    f. Special requirements for pumping.
    g. Range of ambient temperature and humidity for which design is valid.
    h. Special characteristics of mix which require precautions in mixing, placing, or finishing techniques to achieve finished product specified.
    i. Materials and methods for curing concrete.

B. Submit certified laboratory test data or manufacturer's certificates and data for the items listed below certifying that materials are in conformance requirements specified herein. Submit to the Engineering Consultant of Record for review and approval and within 7 calendar days after receipt of Notice-to-Proceed.
1. Concrete mix design(s)
2. Type and source of Portland cement, fly ash, and slag
3. Aggregate gradations
4. Preformed expansion joint filler
5. Field molded/poured sealant
6. Dowel bars
7. Expansion sleeves
8. Tie bars
9. Reinforcing steel bars
10. Welded wire fabric
11. Air entraining admixtures
12. Water-reducing, set-retarding and set-accelerating admixtures (if used)

C. Test Reports: Submit field quality control test reports.

1.4 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Forms shall be of depth equal to depth of curbing or sidewalk, and so designed as to permit secure fastening together at tops. Coat forms with nonstaining type of coating that will not discolor or deface surface of concrete.

B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A185. Furnish in flat sheets.

C. Reinforcing Steel: Deformed steel bars, ASTM A615, Grade 60.

D. Portland Cement: Shall conform to ASTM C150, Type I.

E. Fly Ash: ASTM C618, Class C or F. Use only one type and source throughout project.

F. Slag: ASTM C989, Grade 100 or 120. Use only one type and source throughout project.

G. Exterior Pavement Joint Materials
   1. Joint Back-up Material: Polyethylene foam, 100% closed cell.
   2. Sealant:
      a. Dow 888, by Dow Corning.
      b. 301 NS by Pecora.
      c. Spectrum 800 or 900 by Tremco.

H. Aggregate: ASTM C33.

I. Water: Clean and potable

J. Dowel Bars: ASTM A615, grade 60, and plain steel bars.

K. Air Entrainment: ASTM C260. .
   1. Air-Mix or AEA-92, by Euclid Chemical Corp.
   2. MasterAir VR 10, MasterAir AE 90, or MasterAir E 200 by BASF Admixtures.
   3. Daravair or Darex Series, by W.R. Grace.
   4. Equivalent approved products.

L. Liquid Membrane Curing and Sealing Compound: ASTM C1315, Type I, Class A or B, 25% minimum solids content, clear non-yellowing with no styrene-butadiene.
   1. Water Based, VOC less than 350 g/l:
      a. Super Aqua Cure, by Euclid Chemical Corp.
      b. MasterKure CC 1315WB by BASF Admixtures.
   2. Solvent Based
      a. Super Rez-Seal, by Euclid Chemical Corp.
      b. MasterKure CC 300 SB by BASF Admixtures.

2.2 CONCRETE MIXING

A. Mix concrete and deliver in accordance with ASTM C94. Design mix shall produce normal weight concrete consisting of Portland cement, supplementary cementitious materials, aggregates, admixtures and water to produce the following:
   1. Compressive Strength: 3,500 psi minimum at 28 days unless otherwise indicated on the Drawings.
   2. Slump Range: 2”-4” for hand placed concrete, 1-1/4” to 3” for machine placed (slipform) concrete.
   3. Air Entrainment: 5 to 8 percent.

B. Supplementary Cementitous Materials (SCM):
   1. Concrete mix shall contain SCM at the amounts specified unless other amounts are approved by the Civil Engineer. Either fly ash or ground granulated blast furnace slag (GGBFS) may be used for the SCM but shall not be used together to form a ternary mix. Use of fly ash or GGBFS in the concrete mix is mandatory.
   2. Fly Ash: Substitute fly ash for Portland cement at 15% of the total cementitious content.
      a. If used to mitigate potential aggregate reactivity, only Type F fly ash may be used and shall have the following maximum properties: 1.5% available alkali and 8.0% CaO. When a maximum of 25% replacement is used, up to 10.0% CaO is permitted.
   3. Ground Granulated Blast Furnace Slag (GGBFS): Substitute GGBFS for Portland cement at 20% of the total cementitious content.
      a. If required to mitigate potential sulfate exposure or aggregate reactivity, up to 50% substitution of Portland cement is allowed.
   4. Maintain air-entrainment at specified levels.

C. Calcium chloride:
   1. Calcium chloride (Type L) may be used in solution form as part of the mixing water to accelerate concrete setting and early-strength development.
      a. Amount of calcium chloride added shall not be more than necessary to produce the desired results and shall not exceed 2% by weight of cement.
      b. The dosage range for the calcium chloride for the entire project shall not vary by more than 1%. Range is defined as the difference between the maximum and minimum dosages of calcium chloride for the entire project.
      c. Calcium chloride shall not be used in the following applications unless approved by the Civil Engineer:

1) concrete containing embedded dissimilar metals or aluminum
2) slabs supported on permanent galvanized steel forms
3) concrete exposed to deicing chemicals
4) prestressed or post-tension concrete
5) concrete containing aggregates with potentially deleterious reactivity and concrete exposed to soil
6) concrete exposed to soil or water containing sulfates.

2. Use calcium chloride in accordance with manufacturer's recommendation.
3. Chloride-ion Concentration:
   a. Maximum water-soluble chloride-ion concentrations in hardened concrete at ages from 28 to 42 days contributed from the ingredients including water, aggregates, cementitious material, and admixtures shall not exceed the following limits unless approved by the Civil Engineer:

Type of Member	Maximum water-soluble chloride ion (Cl-) content in concrete (percent by weight of cement)
Prestressed concrete	0.06
Reinforced concrete exposed to chloride in service	0.15
Reinforced concrete that will be dry or protected from moisture in service	1.00
Other reinforced concrete construction	0.30

4. When using calcium chloride or other admixtures containing chlorides, measure water-soluble chloride-ion content (percent by weight of cementitious materials) per ASTM C1218. Sample shall be from concrete representing the submitted mix design and maximum chloride dosage anticipated for the project.

PART 3 - EXECUTION

3.1 PREPARATION

A. Begin paving work only after unsuitable areas have been corrected and are ready to receive paving.

B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.

3.2 INSTALLATION

A. Form Construction
   1. Set forms to required grades and lines, rigidly braced and secured.
   2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place minimum of 24 hours after concrete placement.
   3. Check completed formwork for grade and alignment to following tolerances:
      a. Top of forms not more than 1/8-inch in 10'-0".
      b. Vertical face on longitudinal axis, not more than 1/4-inch in 10'-0".
   4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.

B. Reinforcement: Fasten reinforcing bars or welded wire fabric (if required) accurately and securely in place with suitable supports and ties. Remove from reinforcement all dirt, oil, loose mill scale, rust, and other substances that will prevent proper bonding of the concrete to the reinforcement.

C. Concrete Placement
   1. Concrete shall be mixed and placed when the air temperature in the shade and away from artificial heat is a minimum of 35 degrees F and rising. Hot and cold weather concreting shall be in accordance with ACI 305R (hot weather) and 306.1 and 306R (cold weather).Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until set at required finish elevation and alignment.

2. Place concrete using methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
3. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place construction joint. Automatic machine may be used for curb and gutter placement. Machine placement shall be at required cross section, line, grade, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified herein.

D. Joint Construction
1. Contraction Joints: Construct concrete curb or combination concrete curb and gutter, where specified on Construction Drawings, in uniform sections of approximately 10 feet in length. Form joints between sections either by steel templates, 1/8-inch in thickness, of length equal to width of curb and gutter, and with depth which will penetrate at least 2-inches below surface of curb and gutter; or with 3/4-inch thick performed expansion joint filler cut to exact cross section of curb and gutter; or by sawing to depth of at least 2-inches while concrete is between 4 and 24 hours old. If steel templates are used, they shall be left in place until concrete has set enough to hold its shape, but shall be removed while forms are still in place.
2. Longitudinal Construction Joints: Tie concrete curb or combination concrete curb and gutter to concrete pavement with 1/2-inch round deformed reinforcement bars 2 feet in length and 5 feet on center.
3. Transverse Expansion Joints: Concrete curb, combination concrete curb and gutter, or concrete sidewalk shall have filler cut to exact cross section of curb, gutter, or sidewalk. Joints shall be spaced at approximately 100 feet on center and shall be similar to the type of expansion joint used in concrete pavement areas.

E. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2-inch or more than 1-inch below finished surface where joint sealer is indicated. Furnish joint fillers in 1-piece lengths for full width being placed, wherever possible. Where more than 1 length is required, lace or clip joint filler sections together.

F. Joint Sealants: Install in accordance with manufacturer's recommendations.

3.3 CONCRETE FINISHING

A. After striking off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.

B. Work edges of sidewalks, gutters, back top edge of curb, and formed joints with edging tool, rounding edge to 1/2-inch radius. Eliminate tool marks on concrete surface. After completion of floating and trowelling, when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
1. Curbs, gutters, and sidewalks: Broom finish by drawing fine-hair broom across surface perpendicular to flow of traffic. Repeat operation as necessary to produce fine line texture.

C. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up minor honeycombed areas. Remove and replace areas or sections with major defects as directed Owner.

D. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable work as directed by Owner.

3.4 CURING AND PROTECTION

A. Protect and cure finished concrete paving using with curing compound or with acceptable moist-curing methods in accordance with "water-curing" section of ACI 308. Cure for a period not less than 7 days.

B. Use solvent based curing compound when compound is applied below 40 F.

3.5 BACKFILL

A. After concrete has set sufficiently, spaces on either side of concrete curb, combination concrete curb and gutter, or concrete sidewalk shall be refilled to required elevation with suitable material compacted in accordance with Section 02300.

3.6 CLEANING AND PROTECTION

A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

3.7 FIELD QUALITY CONTROL

A. Field quality control shall be the responsibility of the Contractor. Field quality control testing and inspection shall be at the discretion of the Contractor as necessary to assure compliance with Contract requirements.

END OF SECTION

PROJECT INFORMATION

PROJECT _____
ADDRESS _____
CITY, ST _____
GENERAL CONTRACTOR
COMPANY _____
JOBSITE PHONE _____

A. CONCRETE INFORMATION

Supplier Mix Design # _____
Design Strength (f'c) _____ psi
Water / Cementitious Ratio _____
Total Air Content _____ %
Total Est. Volume of Concrete _____ CY

Mix Developed From:
☐ Trial Mix Test Data (*attach test data*)
☐ Field Experience

Density

Wet _____ pcf Dry _____ pcf

Slump

_____ " (± 1") **WITHOUT** WR Admixture

_____ " (± 1") **WITH** WR Admixture

LEAVE BLANK FOR ENGINEER'S STAMP

B. ADMIXTURE INFORMATION

	ASTM Designation	**Product** (Manufacturer/Brand)	**Dosage (ounces)** oz / cy	oz / cwt
Water Reducing				
Accelerating				
Retarding				

C. MIX DESIGN

Mix Proportions (per cubic yard)

	Identification (Type, size, source, etc.)	**Weight** (pounds)	**Density** (SSD)	**Volume** (cubic feet)	**% Aggregate Absorption**
Cement					
Fly Ash					
Slag					
Coarse Aggregate #1					
#2					
#3					
Fine Aggregate #1					
#2					
Water					
Air Content					
	TOTALS				

Coarse & Fine Aggregate Gradation Information

Sieve Size	**% Passing Each Sieve** (All Sieve Sizes must be entered)					**Combined % Passing**	**Combined % Retained**	
	Coarse Agg. # 1	**Coarse Agg. # 2**	**Coarse Agg. # 3**	**Fine Agg. # 1**	**Fine Agg. # 2**		**Cumulative**	**Individual**
1-1/2"								
1"								
3/4"								
1/2"								
3/8"								
# 4								
# 8								
# 16								
# 30								
# 50								
# 100								
# 200								
% of Vol								

Aggregate Ratios

Coarseness Factor =	$\frac{\text{Combined \% cumulative retained 3/8" sieve}}{\text{Combined \% cumulative retained \#8 sieve}}$	=		
Workability Factor =	Combined % passing #8 sieve	=		
Adj-Workability Factor =	WF + [(Cementitious Material - 564) ÷ 37.6]	=		
Allowable Adj-WF=	Adj-WF = [(11.25 - .15 CF) + 34.5] ± 2.5	=	**Low**	**High**

D. ATTACHMENTS: Include the following with this Mix Design Report.

- ☐ Portland Cement mill test reports
- ☐ Fly ash mill test reports
- ☐ Slag mill test reports
- ☐ Designation, type, quality, and source (natural or manufactured) of coarse and fine aggregate materials

☐ Separate aggregate gradation reports including all required sieve sizes

- All gradation sieve report tests dated within 60 days of this report
- Report for each coarse and fine aggregate material in mix

☐ Statement if possible reactivity of aggregate, based on tests or past service

☐ Statement if possible aggregate pop-outs or their disruptions, based on tests or past service

☐ Product data for the following admixtures:

- Chloride ion data and related calculations
- Water reducing, set retarding, set accelerating, etc.

☐ Measured water-soluble chloride ion content in concrete (percent by weight of cement)

☐ Concrete compressive strength data used for standard deviation calculations

E. CONCRETE SUPPLIER INFORMATION

Company Name _____ **Tel. #** ( )_____

Address _____

City, ST Zip _____

Technical Contact _____ **Cell #** ( )_____

e-mail _____

Sales Contact _____ **Cell #** ( )_____

	PRIMARY PLANT	SECONDARY PLANT
Plant Location:		
Miles from Site:		
Travel Time to Site:		
NRMCA Certified:	☐ YES ☐ NO	☐ YES ☐ NO
State DOT Certified:	☐ YES ☐ NO	☐ YES ☐ NO
Batch Mixing Type:	☐ DRY ☐ CENTRAL MIX	☐ DRY ☐ CENTRAL MIX

SECTION 02812 – SITE IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Underground, automatically controlled lawn and shrub bed irrigation system including electrical connections, water main connections, and accessories.

B. Related Requirements
1. Section 02300 - Earthwork. Trenching, backfill, and compaction for utilities.
2. Section 02510 - Water Distribution Systems.
3. Section 02900 - Planting.
4. Section 02370 - Erosion Control

1.2 REFERENCES

A. ASTM International (ASTM)
1. ASTM D2239 - Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
2. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series).
3. ASTM D2564 - Solvent Cement for poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
4. ASTM D2609 - Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
5. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

B. National Fire Protection Agency (NFPA)
1. NFPA 70 - National Electrical Code (NEC).

C. American Society of Safety Engineers
1. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
2. ASSE 1015 - Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies.

1.3 SUBMITTALS

A. Quality Assurance Submittals:
1. Irrigation Contractor Qualifications: Provide minimum of 3 references and list of similar projects with owner's names, addresses, and telephone numbers.

B. Test Reports
1. Pressure Tests: Contractor shall submit the following pressure tests performed by the Contractor to the CEC and the CEC's Irrigation Designer:
a. Pre-Installation Static Pressure Test: Perform static pressure test at the irrigation system's water source to verify available pressure for system operation.
b. Hydrostatic Test of Installed Irrigation Main Line: Perform hydrostatic test of installed irrigation main line in conformance with ASTM to verify system is free of any leaks prior to proceeding with the installation of the system.

C. Closeout Submittals:
1. As-Built Drawings: Furnish two sets, noting exact locations of elements and changes to Construction Drawings.
2. Operation Manual: Furnish two copies, bound in 1 inch diameter three ring binders, indexed and tabbed for easy reference, and labeled on spine and cover. Manual shall include following:
a. Approved submittals as specified herein.
b. Installation instructions including mounting details for control valves.

c. Operating Instructions:
   1) Winterization procedures.
   2) Recommended operation sequence, frequency, and length of operation cycle, as per relationship to estimated absorption rate, evaporation rate, and anticipated flow.
d. Maintenance Instructions:
   1) Manufacturers' product data, installation, and maintenance instructions.
   2) Copies of completed warranty information. Contractor to complete and mail necessary warranty registration information to manufacturer keeping copies for Owner.

3. Controller Chart: Prepare color coded chart reduced in size, mounted on the inside of the controller cabinet, containing same plan information as as-built drawings, and laminated in plastic on both sides, with following specific information:
   a. Note routing of main line, control wires, and controller location.
   b. Identify valves as to size, station number shown on controller, and type of irrigation head (e.g. micro spray head, rotary head) for each valve.
   c. Delineate each station's limits of coverage by color-coding, with each station having different color showing its zone with zone number designation.
   d. Size, type, and location of water source.
4. Meetings and Inspections Log.
5. Certification of Conformance: Provide certificate of satisfactory performance of irrigation system installation signed by the Contractor and Landscape Architect or irrigation designer.

1.4 QUALITY ASSURANCE

A. Contractor Qualifications: Minimum of 3 consecutive years' experience in area of project and having installed other jobs of similar size and scope including drip irrigation and ET Series Controllers.

B. Pre-Work Meeting and Conference Call: Convene a pre-work meeting and conference call at the Project site prior to commencing subgrade preparation for site paving to review conditions of operations, procedures and coordination with related work. Require attendance of parties directly affecting work of this Section including but not limited to Contractor, irrigation contractor, site work contractor, Landscape Architect, or irrigation designer.
   1. Discuss conditions of Project site.
   2. Review approach and schedule for, but not limited to, the following items:
      a. Water source.
      b. Mainline routing and installation.
      c. Zone installation and site preparation.
      d. Material availability.
      e. Sleeve installation, installation of curb and paving markings for sleeve locations and coordination with site work contractor.
      f. Status of irrigation schedule
      g. Potential conflicts between irrigation and other site utilities
      h. Required Inspections.

C. Meeting and Inspection Log: Maintain log of required meetings and inspections. Record the date; time; weather conditions; and a brief summary of the discussions, decisions, and agreements reached. Landscape Architect or Irrigation Designer will review and sign log at the conclusion of the meeting. Furnish copy of log to each party attending.

1.5 MEETING AND EVENT NOTIFICATIONS

A. Provide the following notifications to the Owner's Civil Engineering Consultant (CEC) within the time period listed below. CEC will notify Owner, landscape architect or irrigation designer, and other necessary sub consultants:
   1. Pre-Work Conference Call: Minimum 14 calendar days prior to meeting date.
   2. Static Pressure Test: 14 calendar days prior to inspection date.
   3. Mainline Inspection and Hydrostatic Test: 7 calendar days prior to beginning irrigation work.
   4. Substantial Completion Inspection: 7 calendar days prior to irrigation substantial completion.
   5. Final Inspection: 7 calendar days prior to irrigation final inspection date.

6. Warranty Inspection: 14 calendar days prior to inspection date.

B. Provide notifications by email or other written means to show proof of delivery.

1.6 PROJECT CONDITIONS

A. Visit site and become familiar with nature and location of work, existing conditions, and conditions that will exist during installation.

1.7 WARRANTY

A. Guarantee Site Irrigation System for a period of 12 months following the Contract Completion Date for:
1. Defects in material, equipment, and workmanship.
2. Repair of damage to premises resulting from leaks or other defects in material, equipment, and workmanship to satisfaction of Owner.

PART 2 - PRODUCTS

2.1 OWNER FURNISHED PRODUCTS

A. There are no owner furnished items associated with this work.

2.2 PIPE

A. Polyvinyl Chloride (PVC): Pipe over 1 inch diameter shall conform to ASTM D224, SDR 21, and Class 200.

B. Polyvinyl Chloride (PVC): Pipe 1 inch diameter and under shall conform to ASTM D2241, SDR 13.5, and Class 315.

C. Flexible Polyethylene (PE): Pipe shall conform to ASTM D2239, SDR 11.5, PE23, rated at 100 PSI, National Sanitation Foundation (NSF) approved. Subject to approval of Owner, PE shall be used for laterals in areas where ground is subject to freezing for extended periods of time each year.

D. Joints:
1. Pipe sizes 2 1/2 inch or smaller shall have bell and socket joints.
2. Pipe sizes larger than 2 1/2 inch shall have snap connections with rubber gasket joints. Thrust blocking shall be required in accordance with Section 02510.

E. Pipe used for reclaimed water shall be appropriate color and marked as designated for such use.

F. Fittings:
1. Polyvinyl Chloride (PVC) Fittings: Fittings shall conform to ASTM D2241, Schedule 40, and Molded.
2. Flexible Polyethylene (PE) Lateral Line Fittings: Fittings shall conform to ASTM D2609, Type 1 PVC insert fittings designed for used with this type of pipe. Pipe and fittings shall be joined with stainless steel pinch clamps or worm gear clamps, including stainless steel screw.

G. Risers above finished grade shall be black in color or receive 2 coats of black exterior semi-gloss enamel paint if a color other than black.

2.3 ACCESSORIES

A. Sleeves: Sleeves for pipes passing beneath paving shall conform to ASTM D2241, Schedule 40. Minimum diameter of 2 inch or 2 sizes larger than pipe scheduled to pass through them.

B. PVC Solvent Cement: Cement shall conform to ASTM D2564.

C. Swing Joint Connections: Connections between heads and laterals shall be thick wall, flexible, polyethylene pipe, with fittings that have male barbs on one end and either male or female screw ends opposite. Glue fittings and female barb adapters are not allowed.

2.4 RECLAIMED WATER PRODUCTS AND MATERIALS

A. Irrigation products used with reclaimed water shall be the appropriate color and marked as designated for such use.

2.5 CUTOFF OR ISOLATION VALVES

A. 3 inches or Smaller: Provide full port brass ball valves with 600 WOG rating as manufactured by Red-White Valve Corporation, Carson, CA.

B. Larger than 3 inches: Provide cast iron and bronze mechanical joint valves, fusion bonded epoxy coated exterior and interior, Resilient Wedge Valve as manufactured by Clow Valve Co., Oskaloosa, IA.

C. Provide a valve key and cast-iron cylindrical valve box with top with each valve.

2.6 QUICK COUPLER VALVES

A. Provide one of following if shown on the plans:
1. Rain Bird model 44NP Valve with model 44K Key.
2. Hunter model HQ-44LRC with model HK-44 Key.
3. Toro model 100-SLVLC 470 Series Valve and 100-SLK Coupler Key.

B. Provide each valve with key having 3/4-inch male top pipe threads for hose connection.

2.7 ELECTRIC CONTROL VALVES

A. Provide one of the following:
1. Hunter ICV Series electric remote-control valves and ICZ Drip Zone Control Kit.
2. Rain Bird PEB Series electric remote-control valves and XCZ Drip Control Zone Kit.
3. Netafim Control Valve Kit.
4. Toro P220 Series plastic valves and DZK Drip Zone Valve Kit.

B. Provide 3M DBY watertight connectors.

2.8 SPRINKLER HEADS

A. Full or Part Circle Pop-Up Fixed Spray Sprinkler:
1. Acceptable Products:
   a. Hunter PRS40 with MP Rotators and check valve (CV) feature.
   b. Rain Bird 1800 Series Sprinklers with Rotary Nozzles including PRS and SAM features.
   c. Toro 570Z PRX Series with MPR Precision Series Spray Nozzles.

B. Full or Part Circle Pop-up Gear Driven Rotor Sprinkler:
1. Acceptable Products:
   a. Rain Bird Rotor, 5000 Series plus MPR rotor nozzle with Seal-A-Matic (SAM) check valve.
   b. Toro Super T5P-COM, with check valve or Toro TR-XTP Series with factory installed check valve, trajectory adjustment, and X Flow Device.
   c. Hunter PGP and PGJ series pop-up rotors, with check valve.

C. Pressure Compensating Micro-Spray Nozzles:
1. Acceptable Products:
   a. Rain Bird Micro Spray.
   b. Hunter Micro Spray.
   c. Toro Stream Spray and Stream Bubbler Nozzles with PC.

2.9 LOW VOLUME AND DRIPLINE IRRIGATION

A. Rain Bird XT-700 distribution tubing

B. Rain Bird Xeri-Bug Emitters XB-05-PC, XB-10-PC, XB-20-PC (refer to plans for specific volumes)

C. Hunter Professional Landscape Dripline with 0.4, 0.6, or 1.0 GPH built-in emitters.

D. Netafim Techline with 0.4, 0.6, or 0.9 GPH dripper.

E. Toro Drip-In PC drip tubing with 0.5 or 1.0 GPH emitter. Use only in groundcover and shrub beds with mulch.

F. Rain Bird XFD (surface installation) or XFS (subsurface installation) drip tubing and components with 0.6 or 0.9 GPH emitter.

2.10 VALVE BOX

A. Valve boxes shall be manufactured by Ametek, Plymouth Products Division, Sheboygan WI., RainBird Corporation or equal by acceptable manufacturer. No irrigation valve box shall be placed in pavement areas unless otherwise shown on the Drawings.
1. When used with single valve, provide Economy Turf Box or Rain Bird model VB-RND with green colored snap fit cover labeled "Valve Box".
2. When used with 2 or more valves, provide Jumbo Box or Rain Bird model VB-STD with 20-inch x 14 inch cover opening with cover labeled "Control Valve".

2.11 MANUAL DRAIN VALVES

A. Manual drain valves shall be provided by acceptable manufacturers specified above.

2.12 CONTROL WIRE

A. Number 14-size minimum copper wire, U. L. approved for underground direct burial.
1. Colored wire shall have same color-coding as shown on controller.
2. All power and control wiring shall be in PVC conduit as shown in the irrigation detail sheets.
3. Provide single wire from controller to each valve.
4. Provide common neutral from controller to each valve.
5. Provide a minimum of two extra sets of wire, 2 control and 1 neutral, to each end of the main for future use.
   a. Loop Systems: Provide two spare control wires in each direction to halfway point of loop.

2.13 BACKFLOW PREVENTER

A. Comply with requirements and codes of local governing authority regarding backflow prevention.

B. Provide the necessary materials, insulation/draining capabilities, and insulated fiberglass enclosure, dark green in color.

C. Backflow preventers shall be type suitable for use in high hazard cross connection to potable water system as manufactured by one of the following manufacturer's: Watts Regulator Company, Febco, or Wilkins.
1. Reduced pressure backflow preventers shall be ASSE # 1013 and labeled accordingly.
2. Double check valve assembly backflow preventers shall be ASSE # 1015 and labeled accordingly.
3. In absence of local codes or requirements, provide double check assembly backflow preventer installed in strict accordance with manufacturer's written instructions.

2.14 METER

A. Meter and meter box shall conform to requirements of local utility company.

2.15 AUTOMATIC CONTROLLER

A. Hunter XC-200i

B. RainBird ESP-ME (Series)

PART 3 - EXECUTION

3.1 PREPARATION

A. Pressure/Flow Test: Perform calculations according to the Irrigation Association's 3-Step Method. Provide written calculations to the Owner's CEC including the following site information:
   1. Static or residual pressure at the POC.
   2. Calculation of pressure for "worst case" sprinkler head.
   3. Calculation of GPM per zone.

B. Prior to installation, receive approval from General Contractor to proceed with construction.

C. Contractor shall field verify all aboveground and underground utilities prior to start of work.

3.2 EXCAVATION

A. Trenching and Backfilling:
   1. Irrigation mainline installation shall conform to same requirements as waterline installation.
   2. Trenching and backfilling shall conform to Section 02300 and 02370.
   3. Excavate trench to proper depth as shown or specified.
   4. Minimum trench width shall be 3 1/2 inches.
   5. Over excavate trenches deeper than required in soils containing rock or other hard material that might damage pipe and backfill to proper depth with selected fine earth or sand.
   6. Backfill and hand tamp over excavation prior to installing piping.
   7. Keep trenches free of obstructions and debris that would damage pipe.
   8. Irrigation piping shall not be installed in same trench as heating duct, electric ducts, storm and sanitary sewer lines, water and gas mains.

B. Do not cut sidewalks, paved areas, or curb and gutter when trenching for piping unless otherwise noted on the Drawings.
   1. Provide sleeves as specified in Part 2 above under paving prior to installation of paving.
   2. Auger, bore, or tunnel under existing paving without disturbing pavement. Damaged pavement shall be removed and replaced in accordance with Section 02740 or 02751.

3.3 WATER METER

A. Provide water meter box for irrigation system if required or shown on the Drawings.

3.4 PIPING INSTALLATION

A. Minimum cover from top of piping to finished grade shall be provided as follows:
   1. Lawn and planting areas:
      a. Mains and Control Valves: 18 inches.
      b. Laterals: 12 inches.
   2. Drives or parking areas: 24 inches.

B. Clearances: Maintain 3-inch minimum horizontal clearance between parallel lines in same trench or vertical clearance between lines crossing at angles.

C. Special Requirements - PVC and PE pipe:
   1. Snake pipe in trench at least 1 foot per 100 feet of pipe to allow for thermal expansion.

2. Pipe laterals shall be laid to drain to low point drains located at lowest elevations of each zone.

D. Rest full length of pipe section on bed of trench, excavating recesses to accommodate joints. Do not lay pipe on unstable material or blocking, or when in opinion of Owner conditions are unsuitable.

E. Threaded Plastic Pipe Jointing:
1. Do not use solvent cement on threaded joints.
2. Wrap joints with Teflon tape or use virgin Teflon lubricant.

F. Bell and Socket Plastic Pipe Jointing: Cement joints in accordance with ASTM D2855.

3.5 QUICK COUPLER AND AUTOMATIC LOW POINT DRAIN VALVES

A. Provide quick coupler valves as shown on the drawings to accommodate winterization.

B. Provide automatic low point drain valves on all zones. Provide two valves at lowest point of each zone with each drain installed above a 12 inch by 12 inch by 12 inch deep area of coarse washed gravel.

3.6 SLEEVING

A. Provide sleeves for both piping and control wiring where either passes under paved surfaces.
1. Depths of sleeves shall be same as that required for piping at each location or condition.
2. Extend sleeves 12 inches beyond paving at each end.
3. Install permanent benchmark at top of curbs for reference to sleeve locations.

3.7 VALVES

A. Do not locate beneath paved surfaces.

B. Do not locate any valve within 5’-0” of any curb

C. Install plumb to within 1/16 inch.

D. Locate within valve box with 6-inch deep layer of coarse gravel beneath bottom of valve.

E. Top of quick coupler valves shall be 6 inches to top of valve box. Top of gravel layer shall be 3 inches below top of valve.

F. Master Valve (if required on the Drawings):
1. Locate immediately behind backflow preventer.
2. Valve shall be energized by master valve circuit on automatic controller.

3.8 SPRINKLERS

A. Install plumb to within 1/16 inch with top collar, not nozzle, flush with finish grade.

B. Provide swing joint with each sprinkler except where entire head is raised above grade and/or where rigid riser piping is required.

C. Heads adjacent to paving and curb: Locate between 6 and 12 inches from edge of paving or back of curb to prevent car overhang to conflict with a fully extended sprinkler.

3.9 ELECTRICAL CONNECTIONS AND CONTROL WIRE

A. Conform to the National Electrical Code (NEC) and local electrical codes.

B. Provide electrical connection to system as designated on the Drawings and as specified herein.

C. Wire Placement:
1. Do not run control and power supply wiring in same conduit.
2. Provide continuous runs of wire between controller and valves. Splices shall be made with one of following:
   a. Watertight below ground electrical junction boxes.
   b. Water-tight connectors, such as utilized for valves, and located within valve box for ease of locating.
   c. The location of electrical splices shall be shown on the As-Built drawings.
3. Bury control wire beside pipe in same trench. Bundle and tape together at not more than 10 ft intervals.

D. Expansion Loops: Construct by wrapping wire around 1/2-inch diameter pipe to create coil. A 3-foot section of wire shall be used to create 12-inch coil with 6-foot section being used to create 24-inch coil.
1. Provide 12-inch coils at each wire splice, not including valves, and at each change of wire direction.
2. Provide 24-inch coils at each control valve and where each valve enters conduit for automatic controller.

3.10 BACKFILLING

A. Sand or fine-grained soils shall be used for initial backfill to sufficient depth to prevent damage to pipe from rocks or other debris during compaction of subsequent backfill.

B. Fill trench to within 3 inches of finish grade with excavated soil and compact in accordance with Section 02300.

C. Fill top 3 inches with existing topsoil in planting or turf areas and wheel roll until compaction of backfill is same as surrounding soil.

D. Grade backfilled trench uniform with surrounding grades.

3.11 BACKFLOW PREVENTER

A. Comply with local codes for installation of backflow preventer. In absence of local codes, install in accordance with manufacturer's written instructions.

3.12 RAINFALL / FREEZE SENSOR

A. Location and installation shall be as shown on the Drawings and per manufacturer’s written recommendations.

3.13 FLOW SENSOR

A. Location and installation shall be as shown on the Drawings and per manufacturer’s written recommendations.

3.14 MASTER VALVE

A. Location and installation shall be as shown on the Drawings and per manufacturer’s written recommendations.
1. Master valve normal operating position shall be open and shall be electronically actuated.

3.15 AUTOMATIC CONTROLLER

A. Location and installation shall be as shown on the Drawings and approved by Owner prior to installation.

B. Install rigid conduits for both power supply and control wiring.
1. Control wire conduit shall extend to 18 inches below grade.
2. Pull spare wires for future valves and extend to area outside paved surfaces.

C. Install electrical grounding for controller in accordance with manufacturer's written instructions.

3.16 FIELD QUALITY CONTROL

A. Irrigation Inspections: Conduct the following inspections during the course of the work and provide photographic documentation of the onsite conditions to the Landscape Architect or irrigation designer to verify conformance to specification requirements. Notify CEC for observation of inspection by the Landscape Architect or irrigation designer. Correct noted deficiencies during each inspection prior to proceeding with subsequent work. After each inspection complete Irrigation Inspection Checklist included at the end of this Section signed by all signators listed thereon.
   1. Mainline Inspection: Inspect the installed main line, electronic control valves, wiring prior to backfilling main line. Provide photographic documentation of pressured mainline with pressure gauge.
   2. Substantial Completion Inspection: Inspect and provide photographic documentation of all completed irrigation work. Landscape Architect or irrigation designer will develop a punch list of deficient or incomplete items and deliver to Contractor within 3 calendar days of inspection date.
   3. Final Inspection: Within 30 days of project substantial completion date and subsequent to correction of punch list deficiencies, convene a final inspection of all irrigation work.
   4. Warranty Inspections: Convene a warranty inspection 30 calendars days prior to expiration of warranty period specified in Part 3 of Section 02900.

B. If additional landscape architect or irrigation designer site visits for observation of inspection are required beyond those described herein as determined by Owner to determine correction to non-conforming or incomplete work, the Contractor shall reimburse the Owner the sum of $4,000 for each additional visit to cover expenses. Additional site observations will be performed as required until all deviations have been corrected by the Contractor and closed by the CEC.

C. Inspection and Adjustments: Following installation and prior to Substantial Completion Inspection, make final adjustments to site irrigation including but not limited to the following:
   1. Flush system completely, with nozzles and screens removed and drip lines ends open to extract debris.
   2. Verify sprinkler operation and alignment for direction of throw. Correct as necessary.
   3. Check pop-up rotor/rotator nozzling for proper arc of spray with no overthrow onto pavement. Adjust nozzles as necessary for proper throw and matched precipitation rate.
   4. Ensure uniform distribution exists.
   5. Ensure proper irrigation head operational after landscaping and/or sod installation.

D. Main Line Inspection and Hydrostatic Tests:
   1. Owner's Landscape Architect or Irrigation Designer will observe testing.
   2. Center load piping with small amount of backfill to prevent arching or slipping under pressure.
   3. Install risers and caps on mainline and sub-main lines. Apply continuous and static water pressure of 75 psi for a minimum of 3 hours when welded plastic joints have cured at least 3 hours.
   4. Allowable Leakage:
      a. Utilize the following formula to calculate the allowable leakage for O-ring gasket pipe.
         1) $L=SD(P)^{0.5}$
         2) 133,200
         3) In which: L=Allowable leakage in gallons per hour
         4) S=Length of pipe tested in feet
         5) D=Pipe diameter in inches
         6) P=Average test pressure in PSI gauge
      b. No allowable leakage shall be acceptable with solvent based mainline system.
   5. Repair leaks and retest.

3.17 CLOSEOUT ACTIVITIES.

A. Demonstration: Following final adjustment, operate entire irrigation installation to demonstrate complete and successful operation of equipment.

END OF SECTION

IRRIGATION INSPECTION CHECKLIST

INSPECTION PROCEDURE

- Contractor shall arrange and conduct inspection and complete checklist and identify defects.
- Conduct inspections in accordance with the Quality Assurance and Quality Control provisions of the Specifications.
- All undersigned parties shall accompany inspection.
- Visually identify location of each defect at the site.
- After irrigation inspection is complete submit signed inspection form to Owner within 24 hours.

COMPLETION OF CHECKLIST AND DEFECTS FORM

- Answer each checklist item Yes or No.
- Mark "N/A" on checklist items which do not apply.
- Identify defects and resolutions on the Project Close-Out Inspection Report
- Number each defect as follows:
    - Identification Symbol-Checklist Item No.-Defect No. (E.g. ML-1-3)
    - The defect number shall be numbered in sequence for each checklist item.

(ML) MAIN LINE INSPECTION:

Piping:

1.	Is the correct type and size of pipe installed?	YES___	NO___	N/A___
2.	Is the pipe installed at the correct depth?	YES___	NO___	N/A___
3.	Does the trench meet the required minimum width?	YES___	NO___	N/A___
4.	Is rock present within the trench?	YES___	NO___	N/A___
5.	If rock is present, has it been properly mitigated?	YES___	NO___	N/A___
6.	Is minimum 3-inch clearance provided between the main and lateral lines?	YES___	NO___	N/A___
7.	Are joints primed prior to solvent weld?	YES___	NO___	N/A___
8.	Is the main line snaked minimum of 1 foot per 100 foot of trench?	YES___	NO___	N/A___
9.	Are joints cemented in accordance with ASTM standard specified?	YES___	NO___	N/A___
10.	Does PVC cement conform to ASTM standards specified?	YES___	NO___	N/A___

Valves:

1.	Is valve box installed plumb and flush with proposed finish grade?	YES___	NO___	N/A___
2.	Is 6-inch layer of coarse gravel installed beneath base of valve?	YES___	NO___	N/A___
3.	Is master valve sized to allow proper flow rate?	YES___	NO___	N/A___
4.	Are splices installed with waterproof connections?	YES___	NO___	N/A___

Control Valves:

1.	Are continuous wire runs provided between valve boxes and controller?	YES___	NO___	N/A___
2.	Is control wire placed beside main line?	YES___	NO___	N/A___
3.	Are control wires bundled and taped at 10-foot intervals?	YES___	NO___	N/A___
4.	Are expansion loops provided at each valve, wire splice, and each change of direction?	YES___	NO___	N/A___

(H) HYDROSTATIC TEST:

1.	Does the main line hold the specified pressure for the specified length of time?	YES___	NO___	N/A___
2.	Are leaks present?	YES___	NO___	N/A___
3.	Were repairs made and line retested?	YES___	NO___	N/A___
4.	If retesting is required, does retest pass?	YES___	NO___	N/A___
5.	Does O-ring gasket pipe remain within the calculated allowable leakage?	YES___	NO___	N/A___

(SC) SUBSTANTIAL COMPLETION INSPECTION

1. Does mainline pressure meet design requirements? YES___ NO___ N/A___
2. Are the backflow prevention/master valves installed as shown on the plans and functioning properly? YES___ NO___ N/A___
3. If pump station is installed, does it operate at the specified capacity? YES___ NO___ N/A___
4. Does head layout provide 100 percent coverage? YES___ NO___ N/A___
5. Does drip system layout and installation provide 100 percent coverage? YES___ NO___ N/A___
6. Are the controller / flow sensors functioning properly? YES___ NO___ N/A___
7. Is the controller communicating with the manufacturer? YES___ NO___ N/A___
8. Are rain and freeze sensors installed and functioning properly? YES___ NO___ N/A___
9. Are the controller zones programmed correctly? YES___ NO___ N/A___

(F) FINAL INSPECTION

1. Does mainline pressure meet design requirements? YES___ NO___ N/A___
2. Does head layout provide 100 percent coverage? YES___ NO___ N/A___
3. Does drip system layout and installation provide 100 percent coverage? YES___ NO___ N/A___
4. Are the controller / flow sensors functioning properly? YES___ NO___ N/A___
5. Is the controller communicating with the manufacturer? YES___ NO___ N/A___
6. Are the controller zones programmed correctly? YES___ NO___ N/A___

(W) WARRANTY INSPECTION

1. Does mainline pressure meet design requirements? YES___ NO___ N/A___
2. Does head layout provide 100 percent coverage? YES___ NO___ N/A___
3. Does drip system layout and installation provide 100 percent coverage? YES___ NO___ N/A___
4. Are the controller / flow sensor functioning properly? YES___ NO___ N/A___
5. Are there any leaks/damage to the system? YES___ NO___ N/A___

ATTENDED BY:

GENERAL CONTRACTOR

(Signature)

(Printed name and title)

LANDSCAPE ARCHITECT OR IRRIGATION DESIGNER

(Signature)

(Printed name and title)

IRRIGATION CONTRACTOR

(Signature)

(Printed name and title)

CIVIL ENGINEERING CONSULTANT

(Signature)

(Printed name and title)

SECTION 02890 - TRAFFIC SIGNS AND SIGNALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Traffic control signs.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. ASTM International (ASTM):
1. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
2. ASTM C94 - Ready Mix Concrete
3. ASTM D4956 - Retroreflective Sheeting for Traffic Control.

C. US Department of Transportation, Federal Highway Administration:
1. Manual on Uniform Traffic Control Devices (MUTCD).

PART 2 - PRODUCTS

2.1 SIGNS

A. Conform to US Department of Transportation MUTCD. Sign classification, type, size, and color shall be as shown on the drawings

B. Retroreflectivity: Microprismatic type sheeting conforming to ASTM D 4956, Type VIII, IX, or XI.

2.2 POSTS

A. Square Post: Square tubular steel sign post, galvanized, 12 ga, perforated full-length with 7/16 inch holes on four sides. Post size shall be as shown on the Drawings.

B. Steel Pipe: ASTM A 53, Type E (electric-resistance welded) or Type S (seamless), Grade B, Schedule 40, size as shown on the Drawings.

2.3 CONCRETE

A. Mix concrete and deliver in accordance with ASTM C 94.

B. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce following:
1. Compressive Strength: 3,500 psi, minimum at 28 days, unless otherwise indicated on the Drawings.
2. Slump Range: 1 to 3-inches at time of placement
3. Air Entrainment: 5 to 8 percent

PART 3 - EXECUTION

3.1 PREPARATION

A. Field verify underground utilities prior to sign installation. Primary utilities of concern of shallow depths are lawn sprinkler systems, electric, telephone, fiber optic, cable and gas.

B. Cost related to repair of damaged surface and subsurface facilities shall be paid by the Contractor at no additional expense to the Owner.

3.2 INSTALLATION

A. Install signs as shown on the Drawings and in accordance with MUTCD and manufacturer's instructions.

B. Install signs of the type and at locations shown on the Drawings.

C. Install posts of the type as shown on the drawing.

D. Where shown as painted, field paint steel pipe posts in accordance with Section 09900.

END OF SECTION

SECTION 02900 – PLANTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Planting of drought tolerant trees, shrubs, sod, seed, groundcover, and associated materials.

B. Related Requirements:
   1. Section 02300 - Earthwork.
   2. Section 02370 - Erosion and Sedimentation Control.
   3. Section 02812 - Site Irrigation System.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced within the text by the basic designation only.

B. American National Standards Institute (ANSI):
   1. ANSI Z60.1 - American Standard for Nursery Stock.

C. ASTM International (ASTM):
   1. ASTM D5268 - Topsoil used for Landscaping Purposes.
   2. ASTM C602 - Agricultural Liming Materials.

D. Erosion Control Technology Council (ECTC):
   1. Standard Specification for Rolled Erosion Control Products.

1.3 SUBMITTALS

A. Submittal Process: Submit in accordance with Section 01330 - Submittal Procedures.

B. Grower / Nursery Information: Submit name, address, phone number and contact person for each Grower / Nursery 30 days prior to plant material selection meeting pre-work teleconference.

C. Materials Test Reports: Submit topsoil test reports to Owner's Civil Engineering Consultant (CEC) minimum 6 weeks prior to placement of topsoil.
   1. Provide location of topsoil borrow area if topsoil is to be imported.
   2. Provide name of independent soil testing laboratory.
   3. Provide date of sampling and testing.

D. Product Data:
   1. Submit certification tags from trees, shrubs, sod, and seed verifying type and purity to Owner's CEC.
   2. Submit contact information for contractor's tree grower and photographs of each species of tree specified to Owner's CEC prior to the Pre-Work Teleconference. Photographs shall be taken at grower's nursery prior to digging. Photographs shall contain tree with measuring rod in vertical position and tree caliper tool on trunk showing caliper of tree no more than 30 days prior to plant material submission and pre-work teleconference.

E. Sample:
   1. Submit minimum one cubic foot representative sample of wood or mineral mulch to Owner's CEC.
   2. Submit minimum one cubic foot representative sample of topsoil to Owner or Owner's CEC upon request.

F. Quality Assurance Submittals:
   1. Submit to Owner and Owner's CEC a copy of the invoice for each shipment of plant materials to the Project site. Invoice shall include name and size of each type of plant material.
   2. Tree Transplanting Contractor Qualifications:
      a. Provide statement of required qualifications of tree transplanting contractor.
      b. Provide Owner project names, addresses, project owner's names and phone numbers for completed projects of similar scope.
      c. Provide progress photographs of the tree transplanting process and final photographs taken at least 2 years after establishment.
      d. Provide evidence of the health of at least 10 trees transplanted 3 or more years ago on at least 3 different projects. Trees shall be of similar size, species, and conditions of the trees indicated on the Plans.

G. Closeout Submittals:
   1. Submit Meetings and Inspections Log prior to Final Completion of the Project.
   2. Certification of Conformance: Provide certificate of satisfactory performance of planting operations signed by the Contractor and Landscape Architect for attachment to CEC Conformance Letter included at the end of Section 01456.

1.4 QUALITY ASSURANCE

A. Pre-Work Teleconference: Convene a pre-work meeting minimum 30 days prior to commencing work on this Section. Review conditions of operations, procedures and coordination with related work. The pre-work teleconference shall be set up as a conference call with the Landscape Architect and Irrigation Designer and will be combined with a discussion on irrigation.
   1. Review photographs provided by Contractor's tree grower nursery of trees to be approved by Landscape Architect.
   2. Review planting schedule and maintenance.
   3. Review required inspections, schedule of topsoil testing, and environmental procedures.

B. Tree Transplanting Contractor Qualifications: Tree transplanting contractor shall meet the following qualifications:
   1. Certified Arborist on staff.
   2. Local representation and offices in the state or an adjoining state where the work is to be performed.
   3. Minimum five years of experience transplanting and establishing trees of the same size, species, and quantity as shown on the plans.

C. Plant Material Selection:
   1. Trees: Trees will be approved by the Landscape Architect from photographs taken at the tree grower nursery prior to purchase and delivery to the site. Approved tree plants will be tagged by the Contractor at the tree grower nursery. The contractor is responsible for verifying the availability of the specified trees and securing a block prior to delivery. Trees delivered to the site shall be similar in size and quality to the approved photographed sample.
   2. Shrubs: Deliver representative samples of each shrub variety and size to the Project site for verification of specification compliance. Mark shrubs with size, genus, species, cultivar, and variety.
   3. Tagging and observation will be based on compliance with requirements for genus, species, variety, cultivar, size, and quality.
   4. Owner and Landscape Architect may observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects.
   5. Remove rejected trees or shrubs immediately from Project site.

D. Plant Measurements: Measure according to ANSI Z60.1. Spread, height, or container sizes shown on the drawings are minimum acceptable sizes. Do not prune to obtain required sizes. If range of sizes is given, no plant shall be less than minimum size, and at least 50 percent of plants shall be as large as upper half of range specified. All minimum sizes shall be met.

1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread. Do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

E. Soil-Testing Laboratory Qualifications:
1. Topsoil Analysis: Independent soil testing laboratory employing a landscape or soil agronomist familiar with the final use of the material and construction practices for large earthwork sites.

F. Quality Assurance Documentations: Conduct the following inspections during the course of the work and provide photographic documentation to the Landscape Architect to verify conformance to specification requirements. Notify CEC for scheduling of inspection photo approvals by the Landscape Architect. Correct noted deficiencies during each inspection prior to proceeding with subsequent work.
1. Island Inspection: Inspect parking islands for excavation depth and soil conditions prior to installation of planting or irrigation. Obtain sample of planting soil mix.
2. Substantial Completion Inspection: Convene a substantial completion inspection to photographically document completed work. Landscape Architect will record the deficient or incomplete items on the deviation log within 3 calendar days of inspection date.
3. Final Inspection: Within 30 days of substantial completion date, convene a final inspection to photographically document that all deviations have been addressed and that work is completed as specified and shown on the drawings.
4. Warranty Inspections: Convene a warranty inspection 60 calendars days prior to expiration of warranty period specified in Part 3 herein.

G. Meeting and Inspection Log: Maintain log of required meetings and inspections. Record the date; time; weather conditions; and a brief summary of the discussions, decisions, agreements (or disagreements) reached. Provide log to CEC for signature and review by Landscape Architect at the conclusion of each meeting. Furnish copy of log to each party attending.

1.5 MEETING AND EVENT NOTIFICATIONS

A. Provide the following notifications to the Owner's Civil Engineering Consultant (CEC) within the time period listed below. CEC will notify Owner, Landscape Architect, and other necessary sub consultants:
1. Pre-Work Meeting: Minimum 14 calendar days prior to meeting date.
2. Island Inspection: 7 calendar days prior to inspection date.
3. Tree Transplanting: Minimum 7 calendar days in advance for transplanting of trees 8 inches in caliper or greater.
4. Substantial Completion Inspection: 7 calendar days prior to substantial completion date.
5. Final Inspection: 7 calendar days prior to Grand Opening.

B. Provide notifications by email or other written means to show proof of delivery.

1.6 PROJECT CONDITIONS

A. Perform work only during weather conditions favorable to landscape construction and to health and welfare of plants. Owner shall determine suitability of such weather conditions.

1.7 WARRANTY

A. Guarantee plant material for a period of 12 months following the Contract Completion Date.
1. A limit of one replacement of each plant shall be required, except for losses or replacements due to failure to comply with requirements.
2. Remove from site any plant that is dead or unsatisfactory to Owner, Jurisdiction having Authority, or Landscape Architect. Replace plants during normal planting season.

PART 2 - PRODUCT

2.1 WOODY PLANT MATERIALS

A. Furnish nursery-grown trees and shrubs complying with ANSI Z60.1 and the following requirements:
   1. Provide plants with healthy root systems developed by transplanting or root pruning.
   2. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as disfiguring knots, sun scald, injuries, abrasions, and disfigurement.
   3. Provide selected specimen quality plants being exceptionally heavy, symmetrical, tight knit, so trained or favored in their development and appearance as to be superior in form, number of branches, compactness and symmetry.
   4. Do not prune plants before delivery.
   5. Trees with fresh cuts of limbs over 1 1/4-inch, which have not completely calloused, shall be rejected.
   6. Provide plants typical of their species or variety and exhibiting a normal habit of growth and be legibly tagged with proper name. Provide plants grown under climatic conditions similar to those of site or have been acclimated to such condition for at least 2 years.
   7. Root system of each plant shall be well-provided with fibrous roots. Parts shall be sound, healthy, vigorous, well-branched, and densely foliated when in leaf.
   8. Plants designated ball and burlap shall be moved with root systems as solid units with balls of earth firmly wrapped with burlap and comply with the following:
      a. Diameter and depth of balls of earth shall comply with the American Standards for Nursery Stock and be sufficient to encompass fibrous root feeding systems necessary for healthy development of plant.
      b. No plant shall be accepted when ball of earth surrounding its roots has been cracked or broken preparatory to or during process of planting. Balls shall remain intact during all operations.
      c. Heel-in plants that cannot be planted immediately by setting in ground and covering balls with soil or mulch and then watering.
      d. Hemp burlap and twine is preferable to treated. If hemp burlap is used, twine is to be cut from around the base of the trunk and the upper 1/3 of the burlap is to be pulled down around the root ball and completely buried. If treated burlap is used, twine shall be cut from around trunk and burlap shall be removed. Any balled and burlapped tree that has not had the twine cut from around the base of the trunk and removed will be rejected.
   9. Provide single trunk trees growing from single unmutilated crown of roots. No part of trunk shall be conspicuously crooked as compared with normal trees of same variety.
   10. Provide shrubs with thickness corresponding to trade classification "No.1". Single-stemmed or thin plants shall not be accepted. Side branches shall be generous, well-twigged, and plant as whole well-branched to ground. Plants shall be in moist condition, free from dead wood, bruises, or other root or branch injuries.

2.2 LAWN SEED

A. Provide fresh, clean, new crop lawn seed mixture. Furnish to Owner dealers guaranteed statement of composition of mixture and percentage of purity and germination of each variety.

B. Seed Mixture: Provide seed of grass species and varieties, proportions by weight and minimum percentages of purity, germination, and maximum percentage of weed seed. Seed mixtures vary by region and season and shall comply with State DOT and Local Soil Conservation Service Standards for lawn turf or as specified on the construction drawings.

2.3 SOD

A. Provide sod species suitable as lawn turf for the region or as specified on the construction drawings. Sod shall be strongly rooted, weed, disease, pest free and uniform in thickness.

2.4 GROUNDCOVER

A. Provide groundcover plants of the variety specified on the plans that are established and well rooted in pots or similar containers and comply with ANSI Z60.1.

2.5 TOPSOIL

A. ASTM D5268, natural, friable, fertile, fine loamy soil possessing characteristics of representative topsoil in the vicinity that produces heavy growth. Topsoil shall be free from subsoil, objectionable weeds, litter, sods, stiff clay, stones larger than 1-inch in diameter, stumps, roots, trash, herbicides, toxic substances, or any other material which may be harmful to plant growth or hinder planting operations. Top soil shall contain:
   1. A pH range of 5.5 to 7.4 percent
   2. A Sand component range of twenty to sixty percent (20% - 60%)
   3. A Silt and Clay component range of thirty-five to seventy percent (35% - 70%)
   4. A maximum of five percent (5%) deleterious material
   5. A minimum of five percent (5%) organic material

B. Topsoil shall be tested in accordance with part 3 below.

C. Salvaged or Existing Topsoil: Reuse suitable topsoil stockpiled on-site or existing topsoil undisturbed by grading or excavation operations. Clean topsoil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

D. Verify amount of suitable topsoil stockpiled if any, and supply additional imported topsoil as needed.

E. Imported Topsoil: Supplement salvaged topsoil with imported topsoil from off-site sources when existing quantities are insufficient.
   1. Obtain topsoil displaced from naturally well-drained sites where topsoil occurs at least 6 inches deep; do not obtain from agricultural land, bogs, or marshes.
   2. Verify borrow and disposal sites are permitted as required by state and local regulations. Obtain written confirmation that permits are current and active.
   3. Obtain permits required by state and local regulations for transporting topsoil. Permits shall be current and active.

F. Amend existing and imported topsoil as indicated in part 3 below.

2.6 ORGANIC SOIL AMENDMENTS

A. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

B. Back to Nature Cotton Burr Compost or approved equivalent.

C. Compost: Decomposed organic material including leaf litter, manure, sawdust, plant trimmings and/or hay, mixed with soil.

D. Pecan Hulls: Composted pecan hulls for local source.

E. Biosolids: Use Grade 1 containing lower pathogen levels.

F. Worm Castings: Earthworms.

2.7 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C602, Class O agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent with a minimum of 95 percent passing No. 8 sieve and minimum of 55 percent passing No. 60 sieve.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing No. 6 sieve and a maximum of 10 percent passing No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

E. Sand: Clean, washed, natural or manufactured, free of toxic materials.

2.8 PLANTING ACCESSORIES

A. Non-Selective Herbicide: Roundup-Pro, Finale or equivalent.

B. Selective Post Emergent Herbicide: EPA registered and approved, of type recommended by manufacturer for application.

C. Selective Pre-Emergent Herbicide: EPA registered and approved, of type recommended by manufacturer for application.

2.9 PLANTING SOIL MIX

A. Planting medium containing 75 percent specified topsoil mixed with 15 percent organic soil amendments and 10 percent sharp washed sand unless otherwise specified on the drawings.

2.10 FERTILIZER

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium.
   1. Composition: Nitrogen, phosphorous, and potassium in amount required to remedy deficiencies identified in the topsoil.

B. Slow-Release Fertilizer: Use one of the following:
   1. Osmocote Standard Granular fertilizer by Scotts Company composed of 13 percent nitrogen, 13 percent phosphorous, and 13 percent potassium, by weight.
   2. Multi-Cote All Purpose by Schultz composed of 17 percent nitrogen, 17 percent phosphorous, and 17 percent potassium, by weight.

C. Deliver fertilizer, mixed as specified, in original unopened standard size bags showing weight, analysis and name of manufacturer. Containers shall bear manufacturer's guaranteed statement of analysis, or manufacturer's certificate of compliance covering analysis shall be furnished to Owner. Store fertilizer in such manner that it shall be kept dry.

2.11 MULCH

A. Straw Mulch: Straw mulch shall not be used for seeding or to stabilize disturbed areas.

B. Wood Mulch: Wood mulch shall be shredded hardwood bark mulch obtained from a local source harvested in a sustainable manner and salt free and free from deleterious materials and suitable as a top dressing of trees and

shrubs. Mulch shall have the characteristics of retaining moisture, forming a mat not susceptible to spreading by wind or rain, and providing a suitable growth medium for plants and shall be free of soil, rocks, weeds, sawdust, dirt, garbage, or other debris.

1. Hardwood Mulch: Shredded hardwood mulch shall consist of long fibrous interlocking strands.
2. Color: Natural.

C. Mineral Mulch: Mineral mulch shall consist of decomposed granite, crushed rock, or gravel. Mulch shall be hard, durable stone, washed free of loam, sand, clay, and other foreign substances.

1. Where wood mulch is shown or specified, mineral mulch shall be used where regionally appropriate or where wood mulch is not readily available.
2. Size Range: 3/4-inch maximum 1/4-inch minimum**.**
3. Color: Readily available natural gravel color range.

D. Softwood, Pine Bark or Pine Needle Mulch shall not be used.

E. Hydro-mulch: Hydra CM Bonded Fiber Matrix shall be used in all hydro-seeding applications. Refer to construction drawings for application rates in various areas.

2.12 TREE STAKING

A. Metal “T”-post stakes of the length specified in the construction details.

B. Provide guy wire ties of 2-strand, twisted, pliable galvanized iron wire not lighter than 12 ga. with zinc-coated turnbuckles.

C. Provide not less than 1/2" diameter rubber or plastic hose, cut to required lengths and of uniform color, material and size to protect tree trunks from damage by wires.

2.13 WATER

A. Potable water, hose, and other watering equipment.

2.14 WEED MAT

A. 4.1 oz., woven polypropylene, needle-punched fabric, weed barrier.

2.15 STEEL EDGING

A. 1/8-inch x 4-inch interlocking steel edging, staked with metal stakes sufficiently to hold in place and where specifically indicated on the drawings.

2.16 EROSION CONTROL BLANKET

A. Rolled Erosion Control Products shall have current QDOR™ (Quality Data Oversight and Review) status issued by the Erosion Control Technology Council and shall meet state or agency specific requirements. Evidence of QDOR™ approval shall accompany the product shipped to the job site for ready identification by the contractor or an agency inspector.

PART 3 - EXECUTION

3.1 PREPARATION

A. If project completion date prohibits in-season planting, prepare for out-of-season seeding or sodding so that lawns shall be completed and ready for acceptance at time of project completion.

B. Unsuitable Subsoils: Locations containing unsuitable subsoil shall be treated by one or more of the following:

1. Where unsuitability is deemed by Owner to be due to excessive compaction caused by heavy equipment and where natural subsoil is other than AASHTO classification of A6 or A7, loosen such areas with spikes, discing, or other means to loosen soil to condition acceptable to Owner. Loosen soil to minimum depth of 12 inches with additional loosening as required to obtain adequate drainage. Contractor may introduce peat moss, sand, or organic matter into the subsoil to obtain adequate drainage. Such remedial measures shall be considered as incidental, without additional cost to Owner.
2. Where unsuitability is deemed by Owner to be due to presence of boards, mortar, concrete, or other construction materials in sub-grade and where natural subsoil is other than AASHTO classification of A6 or A7, remove debris and objectionable material. Such remedial measures shall be considered as incidental, without additional cost to Owner.
3. Where unsuitability is deemed by Owner to be because natural subsoil falls into AASHTO classification of A6 or A7 and contains moisture in excess of 30 percent, then installation of sub-drainage system or other means described elsewhere in Specifications shall be used. Where such conditions have not been known or revealed prior to planting time and they have not been recognized in preparation of The Drawings and Specifications, then Owner shall issue pricing order to install proper remedial measures.

C. Unsuitable Topsoil: Locations containing unsuitable topsoil shall be treated by one or more of the following:
1. Where unsuitability is deemed by Owner to be because of presence of objectionable weeds; litter; sods; stiff clay; toxic substances; herbicides or other material which may be harmful to plant growth, then topsoil shall be removed from the site and disposed of in a legal manner.
2. Where unsuitability is deemed by Owner to be because of presence of the stumps, roots; stones larger than 1 inch in diameter; less than 3 percent organic material; low or high pH range, remove objectionable material and amend topsoil to meet the requirements specified in part 2 above. Such remedial measures shall be considered as incidental, without additional cost to Owner.

D. Perform planting operations at steady rate of work unless weather conditions make it impossible to work. No plant material shall be planted in frozen ground.

E. Tree and Shrub Preparation
1. Dig bare-rooted shrubs with adequate fibrous roots. Cover roots with uniformly thick coating of mud by being puddled immediately after they are dug, or packed in moist mulch or moss.
2. Dig ball and burlap plants with firm natural balls of earth of diameter and depth to include fibrous roots.
3. Protect roots or balls of plants at all times from sun and drying winds.
4. Ball and burlap plants which cannot be planted immediately upon delivery shall be set on ground and protected with soil, wet moss, or other acceptable material. Heel-in bare rooted plants that cannot be planted immediately upon delivery. All shall be kept moist.
5. Open and separate bundles of plants before roots are covered. Prevent air pockets among roots. During planting operations, cover bare roots with canvas, hay, or other suitable material. Plants shall not be bound with wire or rope which will result in damage to bark or branches.

F. Sod and Seed Bed Preparation
1. Newly Graded Subgrades:
   a. Do not place topsoil until subgrade has been approved in accordance with Section 02300.
   b. Before placing topsoil, rake subsoil surface clear of stones, debris, and roots. Disk, drag, harrow, or hand rake subgrade to depth of 4 inches and remove stones larger than 1-1/2 inches to provide bond for topsoil.
   c. Spread topsoil to a depth of 4 inches but not less than required to meet finish grades after light rolling and natural settlement. Adjust depth of topsoil in areas adjacent to paved surfaces or curbs to allow for the placement of sod or seed.
2. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface as follows:
   a. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
   b. Disk, drag, or harrow surface soil to a depth of at least 6 inches.
   c. Remove stones larger that 1-1/2 inch in any dimension and sticks, roots, trash, and other extraneous matter.
   d. Legally dispose of waste material, including grass, vegetation, and turf.

e. Adjust depth of topsoil in areas adjacent to paved surfaces or curbs to allow for the placement of sod or seed.

3. Incorporate soil amendments and commercial fertilizer into the top 4 inches of topsoil to achieve the specified topsoil requirements. Till soil to a homogenous mixture of fine texture.
4. Grade areas to finish grades, filling as needed or removing surplus topsoil. Float areas to smooth, uniform grade as indicated on the Drawings. Lawn areas shall slope to drain.
5. Where no grades are shown, areas shall have a smooth and continual grade between existing or fixed controls, such as walks, curbs, catch basin, steps, or buildings. Roll, scarify, rake, and level as necessary to obtain true, even lawn surfaces. Finish grades shall meet approval of Owner.
6. Sod and seed beds shall be firmed by rolling before seeding begins.

G. Groundcover Bed Preparation:
1. Grade areas to finish grades, filling as needed or removing surplus topsoil. Float areas to smooth, uniform grade as indicated on the Drawings.
2. Set out and space groundcover 12 inches apart maximum or as otherwise indicated on the Drawings.
3. Dig holes large enough to allow spreading of roots, and backfill with planting soil.
4. Remove groundcover from pots.
5. Work soil around roots to eliminate air pockets and leave a slight saucer indention around plants to hold water.
6. Water thoroughly after planting taking care not to cover plant crowns with wet soil.
7. Protect plants from hot sun and wind; remove protection when plants show evidence of recovery from transplanting shock.

H. Island Preparation:
1. Excavate compacted soil to a depth of 24 inches or as otherwise indicated on the Drawings.
2. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
3. Scarify sides of excavation pit smeared or smoothed during excavation.
4. Subsoil or topsoil removed from islands shall not be used in planting soil mix.
5. Notify Owner's CEC if subsoil conditions evidence unexpected water seepage or retention within excavation area.
6. Backfill islands in 8-inch lifts with planting soil mix specified herein. Tamp each lift lightly to prevent settling.
7. Grade areas to finish grades, filling as needed to indicated on the Drawings. Float areas to a smooth, uniform grade as indicated on the Drawings.

I. Raised Planter Preparation:
1. Excavate compacted soil and construction debris within raised planter to minimum 12 inches below finish grade of adjacent sidewalk.
2. Notify Owner's CEC if subsoil conditions evidence unexpected water seepage or retention with the excavation area.
3. Scarify bottom of excavation and provide positive drainage to drainage pipe.
4. Install drainage pipe as shown in the drawings and stone/gravel as shown in the Drawings.
5. Install separator fabric between stone/gravel and planting soil mix as shown in the Drawings.
6. Backfill raised planter in 8-inch lifts with specified planting soil mix to within 1 inch of bottom edge of wall cap. Tamp each lift lightly to prevent settling. If settling occurs prior to planting add additional planting soil mix.
7. Grade areas to finish grades, filling as indicated on the construction Drawings to allow positive drainage. Float areas to a smooth, uniform grade as indicated on the Drawings.

3.2 PROTECTION

A. Topsoil which must be transported across finished sidewalks shall be delivered in such manner that no damage will be done to sidewalks.

B. Before commencing work, trees and shrubs that are to be saved shall be protected from damage by placement of fencing flagged for visibility or some other suitable protective procedure approved by Owner and as shown in the construction Drawings or as required by local code.

C. Trucks or other equipment shall not be driven or parked within drip line of any tree unless tree overspreads paved area.

D. Use precautionary measures when performing work around trees, sidewalks, pavements, utilities, and other features either existing or previously installed.

E. Adjust depth of earthwork and topsoil when working immediately adjacent to aforementioned features in order to prevent disturbing tree roots, undermining sidewalks and pavements, and damage in general to other features either existing or previously installed.

F. Cover plants transported to project in open vehicles with tarpaulins or other suitable covers securely fastened to body of vehicle to prevent injury to plants. Closed vehicles shall be adequately ventilated to prevent overheating of plants. Evidence of inadequate protection following digging, carelessness while in transit, or improper handling or storage shall be cause for rejection. Plants shall be kept moist, fresh, and protected. Such protection shall encompass entire period during which plants are in transit, being handled, or are in temporary storage.

G. Plants shall not be delivered to the site more than seven days prior to planting. Plants not planted within 48 hours of delivery, shall be healed in (covered with sawdust, soil or mulch), and the containers or balls protected from wind and temperature and kept moist until planting.

H. Where excavation, fill, or grading is required within drip line of trees that are to remain, work shall be in accordance with the tree preservation plans and details within the Drawings or as follows. If any discrepancy occurs, detailed Drawings shall take precedents over general specifications::
   1. Trenching: When trenching occurs around trees to remain, tree roots shall not be cut but trench shall be tunneled under or around roots by careful hand digging without injury to roots.
   2. Raising Grades:
      a. Where fill not exceeding 16 inches is required, clean, washed gravel graded from 1 inch to 2 inches in size shall be placed directly around tree trunk. Extend gravel out from trunk on all sides a minimum of 18 inches and finish approximately 2 inches above finished grade at tree. Install gravel before any earth fill is placed. New earth fill shall not be left in contact with trunks of trees requiring fill.
      b. Where fill exceeding 16 inches is required, construct dry-laid tree well around trunk of tree. Tree well shall extend out from trunk on all sides minimum of 3 feet (horizontal) and to 3 inches (vertical) above finish grade. Place coarse-graded rock directly around tree well extending out to drip line of tree. Place clean, washed gravel graded from 1 inch to 2 inches in size directly over coarse rock to depth of 3 inches. Place approved backfill material directly over washed gravel to desired finish grade.
   3. Lowering Grades: Existing trees in areas where new finish grade is to be lowered shall have regrading work done by hand to elevation indicated on The Drawings. Roots as required shall be cut cleanly 3 inches below finished grade and scars covered with tree paint.
   4. Trees marked for preservation that are more than 6 inches above proposed grades shall stand on broad rounded mounds and graded smoothly into lower level. Trees located more than 16 inches above proposed grades shall have dry-laid stone wall or other retaining structure as detailed on The Drawings constructed minimum of 5 feet from trunk. Exposed or broken roots shall be cut clean and covered with topsoil.

3.3 PLANTING BED ESTABLISHMENT

A. Prior to preparing planting beds, the area shall conform to the lines and grades shown on the plans and the condition of the subsoil shall be approved by the Owner.

B. Contractor shall verify the location of any underground utilities on site.

C. Planting beds where existing subsoil is determined by Owner to be unsuitable for plant growth in accordance paragraph Unsuitable Subsoil herein shall be excavated to a depth of 24 inches or as needed to provide adequate drainage. Replace excavated soil with planting soil mix.

D. Planting beds where existing subsoil is acceptable by Owner shall be prepared as follows:
   1. Seven days prior to commencing establishment of the planting areas, apply non selective herbicide. Remove dead vegetation.
   2. Loosen subsoil to a depth of 12 inches. Remove stones larger than 1-inch in any dimension, sticks, roots, rubbish, and other extraneous matter and legally dispose of them off site.
   3. Spread 3 inches of soil conditioner over the surface of the planting area and incorporate into the top 12 inches of the soil. Prior to spreading soil conditioner, add or remove topsoil as needed to accommodate addition of soil conditioner and to achieve finish grade.
   4. Till planting soil mix to a homogenous mixture of fine texture.
   5. Float areas to smooth, uniform grade providing positive drainage out of planting beds and away from structures or as indicated on the Drawings.

E. Apply slow release fertilizer at a rate of 1-1/2 pounds per 100 square feet for beds areas or per recommendations shown on the Drawings or by local agronomist and incorporate into the top 8 inches.

3.4 TREATMENT OF EXISTING TREES

A. Prune or remove existing trees as indicated on the planting plan.

3.5 TREE AND SHRUB PLANTING

A. Plants too large for 2 persons to lift in and out of holes shall be placed with sling. Do not rock trees in holes to raise.

B. If rock or other underground obstruction is encountered, Owner may require plant pits to be relocated, pits enlarged, or plants deleted from project.

C. Make adjustments in locations as directed. In event that pits or areas for planting are prepared and backfilled with planting soil mix or topsoil to grade prior to commencement of lawn operations, they shall be so marked that when planting proceeds, they can be readily located. In case underground obstructions such as ledges or utilities are encountered, change location under direction of Owner without charge.

D. All excavations, drainage improvements, and soil replacement in parking islands shall be completed prior to the installation of any trees and shrubs.

E. Holes for trees shall be at least 2 times the diameter of the root ball and at least 6 inches deeper than root ball or as shown on the Drawings. Holes for shrubs shall be at least 2 feet times the diameter of the root ball and at least 6 inches deeper than the root ball (minimum) or as shown on the Drawings. Holes for vines shall be at least 12 inches greater in diameter than the spread of root ball at least 12 inches deep.

F. Backfill tree holes and shrub beds with planting soil mix. Apply slow-release fertilizer at a rate of 1/4 pounds per caliper inch for trees. Incorporate fertilizer into the planting soil mix.

G. Plants shall be planted at same depth as they had previously grown or as shown on the drawings. Backfill planting soil mix in layers of not more than 8 inches and each layer watered sufficiently to settle before next layer is placed. Tamp planting soil mix under edges of balled plants. Use enough planting soil mix to bring surfaces to finish grade when settled.
   1. Provide saucer around each plant as shown on the Drawings.
   2. Soak plants with water twice within first 24 hours after time of planting. Apply water with low pressure so as to soak in thoroughly without dislodging topsoil.

H. Tree Staking: Install metal “T”-post stakes so that 1/3 of the length is below grade in undisturbed soil, or as specified in the construction details. Install the wire ties of 2-strand, twisted, pliable galvanized iron wire horizontally at a height of 3’ to 4’ with the turnbuckles accessible for adjustment. Run the wires through the 1/2" diameter rubber or plastic hose, to protect tree trunks from damage by wires. Stake trees under 3" caliper with a min. of 2 posts. Stake trees over 3" caliper with a min of 3 posts. In areas of high pedestrian traffic or high wind situations, additional stakes or dead-man stabilizers may be attached to the buried root ball - as detailed. Tie white or fluorescent colored flagging to the wires for visibility.

3.6 MISCELLANEOUS INSTALLATIONS

A. Weed Mat: Place weed mat under planting areas that will not be seeded and in any other locations as shown on the Drawings. Cover weed mat with 4 inches of mulch and secure in place with soil staples. NOTE: Weed mat NOT to be installed in areas with spreading ground cover plantings.

B. Mulch: Place 4 inches of mulch as a top dressing in planting beds. Mulch single trees or shrubs to outside edge of saucer. Type of mulch to be as specified on the drawings and specifications.

C. Peg sodded slopes between 4:1 and 3:1 to hold in place. Sodded slopes greater than 3:1 are to be reinforced as shown on the drawings.

D. Areas to be covered with erosion control blankets shall be properly prepared, fertilized, and seeded before blanket is applied. When blanket is unrolled, netting shall be on top and fibers in contact with soil. In ditches, apply blanket in direction of flow of water. On slopes, apply blankets vertically on slope. Overlap ends and sides 6 inches and staple per manufacturer's written instructions.

3.7 AREAS TO BE TURFED

A. Unless otherwise shown on the plans, disturbed areas including out-lots shall be permanently sodded and seeded.

B. Place 36-inch wide strip of solid slab sod adjacent to paved surfaces including sidewalks, curbs, walls, drainage structures, and vehicular pavement as shown on the drawings.

C. Continually seed remaining disturbed areas until fully turfed with no bare spots.

3.8 SOIL STABILIZATION

A. Provide one or more of the following techniques to prevent soil eroding from denuded areas and leaving the site. Refer to stabilization requirements in Section 02370.
   1. Temporary Seeding or Stabilization.
   2. Permanent Seeding, Sodding, or Mulching.

3.9 SEEDING

A. Do not perform seeding in windy conditions.

B. Seeding shall be dispersed in 2 directions at right angles to each other.

C. Permanently seed and mulch cut and fill slopes as construction proceeds to extent considered desirable and practical. In the event it is not practical to seed areas, slopes shall be stabilized with hydro-mulch and tackifier, netting, blankets or other means to reduce the erosive potential of the area.

D. Slopes that are specified to receive seeding are to be hydro-seeded at the recommended seeding rate prior to installation of the erosion control blanket. After installation of erosion control blankets, the slopes are to have sand spread over the blanket to fill all voids, and then hydro-seeded a second time at the same specified seeding rate.

E. Surface layer of soil for seeded areas shall be kept moist during germination period. Water seeded areas twice the first week to minimum depth of 6 inches with fine spray and once per week thereafter as necessary to supplement natural rain to equivalent of 6 inches depth.

3.10 SODDING

A. Cut and lay sod on same day. Only healthy vigorous growing sod shall be laid.

B. Lay sod across slope and tightly together to result in solid coverage free of gaps. All seams in sod are to be sanded to provide a smooth uniform growing surface.

C. Sodded slopes between 4:1 and 3:1 are to be pegged to hold sod in place.

D. Roll or firmly but lightly tamp new sod with suitable wooden or metal tamper sufficiently to set or press sod into underlying soil.

E. All finished sodding shall be smooth and free of lumps and depressions.

F. After sodding has been completed, clean up and thoroughly water newly-sodded areas.

3.11 MAINTENANCE DURING CONSTRUCTION

A. Begin maintenance operations immediately after each plant is planted and continue as required until acceptance. Water, mulch, weed, prune, spray, fertilize, cultivate, and otherwise maintain and protect plants. Reset settled plants to proper grade and position, restore planting saucers, and remove dead, diseased, or unhealthy plant material. Tighten and repair stakes and wires. Correct defective work as soon as possible after it becomes apparent and weather and season permit.

B. Upon completion of the planting operations, clean up landscaped areas to be free of stones, containers, trash, and other waste and debris to leave area in a neat and well-groomed appearance.

C. Supplement rainfall as required to provide an equivalent of 1 inch of water per week until the plants have rooted and are established.

D. Maintain all plant material in a healthy, vigorous growing condition.

E. Make weekly inspections to determine moisture content of soil and adjust watering schedule established by irrigation system installer to fit conditions.

F. After grass growth has started, reseed or sod areas that fail to show uniform stand of grass in accordance with The Drawings and as specified herein. Continue Reseeding and sodding such areas repeatedly until areas are covered with satisfactory growth of grass. Perform removal and replacement or topsoil conditioning if required to facilitate establishment of grass.

G. Water in such manner and as frequently as is deemed necessary by Owner to assure continued growth of healthy grass. Water areas of site in such a manner as to prevent erosion due to excessive quantities applied over small areas and to avoid damage to finished surface due to watering equipment.

H. Provide water for execution and maintenance at no expense to Owner. Furnish portable tanks, pumps, hose, pipe, connections, nozzles, and any other equipment required to transport water from available outlets and apply it to seeded areas in approved manner.

I. Mowing:
   1. Initiate mowing of turf areas when grass has attained height of 3 inches and roots are firmly established. Maintain grass height at 1 to 1-½ inches for Bermuda grass and 2-1/2 to 3 inches for other turf types at

subsequent cuttings depending on time of year. Remove no more than 1/3 of grass leaf at any cutting and cutting shall not occur more than 10 days apart.

2. Mow undeveloped grassed areas a minimum of once per month during the growing season to a height of no less than 4-6 inches or as required by local codes.

J. Remove heavy cuttings to prevent destruction of underlying turf. If weeds or other undesirable vegetation threaten to smother planted species, such vegetation shall be mowed or, in case of rank growths, shall be uprooted, raked and removed from area by methods approved by Owner.

K. Remove weeds and other undesirable vegetation by applying herbicides as recommended by the manufacturer or by uprooting. Rake and remove uprooted vegetation from area by methods approved by Owner.

L. Protect seeded area from pedestrian or vehicular trespassing while grass is germinating. Provide fences, signs, barriers, or other necessary temporary protective devices. Repair damage resulting from trespass, erosion, washout, settlement, or other causes.

M. Remove fences, signs, barriers, or other temporary protective devices after final acceptance.

N. Remove and replace diseased, distressed, dead, or rejected plants prior to Substantial Completion Date.

O. Replacements shall be plants of same variety and size specified on The Drawings. Furnish and plant as specified herein. Replacements resulting from removal, loss, or damage due to occupancy of project in any part, vandalism, physical damage by animals, vehicles, etc., and losses due to curtailment of water by local authorities will be approved and paid for by Owner.

P. Grassed areas damaged during process of work shall be restored or repaired to condition satisfactory to the Owner. Fill, grade, re-fertilize, replant, or mulch as required to restore to contract requirements.

3.12 FIELD QUALITY CONTROL / TESTING AND INSPECTION (T&I)

A. Field quality control shall be the responsibility of the Contractor. Except for specified mandatory testing, field quality control testing and inspection shall be at the discretion of the Contractor as necessary to assure compliance with Contract requirements. Retain an independent soil testing laboratory to sample and test imported topsoil.

1. Topsoil Analysis: Collect 5 random samples from the topsoil borrow area or areas. Combine samples and test as a composite for percentages of organic matter; presence of herbicides; percentage of sand, silt, and clay content; deleterious material; pH; and mineral and plant-nutrient content of topsoil.
2. Submit topsoil borrow area test reports to Owner's Civil Engineering Consultant (CEC) minimum 6 weeks prior to delivery to site.

END OF SECTION