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Design & Construction Standards:
TECHNICAL GUIDELINES

Division 31

31 23 00 Excavation and Fill

31 25 00 Erosion and Sedimentation Controls

31 69 23 Drilled Concrete Piers and Shafts

FACILITY MANAGEMENT

April 2016

SECTION 31 23 00

EXCAVATION AND FILL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract and Division One and other related specification sections apply to work of this section.

1.02 REGULATORY REQUIREMENTS

- A. Burning will not be allowed on-site. Comply with all applicable codes, regulations, and laws.
- B. Comply with applicable requirements of CABO/ANSI A117.1 for accessibility requirements related to walks, ramps, parking areas, drives, curb ramps, etc.
- C. Obtain and comply with all requirements of the City of Denver and CDPHE Stormwater and/or Groundwater Discharge Permits, as required.
- D. For public improvements only, in the event of a conflict between municipal standards and this specification, municipal standards for products and installation will govern.
- E. Excavation work shall be performed in compliance with City of Denver and current OSHA requirements.

1.03 ENVIRONMENTAL REQUIREMENTS

- A. Protect adjacent structures and surrounding areas from damage during excavation, filling, and backfilling.
- B. Protect work from erosion or other similar types of damage until the project has been accepted. Leave protection in place for building contractors use.
- C. Do not backfill or construct fills during freezing weather. Backfill or construct fills only when temperature is 35°F and rising.
- D. Do not use frozen materials, snow, or ice in any backfill or fill area.
- E. Do not backfill or construct fill on frozen surfaces.
- F. Protect excavated material from becoming frozen.
- G. Do not remove trees from outside excavation or fill areas unless authorized by the Owner; protect from permanent damage by construction activities.
- H. Provide temporary bridges for roadways, walkways, driveways, etc.

1.04 QUALITY ASSURANCE

- A. All imported material to be free of hazardous and organic wastes, “clean” as defined by EPA, and approved for its intended use by the Owner or project geotechnical engineer.

1.05 WARRANTY

- A. Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment or site furnishing. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.
- B. The term of warranty will be 18 months.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Submit all materials in accordance with Section 01 33 00, Submittals.
- B. General backfill quality:
 - 1. Specify acceptable and unacceptable soil classifications for each type of soil backfill material.

2. Specify pipe bedding materials, both inside and outside the building.
 3. Pipe bedding materials should include crushed aggregate that has bridging qualities which will reduce “ovalling” and low spots in gravity flow systems.
 4. Free of brush, sod, organic material, vegetative matter, debris and other deleterious substances.
 5. Shall not contain rocks or lumps having a diameter of more than 2 inches.
 6. Free of frozen material.
 7. The use of acceptable on site soils should be prioritized above other options.
- C. Structural Fill:
1. In conformance with recommendations of Geotechnical Report.
 2. If no Geotechnical Report is provided for the project use the following minimum criteria:
 - a) Imported structural fill, such as ½ inch minus, CDOT Class 7 Aggregate Road Base conforming to the following:
 - i) Gradation: 1 inch – 100% Passing, No. 8 Sieve – 20-85% Passing, No. 20 Sieve – 20% maximum.
 - ii) Liquid Limit: 35 maximum.
 - iii) Plasticity Index: 15 maximum.
 - iv) R Value: 50 minimum.
- D. Non-structural Fill:
1. Non-structural fill material includes all fill not supporting structures or site paving and approved by the Owner’s Testing Agency.
 2. Granular, non-expansive material suitable for specified compaction, as approved by the Geotechnical Engineer.
- E. Geo-grid materials as specified by the geotechnical or civil engineer:
1. Alternate geo-textile or geo-grid materials not conforming to Geotechnical Engineers recommendations, require written approval from Owner’s Testing Agency prior to use.
- F. Flow Fill:
1. Where excavations are required inside of a building or other structure and within 2 feet of the exterior wall or footings, the Contractor shall use flowable concrete fill having a 28-day compressive strength of not less than 60 psi.

PART 3 EXECUTION

3.01 PREPARATION

- A. Stockpile topsoil to location specified by Construction Documents and coordinated with DPS.
- B. Stockpile other materials, in an approved location and manner, as indicated to be salvaged and reused (such as squeegee and sod).
- C. Remove debris and organic matter and dispose of legally off-site.
- D. Utility warning tape: Refer to standard Section 33 00 00, Utilities.

3.02 ZONSTRUCTION

- A. General
 1. Contractor to verify quantities of cuts and fills and perform all earthwork required to meet the grades as shown on the plans, including but not limited to, additional import or export required to handle compaction, building and pavement subgrade preparation, and pipe bedding.
 2. Perform work in a safe and proper manner with appropriate precautions against hazard.
 3. Provide adequate working space and clearances for work performed within excavations and for installation and removal of utilities

4. Contain all construction activity on the designated site and within the limits of work. Cost of restoration off site will be the responsibility of the Contractor
- B. Excavation
1. Contractor shall be responsible for safety of excavations and for protection of existing buried utilities.
 2. Unauthorized excavation and remedial work shall be at the Contractor's expense.
- C. Backfill
1. Owner's Testing Agency must inspect and approve sub-grade prior to backfilling.
 2. Backfill only after the A/E's acceptance of below grade construction.
 3. Reference Geotechnical report for compaction under buildig and pavement
- D. Compaction
1. Compaction under landscaped or lawn areas shall be not less than 80% nor greater than 90% Standard Proctor within the top 18 inches of soil.
 2. Specify proof rolling for paving areas and slab pads and require that the Owner's Testing Agency witness the proof rolling.
- E. Dewatering
1. Dewatering of excavations is the responsibility of the contractor.

3.03 PROTECTION

- A. Field verify the location of all underground utilities, pipelines and structures prior to excavation.
- B. Sediment and erosion control: In no case shall construction activities commence without approved temporary erosion and sediment control measures in place.
- C. Property and environment: Contractor shall protect existing structures, appurtenances, trees and shrubs and their associated root systems. A warranty of 24 months shall be enforced to cover all excavation, backfill, and compaction sitework.
- D. Erosion and Sedimentation Control
1. Comply with Section 31 25 00 Erosion and Sedimentation Controls.
 2. Comply with City of Denver or other local MS4 Permit Requirements.
 3. Comply with City and County of Denver and Urban Drainage and Flood Control District standards for temporary grading, erosion and sedimentation control.

3.04 FIELD QUALITY CONTROL

- A. Notifications:
1. The Contractor shall notify the A/E and the DPS at least 10 working days prior to each phase of excavation, backfill, and compaction.
 2. Contractor shall work with the Owner to schedule Owner's inspections and testing.
- B. Information provided by Owner's consultants is not represented as sufficient to guarantee compliance with Contractor contract requirements. Contractor is responsible for his own testing to assure compliance with Contract Documents, at his own expense.
1. Contractor shall submit qualifications of the testing consultant, if different than Owner's Testing Agency, used for testing purposes on his own behalf.
 2. All additional information resulting from contractor testing shall be shared with the Owner and A/E.
- C. The Owner will retain the services of an Owner's Testing Agency for observation, testing, and quality control of work in this Section.
1. Frequency of testing (including subgrade under curb and gutter, trenches, footings, slabs-on-grade and other bearing surfaces), testing methods (include one sand cone for every ten nuclear tests for correlation),

- and by which method shall be developed in conjunction with the Owner's Testing Agency and approved by the DPS prior to inclusion into this specification section.
2. The Contractor shall supply location and elevation reference points for the use of the Testing Agency to locate the test points.
 3. The Contractor shall track test locations to verify that each lift has been compacted and tested in accordance with these specifications.
 4. Preliminary test reports from subsurface investigations will be provided to the Contractor from the Owner's Testing Agency.
- D. Contractor will be provided test and report information provided by the Owner's Geotechnical Engineer and Testing Agency.
- E. If additional testing/observation is needed, contractor shall obtain and pay for such services at his own expense.
- F. Final Grading:
1. After completion of all other outside work and after backfilling is completed and settled, bring to grade at the indicated elevations.
 2. Graders and other power equipment may be used for final grading and slope dressing if the result is uniform and equivalent to hand work.
 3. Grade all surfaces for effective drainage, provide a 2 percent minimum slope except as otherwise shown on the plans.
 4. Provide a smooth transition between adjacent existing grades and new grades.
 5. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
 6. Slope grades to direct water away from buildings and prevent ponds from forming where not intended.
 7. Finish subgrades at lawns and unpaved areas to required elevations within a tolerance of plus or minus one (1) inch.
 8. Coordinate final subgrade depth with finish landscape treatment.

END OF SECTION 31 23 00

SECTION 31 25 00
EROSION AND SEDIMENTATION CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This work consists of temporary measures needed to control erosion and water pollution. These temporary measures will include, but not be limited to, berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses, slope drains, and other erosion control devices or methods. These temporary measures shall be installed at the locations where needed to control erosion and water pollution during the construction of the project and during site restoration, and as directed by A/E, and as shown on the drawings.
- B. The Erosion Control Plan presented in the drawings serves as a minimum for the requirements of erosion control during construction. Contractor has the ultimate responsibility for providing adequate erosion control and water quality throughout the duration of the project. Therefore, if the provided plan is not working sufficiently to protect the project areas, then Contractor shall provide additional measures as required to obtain the required protection.

1.02 RELATED SECTIONS

- A. Section 32 05 05 – Selective Demolition for Exterior Improvements.
- B. Section 01 50 00 – Temporary Facilities and Controls.
- C. Section 31 23 00 – Excavation and Fill.
- D. Section 32 12 16 – Asphalt Paving.
- E. Section 32 13 13 – Concrete Paving.
- F. Section 32 92 00 – Turf and Grasses.
- G. Section 33 00 00 – Utilities.

1.03 REFERENCES AND STANDARDS

- A. City and County of Denver Stormwater Criteria for Construction Activities.
- B. CDOT – Colorado Department of Transportation.
- C. UDFCD – Urban Drainage and Flood Control District.
- D. CDPHE – Colorado Department of Public Health and Environment.

1.04 SUBMITTALS

- A. Submit under provisions of Division One specifications.
- B. Submit the following information:
 - 1. Erosion Control Plan.
 - 2. Construction schedule for Erosion Control per Article Scheduling.
 - 3. Sequencing Plan per Article Scheduling.
 - 4. All applicable permits for Erosion Control.
- C. Product data: Submit on all products or materials supplied herein.

1.05 REGULATORY REQUIREMENTS

- A. Obtain and comply with all requirements of City and County of Denver and CDPHE Stormwater and/or Groundwater Discharge Permits, as required.
- B. 401 Construction Dewatering Industrial Wastewater Permit (Construction Dewatering Permit 401):

1. Contractor shall apply for and obtain a Construction Dewatering Permit 401 from the Colorado Department of Public Health and Environment.
 2. All costs for this permit shall be the responsibility of Contractor.
 3. This permit requires that specific actions be performed at designated times.
 4. Contractor is legally obligated to comply with all terms and conditions of the permit including testing for effluent limitations.
 5. Contractor shall allow the Colorado Department of Public Health and Environment or other representatives to enter the site to test for compliance with the permit.
 6. Non-compliance with the permit can result in stoppage of all work.
- C. In the event of conflict between these requirements and erosion and pollution control laws, rules, or regulations of other Federal, State, or local agencies, the more restrictive laws, rules, or regulations shall apply.

1.06 SCHEDULING

- A. Sequencing Plan:
1. Contractor shall submit a sequencing plan for approval for erosion control in conformance with Contractor's overall Construction Plan for approval by City and County of Denver and DPS.
 2. Changes to the contractor's Erosion Control Sequencing Plan may be considered by City and County of Denver and DPS only if presented in writing by the Contractor.
- B. Temporary Erosion Control:
1. When so indicated in the Contract Documents, or when directed by City and County of Denver and DPS, Contractor shall prepare construction schedules for accomplishing temporary erosion control work including all maintenance procedures.
 2. These schedules shall be applicable to clearing and grubbing, grading, structural work, construction, etc.
- C. Contractor shall submit for acceptance the proposed method of erosion control on haul roads and borrow pits and a plan for disposal of waste material.
- D. Contractor shall be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the accepted schedule. Temporary erosion control measures shall then be used to correct conditions that develop during construction.
- E. Work shall not be started until the erosion control schedules and methods of operations have been accepted.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Comply with all applicable municipal or local Municipal Separate Storm Sewer System (MS4) requirements.
- B. All materials shall be submitted for approval prior to installation.
- C. Natural or biodegradable materials shall be reasonably clean, free of deleterious materials, and certified weed free. Materials may include, but are not limited to, hay bales, straw, fiber mats, fiber netting, wood cellulose, fiber fabric, gravel.
- D. Grass Seed:
1. Temporary grass cover (if required) shall be a quick growing species, suitable to the area, in accordance with local criteria and permit requirements, which will provide temporary cover, and not compete with the grasses sown for permanent cover.
 2. All grass seed shall be approved by A/E and in accordance with local regulations prior to installation.
- E. Fertilizer and soil conditioners shall be approved by A/E, and in accordance with local regulations prior to installation.

- F. Silt Fence Fabric: woven polypropylene.
 - 1. Mirafi 100X, "Envirofence".
 - 2. Or accepted substitution.
- G. Temporary Slope Stabilization Mat: (if required) approved for use in the City and County of Denver.

PART 3 EXECUTION

3.01 GENERAL

- A. All temporary and permanent erosion and sediment control practices will be maintained and repaired as needed to ensure continued performance of their intended function.
- B. City and County of Denver and DPS will monitor Contractor's erosion control methods. If the overall function and intent of erosion control is not being met, City and County of Denver and DPS will require Contractor to provide additional measures as required to obtain the desired results.
- C. The erosion control features installed by Contractor shall be adequately maintained by Contractor until the project is accepted.

3.02 PROTECTION OF ADJACENT PROPERTIES

- A. Properties adjacent to the site of a land disturbance shall be protected from sediment deposition.
- B. In addition to the erosion control measures required on the drawings, perimeter controls may be required if damage to adjacent properties is likely, and may include, but is not limited to:
 - 1. Vegetated buffer strip around the lower perimeter of the land disturbance.
 - a. Vegetated buffer strips may be used only where runoff in sheet flow is expected and should be at least twenty (20) feet in width.
 - 2. Sediment barriers such as straw bales, erosion logs, and silt fences.
 - 3. Sediment basins and porous landscape detention ponds.
 - 4. Combination of above measures.

3.03 CONSTRUCTION

- A. Stabilization of Disturbed Areas:
 - 1. Temporary sediment control measures shall be established within five (5) days from time of exposure or disturbance.
 - 2. Permanent erosion protection measures shall be established within five (5) days after final grading of areas.
- B. Stabilization of Sediment and Erosion Control Measures:
 - 1. Sediment barriers, perimeter dikes, and other measures intended to either trap sediment or prevent runoff from flowing over disturbed areas shall be constructed as a first step in grading and be made functional before land disturbance takes place.
 - 2. Earthen structures such as dams, dikes, and diversions shall be stabilized within five (5) days of installation.
 - 3. Stormwater outlets shall also be stabilized prior to any upstream land disturbing activities.
- C. Stabilization of Waterways and Outlets:
 - 1. All onsite stormwater conveyance channels used by Contractor for temporary erosion control purposes shall be designed and constructed with adequate capacity and protection to prevent erosion during storm and runoff events.
 - 2. Stabilization adequate to prevent erosion shall also be provided at the outlets of all pipes and channels.

- D. Storm Sewer Inlet Protection: All storm sewer inlets which are made operable during construction or which drain stormwater runoff from a construction site shall be protected from sediment deposition by the use of filters.
- E. Construction Access Routes:
 - 1. Wherever construction vehicles enter or leave a construction site, a Stabilized Construction Entrance is required.
 - 2. Where sediment is transported onto a public road surface, the roads shall be cleaned thoroughly at the end of each day.
 - 3. Sediment shall be removed from roads by shoveling or sweeping and be transported to a sediment controlled disposal area.
 - 4. Street washing shall be allowed only after sediment is removed in the manner described above.

3.04 DISPOSITION OF TEMPORARY MEASURES

- A. All temporary erosion and sediment control measures shall be disposed of within thirty (30) days after final site stabilization is achieved or after the temporary measures are no longer needed as determined by City and County of Denver and DPS.
- B. Trapped sediment and other disturbed soil areas resulting from the disposition of temporary measures shall be permanently stabilized to prevent further erosion.
- C. Substantial Completion of Erosion Control Measures:
 - 1. At the time specified in the Contract Documents, and subject to compliance with specified materials and installation requirements, Contractor shall receive a Substantial Completion Certificate for temporary erosion control measures.
 - 2. Maintenance of Erosion Control Measures after Substantial Completion: Contractor shall be responsible for maintaining temporary erosion control measures as specified in the drawings and Contract Documents until such time as work has been accepted by City and County of Denver and DPS and as specified in Division 1 for Closeout Procedures.

END OF SECTION 31 25 00

SECTION 31 69 23

DRILLED CONCRETE PIERS AND SHAFTS

PART 1 GENERAL

1.01 MEASUREMENT AND PAYMENT

- A. Unit prices: Not allowed in lieu of providing anticipated pier lengths, however unit cost should be included with bid to minimize future disputes.

1.02 SUBMITTALS

- A. The Contractor shall provide Record Drawings including each pier location indicating top of pier elevation, depth of pier and top center of pier location relative to the plan location. The pier location shall be given as dimensions off of the building grid or as a bearing and distance from the plan pier center point to the as-built center point, relative to the building grid north. Use licensed surveyor for this work.

PART 2 PRODUCTS No Requirements

PART 3 EXECUTION

3.01 EXAMINATION

- A. Existing utilities: The Contractor shall be responsible for locating existing utilities (including depth) which may conflict with drilling. The Contractor shall protect, at his own expense, existing utilities and be responsible for their repair if they are damaged during construction.

3.02 CONSTRUCTION

- A. Tolerances:
 - 1. Specify tolerances.
 - 2. Where specified tolerances are not met, the pier shall be removed and replaced to specified tolerances at no additional cost to the Owner.
- B. Requirements:
 - 1. For short piers, specify the use of Sonotubes (or equivalent) to prevent enlargement of the tops of piers. For long piers, casings will increase in diameter at the top.
 - 2. Specify dewatering.
 - 3. Specify when casings shall be used.

3.03 FIELD QUALITY CONTROL

- A. Notifications: Contractor shall notify A/E and DPS minimum three days prior to drilling.
- B. Owner will hire a Testing Agency to be on site continuously during drilling of piers.
- C. Preliminary and final test reports will be delivered to the contractor's project superintendent as soon as possible. Where test results are known at the time of inspection by the Owner's Testing Agency, a copy of the information will be provided to the superintendent at the time of testing/measurement.

END OF SECTION 31 69 23