

## Chapter 13. RIGHT-OF-WAY GRADING & EROSION CONTROL

### 13.1 Right of Way Grading & Erosion Control

#### 13.1.1 Site Remediation

##### Disposal of Waste Materials

Burning is not permitted on Developer's property.

Removal from Developer's Property. Removal of waste materials and unsuitable or excess topsoil from the Developer's property shall be legally disposed of.

These standards and specifications provide the requirements for site preparation and grading. This chapter addresses Right of Way grading as well as site grading for development.

#### 13.1.2 Site Demolition

##### Removal of Structures & Obstructions

- **General.** The work shall consist of removal, salvaging, and backfilling according to CDOT Standard Specifications Section 202.01.
- **Salvage.** Salvageable material shall be handled according to CDOT Standard Specifications Section 202.03 in locations designated by the Designer.
- Disposal.
  - *Designer Responsibility.* The Designer shall make all necessary arrangements for securing legal and suitable disposal sites.
  - *Unestablished Dump Sites.* If disposal is to be at other than established dump sites, the Engineering Division may require the Contractor to furnish written permission from the property owner on whose property the materials are placed.
  - *Concrete and Asphalt.* Broken concrete and asphalt, with no other waste material, may be taken to City's recycling yard. Asphalt and concrete must be separated. Mingling of materials is prohibited.
- **Backfill.** Except in areas to be excavated, all cavities left by structure removal shall be cut to clean undisturbed material and backfilled with suitable material and compacted in accordance with **Chapter 14- Trenching, Backfilling, & Compacting - Utilities** of these STANDARDS AND SPECIFICATIONS. Jetting or ponding will not be allowed.

##### Construction Requirements

- **Structures.** The Developer shall raze, remove, and dispose of all structures, according to CDOT Standard Specifications Section 202.02.
- **Demolition Permit.** Building demolition requires a demolition permit issued by Building Division.

- **Abandoned Pipelines/Conduits.** Abandoned pipelines and conduits shall be removed or abandoned in place by plugging and filling with sand or appropriate alternative in accordance with direction from the Engineering Division.
- Other Obstructions.
  - Miscellaneous Obstructions. The Developer shall remove miscellaneous obstructions and properly dispose of them.
  - Traffic Signals and Signs. Removal of traffic signals and related materials shall be per CDOT Standard Specifications Section 202.04. All traffic signal equipment shall remain the property of the City. Contact the Engineering Division for disposal instructions.
  - Portions of Structures. Removal of portions of structures shall be per Section 13.1.2 of these standards.
  - Detour Structures. Materials used in detour structures for the project shall be removed according to CDOT Standard Specifications Section 202.06.

### 13.1.3 Site Clearing & Grubbing

#### **General**

The work shall consist of clearing, grubbing, removing, and disposing according to CDOT Standard Specifications Section 201.01. This work does not include objects designated to remain nor which are to be removed in accordance with other sections of these Standards.

#### **Construction Requirements**

Construction requirements for site clearing and grubbing shall follow those requirements outlined in CDOT Standard Specifications Section 201.02 with the addition of the following:

- **Construction Limits.** The Developer will establish construction limits in accordance with the City requirements.
- **Buried Perishable Objects.** Buried perishable objects shall be removed to a depth of 3 feet below the existing ground or subgrade, whichever is lower.
- **Disposal.** Disposal of materials or debris shall be done in accordance with Section 13.1.1.

### 13.1.4 Embankment & Excavation

#### **General Construction Requirements**

Excavation and embankment operations shall be done in accordance with CDOT Standard Specifications Section 203.04. Prior to beginning grading operations in any area, all necessary clearing and grubbing in that area shall have been performed in accordance with Section 13.1.3.

#### **Embankment Material**

Embankment material shall consist of approved material acquired from excavations and shall be hauled and placed in embankments in reasonably close conformity with the line, grades, thicknesses, and typical cross-sections shown on the plans.

- **Compaction.** The embankment shall be free of organic material and shall be moisture treated to within 2% (or as specified on the plans or geotechnical report) of optimum moisture content and placed in 6-inch lifts compacted to 95% standard proctor.
- **Source of Material.** When the source of embankment materials is not designated on the plans, approval of the source will be contingent on the material meeting the requirements of **Chapter 5 – Design Report Requirements** and having a resistance value that matches or exceeds the R-value of the in-situ material or as shown on the plans when tested by the Hveem Stabilometer.
- **Unsatisfactory Material.** Refer to the unacceptable soil classification groups from ASTM which apply for locally available material. No topsoil shall be used for fill. In addition, no gap graded material nor material weighing less than 90 pounds per cubic foot shall be used for fill.

### **Excavation**

- **General.** This work shall consist of excavation, disposal, shaping, or compaction of all material encountered within the limits of the work, including excavation for ditches and channels.
  - *Protection of Property and Workmen.* Excavation shall be performed in a careful and orderly manner with due consideration given to protection of adjoining property, the public, and workmen.
  - *Damage Repair Responsibility.* Any damage to streets, parking lots, utilities, irrigation systems, plants, trees, building or structures or private property, or the benchmarks and construction staking shall be repaired and restored to its original conditions by the Developer at the Developer's expense. Following completion of construction, should any of these trees, shrubs, or irrigation facilities, etc. require replacement, it shall be done at the Developer's expense.
  - *Compliance with Standards.* All excavation and the like shall comply with OSHA's "Construction Industry Standards" as well as all applicable Federal and State regulations.
- **Stockpile.** The Contractor shall not leave stockpiles in the Right of Way without the appropriate temporary traffic control and Right of Way Permit requirements.
- **Disposal.** Excess excavated material shall be disposed of outside of the Right of Way unless approval is given by the Engineering Division to do otherwise.
- **Unsanitary Materials.** Unacceptable material defined as any earthen material containing vegetable or organic silt, topsoil, frozen material, trees, stumps, certain manmade deposits, or industrial waste, sludge, or landfill, or other undesirable materials will be removed from the site and disposed of in accordance with applicable City, State, and Federal requirements.
- **Unauthorized Excavation.** Unauthorized excavation consists of removal of materials beyond specified elevations without the specific direction of the Engineering Division. Unauthorized excavation shall be backfilled and compacted as specified for authorized excavations.
- **Rock.** Rock shall be excavated and disposed of according to CDOT Standard Specifications Section 203.05(a), or City Requirements. Rock shall be removed to a level 3 feet below the subgrade surface within the right-of-way. Drainage facilities may be required by the Engineering Division in accordance with **Chapter 9 – Storm Drainage & Other Concrete Facilities.**

### 13.1.5 Embankment Construction

#### General

Embankment construction shall consist of constructing roadway embankments within project areas where unsuitable material has been removed as well as in other areas as noted in CDOT Standard Specifications Section 203.06.

- **Water in Material.** Free running water shall be drained from the material before the material is placed.
- **Maximum Size of Solid Material.** Rocks, broken concrete, or other solid materials more than 3 inches in greatest dimension shall not be placed in embankment, unless approved by the Engineering Division.
- **Archaeological Sites or Artifacts.** When the Developer's excavating operations encounter remains of prehistoric peoples' dwelling sites or artifacts of historical or archaeological significance, the operations shall be temporarily discontinued. The Developer shall contact archaeological authorities to determine the disposition thereof. When directed, the Developer shall excavate the site in such a manner as to preserve the artifacts encountered and shall remove them for delivery to the custody of the proper state or City authorities.
- **Protection of Existing Installations.** The Developer shall at all times take precautions for the protection of culverts, irrigation crossings, mailboxes, driveway approaches, valve boxes, manholes, survey monuments, underground or overhead utility lines, and all other public or private installations that may be encountered during construction. The Developer shall be responsible for the repair of any installations damaged due to their work. Manholes and valve boxes shall be observed by the Engineering Division for displacements and introduction of foreign matter. It shall be the Developer's responsibility to correct any displacement and to remove any foreign matter resulting from the Developer's work.

### 13.1.6 Borrow Material

#### General

Provide approved borrow soil materials from off-site locations when sufficient approved soil materials are not available from excavations on-site. Borrow material shall be placed only after the approved excavation material has been replaced in the fill. Borrow areas shall be finished so that water will not collect or stand therein. The "R" value of the borrow shall be equal or greater than the design "R" value required for the existing subgrade soil. In addition, the LL and PI shall be equal to, or better than, the LL and PI of the subgrade material. Refer to **Chapter 5 – Design Report Requirements**.

#### Satisfactory Borrow Materials

Borrow material must be free of rock or gravel larger than 3 inches, and free of debris, waste, frozen materials, vegetation, and other deleterious matter. Refer to ASTM soil classification groups which apply for locally available material.

#### Unsatisfactory Borrow Materials

Refer to the unacceptable soil classification groups from ASTM which apply for locally available material. No topsoil shall be used for fill. In addition, no gap graded material nor material weighing less than 90 pounds per cubic foot shall be used for fill.

### 13.1.7 Earthwork Grading

#### **General**

Grade all areas to a uniformly smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross-sections, lines, and elevations indicated. Provide a smooth transition between existing adjacent grades and new grades.

Remove soft spots, fill low spots, and trim high spots to conform to required surface tolerances.

#### **Grading During Construction**

Grading shall be done as necessary to prevent surface water from entering the excavation. Any other water accumulation therein shall be promptly removed.

#### **Accessibility During Construction**

Earthwork construction shall be performed in a manner that does not obstruct surface drainage or prohibit access to operational driveways, fire hydrants, manholes, and water valves.

#### **Site Grading**

- **Slope and Elevation of Grades.** The ROW shall be sloped to direct storm runoff flow to the roadway, unless otherwise specified on the plans. Finish subgrades to required elevations within the following tolerances:
  - *Lawn or Unpaved Areas.* Plus or minus 0.25 feet.
  - *Walks.* Plus 0 or minus 0.1 feet.
  - *Pavements.* Plus 0 or minus .04 feet.
- **Construction Stakes.** The Developer shall provide all stakes necessary for curb, gutters, sidewalks and structures and furnish all necessary information relating to lines and grades. The Developer shall be held responsible for preservation of all such stakes.
  - *Stake Removal.* The Developer shall not remove stakes until three working days after placement of concrete unless approved by the Engineering Division.
  - *Vertical Curves.* Curb stakes shall be placed at 25-foot intervals and at the lowest and highest elevations along the vertical curve. This is intended to minimize flat grades at the high and low points.

### 13.1.8 Erosion Control

#### **Soil Protection**

All disturbed soil, on or off-site and related to work at the project site, is required to be protected from wind and storm water erosion. To mitigate erosion, the contractor shall use standard erosion control techniques described in “Volume 3 – Best Management Practices of the Urban Storm Drainage Criteria Manual,” published by the Mile-High Flood District.

All cleared lands shall be at least temporary seeded within fourteen (14) days of removal of grasses. Refer to **Chapter 17– Revegetation & Seeding.**

### 13.1.9 Erosion & Sedimentation Controls

This section includes erosion and sediment control for all disturbed soil, on or off-site and related to work at the project site, is required to be protected from wind and storm water erosion through the use of the following:

- Swales
- Sediment Basins
- Sediment traps
- Silt Fences
- Straw and Bales
- Planting and Ground Cover
- Maintenance of Erosion Control Improvements
- Clean-up and removal of silt from roadways on-site and off-site
- Dust Alleviation and Control by watering or magnesium chloride
- Other techniques described in “Volume 3 – Best Management Practices of the Urban Storm Drainage Criteria Manual”, published by the Mile-High Flood District (MHFD).

#### **Soil Protection**

The Contractor is responsible for temporary erosion control on any project that disturbs a half acre or larger projects or when required in the construction drawings.

#### **Temporary Silt Fence**

- The height of silt fence shall not exceed thirty-six inches (36"). On slopes, the fence line shall follow the contour as closely as possible. In small swales, the fence line shall be curved upstream at the sides to direct the flow toward the middle of the fence.
- If possible, the filter fabric shall be cut from a continuous roll to avoid the use of joints. When joints are necessary, filter cloth shall be spliced only at a support post, with a minimum six-inch (6") overlap and both ends securely fastened to the post.
- Posts shall be spaced a maximum of ten feet (10') apart and driven securely into the ground, a minimum of twelve inches (12"). When extra strength fabric is used without the wire support fence, post spacing shall not exceed six feet (6').
- A trench shall be excavated approximately four inches (4") wide and four inches (4") deep along the line of posts and upslope from the barrier.
- When standard strength filter fabric is used, a wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy duty wire staples at least one inch (1") long, tie wires or hog rings. The wire shall extend into the trench a minimum of two inches (2") and shall not extend more than thirty-six inches (36") inches above the original ground surface.
- The standard strength filter fabric shall be stapled or wired to the fence, and eight inches (8") of the fabric shall extend into the trench. The fabric shall not extend more than thirty-six inches (36") above the original ground surface. Filter fabric shall not be stapled to existing trees.
- When extra strength filter fabric and closer post spacing are used, the wire mesh support fence may be eliminated. In such a case, the filter fabric is stapled or wired directly to the posts with all other provisions of Subparagraph 6, above, applying.

- The trench shall be backfilled and the soil compacted over the toe of the filter fabric.
- Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized.
- Silt fences and filter barriers shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.
- Should the fabric on a silt fence or filter barrier decompose or become ineffective prior to the end of the barriers expected usable life and the barrier is still necessary, the fabric shall be replaced promptly.
- Sediment deposits should be removed when deposits reach approximately one-half (1/2) the height of the barrier.
- Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required should be dressed to conform to the existing grade, prepared and seeded.

### **Special Requirements**

- All basins and check dams shall have been pumped dry, and all debris and silt removed within twenty-four (24) hours after each storm.
- Hydro-seed all fill and cut slopes as approved by the Engineering Division, with a vertical height of five feet (5') or more.
- Changes to the erosion and sediment control plans to meet field conditions will be made only with the approval of, or at the direction of, the Engineering Division.
- During the rainy season, all paved areas will be kept clear of earth material and debris. The site will be maintained so that a minimum of sediment-laden runoff enters the storm drainage system.
- CONTROL OF GROUND WATER The Contractor shall be solely responsible for dewatering excavations and subsequent control of ground water. Permits for Dewatering actions may be required by the CDPHE. Contractor/Developer is responsible for obtaining and complying with all permit requirements. The Contractor shall provide and maintain such pumps or other equipment as may be necessary to control ground water and seepage, to the satisfaction of the Engineering Division, until backfilling is completed.

### **Sediment Basins**

- Areas under the embankment and any structural works shall be cleared, grubbed, and stripped of any vegetation and root mat. In order to facilitate cleanup and restoration, the basin area shall be cleared also.
- A cut-off trench shall be excavated along the centerline of earth-fill embankments. The minimum depth shall be two feet (2'). The cut-off trench shall extend up both abutments to the riser crest elevation. The bottom width shall be wide enough to permit operation of excavation and compaction equipment and a minimum of four feet (4') in width. The side slopes shall be no steeper than one to one (1:1). Compaction requirements shall be the same as those for the embankment. The trench shall be dewatered during the backfilling and compacting operations.
- Fill material for the embankment shall be taken from approved fill areas. It shall be clean material soil free of roots, woody vegetation, oversized stones, rocks or other objectionable material. Relatively pervious materials such as sand or gravel (Unified Soil Classes GW, GP, SW, and SP) shall not be placed in the embankment. Areas on which fill is to be placed shall be scarified prior to placement of fill. The fill material shall contain sufficient moisture so that it can be formed by hand into a ball without crumbling. If water can be squeezed out of the ball, it is too wet for proper compaction. Fill material shall be placed in six to eight inch (6" - 8") thick continuous layers over the entire length of the fill. Compaction shall be obtained by routing the hauling equipment over the fill so that the entire surface of each layer of the fill is traversed by at least one wheel or

tread track of the equipment, or by the use of a compactor. The embankment shall be constructed to an elevation ten percent (10%) higher than the design height to allow for settlement if compaction is obtained with hauling equipment. If compactors are used for compaction, the overbuild may be reduced to not less than five percent (5%).

- The principal spillway riser shall be securely attached to the discharge pipe by welding all around and all connections shall be watertight. The pipe and riser shall be placed on a firm, smooth soil foundation. The connection between the riser and the riser base shall be watertight. Pervious materials such as sand, gravel or crushed stone shall not be used as backfill around the pipe or anti-seep collars. The fill material around the pipe spillway shall be placed in four-inch (4") layers and compacted under the shoulders and around the pipe to at least the same density as the adjacent embankment. A minimum of two feet (2') of hand-compacted backfill shall be placed over the pipe spillway before crossing it with construction equipment. Steel base plates shall have at least two and one-half feet (2-1/2') of compacted earth, stone or gravel placed over them to prevent flotation.
- The emergency spillway shall not be installed in fill. Elevations, design width, and entrance and exit channel slopes are critical to the successful operation of the emergency spillway.
- Baffles shall be constructed of four-inch by four-inch (4" x 4") posts and four feet by eight-feet (4' x 8') by one-half inch (1/2") exterior plywood. The posts shall be set at least three feet (3') into the ground, no further apart than eight feet (8') center to center and shall reach a height six inches (6") below the riser crest elevation. The plywood shall be securely fastened to the upstream side of the posts.
- The embankment and emergency spillway shall be stabilized with vegetation immediately following construction.
- Construction operations shall be carried out in such a manner that erosion and water pollution will be minimized. State and local laws concerning pollution abatement shall be complied with.
- State and local requirements shall be met concerning fencing and signs warning the public of hazards of soft sediment and floodwater.
- Maintenance and repairs shall be carried out as follows:
  - All damages caused by soil erosion or construction equipment shall be repaired before the end of each working day.
  - Sediment shall be removed from the basin when it reaches the specified distance below the top of the riser. This sediment shall be placed in such a manner that it will not erode from the site. The sediment shall not be deposited downstream from the embankment or in or adjacent to a stream or floodplain.
- When temporary structures have served their intended purpose and the contributing drainage area has been properly stabilized, the embankment and resulting sediment deposits shall be leveled or otherwise disposed of in accordance with the approved erosion and sediment control plan.

### **Sediment Traps**

- The area under the embankment shall be cleared, grubbed, and stripped of any vegetation and root mat. The pool area shall be cleared.
- The fill material for the embankment shall be free of roots or other woody vegetation, as well, as oversized stones, rocks, organic material, or other objectionable material. The embankment shall be compacted by traversing with equipment while it is being constructed.



- Sediment shall be removed, and the trap restored to its original dimensions when the sediment has accumulated to within one foot (1') of the outlet elevation. Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode.
- The structure shall be inspected after each rain and repairs made as needed.
- Construction operations shall be carried out in such a manner that erosion and water pollution are minimized.
- The structure shall be removed, and the area stabilized when the remaining drainage area has been properly stabilized.
- All cut-and-fill slopes shall be two-to-one (2:1) or flatter.
- When a riser is used, all pipe joints shall be watertight.
- When a riser is used, at least the top two-thirds of the riser shall be perforated with one-half inch (1/2") diameter holes spaced eight inches (8") vertically and ten to twelve inches (10"-12") horizontally.
- When a pipe outlet is used, fill material around the pipe spillway shall be hand compacted in four-inch (4") layers. A minimum of one and one half feet (1.5') of hand-compacted backfill shall be placed over the pipe spillway. At least two feet (2') of backfill shall be placed if construction equipment will cross over the pipe spillway.

#### **Temporary Straw Bale Dikes and/or Fiber Rolls**

- Bales/Waddles shall be placed in a row with ends tightly abutting as shown on the Plan.
- Each bale shall be embedded in the soil a minimum of four inches (4").
- Bales shall be securely anchored in place by two (2) wood stakes driven through the bales. The first stake in each bale shall be driven toward the previously laid bale to force bale together.
- The dike shall be inspected after each storm, and repair or replacement shall be made promptly as needed.
- Bales shall be removed when they have served their purpose so as not to block or impede storm flow or drainage.