

SECTION 17- GRADING, EROSION AND SEDIMENT CONTROL

A. Planning Standards

Grading, Erosion and Sediment Control Plans: Plans shall be submitted as required by the Submittal Requirements Section in accordance with the following standards. (am. 7-12-05)

1. The existing and final contours shall be shown at 2-foot intervals for subdivisions within the plains area and contours at 5-foot intervals for subdivisions within the mountain areas including the method utilized to obtain all contour intervals. Contours shall be accurate to within 0.5 contour and elevations shall be based on United States Geologic Survey (U.S.G.S.) sea level datum. The U.S.G.S. quad maps shall not be accepted as evidence for topographic contours. (am. 7-12-05)
2. Grading, erosion and sediment control plans shall be prepared in accordance with and in compliance with the standards in the Land Disturbance Section of the Zoning Resolution. (am. 7-12-05)
3. Grading, erosion and sediment control plans must include the following: (reloc. 7-12-05)
 - a. Plans for all private and public streets/roads in accordance with the Roadway Design and Construction Manual and the Circulation Section. (am. 7-12-05)
 - b. Conceptual driveway plans if existing slopes exceed 30%. (reloc. 7-12-05)
 - c. Overlot grading plans for all non-residential, multi-family, manufactured home developments, and single family residential developments with lot sizes under ½ acre. Overlot grading plans are not required for single family residential lots over ½ acre in size if the developer is not proposing overlot grading, grading is not required and/or shown on the drainage plan, and the slopes in the buildable areas do not exceed 30%. Overlot grading plans must be consistent with the grading and basin boundaries shown on the drainage plan. (reloc. 7-12-05)
 - d. Plans for all drainage improvements including but not limited to detention/and water quality facilities, drainage channels, storm sewer and outlet protection. (reloc. 7-12-05)
 - e. Grading, erosion and sediment control plans for each lot in residential developments with lot sizes under ½ acre shall be prepared in accordance with and in compliance with the Notice of Intent standards in the Land Disturbance Section of the Zoning Resolution. (reloc. 7-12-05)
4. Approvals: The Planning and Zoning Division shall approve the plans prior to development approval. The Jefferson Conservation District shall approve the seed mix and mulching rates. (am. 7-12-05)

B. Construction Specifications

1. Scope: The intent of these specifications is to ensure excavation and grading occur according to the approved plan and to establish minimum materials, methods and standards to be used in the construction of site grading fills for support of residences and other structures, embankments or excavations for streets, roads, drainage channels, structures, or other purposes. The work covered by these specifications includes excavation, embankment, grading, compaction, clearing and grubbing, removal of topsoil, trees, stumps, vegetation, removal and/or resetting of minor obstructions and any other work incidental to the construction of site grading fills. When used in this document, AASHTO shall refer to the American

Association of State Highway and Transportation Officials, ASTM shall refer to the American Society for Testing and Materials, and CDOT shall refer to the Colorado Department of Transportation. (reloc. 7-12-05)

2. Clearing and Grubbing

- a. General: Clearing and grubbing consists of removing and disposing of all vegetation and debris within the limits of projects as indicated on the approved grading plans, except such objects as are designated to remain or are to be removed in accordance with this Regulation. Clearing and grubbing shall also include the preservation of all vegetation and objects designated to remain. (am. 7-12-05)
- b. Construction: The plans shall establish construction limits and designate all trees (including dripline), shrubs, plants and other objects to remain. All objects designated to remain shall be preserved. (reloc. 7-12-05)
 - (1) All surface objects and all trees, stumps, roots, and other vegetation over 6 inches in height, and other protruding objects, not designated to remain, shall be cleared and/or grubbed, including mowing, as required. (reloc. 7-12-05)
 - (2) Except in areas to be excavated, stump holes and other holes from which obstructions are removed, shall be backfilled with suitable materials and compacted in accordance with this Section. Materials and debris shall be disposed of in accordance with state and County regulations. Burning is not permitted. Placement of strippings or topsoil in minor amounts in nonstructural areas will be permitted as specified below, but must be identified on the plans. Up to 3 feet of topsoil and strippings may be placed in nonstructural areas where revegetation will occur and these areas are at least 15 feet from any structural pad. (reloc. 7-12-05)
 - (3) Strippings consist of any vegetation not consisting of Clearing and Grubbing. If applicable, the plans shall address arrangements for off-site disposal. All such disposal locations shall be permitted in accordance with the Jefferson County Zoning Resolution and the applicable requirements of the Colorado Department of Public Health and Environment. (am. 7-12-05)
 - (4) The ground surface shall be prepared to receive fill by removing vegetation, topsoil and other unsuitable materials. (reloc. 7-12-05)

3. Topsoil

- a. General: All topsoil, where physically practicable, shall be salvaged and no topsoil shall be removed from the site except as set forth in the approved grading plans. Except for structural areas, topsoil shall be redistributed over the graded area after grading operations are completed. All work shall be in accordance with this Section and in reasonably close conformity with the lines and thickness shown on the grading plans. (reloc. 7-12-05)
- b. Materials: Topsoil shall consist of loose friable loam reasonably free of admixtures of subsoil, refuse, stumps, roots, rocks, brush, weeds, or other material which would be detrimental to the proper development of vegetative growth. (reloc. 7-12-05)
- c. Construction: Materials selected for topsoil and lying within the limits of the project shall be excavated and stockpiled at the project at locations designated on the grading plans. Excavated topsoil shall be placed directly upon constructed cuts and fill slopes without the use of stockpiles whenever possible. The grading work shall be phased in such a way as to allow direct placement of salvaged topsoil if possible. (reloc. 7-12-05)
 - (1) Topsoil shall not be placed until the areas to be covered have been properly prepared in accordance with this Section and grading operations in the area have been completed. (reloc. 7-12-05)

- (2) Topsoil shall be placed and spread at locations and to the thickness shown on the plans and shall be keyed to the underlying materials by the use of harrows, rollers, or other equipment suitable for the purpose. (reloc. 7-12-05)
- (3) Water shall be applied to the topsoil at the locations and in the amounts designated. Water shall be applied in a fine spray by nozzles or spray bars in such a manner that it will not wash or erode the topsoil area. (reloc. 7-12-05)

4. Watering

- a. General: Water specifications shall address wetting, water for landscaping and the application of dust palliatives to soils and aggregates in accordance with this Section and in conformance with the plans. (am. 7-12-05)
- b. Materials: All water used shall be free of any mineral salts or contaminating material which might result in expansion of materials after placement. (reloc. 7-12-05)
- c. Construction
 - (1) Wetting: Sprinkling equipment shall be of a type which ensures uniform and controlled distribution of water without ponding or washing. Water added during finishing operations shall be uniformly applied by spraying across the full width of the course by means of controllable pressures and spray bars of nozzles. (reloc. 7-12-05)
 - (2) Dust Palliative: Dust palliatives shall be applied on portions of the project and on haul roads at the locations and in the amounts as may be called for on the plans. Dust palliatives may consist of water or other substances approved by Jefferson County Department of Health and Environment. Dust palliative shall be of the type and proportions called for on the plans. Water or water mixture shall be spread with acceptable sprinkling equipment. (reloc. 7-12-05)
 - (3) Landscaping: Water shall be provided for seeding, mulching, planting, transplanting, sodding, and soil sterilization, and any other landscaping work, when called for on the plans. (reloc. 7-12-05)

5. Removal of Structures and Obstructions

- a. General: This work shall consist of the removal, wholly or in part, and satisfactory disposal of all foundations, fences, signs, structures, sidewalk, curbing, pavements, not designated or permitted to remain. It shall also include the salvaging of the designated materials and backfilling the resulting trenches, holes, and pits. All backfill work shall be done in accordance with the Compaction provisions. (am. 7-12-05)

When the plans and specifications do not include specific requirements for removal of structures and obstructions as set forth in this Section, such work shall be performed under the Excavation and Embankment provisions. (am. 7-12-05)

- b. Construction: All foundations, signs, structures, fences, old pavements, abandoned pipelines and other structures shall be removed from the site and disposed of in accordance with applicable state, federal and County regulations. (reloc. 7-12-05)

6. Excavation and Embankment

- a. General: Excavation and embankment grading consists of excavation, disposal, shaping, or compaction of all material encountered within the limits of the grading plans including excavation for ditches and channels necessary for the construction of the project in accordance with the grading plans and in reasonably close conformity with the lines, grades, and typical cross-sections shown on the plans. (reloc. 7-12-05)

- b. Excavation: All excavation will be classified as rock excavation, unclassified excavation, sub-excavation or borrow, as hereafter described. (reloc. 7-12-05)
 - (1) Rock Excavation: Rock excavation is excavation of igneous, metamorphic and sedimentary rock which cannot be ripped with a D-8 caterpillar or an equivalent using a single shaft hydraulic ripper tooth, or intact stone or boulders which cannot be handled with a Cat 950 loader or equivalent, and all boulders or other detached stones, each having a volume of 0.5 cubic yards or more, as determined by physical or visual measurement. For ditches and channels, rock excavation also includes bedrock or large boulders which cannot be excavated with a Cat 235 hydraulic excavator or equivalent, with a rock bucket. (reloc. 7-12-05)
 - (2) Unclassified Excavation: Unclassified excavation is the excavation of all other materials of whatever character required for the approved grading and/or construction plans including surface boulders and excavation for ditches and channels. (reloc. 7-12-05)
 - (3) Borrow: Borrow shall consist of material obtained from outside the project limits, required for the construction of embankments of other portions of the grading plans. Borrow material specifications shall be included on the grading plans. All borrow areas must meet the requirements of the Jefferson County Zoning Resolution. (am. 7-12-05)
 - (4) Sub-excavation: The removal and replacement of material below foundation or roadway grades to comply with the Zoning Resolution or the Roadway Design and Construction Manual. (reloc. 7-12-05)
- c. Embankment Material: Embankment material shall consist of approved material acquired from excavations, hauled and placed in embankments in reasonable close conformity with the line, grades, thicknesses and typical cross sections shown on the grading plans. (reloc. 7-12-05)

The type of relative compaction required shall be as called for on the plans or as required by the Compaction provisions, whichever is more stringent. (am. 7-12-05)
- d. Construction - General: The excavation and embankments shall be finished to reasonably smooth and uniform surfaces. Grading operations shall be conducted so that material outside of the limits of slopes will not be disturbed, except as shown on the approved grading plans. Prior to beginning grading operations in any areas, all necessary clearing and grubbing and topsoil in that area shall have been performed in accordance with the Clearing and Grubbing and Topsoil provisions. (am. 7-12-05)
 - (1) The Division of Highways and Transportation shall be notified at least 3 days before beginning grading. (am. 7-12-05)
 - (2) The limits of grading and objects designated to remain shall be staked at least 3 days prior to beginning grading at which time a pre-grading meeting with the site owner, project engineer and contractor may be required by the Division of Highways and Transportation. (am. 7-12-05)
 - (3) When the grading operations encounter remains of prehistoric people's dwelling sites, remains, or artifacts of historical, paleontological or archaeological significance, the operations shall be temporarily discontinued. The developer shall notify the Jefferson County Planning and Zoning Division, and the developer shall promptly contact the proper authorities to determine the disposition thereof. If required by state or federal authorities, the developer shall preserve the area of historical, paleontological or archaeological significance for a maximum period of 30 days to allow authorities to excavate and recover the items of significance. (am. 7-12-05)

- (4) At all times, precautions shall be taken for the protection of culverts, erosion control structures, irrigation crossings, mail boxes, 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. Any damage to such structures caused by grading activities shall be repaired, documented and submitted to the Division of Highways and Transportation prior to issuance of any certificate of completion for the site. (am. 7-12-05)

e. Excavation

- (1) Rock: Unless otherwise specified, rock shall be excavated to a minimum depth of 6 inches below subgrade within the limits of any roadbed and the excavation backfilled with material designated on the plans and in accordance with the Jefferson County Roadway Design Manual. (reloc. 7-12-05)
- (2) Unclassified: Where material encountered within the limits of grading are considered unsuitable for embankment foundations, streets/roads, or structural areas by the soils engineer or by the Division of Highways and Transportation, such material shall be excavated and replaced with suitable material. Some examples of unsuitable material include soils which contain significant amounts of organic material or large diameter rocks, concrete, or asphalt. Excess unsuitable excavated material, including rock and boulders, that cannot be used in embankments may be placed in non-structural areas as approved by the soils engineer and the Division of Highways and Transportation and must be documented with a set of revised plans showing any such locations. (am. 7-12-05)

Whenever shown on the plans or considered necessary by the Division of Highways and Transportation, intercepting ditches shall be made above the top of cut slopes and carried to outlets near the ends of the cuts. In order to blend the intersection of cut slopes with the slope of the adjacent natural ground surfaces in a uniform manner, the tops of all cut slopes shall be flattened and rounded. (am. 7-12-05)

f. Embankment

- (1) Embankment construction shall consist of construction building sites, street/road embankments and drainage structures including preparation of the areas upon which they are to be placed; the construction of dikes; the placing and compacting of material within project areas; and the placing and compacting of material in holes, pits and other depressions within the project area. (reloc. 7-12-05)
- (2) Free running water shall be drained from the fill material and the fill area before the material is placed. Rocks, broken concrete, or other solid materials more than 6 inches in greatest dimension shall be removed from the site and excluded from any borrow material brought onto the site. However, placing of occasional boulders or rock fragments of sizes larger than the maximum layer thickness may be authorized by the soils engineer and must be approved by the Division of Highways and Transportation. Each oversized boulder or rock fragment shall be separated sufficiently to allow placement, leveling and compaction of spalls or fill material between and around each particle. (am. 7-12-05)

When an embankment is to be placed and compacted on hillsides, or when a new embankment is to be compacted against existing embankments, or when an embankment is built one-half width at a time, the slopes that are steeper than 5:1, when measured longitudinally or at right angles to the slope, shall be continuously benched over those areas where it is required as the work is brought up in layers. Benching shall be well keyed and where practical, a minimum of 8 feet wide or of sufficient width to accommodate the equipment being utilized. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the

previous cuts. Material thus cut out shall be recompacted along with the new embankment material. (reloc. 7-12-05)

g. Compaction

- (1) After the foundation for the fill or subexcavated area has been cleared and scarified, it shall be disked or bladed until it is free from large clods, brought to the proper moisture content and compacted to not less than the densities outlined in the Compaction Table. (am. 7-12-05)
- (2) All material shall be compacted to the specified relative compaction. The moisture content of the soil at the time of compaction shall be as specified in the Compaction Table. (am. 7-12-05)
- (3) Should too much water be added to any part of the fill, such that the material is too wet to permit the desired compaction from being obtained, rolling and all work on that section of the fill shall be delayed until the material has been allowed to dry to the required moisture content. Material that is too wet may be reworked in order to hasten drying. (reloc. 7-12-05)
- (4) Selected fill material shall be placed and mixed in evenly spread layers. After each fill layer has been placed, it shall be uniformly compacted to not less than the specified percentage of maximum density. Fill materials shall be placed such that the thickness of loose material does not exceed 10 inches and the compacted lift thickness does not exceed 6 inches. Rocks, broken concrete, or other solid materials more than 6 inches in greatest dimension shall be excluded from fill material. (reloc. 7-12-05)
- (5) Compaction, as specified above, shall be obtained by the use of sheepfoot rollers, multiple-wheel pneumatic-tired rollers, or other equipment approved by the soils engineer. Granular fill shall be compacted using vibratory equipment or other equipment approved by the soils engineer. Compaction of each layer shall be continuous over the entire area. Compaction equipment shall make sufficient passes to attain the required density set forth in the CompactionTable. (am. 7-12-05)

COMPACTION TABLE				
Soil Classification (AASHTO M-145 and Unified)	Depth of Fill	AASHTO T 99 Minimum Relative Compaction (Percent)	AASHTO T 180 Minimum Relative Compaction (Percent)	Moisture Percent of Optimum
CL, CH, SC, SM A-6, A-7, A-2-6, A-2-7	0-20 >20*	95 100		-1, +3 -2, +2
A-1 through A-5 (except A-2-6 and A-2-7) and all others	0-20 >20*	95 100	90 95	-3, +3 -3, +3
*Portion of fill which exceeds 20 feet in depth.				

- (6) Moisture density curves shall be constructed for each predominant soil type encountered. Maximum dry density and optimum moisture for materials found in the field which are of limited extent and amounts, and which are not representative of predominant soil types, may be estimated based upon a one-point curve. (reloc. 7-12-05)
- h. Density Tests: Field density tests shall be made by the soils engineer at locations and depths of their choosing unless otherwise specified by the Division of Highways and Transportation. At least one (1) test shall be taken for each 2,000 cubic yards with a minimum of 4 tests for overlot grading. At least one (1) test per 200 cubic yards is required for structure backfill with a minimum of one (1) test. When performing compaction testing along proposed street/road alignments for subgrade sub-excavation or for completed embankment work, at least one (1) test every 200 feet shall be required for each compacted layer. For utility main pipes, at least one (1) compaction test every 100 feet shall be required for each compacted layer. Lateral pipes shall have the at least one (1) compaction test for each layer for every third lateral. Where sheepfoot rollers are used, the soil may be disturbed to a depth of several inches. Density tests shall be taken in compacted material below the disturbed surface. When density tests indicate the density or moisture content of any layer of fill or portion thereof is below that required, the particular layer or portion shall be reworked until the required density or moisture content has been achieved. The criteria for acceptance of fill shall be as follows: (am. 7-12-05)
- (1) Moisture: The allowable ranges of placement and moisture content given in the Compaction provisions are based on design considerations. The moisture shall be controlled so that moisture content of the compacted earth fill, as determined by tests performed by the soils engineer, shall be within the limits given. The soils engineer shall notify the developer and document when the placement moisture is less than or exceeds the limits specified above, and the developer shall immediately make adjustments in procedures as necessary to maintain placement moisture content within the specified limit. Materials represented by tests falling outside of the optimum moisture content range by a 1/2 percent or less shall be wetted or dried as required and may be approved by the soils engineer without retesting. The maximum number of failing tests which can be rewetted or dried with retesting shall be limited to 3 percent of the total amount of tests taken. All such tests shall be documented in the grading report. (am. 7-12-05)
- (2) Density: Material represented by samples tested having a dry density more than one (1) percent below the minimum relative compaction given in the Compaction provisions shall be rejected. Such rejected materials shall be reworked until a dry density equal to or greater than the minimum relative compaction is obtained as indicated by retests. Materials represented by tests zero (0) to one (1) percent below the minimum relative compaction shall be rerolled and may be approved by the soils engineer without retesting. The maximum number of failing tests which can be rerolled without retesting shall be limited to 3 percent of the total amount of tests taken. All such tests shall be documented in the grading report. (am. 7-12-05)
- (3) Grading Reports: Compaction tests shall be taken under the direct supervision of a geotechnical engineer. The geotechnical engineer or his designated representative shall observe grading activities on a full time basis and shall take sufficient compaction tests to enable the engineer to determine that the site is ready for the intended uses and shall so state on the compaction report. Compaction reports shall be signed and sealed and dated by a registered professional engineer. Compaction reports shall include the moisture density curves, location of test sites, soil type(s), density results, type of test and if a failing test, retesting of the site. The engineer shall provide a complete set of all tests and observations and a report stating that the grading activities have been completed in substantial conformance with the approved

grading plan and the requirements of this Section. A Certificate of Compliance will not be issued until a compaction report is submitted which shows conformance to the applicable grading requirements. (reloc. 7-12-05)

7. Slope Standards

- a. General: All grading and excavation work shall be in accordance with the approved grading plans, Zoning Resolution and the Jefferson County Roadway Design Manual. (am. 7-12-05)
- b. Construction
 - (1) Cut slopes (i.e., excavated slopes) shall be no steeper than two (2) horizontal to one (1) vertical. (am. 7-12-05)
 - (2) Fill slopes shall not exceed two (2) horizontal to one (1) vertical. (am. 7-12-05)
 - (3) All permanent cut and fill slopes shall be constructed at slopes which ensure long term slope stability and will not cause accelerated erosion. (reloc. 7-12-05)
 - (4) The tops and toes of cut and fill slopes shall be set back from property boundaries as far as necessary for safety of the adjoining properties and to prevent damage resulting from water run-off or erosion of the slope. The tops and toes of cut and fill slopes shall be set back from structures as far as it is necessary for adequacy of foundation support and to prevent damage as a result of water run-off or erosion of the slopes. In general, the height of the cut or fill slope is related to the setback requirements as follows. (reloc. 7-12-05)

$$\frac{\text{Height of cut or fill slope}}{3} = \text{Setback (minimum setback is 7 feet)}$$

- (5) Terraces at least eight (8) feet in width shall be established at not more than 30-foot vertical intervals to control surface drainage and debris. (am. 7-12-05)
- (6) At least a two (2) percent gradient shall be maintained from building pads to drainage facilities. (am. 7-12-05)

8. Exemptions

- a. Excavation below finished grade and foundation wall backfill for basements and footings of a building, retaining wall, or other structures authorized by a valid building permit are exempt from these specifications. With the exception of foundation wall backfill, this shall not exempt any fill made with the material from such excavation nor exempt any excavation having an unsupported height greater than five (5) feet after the completion of such structure. (am. 7-12-05)
- b. Cemetery graves. (reloc. 7-12-05)
- c. Refuse disposal sites which are permitted by Jefferson County Department of Health and Environment and the Colorado Department of Public Health and Environment. (reloc. 7-12-05)
- d. Excavations for wells, tunnels, or utilities. (reloc. 7-12-05)
- e. Mining operations which are permitted by Jefferson County. (reloc. 7-12-05)
- f. Exploratory excavations. (reloc. 7-12-05)

- g. Excavations which are less than two (2) feet in depth, or which do not create a cut slope greater than five (5) feet in heights and steeper than one (1) and 1.5 horizontal to one (1) vertical. (am. 7-12-05)
- h. Fills less than two (2) feet in depth, and placed on natural terrain with a slope flatter than 5 horizontal to one (1) vertical, or less than three (3) feet in depth, not intended to support structures, which do not exceed 200 cubic yards on any one (1) lot and do not obstruct a drainage course. (am. 7-12-05)