

6.00 - GRADING, LANDSCAPING, SOIL EROSION AND SEDIMENT CONTROL

6.1 DESIGN STANDARDS

Note: Reference Sections 1.30 & 1.40 - Submittal Procedures, & Plans and Specifications

Design shall meet or exceed Michigan Department of Environmental Quality, Livingston County Soil Conservation Service, and other agencies' applicable standards. Plans must be reviewed and approved by the control agency. The proprietor shall obtain and comply with all applicable permits under this section.

- 6.1.1** In order to provide effective erosion and sediment control, practical combinations of the following technical principles shall be applied to the erosion control aspects of the grading plan.
- A.** The smallest practical area of land shall be exposed at any one time during development.
 - B.** When land is exposed during development, the exposure shall be kept to the shortest period of time.
 - C.** Temporary vegetation and/or mulching shall be used to protect critical areas exposed during development. The plans submitted to the Township shall specify such treatment.
 - D.** Sediment basins (debris basins, or silt traps) shall be installed and maintained to remove sediment from run-off waters from land undergoing development. The plans submitted to the Township shall specify such treatment.
 - E.** Provision shall be made to effectively accommodate the increased run-off caused by changed soil and surface conditions during and after development. The plans submitted to the Township shall specify such treatment.
 - F.** The permanent final vegetation and structures shall be installed as soon as practical in the development. The plans submitted to the Township shall specify such treatment.
 - G.** The development plan should be fitted to the topography and soil so as to create the least soil erosion potential.
 - H.** Wherever feasible, natural vegetation should be retained and protected.
 - I.** Refer to "Guidebook Of Best Management Practices for Michigan Watersheds" published by the MDNR for further information.

6.2 RETAINING WALLS AND LANDSCAPE WALLS

- 6.2.1** When it is determined by the applicant or required by the Township Engineer based upon reasonable standards and principles that retaining walls will be necessary to provide proper grading for development of a subdivision or other improvement, the applicant shall furnish design drawings for such walls as part of the submittal procedure specified above in Section 1.30. These drawings shall be sealed and prepared by the applicant's registered engineer, and shall be complete design drawings showing the wall construction in the plan, and elevation views. Sectional views and details shall be provided to indicate typical, atypical and conditions of the wall construction.

6.2.2 The following limits and technical principles shall be applied to the design of retaining walls.

A. Foundation - The foundation shall bear on undisturbed soil a minimum of 42" depth, for frost penetration .

The bearing capacity of the supporting soil and underlying strata shall be determined by soil analysis.

B. Stability - Retaining walls shall be designed to resist the pressure of the retained material, including both dead and live load surcharges to which they may be subjected, and to insure stability against overturning, sliding, excessive foundation pressure and water uplift. The minimum factor of safety against overturning shall be 1.75. The minimum factor of safety against sliding shall be 1.5 and shall not be based upon any passive earth pressure at the toe.

C. Load - Retaining walls shall be designed to resist the pressure of the retained material in accordance with accepted engineering practice. Walls retaining drained earth may be designed for pressure equivalent to that exerted by a fluid weighing not less than 36 pounds per cubic foot and having a depth equal to that of the retained earth. Any surcharge shall be in addition to the equivalent fluid pressure.

D. Material; Strength - Walls shall be designed and constructed of approved masonry, reinforced concrete, faced steel sheet piling, faced auger-cast piles or other approved materials within the allowable material stresses.

E. Backfill Material - The space for a distance of at least 18 inches from the back of retaining walls and from the top of footing to an elevation of 2'0" below proposed earth grade shall be backfilled with granular material in such a manner as to provide drainage. This granular material shall meet the requirements of the Michigan Department of Transportation (MDOT) specification for Granular Material Class II.

F. Drainage - Provision shall be made to prevent accumulation of water behind the wall. As a minimum, weep holes for drainage shall be provided, or an edge drain installed and properly drained.

G. Top of Wall - Where there is a grade difference on either side of a wall in excess of 4 feet and a walk is located near the back of the wall, a fence or guardrail shall be constructed as an approved protective measure.

6.3 SITE GRADING

A. All proposed developments shall be graded such that storm water runoff shall be intercepted within the boundaries of the site and conducted through a storm sewer system to an approved point of discharge. Open drainage ditches may be approved only where storm sewer systems are not feasible, as determined by the Township Engineer.

B. No storm water runoff from developed property shall flow onto the adjacent lands. Filling and grading shall not create a barrier causing entrapment of water on adjacent lands.

C. The developer shall provide for overland flow of storm water from adjacent properties where the existing off-site land slopes to the site. The amount of runoff to be provided for from off-site lands shall be at least equal to the amount of runoff from the land in the undeveloped

state.

- D.** Each single family lot shall be graded to drain away from the house to swales constructed along the lot lines. Swales shall discharge to a catch basin, roadway gutter, or other approved drainage course.
- E.** Grading plans shall take into account the desirable natural features and the character of the land which must be preserved where possible.
- F.** No filling will be allowed in any areas of land within a proposed subdivision or other type of development which lie either wholly or in part within the flood plain of a river, stream, creek, or lake unless under the terms of a permit granted by the Michigan Department of Natural Resources.

6.4 GRADING REQUIREMENTS FOR SUBDIVISIONS, SITE CONDOMINIUMS, & PUD'S

- A.** Generally, all single family lots shall be graded for drainage away from structures into storm water conveyances. Front to rear or rear to front drainage will be allowed by the Engineer where, due to existing topography, storm water conveyances would be very difficult to install or are not technically feasible. Large acreage lots will be reviewed on an individual basis.
- B.** Where either, front to rear, or both front and rear drainage are used, private easements for drainage shall be dedicated and recorded. For perimeter lots, the easement width shall be 20 feet minimum, with at least 10 feet on any lot.
- C.** All grade point elevations shall be shown for each lot at each lot corner and at all changes in direction.
- D.** The general direction of overland drainage in the rear yard shall be indicated on each lot by an arrow.
- E.** High and low street grade points, slope direction (by arrow) and the location of all catch basins, inlets and drainage ditches shall be shown on the grading plan.
- F.** A maximum slope of 4 feet horizontal to 1 foot vertical shall not be exceeded for all terracing. The toe of slope shall be located outside of the rear and/or side lot line drainage easements.
- G.** Generally grading plans shall be drawn to a scale of 1 inch = 50 feet or larger.
- H.** Grading plans shall include details of typical lot grading and drainage patterns intended to be used.
- I.** The grading plans shall show the existing elevation topography by maximum contours of 2 feet intervals, supplemented with spot elevations. Topography on abutting property within 100 feet of the site boundary shall be shown.
- J.** All elevations shall be to USGS datum.
- K.** In general, for streets with ditches and no curbs, elevation of the front lot line shall be at least 6 inches above the centerline of the road.

- L. Catch basins shall be placed in rear yard swales at low points where front to rear grading is used.
- M. Gravel filters with geotextile or other acceptable temporary measures shall be provided at all catch basins to prevent sedimentation of storm sewers during construction. The developer shall be responsible for maintaining temporary erosion control devices.
- N. The developer shall obtain and comply with all applicable permits within this section.

6.5 GRADING REQUIREMENTS: MULTI-FAMILY, COMMERCIAL, OFFICE, & INDUSTRIAL

- A. Asphalt surface parking lots and roadways shall be graded to a minimum one percent (1%) slope (one foot per one hundred feet) except where concrete curb and gutters are to be provided. Where concrete curb and gutters are to be used, the transverse slope to the gutter shall be a minimum of 1% for parking lots and 2 % for roadway crowns. Longitudinal gutter grades shall be a minimum of 0.5 % for concrete curb and gutter. In general, pavement grades shall not exceed 5 %.
- B. All areas within twenty-five (25) feet of buildings shall slope away from the building at a minimum slope of 2 %. All other areas shall have a minimum of 1% slope.
- C. All lawn or landscaped areas shall drain to parking lots or swales.
- D. Catch basins shall be placed at all low points in parking lots and swales.
- E. Parking lots and roof areas may be utilized for storm water detention purposes for industrial, commercial, multi-tenant, and office sites only.