

### 9.0 RESIDENTIAL LOT DRAINAGE

The issue of lot grading is one of the most important and contentious matters that homeowners, builders, and developers have to deal with in this community. Lack of positive lot grading may result in drainage problems for either single or multiple properties. The problems lead to neighborhood complaints and conflicts due to damages caused by flooding, ponding, seepage into basements, stagnant water, and loss of enjoyment or use of property.

With proper guidelines for the design, field control and certification of lot grading both during and subsequent to development, lot grading and drainage problems can be significantly reduced and the need for expensive repairs eliminated. The use of Low Impact Development (LID) techniques offers opportunity to address runoff issues while reducing the dependence on traditional stormwater management structures. LID techniques are important for urban areas as they reduce the need for large centralized management facilities, potentially freeing more property for development (see Chapter 2 for additional information on the role of LID in the City's stormwater management program). LID uses approaches that infiltrate, evaporate, store, filter, and detain stormwater close to its source. Specific techniques include bioretention (rain gardens), green roofs, permeable pavers, rain barrels and cisterns, soil amendments, tree box filters, and grassed swales.

### 9.1 References

General development and drainage information, as well as specific information related to grading minimization strategies, may be found in the following references:

- Better Site Design: An Assessment of the Better Site Design Principles for Communities Implementing Virginia's Chesapeake Bay Preservation Act, Center for Watershed Protection, Inc.
- Low-Impact Development Design Strategies: An Integrated Design Approach – Prince George's County, MD, Department of Environmental Resources Programs and Planning Division (June 1999)
- VA E&SC Handbook

### 9.2 General Lot Grading

Lot grading for all residential development projects shall meet the following provisions:

- Minimum desirable slope is 2%.
- The minimum acceptable slope is 1% for paved surfaces and 2% for vegetated surfaces.
- The potential for erosion shall be minimized by grading lots to avoid concentrated storm flows flowing down banks and slopes, unless provisions have been made to convey concentrated storm flows down banks and slopes in a manner that is non-erosive.
- Grading for the perimeter area within 10 feet of a proposed inhabited structure shall slope away from the structure at a minimum slope of 5% in accordance with the Uniform Statewide Building Code.

### 9.3 Design Guidelines by Neighborhood Character/Density

Lot layout and site design, including stormwater management and drainage patterns, should be consistent with the character of the surrounding neighborhood. Neighborhood character for residential development across the City can be broken into two broad categories following the Comprehensive Plan; downtown and traditional (typically high density) and suburban (typically low density).

Note: From a stormwater management perspective, how runoff is managed and conveyed will be largely a function of neighborhood density and lot layout rather than the age of structures and architectural elements thereof.

#### 9.3.1 Downtown and Traditional (High Density) Neighborhoods

Downtown and traditional neighborhoods are characterized by small to medium sized lots with consistent building setbacks, an interconnected street grid and narrow tree lined streets. Houses are typically located on narrow lots closely spaced with one another (10 – 30 feet typical) with small side yards and/or driveways between structures and situated close to the street with curb, and sidewalk. Lot sizes typically range from less than 5,000 to as much as 10,000 square feet. Small apartments, townhouses and other multifamily structures may be interspersed through such

neighborhoods. Typical zoning designations for such neighborhoods are R-3, R-5, RM-1 or RM-2.

Many new developments may also be described in this manner with the adoption of the City's revised subdivision ordinance which encourages traditional styles of development and the City's comprehensive plan that encourages the development of housing clusters, dense development with a mixture of housing types.

Key site design elements to be considered when working in these areas include the following:

- Consistent front yard appearance
  - Maintain consistent grade on level lots or consistent grading pattern on sloped streets.
  - Provide sheet flow across front yards (acts as vegetated filter strip and avoids concentrated flows).
  - Significant runoff should not be directed between closely spaced structures although shallow concentrated flow through sideyards or along driveways is permissible provided that erosion control is considered in the site design and the flow is adequately conveyed to the street gutter or directly to a storm drain system.
  - No drainage channels should be located in a front yard, or in a side yard that is readily visible from the street.
  - Rain gardens may be appropriate in a front yard or visible side yard if designed to appear as part of the landscape, and maintains a consistent appearance with the surrounding neighborhood.
  
- Accommodate stormwater management practices in rear yards or dedicated areas of open space.
  - Runoff from the rear of properties may be directed to a shallow vegetated swale or an alley designed to convey runoff from multiple lots.
  - Stormwater management facilities (basins) should be located in areas that are not readily visible from a street and shall meet the minimum setback requirements for a structure in the applicable zoning district.
  - Innovative stormwater management practices such as rain gardens, bioretention basins and shallow vegetated swales may be appropriate for location in the rear yards or side yard areas that are not readily visible from the street.

- Other general considerations as practicable.
  - Use pervious paver systems in lieu of concrete slabs (patios, driveways, parking areas) and asphalt.
  - Direct roof drains to open yard areas or dry wells to minimize direct discharge into storm drain systems.
  - Maximize runoff as sheet flow across yards (vegetated strips) prior to collection in a storm drain systems.

### 9.3.2 Suburban (Low Density) Neighborhoods

Suburban (low density) neighborhoods are characterized by larger lot sizes (typically 7,000 sf or greater) a variety of housing styles, deep front setbacks, wide curvilinear streets and prominent driveways and garages with transportation access based largely on the automobile. In addition to the deep front backs, the houses in suburban neighborhoods are typically spaced further apart on the street with wide side yards. Many suburban streets so not have curb gutter and sidewalk (although now required for new subdivisions) with drainage provided by ditches along the shoulder of the streets. Zoning designations for these areas are typically R-7, R-12 and RA although denser zoning designations may also show these characteristics.

Key site design elements to be considered when working in areas with large lots and spacing between structures include the following:

- Aesthetic front yard appearance
  - Maintain consistent grading pattern across individual lots and along streets to minimize unnecessary concentrations of flow.
  - Provide sheet flow across front yards (acts as vegetated filter strip and avoids concentrated flows) with limited concentrated flow as needed based on lot size.
  - Significant runoff should not be directed between closely spaced structures although shallow channels (swales) may be appropriate (based on easement requirements of Chapter 4) if designed with side slope to blend with the overall site grading. The site design will need to accommodate means to convey flow from such a channel passing through a side yard directly to the storm drainage system as flows will likely be excessive for discharge to a street gutter. As with traditional neighborhoods, shallow concentrated flow through sideyards or along driveways is permissible provided that erosion control is considered in the site

- design and the flow is adequately conveyed to the street gutter or directly to a storm drain system.
- Shallow drainage channels may be acceptable in front yards or visible side yards on large lots if they are graded and landscaped to appear as natural topographic features.
  - Bioretention ponds or rain gardens and vegetated swales are appropriate in a front yard or visible side yard if designed to appear as part of the natural landscape.
- Accommodate stormwater management practices in rear yards or dedicated areas of open space.
    - Runoff from the rear of properties may be directed to shallow vegetated swale or an alley designed to convey runoff from multiple lots.
    - Stormwater management facilities (basins) should be located in areas that are not readily visible from a street and shall meet the minimum setback requirements for a structure in the applicable zoning district.
    - Innovative stormwater management practices such as rain gardens, bioretention basins and shallow vegetated swales are appropriate for location in the rear yards or side yard areas that are not readily visible from the street. These structures are encouraged as their use may reduce the required size of stormwater management facilities leaving more land for actual development.
  - Other general considerations as practicable.
    - Use pervious paver systems in lieu of concrete slabs (patios, driveways, parking areas) and asphalt.
    - Direct roof drains to open yard areas or dry wells to minimize direct discharge into storm drain systems.
    - Maximize runoff as sheet flow across yards (vegetated strips) prior to collection in a storm drain systems.

### 9.4 Flood Protection

The following considerations must be made to account for flood protection:

- Lot grading, house siting, and house elevation shall provide for protection of the house against flooding from storms exceeding the capacity of the normal design storm for which the storm drainage system is sized. Consideration of this factor will also provide protection against occasional blockage of pipes.

- Houses shall be sited outside of areas of depressed grade, where overland flow from the depressed area could only take place when ponded water reaches an elevation higher than that of the first floor elevation of the house. Provision for an inlet in the depression is required, but not sufficient by itself, since it can be blocked or its capacity exceeded by a storm exceeding the design storm.
- Houses sited in natural drainage ways shall be discouraged. Where fill in the drainage way is required in order to site the house, grading shall address on-site and off-site stormwater. The lot shall be graded in such a manner as to protect the proposed structure from flooding.
- Storm drainage systems in relationship to the 100 year flood shall be considered. Paths of overland flow should, in conjunction with the pipe system, provide for discharge of similar flows through internal areas of a development without flooding of homes. Where overlot grading and house locations do not appear to meet this requirement, hydraulic calculations shall be submitted which demonstrate the adequacy of the proposed plan to dispose of the 100 year flood.

### 9.5 Construction Plan Requirements

The Final Subdivision Site Plans and Comprehensive Development Plans are required to show grading and site layout as defined in Appendix B of Chapter 31.1, Subdivisions of the Code of the City of Roanoke (1979), as amended and Chapter 36.2, Zoning of the Code of the City of Roanoke (1979), as amended, respectively. These requirements include the following:

- Existing and proposed contours at two-foot intervals.
- Outline of proposed buildings, streets and related features.

Chapter 3 of this Manual provides supporting requirements for identification of drainage pathways and stormwater management facilities for the Stormwater Management Plan that will accompany a Comprehensive Development Plan.

Construction Plans for residential developments subject to the requirements of Chapter 11.4, Stormwater Management of the Code of the City of Roanoke (1979), as amended shall conform to the following requirements:

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- Construction plans shall provide sufficient grades, ridge lines and directional arrows to define the proposed drainage pattern of the entire subdivision and individual lots to show conformance with these guidelines. A minimum of seven proposed lot grades shall be provided; four at the corners; two at the side yard midpoints; and one grade located at the center of the lot (rear of typical structure location). Intermediate grades will be defined by linear interpolation of lot grades provided.
- Identify finished floor elevation of each habitable structure (first floor and entry to basement if structure includes a basement) relative to adjacent grade to show that structure will not flood.
- If during construction and lot grading the applicant is required to deviate from the grading plan, the revised plan must be approved by the Administrator in accordance with Chapter 3.4.