Champion Hills Property Owners Association

Recommended Stormwater Guidelines

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Champion Hills POA
1 Hagen Drive
Hendersonville, NC 28739

TABLE OF CONTENTS

DEFINITIONS

Applicant. An owner or developer of a site who executes or develops a stormwater plan pursuant to Champion Hillls POA Recommended Stormwater Guidelines.

Built-Upon Area. That portion of a development project that is covered by impervious or partially impervious surface including, but not limited to, buildings; pavement and gravel areas such as roads, parking lots, and paths; and recreation facilities such as tennis courts. "Built-upon area" does not include a wooden slatted deck, the water area of a swimming pool, or pervious or partially pervious paving material to the extent that the paving material absorbs water or allows water to infiltrate through the paving material.

Design Professional. A professional civil engineer or landscape architect who prepares the Stormwater Plan for the person or agent engaged in land-disturbing activity.

Detain. To store and slowly release stormwater runoff following precipitation by means of a surface depression or tank and an outlet structure.

Development. Any land disturbing activity which adds to or changes the amount of impervious or partially pervious cover on a land area or which otherwise decreases the infiltration of precipitation into the soil, other than a rebuilding activity that does not qualify as redevelopment.

Ditch. "Ditch or canal" means a man-made channel other than a modified natural stream constructed for drainage purposes that is typically dug through inter-stream divide areas.

Drainage structures. Should include swales, channels, storm sewers, curb inlets, yard inlets, culverts, and other structures designed or used to convey stormwater.

Driveway/Entryway. An area used for ingress or egress of vehicles and allowing access from a traveled way onto a property.

Energy Dissipater. A structure or a shaped channel section with mechanical armoring placed at the outlet of pipes or conduits to receive and break down the energy from high velocity flow.

Ground Cover. Any natural vegetative growth or other material which renders the soil surface stable against accelerated erosion.

Impervious surface. Any surface that, in whole or in part, restricts or prevents the natural absorption of water into the ground. Such surfaces may include, but are not limited to, gravel, concrete, asphalt or other paving material, and all areas covered by the footprint of buildings or structures.

Non-Erosive Velocity. Means the flow rate of water, usually measured in feet per second, that does not exceed the maximum permissible velocity for the condition and type of soil and groundcover over which the water is flowing. Erosion occurs when the maximum permissible velocity is exceeded. See Appendix B for recommended maximum allowable design velocities.

Two-year, 24-hour storm. The surface runoff resulting from a 24-hour rainfall of an intensity expected to be equaled or exceeded, on average, once in 2 years and with a duration of 24-hours.

Ten-year, 24-hour storm. The surface runoff resulting from a 24-hour rainfall of an intensity expected to be equaled or exceeded, on average, once in 10 years and with a duration of 24-hours.

Redevelopment. For the purposes of this stormwater guideline, redevelopment is considered adding increased square footage to an existing dwelling that is contained under a roof.

Stormwater. Any surface flow, runoff, and drainage consisting entirely of water from rainfall events.

Stormwater Runoff. The surface flow of water resulting from precipitation in any form and occurring immediately after rainfall or melting.

Velocity. The average velocity of flow through the cross section of the main channel at the peak flow of the storm of interest. The cross section of the main channel should be that area defined by the geometry of the channel plus the area of flow below the flood height defined by vertical lines at the main channel banks.

PURPOSE

The purpose of the Champion Hills POA Recommended Stormwater Guidelines is to provide the recommended minimum standards for the design of stormwater systems for residential development within the Champion Hills community. This document and the recommendations presented herein applies to all new residential development and re-development. This document is not applicable to community wide drainage infrastructure.

It is recommended for all new residential development and re-development to have storm drainage facilities designed, constructed and maintained so that adjacent properties are not unreasonably burdened with surface waters as a result of such improvements. More specifically for new residential development the following practices should be considered:

(1) Whenever practical, the drainage system of a residential development site should connect to the community drainage system or drainage ways on surrounding properties or streets.

(2) Stormwater should not be diverted from one natural drainage basin into another.

(3) Stormwater should not be directed into sanitary sewers.

(4) If new Built-Upon-Area is anticipated to cause excessive or problematic runoff to an adjacent property owner, appropriate stormwater detention should be considered as outlined herein.

RECOMMENDATIONS

Recommended Design Parameters

- Excess runoff volume resulting from new Built-Upon-Area (BUA) should be detained. The designer should consider either:
    a) Using the provided stormwater sizing chart located in Appendix A for detention volume sizing. (Detention volumes may be stored in pipes, tanks, rain barrels, earthen basins, etc.)
    OR
    b) Providing peak runoff attenuation for the 2-yr, and 10-yr, 24 hr storm.

Approval

- Requires submittal of stormwater management plans, specifications, and/or calculations sealed by a design professional and transmitted to Champion Hills POA.

Post-Construction

- It is recommended that as-built drawings are provided to the owner/application at the project conclusion to provide insight for maintenance in the future.

HYDROLOGY

This section describes recommended procedures to determine runoff flows and volumes for residential project sites within Champion Hills. It is assumed that practicing Design Professionals preparing stormwater plans have a general understanding of the following procedures. These recommendations are not intended to be a step-by-step guide to stormwater design but rather an acceptable guide for an applicable methodology. Any issues concerning these stormwater guidelines should be brought to the attention of the Champion Hills POA.

Design Storm

The selection of the design storm is the fundamental component for any stormwater design. Each aspect of the stormwater system has a different design storm associated to provide a safe and functional system. The table below outlines the recommended storm event applicable to certain stormwater analysis.

DESIGN STORM	
Stormwater Element	**Design Storm**
Stormwater Sewer Pipes	10 yr
Stormwater Swales	10 yr
Detention Devices	2 & 10 yr (detention)

Calculations

The recommended calculation method is defined below.

1. Rational Method

The rational method is the recommended runoff calculation for sites:

Calculation Q=C*I*A, where:

Q= Runoff, cfs
C= Runoff Coefficient
I= Rainfall Intensity, in/hr *(See latest NOAA rainfall intensities)*
A=Drainage Area, acres

HYDRAULICS

This section provides recommended procedures for the design of stormwater systems and devices.

Design Flows

Design flows should be calculated by the appropriate method outlined in the referenced Hydrology Section. Each stormwater element should be designed using the correct design storm.

Mannings "n"

- The recommended pipe materials are HDPE and Concrete.
- Typical Mannings ñnò values for ditches and pipes are shown below.

MANNING'S "n"	
Material	**"n" - value**
HDPE-Pipe	0.011
Concrete Pipe	0.013
Earthen/Sod Ditch	0.03
Rip-Rap Ditch	0.035

Stormwater Pipe

- Minimum driveway pipe size should be 15ò
- Minimum slope for all stormwater pipes should be 0.5%.
- The hydraulic flow should be calculated using the appropriate design storm as outlined herein.
- All stormwater pipes should have a rip-rap pad or other suitable velocity dissipater at the outlet adequately designed for the velocities exiting the pipe. Recommended maximum discharge velocity is per Appendix B.

Channels/Swales

- The hydraulic flow should be calculated using the appropriate design storm as outlined herein.
- Manningôs equation should be used to determine the size of the channel for the design flow.
- Minimum slope of a grassed ditch should be 2%. Minimum slope of a concrete lined ditch should be 1%.
- All swales should be appropriately lined to minimize erosive conditions.

Detention Devices

- Detention devices should use the appropriate runoff method and design storm outlined in this manual.
- One foot of freeboard is recommended on all devices.
- If the project site has multiple drainage areas due to a topographic divide and/ or multiple outlets/ swales, the designer should attempt to not increase stormwater runoff on the adjacent property owner for either drainage area.

APPENDIX A

Roof Area (SF)**	Detention Volume (CF)	Detention Volume (Gal)	Orifice Size
0-500	N/A	N/A	N/A
501-1000	73	546	2"
1001-2000	119	890	2"
2001-3000	342	2558	2"
3001-4500	559	4182	2"
4501-6000	787	5887	2"
6001-8000	1108	8288	2"
8001 +	Engineering Design Required		

Notes:

1) Entire roof area or equivalent impervious area should be piped to detention system.
2) Each detention system should be inspected routinely for functionality.
3) Detention volumes listed are recommended total volumes for each single family lot. Multiple detention devices may be used as long as the total cumulative volume is greater than or equal the volumes listed above.
4) Where multiple detention devices are utilized, the total of all orifices shall have a combined area of no larger than 3.14 sq. inches (2" equivalent). Each orifice shall be proportionately sized to accommodate the detention device in which it serves.

**See Figure 1

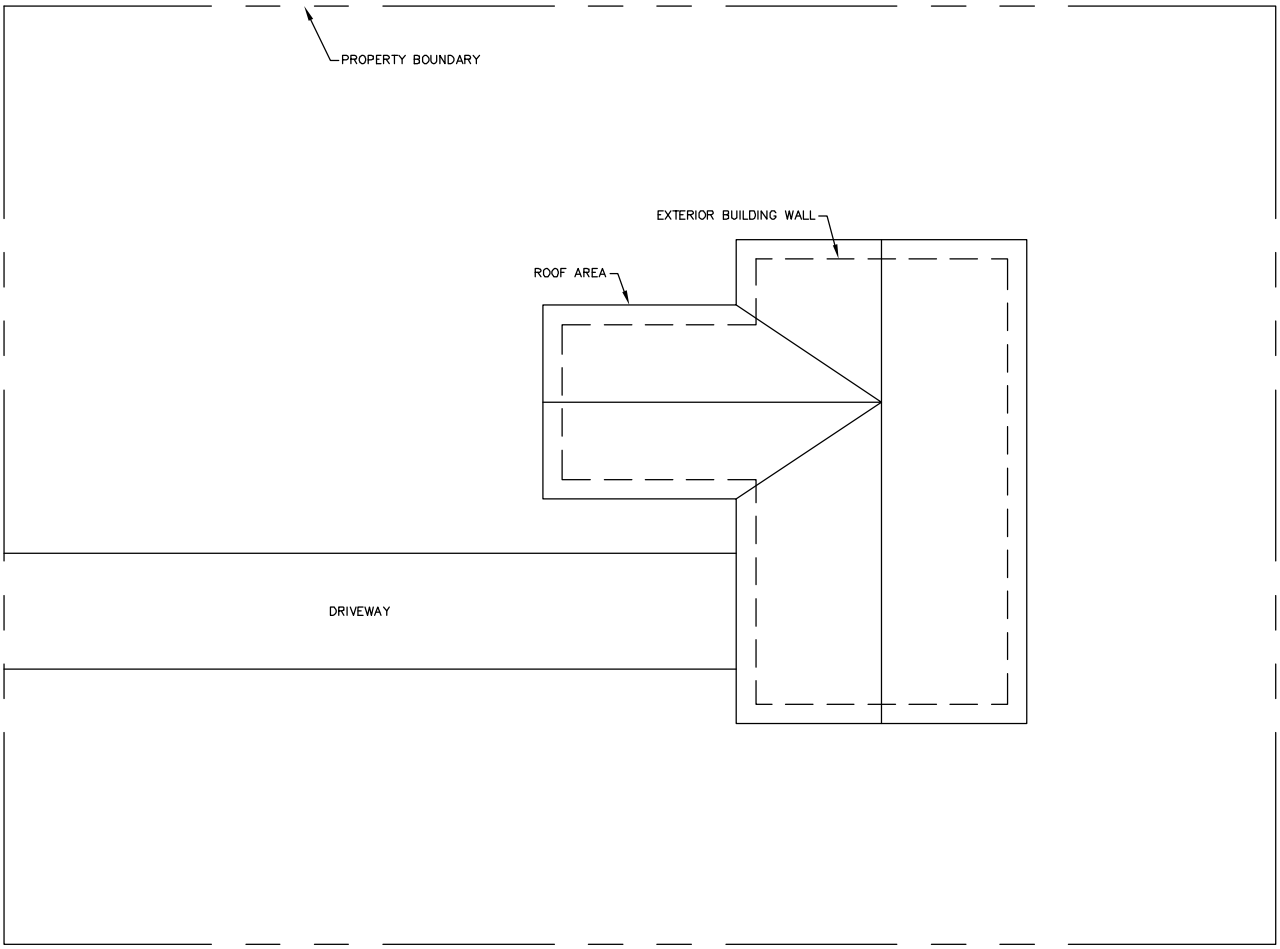
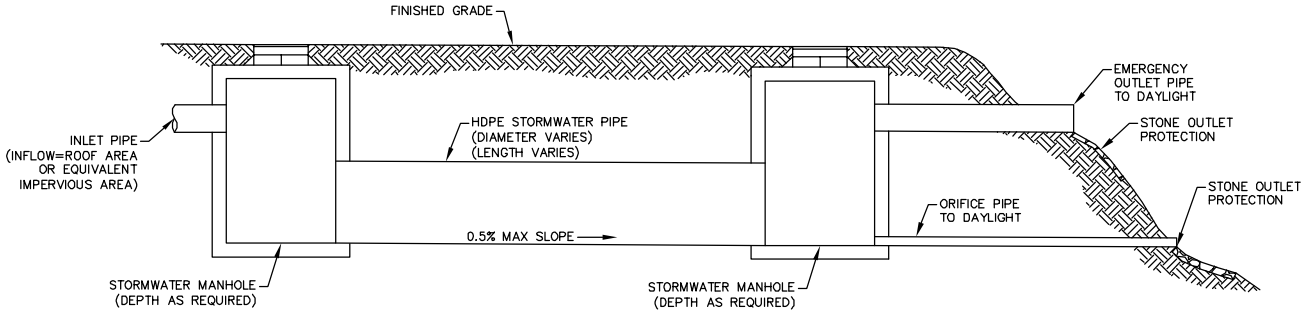


FIGURE 1 – ROOF AREA
NOT TO SCALE



NOTES:
1) SEE CHART FOR REQUIRED PIPE VOLUME.
2) SKETCH IS FOR INFORMATION ONLY. ACTUAL DESIGN, MATERIALS AND CONSTRUCTION MAY VARY
3) SKETCH IS AN EXAMPLE OF ONE SOLUTION, OTHER DEVICES OR METHODS MAY BE UTILIZED.

FIGURE 2 – EXAMPLE STORMWATER SOLUTION
NOT TO SCALE

APPENDIX B

Maximum Allowable Design Velocities[1] for Vegetated Channels

Typical Channel Slope Application	Soil Characteristics[2]	Grass Lining	Permissible Velocity[3] for Established Grass Lining (ft/sec)
0-5%	Easily Erodible Non-plastic (Sands & Silts)	Bermudagrass	5.0
		Tall fescue	4.5
		Bahiagrass	4.5
		Kentucky bluegrass	4.5
		Grass-legume mixture	3.5
	Erosion Resistant Plastic (Clay mixes)	Bermudagrass	6.0
		Tall fescue	5.5
		Bahiagrass	5.5
		Kentucky bluegrass	5.5
		Grass-legume mixture	4.5
5-10%	Easily Erodible Non-plastic (Sands & Silts)	Bermudagrass	4.5
		Tall fescue	4.0
		Bahiagrass	4.0
		Kentucky bluegrass	4.0
		Grass-legume mixture	3.0
	Erosion Resistant Plastic (Clay mixes)	Bermudagrass	5.5
		Tall fescue	5.0
		Bahiagrass	5.0
		Kentucky bluegrass	5.0
		Grass-legume mixture	3.5
>10%	Easily Erodible Non-plastic (Sands & Silts)	Bermudagrass	3.5
		Tall fescue	2.5
		Bahiagrass	2.5
		Kentucky bluegrass	2.5
	Erosion Resistant Plastic (Clay mixes)	Bermudagrass	4.5
		Tall fescue	3.5
		Bahiagrass	3.5
		Kentucky bluegrass	3.5

Source: USDA-SCS Modified

NOTE: [1]Permissible Velocity based on 10-year storm peak runoff
[2]Soil erodibility based on resistance to soil movement from concentrated flowing water.
[3]Before grass is established, permissible velocity is determined by the type of temporary liner used.