

DOCUMENT B: STEP-BY-STEP INSTRUCTIONS FOR USING THE SITE PLANNING & COMPLIANCE SPREADSHEET

The numbering in these instructions generally follows the process outlined in Document A (flowchart). Tab references refer to the appropriate tab in the spreadsheet. Line references refer to the appropriate line in the spreadsheet.

TAB 1: Site Data

- 1.A Utilize environmental site design (ESD) techniques to reduce impervious cover and maximize forest and open space cover. This will affect the post-development treatment volume and pollutant load.
- 1.B Determine the Target Phosphorous Load based upon site size and location and indicate it on **line 18**.
- 1.C For the site, indicate post-development impervious, managed turf, and forest/open space land cover in **lines 23-25**. Guidance for various land covers is provided in Table 1.

Table 1. Land Cover Guidance for Virginia Runoff Reduction Spreadsheet
IMPERVIOUS COVER
<ul style="list-style-type: none"> • Roadways, driveways, rooftops, parking lots, sidewalks, and other areas of impervious cover. • This category also includes the surface area of stormwater BMPs that: (1) are wet ponds, OR (2) replace an otherwise impervious surface (e.g., green roof, pervious parking).¹
MANAGED TURF
<p>Land disturbed and/or graded for eventual use as managed turf:</p> <ul style="list-style-type: none"> • Portions of residential yards that are graded or disturbed, including yard areas, septic fields, residential utility connections • Roadway rights-of-way that will be mowed and maintained as turf • Turf areas intended to be mowed and maintained as turf within residential, commercial, industrial, and institutional settings
FOREST & OPEN SPACE
<p>Land that will remain undisturbed OR that will be restored to a hydrologically functional state:</p> <ul style="list-style-type: none"> • Portions of residential yards that will NOT be disturbed during construction • Portions of roadway rights-of-way that, following construction, will be used as filter strips, grass channels, or stormwater treatment areas; MUST include soil restoration or placement of engineered soil mix as per the design specifications • Community open space areas that will not be mowed routinely, but left in a natural vegetated state (can include areas that will be bush hogged no more than four times per year) • Utility rights-of-way that will be left in a natural vegetated state (can include areas that will be bush hogged no more than four times per year) • Surface area of stormwater BMPs that are NOT wet ponds, have some type of vegetative cover, and that do not replace an otherwise impervious surface. BMPs in this category include bioretention, dry swale, grass channel, ED pond that is not mowed routinely. stormwater wetland, soil amended areas that are vegetated, and infiltration practices that have a vegetated cover.

- Other areas of existing forest and/or open space that will be protected during construction and that will remain undisturbed. These include wetlands.

Operational & Management Conditions for Land Cover in Forest & Open Space Category:

- Undisturbed portions of yards, community open space, and other areas that will be considered as forest/open space must be shown outside the LOD on approved E&S plans AND demarcated in the field (e.g., fencing) prior to commencement of construction.
- Portions of roadway rights-of-way that will count as forest/open space are assumed to be disturbed during construction, and must follow the most recent design specifications for soil restoration and, if applicable, site reforestation, as well as other relevant specifications if the area will be used as a filter strip, grass channel, bioretention, or other BMP
- All areas that will be considered forest/open space for stormwater purposes must have documentation that prescribes that the area will remain in a natural, vegetated state. Appropriate documentation includes: subdivision covenants and restrictions, deeded operation and maintenance agreements and plans, parcel of common ownership with maintenance plan, third-party protective easement, within public right-of-way or easement with maintenance plan, or other documentation approved by the local program authority
- While the goal is to have forest/open space areas remain undisturbed, some activities may be prescribed in the appropriate documentation, as approved by the local program authority: forest management, control of invasive species, replanting and revegetation, passive recreation (e.g., trails), limited bush hogging to maintain desired vegetative community, etc.

¹ Certain stormwater BMPs are considered impervious with regard to the land cover computations. These BMPs are still assigned Runoff Reduction and/or Pollutant Removal rates within the spreadsheet, so their "values" for stormwater management are still accounted for. The reason they are considered impervious is that they either do not reduce runoff volumes (e.g., wet ponds) OR their Runoff Reduction rates are based on comparison to a more conventional land cover type (e.g., green roofs, pervious parking).

2. From the land cover input, a weighted site runoff coefficient (Rv) will be calculated (**line 47**), as will the required Post Development Treatment Volume (**lines 49-50**).
3. A Post Development TP Load, and the required TP load reduction will be calculated based upon the Post Development Treatment Volume (**lines 51-52**). A Total Nitrogen (TN) will also be calculated in line 51 for informational purposes. Compliance is based on TP.

TAB 2: D.A. A (Drainage Area A)

4. If the site has multiple discharge points, or complex treatment sequences, it may be beneficial to divide the site into more than one drainage area. Indicate the post-development impervious, managed turf, and forest/open space land cover for Drainage Area A in **lines 11-13**.
- 5.1.A. Apply Runoff Reduction (RR) Practices to the drainage area to reduce post-development treatment volume and load by indicating in **column G** the number of acres to be treated by a given RR practice. Note that some RR practices are divided into turf area and impervious area to be treated. The site designer should

select the most strategic locations on the site to place RR practices (e.g., drainage areas with the most developed land). This will likely be an iterative process. The available RR Practices include:

- Green roof
- Impervious surface disconnection
- Permeable pavement
- Grass channel
- Dry swale
- Bioretention
- Wet swale
- Infiltration
- Extended detention pond
- Sheetflow to conservation area or filter strip

5.1.B. Based upon the runoff reduction capability of the selected BMP, the spreadsheet will calculate the Runoff Reduction Volume in **column I** and the Remaining Runoff Volume in **column J**.

5.1.C. These practices also have a pollutant removal efficiency (**column K**), which will be applied to the remaining runoff volume (after runoff reduction has been applied). The spreadsheet will calculate the pollutant removal in **column N**.

5.2.A. If a secondary RR practice or a pollutant removal practice will be utilized in sequence downstream of the primary RR practice (for example, 2 acres of impervious rooftop are to be treated first with a green roof, and then, after discharge from the roof, will be conveyed via a dry swale), select the downstream RR practice from the pull-down menu in **column P** (click on the blue box in column P to see the pull-down menu). The spreadsheet will calculate the Remaining Runoff Volume and then direct it to the selected downstream RR practice via **column H**, and the remaining phosphorus load to **column L**. Sequences of three or more practices can be accommodated as well.

5.2.B. Select all the RR practices that will be used for the drainage area. Note that it is possible for a RR practice to be a downstream practice for one area, and a primary practice for another (Using the example above, a dry swale can receive discharge from a green roof and can also receive runoff directly from an impervious parking area.). It is also possible for more than one primary practice to be directed to the same downstream practice. However, the spreadsheet will not allow runoff from one primary practice to be diverted into two different downstream practices. If a site design calls for this, the site will need to be divided into separate drainage areas, or the design worksheet may be utilized instead of the spreadsheet.

5.3.A. From the selected RR practices, the total runoff reduction will be calculated on **line 80**, along with the TP load reduction achieved on **line 81**.

- 5.3.B. The phosphorous load calculations on **lines 80 and 81** account for both the runoff reduction and pollutant removal achieved by runoff reduction practices. Additional practices, including wet swales, filters, ponds, wetlands, and manufactured devices remove phosphorous from runoff via settling, filtering, biological uptake, and other processes, but do not achieve runoff reductions. These practices should be viewed as supplement to runoff reduction measures. **Lines 86-118** account for pollutant removal from practices that do not provide runoff reduction. Indicate acres of turf or impervious cover that drain to these practices *without* first being treated by another practice in **Column D**. The remaining phosphorus load and (unchanged) runoff volume can then be directed to a downstream practice chosen in **Column K**. Runoff volume and phosphorus load from upstream practices are included **Columns F and G**, respectively, for these practices.
- 5.3.C. The TP load reduction for the practices on lines 86-118 are calculated in **Column I** and summed on **cell I120**. This load is added to the phosphorus removal achieved by upstream runoff reduction practices and totaled in **cell I121**.

TAB 3-6: D.A. B – D.A. E (Drainage Areas B, C, D, and E)

If there is only one drainage area for the site, sheet D.A. B, C, D, and E should be left blank. If there is more than one Drainage area, fill out these tabs in the same manner as D.A. A.

TAB 7: Water Quality Compliance

6. The water quality compliance sheet summarizes the runoff reduction and pollutant removal results for the site. **Line 11** will indicate if additional TP load needs to be removed. If there is still a TP load to remove after applying runoff reduction and pollutant removal practices on D.A. A – D.A. E, the site should be reconfigured to reduce impervious or turf areas, or additional RR practices and pollutant removal practices must be selected on sheets D.A. A – D.A. E. The Total Nitrogen (TN) load reduction and adjusted site TN load will be calculated on **lines 20 and 22**. These are for informational purposes, as compliance is based on TP.

TAB 8: Channel and Flood Protection

This sheet assists with calculation of Adjusted Curve Numbers that can be used to calculate the channel protection and flood control volumes necessary for the site.

7. Compare the site area to the total watershed area draining to the point of discharge, and the post-development peak flow from the site for the 1-year storm (see steps 8.A-D below) to the 1-year storm peak flow for the total watershed area draining to the point of discharge. If the site area is less than one percent of the watershed area, or the 1-year post-development peak flow is less than one percent

of the watershed peak flow at the point of discharge, channel protection and flood protection requirements do not apply.

- 8.A Indicate the appropriate regional depths for the 1-year, 2-year, and 10-year 24-hour storms on **Line 2**.
- 8.B Each land cover and soil type is associated with a Natural Resource Conservation Service (NRCS) curve number. Using these curve numbers, a weighted curve number and the total runoff volume for each drainage area is calculated. For Drainage Area A, **Line 37** calculates the runoff volume without regard to the RR practices employed on the site. **Lines 38** subtracts the volume treated by the RR practices from these totals. The spreadsheet then determines the curve number that results in the calculated runoff volume with RR practices. This Adjusted Curve Number is reported on **line 39**.

These steps are repeated for Drainage Areas B – E.

Channel Protection Conditions

Detention or other means may be necessary to reduce the developed peak runoff to the allowable peak runoff values described below. Note that if, on sheets D.A. A – E, Extended Detention, Constructed Wetlands, or Wet Ponds are utilized, there may already be detention volume available to meet these requirements. Actual storage designed in the facility should be accounted for to calculate detention provided. Storage designed into bioretention, permeable pavement, or other practices can also be used to meet detention requirements where the applicant can demonstrate to the approval authority that the practice meets partial or complete detention requirements above and beyond the sizing required for water quality treatment.

- 9.A To meet condition 1, demonstrate that the developed peak runoff from the 2-year 24-hour storm is conveyed without causing erosion of the system.
- 9.B To meet condition 2, demonstrate that the runoff from the developed site, in combination with other existing stormwater runoff, will not exceed the design of the restored stormwater conveyance system nor result in instability of the system.
- 9.C To meet condition 3, the maximum allowable peak runoff from the 1-year storm is equal to the following:

Maximum Peak Flow

$$\text{Allowable } Q_{\text{Developed}} = Q_{\text{Pre-Developed}} \times RV_{\text{Pre-Developed}} / RV_{\text{Developed}}$$

Where:

Allowable $Q_{\text{Developed}}$ = the maximum allowable peak flow from the site to meet condition 3 (cubic feet per second)

$Q_{\text{Pre-Developed}}$ = peak runoff rate for the drainage area in the pre-developed condition (cubic feet per second)

$RV_{\text{Pre-Developed}}$ = Runoff volume for the pre-developed condition (inches)
 $RV_{\text{Developed}}$ = Post-development runoff volume with runoff reduction (inches)

- 9.D To meet condition 4, the maximum allowable peak runoff from the 1-year storm is equal to the following:

Maximum Peak Flow

$$\text{Allowable } Q_{\text{Developed}} = Q_{\text{Good Pasture}} \times RV_{\text{Good Pasture}} / RV_{\text{Developed}}$$

Where:

Allowable $Q_{\text{Developed}}$ = the maximum allowable peak flow from the site to meet condition 4 (cubic feet per second)

$Q_{\text{Good Pasture}}$ = peak runoff rate for the drainage area in the good pasture condition (cubic feet per second)

$RV_{\text{Good Pasture}}$ = Runoff volume for the good pasture condition (inches)

$RV_{\text{Developed}}$ = Post-development runoff volume with runoff reduction (inches)

Flood Control Conditions

Detention or other means may be necessary to reduce the developed peak runoff to the allowable peak runoff values described below. Note that if, on sheets D.A. A – E, Extended Detention, Constructed Wetlands, or Wet Ponds are utilized, there may already be detention volume available to meet these requirements. Actual storage designed in the facility should be accounted for to calculate detention provided. Storage designed into bioretention, permeable pavement, or other practices can also be used to meet detention requirements where the applicant can demonstrate to the approval authority that the practice meets partial or complete detention requirements above and beyond the sizing required for water quality treatment.

10. Using the calculations under 8.A through 8.B above, determine the peak discharge rates for the relevant water flood control storms.
- 11.A. To meet conditions 1, 2, or 3, demonstrate that the developed peak runoff from the 10-year 24-hour storm is confined within the man-made conveyance system.
- 11.B. To meet condition 4, the maximum allowable peak runoff from the 10-year 24-hour storm must be equal to the peak runoff from the site in a good pasture condition
- 11.C Condition 5 is dependent upon local determination,