

# DOCUMENT C-R: SUPPLEMENTAL DOCUMENTATION FOR THE RUNOFF REDUCTION METHOD - REDEVELOPMENT

This supplemental documentation applies to Tab 1: Site Data for redevelopment sites. Document C provides the computation documentation for the remainder of 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 pre-development impervious, managed turf, and forest/open space land cover in **lines 23-25**. Then do the same for post-development in **lines 30-32**. Guidance for various land covers is provided in Table 1-R.

<b>Table 1-R. Land Cover Guidance for Virginia Runoff Reduction Spreadsheet</b>
<b>IMPERVIOUS COVER</b>
<ul style="list-style-type: none"> <li>• Roadways, driveways, rooftops, parking lots, sidewalks, and other areas of impervious cover.</li> <li>• 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).<sup>1</sup></li> </ul>
<b>MANAGED TURF</b>
<p>Land disturbed and/or graded for eventual use as managed turf:</p> <ul style="list-style-type: none"> <li>• Portions of residential yards that are graded or disturbed, including yard areas, septic fields, residential utility connections</li> <li>• Roadway rights-of-way that will be mowed and maintained as turf</li> <li>• Turf areas intended to be mowed and maintained as turf within residential, commercial, industrial, and institutional settings</li> </ul>
<b>FOREST &amp; OPEN SPACE</b>
<p>Land that will remain undisturbed OR that will be restored to a hydrologically functional state:</p> <ul style="list-style-type: none"> <li>• Portions of residential yards that will NOT be disturbed during construction</li> <li>• 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</li> <li>• 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)</li> <li>• 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)</li> <li>• 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.</li> </ul>

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

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.

<sup>1</sup> 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, weighted site runoff coefficients (Rv) will be calculated (**line 55**), as will the Pre- and Post-Development Treatment Volume (**lines 57-58**).

Land Cover Rv:

$$Rv(F) = [(A(fA) \times 0.02) + (A(fB) \times 0.03) + (A(fC) \times 0.04) + (A(fD) \times 0.05)]/SA$$

$$Rv(T) = [(A(tA) \times 0.15) + (A(tB) \times 0.20) + (A(tC) \times 0.22) + (A(tD) \times 0.25)]/SA$$

$$Rv(I) = 0.95$$

$$\%Forest = (A(fA) + A(fB) + A(fC) + A(fD))/SA \times 100$$

$$\%Turf = (A(tA) + A(tB) + A(tC) + A(tD))/SA \times 100$$

$$\%Impervious = (A(iA) + A(iB) + A(iC) + A(iD))/SA \times 100$$

Where:

Rv(F) = weighted forest runoff coefficient

A(fA) = area of pre- or post-development forest and open space in A soils (acres)

A(fB) = area of pre- or post-development forest and open space in B soils (acres)

A(fC) = area of pre- or post-development forest and open space in C soils (acres)

A(fD) = area of pre- or post-development forest and open space in D soils (acres)

Rv(T) = weighted turf runoff coefficient  
A(tA) = area of pre- or post-development managed turf in A soils (acres)  
A(tB) = area of pre- or post-development managed turf in B soils (acres)  
A(tC) = area of pre- or post-development managed turf in C soils (acres)  
A(tD) = area of pre- or post-development managed turf in D soils (acres)

Rv(I) = impervious runoff coefficient  
A(iA) = area of pre- or post-development impervious cover in A soils (acres)  
A(iB) = area of pre- or post-development impervious cover in B soils (acres)  
A(iC) = area of pre- or post-development impervious cover in C soils (acres)  
A(iD) = area of pre- or post-development impervious cover in D soils (acres)

SA = total site area (acres)

Site Rv:

$Rv(S) = Rv(F) \times \%Forest + Rv(T) \times \%Turf + Rv(I) \times \%Impervious$

Where:

Rv(S) = runoff coefficient for the site  
Rv(F) = weighted forest runoff coefficient  
Rv(T) = weighted turf runoff coefficient  
Rv(I) = weighted impervious cover runoff coefficient

Treatment Volume:

$Tv(S) = Rd \times Rv(S) \times SA/12 - Rd \times Rv(f) \times A(f)/12$

Where:

Tv(S) = pre- or post-development treatment volume for site (acre-ft)  
Rd = rainfall depth for target event (1" for water quality storm)  
Rv(S) = runoff coefficient for the site  
SA = total site area (acres)  
Rv(F) = weighted forest runoff coefficient  
A(f) = total area of forest and open space

3. A Pre- and Post-Development TP Load will be calculated (**line 59**). Using these values, the required TP Load Reduction will be calculated (**line 63**) based on whichever of the following applies:
  - a. Decrease TP loads by 10% if the site disturbs less than 1 acre.
  - b. Decrease TP loads by 20% if the site disturbs greater than or equal to 1 acre.
  - c. Decrease TP loads to the applicable TP standard for new development if this is less stringent than the reduction required by (a) or (b), depending on the case.
  - d. Decrease TP loads to a more stringent standard established by a qualifying local program if such exists. In this case, the appropriate values would have to be entered on **lines 18 and 61**.

TP Load

$$L = P \times P_j \times [Tv(S)/Rd] \times C \times 2.72$$

Where:

- L = pre- or post-development pollutant load for site (pounds / year of total phosphorus)
- P = average annual rainfall depth (inches) = 43 inches for Virginia
- P<sub>j</sub> = fraction of rainfall events that produce runoff = 0.9
- Tv(S) = pre- or post-development treatment volume for site (acre-ft)
- Rd = rainfall depth for target event (1" for water quality storm)
- C = flow-weighted mean concentration of pollutant in urban runoff (mg/L) = 0.26 mg/L for total phosphorus
- 2.72 = unit adjustment factor, converting milligrams to pounds and acre-feet to liters

Required TP Load Reduction

$$L_{\text{reduction}} = L_{\text{post}} - L_{\text{pre}} \times (1 - R\%) \quad \text{OR} \quad L_{\text{reduction}} = L_{\text{post}} - P_{\text{target}} \times SA$$

(whichever value is less)

Where:

- L<sub>reduction</sub> = required TP Load Reduction (pounds / year of total phosphorous)
- L<sub>post</sub> = post-development pollutant load for site (pounds /year of total phosphorous)
- L<sub>pre</sub> = pre-development pollutant load for site (pounds / year of total phosphorus)
- R% = Redevelopment reduction percentage (10% if site is less than 1 acre, or 20% if site is greater than or equal to 1 acre)
- P<sub>target</sub> = Target phosphorous load (pounds / acre / year)
- SA = total site area (acres)