Appendix D

Complianc iance Calculation

D.1 Compliance Calculations

All development sites are required to address the Stormwater Retention Volume (SWRv), as described in Chapter 2. For development sites in the Anacostia Waterfront Development Zone (AWDz), retention on site or reduction of 85% of the total suspended solids load for the Water Quality Treatment Volume (WQTv) is also required. Section D.2 provides guidance on using the standard Stormwater Compliance Spreadsheet. Section D.3 provides guidance on using the Stormwater Compliance Spreadsheet for the AWDz, that includes total suspended solids calculations. One of these spreadsheets, or alternative calculations should be submitted with the Stormwater Management Plan for approval.

D.2 District of Columbia Stormwater Compliance Spreadsheet

Note: All cells highlighted in blue are user input cells. Cells highlighted in gray are calculation cells, and cells highlighted in yellow are constant values that generally should not be changed.

Site Data Sheet

1. Input the name of the proposed project on **Line 9**.

2. For the site, indicate post-development Natural Cover, Compacted Cover, and Impervious Cover in **lines 16-18**. Guidance for various land covers is provided in Table 1. Note: Efforts to reduce Impervious Cover on the site and maximize Natural Cover will reduce the required Stormwater Retention Volume (SWRv).

Table 1. Land Cover Guidance for Stormwater Compliance Spreadsheet

NATURAL COVER
Land that will remain undisturbed OR that will be restored to a hydrologically functional state: • 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 have some type of vegetative cover, and that do not replace an otherwise impervious surface. BMPs in this category include bioretention, infiltration, ponds, wetlands, and open channels. • Other areas of existing forest and/or open space that will be protected during construction and that will remain undisturbed <u>Operational & Management Conditions in Natural Cover Category:</u> • 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 natural cover 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 SMP.

- All areas that will be considered natural cover 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 DDOE.
- While the goal is to have natural cover areas remain undisturbed, some activities may be prescribed in the appropriate documentation, as approved by DDOE: forest management, control of invasive species, replanting and revegetation, passive recreation (e.g., trails), limited bush hogging to maintain desired vegetative community, etc.

COMPACTED COVER

Land disturbed and/or graded for eventual use as managed turf or landscaping:

- 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 and landscaped areas intended to be mowed and/or maintained within residential, commercial, industrial, and institutional settings

IMPERVIOUS COVER

- Roadways, driveways, rooftops, parking lots, sidewalks, and other areas of impervious cover.
- This category also includes the surface area of SMPs that replace an otherwise impervious surface (e.g., green roofs and permeable pavement).[1]

[1] Certain SMPs are considered impervious with regard to the land cover computations. These SMPs are still assigned Retention credits within the spreadsheet, so their "values" for stormwater management are still accounted for. The reason they are considered impervious is that their retention credits are based on comparison to a more conventional land cover type (e.g. impervious rooftops and pavement)

2. From the land cover input, a weighted site runoff coefficient (Rv) will be calculated (line 38) based upon the land cover Rv values of 0.00 for Natural Cover, 0.25 for Compacted Cover, and 0.95 for Impervious Cover

%Natural Cover = $A_{NC}/SA \times 100$
%Compacted Cover = $A_{CC}/SA \times 100$
%Impervious Cover = $A_I/SA \times 100$

$Rv = (\%\text{Natural Cover}) \times Rv_{NC} + (\%\text{Compacted Cover}) \times RV_{CC} + (\%\text{Impervious Cover}) \times RV_I$

Where:
A_{NC} = area of post-development natural cover (square feet)
A_{CC} = area of post-development compacted cover (square feet)
A_I = area of post-development impervious cover (square feet)
SA = total site area (square feet)
Rv = weighted site runoff coefficient
Rv_{NC} = runoff coefficient for natural cover (0.00)
Rv_{CC} = runoff coefficient for compacted cover (0.25)
Rv_I = runoff coefficient for impervious cover (0.95)

3. Determine the SWRv that must be retained on the site (**line 31**). The regulatory rain event for calculation of the SWRv varies depending upon the type of development. For federal facilities, the SWRv is based upon the 95th percentile depth (1.7 inches). For non-federal facilities, the SWRv is based upon the 90th percentile depth (1.2 inches). If the site is undergoing substantial improvement as part of a redevelopment project, the SWRv is based upon the 80th percentile depth (0.8 inches).

SWRv = P/12 x Rv x SA

Where:

SWRv = Stormwater Retention Volume (cubic feet)
P = Regulatory Rain Event (inches)
12 = conversion from inches to feet
Rv = weighted site runoff coefficient
SA = total site area (acres)

Stormwater Management Sheet

1. 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**.

2. Apply SMPs to the drainage area to address the required SWRv by indicating the area (in square feet) of impervious cover and compacted cover to be treated by a given SMP in columns B and C. This will likely be an iterative process. The available practices include:

- Green Roof
- Rainwater Harvesting
- Simple Disconnection to a Pervious Area
- Simple Disconnection to a Conservation Area
- Simple Disconnection to Amended Soils
- Permeable Pavement - Enhanced
- Permeable Pavement - Standard
- Bioretention - Enhanced
- Bioretention - Standard
- Stormwater Filtering Systems
- Stormwater Infiltration
- Storage
- Stormwater Ponds
- Wetlands
- Grass Channel
- Grass Channel with Amended Soils
- Dry Swale

- Wet Swale
- Proprietary Practice

3. Based upon the area input for a given practice, the spreadsheet will calculate the Maximum Volume Received by the practice in **column D**. Regardless of the Regulatory Rainfall Event that applies to the site, the volume calculated in column D is based on a rainfall depth of 1.7 inches. – Therefore, for non-federal sites, the value in column D represents that greatest retention volume for which an SMP can be credited, rather than the volume that must be retained to achieve compliance. In other words, it is possible to "oversize" practices that address a portion of a site and "undersize" others to achieve compliance.

$$Vmax = 1.7/12 \times (Rv_{CC} \times A(CC) + Rv_I \times A(I))$$

Where:

Vmax = volume received by practice from 1.7" rain event (cubic feet)
Rv_{CC} = runoff coefficient for compacted cover (0.25)
A(CC) = area of post-development compacted cover (square feet)
Rv_I = runoff coefficient for impervious cover (0.95)
A(I) = area of post-development impervious cover (square feet)

4. If more than one SMP will be employed in series, any overflow from upstream SMPs will be accounted for in column H, and the total volume directed to the SMP will be summed in column I.

5. For most practices it is necessary to input the surface area of the practice and/or the storage volume of the practice in **columns J and K**. These should be calculated using the equations provided in Chapter 3.

6. The spreadsheet calculates a retention volume credit in column L, based on the credit descriptions in columns E-G. Regardless of the storage volume of the SMP, the retention volume credit cannot be greater than the total volume received by the practice (column I).

7. The Treatable Volume Remaining (column M) equals the total volume received by the practice minus the retention volume credit.

8. Any treatable volume remaining can be directed to a downstream practice in **column N** by selecting from the pull-down menu. Selecting an SMP from the menu will automatically direct the treatable volume remaining in column N to column H for the appropriate SMP.

9. From the selected SMPs, the total volume retained will be summed on **line 29**. The retention volume remaining will then be calculated as the difference between the SWRv and the total volume retained on **line 31**. If the entire SWRv has not been retained, the spreadsheet will

calculate the required in-lieu fee on line 35, based on a $30 per gallon rate.

D.A. B – D.A. 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.

Channel and Flood Protection

This sheet assists with calculation of Adjusted Curve Numbers that can be used to calculate peak flows associated with the 2-year storm, 15-year storm, or other storm events.

1. Indicate the appropriate depths for the 1-year, 2-year, and 100-year 24-hour storms (or other storms as needed) on **Line 2**.

Each cover type is associated with a Natural Resource Conservation Service (NRCS) curve number in cells D12, D14, and D16. Using these curve numbers (or other curve numbers if appropriate), a weighted curve number and the total runoff volume for each drainage area is calculated. Line 21 calculates the runoff volume without regard to the SMPs employed on the site. Line 22 subtracts the volume treated by the SMPs from these totals. The spreadsheet then determines the curve number that results in the calculated runoff volume with the SMPs. This Adjusted Curve Number is reported on **line 23.**

These steps are repeated for Drainage Areas B – E.

Weighted Curve Number

$$CN = [(A(NC) \times 70) + (A(CC) \times 74) + (A(I) \times 98)]/SA$$

Where:

- CN = weighted curve number
- A(NC) = area of post-development natural cover (square feet)
- A(CC) = area of post-development compacted cover (square feet)
- A(I) = area of post-development impervious cover (square feet)
- SA = total site area (square feet)

Potential Abstraction

$$S = 1000/(CN-10)$$

Where:

- S = Potential Abstraction (inches)
- CN = weighted curve number

Runoff Volume with no Runoff Reduction

$$RV = (P - 0.2 \times S)^2 /(P + 0.8 \times S)$$

Where:

- RV = Runoff volume with no SMPs (inches)

P = Precipitation depth for a given 24-hour storm (inches)
S = Potential Abstraction (inches)

Runoff Volume with SMPs

$RV_{SMP} = RV – (Cv(da) \times 12 / SA$

Where:
RV_{SMP} = Runoff volume with SMPs (inches)
RV = Runoff volume with no SMPs (inches)
Cv(da) = total storage volume provided by SMPs for the drainage area (cubic ft)
3630 = unit adjustment factor, cubic feet to acre-inches
DA = site area (acres)

Adjusted Curve Number:

The adjusted curve number is calculated using a lookup table of curve number and runoff volumes so that:

$CN_{adjusted}$, so $(P-0.2 \times S_{adjusted})^2 / (P + 0.8 \times S_{adjusted}) = V_{SMP}$

$S_{adjusted} = 1000/(CN_{adjusted} -10)$

Where:
$CN_{adjusted}$ = Adjusted curve number that will create a runoff volume equal to the drainage area runoff volume including SMPs
P = Precipitation depth for a given 24-hour storm (inches)
$S_{adjusted}$ = Adjusted potential abstraction based upon adjusted curve number (inches)
V_{SMP} = Runoff volume with SMPs (inches)

D.3 District of Columbia Stormwater Compliance Spreadsheet – Anacostia Waterfront Development Zone

Note: All cells highlighted in blue are user input cells. Cells highlighted in gray are calculation cells, and cells highlighted in yellow are constant values that generally should not be changed.

Site Data Sheet

1. Input the name of the proposed project on **Line 9**.

2. For the site, indicate the specific types of post-development Natural Cover, Compacted Cover, and Impervious Cover in **lines 16-28**. Guidance for various land covers is provided in Table 1. Note: Efforts to reduce Impervious Cover on the site and maximize Natural Cover will reduce the required Stormwater Retention Volume (SWRv) and Water Quality Treatment Volume (WQTv).

Table 2. Land Cover Guidance for Stormwater Compliance Spreadsheet – Anacostia Waterfront Development Zone
NATURAL COVER
Land that will remain undisturbed OR that will be restored to a hydrologically functional state: • 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 have some type of vegetative cover, and that do not replace an otherwise impervious surface. BMPs in this category include bioretention, infiltration, ponds, wetlands, and open channels.
- Other areas of existing forest and/or open space that will be protected during construction and that will remain undisturbed

Operational & Management Conditions in Natural Cover 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 natural cover 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 SMP.
- All areas that will be considered natural cover 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 DDOE.
- While the goal is to have natural cover areas remain undisturbed, some activities may be prescribed in the appropriate documentation, as approved by DDOE: forest management, control of invasive species, replanting and revegetation, passive recreation (e.g., trails), limited bush hogging to maintain desired vegetative community, etc.

COMPACTED COVER

Land disturbed and/or graded for eventual use as managed turf or landscaping:

Lawn	• Portions of residential yards that are graded or disturbed, and maintained as turf, including yard areas, septic fields, residential utility connections, and roadway rights-of way.
Landscaping	o Areas intended to be maintained in vegetation other than turf within residential, commercial, industrial, and institutional settings

IMPERVIOUS COVER

Roadways, driveways, rooftops, parking lots, sidewalks, and other areas of impervious cover. This category also includes the surface area of SMPs that replace an otherwise impervious surface (e.g., green roofs and permeable pavement).[1]

Rooftop	• All rooftops
Res/Comm Parking Lot	• Parking lots in residential or commercially zoned areas.
Industrial Parking Lot	• Parking lots in industrially zoned areas.
Driveway/Sidewalk/Street	• All driveways, sidewalks, and residential streets
Commercial Street	• Streets in commercial or industrially zoned areas.

[1] Certain SMPs are considered impervious with regard to the land cover computations. These SMPs are still assigned Retention credits within the spreadsheet, so their "values" for stormwater management are still accounted

for. The reason they are considered impervious is that their retention credits are based on comparison to a more conventional land cover type (e.g. impervious rooftops and pavement)

2. From the land cover input, a weighted site runoff coefficient (Rv) will be calculated (line 38) based upon the land cover Rv values of 0.00 for Natural Cover, 0.25 for Compacted Cover, and 0.95 for Impervious Cover

%Natural Cover = A_{NC}/SA x 100
%Compacted Cover = A_{CC}/SA x 100
%Impervious Cover = A_I/SA x 100

Rv = (%Natural Cover) x Rv_{NC} + (%Compacted Cover) x RV_{CC} + (%Impervious Cover) x RV_I

Where:
A_{NC} = area of post-development natural cover (square feet)
A_{CC} = area of post-development compacted cover (square feet)
A_I = area of post-development impervious cover (square feet)
SA = total site area (square feet)
Rv = weighted site runoff coefficient
Rv_{NC} = runoff coefficient for natural cover (0.00)
Rv_{CC} = runoff coefficient for compacted cover (0.25)
Rv_I = runoff coefficient for impervious cover (0.95)

3. Determine the SWRv that must be retained on the site (**line 43**). The regulatory rain event for calculation of the SWRv varies depending upon the type of development. For federal facilities, the SWRv is based upon the 95th percentile depth (1.7 inches). For non-federal facilities, the SWRv is based upon the 90th percentile depth (1.2 inches). If the site is undergoing substantial improvement as part of a redevelopment project, the SWRv is based upon the 80th percentile depth (0.8 inches).

SWRv = P/12 x Rv x SA

Where:
SWRv = Stormwater Retention Volume (cubic feet)
P = Regulatory Rain Event (inches)
Rv = weighted site runoff coefficient
SA = total site area (acres)

4. Determine the WQTv that must be treated on the site (**line 44**). The WQTv is based upon the 1-year storm event (3.2 inches).

WQTv = P_1/12 x Rv x SA

Where:
WQTv = Stormwater Retention Volume (cubic feet)
P_1 = 1-year storm event (3.2 inches)
12 = conversion from inches to feet

Rv = weighted site runoff coefficient
SA = total site area (acres)

5. The WQTv must be treated to remove 85% of total suspended solids (TSS). The total TSS load for the site is calculated on line 46 based on the event mean concentrations of TSS for each land cover type (column C).

$$\text{TSS Load} = P_1/12 \times (Rv_{NC} \times A_{NC} \times TSS_{NC} + Rv_{CC} \times (A_{lawn} \times TSS_{lawn} + A_{ls} \times TSS_{ls}) + Rv_I \times (A_{roof} \times TSS_{roof} + A_{rcpl} \times TSS_{rcpl} + A_{ipl} \times TSS_{ipl} + A_{dss} \times TSS_{dss} + A_{cs} \times TSS_{cs})) \times 2.72/43560$$

Where:

TSS Load = total TSS load for the site (pounds)
P_1 = 1-year storm event (3.2 inches)
12 = conversion from inches to feet
Rv_{NC} = runoff coefficient for natural cover (0.00)
A_{NC} = area of post-development natural cover (square feet)
TSS_{NC} = TSS event mean concentration for natural cover (49 mg/L)
Rv_{CC} = runoff coefficient for compacted cover (0.25)
A_{lawn} = area of post-development lawn cover (square feet)
TSS_{lawn} = TSS event mean concentration for lawn cover (602 mg/L)
A_{ls} = area of post-development landscaping cover (square feet)
TSS_{ls} = TSS event mean concentration for landscaping cover (37 mg/L)
Rv_I = runoff coefficient for impervious cover (0.95)
A_{roof} = area of post-development rooftop cover (square feet)
TSS_{roof} = TSS event mean concentration for rooftop cover (15 mg/L)
A_{rcpl} = area of post-development residential/commercial parking lot cover (square feet)
TSS_{rcpl} = TSS event mean concentration for residential/commercial parking lot cover (27 mg/L)
A_{ipl} = area of post-development industrial parking lot cover (square feet)
TSS_{ipl} = TSS event mean concentration for industrial parking lot cover (228 mg/L)
A_{dss} = area of post-development driveways, sidewalks, and residential streets (square feet)
TSS_{dss} = TSS event mean concentration for driveways, sidewalks, and residential streets (173 mg/L)
A_{cs} = area of post-development commercial and industrial streets (square feet)
TSS_{cs} = TSS event mean concentration for commercial and industrial streets (468 mg/L)
2.72 = unit adjustment factor, converting milligrams to pounds and acre-feet to liters
43,560 = conversion from square feet to acres

6. The TSS Load reduction required (85% of the total site TSS) is calculated on **line 47.**

Stormwater Management Sheet

1. 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**.

2. Apply SMPs to the drainage area to address the required SWRv and TSS load by indicating the area (in square feet) of specific types of impervious cover and compacted cover to be treated by a given SMP in columns B and D. This will likely be an iterative process. The available practices include:

- Green Roof
- Rainwater Harvesting
- Simple Disconnection to a Pervious Area
- Simple Disconnection to a Conservation Area
- Simple Disconnection to Amended Soils
- Permeable Pavement - Enhanced
- Permeable Pavement - Standard
- Bioretention - Enhanced
- Bioretention - Standard
- Stormwater Filtering Systems
- Stormwater Infiltration
- Storage
- Stormwater Ponds
- Wetlands
- Grass Channel
- Grass Channel with Amended Soils
- Dry Swale
- Wet Swale
- Proprietary Practice

3. Based upon the area input for a given practice, the spreadsheet will calculate the Maximum Volume Received by the practice in **column D**. Regardless of the Regulatory Rainfall Event that applies to the site, the volume calculated in column D is based on a rainfall depth of 1.7 inches. – Therefore, for non-federal sites, the value in column D represents that greatest retention volume for which an SMP can be credited, rather than the volume that must be retained to achieve compliance. In other words, it is possible to "oversize" practices that address a portion of a site and "undersize" others to achieve compliance.

3. Based upon the area input for a given practice, the spreadsheet will calculate the Maximum Retention Volume Received by the practice in **column F**. Regardless of the Regulatory Rainfall Event that applies to the site, the volume calculated in column F is based on a rainfall depth of 3.2 inches. Therefore, the value in column F, represents the WQTv. The full WQTv must be treated for TSS removal, but not all of the WQTv needs to be retained to achieve the retention requirements.

$$Vmax = 3.2/12 \times (Rv_{NC} \times A_{NC} + Rv_{CC} \times (A_{lawn} + A_{ls}) + Rv_{I} \times (A_{roof} + A_{rcpl} + A_{ipl} + A_{dss} + A_{cs})$$

Where:

$Vmax$ = volume received by practice from 3.2" rain event (cubic feet)
Rv_{NC} = runoff coefficient for natural cover (0.00)
A_{NC} = area of post-development natural cover (square feet)
Rv_{CC} = runoff coefficient for compacted cover (0.25)
A_{lawn} = area of post-development lawn cover (square feet)

A_{ls} = area of post-development landscaping cover (square feet)
Rv_I = runoff coefficient for impervious cover (0.95)
A_{roof} = area of post-development rooftop cover (square feet)
A_{rcpl} = area of post-development residential/commercial parking lot cover (square feet)
A_{ipl} = area of post-development industrial parking lot cover (square feet)
A_{dss} = area of post-development driveways, sidewalks, and residential streets (square feet)
A_{cs} = area of post-development commercial and industrial streets (square feet)

4. If more than one SMP will be employed in series, any overflow from upstream SMPs will be accounted for in column J, and the total volume directed to the SMP will be summed in column K.

5. For most practices it is necessary to input the surface area of the practice and/or the storage volume of the practice in **columns L and M**. These should be calculated using the equations provided in Chapter 3.

6. The spreadsheet calculates a retention volume credit in column N, based on the credit descriptions in columns G-I. Regardless of the storage volume of the SMP, the retention volume credit cannot be greater than the total volume received by the practice (column K).

7. The Treatable Volume Remaining (column O) equals the total volume received by the practice minus the retention volume credit.

8. Practices that have a less than 100% retention credit may have a TSS removal efficiency as well, meaning that the practice includes filtering or other processes that remove TSS from the runoff that flows through them. This efficiency is indicated in column P. The TSS load to the practice is calculated in column R.

$$TSS\ Load_{practice} = P_1/12 \times (Rv_{NC} \times A_{NC} \times TSS_{NC} + Rv_{CC} \times (A_{lawn} \times TSS_{lawn} + A_{ls} \times TSS_{ls}) + Rv_I \times (A_{roof} \times TSS_{roof} + A_{rcpl} \times TSS_{rcpl} + A_{ipl} \times TSS_{ipl} + A_{dss} \times TSS_{dss} + A_{cs} \times TSS_{cs})) \times 2.72/43560 + TSS_{upstream}$$

Where:

$TSS\ Load_{practice}$ = TSS load directed to a practice (pounds)
P_1 = 1-year storm event (3.2 inches)
12 = conversion from inches to feet
Rv_{NC} = runoff coefficient for natural cover (0.00)
A_{NC} = area of post-development natural cover (square feet)
TSS_{NC} = TSS event mean concentration for natural cover (49 mg/L)
Rv_{CC} = runoff coefficient for compacted cover (0.25)
A_{lawn} = area of post-development lawn cover (square feet)
TSS_{lawn} = TSS event mean concentration for lawn cover (602 mg/L)
A_{ls} = area of post-development landscaping cover (square feet)
TSS_{ls} = TSS event mean concentration for landscaping cover (37 mg/L)
Rv_I = runoff coefficient for impervious cover (0.95)
A_{roof} = area of post-development rooftop cover (square feet)
TSS_{roof} = TSS event mean concentration for rooftop cover (15 mg/L)

A_{rcpl} = area of post-development residential/commercial parking lot cover (square feet)
TSS_{rcpl} = TSS event mean concentration for residential/commercial parking lot cover (27 mg/L)
A_{ipl} = area of post-development industrial parking lot cover (square feet)
TSS_{ipl} = TSS event mean concentration for industrial parking lot cover (228 mg/L)
A_{dss} = area of post-development driveways, sidewalks, and residential streets (square feet)
TSS_{dss} = TSS event mean concentration for driveways, sidewalks, and residential streets (173 mg/L)
A_{cs} = area of post-development commercial and industrial streets (square feet)
TSS_{cs} = TSS event mean concentration for commercial and industrial streets (468 mg/L)
2.72 = unit adjustment factor, converting milligrams to pounds and acre-feet to liters
43,560 = conversion from square feet to acres
$TSS_{upstream}$ = TSS load directed to practice from upstream sources

9. Column S indicates the TSS load removed by the practice, based on both the volume retained (for which 100% TSS removal is credited) plus the TSS removal efficiency from column P applied to any remaining TSS. As with the retention volume credit, the TSS removed by the practice cannot be greater than the TSS received by the practice.

10. The Remaining TSS Load (column T) equals the TSS load received by the practice minus the TSS load removed.

11 Any treatable volume or TSS load remaining (column O and T) can be directed to a downstream practice in **column U** by selecting from the pull-down menu. Selecting an SMP from the menu will automatically direct the treatable volume and TSS load remaining to column J and Q, respectively, for the appropriate SMP.

12. From the selected SMPs, the total volume retained will be summed in **cell N106**. The retention volume remaining will then be calculated as the difference between the SWRv and the total volume retained in **cell N108**. If the entire SWRv has not been retained, the spreadsheet will calculate the required in-lieu fee on line 35, based on a $30 per gallon rate.

13. The total TSS load removed for the site is summed in cell **S110**. The TSS load remaing is calculated as the difference between the required TSS load reduction and the TSS load removed for the site in **cell S112**.

D.A. B – D.A. 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.

Channel and Flood Protection

This sheet assists with calculation of Adjusted Curve Numbers that can be used to calculate peak flows associated with the 2-year storm, 15-year storm, or other storm events.

1. Indicate the appropriate depths for the 1-year, 2-year, and 100-year 24-hour storms (or other

storms as needed) on **Line 2**.

Each cover type is associated with a Natural Resource Conservation Service (NRCS) curve number in cells D12, D14, and D16. Using these curve numbers (or other curve numbers if appropriate), a weighted curve number and the total runoff volume for each drainage area is calculated. Line 21 calculates the runoff volume without regard to the SMPs employed on the site. Line 22 subtracts the volume treated by the SMPs from these totals. The spreadsheet then determines the curve number that results in the calculated runoff volume with the SMPs. This Adjusted Curve Number is reported on **line 23.**

These steps are repeated for Drainage Areas B – E.

Weighted Curve Number

$CN = [(A(NC) \times 70) + (A(CC) \times 74) + (A(I) \times 98)]/SA$

Where:
- CN = weighted curve number
- A(NC) = area of post-development natural cover (square feet)
- A(CC) = area of post-development compacted cover (square feet)
- A(I) = area of post-development impervious cover (square feet)
- SA = total site area (square feet)

Potential Abstraction

$S = 1000/(CN-10)$

Where:
- S = Potential Abstraction (inches)
- CN = weighted curve number

Runoff Volume with no Runoff Reduction

$RV = (P - 0.2 \times S)^2 / (P + 0.8 \times S)$

Where:
- RV = Runoff volume with no SMPs (inches)
- P = Precipitation depth for a given 24-hour storm (inches)
- S = Potential Abstraction (inches)

Runoff Volume with SMPs

$RV_{SMP} = RV - (Cv(da) \times 12 / SA$

Where:
- RV_{SMP} = Runoff volume with SMPs (inches)
- RV = Runoff volume with no SMPs (inches)
- Cv(da) = total storage volume provided by SMPs for the drainage area (cubic ft)
- 3630 = unit adjustment factor, cubic feet to acre-inches
- DA = site area (acres)

Adjusted Curve Number:

The adjusted curve number is calculated using a lookup table of curve number and runoff volumes so that:

$CN_{adjusted}$, so $(P-0.2 \times S_{adjusted})^2 / (P + 0.8 \times S_{adjusted}) = V_{SMP}$

$S_{adjusted} = 1000/(CN_{adjusted} - 10)$

Where:

$CN_{adjusted}$ = Adjusted curve number that will create a runoff volume equal to the drainage area runoff volume including SMPs

P = Precipitation depth for a given 24-hour storm (inches)

$S_{adjusted}$ = Adjusted potential abstraction based upon adjusted curve number (inches)

V_{SMP} = Runoff volume with SMPs (inches)