# Impervious Surface Worksheet

City of Burnsville, Minnesota
Shoreland Ordinance

Owner's Name: _____

Site/Project Name: _____

Site/Project Location: _____

Parcel ID (if known): _____ Date: _____

**Step 1**: Determine site area and **proposed** impervious area in acres for the site.

a. Total site surface area landward from the OHWL (e.g., lot, parcel). _____ acres

b. **Proposed** impervious surface area (see definition below). _____ acres

Impervious Surface: The portion of the buildable parcel that has a covering, which does not permit water to percolate into the natural soil. Impervious surface shall include, but not be limited to, buildings, all driveways and parking areas (whether paved or not), sidewalks, patios, swimming pools, tennis and basketball courts, covered decks, porches, and other structures. Open, uncovered decks are not considered impervious for the purposes of this ordinance. The use of patio blocks, paver bricks or class 5 gravel material are considered impervious surfaces as a majority of water runs-off the surface rather than being absorbed into natural soils underneath.

**Step 2**: Determine proposed percent impervious for the site, and (if applicable) your mitigation options.

a. Percent Impervious = 100 x (Step 1.b. / Step 1.a.)
= 100 x (_____/_____ )
= _____ %

b. If the result for Step 2.a is 25% or less, **STOP HERE**. You do not need to complete the rest of the worksheet.

c. If the result for Step 2.a is more than 25% and your parcel is:

1) **Non-riparian (**parcels that do not abut a lake, river or stream covered by the ordinance):

- You must complete the rest of the worksheet.

2) **Riparian (**parcels that abut a lake, river or stream covered by the ordinance):

- If the result for Step 2.a is more than 25%, but does not exceed 30%, you must do one of the following:
  i. Complete the rest of the worksheet; **OR**
  ii. Agree to install and maintain a native vegetation buffer strip that runs parallel to the shoreline and has an average width of at least 20 feet.

- If the result for Step 2.a is more than 30% you must complete the rest of the worksheet.

**Step 3**: Determine the soil type and soil infiltration rate for the site (circle one in the table below).

Select the infiltration rate from the Table below that corresponds to the soils present at the site. Use site specific soils information from soil borings (if taken), information in the Dakota County Soil Survey Manual; or contact City Engineering staff (952.895.4459) for assistance. If multiple soil types are present, you should use an average infiltration rate or the lowest infiltration rate for soils present.

Soil Infiltration Rates. (Source: Urban Hydrology for Small Watersheds, SCS, June 1986)

| Soil Hydrologic Group | Infiltration Rate (in/hr) | Soil Textures |
|---|---|---|
| A | 0.50 | Sand, loamy sand, or sandy loam |
| B | 0.25 | Silty loam or loam |
| C | 0.10 | Sandy clay loam |
| D | 0.03 | Clay loam, silty clay loam, sandy clay, silty clay, or clay |

**Step 4**: Determine per acre runoff volumes for 25% impervious level (based on Figure 1).

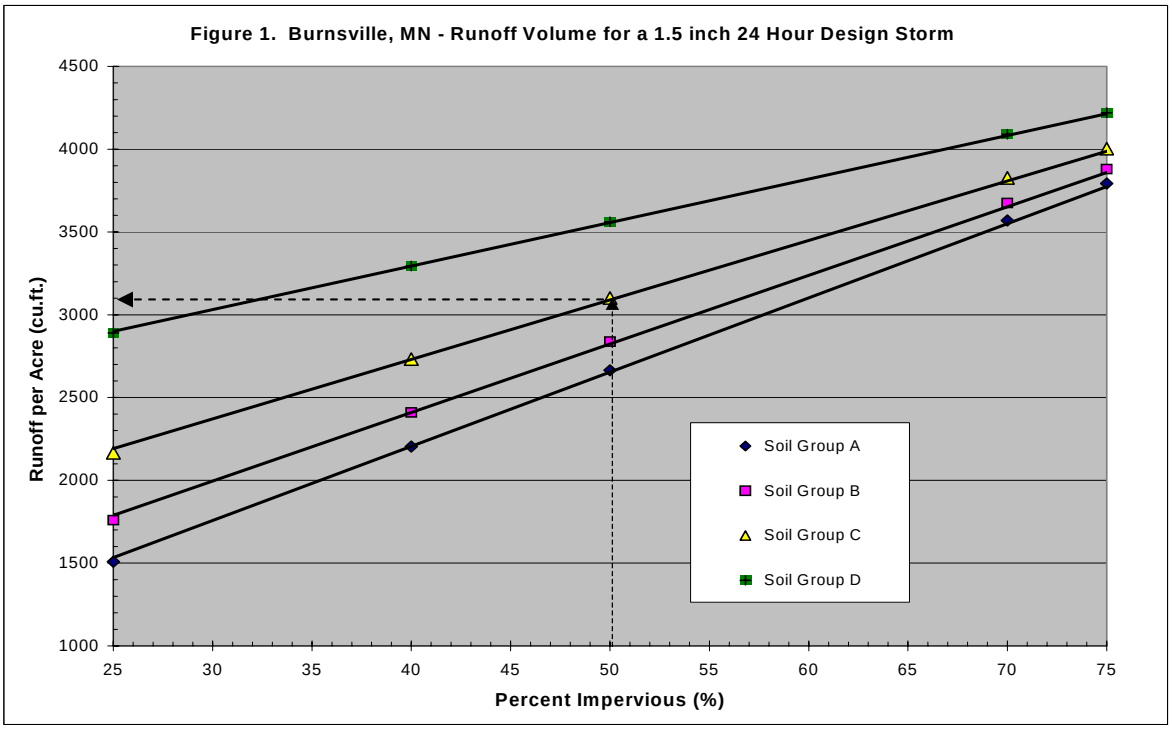
Runoff volume per acre for 25% impervious and soil Group from Step 3 = _____ cu. ft.

**Group A** 1510 cu. ft. **Group C** 2170 cu. ft.
**Group B** 1760 cu. ft. **Group D** 2890 cu. ft.

**Step 5**: Determine per acre runoff volumes from Figure 1 for proposed site percent impervious.

On Figure 1 (see below), draw a line up from the percent impervious determined in Step 2 until it intersects the diagonal line for the soil Group identified in Step 3. Next, draw a line to left from that point to the total runoff per acre value. . Enter this value below as the result for Step 5. *(See example for 50% impervious with result = 3100 cu. ft. per acre).*

Runoff volume per acre for proposed % impervious = _____ cu. ft.



**Step 6**. Calculate excess runoff volume for the 1.5-inch design storm.

Excess runoff volume = Site Area x (Proposed site runoff per acre - 25% impervious runoff per acre)
= Step 1.a. x (Step 5 - Step 4)

= _____ x ( _____ - _____ )

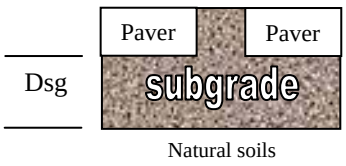
= _____ cu. ft.

This is the volume of runoff that you must capture in storage/non-infiltration practices (Step 7) and/or infiltrate using infiltration practices (e.g., rainwater gardens, bio-retention areas, infiltration trenches).

**Step 7**. Determine mitigation credit for runoff volume captured by storage/non-infiltration practices.

If you will NOT use storage-type practices on your lot or parcel, skip this step and proceed to Step 8. If you will use storage-type practices, for each of the storage or non-infiltration practices you propose to use, enter the type and quantity of each practice in the chart provided below. Select the storage volume calculation method from Table 1 that best fits the practice(s), calculate the volume-per-practice and a total volume for storage or non-infiltration practices.

Table 1. Example Calculations for Volume Captured by Non-Infiltration Practices.

| Practice | Volume Calculation (cubic-feet) | Notes |
|---|---|---|
| Rain Barrels | $V = 0.785 \times D^2 \times H$<br>-or-<br>V = gallons per barrel x 0.1337 | D = diameter of barrel (ft.)<br>H = height of barrel (ft.) |
| Cisterns | V = L x W x H<br>Or<br>V = gallons per tank x 0.1337 | L = length of tank (ft.)<br>W = width of tank (ft.)<br>H = height of tank (ft.) |
| Green roofs – roof gardens | V = L x W x [(Ds x Pe) + Dt]<br>  | L = length of soil area (ft.)<br>W = width of soil area (ft.)<br>Ds = depth of soil (ft.)<br>Dt = depth of storage between soil surface and overflow of practice (ft.)<br>Pe = effective porosity of the soil = 0.4 (for this estimate).<br>Typical range, most soils = 0.3 - 0.5 |
| Porous Paver Systems<br><br>(may be accounted for here **or** in Step 8 – but **NOT** both.) | V = L x W x (Dsg x Pe)<br>  | L = length of paved area (ft.)<br>W = width of paved area (ft.)<br>Dsg = depth of subgrade (ft.)<br>Pe = effective porosity of the subgrade = 0.32 |

List the type and quantity of each practice to be used in the following chart. Add the volumes in the far right column to determine the total volume captured in Step 7. Add additional sheets if more than 3 types of practices to be used.

| Practice | Quantity | Vol.-per-practice (cubic-feet) | Total Practice Vol. = Quantity x vol.-per-practice (cubic-feet) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| **Volume Captured (add volumes in far-right column) =** | | | cu. ft. |

**Step 8**. Identify LID infiltration practices and determine the infiltration practice surface area.

For each of the infiltration practices you will use, enter the type and quantity of each practice in the chart provided below and calculate the surface area per-practice and a total surface area for infiltration practices. This number is the Effective Pervious Area for infiltration practices and should only include areas available to accept runoff from impervious surfaces. Areas such as parking lot green islands located above the elevation of the parking surface shall not be included here. This number should also not include the wetted area of permanent ponds. Attach a site sketch or plan sheet showing the location of BMPs listed here and in Step 7 and the general direction of runoff into the practice.

| Practice | Quantity | Area-per-practice (square-feet) | Total Practice Area = Quantity x area-per-practice (square-feet) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| **Infiltration Surface Area (add areas in far-right column) =** | | | _____ sq. ft. |

**Step 9**. Calculate the volume infiltrated during a 48-hour period.

Volume Infiltrated = infiltration rate from Step 3 x Step 8 x 48 x 1/12

= _____ in/hr. x _____ sq. ft. x 48 hrs x 1/12 in/ft.

= _____ cu. ft.

**Step 10**. Determine if your proposed practices mitigate runoff volume to the 25% impervious level.

a. Total volume captured/infiltrated = Step 7 + Step 9 = _____ + _____

= _____ cu. ft.

b. Is the result for Step 10.a. greater than or equal to the result for Step 6? **YES** **NO**

Step 6 = _____ cu. ft.

If the answer to Step 10.b. is "**YES**," the proposed project site has met the 25% impervious surface mitigation requirements. Submit this form with your plans/sketch for review by the City's engineering department.

If the answer to Step 10.b. is "**NO**," the proposed project site does not have sufficient practices incorporated to mitigate storm water runoff volume to an effective level of 25% impervious. You should re-evaluate your site plans to identify areas and practices to mitigate additional storm water runoff volume. Then update and recalculate Steps 6 through 10 until you have answered "YES" in Step 10.b.