CITY OF PITTSBURGH SMALL PROJECT STORMWATER MANAGEMENT WORKSHEET

500 – 5,000 square feet new impervious cover, riverfront and uptown zoning districts

According to City of Pittsburgh Code Chapter 915.03, this worksheet shall be completed for all projects with land disturbance of more than 500 square feet and less than 5,000 square feet. Within the City of Pittsburgh, many sewersheds are often overwhelmed by stormwater runoff, resulting in combined sewer overflow (CSO) events, localized surface flooding, and basement backups. To mitigate the effects of stormwater on public health and the environment, stormwater best management practices (BMPs) should be introduced on new development and re-development projects. This worksheet provides the property owner an opportunity to identify the type of proposed construction, including new impervious surfaces, and one or a series of BMPs that will be used to offset the stormwater impacts of any new impervious surface proposed. Before any land disturbance you must call 811 to locate all utility lines on your property.

PROPERTY OWNER INFORMATION

Project Name: _____

Project Address: _____

Parcel Number: _____

Owner's Name: _____

Owner's Mailing Address: _____

APPLICANT INFORMATION Same as Above: ☐

Applicant's Name: _____

Business or Relationship to Owner: _____

Phone: _____ Email: _____

TYPE OF PROPOSED DEVELOPMENT:

☐ New Addition
☐ Patio/Deck
☐ Parking Pad
☐ Garage
☐ Shed
☐ Walkway
☐ Other, please describe: _____

IMPERVIOUS AREA

Impervious surfaces prevent the infiltration of water into the ground. Compacted soils also prevent infiltration, so care should be taken to minimize compaction during construction, especially where BMPs will be located. Pervious options that allow water to infiltrate are available for decks and various types of paving, and should be used wherever possible. Please complete the following worksheet to determine the amount (volume) of stormwater generated from the impervious area on the project site.

Total New Impervious ($ft.^2$)	X	1in x (1 ft./12in) = .083	=	Total Volume of Stormwater required to be Managed ($ft.^3$)
Ex: 500 ft^2 building addition	*X*	*0.083*	=	*41.5 ft^3*
	X	0.083	=	
	X	0.083	=	

PROJECT SITE INFORMATION

Please attach a site plan to this application. At a minimum, the site plan shall include the following:

- ☐ Project Name and Address
- ☐ Name of individual / firm that prepared site plan if different than landowner or applicant
- ☐ Total lot area in square feet. (Lot Area = Lot Width X Lot Depth)
- ☐ Location and area of existing impervious surfaces (buildings, patios, sidewalks, etc.)
- ☐ Location and area of new impervious surface(s) or land disturbance (grading and/or excavation)
- ☐ Approximate footprint and location of all structures on adjacent properties within 50 feet
- ☐ Approximate location of existing stormwater management facilities with dimensions (BMPs)
- ☐ Location and description of proposed stormwater management facilities with dimensions (BMPs)
- ☐ Direction of proposed stormwater discharge (e.g. with arrows) to management facilities (BMPs)
- ☐ Direction of proposed stormwater overflow routes (e.g. with arrows) in case BMP reaches capacity, to ensure no negative impacts to neighboring properties
- ☐ Locations of private utilities on site
- ☐ Proposed BMP Operation and Maintenance Plan

BMP SELECTION

BMP	Volume Managed by BMP
Rain Barrel or Cistern	
Rain Garden or Bioretention Storage	
Infiltration Trench	
Dry Well Storage	
Tree Planting	
Other	
Total Volume Storage Provided by BMPs	

EROSION & SEDIMENT CONTROLS

Per Pennsylvania Department of Environmental Protection Code Chapter 102, activities must comply with all state erosion and sediment control requirements, including:

(i) Minimize the extent and duration of the earth disturbance.
(ii) Maximize protection of existing drainage features and vegetation.
(iii) Minimize soil compaction and revegetate as soon as possible.
(iv) Utilize other measures or controls that prevent or minimize the generation of increased stormwater runoff.

I, as property owner or designee, hereby certify that the information contained in the application is true and accurate to the best of my knowledge. I acknowledge that no person shall modify, remove, fill, landscape or alter any stormwater management BMPs, facilities, areas, or structures without the written approval of the City of Pittsburgh. I understand that false information may result in a notice of violation or revocation of any associated permits. I also understand that City representatives may enter my property to investigate or ascertain the condition of the stormwater management facilities on my property.

Property Owner's/Agent Signature *Date*

BMP SELECTION AND SIZING

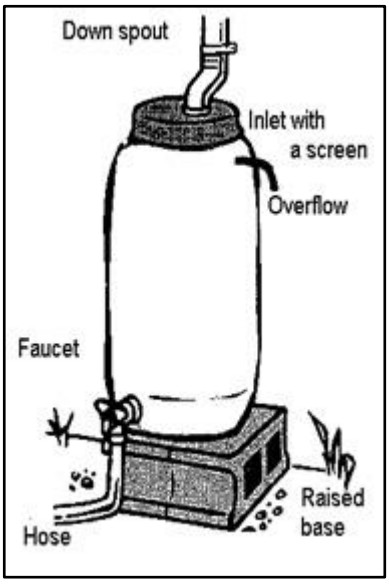
You may choose a combination of BMP types, or multiple of the same kind, to meet the volume of stormwater to be managed from the last table. To adequately manage stormwater, it is best to size the BMP even larger than required for total volume in the above table, as storms are getting longer and more intense. While sizing for 1 inch is the minimum requirement, designing BMPs to manage 1.5 – 2 inches of stormwater is a smart choice.

Rain Barrel or Cistern

Rain barrels are large containers that collect drainage from rooftops and temporarily store water to be released to lawns, gardens, and other landscaped areas after the rainfall has ended. They can be used regardless of the soil's rate of infiltration. Rain barrels are typically between 50 and 200 gallons in size.

Design Considerations:

- Rain barrels should be directly connected to the roof gutter/spout.
- There must be a means to release the water stored between storm events to provide the necessary storage volume for the next storm. You must include details in the operation and maintenance plan for draining between storm events.
- When calculating rain barrel size, rain barrels are typically assumed to be 25% full because they are not always emptied before the next storm.
- Use screens to filter debris and cover lids to prevent mosquitoes.
- An overflow outlet should be placed a few inches below the top with an overflow pipe to divert flow away from structures.
- It is possible to use a number of rain barrels jointly for an area.



Graphic from Lake George Association

Sizing Example for a Rain Barrel:

1. Determine contributing impervious rooftop area and calculate the volume to be captured and reused, per Table 1: _____ ft.^{3}

2. Size the rain barrel:

_____ ft^3 x 7. 48 gallons per ft^3 = _____ gallons

_____ gallons x (0.25*) = _____ gallons

(*assuming that the rain barrel is always at least 25% full)

The rain barrel(s) should be large enough to hold at least this many gallons of water.

Rain Garden or Bioretention Storage

A Rain Garden is a planted shallow depression designed to catch and filter rainfall runoff. The garden captures rain from a downspout or a paved surface. The water sinks into the ground, aided by deep rooted plants that like both wet and dry conditions. The ideal location for a rain garden is between the source of runoff (roofs and driveways) and the runoff destination (drains, low spots).

Design Considerations:

- A maximum of 3:1 side slope is recommended.
- The depth of a rain garden should range from about 6 - 8 inches. In the sizing example, we will design for a ponded water depth not to exceed 6 inches.
- The rain garden should drain within 24-72 hours.
- The garden should be at least 10 feet from building foundations, and 5 feet from sewer lines and retaining walls.
- If the site has clay soil, soil should be amended with compost or organic material and sand, ideally less than 10% of the soil should be composed of clay and silt
- Choose native plants. See http://pa.audubon.org/habitat/PDFs/RGBrochure_complete.pdf and www.pawildflower.org for native plant lists.
- At the rain garden location, the water table should be at least 2' below the soil level. If water stands in an area for more than one day after a heavy rain you can assume it has a higher water table and is not a good choice for a rain garden.

Maintenance:

- Water plants regularly until they become established.
- Inspect twice a year for sediment buildup, erosion and vegetative conditions.
- Mulch with hardwood when erosion is evident and replenish annually.
- Prune and remove dead vegetation in the spring season.
- Weed as you would any garden.
- Locate different plant species depending on how much wetness/dryness they tolerate.
- Remove sediment build-up.

Soil infiltration:

For any infiltration-based BMP, it will be important to know how quickly stormwater will infiltrate into the surrounding soil. There are numerous methods for sizing and designing rain gardens, but they all depend on the rate of soil infiltration (also known as percolation rate).

It is recommended to have a professional perform infiltration tests and help to design and construct your BMP. The stormwater professional may use a tool such as a double ring infiltrometer, like the product found here: https://www.eijkelkamp.com/files/media/Gebruiksaanwijzingen/EN/m1-0904eringinfiltrometer.pdf

Alternatively, you can get an estimate of the percolation rate in the area you're planning the BMP by using a simple method such as the following:

- Remove grass and dig a hole about 12" wide and 12-18" deep, removing soil.
- If soil is dry, fill with water several times and wet a 1 foot area around the hole until soil is saturated.
- Fill with water and immediately measure the water height in the hole with a yardstick.
- Measure how far down the water drains after several hours (ideally 4 hours.
- Divide the depth drained (in inches) by the number of hours passed to get the percolation rate per hour.

An acceptable percolation rate for most infiltration practices in Pittsburgh is a quarter inch (0.25") to half inch (0.5") per hour.

If the percolation rate is less than a tenth inch (0.10") per hour, or if you cannot accommodate the necessary surface area, you will need to include a gravel storage layer underneath the rain garden. You should also consider installing an overflow drain or underdrain in order to avoid excessive standing water / flooding. Be sure to show the stormwater overflow pathways on your management plan, and oversize the facility if slow infiltration and/or overflow drainage would be problematic.

You should always consider which way and how quickly water will drain out of your rain garden in order to prevent basement backups and flooding. In addition to sitting your raingarden downslope from the foundation of your house, there are some instances when you may wish to line your raingarden with waterproof material or otherwise prevent or slow down the rate of infiltration into the adjacent soil, especially if the percolation rate is greater than half an inch (0.5") per hour.

Sizing Example for a Rain Garden

This sizing example is based on controlling 1" of runoff and approximately a 6" ponding depth. Another great resource for sizing your raingarden can be found here: http://www.raingardenalliance.org/right/calculator

1. Locate the rain garden between the source of runoff and a low lying area (drainage area.)

2. This sizing calculation is based on controlling 1" of runoff. Divide the total impervious surface area to be managed by one of the following numbers, depending on the content of the surrounding soil:
    - Divide by 3 for clayey soil
    - Divide by 4 for silty soil
    - Divide by 6 for sandy soil

Total impervious surface _____ ft^2 / _____ (3, 4, or 6 depending on soil type) = _____ ft^2 rain garden area.
(In order to control 2" of runoff volume, simply multiply the rain garden area by 2.)

3. To calculate the thickness of the gravel drainage layer (if percolation rate is too slow, or extra space is needed):

Thickness of gravel layer (in feet) = water volume to be managed / (area of garden x 0.4 void ratio)

_____ ft. thick gravel layer= _____ ft^3 water volume to be managed / (_____ ft^2 rain garden area x 0.4)

This calculation allows for the entire management volume to be captured in the gravel layer. You could also count the volume stored in the soil by figuring a void ratio of 0.2 and the volume stored in the ponding depth by figuring a void ratio of 1.0.

More information on rain garden sizing, design, and maintenance can be found in PA Stormwater Manual chapter 6.4: http://www.dep.state.pa.us/dep/subject/advcoun/Stormwater/Manual_DraftJan05/Section06-StructuralBMPs-part1.pdf

Infiltration Trench

An infiltration trench (also known as a french drain) is a linear stormwater BMP consisting of continuously perforated pipe at a minimum slope in a stone-filled trench. During small storm events, infiltration trenches can significantly reduce volume and serve in the removal of fine sediments and pollutants. Runoff is stored between the stones and infiltrates through the bottom of the facility and into the soil matrix. Runoff should be pretreated using vegetative buffer strips or swales to limit the amount of coarse sediment entering the trench which can clog and make the trench ineffective. In all cases, an infiltration trench should be designed for positive outflow, so it drains away from buildings and the trench itself.

Design Considerations:

- Although the width and depth can vary, it is recommended that infiltration trenches be limited to not more than six (6) feet depth of stone.
- Trench is wrapped is nonwoven geotextile (top, sides, and bottom).
- Trench needs to be placed on un-compacted soils.
- Slope of the trench bottom should be level or with a slope no greater than 1%.
- A minimum of six inches of topsoil is placed over trench and vegetated.
- Cleanouts or inlets should be installed at both ends of the infiltration trench and at appropriate intervals to allow access to the perforated pipe.
- Volume of facility= depth x width x length x void space of the gravel bed (assume 40% void)

Maintenance:

- Catch basins and inlets should be inspected and cleaned at least two times a year.
- The vegetation along the surface of the infiltration trench should be maintained in good condition and any bare spots should be re-vegetated as soon as possible.
- Vehicles should not be parked or driven on the trench and care should be taken to avoid soil compaction by lawn mowers.

Sizing Example for Infiltration Trench:

1. Divide total volume to be managed by 0.4, assuming 40% void in gravel bed.

_____ ft.^{3} / 0.4* = _____ ft.^{3} volume to be managed accounting for gravel void ratio

2. Sizing the infiltration trench facility:

Volume of facility = Depth x Width x Length

Set Depth to 3 feet and determine required surface area of trench.

_____ ft.^{3} volume accounting for void ratio / 3 ft. depth = _____ ft.^{2} surface area

Decide how wide the trench should be (generally no more than 6 feet) to determine trench length:

_____ ft.^{2} surface area / desired width = _____ ft. length

Final infiltration trench dimensions: _____ ft. *(D) x* = _____ ft. *(W) x* = _____ ft. *(L)*

More information on infiltration trench sizing, design, and maintenance can be found in PA Stormwater Manual chapter 6.4: http://www.dep.state.pa.us/dep/subject/advcoun/Stormwater/Manual_DraftJan05/Section06-StructuralBMPs-part1.pdf

Dry Well

A Dry Well, sometimes called a Seepage Pit, is a subsurface storage facility that temporarily stores and infiltrates stormwater runoff from the roofs of structures. By capturing runoff at the source, Dry Wells can dramatically reduce the increased volume of stormwater generated by the roofs of structures. Roof leaders connect directly into the Dry Well, which may be either an excavated pit filled with uniformly graded aggregate wrapped in geotextile, or a prefabricated storage chamber or pipe segment. Dry Wells discharge the stored runoff via infiltration into the surrounding soils. In the event that the Dry Well is overwhelmed in an intense storm event, an overflow mechanism (surcharge pipe, connection to a larger infiltration are, etc.) will ensure that additional runoff is safely conveyed downstream.

Design Considerations:

- Dry Wells typically consist of 18 to 48 inches of clean washed, uniformly graded aggregate with 40% void capacity. "Clean" gravel fill should average one and one-half to three (1.5 – 3.0) inches in diameter.
- Dry Wells are not recommended when their installation would create a significant risk for basement seepage or flooding. In general, 10 - 20 feet of separation is recommended between dry wells and building foundations.
- The facility may be either a structural prefabricated chamber or an excavated pit filled with aggregate.
- Depth of dry wells in excess of three-and-a-half (3.5) feet should be avoided unless warranted by soil conditions.
- Stormwater dry wells must never be combined with existing, rehabilitated, or new septic system seepage pits. Discharge of sewage to stormwater dry wells is strictly prohibited. The installation should include a surcharge or overflow pipe.
- Proprietary / pre-cast storage tanks can be used, too. Make sure the tank will be able to hold at least the volume you need to manage.

Maintenance:

- Dry wells should be inspected at least four (4) times annually as well as after large storm events.
- Remove sediment, debris/trash, and any other waste material from a dry well.
- Regularly clean out gutters and ensure proper connections to the dry well.
- Replace the filter screen that intercepts the roof runoff as necessary.

Sizing Example for a Dry Well:

1. Divide total volume to be managed by 0.4, assuming 40% void in gravel bed.

_____ ft.^{3} / 0.4* = _____ ft.^{3} volume to be managed accounting for gravel void ratio.

2. Sizing the drywell:

Volume of facility = Depth x Width x Length

Set Depth to 3.5 feet and determine the area of the chamber. Assume equal width and length for a square chamber:

_____ ft.^{3} volume accounting for void ratio = 3.5 ft. D x _____ ft. W x _____ ft. L

To determine approximate length and width of a square chamber, divide volume by 3.5 ft. depth, and take the square root of the resulting number.

More information on dry-well sizing, design, and maintenance can be found in PA Stormwater Manual chapter 6.4: http://www.dep.state.pa.us/dep/subject/advcoun/Stormwater/Manual_DraftJan05/Section06-StructuralBMPs-part1.pdf

Tree Preservation and Planting

Trees and forests reduce stormwater runoff by capturing and storing rainfall in the canopy and releasing water into the atmosphere through evapotranspiration. Tree roots and leaf litter also create soil conditions that promote the infiltration of rainwater into the soil. In addition, trees and forests reduce pollutants by taking up nutrients and other pollutants from soils and water through their root systems. A development site can reduce runoff volume by planting new trees or by preserving trees which existed on the site prior to development.

The volume reduction calculations either determine the cubic feet to be directed to the area under the tree canopy for infiltration or determine a volume reduction credit which can be used to reduce the size of any one of the planned structural BMPs on the site.

Tree Considerations:

- Existing trees must have at least a 4" trunk caliper or larger.
- Existing tree canopy must be within 100 ft. of impervious surfaces.
- A tree canopy is classified as the continuous cover of branches and foliage formed by a single tree or collectively by the crowns of adjacent trees.
- New tree plantings must generally be at least 6 ft. in height and have a 2" trunk caliper.
- All existing and newly planted trees must be native to Pennsylvania. See http://www.dcnr.state.pa.us/forestry/commontr/commontrees.pdf for a guide book titled Common Trees of Pennsylvania for a native tree list.
- When using trees as volume control BMPs, runoff from impervious areas must be directed to drain under the tree canopy –show on plans how the site will be graded to direct water to from the impervious area to the the tree area. If the water is channeled as opposed to sheet-flowing, you may need to construct a swale or otherwise prevent erosion from occurring.

Determining the required number of planted trees to reduce the runoff volume:

- A newly planted deciduous tree can reduce runoff volume by 6 cu. ft.
- A newly planted evergreen tree can reduce runoff volume by 10 cu. ft.

Total Volume to be Managed / 6 $ft.^3$. = _____ Number of Deciduous Trees

Total Volume to be Managed / 10 $ft.^3$ = _____ Number of Evergreen Trees

Determining the volume reduction for preserving existing trees:

1. Calculate approximate area of the existing tree canopy: _____ $ft.^2$
2. Measure distance from impervious surface to tree canopy: _____ ft.
3. Calculate the volume reduction credit by preserving existing trees:

For Trees within 20 feet of impervious cover:

Volume Reduction = (Existing Tree Canopy SF x 1 inch) / 12 = _____ $ft.^3$

For Trees beyond 20 feet but not farther than 100 feet from impervious cover:

Volume Reduction = (Existing Tree Canopy SF x 0.5 inch) / 12 = _____ $ft.^3$

This volume credit can be utilized in reducing the size of any one of the structural BMPs planned on the site.

More information on non-structural stormwater management BMPs, such as tree preservation and planting, can be found in PA Stormwater Manual chapter 5:
http://www.stormwaterpa.org/assets/media/BMP_manual/06_Chapter_5.pdf