BMPS	DESCRIPTION		LAND USE & LOCATION SUITABILITY	SIZING CRITERIA
Stormwater Ponds**, [8]	Practices that have either a permanent pool or a combination of a permanent pool and extended detention, and some elements of a shallow marsh equivalent capable of treating the full water quality volume.		Group-wide criteria: Good option for rural land uses; commercial/high density land use - depends site conditions or may be used to treat portion of site, seldom or never suitable in ultra-urban sites. Addresses channel protection, overbank flood protection & extreme flood protection.	Group-wide criteria: applicable with most soils but some soils may require pond liner, practices occupy 2-3% of contributing drainage area, 3:1 side slope
	Micropool Extended Detention Pool *(P-1)*	Pond that treats majority of the water quality volume through extended detention, and incorporates a micropool at the outlet of the pond to prevent sediment resuspension,	Good option for roads & highways	Min. 10 ac. Drainage area, 15% or less slope, 2' separation from groundwater table, head 6-8'
	Wet Pond *(sometimes referred to as Retention Ponds)*	Pond that provides storage for the entire water quality volume in the permanent pool.	Good option for roads & highways	Min. 25 ac drainage area, 15% or less slope, 2' separation from groundwater table, head 6-8'
	Wet Extended Detention Pond	Pond that treats portion of the water quality volume by detaining storm flows above a permanent pool for a specified minimum detention time.	Good option for roads & highways	Min. 25 ac drainage area, 15% or less slope, 2' separation from groundwater table, head 6-8'
	Multiple Pond System	Group of ponds that collectively treat the water quality volume.	Roads & highways use: Site conditions dictate if suitable or may be used to treat portion of site.	Min. 25 ac drainage area, 15% or less slope, 2' separation from groundwater table, head 6-8'
	Pocket Pond	A stormwater wetland design adapted for the treatment of runoff from small drainage areas that has little or no baseflow	Good option for roads & highways Suitable for residential under certain conditions or may be used to treat a portion of the site.	Max 5 ac. Drainage area, 15% or less slope, placement below water table, 4' head
Stormwater Wetland**	Practices that include significant shallow marsh areas, and may also incorporate small permanent pools and extended detention storage to achieve full water quality volume.		Site conditions dictate if suitable for commercial/high density land use, good option for rural land use & not suitable for ultra-urban land use. Residential Subdivision Use, Depending upon soil types may require liner. Addresses water quality, channel protection, overbank flood protection and extreme flood protection.	Group-wide criteria: applicable with most soils but some soils may require liner., head 1-6', practices occupy >1-1.5% of contributing drainage area
	Shallow Wetland	A wetland that provides water quality treatment entirely in a wet shallow marsh.	Good for residential land use, site conditions dictate if suitable for roads & highways.	Min. 25 ac drainage area, 8% or less slope, length to width ratio (min.) 2:1, consumes most land of any stormwater wetland/pond option, 2' separation from groundwater table, 3-5' head.
	Extended Detention Wetland	Wetland system that provides some fraction of water quality volume by detaining storm flows above the marsh surface. Wetland with extended detention storage provided above the wetland. The primary removal mechanism is settling in the wetland and the detention zone, but some pollutants are removed through biological action in the wetland.	Good for residential land use, site conditions dictate if suitable for roads & highways.	Min. 25 ac drainage area, 8% or less slope, length to width ratio (min.) 2:1, 2' separation from groundwater table, 3-5' head
	Pond / Wetland System	Wetland system that provides a portion of the water quality volume in the permanent pool of a wet pond that precedes the marsh for a specified minimum detention time.	Good for residential land use, seldom or never suitable for roads & highways.	Min. 25 ac drainage area, 8% or less slope, length to width ratio (min.) 2:1, 2' separation from groundwater table, 3-5' head
	Pocket Wetland	Shallow wetland design adapted fro the treatment of runoff from small drainage areas that has variable water levels and relies on groundwater for its permanent pool.	Site conditions dictate if good for residential land use, good for roads & highways.	Max 5 ac. drainage area, 8% or less slope, length to width ratio (min.) 2:1, below water table, 2-3' head
Infiltration Systems [5]	Practices that capture and temporarily store the water quality volume before allowing it to infiltrate the soil over a 2 day period.		Site conditions dictate if good for rural and urban-urban land use. Residential Subdivision Use, High Density/Ultra-Urban, Not to be placed under pavement or concrete. Addresses water quality.	Group-wide criteria: soils need to have infiltration rate of at least 0.5"/hr, practices occupy 2-3% of contributing drainage area, must be 3-4' above groundwater table.
	Infiltration Trench [3]	An infiltration practice that stores the water quality volume in the void spaces of a gravel trench before it is infiltrated into the ground. Can only capture a small amount of runoff (I.e. first flush) and therefore, often used in combination with another BMP such as detention basin.	Site conditions dictate suitability for residential land use, good for roads, highways and commercial/high density.	Max 5 ac. drainage area, 15% or less slope, 1' head

TABLE 9 - STORMWATER TREATMENT BMP'S, USE & SIZE CRITERIA

BMPS	DESCRIPTION		LAND USE & LOCATION SUITABILITY	SIZING CRITERIA
Infiltration Systems [5] ***continued***	***Infiltration Basin***	An infiltration practice that stores the water quality volume in a shallow depression, before it is infiltrated into the ground.	Good for residential land uses, never suitable for roads/highways, site conditions dictate suitability for commercial/high density.	Max 10 ac. drainage area, 8% or less slope, 3' head
	Dry Well	An infiltration practice similar in design to the infiltration trench and best suited for treatment of rooftop runoff	Good for residential land uses, never good for roads & highways,	Max 1 ac. drainage area, 8% or less slope, 1' head. If site with less than 75% impervious cover will require sedimentation.
Filtration Systems	Use some combination of a granular filtration media such as sand, soil, organic material, carbon or a membrane to remove constituents found in runoff. Quantity control can be included by providing additional storage volume in an associated pond or basin. Generally filters are multichamber structure that treats runoff through filtration using a sediment forebay, a primary filter median and an underdrain collection system.		Good for residential & ultra urban land uses with high percentage of impervious cover.	Group-wide criteria: most soils, head 2-7', practices occupy 2-7% of contributing drainage/impervious area, groundwater table must be at least 2' below filter bottom
	Surface Sand Filter [3]	A filtering practice that treats stormwater by settling out larger particles in a sediment chamber, and then filtering stormwater through a sand matrix.	Good for roads & highways; site conditions dictate if suitable for residential, not good for rural areas. Typically needs to be e combined with other controls to provide water quantity control. Addresses water quality.	Max 10 ac. drainage area, 6% or less slope, typically require 2-3% area of contributing impervious area.
	Underground Sand Filter [3, 4]	A filtering practice that treats stormwater as it flows through underground settling and filtering chambers.	Not good for rural & residential land uses. Site conditions dictate if suitable for roads & highways.	Max 2 ac. drainage area, 6% or less slope, typically require 2-3% area of contributing impervious area.
	Perimeter Sand Filter [3]	A filter that incorporates a sediment chamber and filter bed as parallel vaults adjacent to a parking lot.	Same as underground filter.	Max 2 ac. drainage area, 6% or less slope, typically require 2-3% area of contributing impervious area.
	Organic Filter	Organic material such as compost or peat is used in the filter instead of sand.	Same as surface sand filter.	Max 5 ac. drainage area, 6% or less slope.
	Bioretention [3]	A shallow depression that treats stormwater as it flows through a soil matrix and is returned to the storm drain system. Includes grass buffer strips, ponding area, organic mulch layer, planting soil bed, sand bed and plants.	Good for roads & highways. Seldom or never in rural or residential land uses. Parking lot islands, landscaped areas around building, perimeter of parking lots, individual residential lots (often referred to as rain gardens). Planting soils must meet criteria and use of native plants recommended. Addresses water quality	Max 5 ac. drainage area, 6% or less slope, typically require 5% area of contributing impervious area.
Open Channels*	Vegetated open channels that are designed to capture and treat the full water quality volume within dry or wet cells formed by check dams or other means.		May have residential subdivision use, Good for rural and road/highways. Addresses water quality.	Group-wide criteria, 5 ac. Drainage area max, site slope nor more than 4%, 1' head, side slopes gentler than 2:1 (3:1 preferred)
	Dry Swale [3]	Open vegetated drainage channel or depression designed to detain water within dry cells formed by check dams or other means. Promotes filtration of stormwater runoff into the soil media. Permeable soil layer.	May be okay for residential/subdivision use, urban-urban use & commercial/high density use. Ideal for open section roads and low density residential streets. Use where standing water not desired, Addresses water quality.	Max 5 ac. drainage area, 4% or less slope, typically requires 10-20% area of contributing impervious area, 2' above groundwater table, made soils
	Wet Swale [3]	Open vegetated drainage channel or depression designed to retain water or intercept groundwater for water quality treatment in wet cell formed by check dams or other means. Creates a linear series of wetland cells.Wetland plants utilized.	Seldom or never suitable for residential subdivision use, use in residential only where standing water is not a nuisance or high groundwater table Good option in rural and roads & highways. Seldom or never in commercial/high density & ultra urban land uses. Addresses water quality.	Max 5 ac. drainage area, 4% or less slope, Place below groundwater table. Typically requires 10-20% area of contributing impervious area.
Other Vegetated Systems (biofilters)	***Grassed channel*** *(also vegetated channels, grassed swales, vegetated swales)* [3]	Grassed channels that collect and convey runoff usually to a basin or another BMP. Designed to treat shallow flows. Designed to filter stormwater runoff and meet velocity targets for the water quality design storm and the 2-year storm event.	Residential Subdivision Use. Use for pretreatment, runoff reduction/impervious cover disconnection and as curb and gutter replacement. NYS deems as pretreatment, treatment of small portion of site or supplemental method only. Not deemed effective for stand-alone water quality treatment.	Typically requires 5% area of contributing impervious area. Max 5 ac. Drainage area, 10-20% of total drainage area required for BMP. 2-5' head, not on slopes >4%, recommend 1-2%, bottom width of trapezoid or parabola 2-8', slopes 3:1 or flatter

TABLE 9 - STORMWATER TREATMENT BMP'S, USE & SIZE CRITERIA

BMPS	DESCRIPTION		LAND USE & LOCATION SUITABILITY	SIZING CRITERIA
Other Vegetated Systems (biofilters) continued	***Vegetated Filter Strips***	Grass or other vegetation planted within uniformly graded areas which accepts sheet flow runoff from adjacent surfaces such as parking lots, highways and rooftops. Slows runoff velocity and filters out sediments and other pollutants through filtration and infiltration. Used in combination with riparian/wetland buffer to treat sheet flows and in stabilizing streambanks	Residential subdivision use, area adjacent to streambanks or riparian/wetland buffers. Applications: pretreatment, runoff reduction/impervious cover disconnection; and use in buffer system. NYS deems as pretreatment, treatment of small portion of site or supplemental method only. Not deemed effective for stand-alone water quality treatment.	BMP surface area is 100% of contributing impervious area, BMP required 25% of total drainage area, negligible head requirement, area typically serviced less than 5 ac. Max overall slope 8%
	Vegetated Buffers *(grassed and treed)* ***I.e. Wetland and Riparian buffers***	Native or planted vegetation along edges of sensitive environmental resources which slows runoff velocity and filters out sediment and pollutants. Controls erosion of banks.	Upland areas, slopes, land areas adjacent to surfaces waters, bluffs, streambanks, drainageways.	Max. overall slope 6%
Other Infiltration Systems	***Porous pavement systems*** [3]	Stormwater runoff is infiltrated into the ground through a permeable layer of pavement or other stabilized permeable surface (I.e. porous asphalt, porous concrete, modular perforated concrete block, cobble pavers with porous joints or gaps or reinforced/stabilized turf.	Overflow parking lots, driveways, sidewalks, roads and other paved areas not exposed to high volumes of traffic, heavy equipment, or high amounts of sediment. NYS deems method as a pretreatment or supplemental method, and not effective for stand-alone water quality treatment.	Drainage acreage should be less than 5 acres. Parent soil infiltration minimum of 0.5"/hr. Area not sanded nor salted during winter. No high volume traffic nor sediment.
Rain Garden	This is a smaller variation of bioretention and combines physical filtering and adsorption with bio-geochemical processes to remove pollutants. The system typically consists of inflow component, shallow ponding area over a planted soil bed, mulch layer, gravel filter chamber, and overflow mechanism for larger rain events.		Typically used in residential and institutional settings collecting runoff from roof drains, driveways, small parking areas, sidewalks and other hard surfaces. Small amount of stormwater runoff is directed into a vegetated shallow depression . Should be located approx. 30 feet of downspout or impervious area.	Rain garden size can vary from 40-300 square feet. Max. ponded water depth is 6 inches. 3:1 side slopes. 12-24" of soil media above 6-12" washed stone above subsoil (or underdrain if required). Ponding occurs for 1-2 days. Loading ratio not to exceed 5:1, drainage to infiltration. Length to width ratio of 2:1 is recommended.
Green Roof	Green roofs consist of a layer of vegetation and soil installed on top of a conventional flat or sloped roof. The rooftop vegetation captures rainwater allowing evaporation and evapotranspiration processes to reduce stormwater runoff, as well as moderating building temperatures and providing insulation from heat and cold. Components include roof structure capable of supporting weight of green roof system, waterproof barrier, drainage layer, geosynthetic layer, and plants selected for climatic variation tolerance and shallow rooting.		Green roofs are suitable for municipal, industrial, and commercial buildings, multifamily housing, and parking garages, as well as, r retrofit or redevelopment projects. Generally green roofs are installed on flat roofs or sloped roofs up to 30% (with strapping and erosion control devices).	Generally, green roofs weighing >17lbs./sq.ft. saturated should consult a structural engineer. Soils used are typically lighted than standard mixes; 75% mineral and 25% organic an no clay size particles. Porosity of drainage system should be >25%, made up of gravel or recycled polyethylene materials. Waterproof roof surface with monolithic or thermoplastic sheets.
Stormwater Planters	Small landscaped stormwater treatment devices placed above or below ground and designed for infiltration or filtering practices. Three types - contained planters, infiltration planters, and flow-through planters. All planters have "box" materials, organic soil media, and vegetation. Infiltration and flow-through planters may also include gravel drainage layer, filter fabric, splash rock, and perforated pipe.		Well suited for urban redevelopment sites. Can be placed adjacent to buildings, on sidewalks, terraces or rooftops. Downspouts can be directed into infiltration or flow-through planters. Contained planters can reduce overall impervious area.	Most effective at treating small storm events. Soil infiltration rate of 2"/hr. Designed to pond water for <12hrs.with max. ponding depth of 12". Infiltration and flow-through planters should have a min. 1,5ft and 2.5ft width. Infiltration and flow-through planters should not receive drainage from >15,000 sq.ft. impervious areas. Infiltration planters to be located min. 10ft from structures.
Rain Barrels/ Cisterns	Rain barrels and cisterns capture and store stormwater runoff to be used later for nonpotable uses (lawn and landscape irrigation, car washing, filling swimming pools, etc.). Components include a lightweight storage container, secure cover, debris/mosquito screen, inlet filter with clean-out valve, overflow pipe, access hatch, cleaning drain, and extraction system.		May be used in residential, commercial and industrial areas; from very dense urban to more rural areas. A rain barrel may be located beneath single downspouts or multiple barrels can be situated to receive flows from several rooftop sources.	Barrel/cistern sizing is based on the water demand for the intended use. The amount of water available for reuse is a function of the impervious surface area that drains to the barrel/cistern.

TABLE 9 - STORMWATER TREATMENT BMP'S, USE & SIZE CRITERIA

BMPS	DESCRIPTION		LAND USE & LOCATION SUITABILITY	SIZING CRITERIA
Dry Ponds i.e. Detention Basins, Dry Extended Detention Ponds, Extended Detention Basins/Ponds	Basins designed to temporarily detain runoff for some minimum time and releases shortly after storm event (usually within 24 hours) . Reduces peak flow rate of stormwater discharges. Used for water quantity control only.		Residential/Subdivision use. NYS states practice not capable of providing water quality treatment alone but can function as pretreatment, treatment of small portion of site or as a supplemental practices.	Services min. 2 ac. Drainage area, 10-20% of area required for BMP, 2-5 head.
Oil/Grit Separators (also called oil and water separators) & Other Hydrody-namic Structures includes non-proprietary systems noted below and proprietary systems. [2, 7]	Specifically designed, baffled inlets, remove or segregate trash, debris and some amount of sediment and petroleum hydrocarbons from stormwater. Operate by principles of sedimentation for grit and phase separation for oil. Minimal flow attenuation and not designed for significant detention storage.		Used in retrofit situations to provide some water quality treatment for small urban lots where larger BMPs not feasible. Best used in impervious areas with high sediment and hydrocarbon loadings especially commercial, industrial and transportation land uses. NYS deems as pretreatment, treatment of small portion of site or supplemental method only. Not capable of providing water quality treatment as a stand-alone device.	Typically Contributing area to any individual inlet limited to one acre or less of impervious cover. Less than 1% of area required from BMP. 2-5' head required. Can be used for retrofitting small urban lots where larger BMPs are not feasible or where above-ground BMPS are not an option. Standard designs for easy installation. Requires aggressive maintenance plan.
	Stormceptors *(Trademark)*	Proprietary oil/grit separator uses a bypass chamber & treatment chamber to trap and retain nps pollutants.	Same as above	Stormceptor available in prefabricated sizes up to 12' in diameter by 6-8' deep. Stormceptor recommends use: redevelopment project of >2500 sq.ft. where there was no previous stormwater management, projects that double impervious area, and projects that disturb at least 50% of site.
	Grit Chambers / Water Quality Inlets	Consists of 3 bays: forebay for sediment trapping, separator section for oil separation and afterbay allows for some settling but generally stormwater is routed out to another BMP or storm drain system.	Same as above	Combined volume of 3 bays should be maximized and should equal at least 400 cu. feet per acre of contributing impervious area.
	Deep Sump Catch Basins	Modified catch basin with the outlet pipe 4' below the inlet pipe. Allows suspended solids to settle out and oil and grease to float on surface of pool of water. Eventually oil and grease attach to sediment. Must be cleaned out for it to be effective.	Same as above	Same as above.
Catch Basin Insert	Designed to be suspended from storm drain inlet structure. Treats only the designed flow rate, should have a high-flow bypass to prevent resuspension and washout. Can contain one or more treatment mechanisms, including filtration, sedimentation or gravitational absorption of oils. Not suitable for removal of fine particulate stormwater pollutants (i.e. metals, nutrients, silts or clays).		Unpaved areas where sediment concentration is expected to contain coarse material. Sites where stormwater has lots of debris Use in unpaved roads, parking areas, construction sites, unpaved industrial sites and lumber yards. NYS deems as pretreatment, treatment of small portion of site or supplemental method only. Not capable of providing water quality treatment as a stand-alone device.	Typically services less than 1 acre, no area required for bmp, 1-2' head. Designed to perform acceptably for a reasonable design storm (I.e. 2-yr. Rainfall event based on hydrologic characteristics and percent of imperviousness of site. Should not interfere with drainage for larger rainfall events (I.e. 10-yr rainfall event)

TABLE 9 - STORMWATER TREATMENT BMP'S, USE & SIZE CRITERIA

BMPS	DESCRIPTION	LAND USE & LOCATION SUITABILITY	SIZING CRITERIA
In-line storage in the storm drain network	Collection of stormwater runoff from parking lots and roadways; allows for percolation of runoff. Provides storage within storm drain system to detain flows.	In areas where there is adequate depth between the bottom of leaching pools and leaching catch basins and seasonal high water table. Acts as a surrogate for aboveground storage when little space available for aboveground storage facilities. If pipes not oversize could cause upstream flooding. Can reduce storm peak flows but unable to improve water quality or protect downstream channels.	Pipes must be oversized to prevent upstream flooding. Slopes of existing piping system must be neither very flat or steep. Consumes little surface area.

Notes:

Practices noted in italics are noted as effective BMPs for addressing water quality by NYSDEC. Includes 5 categories of effective BMPS: stormwater wetlands, stormwater ponds, filtration systems, infiltration systems and open channels. NYSDEC noted BMPs as effective if met water quality goals: 80% TSS (suspended inorganic and inorganic material) reduction; 40% TP removal and a proven record of longevity in the field. G=good pollutant removal (>30% TN, >60% metals, >70%) F= fair (15-30% TN, 30-60% Metals, 35-70% bacteria), P=poor ((<15% TN, <30% metals, <35% bacteria)

Footnote

[1] = Pollutant Removal Efficiencies from sources noted in color.

[2] Pathogens = Coliform, Streptococci, E. coli removal measured as by NYSDEC 2001.

[3] = Data is based on fewer than 5 data points for the pollutant removals from the National Pollutant Removal Performance Database for Stormwater Treatment Practices 2nd Edtn.

[4] = Assumed vertical sand filter is same as underground sand filter for National Pollutant Removal Database values.

[5=] Infiltration Practices Group pollutant removal efficiencies according to National Pollutant Removal Database 2nd Edtn. based on median value for Infiltration Trench & Porous Pavement methods.

[6] = Stormwater Dry Ponds group's median pollutant removal efficiency from National Pollutant Removal Performance Database incorporate efficiencies of Quality Control Pond & Dry Extended Detention Pond. Group median utilized for Dry Extended Pond pollutant removal efficiency.

[7] = Pollutant removal efficiency noted for Oil Grit separators separate and distinct from Stormceptor (trademark) value from National Pollutant Removal Performance Database 2nd Edtn.

[8 =] Assumed stormwater wetlands same as stormwater wet ponds for bacteria, organic carbon and hydrocarbon pollutant removal efficiency per National Pollutant Removal Performance Database 2nd Edtn.

[9] = Bacteria data include fecal streptococci, enterococci, fecal Coliform, E. coli and total Coliform as per National Pollutant Removal Performance Database 2nd Edtn.

[10 =] Excludes carbon data includes BOD, COD and TOC removal data.

n/a indicates that the data is not available

** Pollutant removal values from National Pollutant Removal Performance Database for group do not necessarily reflect all stormwater treatments listed in the group and may incorporate additional treatment types not included in this list.

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