

This chapter presents a series of matrices that can be used as a screening process to select the best SMP or group of SMPs for a development site. It also provides guidance for best locating practices on the site. The matrices presented can be used to screen practices in a step-wise fashion. The screening factors include:

1. Land Use
2. Physical Feasibility
3. Watershed/ Regional Factors
4. Stormwater Management Capability
5. Community and Environmental Factors

The five matrices presented here are not exhaustive. Specific additional criteria may be incorporated depending on local design knowledge and resource protection goals. Furthermore, many communities may wish to eliminate some of the selection factors presented in this section. Caveats for the application of each matrix are included in the detailed description of each.

More detail on the proposed step-wise screening process is provided below:

Step 1 Land Use

Which practices are best suited for the proposed land use at this site? In this step, the designer makes an initial screen to select practices that are best suited to a particular land use.

Step 2 Physical Feasibility Factors

Are there any physical constraints at the project site that may restrict or preclude the use of a particular SMP? In this step, the designer screens the SMP list using Matrix No. 2 to determine if the soils, water table, drainage area, slope or head conditions present at a particular development site might limit the use of a SMP.

Step 3 Watershed Factors

What watershed protection goals need to be met in the resource my site drains to? Matrix No.3 outlines SMP goals and restrictions based on the resource being protected.

Step 4 Stormwater Management Capability

Can one SMP meet all design criteria, or is a combination of practices needed? In this step, designers can screen the SMP list using Matrix No. 4 to determine if a particular SMP can meet water quality, channel protection, and flood control storage requirements. At the end of this step, the designer can screen the SMP options down to a manageable number and determine if a single SMP or a group of SMPs is needed to meet stormwater sizing criteria at the site.

Step 5 Community and Environmental Factors

Do the remaining SMPs have any important community or environmental benefits or drawbacks that might influence the selection process? In this step, a matrix is used to compare the SMP options with regard to cold climate restrictions, maintenance, habitat, community acceptance, cost and other environmental factors.

Section 7.1 Land Use

This matrix allows the designer to make an initial screen of practices most appropriate for a given land use (Table 7.1).

Rural. This column identifies SMPs that are best suited to treat runoff in rural or very low density areas (e.g., typically at a density of less than ½ dwelling unit per acre).

Residential. This column identifies the best treatment options in medium to high density residential developments.

Roads and Highways. This column identifies the best practices to treat runoff from major roadways and highway systems.

Commercial Development. This column identifies practices that are suitable for new commercial development

Hotspot Land Uses. This last column examines the capability of an SMP to treat runoff from designated hotspots (see Appendix A). An SMP that receives hotspot runoff may have design restrictions, as noted.

Ultra-Urban Sites. This column identifies SMPs that work well in the ultra-urban environment, where space is limited and original soils have been disturbed. These SMPs are frequently used at redevelopment sites.

Table 7.1 Land Use Selection Matrix

SMP Group	SMP Design	Rural	Residential	Roads and Highways	Commercial/High Density	Hotspots	Ultra Urban
Pond	Micropool ED	○	○	○	◐	①	●
	Wet Pond	○	○	○	◐	①	●
	Wet ED Pond	○	○	○	◐	①	●
	Multiple Pond	○	○	◐	◐	①	●
	Pocket Pond	○	◐	○	◐	●	●
Wetland	Shallow Wetland	○	○	◐	◐	①	●
	ED Wetland	○	○	◐	◐	①	●
	Pond/Wetland	○	○	●	◐	①	●
	Pocket Wetland	○	◐	○	◐	●	●
Infiltration	Infiltration Trench	◐	◐	○	○	●	◐
	Shallow I-Basin	◐	◐	◐	◐	●	◐
	Dry Well ¹	◐	○	●	◐	●	◐
Filters	Surface Sand Filter	●	◐	○	○	②	○
	Underground SF	●	●	◐	○	○	○
	Perimeter SF	●	●	◐	○	○	○
	Organic SF	●	◐	○	○	②	○
	Bioretention	◐	◐	○	○	②	○
Open Channels	Dry Swale	○	◐	○	◐	②	◐
	Wet Swale	○	●	○	●	●	●

○: Yes. Good option in most cases.
 ◐: Depends. Suitable under certain conditions, or may be used to treat a portion of the site.
 ●: No. Seldom or never suitable.
 ①: Acceptable option, but may require a pond liner to reduce risk of groundwater contamination.
 ②: Acceptable option, if not designed as an exfilter.
 1: The dry well can only be used to treat rooftop runoff

Section 7.2 Physical Feasibility Factors

This matrix allows the designer to evaluate possible options based on physical conditions at the site (Table 7.2). More detailed testing protocols are often needed to confirm physical conditions at the site. Five primary factors are:

Soils. The key evaluation factors are based on an initial investigation of the NRCS hydrologic soils groups at the site. Note that more detailed geotechnical tests are usually required for infiltration feasibility and during design to confirm permeability and other factors. Appendix H describes geotechnical testing requirements for New York State.

Water Table. This column indicates the minimum depth to the seasonally high water table from the bottom elevation, or floor, of an SMP.

Drainage Area. This column indicates the minimum or maximum drainage area that is considered optimal for a practice. If the drainage area present at a site is slightly greater than the maximum allowable drainage area for a practice, some leeway is warranted where a practice meets other management objectives. Likewise, the minimum drainage areas indicated for ponds and wetlands should not be considered inflexible limits, and may be increased or decreased depending on water availability (baseflow or groundwater), mechanisms employed to prevent clogging, or the ability to assume an increased maintenance burden.

Slope. This column evaluates the effect of slope on the practice. Specifically, the slope guidance refers to how flat the area where the practice is installed must be and/or how steep the contributing drainage area or flow length can be.

Head. This column provides an estimate of the elevation difference needed for a practice (from the inflow to the outflow) to allow for gravity operation.

Table 7.2 Physical Feasibility Matrix						
SMP Group	SMP Design	Soils	Water Table	Drainage Area (acres)	Site Slope	Head (ft)
Pond	Micropool ED	HSG A soils may require pond liner.	2 foot separation if hotspot or aquifer	10 min ¹	No more than 15%	6 to 8 ft
	Wet Pond			25 min ¹		
	Wet ED Pond					
	Multiple Pond					
	Pocket Pond	OK	below WT	5 max ²		4 ft
Wetland	Shallow Wetland	HSG A soils may require liner	2 foot separation if hotspot or aquifer	25 min	No more than 8%	3 to 5 ft
	ED Wetland					
	Pond/Wetland					
	Pocket Wetland	OK	below WT	5 max		2 to 3 ft
Infiltration	Infiltration Trench	f _c > 0.5 inch/hr; additional pretreatment required over 2.0 in/hr (See Section 6.3.3)	3 feet, 4 feet if sole source aquifer.	5 max	No more than 15%	1 ft ⁶
	Shallow I-Basin			10 max ³		3 ft
	Dry Well			1 max ⁴		1 ft
Filters	Surface SF	OK	2 feet ⁵	10 max ²	No more than 6%	5 ft
	Underground SF			2 max ²		5 to 7ft
	Perimeter SF			2 max ²		2 to 3 ft
	Organic SF			5 max ²		2 to 4 ft
	Bioretention			5 max ²		5 ft
Open Channels	Dry Swale	Made Soil	2 feet	5 max	No more than 4%	3-5 ft
	Wet Swale	OK	below WT	5 max		1 ft

Notes:

- 1: Unless adequate water balance and anti-clogging device installed
- 2: Drainage area can be larger in some instances
- 3: May be larger in areas where the soil percolation rate is greater than 5.0 in/hr
- 4: Designed to treat rooftop runoff only
- 5: If designed with a permeable bottom, must meet the depth requirements for infiltration practices.
- 6: Required ponding depth above geotextile layer.

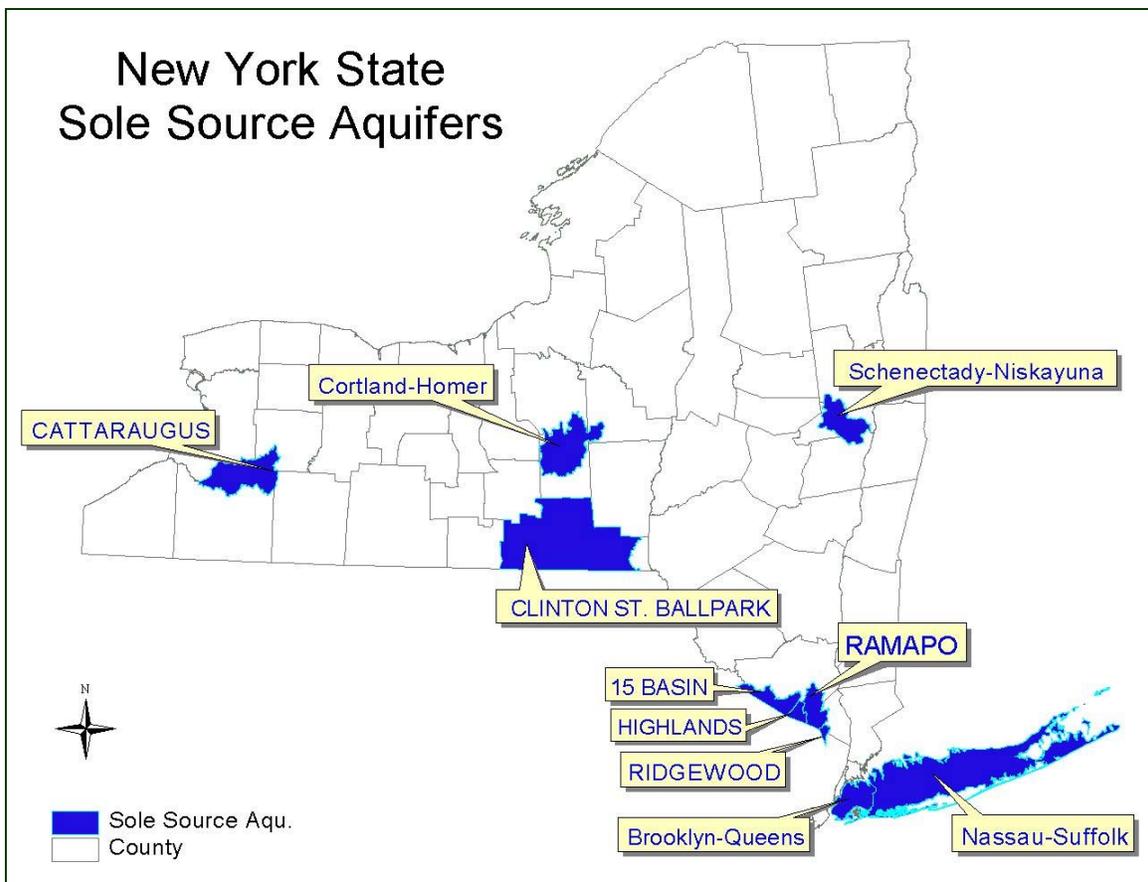
Section 7.3 Watershed/Regional Factors

The choices made by the designer should be influenced to some extent by the resource being protected, and the region of New York State where the site is located. The following matrices (Tables 7.3a and 7.3b) present some design considerations for six watershed or regional factors in New York:

Sensitive Streams. The guidance presented here should apply to all trout waters and Class N waters, and any streams that support high biodiversity and water quality, and have a low density of development.

Aquifers. In sole source aquifers, special care should be taken to select practices and incorporate design considerations that protect the groundwater quality. Figure 7.1 depicts sole source aquifers in the State of New York.

Figure 7.1 Sole Source Aquifers in New York State



Lakes. Lakes are of particular concern in New York, which has many natural lake systems and borders on two Great Lakes. The information in this matrix focuses on phosphorous removal, which is an important concern in most lake systems. It is important to note, however, that many lakes in New York State have other important issues to address. Some lakes, such as Onondaga Lake, have other specific concerns, such as toxics and metals. Each community should also take these goals into consideration when reviewing site plans.

Table 7.3a Watershed/ Regional Selection Matrix-1

SMP Group	Sensitive Stream	Aquifer	Lakes
Ponds	Emphasize channel protection. Restrict in-stream practices. In trout waters, minimize permanent pool area, and encourage shading.	May require liner if HSG A soils are present. Pretreat 100% of WQ _v from hotspots.	Encourage the use of a large permanent pool to improve phosphorus removal.
	Wetlands	Require channel protection. Restrict in-stream practices. Restrict use in trout waters.	
Infiltration	Strongly encourage use for groundwater recharge. Combine with a detention facility to provide channel protection.	Provide 100' horizontal separation distance from wells and 4' vertical distance from the water table.	OK. Provides high phosphorus removal.
Filtering Systems	Combine with a detention facility to provide channel protection.	Excellent pretreatment for infiltration or open channel practices.	OK, but designs with a submerged filter may result in phosphorus release.
Open Channels	Combine with a detention facility to provide channel protection.	OK, but hotspot runoff must be adequately pretreated	OK. Moderate P removal.

Reservoirs. For drinking water reservoirs, and in particular for unfiltered water supplies such as the New York City Reservoir system, turbidity, phosphorous removal, and bacteria are of particular concern. A particular reservoir may have other specific concerns, which should be identified as part of a Source Water Assessment.

Estuary/Coastal. In New York State, coastal or estuary areas include the South Shore Estuary Reserve, Peconic Estuary, NY/NJ Harbor, and Hudson River Estuary. In these areas, nitrogen is typically a concern due to potential eutrophication. In addition, bacteria control is important to protect shellfish beds.

Cold Climates. Many portions of New York State experience cold or very snowy winters. This matrix summarizes some of the design considerations in these cold climate areas. For more detailed information, consult Chapter 6, which provides cold climate design guidance for each group of SMPs.

Table 7.3b Watershed/Regional Selection Matrix-2			
SMP Group	Reservoir	Estuary/Coastal	Cold Climates
Ponds	<p>Encourage the use of a large permanent pool to improve sediment and phosphorous removal.</p> <p>Promote long detention times to encourage bacteria removal.</p>	<p>Encourage long detention times to promote bacteria removal.</p> <p>Provides high nitrogen removal.</p> <p>In flat coastal areas, a pond drain may not be feasible.</p>	<p>Incorporate design features to improve winter performance.</p>
Wetlands			<p>Encourage the use of salt-tolerant vegetation.</p>
Infiltration	<p>Provide a separation distance from bedrock and water table</p> <p>Pretreat runoff prior to infiltration practices.</p>	<p>OK, but provide a separation distance to seasonally high groundwater.</p> <p>In the sandy soils typical of coastal areas, additional pretreatment may be required (See Section 6.3.3)</p>	<p>Incorporate features to minimize the risk of frost heave.</p> <p>Discourage infiltration of chlorides.</p>
Filtering Systems	<p>Excellent pretreatment for infiltration or open channel practices.</p> <p>Moderate to high coliform removal</p>	<p>Moderate to high coliform removal</p> <p>Designs with a submerged filter bed appear to have very high nitrogen removal</p>	<p>Incorporate design features to improve winter performance.</p>
Open Channels	<p>Poor coliform removal for wet swales.</p>	<p>Poor coliform removal for grass wet swales.</p>	<p>Encourage the use of salt-tolerant vegetation.</p>

Section 7.4 Stormwater Management Capability

This matrix examines the capability of each SMP option to meet stormwater management criteria (Table 7.4). It shows whether an SMP can meet requirements for:

Water Quality. The matrix summarizes the relative pollutant removal of each practice for nitrogen, metals, and bacteria. All of the practices approved for water quality achieve at least 80% TSS and 40% TP removal. For more detailed information, consult Appendix A, which describes the application of the Simple Method in New York State. Pollutant removals are based a comprehensive pollutant removal database produced by the Center for Watershed Protection (Winer, 2000).

Channel Protection. The matrix indicates whether the SMP can typically provide channel protection storage. The finding that a particular SMP cannot meet the channel protection requirement does not necessarily imply that the SMP should be eliminated from consideration, but is a reminder that more than one practice may be needed at a site (e.g., a bioretention area and a downstream ED pond).

Flood Control The matrix shows whether an SMP can typically meet the overbank flooding criteria for the site. Again, the finding that a particular SMP cannot meet the requirement does not necessarily mean that it should be eliminated from consideration, but rather is a reminder that more than one practice may be needed at a site (e.g., a bioretention area and a downstream stormwater detention pond).

Table 7.4 Stormwater Management Capability Matrix

SMP Group	SMP Design	Water Quality			Channel Protection	Flood Control
		Nitrogen	Metals	Bacteria		
Pond	Micropool ED				○	○
	Wet Pond				○	○
	Wet ED Pond	○	○	○	○	○
	Multiple Pond				○	○
	Pocket Pond				○	○
Wetland	Shallow Wetland				○	○
	ED Wetland	○	◐	○	○	○
	Pond/Wetland				○	○
	Pocket Wetland				○	①
Infiltration	Infiltration Trench				●	●
	Shallow I-Basin	○	○	○	②	②
	Dry Well				●	●
Filters	Surface Sand Filter				①	●
	Underground SF				●	●
	Perimeter SF	○	○	◐	●	●
	Organic SF				●	●
	Bioretention				①	●
Open Channels	Dry Swale	◐	○	●	●	●
	Wet Swale				●	●

○: Good option for meeting management goal
 Good pollutant removal (>30% TN, >60% Metals, >70% Bacteria)

◐: Fair pollutant removal (15-30% TN, 30-60% Metals, 35-70% Bacteria)

●: Cannot meet management goal.
 Poor pollutant removal (<15% TN, <30 Metals, <35% Bacteria)

①: In most cases, cannot meet this goal, but the design may be adapted to add storage.

②: Generally cannot meet this goal, except in areas with soil percolation rates greater than 5.0 in/hr

Section 7.5 Community and Environmental Factors

The last step assesses community and environmental factors involved in SMP selection. This matrix employs a comparative index approach (Table 7.5.). An open circle indicates that the SMP has a high benefit and a dark circle indicates that the particular SMP has a low benefit.

Ease of Maintenance. This column assesses the relative maintenance effort needed for an SMP, in terms of three criteria: frequency of scheduled maintenance, chronic maintenance problems (such as clogging) and reported failure rates. It should be noted that **all SMPs** require routine inspection and maintenance.

Community Acceptance. This column assesses community acceptance, as measured by three factors: market and preference surveys, reported nuisance problems, and visual orientation (i.e., is it prominently located or is it in a discrete underground location). It should be noted that a low rank can often be improved by a better landscaping plan.

Affordability. The SMPs are ranked according to their relative construction cost per impervious acre treated.

Safety. A comparative index that expresses the relative safety of an SMP. An open circle indicates a safe SMP, while a darkened circle indicates deep pools may create potential safety risks. The safety factor is included at this stage of the screening process because liability and safety are of paramount concern in many residential settings.

Habitat. SMPs are evaluated on their ability to provide wildlife or wetland habitat, assuming that an effort is made to landscape them appropriately. Objective criteria include size, water features, wetland features and vegetative cover of the SMP and its buffer.

Table 7.5 Community and Environmental Factors Matrix						
SMP Group	SMP List	Ease of Maintenance	Community Acceptance	Affordability	Safety	Habitat
Ponds	Micropool ED	●	●	○	○	●
	Wet Pond	○	○	○	●	○
	Wet ED Pond	○	○	○	●	○
	Multiple Pond	○	○	●	●	○
	Pocket Pond	●	●	○	●	●
Wetlands	Shallow Wetland	●	○	●	○	○
	ED Wetland	●	●	●	●	○
	Pond/Wetland	○	○	●	●	○
	Pocket Wetland	●	●	○	○	●
Infiltration	Infiltration Trench	●	○	●	○	●
	Shallow I-Basin	●	●	●	○	●
	Dry Well	●	●	●	○	●
Filters	Surface SF	●	●	●	○	●
	Underground SF	●	○	●	●	●
	Perimeter SF	●	○	●	○	●
	Organic SF	●	○	●	○	●
	Bioretention	●	●	●	○	●
Open Channels	Dry Swale	○	○	●	○	●
	Wet Swale	○	●	○	○	●

Note: ○ High, ● Moderate, ● Low