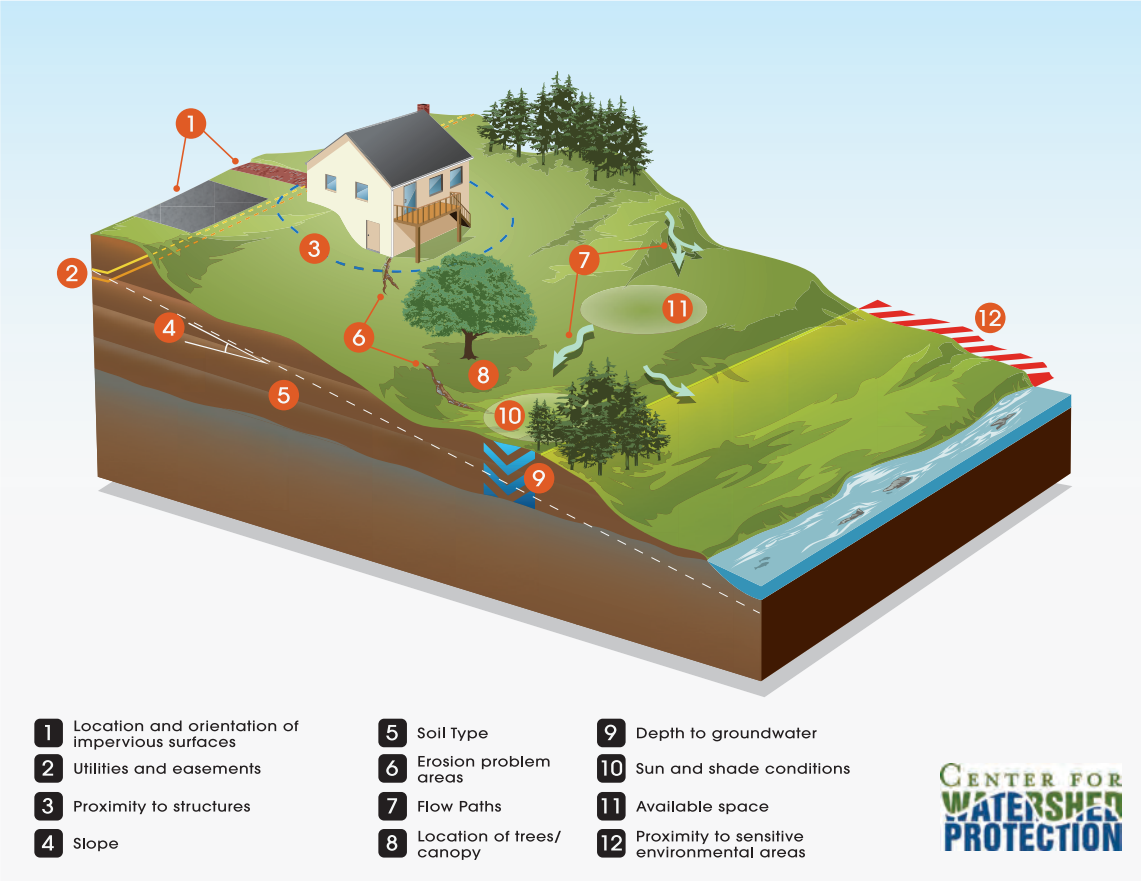
Appendix A:
Site Assessment: Methods & Recommendations



Introduction

The first step to implementing a stormwater management practice is to assess the opportunities and the challenges specific to the site. A deliberate, multi-step process is critical to ensuring that the design benefits the environment, the best and most appropriate practices are selected, and undesirable impacts are avoided. Guidance is presented as a step-wise process, but the key points can be addressed in various ways. Some vital considerations are called out in information boxes.

Even a video from yesterday might not show the site's accurate condition as of today. Be prepared!

"Pace off" means to walk the length of a feature. An average stride length is about ½ of the person's height. For example, a 6-foot tall person has approximately a 3-foot length for 1 step at a normal walking stride. If a long tape measure isn't available, this can be a good substitute.

Much information can be gathered about a site before conducting a site visit, including layout, topography, and many soil and hydrologic conditions. However, a site assessment is never complete without a site visit. Note that conditions on residential sites can change rapidly. It is important to be prepared for changing conditions or information that may no longer be accurate.

Step 1 - Create an Existing Conditions or Base Map

Begin by obtaining a recent aerial photo of the property available at *My Anne Arundel GIS* (does not work with Google Chrome), *LandServer*, *Google Earth*, *Google Maps*, or *Bing Maps* (does not work with Google Chrome browser). **Figure A.1** below is a screenshot from Google Earth Pro, marked to help highlight the actions described in the next paragraph.

> Never install an in-ground stormwater practice under mature tree canopy. Digging can damage the roots and kill the tree. It is fine to plant trees that will eventually spread canopy over a practice. If the practice involves native plants, as in a Conservation Landscape or a Rain Garden, consider if the plant is suited to thrive in shade.

Next, outline the boundary of the property (dotted green box) and highlight the hard, impervious surfaces such as roof surfaces, decks, sheds, pools, the driveway and sidewalks (shaded red polygons). Mark major trees (shaded blue circles), taking into account the size and spread of the tree and existing landscaping beds. Pace off or use a tape to measure the approximate dimensions of all the impervious surfaces and landscaping areas, and calculate the area of each. Summarize this information in the table provided below to determine how much impervious surface is present. Google Earth has the capability of measuring these in the map view, but measuring on the site will provide more accurate measurements.

The quantities in the following table can be automatically calculated, for the most part, using the Clean Water Communities online calculator. If the site of interest is in Anne Arundel County, *click here* to use the tool, find out how much impervious cover there is on site, and the stormwater benefit of installing certain practices.

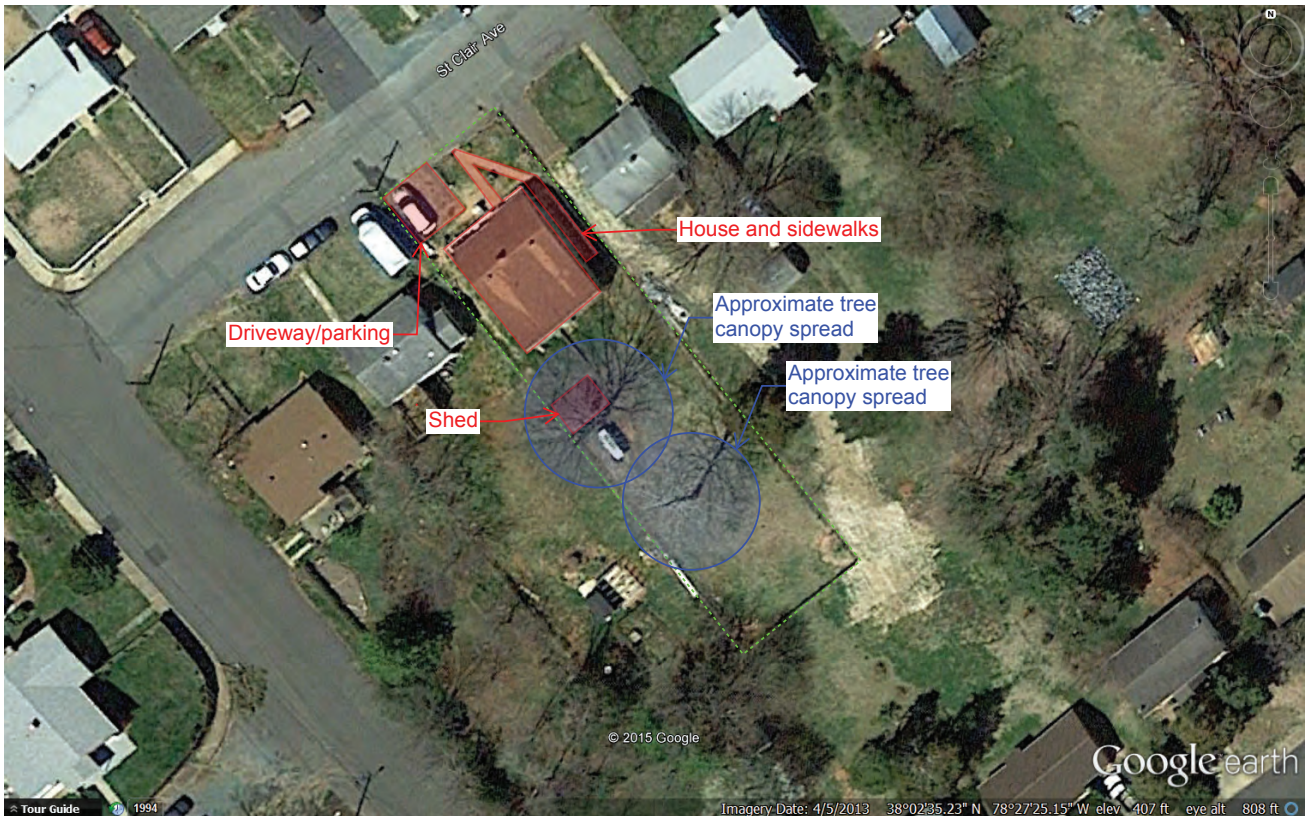


Figure A.1. *Google Earth Pro screenshot with lot features marked and highlighted*

LOT COVERAGE	Area: Square Feet
Hard Surfaces	
Rooftops	
Driveway/Sidewalk/Patios	
Pervious Cover	
Trees/Landscaping	
Lawn	
TOTAL	

Step 2 - Map Flow Paths

The next step is to map how water flows on the site. In general, most lots are graded to move rainwater away from the home and down to the street or, in some cases, the back yard. The best way to assess how water flows on the site is to watch and take note during a rain event. Observe how water is flowing off of sidewalks and driveways, look closely at downspouts, note which way they are pointing and how much water is coming out relative to the other downspouts. On the map, indicate the flow paths (most lots have multiple flow paths) using arrows. Note the movement of water from the house or driveway on the map, and any areas where water naturally ponds after a heavy rain.

If the site visit does not coincide with a rain event, it is still possible to get a good idea of the water flow. Water always follows the path of least resistance. It flows downhill, and given obstacles, it will push through softer material and move around immovable barriers. The most accurate way to gauge flow paths is by measuring relative elevations using a site level or even a hand level, as the eye can be deceiving when trying to ascertain the slope of the land, particularly on relatively flat sites. Also, take note of any gullies that have formed, particularly adjacent to solid structures like steps, sidewalks, and under downspouts. Look for accumulation of sand or soil deposits carried by runoff. **Figure A.2** shows a gully large enough to be seen in aerial imagery where the water flows from a gravel parking lot downhill toward a house next door. Flow paths should also be confirmed with the resident or owner, as they will have first-hand knowledge of where water flows, ponds, or is causing a problem.

Figure A.2. *Google Maps aerial image showing significant gully along stormwater flow path*

It is possible to get an idea of the drainage pattern of a site before or without visiting it. In Google Earth, hovering the cursor over a point on the map will show the elevation in the lower right corner, as shown in **Figure A.3** below. Other online mapping tools may show elevation contours, though the contours may not be at a high enough resolution or accuracy for residential scale assessment, especially for relatively flat sites. Depending on the locality, contours are often at 2-foot or 10-foot elevation changes, and residential assessment often may require a scale as fine as a 1-foot resolution.

Figure A.4 shows a screenshot from a local GIS viewing tool. The red box shows where a user can select the topographic data layer, which in this case is at the 2-foot resolution. The red arrows drawn on the site show the general direction water will flow, since it flows downhill.

Figure A.3. *Google Earth screenshot, showing cursor position and elevation reading*

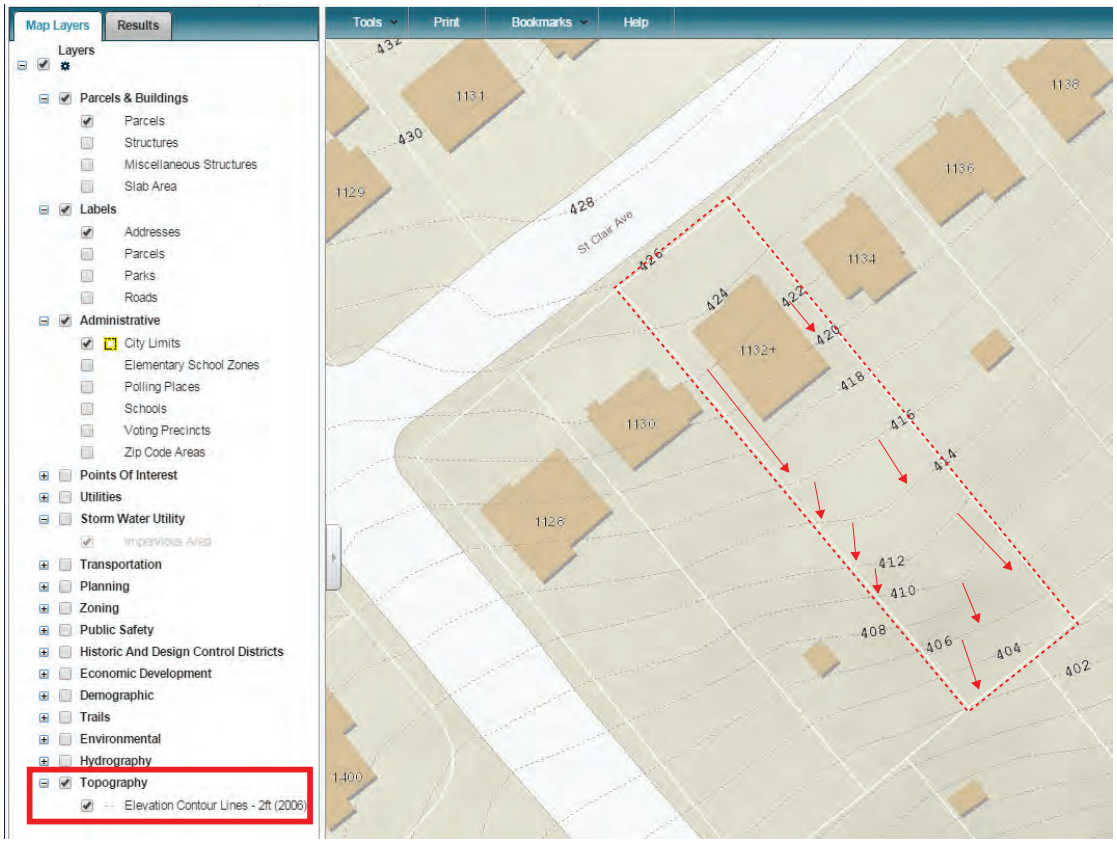


Figure A.4. *A local GIS Viewer screenshot, showing contour layer selection at left, parcel of interest outlined in dotted red, and general flow direction of runoff in red arrows*

Step 3 - Map Utilities and Easements

Utilities can be located almost anywhere and can complicate the design of a residential stewardship practice. Many of these utilities are located below ground and are not easily recognized. Therefore, contact a utility marking service to identify the location and type of underground utilities. Maryland requires calling the Miss Utility Hotline (1-800-257-7777 or 811) before excavation. Miss Utility and similar hotlines consolidate utility marking services but do not mark private utilities, such as invisible dog fences, some street lights irrigation lines, etc. It is necessary to scout the property to locate where these utilities leave, enter, and cross the yard.

More information about this free resource can be found: *http://www.call811.com.* Once Miss Utility marks the locations of the underground utilities, draw these on the property sketch. Typical utilities are listed in the table below.

Locate and Add to Property Sketch:		
Natural gas feeder line	Underground electric lines	Street right of way
Sewer lateral and cleanout	Cable and fiber optic lines	Septic field (if present)
Water lines and wells	Sump pump discharges	Overhead forest canopy

Also, some GIS and other public resources will show the locations of utilities. **Figures A.5** and **A.6** below show a random site in Anne Arundel County using the My Anne Arundel GIS viewer, and the example site fto help illustrate this process. The property shows both an underground gas line, and a sanitary sewer line. The sewer laterals, the connections between the houses and the main sewer line, are not shown in this viewer. Similarly, only the water main is shown, but not the lateral connections to the residences. These laterals are utilities that must be marked by the utility locators. **A call to Miss Utility** (or equivalent location service, if the site is in another state) **is always required!**

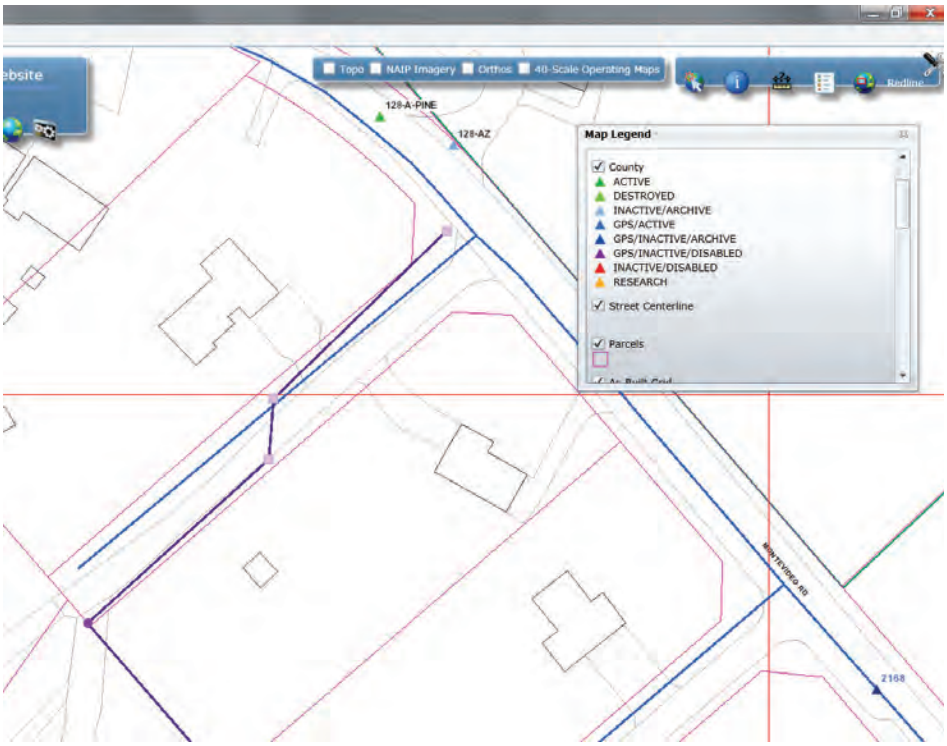


Figure A.5. *My Anne Arundel GIS Viewer screenshot showing utility locations*

Figure A.6. *GIS Viewer highlighting utility locations*

Always check the property to confirm GIS data to the extent possible. GIS data is not always current.

Step 4 - Map Problem Locations and Areas of Interest

There are a number of other potential challenges unique to the site that should be documented on the map. These include areas that are soggy or wet for prolonged periods; areas that have signs of erosion, poor grass cover, invasive plants, steep slopes, rocky areas; and areas where there are other planned activities (play areas for kids and pets). Environmentally sensitive and historic areas are often regulated and must be observed carefully. Floodplains, wetlands, stream buffers, critical resource protection areas and wildlife habitats, and historic landmarks and assets have additional constraints that are beyond the scope of this manual. GIS data often includes layers with these critical areas. Consult with local and state government or land management entities, such as Maryland Department of Natural Resources, if there is any question about the location or status of the project site relative to these sensitive areas.

Mark these areas on the map and indicate the specific concern or condition. Wet areas are very likely not appropriate for infiltration-dependent practices like Conservation Landscapes and Rain Gardens. Erosion (like the aforementioned gullies) is a sign that a large amount of water is passing that area and the soil needs stabilized. Steep slopes are typically very difficult and not practical for many stormwater practices. Rocky areas may be difficult for practices that require excavation and/or infiltration. Refer to the *Soil Assessment section* (Appendix B) for more detail.

In-ground stormwater practices should not be installed under mature tree canopy. Excavation could damage roots, harming the tree. Also, the tree itself is providing stormwater runoff reduction, in addition to many other benefits. Newly-planted trees may be co-located with other plants and be part of a stormwater practice like a Conservation Landscape or a Rain Garden. Newly-planted trees should be installed properly. Some example guidance can be *found here*. Established, healthy areas of native vegetation should not be removed or damaged in order to install new stormwater management practices. Instead, these areas should be protected and, if practical, expanded or enhanced with increased plant and wildlife diversity.

Step 5 - Create Proposed Conditions Map

Mark on the map the locations available for projects. Based on the location of the project, estimate the area available to treat stormwater. Most practices should be downhill and within the flow path of uphill impervious surfaces or other yard areas. The intention of the practice is to treat runoff from these areas.

If desired, use the one of the BMP worksheets to help determine the ideal size of the stormwater treatment practice for the site and compare to the available space. If less than the ideal amount of space is available, the practice will likely still have a positive effect. However, if the practice is severely undersized, perhaps only ¼ of the ideal size, and downhill from a lot of drainage area, the water draining to it may damage or otherwise negatively affect the practice.

Figure A.7 shows two viable areas for stormwater practices on the example property previously referenced. The green polygons downhill from the impervious surfaces on the site, not under tree canopy, are 250 square feet and 500 square feet in size. The red circles indicate the locations of the centers of the trees.

Don't excavate under tree canopy. Tree roots extend outward from the tree trunk approximately as far as the branches (the "dripline"). It is advisable to excavate carefully within about 1 ½ times the tree canopy diameter as some trees send roots out farther. Damage to tree roots can harm, or even kill, a tree. This can also create a threat of falling trees or limbs to people and any adjacent structures. Hand excavation may be required. Root pruning of small (1-2 in diameter) lateral roots *may* be an option outside a circle 5 times the trunk diameter without any impact on tree stability. A professional arborist must be consulted if root pruning is being considered.

Figure A.7. *Google Earth Pro screenshot, showing red circles at tree trunk locations, and green highlighting at two possible, recommended project locations*

Step 6 - Choose Appropriate Practices

The map should now show areas to avoid and areas to install the planned project. These steps provide the basic data for the decision-making process of locating a stormwater practice on the site. This information, combined with the additional factors listed below will help in selecting the stewardship practice that meets the clients' environmental objectives and lawn

and landscaping preferences. The stormwater best management practice (BMP) chapters describe how to design and install the different options for stormwater practices.

In **Figure A.7** above, the smaller practice location is a good candidate for a Conservation Landscape. The larger practice location could be a very good candidate for a Rain Garden since the low side could be built up as a berm using some of the excavated soil. Rain Barrels or cisterns are an excellent choice for the downspout(s) at the corners of the southeast side of the house (back). The back of the roof is larger than the front, and a relatively short distance from the smaller practice location. The water from the downspout(s) and Rain Barrel(s) would need to be guided to the practice using either a pipe or an open channel, perhaps lined with river rock.

The depth to water table in these locations is more than 80 inches (6 feet, 8 inches) according to the Web Soil Survey. Apart from the known sanitary sewer line, it is unlikely that any other utilities are in the marked locations in the back yard; the water main will come from the street and go to the house, the sewer lateral connection will likely take a short path to connect to the sewer main, the gas line is in the front and on the southwest side of the house, and the electric is overhead on that same side (known from site visit, and barely visible in aerial imagery).

Table A.1 provides an "at a glance" comparison of site constraints and the practices that may work, given those constraints.

Table A.1. Site constraints comparison for practices presented in this manual

Constraint/ Condition	1. Conservation Landscape	2. Rain Garden / Bioretention	3. Permeable Hardscape	4. Infiltration	5. Rainwater Harvesting	6. Vegetated Roof	Notes
Next to building	✓[1]	✓[2,3]	×	×	✓[3,4]	✓	1. Refer to chapter for guidelines, section "Location and Feasibility." 2. Stormwater planters or ultra-urban bioretentions are an option. 3. Overflow should be directed at least 5 ft. from foundation. 4. Underground tanks should be at least 10 ft. from foundation.
Next to drinking water well	×	×	×	×	✓[1]	N/A	1. Overflow should be directed at least 25 ft. from well.
Next to septic drain field	×	×	×	×	✓[1]	N/A	1. Should not sit directly on drain field, due to potential compression.
Under tree canopy	×	×	×	×	✓	✓[1]	1. Plant selections should match sunlight conditions.
Sandy soils	✓	✓	✓	✓	×	N/A	
Clay soils	✓[1]	✓[1]	✓[1]	×	✓	N/A	1. Soil amendment, or localized replacement may be necessary. See Soil Assessment for more detail.
Top of slope	✓	×[1]	✓[2]	×[1]	✓	N/A	1. Rain Gardens and infiltration basins generally handle more water than other practices, and therefore should be located where they can accept more runoff. 2. Permeable Hardscapes can be at the bottom of a slope, but care should be taken in sizing to not overload the practice.

Table continued next page



Constraint/ Condition	1. Conservation Landscape	2. Rain Garden / Bioretention	3. Permeable Hardscape	4. Infiltration	5. Rainwater Harvesting	6. Vegetated Roof	Notes
Bottom of slope	✓[1]	✓	✓[1]	✓	✓	N/A	1. It is important not to send too much water to these practices.
Near/over utility lines	✓[1]	✗[2]	✗[2]	✗[2]	✓[3]	N/A	1. Allowable proximity to utility lines should be confirmed by utility company or municipal government. 2. Under certain special circumstances, it may be possible to locate these over underground utilities, with careful coordination with the utility companies. 3. Underground tanks have the same considerations as below-ground practices. (See note 2)

Additional Considerations and Resources

Other factors to consider include soil types and the amount of sun available for plants in the practice. *See Appendix B* for simple soil testing instructions, and resources and guidance for gathering more detailed information. Observe how much sun hits the areas identified for stormwater practices throughout a typical day. The soil characteristics and sun/shade situation will help determine feasibility of the practice and appropriate plants.

The *WSA Conservation Landscape Design Tool* provides additional tips and guidance for assessing the site and sizing the project. The tool provides step-by-step guidance for choosing a layout, provides recommendations and options on plant types and sources, installation instructions, maintenance plans, and material quantities and costs.

Anne Arundel County GIS Mapping
http://gis-world2.aacounty.org/silverlightviewer/?Viewer=WERS
Note: Google Chrome does not work well with this site.

Anne Arundel County Watershed Stewards Academy
http://aawsa.org/