Bioretention design without an established infiltration rate:

This policy applies to bioretention areas designed where infiltration rates cannot be determined through geotechnical testing (either infiltration testing or an estimated infiltration rate based upon soil type[1]) and/or where bioretention is being placed on fill or in over excavated bedrock. A Low Impact Development (LID) Waiver will be required to use this modified bioretention design. Please see the flow chart and associated notes on following pages for more information on infiltration testing limitations. Note: this policy is for the MS4 only.

Requirements:

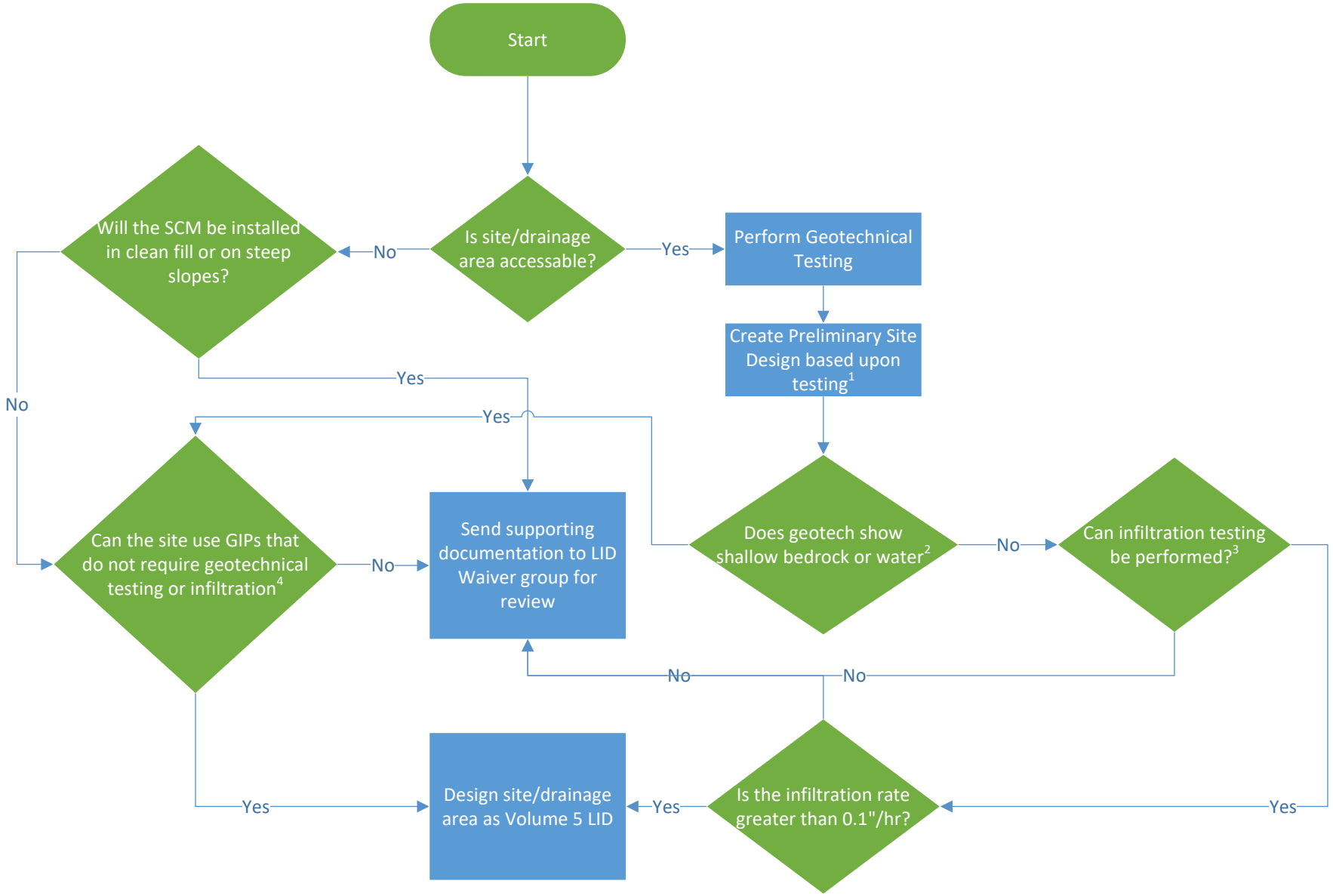
- If the bioretention area is being placed on fill from leveling a site, it should be located at least twenty-five feet from the top of a slope of 3:1 or greater.
- A two-foot separation from bedrock or high-water table is required.
- If the bioretention area is being installing in over excavated bedrock a minimum of two feet of fill shall be placed below the 12" sump. The fill should be composed of inert mineral soil or #57 clean washed stone.
- Subsurface constraint requirements in Bioretention GIP-01 will still apply.
- Bioretention areas shall be designed as Volume 5 Level 2 with underdrain (Specification GIP-1A). The following design parameters will apply:
    - The 12" gravel sump below the underdrain will not count towards the equivalent storage depth. Any material below the sump shall not count towards the equivalent storage depth.
    - The water quality volume for the drainage area will be a direct calculation of the drainage area. There will be no reductions for modified land use or intrinsic GIPs.
    - If this is a hybrid site (utilizing traditional LID and the modified bioretention) the area draining to the bioretention area cannot contribute towards the overall site Rv.
    - The drainage area cannot use the adjusted curve number.
    - The volume of the bioretention area cannot be increased for quantity mitigation. The 12" sump cannot be routed through, nor can additional detention (e.g. R-tanks), be used since we can no longer quantify the infiltration rate of the soils below. Detention shall not be located in the bioretention footprint.

Calculation for modified bioretention design:

- The treatment volume and surface area shall be calculated using Equations 3.4 and 3.5 from the Stormwater Management Manual, Volume 5, Low Impact Development, Chapter 3, pg. 15, with the following parameters:
    - M = 1.25
    - Runoff coefficients (Rv) from Table 2, pg. 11
    - The required 12" sump cannot be used in the Equivalent Depth or Surface Area calculations

[1]Soil borings should extended a minimum of 5 feet below the bottom of the proposed infiltration practice and that the most restrictive soil layer be considered in estimating infiltration rate.

https://stormwater.pca.state.mn.us/index.php?title=Determining_soil_infiltration_rates


Start
Is site/drainage area accessable?
No
Will the SCM be installed in clean fill or on steep slopes?
Yes
Perform Geotechnical Testing
Create Preliminary Site Design based upon testing[1]
Does geotech show shallow bedrock or water[2]
No
Can infiltration testing be performed?[3]
Yes
Yes
No
Can the site use GIPs that do not require geotechnical testing or infiltration[4]
No
Send supporting documentation to LID Waiver group for review
Yes
No
No
Is the infiltration rate greater than 0.1"/hr?
Yes
Yes
Design site/drainage area as Volume 5 LID
Yes

1. Site Assessment & Preliminary Design:

- Site design should strive to use LID as the initial water quality methodology in areas with good infiltration and clearance from bedrock. Ideally geotechnical analysis should be performed prior to site design.

2. Shallow Bedrock:

- Geotechnical testing should be performed in areas where stormwater control measures may be located. Designer should evaluate the potential for the following GIPs based upon depth of depth of bedrock/depth to water table:
    - Depth $\geq$ 7' - Bioretention, Infiltration Trench, WQ Swale, Pavers
    - Depth $\geq$ 6' - Infiltration Trench, WQ Swale, Pavers
    - Depth $\geq$ 5' - WQ Swale, Pavers
    - Depth $\geq$ 4' - Pavers

3. Limitations to Geotechnical Testing:

- Excessive cut: Soil borings should still be performed if possible, but Infiltration testing may be limited. If the testing is being performed in a trench, OSHA only allows a four-foot depth before shoring is required. However, you can still auger down a few feet from that depth to perform test. Infiltration tests can be performed at the same time as soil borings if the boring indicates there is at least a 2' separation from rock or groundwater. The drill rig can create an additional boring hole to use for the infiltration test. This is typically limited to 15' deep.
- Site is occupied or has conditions that prevent testing from being performed, and the design needs to be completed/approved while the site is still occupied. This will be evaluated on a case-by-case basis.

4. Green Infrastructure Practices (GIPs) Not Dependent on Geotech:

- Cistern: should have dedicated use, not appropriate for townhomes or single family residential. Can be used in multifamily if for non-residential common areas or mixed-use.
- Green Roof: not practical for warehouses, single family, or townhome developments
- Urban Bioretention, Extended Detention, Grass Channel, Sheet Flow, and Reforestation are also options for consideration.

Infiltration Testing Notes:

- Infiltration tests depths may vary by $\pm$1 foot to avoid the need to retest if performed at the wrong elevation assuming boring show similar soils.
- Infiltration tests should not be performed in bedrock.
- Infiltration estimates can be made from soil borings.

LID Waivers:

- Sites may receive LID Waivers for the entire site or specific drainage areas.
- Drainage areas that receive a LID Waiver should be designed for 80% TSS removal efficiency (Volume 4).
- If a filtrative bioretention design will be utilized, please follow the Bioretention without an established infiltration rate guidance document.
- The drainage area cannot use the adjusted curve number and there will be no bypass (no site weighted Rv).