**Objective:** The Contractor will update the sections on [infiltration trenches](http://stormwater.pca.state.mn.us/index.php/Infiltration_trench) and [infiltration basins](http://stormwater.pca.state.mn.us/index.php/Infiltration_basin) in the Minnesota Stormwater Manual (Manual), including providing updates to existing information, providing new information for incorporation into the Manual, and providing updated and new visual information (e.g. photos, schematic drawings, graphs, plans and cross-sections, etc.).

**Task A.** Work with the Project Manager (PM) to organize a technical team that will meet to discuss the tasks described in this scope of work, review and comment on MPCA-approved draft reports, and meet at a later date, agreed upon by the Contractor and PM, to discuss progress of the work described in this scope of work. The Contractor will work with the PM to arrange an initial meeting in which the review team will discuss the scope of work with the Contractor, PM and other MPCA staff. The Contractor will work with the PM to arrange a second meeting at an agreed upon time to discuss the progress of the work. This meeting will likely occur after drafts have been prepared and reviewed by the team for the majority of the tasks described in this scope of work. The PM and Contractor will develop the agenda and summaries for these meetings.

**Task B.** Review and update the section in the Manual called [Types of Infiltration trench](http://stormwater.pca.state.mn.us/index.php/Types_of_Infiltration_trench). Note that the Manual currently discusses infiltration basin, infiltration trench, dry well, and underground infiltration systems as different types of infiltration systems. Determine if this differentiation is accurate or recommend changes to this list, including further dividing or combining these types of infiltration systems. Determine if dry swale with check dams and no underdrain should be included in this list (see <http://stormwater.pca.state.mn.us/images/b/be/MIDS_Dry_Swale_Sections-SHEET_2.pdf>). Provide detailed descriptions that allow the Manual user to differentiate between different types of infiltration practices, including but not limited to a general description, recommended treatment area, BMP dimensions, location in the treatment train, applicability for different land use settings (e.g. ultra-urban), and mechanism(s) of pollutant removal for each BMP type. Develop a table for insertion into the Manual that summarizes and compares characteristics of each type of infiltration practice, including but not limited to mechanism(s) of pollutant removal (e.g. filtering, settling, etc.), general pollutant removal (e.g. low, medium, high), general cost (e.g. low, medium, high), general maintenance requirements (low, medium, high), and general space requirements (low, medium, high). Include bioinfiltration, permeable pavement (no underdrain), and tree trench/tree box (no underdrain) in this table. Include photos, schematics, and other visual materials illustrating the different types of infiltration practices. Where necessary, MPCA will secure permission for inclusion of copyrighted or third party materials in the Manual. Ensure that all information is consistent with the [Minnesota Construction Stormwater General Permit (CGP)](http://stormwater.pca.state.mn.us/index.php/Construction_stormwater_permit). Deliverables for this task will be compiled and disseminated in a technical memorandum.

**Task C. R**eview, update and provide new information on design criteria for the different types of infiltration practices described in Task B in a technical memorandum. Clearly identify when information applies to specific types of practices or if the information applies to all types of infiltration practices. If appropriate, prepare a table or tables identifying differences between the different types of practices.

**Subtask 1.** Review information in the Manual on contributing drainage area to each of the types discussed in Task B, compare to recent research findings and information in other manuals, and if appropriate, provide recommended changes to the Project Manager and technical team.

**Subtask 2.** Develop a section on media and materials for infiltration practices, similar to section 16.3.7 in the [North Carolina](http://portal.ncdenr.org/c/document_library/get_file?uuid=05164012-4410-4c98-8771-c2507346585e&groupId=38364) Stormwater Manual and [section 6.9, Specification 8 of the Virginia Stormwater Manual](http://www.vwrrc.vt.edu/swc/april_22_2010_update/DCR_BMP_Spec_No_8_INFILTRATION_Final_Draft_v1-8_04132010.htm).

**Subtask 3.** Provide a brief description of preferred pretreatment practices. Since detailed descriptions of these pretreatment practices are being addressed through another Work Order, recommendations will be based on the most current information.

**Subtask 4.** Review the section on *Major design elements* on the page [Design criteria for bioretention](http://stormwater.pca.state.mn.us/index.php/Design_criteria_for_bioretention) and determine what information should be incorporated into the design information for infiltration practices to maintain consistency in design criteria for bioinfiltration and infiltration practices.

**Subtask 5.** Provide a detailed discussion of drawdown time, including how it is defined and calculated for infiltration systems that capture more than the water quality volume (defined as bounce within the infiltration system). Include illustrations as appropriate.

**Subtask 6.** For the infiltration practice types discussed in Task B, provide specific design information not currently contained in the Manual. This is particularly relevant for underground infiltration systems, which may have specific design considerations including but not limited to site access, manufacturer specifications, pretreatment, piping, materials, sizing criteria, and specific maintenance requirements (see [1](http://www.ct.gov/deep/lib/deep/water_regulating_and_discharges/stormwater/manual/CH11_UIS_S-12.pdf), [2](http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/library/underground_stormwater_infiltration-2014.pdf)).

**Subtask 7.** Specific to underground infiltration practices, develop sizing criteria consistent with sizing criteria for other infiltration practices in the Manual and with the Minimal Impact Design Standards calculator. Review literature on removal of total suspended solids, total phosphorus, total nitrogen, metals, organic compounds, and bacteria and incorporate this information into a report. Provide concentration-based median, minimum and maximum pollutant removal if data exist; otherwise indicate removal as low, medium or high. Include information for individual metals and classes of organic compounds (e.g. VOCs, low molecular weight PAHs, high molecular weight PAHs) if the data exist. The Contractor shall reference a broad range of data and information from the literature if available, including but not limited to <http://www.lakesuperiorstreams.org/stormwater/toolkit/underground.html> and <http://www.ct.gov/deep/lib/deep/water_regulating_and_discharges/stormwater/manual/CH11_UIS_S-12.pdf>.

**Task D.** Develop a technical memorandum to be called *Understanding and interpreting soils and soil boring reports* ***for a stormwater bmp***. This memorandum will include but is not limited to the following information (for example information, see <http://www.sportsbuilders.org/events/presentations/pontevedra_2chummel.pdf>, <http://www.pdhonline.org/courses/g106/g106.htm>, <http://web.extension.illinois.edu/septicsystems/soil.cfm>). In preparing this memorandum, the Contractor should only include information pertinent to stormwater BMPs.

* + A brief discussion of methods for soil sampling, including hand or machine-driven soil augers, hammers with sample tubes, and excavation equipment. Include pictures, references and links to more detailed information as appropriate.
	+ A summary and brief discussion of information that should be collected with a soil boring, including but not limited to soil thickness, layer boundaries, Munsell soil color notation, presence and abundance of mottling or redoximorphic features, soil texture, soil structure, soil consistency, depth to bedrock, depth to water. Include pictures and references to more detailed information as appropriate.
	+ A summary and brief description of soil samples that should be collected from borings for laboratory analysis, including but not limited to particle size distribution, bulk density, compressibility, and saturated hydraulic conductivity. Include pictures and references to more detailed information as appropriate.
	+ Provide a minimum of two example interpretations of soil boring logs.
	+ Develop an example soil boring report form and/or provide links to existing forms.
	+ Provide information on how to request a soil boring.
	+ Provide a discussion of restrictive layers. Define what they are and how they affect the decision to infiltrate or not at a site. For example, provide guidance on determining what type of material and thickness of material constitute a restrictive layer.

**Task E.** Review the information on [construction specifications in the Manual](http://stormwater.pca.state.mn.us/index.php/Construction_specifications_for_Infiltration_trench#Construction_sequence_scheduling) and provide recommendations for updates in a technical memorandum. Include information on legally binding and enforceable access agreements, including easements. Provide an example of a construction access agreement. Expand the information on construction of infiltration practices currently in the Manual to include explanations where appropriate. Include guidance on protecting a construction area during construction, including methods, images, and examples. Develop a construction sequence with explanations for each step in the sequence. Include photos, schematics, and other images as appropriate. In completing this task, review the Minnesota Department of Transportation (MnDOT) [Standard Specifications for Construction](http://www.dot.state.mn.us/pre-letting/spec/) and communicate with appropriate MnDOT staff to ensure consistency with the information in this document. Ensure that information is consistent with the Construction Stormwater Permit and with information in the section on [Construction specifications for bioretention](http://stormwater.pca.state.mn.us/index.php/Construction_specifications_for_bioretention#Construction_observation).

**Task F.** Review the section on [Post-construction operation and maintenance](http://stormwater.pca.state.mn.us/index.php/Operation_and_maintenance_of_Infiltration_trench#Post-construction_operation_and_maintenance) on the page titled [Operation and maintenance of Infiltration trench](http://stormwater.pca.state.mn.us/index.php/Operation_and_maintenance_of_Infiltration_trench). Recommended updates will be provided in a technical memorandum.

**Subtask 1.** Provide information regarding legally binding and enforceable maintenance agreements, including but not limited to needed education of private entities that will maintain infiltration practices; need for deed restrictions, drainage easements or other mechanisms enforceable by the qualifying local program to ensure that infiltrating areas are not converted or disturbed; a mechanism to grant authority for local agencies to access the property for inspection or corrective action; notification process if ownership is transferred; and a minimum of two example maintenance agreements.

**Subtask 2.** Review and update the following tables as needed, based on information from the literature. Recommended references include Section 9 of [VA Design Specification 8](http://www.vwrrc.vt.edu/swc/april_22_2010_update/DCR_BMP_Spec_No_8_INFILTRATION_Final_Draft_v1-8_04132010.htm), Section 16.5 of the [North Carolina Stormwater Manual](http://portal.ncdenr.org/c/document_library/get_file?uuid=05164012-4410-4c98-8771-c2507346585e&groupId=38364), and [Stormwater Treatment: Assessment and Maintenance](http://stormwaterbook.safl.umn.edu/content/maintenance-infiltration), developed by the University of Minnesota, St. Anthony Falls Stormwater Research.

[Typical maintenance problems for infiltration trenches and basins](http://stormwater.pca.state.mn.us/index.php/Typical_maintenance_problems_for_infiltration_trenches_and_basins)

[Typical maintenance activities for infiltration trenches and infiltration basins](http://stormwater.pca.state.mn.us/index.php/Typical_maintenance_activities_for_infiltration_trenches)

**Subtask 3.** Review the section on [post-construction operation and maintenance for biotretention practices in the MN Stormwater Manual](http://stormwater.pca.state.mn.us/index.php/Operation_and_maintenance_of_bioretention#Post-construction_operation_and_maintenance) and identify information in this section that should be incorporated into the O&M section for infiltration practices. Similarly, determine what information gathered from Task F should be incorporated into the bioretention section.

**Subtask 4.** Develop a maintenance inspection checklist for infiltration practices. Examples can be found [here](http://green.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/Appendix%20L%20%20Maintenance%20Inspection%20Checklists.pdf) and [here](http://stormwaterbook.safl.umn.edu/sites/stormwaterbook.safl.umn.edu/files/infiltration_visual_inspection.pdf).

**Subtask 5.** Identify and differentiate between short-term, long-term, and seasonal maintenance and include this in the checklist.

**Subtask 6.** Include an estimation of hours required for the maintenance activities discussed under this task.

**Task G.** Provide a technical memorandum with three case studies of properly installed infiltration practices, including at least one underground and one above-ground system. The systems shall include pretreatment practices that are consistent with information presented in the current version of the Manual or that demonstrate a higher level of pretreatment than currently described in the Manual. For each case study, provide the following information.

* + A project summary, including location, size of project area including impervious acres, land use, reason for implementing the infiltration practice, and construction and completion dates.
	+ A summary of design considerations, including but not limited to size of the practice, desired performance goal (e.g. 1 inch of runoff from new impervious surfaces), description of soils and/or engineered media, any constraints to infiltration, vegetation (if applicable), and other design materials and specifications.
	+ Summary of applicable costs.
	+ Maintenance plans for the practice.
	+ Photos and, if applicable, schematics. Where necessary, MPCA will secure permission for inclusion of copyrighted or third party materials in the Manual.

**Task H.** Review and provide updated information for the Manual on cold climate suitability for infiltration practices in a technical memorandum. This includes the section on [cold climate suitability](http://stormwater.pca.state.mn.us/index.php/Overview_for_Infiltration_trench#Cold_climate_suitability) for infiltration practices and [the infiltration section](http://stormwater.pca.state.mn.us/index.php/Cold_climate_impact_on_runoff_management#Infiltration) on the Manual page addressing cold climate impact on stormwater runoff. Review literature published since the original Manual (2005) and determine if the recommendations and practices described in the Manual are still applicable or whether more recent information supports different or updated practices for infiltration systems in cold climates. Additional information includes but is not limited to vegetation management (if appropriate), snow storage in infiltration practices, management of deicers, design considerations to improve storage and infiltration, special pretreatment needs, winter maintenance, and landscaping. Provide specific guidelines for types of snowmelt that can or should not be infiltrated based on likely concentrations of pollutants, as well as specific management practices and considerations for snowmelt from different source areas. Suggested literature includes [Seasonal Performance Variations for Storm-Water Management Systems in Cold Climate Conditions](http://www.placer.ca.gov/~/media/cdr/ECS/EIR/Homewood/Hydro/WQ%2060_JEE_3_09_UNHSC%20Cold%20Climate_final%20print%20copy.PDF).