ATTACHMENT 2:
INFILTRATION RATE EVALUATION GUIDELINES

An evaluation of infiltration rate is necessary to determine if infiltration is feasible and to establish design infiltration rates for stormwater Best Management Practices (BMP). There are three basic steps for evaluating a site's infiltration rate:

A. Desktop Study

Desktop resources such as soil survey maps, published reports, or other available data is appropriate for screening to assess the feasibility and desirability of infiltration. The infiltration rate can be derived from the hydraulic conductivity listed in the U.S. Department of Agriculture National Resources Conservation Service Soil Survey for the location and soil type reported for the site. Geotechnical data from previous site studies or nearby representative locations may also be used. If a range of hydraulic conductivity values is available, estimate the infiltration rate as the geometric mean. Porous Pavement for Pedestrian Use may be designed without additional field verification or sampling. Additional field sampling or testing is required for other infiltration-dependent controls.

B. Field Sampling

The purpose of field sampling is to evaluate the depth and texture of soil at the location of the proposed water quality control. Field sampling activities must be conducted under the direction of a licensed Landscape Architect or Engineer. Soil depth and texture within the proposed footprint of the control must be evaluated via test pits, probes, borings, or similar means at a minimum frequency of one test location per 1,000 square feet. The probe or hole must extend to the minimum soil depth required for the proposed control. For example, the depth to an impermeable layer must be at least 2 feet below the bottom of a rain garden. If the bottom of the proposed rain garden is 1.5 feet below existing ground, the probe or hole must extend a minimum depth of 3.5 feet. Soil samples must be collected and evaluated at a depth below the expected bottom of the infiltration BMP (i.e., in the layer of underlying soil where infiltration will occur). Soil texture of representative samples may be classified in the field or by laboratory methods such as sieve and hydrometer analysis. Based on the soil texture determined in the field, a representative infiltration rate can be estimated from desktop resources (as described above). In the event that soil textures in the field differ from published references, additional testing and analysis must be conducted to establish a representative infiltration rate.

C. In-situ Testing

In-situ infiltration testing methods provide the most accurate estimate of infiltration rate. A variety of in-situ tests are available for measuring the infiltration capacity of the soil. Laboratory tests are not recommended because typical laboratory samples are less representative of field conditions.

In-situ testing must be conducted under the direction of a registered professional engineer licensed by the Louisiana Professional Engineering and Land Surveying Board (LAPELS). Testing must be conducted at a **minimum of two times within each proposed infiltration BMP area[1].** When more than one infiltration test is conducted for a single control, a representative infiltration rate may be calculated as the geometric mean of the test results. Such tests should be conducted at a minimum depth of two feet below the proposed infiltration interface of the BMP (the lowest elevation where infiltration is proposed). Based on observed field conditions, the designer may elect to modify the proposed bottom elevation of the control. Personnel conducting infiltration tests should be prepared to adjust test locations and depths depending on observed conditions.

Designers should be aware of the difference between percolation tests and infiltration tests when determining the infiltration rate. A measured infiltration rate can be determined from a single or double ring infiltrometer test. However, a percolation rate determined from the simple open pit percolation test is related to the infiltration rate but tends to overestimate infiltration rates due to both downward and horizontal movement of water. Infiltration rates correspond only to the downward movement of water.

Testing methods that may be used but not discussed in detail in this section include:

- Single Ring Infiltrometer Test (ASTM D5126).
- Double Ring Infiltrometer Test (ASTM D3385).
- Guelph Permeameter.
- Constant Head Permeameter (Amoozemeter or USBR Procedure 7300-89).
- Other analysis methods at the discretion of the designer and approval of the Executive Director of the City Planning Commission.

[1] For small BMPs or innovative approaches, the Executive Director may reduce or waive this requirement.

INFILTRATION RATE EVALUATION GUIDELINES (cont.)

D. Percolation Test Protocol

The percolation test is geared towards investigating smaller infiltration facilities (i.e., facilities with drainage areas 2 acres or less and maximum ponding depths 12 inches or less). The test can be conducted using simple tools and manual labor, and does not require extensive excavation.

1. Test Preparation

   - The test hole opening shall be between 8 and 12 inches in diameter or between 7 and 11 inches on each side if square.
   - The bottom elevation of the test hole shall correspond to the bottom elevation of the proposed control (infiltration surface).
   - Place approximately 2 inches of gravel in the bottom of the hole to protect the soil from scouring (optional).
   - If horizontal infiltration is to be allowed, scarify the sides of the test hole.
   - Pre-soak the hole by carefully filling it with water. If the hole has not drained completely within 24 hours, then an infiltration design is not recommended. Testing may commence after all of the water has percolated or after 15 hours has elapsed since initiating the pre-soak. However, to approximate saturated conditions, testing must commence no later than 26 hours after all pre-soak water has percolated through the test hole.
   - Place a bar over the top of the hole or a nail near the top of the hole to serve as a datum from which depth measurements will be made.
   - Measure the depth and diameter of the test hole.

2. Test Procedure
   - Carefully fill the hole with water to a level greater than or equal to the maximum ponding depth of the rain garden. Measure this water elevation and the time it was taken.
   - Measure the water surface elevation as it drops, and record the time of each measurement. Measurements shall be taken with a precision of 0.25 inches or better. The number of measurements, and thus time required to conduct the testing, will depend on the infiltration rate of the soil and the time available. Refill the hole as necessary to extend the test to at least 2 hours. The test can be terminated when near steady-state conditions (i.e., when the rate of drop is approximately constant). Alternatively, terminate the test when the test hole is empty (this may require a much longer test period).
   - Calculate the percolation rate using representative steady-state data points from the latter stages of test where the rate of drop is approximately constant. The percolation rate is the change in water elevation (in inches) by the corresponding time interval (in hours).
   - Convert the steady-state percolation rate (p) to a representative infiltration rate (i) using the reduction factor (Rf) as follows:

     $$i = p/R_f$$

     The reduction factor (R_f) is given by:

     $$R_f = ((2d_1 - \triangle d)/D) + 1$$

     Where:

     D_1 = water depth at start of representative time interval (in.)

     $\triangle d$ = water level drop during representative time interval (in.)

     D = diameter of percolation hole (in.)

     The reduction factor accounts for water losses through the sides of the percolation hole. It assumes that the percolation rate is affected by the depth of water in the hole and that the hole is located in uniform soil. If there are deviations from these assumptions, then other adjustment may be necessary.

Source: Adapted from City of Austin, TX Environmental Criteria Manual