2.4 Evaluating Fill Material

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This section provides general information for property owners to consider when filling a site, and it is not an approved alternative design. Property owners interested in pursuing a fill material project will need to get prior approval of their site modification plan. The site modification plan will be part of an application for a septic system permit. It is recommended that the property owner seek assistance from a certified soil scientist in preparing the site modification plan. Fill material typically has great variability, and property proposed for fill will require more extensive on-site investigation to determine the existence of restrictive layers.

Weathered Fill

Weathered or natural settling of fill will, over time, give fill similar characteristics to that of the natural soils. The annual precipitation cycle causes fill to settle and compact. Idaho has a wide range of precipitation, ranging from about 7 inches to near 80 inches. Differences in annual precipitation affect the rate and amount fill material will settle or compact. Normal settling and compaction will usually take at least 10 years to occur, depending on soil texture, fill depth, and precipitation. Fill in low precipitation zones may never become naturally compacted enough to prevent settling in the drainfield area. Table 2-11 shows the natural settling of fill. Fill depths in excess of the moisture penetration depths will not naturally settle in 10 years.

Table 2-11. Natural settling of fill over a 10-year period.

Soil Class	Precipitation Zones (inches)		
	7–16	16–24	>24
	Depth of Moisture Penetration and Settling (inches)		
A	40	60	120
B	30	48	60
C	20	30	40

Supplemental Irrigation

Supplemental spray irrigation water can be used to aid settling where natural precipitation is not adequate. Generally, fill must be adequately saturated by irrigation for a minimum of 5 years to ensure natural settling. Ideally, potential drainfield sites in fill should be planned 5–7 years in advance. Adequate depth and area should be planned, and the site should be leveled before the settling period begins. For additional details, see section 2.4.8.

Fill Material Sites

Fill material sites must have a minimum of 12 inches of unsaturated suitable soil above the seasonal high ground water level. Judgment in site evaluation will be necessary when layers of different textures occur.

Fill Material

If a fill has a continuous horizontal layer of a finer-textured soil, the settling should be calculated for the most restrictive soil. For example, most of a fill is an A soil, but a continuous layer of C soil occurs at 20 inches or less in a 7- to16-inch precipitation zone. In this situation, the fill should be considered a C soil. If the layer occurred at 30 inches then the depth between 30 and 40 inches may lack natural compaction. Understanding field capacity of the soils is critical to determining if the fill material has adequately settled.

Acceptable Fill Material

Fill material must be an acceptable soil type and free of trash, garbage, solid waste, demolition materials, woody debris (e.g., stumps, branches, sticks, forest slash, and mill yard debris), organic material (e.g., manure, grass and lawn clippings, biosolids, sludge, and compost), unsuitable soils, and large rocks. Based on the site evaluation, the fill material must be no more permeable than the next soil subgroup of the receiving soil. Fill material may be less permeable than the receiving soils.

Mechanical Compaction Not Authorized

Mechanical compaction of fill soils is not an acceptable substitute to weathered fill. Mechanical compaction has its place in providing buildings with structurally stable level bases, essentially preventing the building from settling. The soil-based treatment system of a drainfield, while it too needs a stable base, is easily over-compacted resulting in horizontal flow paths and break out (a type of system failure), or greatly reduced long-term infiltration and subsequent system failure.

Site Preparation

Thick vegetative mats should be removed. Prior to placement of any fill, the natural ground surface should be scarified or plowed to a depth of 6 to 8 inches. This will increase stability and avoid the problems associated with a layer of organic material. Include enough area to run compaction and settling tests. This area should not be included in the drainfield area calculations because the test pit excavations will destroy the area for use as a drainfield.

The original soil should not be compacted before the placement of fill. Compaction can easily happen at construction sites if equipment or other types of vehicles have been operated during periods when the site was wet. On sloping areas, preventing compaction is very critical because saturation zones can develop just above the compacted layer, creating stability problems. Loose soils with significant amounts of volcanic ash are particularly susceptible to compaction. No pneumatic-tired equipment should be permitted on the fill area and fill material in order to prevent soil compaction.

Sites should be avoided where fill has been dumped in piles for a long period and then leveled out because differential settling occurs. The calculation of settling time will begin after leveling.

Enhanced Weathering Procedures

Supplemental irrigation may be employed to shorten the fill weathering time. Enhanced weathering of fill is a process that mimics the yearly or annual hydrologic cycle of soil weathering. The fill soils are brought up to their field capacity by using an irrigation system to mimic rainfall, and then the fill soils are left to dry and settle. Irrigation application methods need to avoid erosion of the fill and formation of rills that allow runoff to occur. A sufficient timeline between irrigation sets needs to be determined based on soil transpiration or soil measurements. Natural weathering of fill material can be enhanced by using supplemental spray irrigation and drying. Fill depth and fill soil type are key factors in determining the length of time needed for this type of site modification.

Elements of a site modification plan for enhanced weathering procedures should include, but may not be limited to the following:

1. Site modification plan application information
    a. Proposed fill area including
        1) Primary and replacement drainfield areas in square feet (ft^2)
        2) Test pads of sufficient size are calculated.
            a) Testing pads are sacrificed by excavation to bottom of fill to determine soil structure/weathering.
    b. Site map
2. Site evaluation
    a. Topography
        1) Elevation
        2) Primary wind direction
    b. Climate
        1) Precipitation and evaporation based on the 30-year averages (this will be an important part of field capacity analysis and natural weathering for the test period)
    c. Access
        1) Equipment access for site ingress and egress
    d. Setbacks
    e. Ground water level determination
3. Soil characterization
    a. Native soil horizons and native soil types
    b. Effective soil depth determination
    c. Soil structural characteristics
    d. Percent rock/gravel
    e. Limiting layers
4. Site modification plan details
    a. Fill depth needed to achieve effective soil depth
    b. Proposed soil type for fill
        1) Follow TGM particularly on sloped ground.
        2) Use information gained in the soil characterization (step 3) to determine fill soil type.
    c. Determine fill soil field capacity.
        1) Soil type for the fill will determine the field capacity of the soil.

2) A soil scientist should determine the volume of fill and corresponding field capacity for the fill. This step is critical to determine the amount of water to apply to the fill material.
3) The goal is to simulate a natural weathering cycle through artificial water sprinkler application.

d. Irrigation water management plan
1) The objective is to apply enough water through the sprinkler system to achieve the field capacity of the fill material.
2) Describe the source of irrigation water, method of application, length of application based on calculated sprinkler flows, and length of the resting period.
3) Supplemental water application must be through a metered supply with sprinkler coverage measured and monitored.
4) Irrigation days with high winds and hot temperature (> 90 °F) should be avoided as the water from the sprinkler system will drift and evaporate out of the fill material and not achieve field capacity.
5) Soil lysimeters can be installed at several depths to measure field capacity and determine when sprinkler application can stop.
a) The lysimeters provide certainty that the irrigation system is achieving field capacity.
6) Without lysimeters, additional test pad areas are likely to be needed, along with potentially longer time frames to complete the enhanced weathering process.
7) Sprinkler activity is on a month-by-month basis to achieve the equivalent of a 10 year soil weathering cycle for a deep fill project.
a) The sprinkler application period should occur during the growing season, which is typically May–October.
b) The water cycle must stop during the non-growing season and allow the fill materials to completely dry out to replicate the weathering pattern.
c) Sprinkler activity should occur over two summers, with additional sprinkler activity in years 3 and 4 depending on the test pad results.

5. Submit plans for review.
6. Install fill material as per section 2.4.7 and any additional conditions identified in the plan review.
7. Monitoring
a. Monitor sprinkler application rate to confirm calculated time for the sprinkler set.
b. Monitor sprinkler coverage to ensure no areas are left dry.
1) Ensure overlap of sprinkler coverage.
c. Monitor lysimeters to confirm field capacity has been met.
d. Fill material monitoring
1) Test holes are first excavated with a soil auger to determine soil stability.
2) Holes that collapse when the soil auger is removed indicate that the fill is not ready for further tests.
3) Refill hole and tag or mark the spot as sacrificed.
a) Do not test in this location again.
4) If necessary, repeat test hole soil auger determination until test hole remains open and does not collapse.

a) This process will require extra weathering time before repeating test hole auger determination.

8. Fill material weathering tests
   a. Excavate test hole with backhoe after the soil auger stability tests are successful.
      1) Test hole excavation needs to be done carefully.
         a) Collapse of the test hole is likely in deep fill materials or with inadequate sprinkling.
         b) Follow safety protocols for septic tank excavation. Be cautious of cave in and sidewall collapse.
         c) Observe the soil structure. Look for massive collapses or sections of sidewall collapse—this is a failure.
         d) Refill test hole and tag or mark the spot as sacrificed.
            a. Do not test in this location again.
         e) Additional sprinkling over the entire area is needed if areas have massive sidewall collapse.
            a. Minor sidewall collapse may be acceptable as this can easily occur with poor excavation technique.
         f) Observing the excavation is critical to determine if partial soil collapse was a result of the mechanical disturbance by the backhoe.
         g) U-shaped trenches indicate unstable soil sidewalls and the need for additional weathering.
   b. Use a geology pick to look for penetration on side walls.
      1) Follow test hole safety protocols.
      2) To check for compaction run a knife or geology pick point vertically on the pit face.
         a) Penetration depth should be about one-half inch to 1 inch into the soil.
         b) A change in resistance to the movement of this sharp object across the soil horizons indicates compaction.
      3) Very distinct platy structure or high bulk density is also indicates compaction.
      4) Field soil densitometer tests should be run, and laboratory bulk density tests should be collected and analyzed.
         a) Compare results to normal soil values for the soil type.
   c. If fill, other than sand, is loose or can be easily dug out by a gloved hand, then adequate settling has not occurred.
9. Fill is ready for installation of a septic system when the pick test, soil densitometer, and soil bulk density test show normal soil compaction.