Excavation Guidelines for Septic System Soil Profile Hole Investigations

PURPOSE

To provide guidelines for when and how Permit and Resource Management Department (PRMD) staff and customers shall apply the Cal/OSHA standards on excavation, trenches, and earthwork to site surveys/soil investigations conducted for septic system feasibility and design.

GENERAL

Excavations into soil can present hazards to persons entering the excavation. Hazards associated with excavations are cave-ins, the striking of underground utilities, falling tools, materials and equipment, and hazardous air contaminants or oxygen-deficient environments.

This policy and procedure will focus on excavations for the purpose of investigating site soil characteristics for potential sewage disposal system installations. There may also be projects with deep trenches excavated for disposal lines. This policy shall apply to any excavation relating to septic systems.

The investigative excavations are referred to as soil profile holes. Soil profile holes are essential in the evaluation of any site for soil suitability for sewage disposal systems. Soil profile holes are excavated to depths of five (5) feet or more so the PRMD Well & Septic staff and septic consultant can view the soil horizons in their natural state. The visual investigation allows the staff and consultant to identify the soil structures, texture, formations; depths of each soil type; percentage of rock; presence of plant roots; presence of mottling and/or groundwater; and impervious formations. This information is used with other features such as the location of wells, cut banks, waterways, soil-filled areas and can determine the site suitability for a sewage disposal systems.

Workers in relatively shallow trenches may feel that the trench is not deep enough to cause serious injury. The fact is that soil is extremely heavy and may weight over 100 pounds per cubic foot (pcf). A cubic yard, which contains 27 cubic feet, can weigh over 2,700 pounds. This is the equivalent weight of an average car in a space less than the size of an average desk. Wet soil, rocky soil, or rock can be even heavier. Workers that have been buried to their waist have suffered serious injury to knees and hips that can leave them crippled for life. The pressure created on the abdomen of a worker buried just above the waist is great enough to force their intestines and stomach up into their lungs causing them to die from asphyxiation. Because of the potential hazards, it is crucial that soil investigations be conducted in compliance with the Cal/OSHA standards. In the event of a conflict between the County policy and Cal/OSHA Guidelines, the Cal/OSHA Guidelines shall control.

AUTHORITY
California Code of Regulations
Title 8, Subchapter 4. *Construction Safety Orders*, Article 6. *Excavations*
Commencing with section 1540 (Cal/OSHA)

PROCEDURE
PRMD Policy 9-2-17, *Sonoma County Site Evaluation and Percolation Test Methods,* from the *Regulations for Onsite Sewage Disposal in Sonoma County*, states that "all profile holes excavated shall be evaluated for soil suitability by a Registered Civil Engineer, Registered Geologist or Registered Environmental Health Specialist experienced in on-site sewage disposal systems. All profile holes used for the system design shall be subject to field review by Departmental staff."

Title 8 of the California Code of Regulations was developed to ensure a safe and healthful work environment for the California workforce by setting minimum standards for workplace safety and health. All employers and employees working in California are subject to these regulations. PRMD staff and the septic industry consultants and contractors shall comply with the Cal/OSHA regulations relating to excavation and trenching. Cal/OSHA regulations in an abbreviated form follow in pages 5 through 9 of this Policy and Procedure. It is recommended that people using this policy become familiar with the full regulations.

A. Definitions

Competent person – A Registered Civil Engineer (RCE), Registered Geologist (RG), Registered Environmental Health Specialist (REHS) or a licensed contractor who meet the requirements listed in section B of *Excavation, Trenches, and Earthwork,* incorporated as part of this Policy and Procedure; pages 5 through 9. The competent person must:

1. Identify all possible hazards associated with the excavation work; i.e., underground utilities.
2. Identify the soil classification according to Illustration 5, Soil Classification Flowchart on page 7.
3. Determine if a protective system is required and what type should be used.
4. Be responsible for ensuring the protective system is in place.

Excavation – Any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Protective System – A method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Soil Classification System – A method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the environmental conditions of exposure.

Soil Profile Hole – A vertical-sided trench for the purpose of evaluating the soil structures, texture, formations; depths of each soil type; percentage of rock; presence of plant roots; presence of mottling and/or groundwater; impervious formations to determine the suitability of a sewage disposal system installation.

1. Only vertically-sided trenches will be utilized for soil profile holes.
2. Benching and sloping are not acceptable for profile holes excavations due to excessive disturbance of the site.
3. Profile holes are limited to a maximum depth of 15 feet.

Support System – A structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Trench (Trench excavation) – A narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of the trench (measured at the bottom) is not greater than 15 feet. If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

Type A soil
Cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

1. The soil is fissured; or
2. The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or
3. The soil has been previously disturbed; or
4. The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or
5. The material is subject to other factors that would require it to be classified as a less stable material.

Type B soil

1. Cohesive soil with an unconfined compressive strength greater that 0.5 tsf but less than 1.5 tsf; or
2. Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silty loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.
3. Previously disturbed soils except those which would otherwise be classed as Type C

soil.

4. Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or
5. Dry rock that is not stable; or
6. Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C soil

1. Cohesive soil with an unconfined compressive strength of 0.5 tsf or less; or
2. Granular soils including gravel, sand, and loamy sand; or
3. Submerged soil or soil from which water is freely seeping; or
4. Submerged rock that is not stable, or
5. Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

B. Typical Soil Profile Hole Investigation

The activities of a typical soil profile hole investigation will generally proceed as listed below. The applicable section of the abbreviated Cal/OSHA regulations are referenced with the requirement whenever possible. Please note that all requirements may not be listed below. Nevertheless, compliance is required with all Cal/OSHA regulations.

Pursuant to the Cal/OSHA regulations, Section B on employees in excavations, "Employees shall be protected from cave-ins by an appropriated protective system." The requirements for protective systems are listed in Section C.

The competent person must:

1. Identify possible hazards associated with the excavation work including hazardous atmospheres. [Section B.2.a) and B.3.a)]
2. Classify the type of the soil being excavated.Classification must take into account both the site and environmental conditions. [Section C.2.a) and b)]
3. Dependent on soil classification, determine what protective systems will be needed for the excavation. [Section C.1.]
   The protective systems must allow for the visual investigation of the soil as described in the GENERAL section of this policy.
4. Inspect and certify that the protective system was installed correctly.The tabulated data for the protective system must be present on-site at all times. [Section C.3.]
   Note that benching and sloping are not acceptable protective systems for soil profile holes as defined in the definitions.
5. Ensure that the excavated materials shall be placed 2 feet from the excavation edge unless a barrier device is utilized to protect persons in the excavation. [Section C.9.]
6. Provide ladders or other safe access in trenches, 4 feet or deeper. [Section C.10.]

The following may be conducted in compliance with Cal/OSHA requirements:

1. The installation of protective systems will not be required if the trench is no more than 5 feet deep and the competent person has determined that the soils are Type A and/or B.
2. The installation of protective systems will not be required if the trench is no more than 4 feet deep and the competent person has determined that the soils are Type C.
3. For the trenches described in #1 or #2, if a review of soils at deeper depths is required, all persons shall exit the trench. The profile hole may be excavated deeper in the presence of the PRMD staff and the soil may be placed on the excavated edge for review.

The following section was taken from the *Cal/OSHA Pocket Guide for the Construction Industry.*

Excavation, Trenches, and Earthwork

Hazards associated with excavation are cave-ins; the striking of underground utilities; falling tools, materials, and equipment; and hazardous air contaminants or oxygen-deficient environments.

A. The minimum safety requirements are as follows:

1. Before opening an excavation these actions should be taken:

   a) Notify all regional notification centers and all underground utility owners who are not members of the notification centers two working days before starting the work.
   b) Estimate the location of the underground utilities……..1541(b)(1), (2)
   c) Obtain a permit from DOSH if workers are required to enter an excavation that is 5 ft. or deeper……341(a)(1)

2. While excavating, the exact locations of the underground utilities must be determined by safe and acceptable means……..1541(b)(3)
3. While the excavation is open, the underground utilities must be protected, supported, or removed as necessary……..1541(b)(4)

B. When employees are in an excavation, the following requirements apply:

1. Employees shall be protected from cave-ins by an appropriate protective system….1541.1(a)(1)

Exception: If excavations are made entirely in stable rock, or are less than 5 ft. deep, and a *competent person* has determined that there is no potential for a cave-in, no protective system is needed.

2. A *competent person* must be on site to do the following:

   a) Conduct inspections of the excavations, adjacent areas, and protective systems before the start of work; as needed throughout the shift; and daily for potential cave-ins, failures, hazardous atmospheres, or other hazards . . . . . 1541(k)(1)
   b) Take prompt corrective action or remove employees from the hazard.

3. The *competent person* must be able to demonstrate the following:

   a) The ability to recognize all possible hazards associated with excavation work and to test for hazardous atmospheres.
   b) Knowledge of the current safety orders pertaining to excavation and trenching.
   c) The ability to analyze and classify soils.
   d) Knowledge of the design and use of protective systems.
   e) The authority and ability to take prompt corrective action when conditions change.

C. Requirements for protective systems include the following:

1. Protective system design must be based on soil classification: Type A, B, or C soils . . . . . 1541.1(b), (c)
2. Soil classification is required as follows unless the protective system design is based on Type C soil:

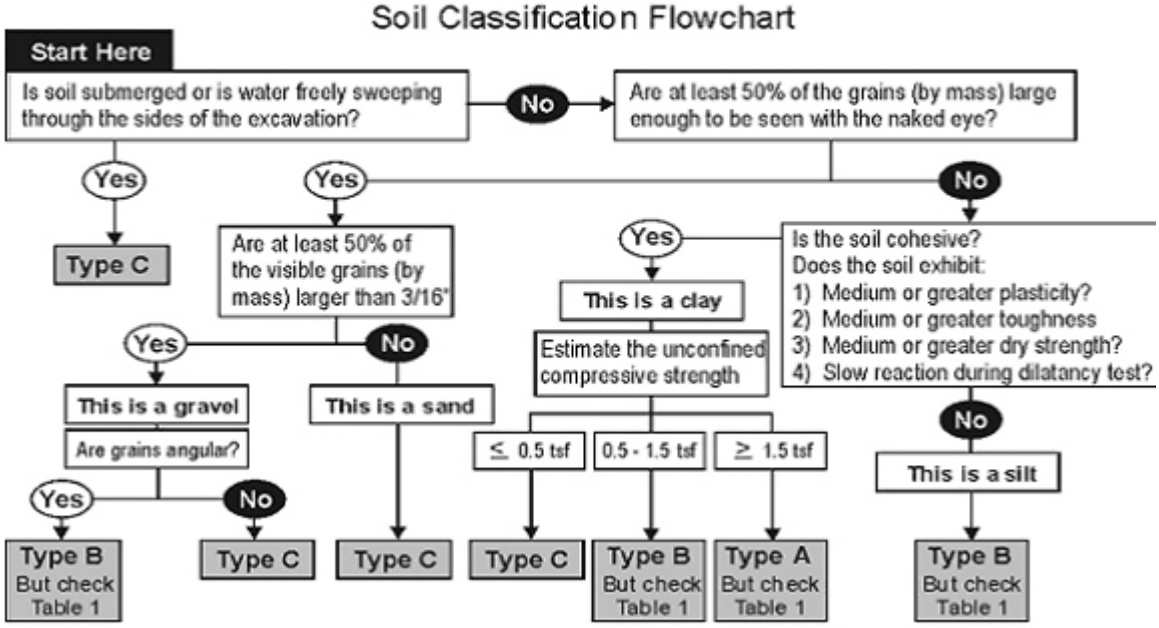
   a) Classification must take into account both site and environmental conditions . . . . . 1541.1 Appendix A (a)(1)
   b) Soil must be classified by a *competent person* as Type A, B, or C soil . . . . . 1541.1 Appendix A (c)(1)
   c) Classification must be based on the results of at least one visual and one manual analysis (see Table 1 and Illustration 5) . . . . . 1541.1 Appendix A ©)(2)

Table 1

Site Conditions That Affect Rock/Soil Slope Stability

Condition	***Requirement***
Soil is fractures/unstable dry rock.	Downgrade to Type B
Soil is fractures/unstable submerged rock.	Downgrade to Type C
Soil is cemented (caliche, hardpan, etc.).	Classify as Type A
Soil is fissured.	Downgrade from Type A to Type B
Soil is subject to vibration.	Downgrade from Type A to Type B
Soil has been previously disturbed.	Downgrade from Type A to Type B
Soil is submerged or water is freely seeping through the sides of the excavation.	Downgrade from Type A to Type C. Downgrade from Type B to Type C.
Soil profile is layered with the layers dipping into the excavation on a slope of four horizontal to one vertical or steeper.	Downgrade from Type A to Type C. Downgrade from Type B to Type C.

Illustration 5
Soil Classification Flowchart



3. Standard shoring, sloping, and benching must be used as specified in 1540 and 1541.1(b) or according to tabulated data prepared by a registered engineer (see illustrations 6-8 on pages 70-72).
4. Protective systems for excavations deeper than 20 ft. shall be designed by a registered engineer . . . . . 1541.1, Appendix F
5. Additional bracing must be used when vibration or surcharge loads are a hazard . . . . . 1541.1, Appendix A
6. Excavations must be inspected as needed after every rainstorm, earthquake, or other hazard increasing occurrence. (Water in the excavation may require a reclassification of soil type.) 1541(k)(1)
7. Employees must be protected from falling materials by scaling, installation of protective barriers, or other methods . . . . . 1541(j)(1)
8. Uprights shall extend to the top of the trench and its lower end not more than 2 feet from the bottom of the trench . . . . . 1541(j)(1)
9. Employees must be protected from excavated or other material by keeping such material 2 ft. from the excavation edge or by using barrier devices . . . . . 1541(j)(2)
10. *Ladders* or other safe *access* must be provided within 25 ft. of a work area in trenches 4 ft. or deeper . . . . . 1541(c)(2)
11. Excavation beneath the level of adjacent foundations, retaining walls, or other structures is prohibited unless requirements of 1541(i) have been met . . . . . 1541(i)(1)
12. Shored, braced, or underpinned structures must be inspected daily when stability is in danger . . . . . 1541(i)(2)
13. Walkways or bridges with standard *guardrails* must be installed when employees or equipment are required or permitted to cross over excavations that are at least 6 ft. deep and wider than 30 in . . . . . 1541(l)(1)

14. Barriers must be erected around excavations in remote locations. All wells, pits, shafts, and caissons must be covered or barricaded, or if temporary, backfilled when work is completed 1541(l)(2)

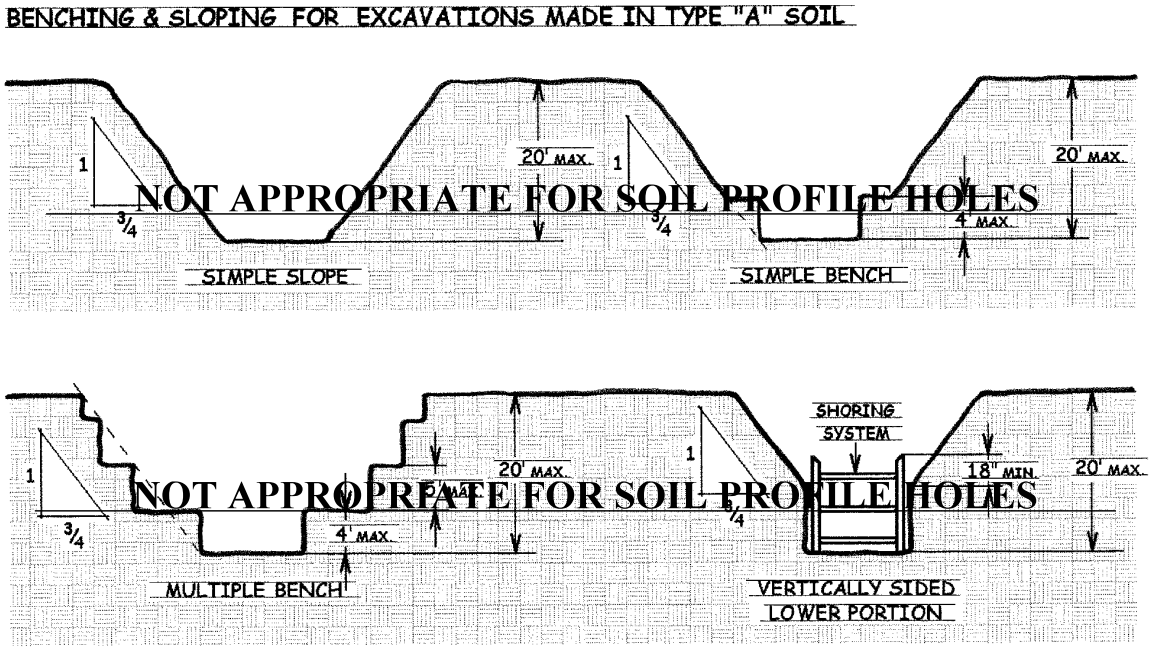
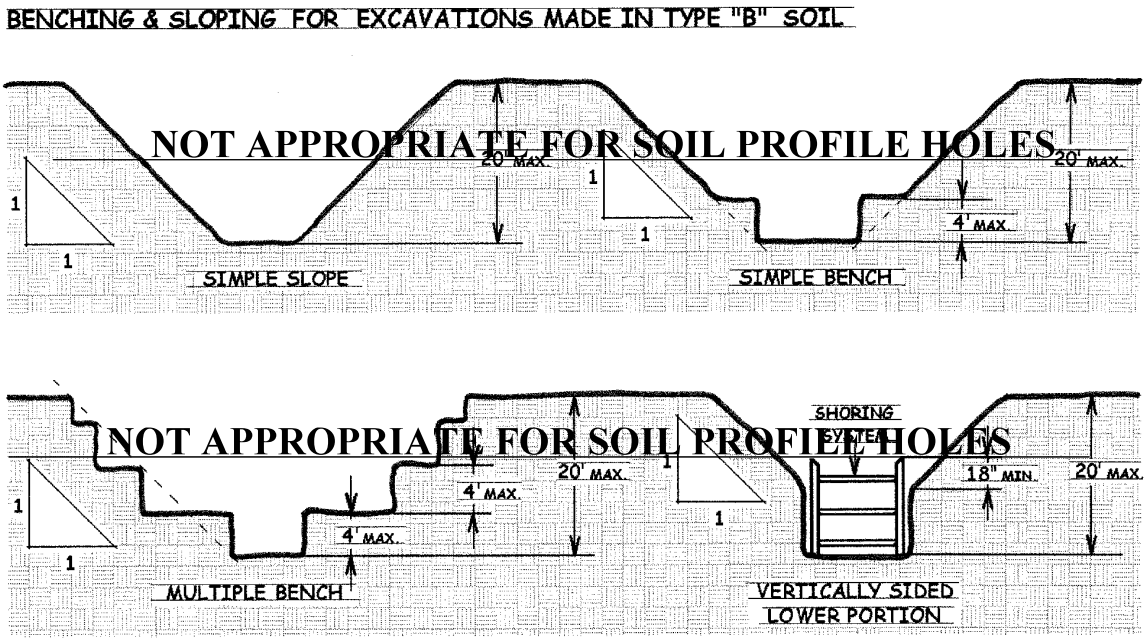
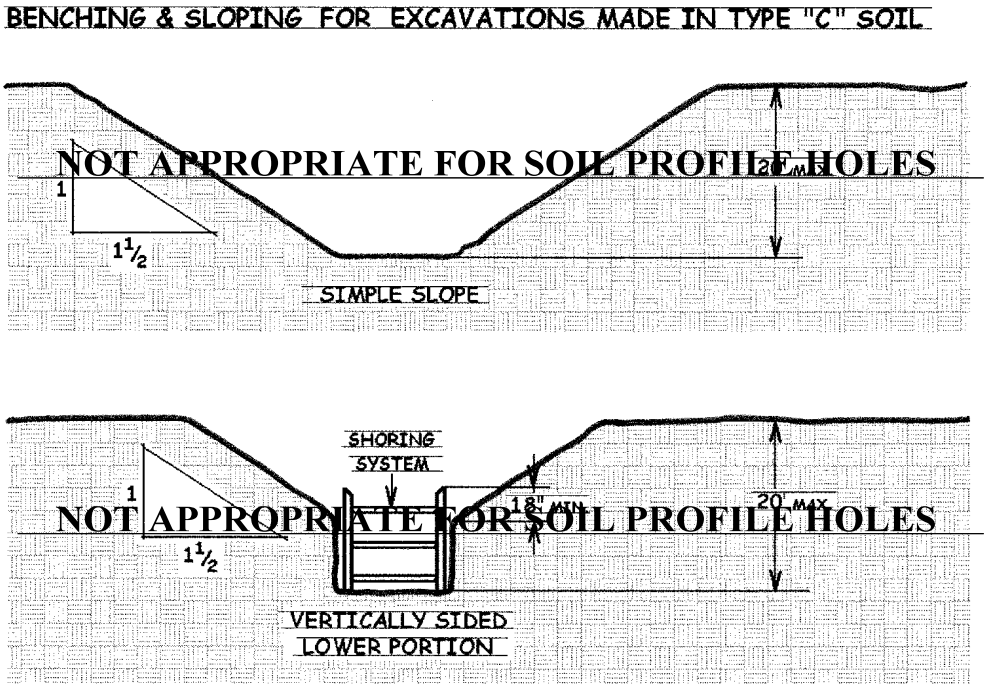


Figure 2





D. Safety orders pertaining to shafts and wells include the following:

1. All shafts and wells more than 5 ft. deep into which workers are required to enter must be retained with lagging, spiling, or casing . . . . . 1542(a)(1)
2. Tests or procedures shall be performed before entry into exploration shafts to ensure the absence of dangerous air contamination or oxygen deficiency . . . . . 1542(c)(3), 5158
3. An employee entering a bell-bottom pier hole or other deep or confined-footing excavation shall wear a harness that has a lifeline attended by another employee . . . . . 1541(g)(2)(B)
4. Shafts in other than hard, compact soil shall be completely lagged and braced.. .1542(c)(1)
5. Head protection is required for workers who enter a well or shaft 3381
6. Shafts more than 20 ft. deep are subject to the TSOs . . . . . .8403(a)

Approved by:

/s/ Pete Parkinson

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