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# **North Star Pipelines Inc.**

## **Trench Excavation and Safety Handbook**



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### **Access and egress**

Excavations of four feet or greater in depth require:

- Ladder, stairway, or ramp.
- No more than 25 feet of lateral travel for any worker.
- Ladder must extend at least three feet above the top of the excavation.
- Do not use lifting or digging equipment to enter or exit trenches.

### **Exposure to vehicular traffic**

- Employees exposed to public vehicular traffic shall be provided with, and shall wear warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

### **Exposure to falling loads**

- No employee shall be permitted underneath loads handled by lifting or digging equipment.
- Use tag lines to move or swing loads.

### **Warning system for mobile equipment**

- When mobile equipment is operated adjacent to an excavation, a warning system shall be utilized, such as barricades, hand or mechanical signals, or stop logs.



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### Standard Safety Requirements

OSHA standards must be followed at all times.

The North Star Pipelines, Inc. Safety Manual must be followed at all times.

Hard hats must be worn at all times.

Work boots must be worn at all times.

Shoring is required in all ditches over 5' deep.

Ladders are required in all ditches over 4' deep.

No drugs or alcohol on job site.

Wear Orange safety vests when working in roadway.

Riding on Equipment is prohibited.

All trenches shall be in a flagged, taped, barricaded or fenced off area.

Any accidents shall be reported immediately on injury report.

Trench excavation checklist shall be filled out daily.



# DAILY JOB REPORT

**JOB NAME:** \_\_\_\_\_

**Foreman Name:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Weather:** (check all that apply)

-  High Temperature
-  Cloudy
-  Clear Skies
-  Rain

HOURS	LABOR USED	HOURS	EQUIPMENT USED
_____	1. _____	_____	1. _____
_____	2. _____	_____	2. _____
_____	3. _____	_____	3. _____
_____	4. _____	_____	4. _____
_____	5. _____	_____	5. _____
_____	6. _____	_____	6. _____
_____	7. _____	_____	7. _____
_____	8. _____	_____	8. _____

**MATERIALS USED:**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**DESCRIPTION OF WORK:**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



## DAILY EXCAVATION CHECKLIST

An inspection shall be conducted by the competent person prior to the start of work, and as needed throughout the shift. **This form must be completed fully every day.**

DEPTH \_\_\_\_\_ WIDTH \_\_\_\_\_ LENGTH \_\_\_\_\_

TYPE OF SOIL (circle one):      A              B              C

TESTS PERFORMED:    THUMB    VISUAL    PLASTICITY    DRY STRENGTH

### DAILY INSPECTION

Yes	No	CRACKS OR FISSURES:	Notes: _____
Yes	No	RAIN OR SATURATION:	Notes: _____
Yes	No	PREVIOUSLY EXCAVATED SOIL:	Notes: _____
Yes	No	POWER POLE, SCAFFOLD OR OTHER SIMILAR HAZARD:	Notes: _____
Yes	No	VIBRATION PRESENT:	Notes: _____
Yes	No	OVERNIGHT CAVING OR SLOUGHING:	Notes: _____
Yes	No	UTILITIES PRESENT:	Notes: _____
Yes	No	CONFINED SPACE:	Notes: _____
Yes	No	SHORING: Type and # _____	Notes: _____
Yes	No	SLOPED:	Notes: _____
Yes	No	LADDER WITHIN 25' OF WORKERS:	Notes: _____
Yes	No	SPOILS 2' FROM TRENCH:	Notes: _____
Yes	No	TRENCH BARRICADED/FLAGGED:	Notes: _____
Yes	No	PIPE CENTER LOADED:	Notes: _____

PRINT NAME: \_\_\_\_\_

## **Appendix A - Soil Classification**

### **Scope and Application:**

- This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth's deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

### **Definitions**

#### **Cemented soil**

- Soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-size sample cannot be crushed into powder or individual soil particles by finger pressure.

#### **Cohesive soil**

- Clay, (fine grained soil), or soil with high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical side slopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clay silt, silty clay, sandy clay, clay, and organic clay.

### **Fissured**

- Soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks such as tension cracks, in an exposed surface.

### **Granular**

- Gravel, sand, or silt (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

### **Stable rock**

- Natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.



## Soil Types

### Type A soil

- Cohesive soil with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144 kPa) 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

Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or

Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam, and, in some cases, silty

- Previously disturbed soils except those which would otherwise be classified as Type C soil.
- Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or
- Dry rock that is not stable; or
- 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**

- Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or
- Granular soils including gravel, sand, and loamy sand; or
- Submerged soil or soil from which water is freely seeping; or
- Submerged rock that is not stable; or
- Material in a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or steeper.

## Acceptable Visual and Manual Tests

At least one visual test and one manual test must be performed by a "Competent Person" to properly classify soil.

### Visual tests

- Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and soil taken as samples from excavated material.
- Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material is cohesive material. Soil composed of primarily coarse-grained sand or gravel is granular material.
- Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.
- Observe the side of the opened excavation and the surface area adjacent to the excavation. Crack-like openings, such as tension cracks, could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

- Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.
- Observe the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of the slope of the layers.
- Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.
- Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

### **Manual tests**

- Manual analysis of soil samples are conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.
- Manual tests include:
  - 1) Plasticity: Thread and Ribbon
  - 2) Dry Strength
  - 3) Thumb Penetration

## **Appendix D - Aluminum Hydraulic Shoring for Trenches**

- This appendix contains information that can be used when aluminum hydraulic shoring is provided as a method of protection against cave-ins in trenches that do not exceed 20 feet (6.1 m) in depth.

### **Vertical shores**

- When vertical shores are used, there must be a minimum of three shores spaced equally, horizontally, in a group.

### **Hydraulic cylinder specifications**

- Two inch cylinders shall have a minimum 2" inside diameter with a minimum safe working capacity of no less than 18,000 pounds axial compressive load at maximum extension.

### **Plywood**

- Plywood shall be 1.125" thick softwood or 0.75" thick, 14 ply, arctic white birch (Finland form). Please note that plywood is not intended as a structural member, but only for prevention of local raveling (sloughing of the trench face) between shores.

**TABLE D-1.1  
ALUMINUM HYDRAULIC SHORING  
VERTICAL SHORES FOR SOIL TYPE A**

HYDRAULIC CYLINDERS					
DEPTH OF TRENCH (FEET)	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	8				
OVER 15 UP TO 20	7				
OVER 20	NOTE (1)				

Footnotes to tables and general notes on hydraulic shoring are found in Appendix D, Item (g)

Note (1): See Appendix D, Item (g)(1)

Note (2): See Appendix D, Item (g)(2)

**TABLE D-1.2  
ALUMINUM HYDRAULIC SHORING  
VERTICAL SHORES FOR SOIL TYPE B**

HYDRAULIC CYLINDERS					
DEPTH OF TRENCH (FEET)	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 10 UP TO 15	6.5				
OVER 15 UP TO 20	5.5				
OVER 20	NOTE (1)				

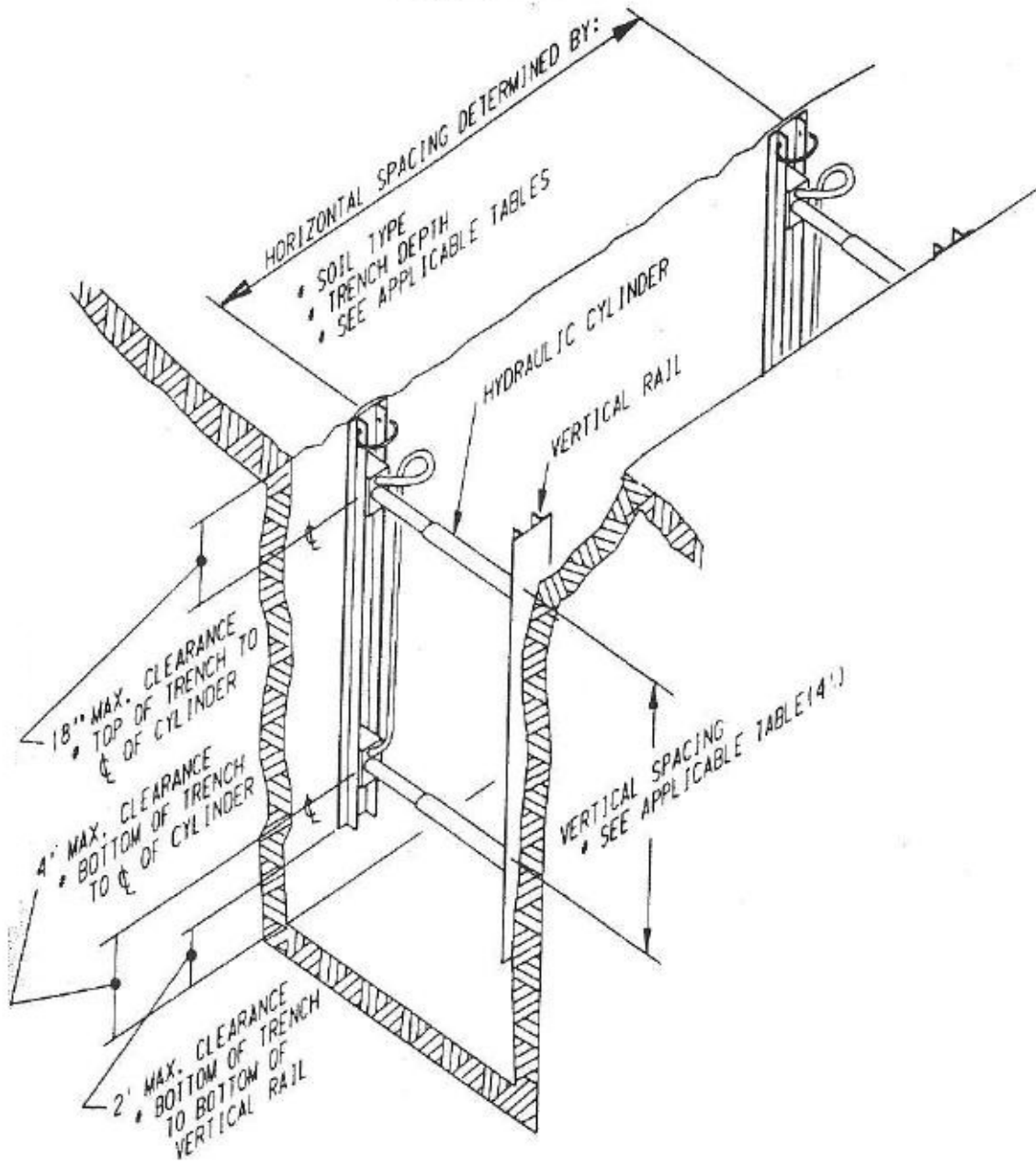
Footnotes to tables and general notes on hydraulic shoring are found in Appendix D, Item (g)

Note (1): See Appendix D, Item (g)(1)

Note (2): See Appendix D, Item (g)(2)

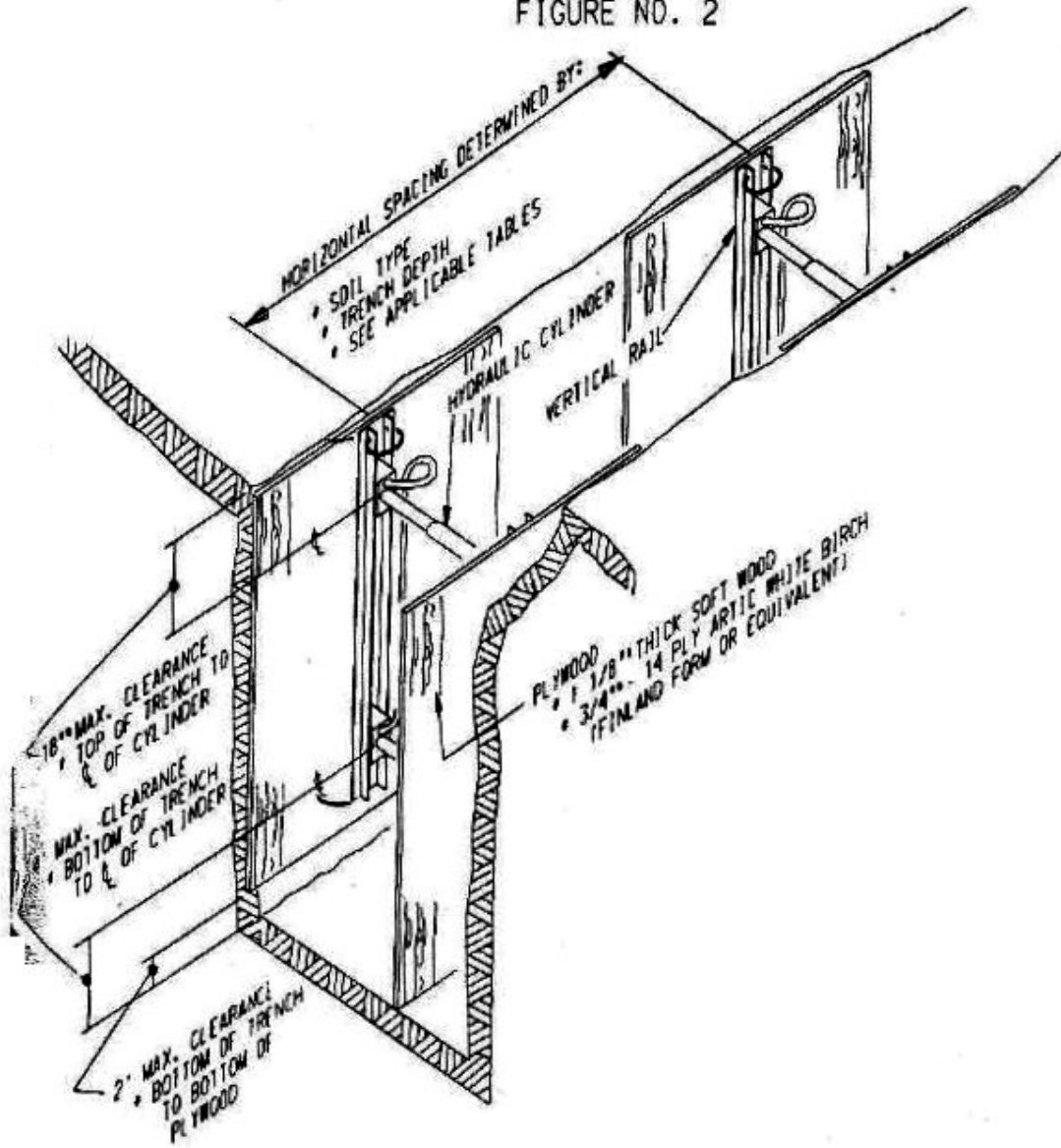
# ALUMINUM HYDRAULIC SHORING - TYPICAL INSTALLATIONS

FIGURE NO. 1



ALUMINUM HYDRAULIC SHORING - TYPICAL INSTALLATIONS

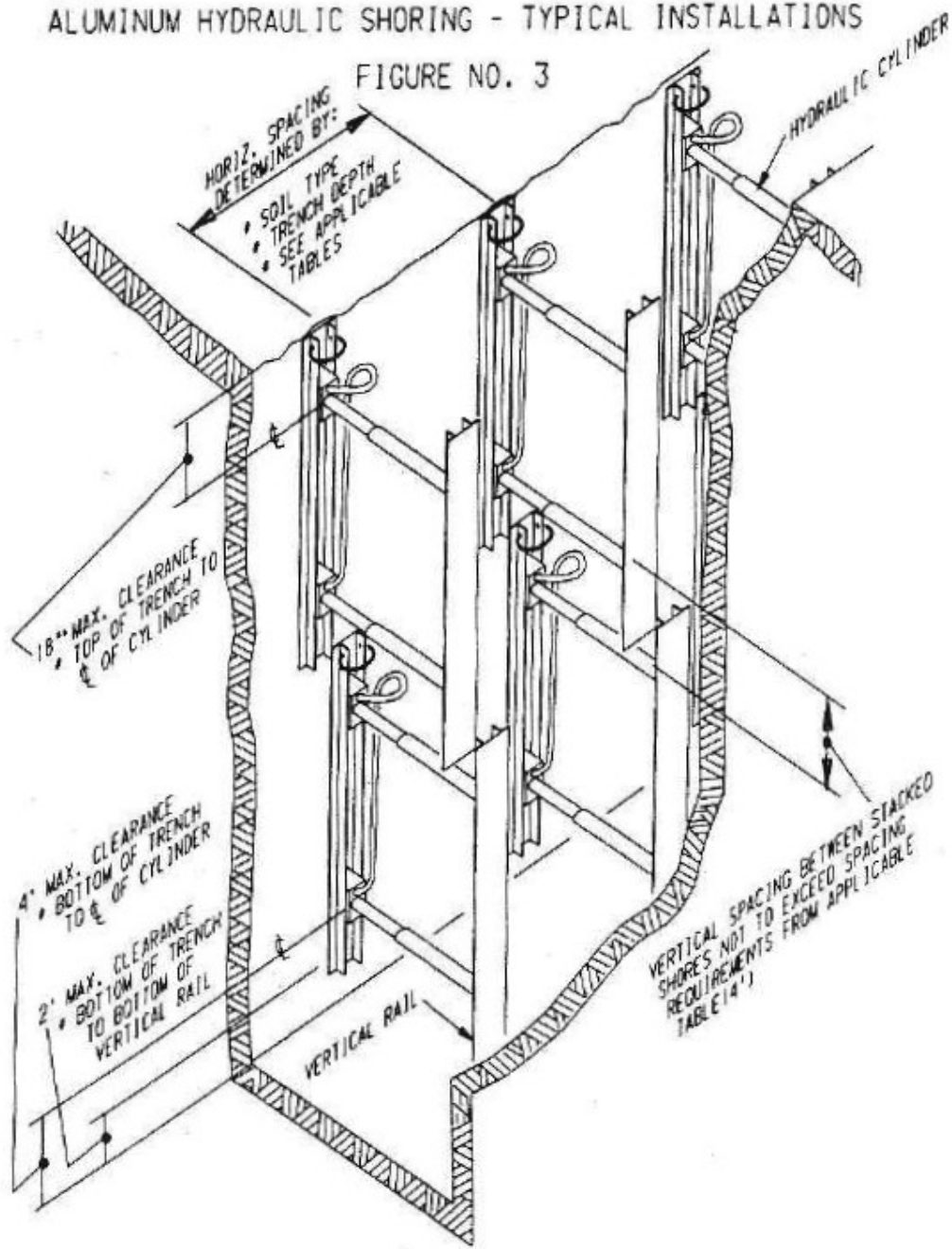
FIGURE NO. 2





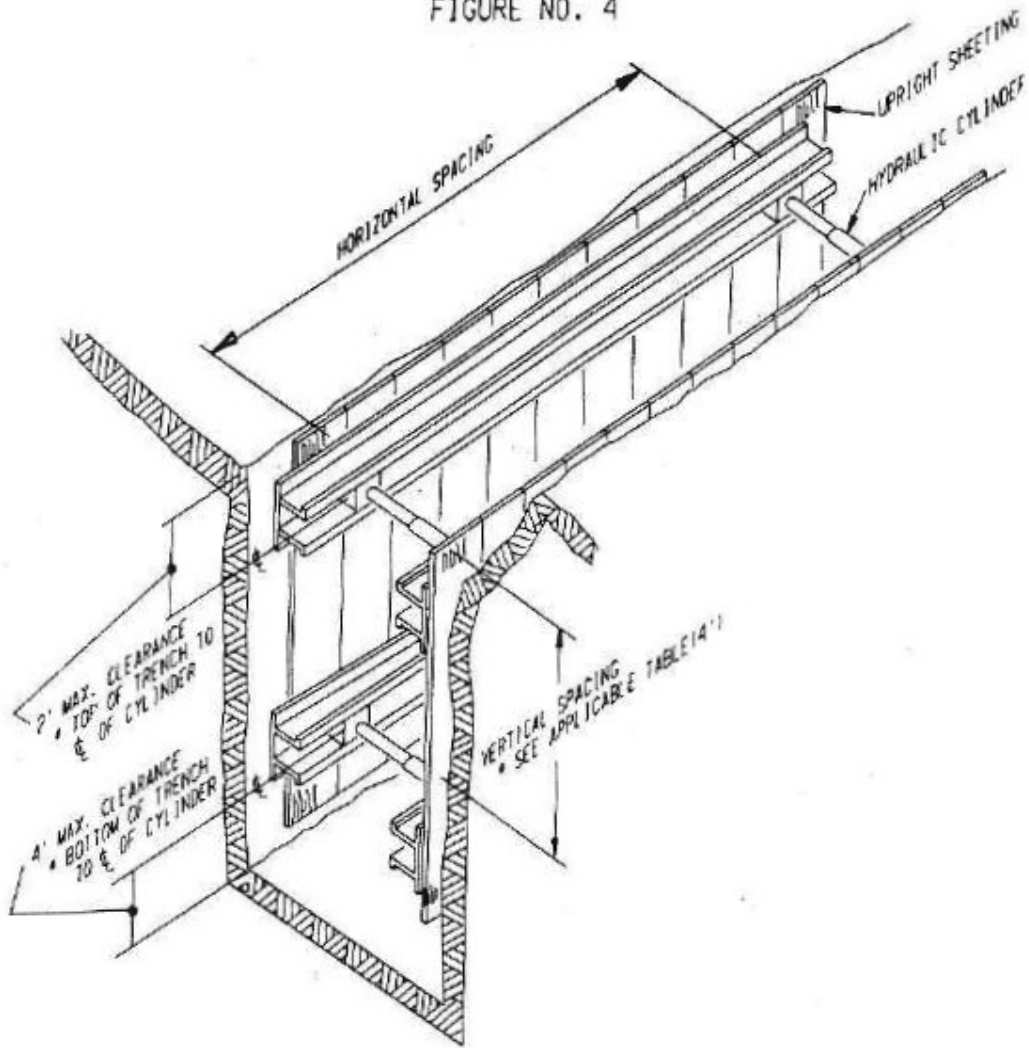
# ALUMINUM HYDRAULIC SHORING - TYPICAL INSTALLATIONS

## FIGURE NO. 3



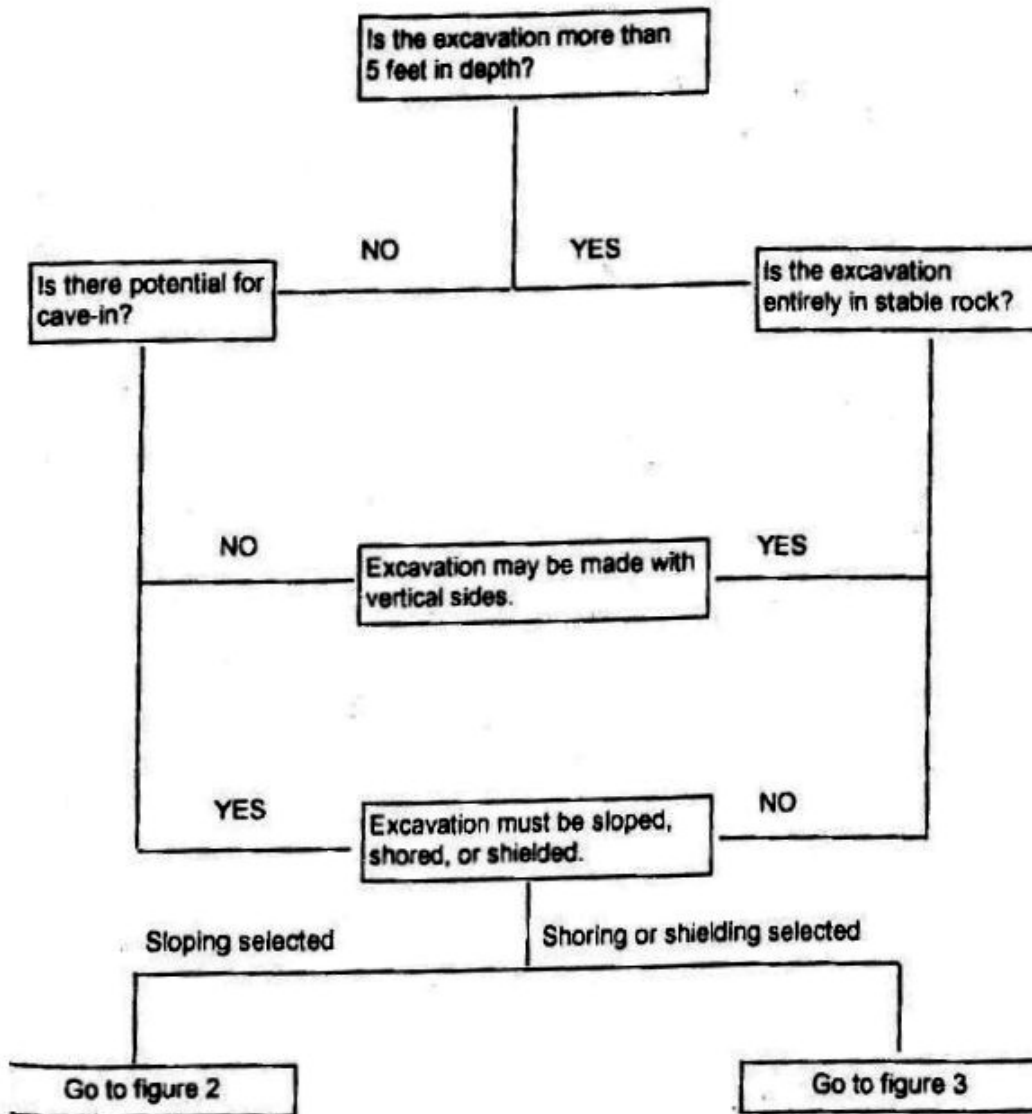
ALUMINUM HYDRAULIC SHORING - TYPICAL INSTALLATIONS

FIGURE NO. 4



## Appendix F - Selection of Protective Systems

- Decision making flow chart to help the "Competent Person" choose the applicable protective system.

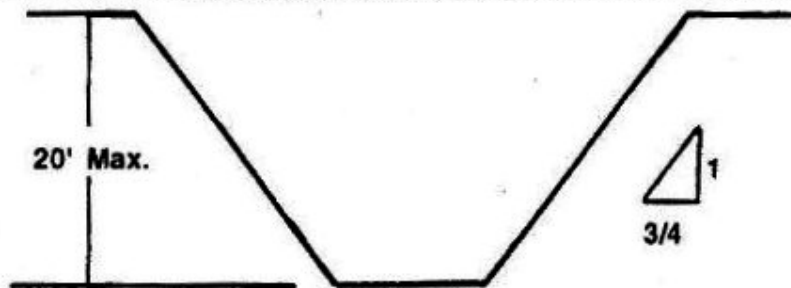


### FIGURE B-1—SLOPE CONFIGURATIONS

(All slopes stated below are in the horizontal to vertical ratio)

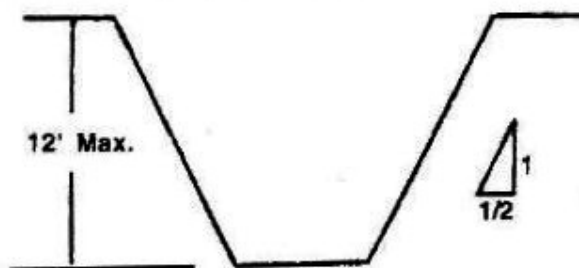
#### B-1.1 Excavations made in Type A soil.

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of  $\frac{3}{4}$ :1.



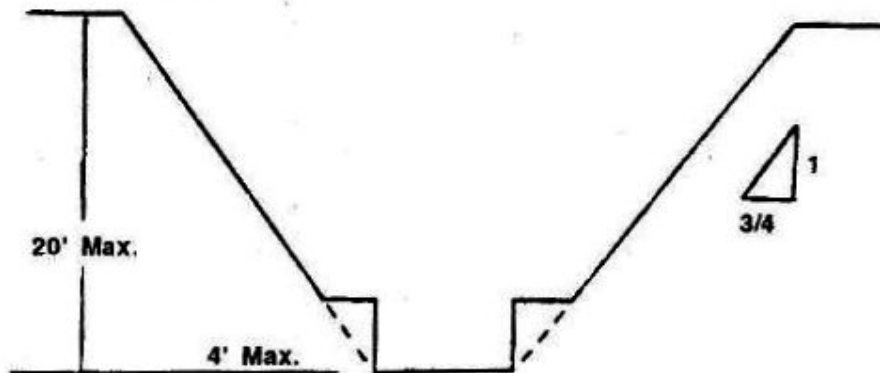
**SIMPLE SLOPE—GENERAL**

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of  $\frac{1}{2}$ :1.

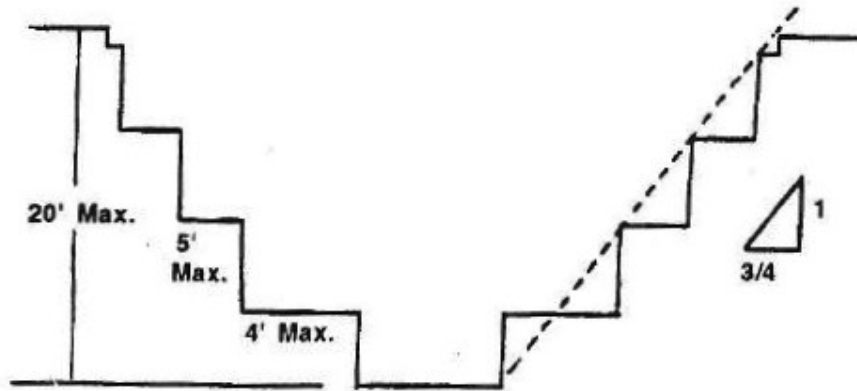


**SIMPLE SLOPE—SHORT TERM**

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of  $\frac{3}{4}$ :1 and maximum bench dimensions as follows:

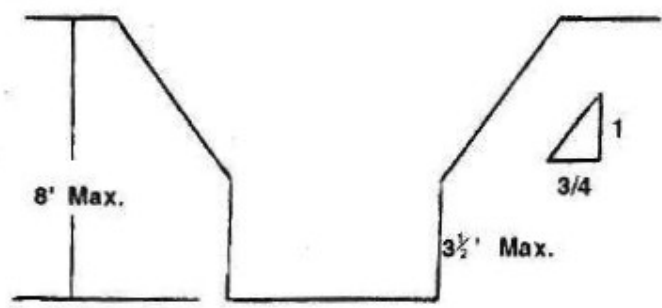


**SIMPLE BENCH**



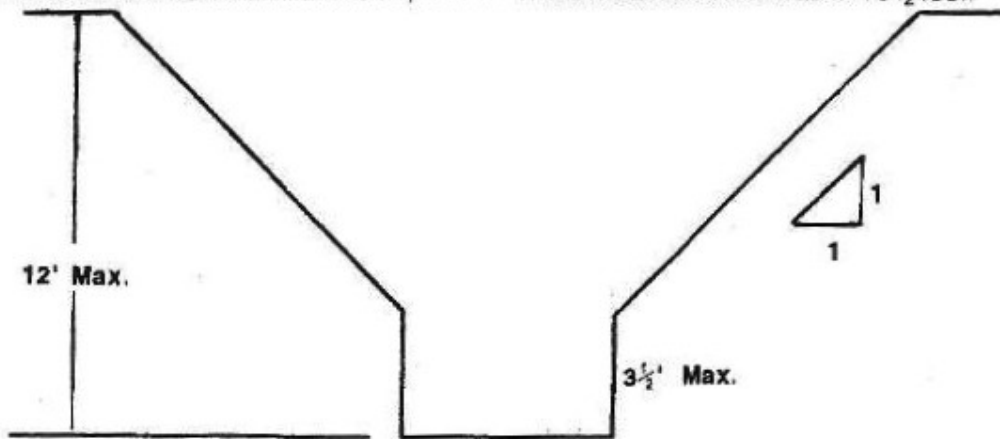
MULTIPLE BENCH

3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3 1/2 feet.



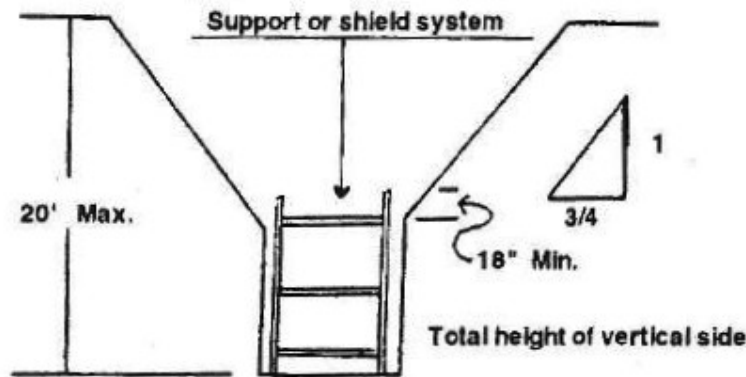
UNSUPPORTED VERTICALLY SIDED LOWER PORTION—MAXIMUM 8 FEET IN DEPTH)

All excavations more than 8 feet but not more than 12 feet in depth with unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3½ feet.



**UNSUPPORTED VERTICALLY SIDED LOWER PORTION—MAXIMUM 12 FEET IN DEPTH)**

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of ¾:1. The support or shield system must extend at least 18 inches above the top of the vertical side.

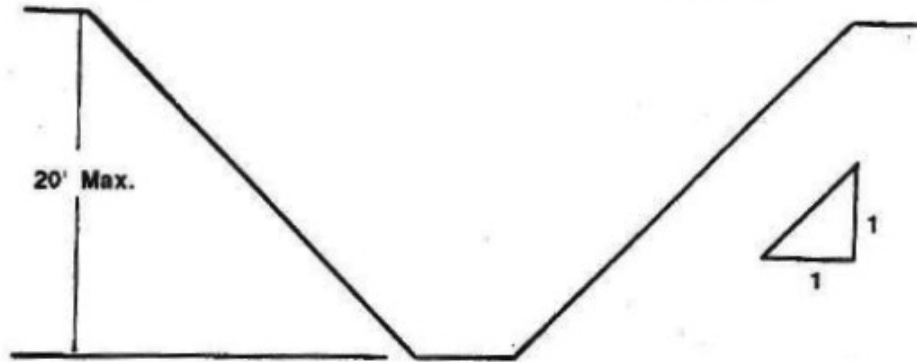


**SUPPORTED OR SHIELDED VERTICALLY SIDED LOWER PORTION**

4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under §1926.652(b).

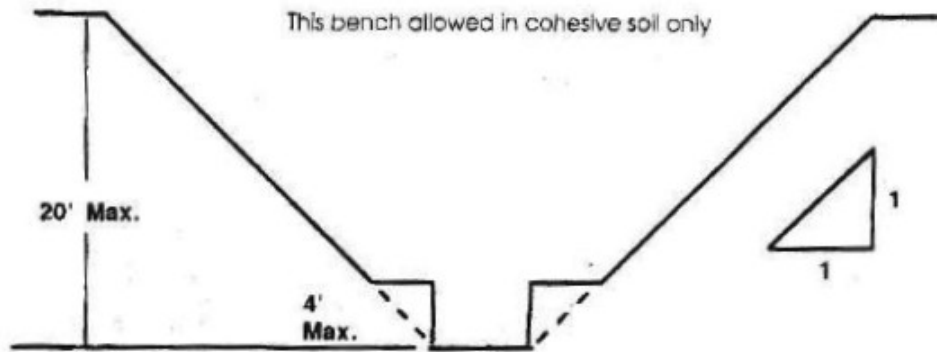
B-1.2 Excavations Made in Type B Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

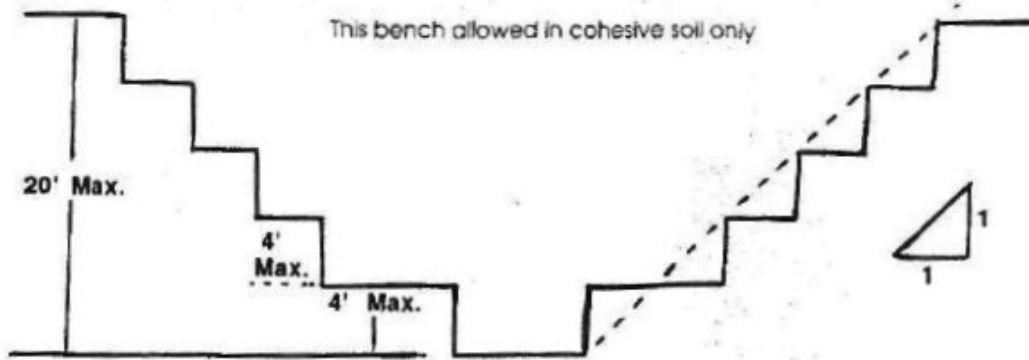


SIMPLE SLOPE

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:

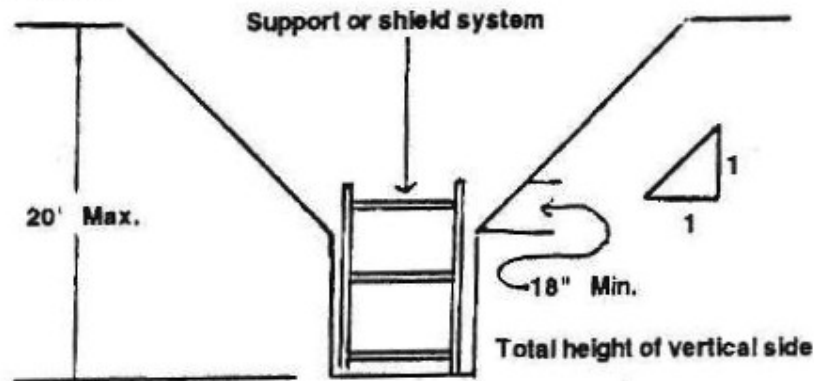


SINGLE BENCH



MULTIPLE BENCH

3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

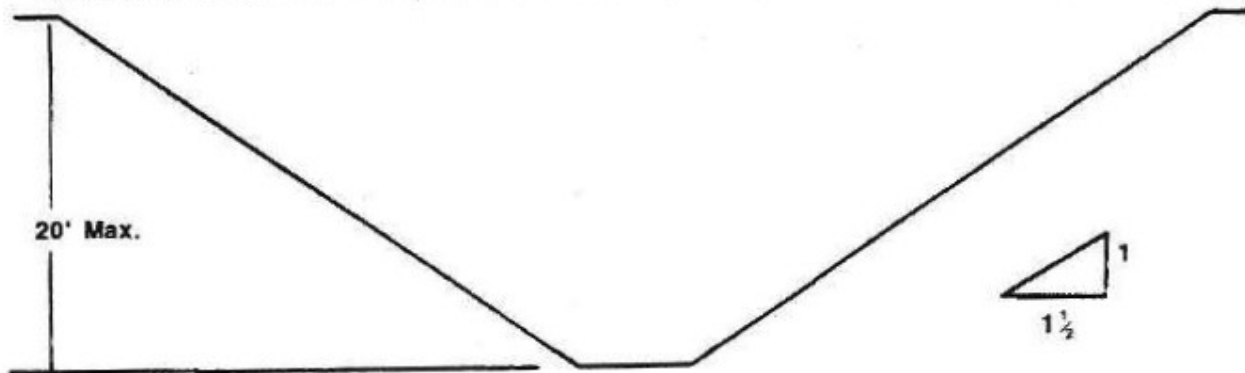


**VERTICALLY SIDED LOWER PORTION**

4. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

*B—1.3 Excavations Made in Type C Soil*

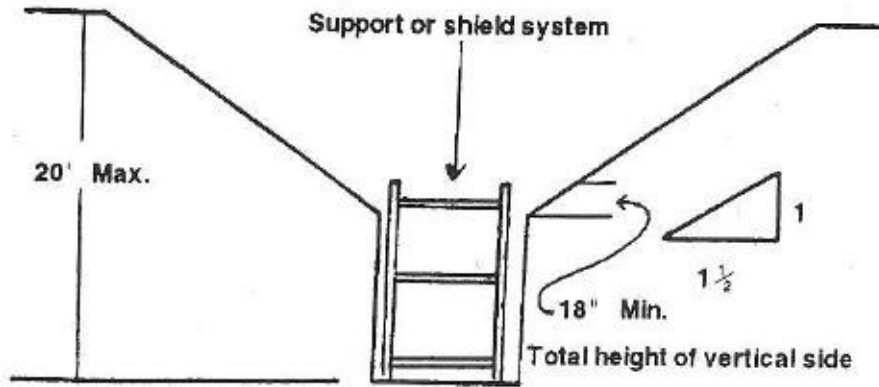
1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1½:1.



**SIMPLE SLOPE**



2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of  $1\frac{1}{2}:1$ .



**VERTICAL SIDED LOWER PORTION**

3. All other sloped excavations shall be in accordance with the other options permitted in §1926.652(b).

*B-1.4 Excavations Made in Layered Soils*

1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.

