SECTION 31 05 13 - SOILS FOR EARTHWORK

Some of the paragraphs may be deleted. When deleting, do not renumber all the paragraphs. Simply leave the section number and title as is, delete the text, and add the words "Not Used".

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes range of soil and subsoil materials intended to be referenced by other sections, generally for fill and grading purposes. Materials are indicated by "Type" to assist in referencing from other sections and on Drawing notes.

B. Section includes:

1. Subsoil materials
2. Topsoil materials

C. Related Sections

Each of the following listing of sections references this section for soil materials.

Edit to fit Project.

1. Section 31 05 16, Aggregates for Earthwork
2. Section 31 10 00, Site Clearing
3. Section 31 22 13, Rough Grading
4. Section 31 23 16, Excavation
5. Section 31 23 17, Trenching
6. Section 31 23 18, Rock Removal
7. Section 31 23 23, Fill
8. Section 31 37 00, Riprap

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

Select appropriate AASHTO standard based upon input/standards of client.

If no preference is standard, standard is T99.

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

OR

2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

B. ASTM International (ASTM):

For #1, select appropriate ASTM standard based upon input/standards of client.

ASTM D698 test methods correspond with AASHTO T99,

ASTM D1557 test methods correspond with AASHTO T180.

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))

OR

2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)

4. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.3 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Materials Source: Submit name of imported materials source.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Furnish materials of each type from same source throughout the Work.

B. Soil Testing:

1. Soil sampling and testing to be completed by an independent laboratory approved by the Engineer.

2. Frequency of testing shall be determined by the Engineer.

3. All soil testing shall be paid for by the Contractor.

C. Compaction Tests:

Select appropriate ASTM standards used in 1.3 above. Use "ASTM D698 (AASHTO T99)" or "ASTM D1557 (AASHTO T180)"

1. Maximum density at optimum moisture content determined by <_____>.

2. In-place density in accordance with Nuclear Testing Method, ASTM D6938.

D. Soil Classification: All imported materials shall be classified in accordance with ASTM D2487.

PART 2 PRODUCTS

2.1 SUBSOIL MATERIALS

Adjust material requirements to local availability; edit the following paragraphs accordingly.

Include one or more subsoil types suitable for fill material. Refer to geotechnical report.

Soil types are indicated by "S#" designation. Aggregate fill materials specified in Section 31 05 16 are indicated by "A#" designation.

A. Subsoil Type S1, Select Native Material:

1. Select earth obtained from on-site excavations approved for use by Engineer.
2. Graded.
3. Free of peat, humus, vegetative matter, organic matter, and rocks larger than [6] <___> inches in diameter.
4. Processed as required to be placed in thickness as prescribed and at the optimum moisture content to obtain level of compaction required by these specifications.

B. Subsoil Type S2, Imported Fill Material:

1. Imported earth approved for use by Engineer.
2. Meeting the requirements of Subsoil Type S1.

2.2 TOPSOIL MATERIALS

Adjust material requirements to local availability; edit the following paragraphs accordingly.

Include one or more suitable topsoil types. Refer to geotechnical report.

Topsoil types are indicated by "TS#" designation. Aggregate fill materials specified in Section 31 05 16 are indicated by "A#" designation.

A. Topsoil Type TS1, Select Native Topsoil Material:

1. Top 6 - 12 inches of existing soil containing organic matter.
2. Engineer decision shall be final as to determination of what material is topsoil quality.
3. Graded.
4. Free of roots, rocks larger than [1/2] <___>-inch subsoil, debris, large weeds, and foreign matter.
   a. Screening: Single screened.

B. Topsoil Type TS2, Imported Topsoil Material:

1. Imported borrow.

2. Friable loam.

3. Reasonably free of roots, rocks larger than [**1/2**] <___>-inch, subsoil, debris, large weeds, and foreign matter.

   a. Screening: Single screened.

4. Acidity range (pH) of 5-1/2 to 7-1/2.

5. Containing minimum of 4 percent and maximum of 25 percent inorganic matter.

2.3 SPOILS

A. All excess material not suitable or not required for backfill and grading shall be hauled off site and disposed of at a location provided by the Contractor and approved by the Engineer.

B. Make arrangements for disposal of the material at no additional cost to the Owner.

C. Landfill permit to be obtained by the Contractor and provided to Engineer prior to commencement of disposal.

2.4 SOURCE QUALITY CONTROL

Select appropriate ASTM standards used in 1.3 above. Use "ASTM D698 (AASHTO T99)" or "ASTM D1557 (AASHTO T180)"

A. Testing and Analysis of Subsoil Material: Perform in accordance with <_____>.

B. When tests indicate materials do not meet specified requirements, change material, or vary compaction methods and retest. Additional testing shall be completed and paid for by the Contractor with no reimbursement by the Owner.

C. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate material of every nature and description to the lines and grades as indicated on the Drawings and/or as required for construction of facilities.

B. Site within clearing limits shall be stripped of topsoil as required to obtain additional topsoil necessary to complete Work indicated in the Drawings or as specified.

C. When practical, do not excavate wet topsoil.

D. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.

E. Remove excess excavated subsoil and topsoil not intended for reuse from Site.

F. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from Site.

3.2 STOCKPILING

A. Stockpile soils **[at locations shown in the Drawings] [or]** at locations as approved by Engineer for redistribution as specified.

1. Site may not have sufficient area to stockpile excavated material that will be required for fill later in the Project. If additional stockpile area is required to complete the Project on schedule, arrange off-site stockpile areas.

2. No additional payments will be made for stockpiling excavated materials off-site.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Prevent intermixing of soil types or contamination.

E. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

1. Grade surface of stockpiles to prevent ponding of water.

2. Cover stockpiles to minimize the infiltration of water.

F. Stockpile unsuitable and/or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 05 16 - AGGREGATES FOR EARTHWORK

Some of the paragraphs may be deleted. When deleting, do not renumber all the paragraphs. Simply leave the section number and title as is, delete the text, and add the words "Not Used".

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes a range of coarse and fine aggregate materials intended to be referenced by other Sections, generally for fill and grading purposes. Materials are indicated by "Type" to assist in referencing from other Sections and in Drawing notes.

B. Section Includes:

1. Coarse aggregate materials
2. Fine aggregate materials

C. Related Sections

Each of the following listing of sections references this section for soil materials.

Edit to fit Project.

1. Section 31 05 13, Soils for Earthwork
2. Section 31 22 13, Rough Grading
3. Section 31 23 17, Trenching
4. Section 31 23 19, Dewatering
5. Section 31 23 23, Fill
6. Section 31 37 00, Riprap
7. Section 32 11 23, Aggregate Base Courses
8. Section 33 11 10, Water Utility Distribution and Transmission Piping
9. Section 33 41 10, Storm Utility Drainage Piping

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses
2. AASHTO T27 - Sieve Analysis of Fine and Coarse Aggregates

For #3, select appropriate AASHTO standard based upon input/standards of client.

If no preference is standard, standard is T99.

3. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

OR

4. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

5. AASHTO TP61 - Standard Method of Test for Determining the Percentage of Fracture in Coarse Aggregate

B. ASTM International (ASTM):

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

For #2; select appropriate ASTM standard based upon input/standards of client.

ASTM D698 test methods correspond with AASHTO T99

ASTM D1557 test methods correspond with AASHTO T180.

2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))

OR

3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)

5. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

6. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.3 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Materials Source: Submit name of imported materials suppliers.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. Results of aggregate sieve analysis and standard proctor tests for all granular material.

1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Aggregate Testing:

1. Aggregate sampling and testing to be completed by an independent laboratory approved by the Engineer.

2. The frequency of testing shall be determined by the Engineer.

3. All aggregate testing shall be paid for by the Contractor.

C. Compaction Tests:

Use either "ASTM D698 (AASHTO T99)" or "ASTM D1557 (AASHTO T180)".

1. Maximum density at optimum moisture content determined by <_____>.

2. In-place density in accordance with Nuclear Testing Method, ASTM D6938.

D. Aggregate Classification: All imported materials shall be classified in accordance with ASTM D2487.

PART 2 PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

Adjust material limits and grading to local availability; edit the following paragraphs accordingly.

Include one or more aggregate types suitable for backfill material. Refer to geotechnical report.

Aggregate types are indicated by "A#" designation. Soil fill materials specified in Section 31 05 13 are indicated by "S#" and "TS#" designations.

When using state standards, refer to aggregate types by state standard designation.

Subsections for Washington listed before Section 2.2

A. Coarse Aggregate Type A1, Dense-Graded Aggregate: Crushed rock with ¾-inch-0, 1-inch-0, 1-1/2-inch-0, 2-inch-0 and 2-1/2-inch-0 gradation as shown on the Drawings and meeting the requirements provided below.

1. Grading - Dense-graded base aggregate shall be crushed rock, including sand. Uniformly grade the aggregates from coarse to fine.

2. Sieve analysis shall be determined according to AASHTO T27.

3. The aggregates shall conform to one of the grading requirements Table 31 05 16-A below.

Table 31 05 16-A
Grading Requirements for Dense-Graded Aggregate
Separated Sizes
Percent Passing (by weight)

Sieve Size	2-1/2" - 0	2" - 0	1-1/2" - 0	1" - 0	3/4" - 0
3”	100				
2-1/2”	95 - 100	100			
2”	-	95 - 100	100		
1-1/2"	-	-	95 - 100	100	
1-1/4”	55 - 75	-	-	-	
1”	-	55 - 75	-	90 - 100	100
3/4"	-	-	55 - 75	-	90 - 100
1/2"	-	-	-	55 - 75	-
3/8”	-	-	-	-	55 - 75
1/4"	30 - 45	30 - 45	35 - 50	40 - 55	40 - 60
No. 4*	-	-	-	-	-
No. 10	[1]	[1]	[1]	[1]	[1]

[1] Of the fraction passing the 1/4-inch sieve, 40 percent to 60 percent shall pass the No. 10 sieve.
* Report percent passing sieve when no grading requirements are listed.

Paragraphs 4-6 below are specific to City of Portland project, or as may be otherwise requested by Owner.

Delete if not appropriate.

4. Fracture of Rounded Rock:

   a. Determined according to AASHTO TP61.

   b. Provide at least one fractured face based on the following percentage of particles retained on the 1/4-inch sieve for the designated size:

Minimum Percent of Fractured Particles
by Weight of Material

Designated Size	Retained on 1/4-Inch Sieve
1-1/2-inch – 0 and larger	50
Smaller than 1-1/2-inch – 0	70

5. Durability:

   a. Crushed rock aggregate shall meet the following durability requirements:

Test	Test Method	Requirements
Abrasion	AASHTO T 96	35.0 percent maximum
Degradation (Coarse Aggregate)	ODOT TM 208	30.0 percent maximum
Passing No. 20 Sieve, Sediment Height	ODOT TM 208	3.0-inch maximum

6. Sand Equivalent -- Crushed rock aggregate will be tested according to AASHTO T 176 and shall have a sand equivalent of not less than 50.

B. Coarse Aggregate Type A2, Granular Drain Backfill Material: Crushed or uncrushed rock or gravel as shown on the Drawings.

1. Material shall be clean and free draining.

2. Sieve analysis shall be according to AASHTO T27.

3. Grading: Meeting the gradation requirements provided in Table 31 05 16-B below.

Table 31 05 16-B
Grading Requirements for Granular Drain Backfill Material
Separated Sizes
Percent Passing (by weight)

Sieve Size	Separated Sizes 1-1/2-inch – 3/4-inch	Separated Sizes 3/4-inch – 1/2-inch
2-inch	100	
1-1/2-inch	90 - 100	
1-inch	20 - 55	100
3/4-inch	0 - 15	85 - 100
1/2-inch	-	0 - 15
3/8-inch	0 - 5	-

Subsections to use on Washington projects.

C. Coarse Aggregate Type A1, Dense-Graded Aggregate with material, gradation and quality as shown on the Drawings and equal to Crushed Surfacing Base Course per WSDOT Section 9-03.9(3).

D. Coarse Aggregate Type A2: Crushed or uncrushed rock or gravel as shown on the Drawings and equal to Gravel Backfill for Pipe Zone Bedding per WSDOT Section 9-03.12(3).

E. Top Course Aggregate Type A3, shall meet the requirements for material, grading and quality as shown on the Drawings and equal to Crushed Surfacing Top Course and Keystone per WSDOT Section 9-03.9(3).

2.2 SAND

When using state standards, refer to aggregate types by state standard designation.

Subsections for Washington listed before Section 2.3

A. Sand: Sand material shall consist of granular material, naturally produced, or produced from crushed gravel, or dredge sand that is reasonably free of organic material, mica, clay, fly ash, and other deleterious material, meeting the gradations of Table 31 05 16-C below.

Table 31 05 16-C
Grading Requirements for Sand
Separated Sizes
Percent Passing (by weight)

Sieve Size	Coarse Sand	Medium Sand	Fine Sand
1-inch	100	100	100
3/8-inch	95 - 100	95 - 100	-
#4	80 - 100	70 - 95	90 - 100
#30	10 - 30	10 - 45	-
#100	-	2 - 10	2 - 10
#200	0 - 8	0 - 7	0 - 4
Sand Equivalent	50 min.	50 min.	50 in.

Subsections to use on Washington projects.

B. Sand: Sand material shall consist of granular material, naturally produced or produced from crushed gravel, or dredge sand that is reasonably free of organic material, mica, clay, fly ash and other deleterious material, as shown on the Drawings and equal to Backfill for Sand Drains per WSDOT Section 9-03.13.

2.3 SOURCE QUALITY CONTROL

Use either "ASTM D698 (AASHTO T99)" of "ASTM D1557 (AASHTO T180)".

A. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM C136 and <_____>.

Use either "ASTM D698 (AASHTO T99)" of "ASTM D1557 (AASHTO T180)".

B. Sand - Testing and Analysis: Perform in accordance with ASTM C136 and <_____>.

C. When tests indicate materials do not meet specified requirements, change material and retest. Additional testing shall be completed and paid for by the Contractor with no reimbursement by the Owner.

PART 3 EXECUTION

3.1 STOCKPILING

A. Stockpile materials imported to site [as shown on the Drawings] [or] at locations as approved by Engineer for redistribution as specified.

B. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

C. Prevent intermixing of aggregate types or contamination.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

1. Grade surface of stockpiles to prevent ponding of water.

2. Cover stockpiles to minimize the infiltration of water.

3.2 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 10 00 - SITE CLEARING

Some of the paragraphs may be deleted. When deleting, do not renumber all the paragraphs. Simply leave the section number and title as is, delete the text, and add the words "Not Used".

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes clearing site of incidental paving and curbs, debris, grass, trees, and other plant life in preparation for site or building excavation work.

B. Related Sections:

1. Section 01 56 39, Temporary Tree and Plant Protection
2. Section 02 41 00, Demolition
3. Section 31 22 13, Rough Grading
4. Section 31 23 18, Rock Removal

1.2 DEFINITIONS

A. Clearing: Removal of interfering or objectionable material lying on or protruding above ground surface.

B. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots greater than 2-inch caliper to a depth of 12 inches below subgrade.

C. Interfering or Objectionable Material: Trash, rubbish, and junk; vegetation and other organic matter, whether alive, dead, or decaying; topsoil.

D. Limits of Disturbance: Work area boundary as shown on the Drawings.

E. Root Wad: Tree stump and root mass including all roots greater than 1-inch diameter.

F. Stripping: Removal of topsoil remaining after applicable scalping is completed.

1.3 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Clearing, Grubbing, and Stripping Plan: Drawings clearly showing proposed limits to clearing, grubbing, and stripping activities at Site.

C. Certification or disposal permit for landfill and/or waste disposal site.

D. A copy of written permission of private property owners, with copy of fill permit for said private property, as may be required for disposal of materials.

1.4 QUALITY ASSURANCE

A. Existing Conditions: Determine the extent of Work required and limitations before proceeding with Work.

B. Obtain Engineer's approval of staked clearing, grubbing, and stripping limits prior to commencing clearing, grubbing, and stripping.

C. Conform to applicable local, state, and federal codes for environmental requirements and disposal of debris,

1. Burning on Project Site will not be permitted.

2. Use of herbicides will not be permitted.

D. Permits: The Contractor is responsible for obtaining all necessary permits required for completion of the Work described in this Section.

E. Protection of Persons and Property: Meet all federal, state, and local safety requirements for the protection of laborers, other persons, and property in the vicinity of the work and requirements of the General Provisions.

PART 2 PRODUCTS

2.1 MATERIALS

A. Existing Materials: All materials, equipment, miscellaneous items, and debris involved, occurring or resulting from demolition, clearing, and grubbing work shall become the property of the Contractor at the place of origin, except as otherwise indicated on the Drawings or specifications.

B. Wound Paint: Emulsified asphalt formulated for use on damaged plant tissues.

PART 3 EXECUTION

3.1 GENERAL

A. Clear, grub, and strip areas needed for waste disposal, borrow, or Site improvements within limits shown in approved Clearing, Grubbing, and Stripping Plan.

B. Remain within the property lines at all times.

C. Do not injure or deface vegetation or structures that are not designated for removal.

3.2 EXAMINATION

A. Verify existing plant life designated to remain is tagged or identified.

B. Identify waste and salvage areas for placing removed materials.

3.3 PREPARATION

A. Carefully coordinate the work of this Section with all other work and construction.

Insert appropriate phone number

Oregon: 1-800-332-2344

Washington: 1-800-424-555

Idaho: 1-800-342-1585

B. Call Local Utility Line Information service at <_____>, not less than three working days before performing Work.

C. Request underground utilities to be located and marked within and surrounding construction areas.

1. Disconnect or arrange for disconnection of utilities (if any) affected by required work.

2. Keep all active utilities intact and in continuous operations.

D. Prepare Site only after:

1. Erosion and sediment controls are in place.

Update for project jurisdiction if not City of Portland.

a. Limit areas exposed uncontrolled to erosion during installation of temporary erosion and sediment controls and in compliance with [COP Erosion and Sediment Control Manual and ESC Permits] [ ].

2. Tree and vegetation protection is installed.

a. Protect existing site improvements, trees, and shrubs to remain to preclude damage during construction.

b. Follow the provisions set forth in 01 56 39, Temporary Tree and Plant Protection for all temporary tree and plant protection measures.

3. Temporary [security] fencing is installed [along the Limits of Disturbance] [as shown on Drawings].

4. Notification of utility agencies; disconnect or arrange for disconnection of utilities (if any) affected by required work. Keep all active utilities intact and in continuous operation.

3.4 PROTECTION

Ensure items to remain are schedule or indicated on Drawings.

A. Utilities: Locate, identify, and protect utilities located by utilities and indicated on the Drawings to remain from damage.

B. Survey control: Protect benchmarks, survey control points, and existing structures from damage or displacement.

The following paragraph is very general in its protect measures.

When protection to existing plant life is required to be more extensive than described in the following paragraph, use Section 01 56 39, Temporary Tree and Plant Protection.

C. Preservation and Trimming of Trees, Shrubs, and Other Vegetation:

1. Avoid injury to trees, shrubs, vines, plants, grasses, and other vegetation growing outside of the areas to be cleared and grubbed and those trees and shrubs designated to be preserved.

2. Protect existing trees and shrubs against cutting, breaking, or skinning of roots, skinning and bruising of bark, smothering of roots by stockpiling construction materials, excavated materials, excess foot or vehicular traffic, and parking of vehicles within drip line.

3. Provide temporary guards, as necessary, to protect trees and vegetation to be left standing.

4. Temporarily cover exposed roots with wet burlap to prevent roots from drying out, cover with earth as soon as possible.

5. Provide protection for roots and limbs over 1-1/2-inch diameter cut during construction operations. Coat cut faces with emulsified asphalt.

6. Repairable damage to trees and shrubs designated to remain shall be made by a professional tree surgeon approved by the Engineer. Cost shall be borne by the Contractor.

D. Landscaped Areas:

1. When any portion of the Work crosses private property or landscaped areas, excavate topsoil separately and pile it on the opposite side of the trench from the subsoil.

2. Conduct Work in a manner that will restore original conditions as nearly as practicable.

3. Remove and replace any trees, shrubs, plants, sod, or other vegetative material as needed to complete Work.

4. All shrubs or plants shall be balled by experienced workers, carefully handled and watered, and replaced in their original positions without damage. Sod shall be handled in a similar manner.

5. Wherever sod cannot be saved and restored, the ground must be reseeded and cared for until a stand of grass is reestablished.

6. Plants or shrubs killed or destroyed shall be replaced and paid for by the Contractor.

7. It is the intent of this paragraph that the Contractor shall leave the surface and plantings in substantially the same conditions as before the Work is undertaken.

E. Miscellaneous Site Features: Protect all existing miscellaneous site features from damage by excavating equipment and vehicular traffic, including but not limited to existing structures, fences, mailboxes, sidewalks, paving, and curbs.

F. Repair and Replacement:

1. Damaged items, including but not restricted to those noted above, shall be repaired or replaced with new materials as required to restore damaged items or surfaces to a condition equal to and matching that existing prior to damage or start of work of this contract.

2. Any damage to existing facilities or utilities to remain as caused by the Contractor's operations shall be repaired at the Contractor's expense.

3.5 LIMITS

Detail this subsection as appropriate to Project. General recommendations and minimum requirements provided herein.

A. As follows[, **but not to extend beyond Limits of Disturbance and within the approved disturbance limits in the Environmental Zones**]:

1. Excavation: 5 feet beyond top of cut slopes.

2. Trench Excavation: 6 feet from trench centerline, regardless of actual trench width.

3. Fill:

a. Clearing and Grubbing: 5 feet beyond toe of permanent fill.

b. Stripping: 2 feet beyond toe of permanent fill.

4. Structures: 15 feet outside of new structures.

5. Roadways: Clearing, grubbing, scalping, and stripping 5 feet from roadway shoulders.

6. Other Areas: As shown.

B. Remove rubbish, trash, and junk from entire area within the Limits of Disturbance as material is generated. Stockpiling shall not be permitted without written approval of Owner.

3.6 CLEARING AND GRUBBING

A. Clear and grub areas within limits shown in approved Clearing, Grubbing, and Stripping Plan.

B. Except in areas to be excavated, all holes resulting from the clearing and grubbing operations shall be backfilled and compacted in accordance with the applicable sections of these Specifications.

C. Clearing:

1. Remove trees, saplings, snags, stumps, shrubs, brush, vines, grasses, weeds, and other vegetative growth within the clearing limits shown on the Drawings, except those trees and shrubs noted to remain on the Drawings or as directed by the Engineer.

2. Clearing shall be performed in such a manner as to remove all evidence of the presence of vegetative growth from the surface of the Project Site and shall be inclusive of sticks and

branches of thickness or diameter greater than 3/8-inch and of grasses, weeds, exceeding 12 inches in height except as otherwise indicated.

3. Clear undergrowth and deadwood, without disturbing subsoil.

D. Grubbing: Clear areas required for access to site and execution of Work and remove all stumps, root wads, and roots over 1-inch diameter to the following depths:

1. Future Structures and Building Areas	24 Inches
2. Roads and Parking Areas	18 Inches
3. All other Areas	12 Inches

3.7 TREE REMOVAL

A. Exercise care in cutting, felling, trimming, and handling of those trees shown for removal to prevent damage to neighboring trees and structures to remain.

B. Tree Salvage: As shown on the Drawings.

C. No trees may be removed unless approved and permitted by the Engineer.

D. Do not top trees unless otherwise specified or approved by Owner in writing.

Include the following item if additional detail is required for this work.

E. Refer to Section 01 56 39, Temporary Tree and Plant Protection for tree protection requirements.

3.8 REMOVAL AND DISPOSAL

A. Native vegetation may be mulched and used on Site.

B. Asphalt and Gravel Surfaces:

1. Asphalt, concrete, and gravel surfaces designated for removal shall be done to full depth.

2. Asphalt, concrete, and gravel removed at Site may be reused at Site where shown on the Drawings or following approval of the Engineer.

3. Haul removed asphalt, concrete, and gravel which is unsuitable for reuse or that exceeds quantity required.

C. Remove debris, rock, abandoned piping, and extracted plant life from Site.

D. Remove from the Site all debris, materials, equipment, and items found thereon and materials and debris resulting from the Work, except as otherwise indicated.

1. All existing improvements designated on the Drawings or specified to be removed including but not limited to structures, pipelines, walls, footings, foundations, slabs, pavements, curbs, fencing, and similar structures occurring above, at, or below existing ground surface shall be included in the Work.

2. Unless otherwise specified, any resulting voids shall be thoroughly cracked out for drainage and backfilled with suitable excavated or imported material compacted to the density of the adjacent soil.

E. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

F. Do not burn or bury materials on site. Leave site in clean condition.

G. Removal: All material resulting from demolition, clearing, and grubbing, and trimming operations shall be removed from the Site and disposed of in a lawful manner. Materials placed on property of private property owners shall be by written permission only.

H. Cleanup: During and upon completion of work, promptly remove all unused tools and equipment, surplus materials, and debris.

I. Adjacent areas shall be returned to their existing condition prior to the start of Work.

3.9 CLEANUP

A. During the time Work is in progress, make every effort to maintain the Site in a neat and orderly condition.

B. All refuse, broken pipe, excess fill material, cribbing, and debris shall be removed as soon as practicable.

C. Should the Work not be maintained in a satisfactory condition, the Owner may cause the work to stop until the cleanup of the Work has been done to the satisfaction of the Engineer.

D. The Work will not be considered complete, or the final payment certificate issued until all rubbish, unused material, or equipment shall have been removed and the premises left in a condition satisfactory to the Owner and the Engineer.

END OF SECTION

SECTION 31 22 13 - ROUGH GRADING

Some of the paragraphs may be deleted. When deleting, do not renumber all the paragraphs. Simply leave the section number and title as is, delete the text, and add the words "Not Used".

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes rough grading and filling associated with contouring of Site in preparation for building excavation and subsequent site work.

B. Section Includes:

1. Excavating topsoil
2. Excavating subsoil
3. Cutting, grading, filling, and rough contouring of Site

C. Related Sections:

1. Section 01 45 00, Quality Control
2. Section 31 05 13, Soils for Earthwork
3. Section 31 05 16, Aggregates for Earthwork
4. Section 31 10 00, Site Clearing
5. Section 31 23 16, Excavation
6. Section 31 23 17, Trenching
7. Section 31 23 18, Rock Removal
8. Section 31 23 23, Fill

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

Select appropriate AASHTO standard based upon input/standards of client.

If no preference is standard, standard is T99.

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

OR

2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

B. ASTM International (ASTM):

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

For #2, select appropriate ASTM standard based upon input/standards of client.

ASTM D698 test methods correspond with AASHTO T99, ASTM D1557 test methods correspond with AASHTO T180.

2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))

OR

3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

4. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate

5. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head)

6. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.3 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Soils for Earthwork: As specified in Section 31 05 13, Soils for Earthwork.

C. Aggregates for Earthwork: As specified in Section 31 05 16, Aggregates for Earthwork.

1.4 CLOSEOUT SUBMITTALS

Use the following paragraph only when utilities are present in work area.

If not used, delete text, and add "Not Used".

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C136, ASTM D2419, and ASTM D2434.

PART 2 PRODUCTS

2.1 MATERIALS

Use the following paragraphs only when filling is to be part of this section. Edit A for type of fill material used. (Type S fill materials are soils. Type TS fill materials are topsoils. Type A fill materials are granular.)

A. Subsoil Fill: Type [S1] [S2] [S1 and S2] as specified in Section 31 05 13, Soils for Earthwork.

B. Topsoil: As specified in Section 31 05 13, Soils for Earthwork.

1. Type TS1, Select Native Topsoil Material, as may be available.

2. TS2, Imported Topsoil Material, as may be required.

Edit where specifically shown on the drawings if available.

C. Structural Fill: Type A1, Dense-Graded Aggregate as specified in Section 31 05 16, Aggregates for Earthwork. Size of aggregate as shown on the Drawings [or call out here].

D. Granular Fill: Type A2, Granular Drain Backfill Material as specified in Section 31 05 16, Aggregates for Earthwork. Size of aggregate as shown on the Drawings [or call out here].

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify survey benchmark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

Insert local utility locating service telephone number.

Oregon 1-800-332-2344

Washington 1-800-424-5555

Idaho 1-800-342-1585

A. Call Local Utility Line Information service at<_____> not less than 3 working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

2. Notify Engineer of any potential conflicts resulting from utility locations and the Drawings.

3. Notify utility company to remove and relocate utilities, as may be necessary.

B. Identify required lines, levels, contours, and datum.

C. See Section 31 10 00, Site Clearing for additional requirements in protection of existing utilities, survey control, plant life, and landscaped areas in coordination with the Work of this Section.

3.3 TOPSOIL EXCAVATION

A. Excavate and stockpile topsoil as specified in Section 31 05 13, Soils for Earthwork.

3.4 SUBSOIL EXCAVATION

Subsoil excavation is also described in Section 31 05 13; coordinate requirements.

A. Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded as shown on the Drawings.

B. When practical, do not excavate wet subsoil. When wet subsoil must be excavated and is to be reused on site for the Work, process wet material to obtain optimum moisture content.

C. Stockpile excavated material in area designated onsite in accordance with Section 31 05 13, Soils for Earthwork.

D. When excavating through roots, perform Work by hand and cut roots with sharp axe.

Coordinate slope benching requirements below with geotechnical reporting.

E. Benching Slopes: Horizontally bench existing slopes greater than 1:2 to key placed fill material to slope to provide firm bearing.

F. Stability: Replace damaged or displaced subsoil as specified for fill.

3.5 FILLING

A. General:

1. Grading and filling operations shall not take place when weather conditions and moisture content of fill materials prevent the attainment of specified density.

2. Vertical curves or roundings at abrupt changes in slope shall be established as approved by Engineer.

3. Bring all graded areas to a relatively smooth, even grade and slope by blading or dragging. Remove high spots and fill depressions.

B. Fill areas to contours and elevations shown on the Drawings with unfrozen materials.

C. Topsoil Fill:

1. Scarify prepared subgrade to depth of [4] [ ] inches immediately prior to placing topsoil.

2. Place topsoil in areas to be seeded to depths indicated on the Drawings, minimum depth of [6] [ ] inches.

3. Place topsoil material loose; do not compact, do not place in wet or muddy conditions.

D. Place material in continuous layers as follows:

1. Subsoil Fill: Maximum 8 inches compacted depth.

2. Structural Fill: Maximum 12 inches compacted depth.

3. Granular Fill: Maximum 12 inches compacted depth.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Slope grade away from building minimum 2 percent slope for minimum distance of 10 feet, unless noted otherwise.

G. Make grade changes gradual. Blend slope into level areas.

H. Repair or replace items indicated on the Drawings to remain which are damaged by excavation or filling. All costs shall be borne by the Contractor.

3.6 TOLERANCES

Edit tolerance to fit Project. Typical is "1/10 of a foot".

A. Top Surface of Subgrade: Plus or minus <_____> from required elevation.

3.7 FIELD QUALITY CONTROL

Select test standards referenced in the following paragraph appropriate for fill materials and Project requirements. Consult geotechnical report.

AASHTO T99 or AASHTO T180

AASHTO T99 is testing standard.

A. Perform laboratory material tests in accordance with <_____>.

B. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D6938

2. Moisture Tests: ASTM D3017

C. Frequency and location of testing is dependent upon type of material placed. See Section 01 45 00, Quality Control for testing requirements.

D. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest at the sole expense of the Contractor.

END OF SECTION

SECTION 31 23 16 – EXCAVATION

Some of the paragraphs may be deleted. When deleting, do not renumber all the paragraphs. Simply leave the section number and title as is, delete the text, and add the words "Not Used".

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes excavation required for building foundations, [down to pile caps or piers], site structures, or under slabs-on-grade or paving. Excavating for utilities outside building is included in Section 31 23 17, Trenching.

B. Section Includes:

1. Excavating for building foundations
2. Excavating for paving, roads, and parking areas
3. Excavating for slabs-on-grade
4. Excavating for site structures
5. Excavating for landscaping

C. Related Sections:

Edit the following paragraph to fit your project.

For Division 26, input required from electrical/control subconsultant.

1. Section 01 45 00 - Quality Control
2. Section 02 41 00 - Demolition
3. Section 26 42 00 - Cathodic Protection
4. Section 31 05 13 - Soils for Earthwork
5. Section 31 05 16 - Aggregates for Earthwork
6. Section 31 10 00 - Site Clearing
7. Section 31 22 13 - Rough Grading
8. Section 31 23 17 - Trenching
9. Section 31 23 18 - Rock Removal
10. Section 31 23 19 - Dewatering
11. Section 31 23 23 - Fill

12. Section 31 50 00 - Excavation Support and Protection

13. [Section XX XX XX – Aggregate Pier Foundation Systems].IN PROCESS.

14. Section 33 11 10 - Water Utility Distribution and Transmission Piping.

15. [Supplemental Information: Geotechnical report; bore hole locations, and findings of subsurface materials.]

Commented [JW1]: Technical Lead to review

1.2 DEFINITIONS

A. Common Excavation: All excavation required for Work, regardless of the type, character, composition, or condition of the material encountered. Common Excavation shall further include all debris, junk, broken concrete, and all other material. All excavation shall be classified as Common Excavation, unless provided as Rock for under Section 31 23 18, Rock Removal below.

B. Common Material: All soils, aggregate, debris, junk, broken concrete, and miscellaneous material encountered in Common Excavation, excluding rock as defined below.

C. Concrete Excavation: The removal of pieces of concrete larger than 1 cubic yard in volume that requires drilling, splitting and breaking methods, or a necessitating a trench width increase of 18 inches or more than the width of the preceding 10 feet of trench. Concrete excavation includes materials composed of Portland cement that are not identified other than manholes, structures, sewer pipe, or other appurtenances.

D. Exploratory Excavation: The removal and replacement of material from locations shown on the Drawings, or as directed for the purpose of investigating underground conditions and identifying potential utility conflict between existing and proposed utilities.

E. Overbreak: Material beyond and outside of the slope limits established by the Owner's Representative, which becomes displaced or loosened during excavation and is excavated.

F. Pothole Excavation: Pothole excavation is the removal and replacement of all materials via coring, vacuum extraction, or similar method, not classified as exploratory excavation, for the purposes of locating an underground utility and to investigate underground conditions.

G. Rock Removal: As defined in Section 31 23 18, Rock Removal.

H. Spoils: Excavated materials from Site unsuitable for use as fill or not required for backfill and grading.

I. Unsuitable Materials: See Spoils.

1.3 REFERENCES

A. Local utility standards when working within 24 inches of utility lines.

1.4 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

Edit paragraph below as may be needed for Project.

Use Excavation Protection Plan below for minor excavation projects. For projects requiring larger shoring systems, use Section 31 50 00 - Excavation Support and Protection.

B. Excavation Protection Plan: At a minimum, to include the following:

1. Methods and sequencing of mass excavation.
2. Proposed onsite and off-site spoil disposal locations.
3. Anticipated difficulties and proposed resolutions.
4. Proposed routes for Owner's access to Owner's facilities impacted by excavation Work.
5. Proposed haul routes.

[OR]

C. Excavation support plan and utility protection plan as specified in Section 31 50 00, Excavation Support and Protection.

1.5 QUALITY ASSURANCE

A. Allowable Tolerances: Final grades shall be plus or minus 0.1-foot.

B. Provide adequate survey control to avoid unauthorized over-excavation.

C. Weather Limitations:

1. Material excavated when frozen or when air temperature is less than 32 degrees Fahrenheit (F) shall not be used as fill or backfill until material completely thaws.
2. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

1.6 QUALIFICATIONS

Edit paragraph below as may be needed for Project. Delete if not needed. Note some clients allow specialty contractors to be pre-qualified prior to bidding, while others can only ask for a Statement of Qualifications following the bid.

Prequalified Earthwork Contractors typically specified for construction projects with adverse existing site conditions, large quantities of removal/fill, and subsurface improvements.

Special minimum experience qualifications apply to the [reservoir excavation] [and] [subgrade preparation] [other?] for this Project. The Earthwork Contractor must be qualified by the Engineer [prior to bidding]. A Statement of Qualifications Form shall be submitted to the Engineer for review and approval by those prospective earthwork contractors not already listed as prequalified contractors in Section 00 21 13, Instructions to Bidders. Refer to Section 00 21 13, Instructions to Bidders and Section 00 20 60, Earthwork Contractor Statement of Qualifications Form for prequalification information.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 PREPARATION

A. Prior to commencing work in this Section, become familiar with site conditions. In the event discrepancies are found, notify the Engineer as to the nature and extent of the differing conditions.

Insert local utility locating service telephone number.

Oregon 1-800-332-2344

Washington 1-800-424-5555

Idaho 1-800-342-1585

B. Call Local Utility Line Information service at <_____> not less than 3 working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

2. Coordinate with and notify utility companies should it be necessary to remove or relocate facilities.

C. Identify required lines, levels, contours, and datum.

D. See Section 31 10 00, Site Clearing for additional requirements in protection of existing utilities, survey control, plant life, and landscaped areas in coordination with Work in this Section.

3.2 SITE CONDITIONS

A. Quantity Survey: The Contractor shall be responsible for calculations for quantities and volume of cut and fill from existing site grades to finish grades established under this contract as indicated in the Drawings or specified and shall include the cost for all earthwork in the total basic bid.

B. Dust Control: Must meet all federal, state, and local requirements. Protect persons and property from damage and discomfort caused by dust. Water surfaces as necessary and when directed by Engineer to quell dust.

C. Soil Control: Soil shall not be permitted to accumulate on surrounding streets or sidewalks nor to be washed into sewers.

3.3 EXISTING UNDERGROUND UTILITIES

A. Protect active utilities encountered, located or otherwise, and notify persons or agencies owning same.

B. Remove inactive or abandoned utilities from within the project grading limits in accordance with Section 33 05 50, Existing Pipe Abandonment.

C. For sewer and other miscellaneous drainage facilities, fill and plug pipes as follows:

1. General:

   a. Remove all structures to a minimum of 3 feet below subgrade, unless otherwise noted.

   b. Cover top surface of all abandoned structures with two sheets of nonwoven geotextile, extended at least 1-foot beyond the outside walls of the abandoned manhole, sump, or basin.

   c. Plug all abandoned pipes with permanent plugs as specified in Section 33 05 50, Existing Pipe Abandonment.

2. Sumps:

   a. Remove existing sediment, soil, and water. Properly dispose of these materials in accordance with the requirements of these specifications.

   b. Remove top cone and first solid concrete section to a depth of approximately 8 to 10 feet below ground.

   c. Fill sump with flowable fill as specified in Section 31 23 24, Flowable Fill.

   d. Backfill remaining voids for facilities within existing or proposed roadways with approved materials meeting the requirements of Section 32 11 23, Aggregate Base Courses.

3. Salvaging Manhole Frames, Covers, and Grates:

   a. Remove manhole frames, covers, and grates scheduled for salvage and store in approved location.

   b. Frames, grates, and covers meeting Specifications may be salvaged from structures to be adjusted and may be reused in the Work if of suitable size and condition.

   c. Replace, at no additional cost to the Owner, all items damaged or lost by the Contractor with similar items that are comparable in all respects with those they are to replace, and which are adequate for the intended purpose.

   d. Clean salvaged components to be reused of foreign material by methods that will not harm the components.

4. Existing Manhole Frames and Covers: Manhole frames and covers removed by the Contractor are the property of the Owner. Notify the Engineer a minimum of 48 hours before removal to arrange for pickup of the removed frames and covers, if not reused.

3.4 PRESERVATION OF EXISTING IMPROVEMENT

The following paragraph is intended to cover incidental occurrences. When extensive or difficult excavation is required, specify protection of structures accordingly.

Specify requirements for preconstruction survey to determine specific underpinning, needling, or shoring methods appropriate for Project conditions.

Additionally, recommend Owner conduct preconstruction survey of nearby existing structures to determine if existing damage is present in structure prior to nearby excavation activities.

When extensive Work in this area is anticipated, consider developing separate Section.

A. Protect adjacent existing structures which may be damaged by excavation work.

1. Conduct operations in such a manner that existing street facilities, utilities, railroad tracks, structures, and other improvements, which are to remain in place, will not be damaged. Furnish and install cribbing and shoring or whatever means necessary to support material around existing facilities, or to support the facilities themselves, and maintain such supports until no longer needed.

2. Open slopes shall not be cut within 5 feet of any existing spread footings unless approved by the Engineer.

3. Do not interfere with 45 degree bearing splay of foundations unless approved by the Engineer

4. Excavated material shall not be placed adjacent to existing or proposed structures.

3.5 EXCAVATION

A. General:

1. Method of excavation shall be the Contractor's option, but care shall be exercised as final grade is approached to leave it in undisturbed condition.

2. If the final grade for supporting structures is disturbed, it shall be restored to requirements of these Specifications and satisfaction of the Engineer at no additional cost to Owner.

3. The Contractor is advised that footings should be poured as soon as possible to minimize unfavorable final grade conditions from developing.

4. Provide all measures to ensure public safety.

B. Control of Water:

1. Provide and maintain equipment to remove and dispose of water during the course of the work of this Section and keep excavations dry and free of frost or ice.

2. Bearing surfaces that become softened by water or frost must be re-excavated to solid bearing at Contractor's expense and backfilled with compacted crushed rock at Contractor's expense.

3. Grade top perimeter of excavation to prevent surface water from draining into excavation.

4. See additional requirements in Section 31 23 19, Dewatering.

C. Frozen Ground: Frost protection shall be provided for all structural excavation work. Foundation work shall not be placed on frozen ground.

D. Excavate material of every nature and description to the lines and grades as indicated in the Drawings and/or as required for construction of the facility.

1. Allow for forms, shoring, working space, granular base, topsoil, and similar items, wherever applicable.

2. Trim excavations to neat lines. Remove loose matter and lumped subsoil.

E. Excavated Materials: Soils excavated at Site will be treated and used as one of two general categories of material as provided below.

1. Fill:

a. Subsoil Type S1, Select Native Fill, as approved for use by Engineer.

2. Spoils:

a. Ensure there is sufficient suitable material available to complete embankments and other required fillings prior to disposing of any excavated materials.

b. Make arrangements for disposal of spoils and include as part of contract work in preparing of project bids.

c. Landfill permit or written permission from private property owner to be obtained by the Contractor and provided to the Engineer.

For projects requiring larger shoring systems, use Section 31 50 00 - Excavation Support and Protection instead of F below.

For minor excavation projects, use general Shoring language below.

F. Shoring:

Edit paragraph below as may be needed for Project.

1. As specified in Section 31 50 00, Excavation Support and Protection.

[OR]

2. The Contractor shall be solely responsible for excavation protection and worker safety and shall provide sheeting and shoring wherever required, all in accordance with current local, state, and federal laws, codes, and ordinances.

3. Where shoring, sheet piling, sheeting, bracing, lagging, or other supports are necessary to prevent cave-ins or damage to existing structures, it shall be the responsibility of the Contractor to design, furnish, place, maintain, and remove such supports in accordance with applicable ordinances and safety requirements.

4. The design, planning, installation, and removal of all sheeting accomplished in such a manner as to maintain the undisturbed state of the soil below and adjacent to the excavation.

G. Slope existing banks with machine to angle of repose or less until shored.

1. Shape, trim, and finish cut slopes to conform to lines, grades, and cross-sections shown, with proper allowance for topsoil or slope protection, where shown.

2. Protection of excavation side slopes:

a. Use excavation methods that will not shatter or loosen excavation slopes.

b. Where practical, excavate materials without previous loosening and in limited layers or thickness to avoid breaking the material back of the established slope line.

c. Avoid overbreaks. Overbreak is incidental to the Work, except in cases where the Owner's Representative determines that such overbreak was unavoidable.

d. Excavation in rock or rocky cuts:

1) Once completed, thoroughly test the slopes with bars or other approved means to remove all loose, detached, broken, or otherwise unstable material.

2) Remove jutting points. Scale slopes using mine scaling rods or other approved methods to remove loose or overhanging materials and provide a safe, trim, neat, and stable condition.

3) Dispose of the materials removed under this subparagraph in the same manner as other excavated material.

e. Remove all exposed roots, debris, and all stones more than 3 inches in size which are loose or could become loosened.

3. Construct slopes free of all exposed roots.

4. Construct slopes free of unstable rock and loose stones exceeding 3 inches in diameter.

5. Round tops of cut slopes in soil to not less than a 6-foot radius, provided such rounding does not extend off-site, outside of easements, outside of rights-of-way, or adversely impacts existing facilities, adjacent property, or completed Work.

6. Trim all surfaces neatly and smoothly.

H. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 31 23 17, Trenching and Section 31 23 23, Fill.

I. Notify Engineer of unexpected subsurface conditions.

J. Over-excavation for Unsuitable Foundation Conditions:

1. Cross-sectional dimensions and depths of excavations shown in the Drawings shall be subject to such changes as may be found necessary by the Engineer to secure foundations free from soft, weathered, shattered, and loose material or other objectionable materials.

2. Unsuitable materials encountered shall be removed and replaced with Coarse Aggregate Type A1, 2-1/2-inch – 0 gradation, as specified in Table 31 05 16-A of Section 31 05 16, Aggregates for Earthwork. All material placed shall be compacted to 95 percent of maximum dry density.

3. Unsuitable materials shall be removed and replaced only as directed in writing by Engineer.

K. Rock Removal:

1. Remove boulders and rock up to 1/2 cubic yard measured by volume per the requirements of this Section.

2. Remove larger boulders and rock material as specified in Section 31 23 18, Rock Removal.

3. Concrete removal, as defined herein, shall be treated as Rock Removal.

L. Stockpile excavated material in area(s) designated on or off site in accordance with Section 31 05 13, Soils for Earthwork.

3.6 FIELD QUALITY CONTROL

A. Perform excavation and controlled fill operations in accordance with the requirements of this Section.

B. Coordinate the visual inspection and approval of all bearing surfaces by Engineer before installing subsequent work.

3.7 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability and store excavated materials at a distance from top of excavation.

B. Protect structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

SECTION 31 23 17 - TRENCHING

Note: 8/4/17: This was modified "Pipe Bedding, Pipe Zone and Trench Backfill Classifications" (Article 1.3(J), Definitions) for materials designated in Class A, B, C, D, or E backfill. Classifications now match those typically used by clients and Oregon Department of Transportation.

Some of the paragraphs may be deleted. When deleting, do not renumber all the paragraphs. Simply leave the section number and title as is, delete the text, and add the words "Not Used".

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the requirements for excavation and backfill of all utilities, including installation of pipe bedding, pipe zone backfill, trench backfill, and related Work as shown on the Drawings and as specified.

B. Section includes:

1. Excavating trenches for pipe, utility vaults, and other utilities.
2. Compacted fill from top of utility bedding to final grades.
3. Trench and utility vault backfilling and compaction.

C. Related Sections:

Edit the following paragraph to fit your project requirements.

1. Section 01 45 00, Quality Control
2. Section 03 30 00, Cast-In-Place Concrete
3. Section 31 05 13, Soils for Earthwork
4. Section 31 05 16, Aggregates for Earthwork
5. Section 31 10 00, Site Clearing
6. Section 31 22 13, Rough Grading
7. Section 31 23 16, Excavation
8. Section 31 23 18, Rock Removal
9. Section 31 23 23, Fill
10. Section 31 23 24, Flowable Fill
11. Section 31 37 00, Riprap
12. Section 33 11 10, Water Utility Distribution and Transmission Piping

13. Section 33 31 10, Sanitary Utility Sewerage Piping: Sanitary sewer piping and bedding

14. Section 33 41 10, Storm Utility Drainage Piping

D. [**Supplemental Information: Geotechnical report; bore hole locations and findings of subsurface materials.**]

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

Select only one AASHTO standard based upon input/standards of client.

If no preference is standard, standard is T99.

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

OR

2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

B. ASTM International (ASTM):

1. ASTM C403 - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance

Select only one ASTM standard based upon input/standards of client.

ASTM D698 test methods correspond with AASHTO T99

ASTM D1557 test methods correspond with AASHTO T180

2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))

OR

3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

4. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

6. D4832, Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders

1.3 DEFINITIONS

A. Controlled Low Strength Material (CLSM): Also referred to as Flowable Fill. Lean cement concrete fill. A self-compacting, cementitious material.

B. Flexible Pipe: For the purposes of these Specifications, tubing between 1/2-inch and 4-inch diameter constructed of polyvinyl chloride (PVC) and high-density polyethylene (HDPE) are considered flexible pipes. HDPE piping 4 inches in diameter and larger is also considered flexible pipe.

C. Geosynthetics: Geotextiles, geogrids, geomembranes, and drainage composite materials.

D. Imported Material: Materials obtained from sources offsite, suitable for specified use.

E. Lift: Loose (uncompacted) layer of material.

F. Obstructions: Items which may be encountered during utility and vault trenching which do not require replacement.

G. Optimum Moisture Content:

1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.

2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.

H. Pipe Bedding: Trench backfill zone for full trench width which extends from the bottom outside surface of the pipe to a minimum of 6 inches below the bottom outside surface of pipe, conduit, cable, or duct bank to the trench foundation so as to uniformly support the barrel of the pipe.

I. Pipe Zone: Trench backfill zone for full trench width which extends from the bottom outside surface of the pipe to a minimum of [12] [6] inches above the top outside surface of pipe, conduit, cable, or duct bank.

Update Class reference to align with trench detail call outs.

J. Pipe Bedding, Pipe Zone, and Trench Backfill Classifications:

1. Class A: Backfill with suitable native or imported material that is approved to meet the characteristics required for the specific surface loading or other criteria of the backfill zone.

2. Class B: Backfill with imported granular material consisting of gravel or crushed rock meeting the requirements of this Section and Coarse Aggregate Type A1 as specified in Section 31 05 16, Aggregates for Earthwork; typical designated size shall be 1-inch-0 or 3/4-inch-0.

3. Class C: Backfill with Fine Sand, as specified in Section 31 05 16, Aggregates for Earthwork.

4. Class D: Backfill with approved pit run or bar run material, well-graded from coarse to fine; maximum dimension shall be 3 inches.

5. Class E: Backfill with CLSM. See Section 31 23 24, Flowable Fill.

K. Pothole Excavations: Removal and replacement of all materials via coring, vacuum extraction, or similar method for the purposes of locating an underground utility and to investigate underground conditions.

L. Prepared Trench Bottom: The bottom of the trench on which the pipe bedding is to lie, and which provides support for the pipe.

M. Relative Compaction: Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM Standards.

N. Rigid Pipe: For the purposes of these Specifications, pipe constructed of PVC, ductile iron, steel, concrete, and clay pipes are considered rigid pipes.

O. Sewer, Pipes, and Mains: Conduits of circular or other geometric shapes, used to convey liquids or gases, or other material.

P. Trench Backfill: Trench backfill zone for full trench width extending from the top of the pipe zone to pavement base rock, ground surface, or other surface material.

Q. Trench Stabilization: Removal of unsuitable material in the bottom of a trench and replacement with specified material for support of a pipe, main, conduit, structure, or appurtenances.

R. Utility: Any buried pipe, duct, conduit, or cable.

S. Well-Graded: A mixture of particle sizes with no specific concentration or lack thereof of one or more sizes that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

1.4 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

Use Excavation Protection Plan below for minor excavation projects. For projects requiring larger shoring systems, use Section 31 50 00 - Excavation Support and Protection.

B. Excavation Protection Plan: At a minimum, to include the following:

1. Methods and sequencing of mass excavation.
2. Proposed on-site and off-site spoil disposal locations.
3. Anticipated difficulties and proposed resolutions.
4. Proposed routes for Owner's access to Owner's facilities impacted by excavation Work.
5. Proposed haul routes.

[OR]

C. Excavation support plan and utility protection plan as specified in Section 31 50 00, Excavation Support and Protection.

Edit Product Data requirements for Project needs.

D. Product Data:

1. Geotextile fabric, indicating fabric and construction

2. Marking tapes

3. Tracer wire

4. Connectors for tracer wire and/or marking tapes

5. Tracer wire locate boxes

6. Marker balls

7. Locator stations

8. Ground wires

9. Plastic or copper markers for service laterals.

E. Imported Materials:

1. Materials Source: Submit name and location of imported fill materials suppliers.

2. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

3. Submit results of aggregate sieve analysis and standard proctor test for granular material.

F. CLSM: Mix designs in accordance with Submittal requirements of Section 31 23 24, Flowable Fill.

G. Concrete: Mix designs in accordance with Submittal requirements of Section 03 30 00, Cast-in-Place Concrete.

1.5 QUALITY ASSURANCE

A. Subsoil and topsoil fill materials: In accordance with Quality Assurance requirements stated in Section 31 05 13, Soils for Earthwork.

B. Aggregate fill materials: In accordance with Quality Assurance requirements stated in Section 31 05 16, Aggregates for Earthwork.

C. CLSM:

1. In-place testing: In accordance with ASTM C403.

2. Compressive testing: In accordance with ASTM D4832.

D. Allowable Tolerances: Final grades shall be plus or minus 0.1-foot.

1.6 QUALIFICATIONS

Edit paragraph below as may be needed for Project.

If not needed replace text with "Not Used".

Note some clients allow specialty contractors to be pre-qualified prior to bidding, while others can only ask for a Statement of Qualifications following the bid.

Prequalified Transmission Main Contractors typically specified for construction projects with adverse existing conditions, restricted utility corridors, large quantities of main installation, and large diameter projects.

Special minimum experience qualifications apply to the installation of water mains for this Project. The Water Main Contractor must be qualified by the Engineer [prior to bidding]. A Statement of Qualifications Form shall be submitted to the Engineer for review and approval by those prospective water main contractors not already listed as prequalified contractors in Section 00 21 13, Instructions to Bidders. Refer to Section 00 21 13, Instructions to Bidders and Section 00 20 50, Water Main Contractor Statement of Qualifications Form for prequalification information.

1.7 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

B. Coordinate trenching and utility installation work with other work at utility construction location occurring near or adjacent to specified herein.

PART 2 PRODUCTS

2.1 FILL MATERIALS

Coordinate and edit material sections indicated in paragraphs below. Renumber if necessary.

Select fill materials as appropriate to site conditions. Check Geotechnical reporting to for trench backfill material recommendations.

Subsoil fill for Class A trench backfill conditions.

A. Subsoil Fill: Type S1, Select Native Material as specified in Section 31 05 13, Soils for Earthwork.

Imported granular fill for Class B trench backfill conditions.

B. Imported Granular Fill: Coarse Aggregate Type A1, Dense-Graded Aggregate with gradation as shown in the Drawings and specified in Section 31 05 16, Aggregates for Earthwork.

CLSM / concrete for Class E trench backfill conditions.

C. Concrete:

1. Lean concrete as specified in Section 31 23 24, Flowable Fill, with compressive strength of 100 pounds per square inch (psi).

2. Structural concrete as specified in Section 03 30 00, Cast-in-Place Concrete with compressive strength of 3,000 psi.

D. Drain Rock: Coarse Aggregate Type A2, Granular Drain Backfill Material with gradation as shown in the Drawings and specified in Section 31 05 16, Aggregates for Earthwork.

Sand for pipe bedding & pipe zone backfill material with polyethylene wrapped pipe or direct bury cable.

E. Sand: As specified in Section 31 05 16, Aggregates for Earthwork.

F. Trench Stabilization Material: Coarse Aggregate Type A1, Dense-Graded Aggregate, 2-1/2-inch - 0 gradation as specified in Section 31 05 16, Aggregates for Earthwork.

Edit paragraphs 2.2 – 2.5 to fit Project needs.

Information provided below per City of Portland requirements. Check against individual Owner preferences. Many of these items only required for direct bury cable and/or PVC & HDPE piping.

2.2 MARKING TAPE

A. Detectable:

1. Solid aluminum foil, visible on unprinted side, encased in protective high visibility, inert polyethylene plastic jacket.

2. Foil Thickness: Minimum 0.35 mils.

3. Laminate Thickness: Minimum 5 mils.

4. Width: 6 inches.

5. Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.

6. Joining Clips: Tin or nickel-coated furnished by Tape Manufacturer.

7. Manufacturers and Products:

a. Reef Industries; Terra Tape, Sentry Line Detectable

b. Mutual Industries; Detectable Tape

c. Presco; Detectable Tape

B. Color: In accordance with APWA Uniform Color Code for Temporary Marking of Underground Facilities and as specified in NEMA Z535.1, Safety Color Code.

Color	Facility
Red	Electric power lines, cables, conduit, and lightning cables
Orange	Communicating alarm or signal lines, cables, or conduit
Yellow	Gas, oil, steam, petroleum, or gaseous materials
Green	Sewers and drain lines

Color	Facility
Blue	Potable water
Purple	Reclaimed water, irrigation, and slurry lines

2.3 ELECTRONIC LOCATING MATERIALS

A. Marker Balls:

1. Exterior Material: High-density polyethylene.

2. Size: Maximum 4-1/2 inches in diameter.

3. Range: Locatable with standard electronic marker locating devices at depths up to 5 feet.

4. Field Type: Spherical RF field regardless of orientation.

5. Contain no floating or movable parts, and no batteries or active components.

6. Color: Provide colored marker balls per Article 2.03.B above.

7. Manufacturer and Product: Omni Marker Model 162 (green), Omni Marker Model 161 (blue), or equal.

B. Tracer Wire:

1. Direct burial No. 12 AWG solid, annealed copper-clad steel (CCS) high strength tracer wire.

2. Tensile Breaking Load: 380-pound average.

3. Jacket:

a. High molecular weight high-density polyethylene complying with ASTM D1248, 30-volt rating.

b. Color: Provide in colors per Article 2.03.B above.

4. Manufacturer and Product: Copperhead Industries; LLC, 12 CCS high strength reinforced tracer wire, or equal.

C. Tracer Wire Connectors:

1. Waterproof, corrosion proof and suitable for No. 12 AWG solid core wire.

2. Prefilled with silicone and suitable for use with low-voltage tracer lines of less than 50 volts.

3. Lug Connectors:

a. Waterproof plastic housing that encases the silicone prefilled lug terminals.

b. Manufacturer and Product: King Innovations; DryConnTM Direct Bury Lug or equal.

4. Twist Connectors:

a. Waterproof epoxy-filled packaging that encases the silicone prefilled twist connectors.

b. Manufacturer and Product: 3M Division; DBY Direct Bury Splice Kit 09053 connectors or equal.

D. Ground Wire: No. 12 AWG bare solid copper wire.

E. Locator Station:

1. Test Station:

a. Lexan® polycarbonate.

b. Color: Provide in colors per Article 2.03.B above.

2. Terminals suitable for No. 12 AWG leads.

3. Use single (two lead) locator stations with two terminals, one for ground wire and one for tracer wire, when only one tracer wire is terminated in manhole.

4. Use multi-lead locator stations with the appropriate number of terminals when 2 or more tracer wire leads are terminated in manhole.

5. Manufacturer and Product: Cott Manufacturing Company; FlangeFink® Cathodic Protection Test Station.

2.4 VISUAL IDENTIFICATION MATERIALS

A. Tracer Wire Locate Boxes:

1. Material: Polyolefin.

2. Cover:

a. Color: Provide in colors per Article 2.03.B above.

b. Provide box cover identification marking for facility type such as “Sewer Locate Wire”, as approved by Owner.

c. Locking type with a nominal 6-inch opening.

3. Manufacturer and Product: Carson Industries LLC; L Series Model 708 or equal.

B. Service Lateral Plastic or Copper Markers:

1. Service Lateral Plastic or Copper Markers: Use markers of the type that requires installation to be recessed below grade.

a. Material: Plastic or copper. In new concrete, use “new construction” markers; in existing concrete use “retrofit” markers and use adhesive recommended by the Manufacturer.

b. Plastic Pavement Markers:

1) UV stabilized and fade resistant.

2) Material: Meet or exceed a tensile strength of 3,500 psi, and meet test requirements as outlined in ASTM G53, Standard Practice for Light and Water Exposure of Nonmetallic Material.

3) Color: Provide in color per Article 2.03 B above with the words, "WARNING, BURIED [UTILITY TYPE], Call Before You Dig," molded to the top of marker.

a) Provide wording for specific facility as approved by Owner.

4) Manufacturer and Product: Rhino Marking and Protective Systems; A-TAG pavement markers or equal.

c. Copper Pavement Markers:

1) Material: Copper material chosen by Manufacturer.

2) Diameter: 1-5/32-inch.

3) Wording: Provide facility identification wording stamped on the top such as "Sewer Lateral" as approved by Owner.

4) Manufacturer and Product: Berntsen Concrete Marker; BP2-U or equal.

C. Service Lateral 2-inch by 4-inch Markers:

1. S4S Douglas fir, pressure-treated 2-inch by 4-inch lumber, utility grade or better.

2. Grade stamped by an American Lumber Standards certified inspection agency.

PART 3 EXECUTION

3.1 PREPARATION

Insert local utility locating service telephone number.

Oregon 1-800-332-2344

Washington 1-800-424-5555

Idaho 1-800-342-1585

A. Call Local Utility Line Information service at <_____> not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

2. Coordinate with and notify utility companies should it be necessary to remove or relocate facilities.

3. Maintain and protect above and below grade utilities indicated to remain.

B. Identify required lines, levels, contours, and datum locations.

C. Drawings and/or Specifications cover and govern replacement and restoration of foreseeable damage.

D. The site of an open cut excavation shall be first cleared of all obstructions preparatory to excavation in accordance with Section 31 10 00, Site Clearing.

E. See Section 31 10 00, Site Clearing for additional requirements in protection of existing utilities, survey control, plant life, and landscaped areas in coordination with Work in this Section.

1. Intent of Drawings and Specifications is that all streets, structures, and utilities be left in condition equal to or better than original condition.

2. Where damage occurs, and cannot be repaired or replaced, the Contractor shall purchase and install new material, which is satisfactory to Owner.

F. Potholing / Exploratory Test Pits: Dig such exploratory test pits and perform potholing as may be necessary in advance of trenching to determine the exact location and elevation of subsurface structures, pipelines, duct banks, conduits, and other obstructions which are likely to be encountered or need to be connected to and shall make acceptable provision for their protection, support, and maintenance of their continued operation.

G. Paved or Surfaced Streets:

1. Wherever paved or surfaced streets are cut, saw wheel, or approved cutting devices shall be used.

2. Width of pavement cut shall be as shown on the Drawings.

3. Any cut or broken pavement shall be removed from site during excavation.

H. Traffic:

1. Maintain street traffic at all times as required by the Drawings and as specified herein.

2. Erect and maintain barricades, warning signs, traffic cones, and other safety devices during construction in accordance with the latest edition of Manual of Uniform Traffic Control Devices (MUTCD), Part 6, to protect the traveling public in any area applicable.

3. Provide flaggers as required during active work in roadway areas.

I. Operations shall be confined to rights-of-way and easements provided. Avoid encroachment on, or damage to, private property or existing utilities unless prior arrangements have been made with copy of said arrangement submitted to Engineer.

3.2 EASEMENTS

A. Where portions of the Work are located on private property, easements and permits will be obtained by the Owner. Easements shall provide for the use of property for construction purposes to the extent indicated on the easements.

B. Copies of these easements and permits will be available from the Owner for inspection by the Contractor. It shall be the Contractor's responsibility to determine the adequacy of the easement obtained in every case.

C. Confine construction operations to within the easement limits or street right-of-way limits or make special arrangements with the property owners for the additional area required and notify the Engineer with a copy of the written approval from property owners of any such conditions.

D. Any damage to private property, either inside or outside the limits of right-of-way or easements provided by the Owner, resulting from Work shall be the responsibility of the Contractor. Before the Engineer will authorize final payment, the Contractor will be required to furnish the Owner with written releases from property owners where the Contractor has obtained special agreements or easements or where the Contractor's operations, for any reason, have not been kept within the construction right-of-way obtained by the Owner.

3.3 PROTECTION

A. Existing Facilities:

1. It is the intent of these specifications that all streets, structure, and utilities be left in a condition equal to or better than original condition at the completion of the Project.

2. Where damage occurs, and cannot be repaired or replaced, the Contractor shall purchase and install new material to the satisfaction to the Engineer.

3. Drawings and/or specifications cover and govern replacement and restoration of foreseeable damage.

B. Removal of Water:

1. As specified in Section 31 23 19, Dewatering.

2. At all times during construction provide and maintain ample means and devices with which to remove promptly and dispose of properly all water entering the excavations or other parts of the Work.

3. Keep all excavations dry until the utilities or vaults to be placed therein are completed. In water bearing sand, well points and/or sheeting shall be supplied, together with pumps and other appurtenances of ample capacity to keep the excavation dry as specified.

4. Dispose of water from the Work in a suitable legal manner without damage to adjacent property or structures.

C. Trench Protection:

1. Provide the materials, labor, and equipment necessary to protect trenches at all times.

2. Trench protection shall provide safe working conditions in the trench and protect the Work, existing property, utilities, pavement, etc.

3. The method of protection shall be according to the Contractor's design.

4. The Contractor may elect to use a combination of shoring, overbreak, tunneling, boring, sliding trench shields, or other methods of accomplishing the work provided the method meets the approval of all applicable local, state, and federal safety codes.

5. Damages resulting from improper shoring, improper removal of shoring, or from failure to shore shall be the sole responsibility of the Contractor.

3.4 LINES AND GRADES

A. Trench excavation for piping, utility vaults, and other utilities shall be performed to the alignment and grade as indicated on the Drawings.

B. Where grades are not shown on the Drawings, utilities shall be laid to grade between control elevations shown.

Check Owner's requirements for minimum cover. Thirty-six inches typical.

C. Water mains shall be installed with a minimum cover of <_____> inches.

D. The Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

E. Changes in the grade and horizontal alignment of the pipeline as shown on the Drawings or as provided elsewhere in the Specifications may be necessary due to unanticipated interferences or other reasons.

1. No additional compensation will be allowed the Contractor for changes in horizontal alignment.

2. No additional compensation will be allowed for changes in grade which require additional depth of trench excavation and backfill up to 2 feet from those shown on the Drawings.

F. Use laser-beam instrument with qualified operator to establish lines and grades.

3.5 OBSTRUCTIONS

A. Obstructions to the construction of the trench, such as tree roots, stumps, abandoned pilings, abandoned buildings and concrete structures, logs, rubbish, and debris of all types shall be removed without additional compensation from the Owner.

B. The Engineer may, if requested by the Contractor or Owner, make changes in the trench alignment to avoid major obstructions if such alignment changes can be made within the perpetual easement and right-of-way and without adversely affecting the intended function of the facility or increasing costs to the Owner.

3.6 INTERFERING ROADWAYS AND STRUCTURES

A. Remove, replace and/or repair any damage done during trenching activities to fences, buildings, cultivated fields, drainage crossings, and any other properties without additional compensation from the Owner.

1. Replace or repair these structures to a condition as good as or better than their pre-construction condition prior to commencing work in the area.

B. Paved Roadways:

1. Where paved roadways are cut as part of trenching activities, Class D trench backfill will be required to the bottom of pavement base.

2. New pavement shall be equal to or better than the existing paved surface.

3. New surface shall not deviate by more than 1/4-inch from the existing finish elevation.

C. Existing Structures:

1. If existing structures are encountered as part of trenching activities which will prevent construction and are not adequately shown on the Drawings, the Contractor shall notify the Engineer before continuing with the Work.

2. The Engineer may make such field revisions to the utility alignment as necessary to avoid conflict with the existing conditions.

3. The cost of waiting or "down time" during such field revisions shall be borne by the Contractor without additional cost to the Owner or liability to the Engineer.

4. If the Contactor fails to so notify the Engineer when a conflict of this nature is encountered, but proceeds with construction despite this interference, the Contractor shall do so at the Contractor's own risk with no additional payment.

3.7 TRENCHING

A. Excavate subsoil as required for construction of utilities to elevations shown on the Drawings.

B. Remove boulders and rock up to 1/2 cubic yard measured by volume per the requirements of this Section. Remove larger boulders and rock material as specified in Section 31 23 18, Rock Removal.

C. Open Trench Limit:

1. Do not advance open trench beyond the distance which will be backfilled and compacted the same day.

2. A maximum length of open trench shall not exceed [100] <___> feet at any one time.

3. Temporary resurfacing shall be completed within 300 feet of the associated open trench limit for each main pipe laying operation.

4. Cover or backfill excavations at the end of each day.

5. If the trench is not backfilled at the end of each working day:

a. Provide means to prevent caving of excavation sides, as necessary, during non-working hours.

b. Cover the excavation with a system as needed to provide public safety and prevention of entry during non-working hours.

c. Provide signed and stamped submittal of caving prevention system and cover system.

6. New trenching shall not be started when earlier trenches need backfilling, or the surfaces of streets or other areas need to be restored to a safe and proper condition.

D. Utility Crossings: Avoid horizontal and vertical conflicts with existing utilities.

1. Perform excavation within 24 inches of existing utility service in accordance with utility's requirements.

2. Vertical clearance between the new pipe and existing utilities shall be 12 inches minimum, unless otherwise noted on the Drawings.

3. Where existing utility lines are damaged or broken during trenching activities, the utility shall be repaired or replaced. For water or sewer bearing lines, care being taken to insure a smooth flow line and absolutely no leakage at the new joints.

4. All expenses involved in the repair or replacement of leaking or broken utility lines that have occurred due to the Contractor's operations shall be borne by the Contractor, and the amount thereof shall be absorbed in the unit prices of its bid.

E. Water Lines Crossing Sewer Lines: Whenever water lines cross sewer lines, the Contractor shall comply with local Health Department requirements.

1. Wherever possible, the bottom of the water line shall be 18 inches or more above the top of sewer pipe. One full length of the water line pipe shall be centered at the crossing.

2. For clearances less than 1-1/2 feet, the Contractor shall replace the existing sewer pipe with ductile iron or PVC of equal size, centered at the utility crossing, or shall encase existing sewer pipe with concrete for a minimum of 10 feet on both sides of crossing, as directed by the Engineer, at no additional cost to the Owner.

F. Excavate trenches to width and depth as indicated on Drawings. No additional payment will be provided for trenching activities beyond dimensions shown on the Drawings.

1. Excavation for trenches in which pipelines are to be installed shall provide adequate space for workers to place and joint the pipe properly and safely, but in every case the trench shall be kept to a minimum width.

Coordinate specification requirements in paragraph below with Owner's standards and Drawings.

Typical standard dimensions are provided below.

2. The width of the pipe trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench shall not exceed [12] <___> inches on either side of the pipe.

3. Excavation for utility vaults and other structures shall be wide enough to provide [18] <___> inches between the structure surface and the sides of the excavation.

4. For pipe or utility vaults to have bedding material, excavate to a depth of [6] <___> inches below the bottom of the pipe or utility vault. Care shall be taken not to excavate below depths required.

5. If over digging occurs, the trench bottom shall be filled to grade with compacted bedding material.

G. Remove water or materials that interfere with Work.

1. The trench at all times shall be kept free from water to facilitate fine grading, the proper laying and joining of pipe, and prevention of damage to completed joints.

2. Adequate pumping equipment shall be provided to handle and dispose of the water without damage to adjacent property.

3. Water in the trench shall not be allowed to flow through the pipe while construction work is in progress unless special permission to do so has been given by the Engineer.

4. An adequate screen shall be provided to prevent the entrance of objectionable material into the pipe.

5. Remove and dispose of existing abandoned sewer pipe, structures, and other facilities as necessary to construct the improvements.

a. Where the excavation activities require the removal of portions of an abandoned pipeline, masonry plugs shall be installed in the open ends of the pipe, unless otherwise noted on the Drawings or by the Engineer.

b. Coordinate with Engineer prior to plugging.

c. For plugs less than 36 inches in diameter, 8-inch-deep masonry units shall be used. For plugs in larger pipelines, 12-inch-deep masonry units shall be used.

6. The costs associated with the removal of water and materials noted above will be considered incidental to trench excavation and backfill.

H. Do not interfere with 45 degree bearing splay of foundations.

I. Over-excavation for Unsuitable Trench Foundation Conditions:

1. Cross-sectional dimensions and depths of excavations shown on the Drawings shall be subject to such changes as may be found necessary by the Engineer to secure foundations free from soft, weathered, shattered, and loose material or other objectionable materials.

2. Unsuitable materials shall be removed and replaced only as directed in writing by Engineer.

3. Unsuitable materials encountered shall be removed and replaced with Coarse Aggregate Type A1, 2-1/2-inch – 0 gradation, as specified in Table 31 05 16-A of Section 31 05 16,

Aggregates for Earthwork. All material placed shall be compacted to 95 percent of maximum dry density.

4. Install nonwoven geotextile under trench stabilization material, over the soft or yielding excavated surface.

   a. Install the nonwoven geotextile ahead of placement of the trench stabilization material, continuously along the excavation bottom and centered on the pipe centerline.

   b. Use nonwoven geotextile width equal to the pipe diameter plus 2 feet.

   c. Place laps or splices in the geotextile in the direction of the pipe laying.

J. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

K. Excavated material shall be placed at locations and in such a manner that it does not create a hazard to pedestrian or vehicular traffic or interfere with the function of existing drainage facilities or system operation.

L. Remove excess subsoil not intended for reuse from site.

M. Stockpile excavated material in area designated on site in accordance with Section 31 05 13, Soils for Earthwork.

3.8 TUNNELING

A. In lieu of open cut trenching as specified above, the Contractor may utilize tunnel methods for installation of pipe where ground conditions are favorable and such methods will not disturb foundations under curbs, sidewalks, and other structures.

1. The Engineer must approve tunneling methods prior to utility installation.

2. Where tunneling is used, payment for the pipe installation will be made for the equivalent trench excavation and backfill as if the open cut method was used. Payment will not be made for surface restoration including pavement, curbs, sidewalks, and other surface improvements whose replacement is avoided by the tunneling method.

Use the SHEETING AND SHORING subsection below for minor excavation projects, where general Sheeting & Shoring language is sufficient.

As previously noted in this Section, for projects requiring larger shoring systems, use Section 31 50 00, Excavation Support and Protection and delete the following subsection text and add "Not Used".

3.9 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, new and existing structures, and adjacent and neighboring properties and to prevent caving, erosion, settlement, and loss of surrounding subsoil.

B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

C. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.

D. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

E. Design sheeting and shoring to be removed at completion of excavation work, unless shown otherwise on the Drawings.

F. Construction Sheeting Left in Place:

1. Furnish, install, and leave in place construction sheeting and bracing when specified or when indicated or shown on the Drawings.

2. Construction sheeting and bracing originally intended for temporary installation, placed by the Contractor to protect adjacent and neighboring structures, may be left in place if desired by the Contractor and approved by the Engineer. All such sheeting and bracing left in place shall be included in the cost for excavation.

3. Any construction sheeting and bracing which the Contractor has placed to facilitate its work may be ordered in writing by the Engineer to be left in place. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating an obligation on its part to issue such orders. Failure of the Engineer to order sheeting and bracing left in place shall not relieve the Contractor of its responsibility under the contract.

4. For sheeting and shoring to be left in place as part of the completed Work, cut off minimum 18 inches below finished grade.

3.10 COMPACTION

A. Testing will be required to show specified densities of compacted backfill are being achieved by the Contractor's compaction methods.

B. Moisture Control:

1. Moisture condition backfill material to within 2 percent of optimum moisture content required for compaction throughout each lift of the fill.

2. Add moisture to granular backfill by sprinkling during compaction operation.

3. Compaction by ponding or jetting is not permitted.

C. Compact all materials and areas that are not accessible for in-place density testing, as determined by the Engineer, in place by whatever equipment and method is practicable or specified, and as approved by the Engineer.

1. Perform compaction at such moisture content as is required to produce well-filled, dense, and firm material in place that will show no appreciable deflection or reaction under the compacting equipment.

3.11 BEDDING

A. All utility vaults, potable water pipe 4-inch nominal diameter and over, all steel pipe, all concrete sewer pipe, all plastic pipe, all pipe under existing or future structures or roadways, and any and all utilities at a depth greater than 6 feet shall be laid in pipe bedding material.

B. Unless otherwise noted on the Drawings, pipe, or conduit of less than 4-inch diameter, outside structure lines and at a depth of less than 6 feet shall be bedded in native material properly shaped as specified below, all as detailed on the Drawings.

C. Compacted bedding material shall be placed the full width of the excavated trench to a depth as shown on the trench detail included on the Drawings.

1. In lieu of a detail, the depth shall be 6 inches.

D. Spread the bedding smoothly over entire width of trench to the proper grade so that the pipe is uniformly supported along the barrel.

E. Hand grade and compact each lift to provide a firm, unyielding surface along the entire pipe length. For rigid pipe, compact to at least 90 percent relative compaction.

F. Excavate bell holes at each joint to permit proper assembly and inspection of the joint.

G. Check grade and correct irregularities in bedding material.

H. Center pipes horizontally in trench width.

3.12 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

C. Maintain optimum moisture content of fill materials to attain required compaction density.

D. Place fill material, with the exception of CLSM, in continuous layers and compact in 6- to 8-inch lifts.

1. Prevent pipe from moving either horizontally or vertically during placement and compaction of pipe zone material.

2. Where trenches are under existing or future structures, paved areas, road shoulders, driveways, or sidewalks, or where designated on the Drawings or specified elsewhere in these specifications, the trench backfill shall be Class B or Class E and pipe zone backfill shall be Class B or Class E. Class B backfill shall be compacted to 95 percent of maximum density at optimum moisture content.

3. Where trenches are outside existing or future structures, paved areas, road shoulders, driveways, or sidewalks, or where designated on plans or specified elsewhere, the trench backfill shall be Class A and pipe zone backfill in these areas shall be Class B. For these locations, compaction of Class B backfill shall be to not less than 90 percent of maximum

density at optimum moisture content. Class B backfill shall be compacted to not less than 95 percent of maximum density at optimum moisture content.

E. Employ placement method that does not disturb or damage nearby or adjacent foundation perimeter drainage or utilities in trench.

F. Do not use power-driven impact compactors to compact pipe zone material.

G. Backfill Immediately: All trenches and excavations shall be backfilled immediately after pipe or conduit is in approved condition to receive it and shall be carried to completion as rapidly as possible, unless otherwise directed by the Engineer.

H. Under no circumstances shall water be permitted to rise in open trenches after pipe has been placed.

I. Do not allow backfill material to free fall into the trench or allow heavy, sharp pieces of material to be placed as backfill until after at least 2 feet of backfill has been provided over the top of pipe.

J. Use hand compactors for compaction until at least 2 feet of backfill is placed over top of pipe. Thoroughly tamp each lift, including area under haunches, with handheld tamping bars supplemented by "walking in" and slicing material under haunches with a shovel to ensure that voids are completely filled before placing each succeeding lift.

K. Placement of Sand:

1. Place medium sand in lifts not exceeding 8 inches in uncompacted thickness.

2. Compact each lift to a minimum of 95 percent relative compaction prior to placing succeeding lifts.

L. Placement of CLSM:

1. Discharge from truck-mounted drum-type mixer into trench.

2. Place in lifts not exceeding 2 feet in thickness.

3. No compaction of CLSM is allowed.

4. Use steel plates to protect the CLSM from traffic a minimum of 24 hours. After 24 hours, the CLSM may be paved, or opened to traffic until permanent surface restoration is completed if it has hardened sufficiently to prevent rutting.

M. New trenching shall not be started when earlier trenches need backfilling, or the surfaces of streets or other areas need to be restored to a safe and proper condition.

N. Do not leave trench open at end of working day.

Detail installation of utility locating facilities as needed. Otherwise, delete text and add "Not Used".

3.13 MARKING TAPE INSTALLATION

A. Continuously install marking tape along centerline of all buried piping, install 24 inches below finished grade. Coordinate with piping installation Drawings.

3.14 ELECTRONIC LOCATING FACILITY INSTALLATION

A. Marker Balls:

1. Install according to Manufacturer's recommendations and as shown or directed and according to the following requirements:

   a. Install marker balls directly above the pipe alignment at a depth no less than 3 feet and no more than 4-1/2 feet below final surface grade.

   b. Install marker balls during trench backfill operations by placing the marker ball in compacted backfill.

   c. Cover marker ball with a minimum of 6 inches of backfill and compact backfill before continuing trench backfill operations.

   d. Install markers balls with trenchless pipe installations by core-drilling hole of a minimal diameter needed to allow clearance for placement of marker ball. Backfill with approved trench backfill, pavement base and pavement, as applicable.

2. Water Marker Ball Locations: Install at locations as required by Sewer Marker Ball Locations specified herein.

3. Sewer Marker Ball Locations:

   a. Install marker balls directly above connection points, termination points and all fitting locations, and at a minimum spacing of 50 linear feet on sewers with a straight horizontal alignment.

   b. Install marker balls at a minimum spacing of 25 lineal feet directly above sewer mains installed on a radius.

   c. Install marker balls on new or reconstructed sewer service laterals, directly above the centerline of the end of the lateral at the curb, property line or other end of lateral location, as directed.

   d. Install marker balls directly above every alignment change along sewer mains and service laterals.

   e. Install marker balls directly above manholes for manholes with buried covers.

B. Tracer Wire and Terminal Appurtenances:

1. Tracer Wire:

a. Install as shown or directed directly over the pipe centerline and on top of the pipe zone in all sewer trenches, including mainline sewers, service laterals and storm sewer inlet leads.

b. Connect mainline and service lateral tracer wires using either an approved direct-bury lug connector or direct-bury twist connector.

c. Extend tracer wire to locator stations in manholes, locator boxes, storm inlets, or other visually identifiable terminal appurtenances, allowing for access with electronic locating equipment, as shown or directed and according to the following requirements:

2. Locator Stations:

a. Install locator stations as shown within manholes.

b. Mount locator station to manhole wall within 18 inches of manhole rim with two stainless steel expansion anchors.

c. Drill a minimum 3/8-inch diameter hole through the manhole wall within 18 inches of the finish grade of the manhole rim.

d. Extend the tracer wire from the pipe trench in one continuous piece up the outside of the manhole and through the hole and into a locator station and attach to one of the lugs in the locator station.

e. When multiple tracer wires are terminated in manhole install a multi-lead locator station.

f. Extend a ground wire from the locator station through a minimum 3/8-inch diameter hole in the manhole wall.

g. Install ground wire approximately 3 feet deep and extend from the outside manhole wall a minimum of 3 feet horizontally in any direction.

h. Seal all holes drilled in manhole walls with silicone sealant.

3. Storm Inlet Tracer Wire Termination: Terminate tracer wire inside inlet and directly over storm outlet pipe by placing tracer wire as follows:

a. Drill a minimum 3/8-inch diameter hole through inlet wall to pass tracer wire through to inside inlet wall.

b. Seal hole with silicon sealer or material approved by Engineer.

c. Leave 6 inches of coiled tracer wire along inside of inlet wall approximately 3 inches below the inlet frame and grate or as directed by Engineer.

4. Service Lateral Tracer Wire Termination: Terminate tracer wire at ends of service laterals as shown or directed, as follows:

a. Termination in Tracer Wire Locate Boxes: Extend the tracer wire in one continuous piece up vertically from the pipe trench and into the bottom of the locate box. Leave 18 inches of coiled tracer wire inside locate box.

b. Termination at 2-inch by 4-inch Markers: Extend tracer wire in one continuous piece directly up service lateral 2-inch by 4-inch markers and leave 18 inches of tracer wire wrapped around the exposed top end of 2-inch by 4-inch marker.

3.15 VISUAL IDENTIFICATION FACILITIES

A. Tracer Wire Locate Boxes: Install tracer wire locate boxes directly over service laterals at property line, service boundary, or other location as shown or directed by the Engineer.

B. Service Lateral Plastic or Copper Markers:

1. Install plastic or copper markers in the concrete curb directly over the centerline of the service lateral, as shown or directed by the Engineer.

2. Either plastic or copper markers may be used.

3. If there is not suitable concrete curb for marker placement, then install a lateral cleanout as close to property line as practical at location approved by Engineer.

C. Service Lateral 2-inch by 4-inch Markers:

1. Place a 2-inch by 4-inch marker at the end of each new service lateral not connected to a building sewer.

2. Omit markers only as approved.

3. Block the capped or plugged service lateral end with a wood block against undisturbed earth and install the marker.

4. Extend the marker from the blocked service lateral invert to at least 12 inches above the existing or proposed finish ground surface.

5. Install marker in one piece. No splicing will be accepted.

6. Paint the exposed portion of the marker after its installation with quality quick drying enamel white paint for a storm only sewer and green paint for a sanitary or combined sewer.

7. After the paint has dried, use black, quick drying enamel, and neatly indicate the distance from the ground surface to the top of the service lateral in feet and inches.

8. Do not disturb the position and location of the marker during the backfilling operation.

9. If the marker is broken, moved out of location, or vertical alignment is changed during the backfilling operation, reopen the trench, and replace the marker.

3.16 FIELD QUALITY CONTROL

Coordinate with the Owner on payment for third party quality control testing. It is a requirement of the International Building Code (IBC) that the independent testing lab be hired by the Owner for all testing of structural subgrade and backfill under critical structures (reservoirs, pump stations, etc.). The Authority Having Jurisdiction (AHJ) makes this determination which is typically the Owner.

Choose one of the two below.

A. All testing and reporting shall be conducted and completed by an independent laboratory provided by the Contractor.

OR

B. All testing and reporting shall be conducted and completed by an independent laboratory provided by the Owner. Initial testing will be paid for by the Owner. Subsequent testing after failure of initial acceptance testing shall be paid by the Contractor.

Select test standards referenced in the following paragraph appropriate for fill materials and to fit Project requirements.

ASTM D1557 (AASHTO T180) or ASTM D698 (AASHTO T99)

Consult geotechnical report and Owner's standards. AASHTO T99 is testing standard.

Cross-check requirements below with Section 01 45 00, Quality Control.

C. Perform laboratory material tests in accordance with <_____>.

D. In-place compaction testing of pipeline backfill materials shall be performed at 2-foot elevation increments, one test per [200] <___> lineal feet of pipeline trench as measured along pipe centerline.

1. The Engineer may reduce the frequency when satisfied with method of compaction.

2. The Engineer may direct testing at a higher frequency at no additional cost to the Owner upon failure to obtain specified densities or if the Contractor changes compaction equipment or methods of compaction.

3. The Engineer shall determine all test locations.

E. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D6938

2. Moisture Tests: ASTM D3017

F. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest at the sole expense of the Contractor.

3.17 SURFACE RESTORATION AND CLEANUP

A. Open Trenches: At the end of each workday, all open trenches shall be backfilled and all trenches within streets shall be temporarily paved or covered to the satisfaction of the Engineer and the local permitting agency.

1. Temporary paving shall be replaced with permanent street paving at the completion of construction within street rights-of-way, or sooner, if deemed necessary by the Engineer.

2. No gravel-filled trenches shall be left open within the street right-of-way at the end of the workday.

B. Topsoil:

1. Where trenches cross lawns, garden areas, pastures, cultivated fields, or other areas on which reasonable topsoil conditions exist, remove the topsoil to the specified depth and place the material in a stockpile.

2. Topsoil shall not be mixed with other excavated material.

3. After the trench has been backfilled, the topsoil shall be replaced.

C. Clean up and remove all excess materials, construction materials, debris from construction, etc. Replace or repair any fences, mailboxes, signs, landscaping, or other facilities removed or damaged during construction. Replace all lawns, topsoil, shrubbery, flowers, etc., damaged or removed during construction. The Contractor shall be responsible for seeing that lawns, shrubs, etc. remain alive and leave premises in condition equal to original condition before construction.

3.18 SCHEDULE

For complex projects, or at the Owner's request, include schedule to identify location, fill material used (identify from lower to upper fill type), compacted thickness of each fill, and compaction expressed as percentage of maximum density and optimum moisture in comparison with specified test standards.

Consider the following examples when developing Project schedule.

A. Storm and Sanitary Piping:

1. Cover pipe and bedding with Fill Type <_____>: **[To subgrade elevation.] [<_____> thick.]**

2. Compact uniformly to minimum **[95]** <_____> percent of maximum density.

B. Duct Bank:

1. Cover duct and bedding with Fill Type <_____>: **[To subgrade elevation.] [<_____> thick.]**

2. Compact uniformly to minimum **[95]** <_____> percent of maximum density.

END OF SECTION

SECTION 31 23 18 - ROCK REMOVAL

Rock removal by use of explosives is typically not permitted on our projects.

Several items in this Section have been placed in highlights and bolded to indicated work that is required should explosives be allowed.

If no explosives are allowed on the Project, delete these highlighted items.

Some of the paragraphs may be deleted. When deleting, do not renumber all the paragraphs. Simply leave the section number and title as is, delete the text, and add the words "Not Used".

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes removal of subsurface rock during excavation by mechanical method [**or use of explosives to assist in removal. The use of explosives for rock removal is not permitting for this Project**].

B. Section Includes:

1. Removing identified and discovered rock during excavation.
2. Expansive tools to assist rock removal.
3. [**Explosives to assist in rock removal.**]

C. Related Sections:

1. Section 31 22 13, Rough Grading
2. Section 31 23 16, Excavation: Building excavation
3. Section 31 23 17, Trenching: Trenching and backfilling for utilities
4. Section 31 23 23, Fill: Backfill materials
5. Section 31 37 00, Riprap

D. [**Supplemental Information: Geotechnical report; bore hole locations and findings of subsurface materials**].

Only use References subsection below if explosives are allowed on Project; otherwise, delete entire subsection text and add "Not Used".

1.2 REFERENCES

A. National Fire Protection Association:

1. NFPA 495 - Explosive Materials Code.

1.3 DEFINITIONS

A. Common Excavation: All excavation required for Work, regardless of the type, character, composition, or condition of the material encountered. All excavation shall be classified as Common Excavation, unless provided for under Rock Removal below.

B. Common Material: All soils, aggregate, debris, junk, broken concrete, and miscellaneous material encountered in Common Excavation, excluding rock as defined below.

C. Rock: Solid mineral material, including boulders, solid bedrock, or ledge rock, with volume in excess of 1/2 cubic yard or solid material which, by actual demonstration, cannot be reasonably excavated with suitable machinery as defined herein. The Engineer may waive the requirements for actual demonstration if the material encountered is well-defined rock.

D. Rock Removal: Removal of rock as defined herein by systematic and continuous drilling, [**blasting,**] hammering, breaking, splitting, or other methods approved by the Engineer.

E. Suitable Machinery: A track-mounted hydraulic excavator of the 52,800- to 72,500-pound class equipped with a single shank ripper.

1.4 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate proposed method of [**blasting, delay pattern, explosive types, type of blasting mat or cover for**] rock removal.

C. Equipment: Manufacturer information regarding pound class of machinery proposed for rock removal.

D. Survey Report: Submit survey report mapping extent and locations of rock encountered, to be used in calculating total volume of rock removal.

Only use Quality Assurance subsection below if explosives are allowed on Project; otherwise, delete entire subsection text and add "Not Used".

1.5 QUALITY ASSURANCE

A. Seismic Survey Firm: Licensed company specializing in seismic surveys with [**five**] <_____> years [**documented**] experience.

B. Explosives Firm: Company specializing in explosives for disintegration of rock, with [**five**] <_____> years [**documented**] experience.

1.6 PROJECT CONDITIONS

A. Conduct survey of rock uncovered in excavation for structures or trenching for utilities prior to removal of material.

Include the following articles only when rock removal by explosive method is used.

B. Conduct survey and document conditions of buildings near locations of rock removal, prior to blasting, and photograph existing conditions identifying existing irregularities.

C. Advise owners of adjacent buildings or structures in writing, prior to executing seismographic survey. Explain planned blasting and seismic operations.

D. Obtain seismic survey prior to rock excavation to determine maximum charges that can be used at different locations in area of excavation without damaging adjacent properties or other work.

Only use Scheduling subsection below if explosives are allowed on Project; otherwise, delete entire subsection text and add "Not Used".

1.7 SCHEDULING

A. Schedule Work to avoid [working hours of] [disruption to] occupied buildings nearby.

B. Conduct blasting operations between hours of <_____> and <_____> only.

PART 2 PRODUCTS

Only use Materials subsection below if explosives are allowed on Project; otherwise, delete entire subsection text and add "Not Used".

2.1 MATERIALS

When NFPA 495 is included in this section by reference, edit or delete the following paragraphs. Edit the following paragraphs depending on removal method chosen.

A. Explosives: Type recommended by explosive firm following seismic survey [and required by authorities having jurisdiction].

B. Delay Device: [Type recommended by explosives firm.] <_____.>

C. Blast Mat Materials: [Type recommended by explosives firm.] <_____.>

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions and note subsurface irregularities affecting Work of this section.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Engineer Approval for Rock Removal:

1. Prior to commencement of rock removal, expose all material anticipated to be rock by removing the common material above it and then notify the Engineer.

2. The Engineer, in association with the Contractor or the Contractor's representative, will measure the amount of material to be removed in an effort to reach a mutually agreeable volume for anticipated rock removal.

3. Prior to commencing the proposed rock removal, the Contractor must receive written approval by the Engineer stating the approximate volume of excepted rock removal to receive payment.

4. During rock removal activities, should it become apparent the previously agreed upon volume of rock removal will be exceeded, notify the Engineer immediately. Should the Contractor proceed with rock removal in excess of the previously agreed upon volume, the Contractor will do so at their own risk and expense.

3.3 ROCK REMOVAL BY MECHANICAL METHOD

A. Excavate and remove rock by mechanical method.

1. Use single shank ripper to fracture rock.

2. Drill holes and use expansive tools and wedges to fracture rock.

B. Cut away rock at bottom of excavation to form level bearing.

C. Remove shaled layers to provide sound and unshattered base for footings and foundations.

D. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.

E. For vaults and other structures, excavate to the depth necessary to install the structure and to a maximum of 18 inches beyond the outside walls of the vault or structure.

F. Remove excavated materials [**from site.**] [**and reuse for site landscaping.**]

G. Correct unauthorized rock removal associated with structural excavations in accordance with backfilling and compacting requirements of Section 31 23 16, Excavation and as directed by Engineer.

H. Correct unauthorized rock removal associated with utility work in accordance with backfilling and compacting requirements of Section 31 23 17, Trenching and as directed by Engineer.

I. If material which would be classified as rock as defined herein is mechanically removed with equipment of a larger size than specified as Suitable Machinery herein, it shall be understood that any added costs for the removal of rock by this method shall be included in the unit price for common excavation and not paid for under this pay item. If material which would be classified as rock as defined herein is mechanically removed without [**blasting,**] hammering, breaking, or splitting, it will be considered common excavation and not paid for under this pay item. If equipment larger than the suitable machinery as defined herein is brought on the Project Site for the sole purpose of rock removal without hammering, breaking, or splitting, then such excavation will be considered rock removal.

Only use ROCK REMOVAL BY EXPLOSIVE METHODS subsection below if explosives are allowed on Project; otherwise, delete entire subsection text and add "Not Used".

3.4 ROCK REMOVAL BY EXPLOSIVE METHODS

A. When rock is uncovered requiring explosives method for rock disintegration, [notify Engineer.] [execute as follows.]

B. Provide seismographic monitoring during progress of blasting operations.

C. Drill blasting holes within [12] <_____> feet of finished slope.

D. Disintegrate rock and remove from excavation.

E. Remove rock at excavation bottom to form level bearing.

F. Remove shaled layers to provide sound and unshattered base for [footings.] [foundations.] <_____.>

G. In utility trenches, excavate to [6] <_____> inches below invert elevation of pipe and [24] <_____> inches wider than pipe diameter.

H. Remove excavated material [from site.] <_____.>

I. Correct unauthorized rock removal associated with structural excavations in accordance with backfilling and compacting requirements of Section 31 23 16, Excavation and as directed by Engineer.

J. Correct unauthorized rock removal associated with utility work in accordance with backfilling and compacting requirements of Section 31 23 17, Trenching and as directed by Engineer.

3.5 FIELD QUALITY CONTROL

A. Request visual inspection of foundation bearing surfaces by Engineer before installing subsequent work.

END OF SECTION

SECTION 31 23 23 – FILL

Some of the paragraphs may be deleted. When deleting, do not renumber all the paragraphs. Simply leave the section number and title as is, delete the text, and add the words "Not Used".

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes backfilling required at building perimeter and site structures to subgrade elevations, fill under interior and exterior slabs-on-grade or pavement, and fill under landscaped areas. Backfilling for utilities within building proper is included within this section; backfilling for utilities outside building is included in Section 31 23 17, Trenching.

B. Section includes:

1. Backfilling building perimeter to subgrade elevations.
2. Backfilling site structures to subgrade elevations.
3. Fill under slabs-on-grade.
4. Fill under paving.
5. Fill for over-excavation.

C. Related Sections:

Edit the following paragraph per Project requirements.

1. Section 03 30 00, Cast-In-Place Concrete
2. Section 31 05 13, Soils for Earthwork
3. Section 31 05 16, Aggregates for Earthwork
4. Section 31 22 13, Rough Grading
5. Section 31 23 16, Excavation
6. Section 31 23 17, Trenching
7. Section 31 23 24, Flowable Fill
8. Section 31 25 00, Erosion and Sediment Controls
9. Section 31 37 00, Riprap
10. Section 33 11 10, Water Utility Distribution and Transmission Piping
11. Section 33 31 13, Public Sanitary Utility Sewerage Piping
12. Section 33 41 10, Storm Utility Drainage Piping

D. [Supplemental Information: Geotechnical report; bore hole locations and findings of subsurface materials.]

1.2 REFERENCES

List reference standards included within text of this section. Edit the following for Project conditions.

A. American Association of State Highway and Transportation Officials:

Select only one AASHTO standard based upon input/standards of client. If no preference is standard, standard is T99.

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.

OR

2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International (ASTM):

1. ASTM C403 - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance

Select only one ASTM standard based upon input/standards of client. ASTM D698 test methods correspond with AASHTO T99, ASTM D1557 test methods correspond with AASHTO T180.

2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

OR

3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

4. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

6. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.

1.3 DEFINITIONS

A. Controlled Low Strength Material (CLSM): Also referred to as Flowable Fill elsewhere in these Specifications. A self-compacted, cementitious material.

B. Imported Material: Materials obtained from sources offsite, suitable for specified use.

C. Lift: Loose (uncompacted) layer of material.

D. Optimum Moisture Content:

1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.

2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.

1.4 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Imported Materials:

1. Materials Source: Submit name and location of imported fill materials suppliers.

2. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

3. Submit results of aggregate sieve analysis and standard proctor test for granular material.

C. CLSM: Mix designs in accordance with Submittal requirements of Section 31 23 24, Flowable Fill.

1.5 QUALITY ASSURANCE

A. Subsoil and topsoil fill materials: In accordance with Quality Assurance requirements stated in Section 31 05 13, Soils for Earthwork.

B. Aggregate fill materials: In accordance with Quality Assurance requirements stated in Section 31 05 16, Aggregates for Earthwork.

C. CLSM:

1. In-place testing: In accordance with ASTM C403.

2. Compressive testing: In accordance with ASTM D4832.

D. Allowable Tolerances: Final grades shall be plus or minus 0.1-foot.

PART 2 PRODUCTS

2.1 FILL MATERIALS

Coordinate and edit material sections indicated in paragraphs below. Select fill materials as appropriate to site conditions. Check Geotechnical reporting to for trench backfill material recommendations.

A. Subsoil Fill: Type S2, Imported Fill Material, as specified in Section 31 05 13, Soils for Earthwork.

B. Imported Granular Fill: Coarse Aggregate Type A1, Dense-Graded Aggregate with gradation as shown in the Drawings and specified in Section 31 05 16, Aggregates for Earthwork.

C. Concrete:

1. Lean concrete as specified in Section 31 23 24, Flowable Fill, with compressive strength of 100 pounds per square inch (psi).

2. Structural concrete as specified in Section 03 30 00, Cast-in-Place Concrete. Compressive strength as required by the application or as noted in the Drawings.

D. Drain Rock: Coarse Aggregate Type A2, Granular Drain Backfill Material with gradation as shown in the Drawings and specified in Section 31 05 16, Aggregates for Earthwork.

E. Foundation Stabilization Material: Coarse Aggregate Type A1, Dense-Graded Aggregate, 2-1/2-inch - 0 gradation as specified in Section 31 05 16, Aggregates for Earthwork.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to Work in this Section, become familiar with Site conditions. In the event discrepancies are found, notify Engineer as to the nature and extent of the differing conditions.

Coordinate and edit paragraphs B - D below with Project work.

B. Verify sub-drainage, damp-proofing, or waterproofing installation has been inspected.

C. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

D. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 SITE CONDITIONS

A. Quantity Survey: The Contractor shall be responsible for calculations for quantities and volume of cut and fill from existing site grades to finish grades established under this contract as indicated in the Drawings or specified and shall include the cost for all earthwork in the total basic bid.

B. Dust Control: Must meet all federal, state, and local requirements. Protect persons and property from damage and discomfort caused by dust. Water surfaces as necessary and when directed by Engineer to quell dust.

C. Soil Control: Soil shall not be permitted to accumulate on surrounding streets or sidewalks nor to be washed into sewers.

D. See provisions for Work in Section 31 25 00, Erosion and Sediment Controls.

3.3 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Control of Water:

1. Excavated areas shall be kept free of water and frost.

2. Bearing surfaces which become softened by water or frost shall be re-excavated to solid bearing at Contractor's expense and backfilled with compacted crushed rock at Contractor's expense.

3. See Section 31 23 19, Dewatering for additional details.

C. Compact subgrade to density requirements for subsequent backfill materials.

D. Cut out soft areas of subgrade not capable of compaction in place and replace with specified granular fill material. See Article 3.5, Over-excavation for Unsuitable Foundation Conditions in Section 31 23 16, Excavation for additional details.

E. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

F. Subgrade to be approved by Engineer prior to placement of structures and commencement of backfill activities.

G. Do not allow or cause any work performed or installed to be covered up or enclosed prior to required tests and approvals. Should any Work be enclosed or covered up, uncover at Contractor's expense.

3.4 BACKFILLING

A. Backfill areas to contours and elevations shown in the Drawings with unfrozen materials.

B. Do not place materials when weather conditions and/or moisture content prevent attainment of specified density.

C. Maintain optimum moisture content of backfill materials to attain required compaction density.

D. Employ placement method that does not disturb or damage other work.

E. Mechanical tampers permitted in confined areas.

F. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

G. Foundation Base for Structures:

1. Bring excavation to required subgrade elevation shown in the Drawings.

2. Place foundation base material to required grade shown in the Drawings.

3. Place foundation base material in 6-inch lifts and compact to 95 percent maximum dry density.

Coordinate depths of crushed rock material with geotechnical reporting and structural recommendations.

General guidance and recommendations for minimum allowable depths of crushed rock foundation base provided highlighted in paragraphs below.

Include paragraphs below as related to Project.

4. Reservoir Foundation:

    a. Concrete Footings: Place a [**12**] <___>-inch minimum layer of Coarse Aggregate Type A1, Dense-Graded Aggregate, [**3/4**] <___>-inch-0 gradation to required grade under all concrete footings.

    b. Concrete Slabs: Place an [**8**] <___>-inch minimum layer of Coarse Aggregate Type A1, Dense-Graded Aggregate, [**3/4**] <___>-inch-0 gradation under all concrete slabs.

5. Pump Station:

    a. Concrete Footings: Place a [**6**] <___>-inch minimum layer of Coarse Aggregate Type A1, Dense-Graded Aggregate, [**3/4**] <___>-inch-0 gradation to required grade under all concrete footings.

    b. Concrete Slabs: Place an [**8**] <___>-inch minimum layer of Coarse Aggregate Type A1, Dense-Graded Aggregate, [**3/4**] <___>-inch-0 gradation under all concrete slabs.

6. Foundations established near finished site grades:

    a. Place a [**3**] <___>-inch-thick layer of Coarse Aggregate Type A1, Dense-Graded Aggregate, [**3/4**] <___>-inch-0 gradation in the bottom of footing excavations to minimize disturbance of silty foundation soils during wet weather.

    b. Lightly compact material with a light-weight hand-operated vibratory plate compactor.

    c. To provide uniform support, slabs should be underlain by a minimum 8-inch-thick granular base course consisting of [**1-1/2**] or [**3/4**] <___>-inch - 0 gradation.

    d. The base course material should be installed in a single lift and compacted to at least 95 percent of the maximum dry density. See Drawings for details.

H. Backfill for Structures:

1. Prior to placing backfill, remove forms, temporary construction, and debris below grade.

2. Backfill shall not be placed against poured concrete until 28 days have passed from completion of original concrete pour, unless otherwise approved by Engineer.

3. Heavy compactors and large pieces of construction equipment shall be kept away from any embedded wall a distance of a least 5 feet in order to avoid the build-up of excessive lateral pressures.

    a. Over-compaction of fill near walls should be avoided.

4. Compaction within 5 feet of the walls shall be accomplished using hand-operated vibratory plate compactors or tamping units.

5. The maximum particle size of granular material placed against buried structures shall be limited to no greater than 1-1/2-inch diameter.

6. Structural fill backfill material shall be brought up on all sides of the walls and footings in such a manner as to avoid adverse differential lateral earth pressures on the vertical surfaces.

7. Appropriate lift thickness will depend on the type of compaction equipment used and the type of material being placed. All material shall be compacted to at least 95 percent of the standard maximum dry density.

   a. For moderate- to heavy-weight compactors, a maximum loose lift thickness of 12 inches shall be used.

   b. For hand-operated or small compactors, a maximum loose lift thickness of 8 inches shall be used.

8. Particular care must be taken to avoid damage to the pipe connections to the structure.

9. Utility trench backfill within 10 feet of all structural perimeters shall meet the requirements for structural fill.

Edits highlighted items to fit Project.

I. For areas receiving surface structures or existing paved areas to be constructed or replaced, such as [railways,] [roadways,] [driveways,] [parking lots,] [and] [sidewalks]:

1. Place Coarse Aggregate Type A1, Dense-Graded Aggregate, 3/4-inch-0 gradation in 6-inch lifts.

2. Compact with vibratory equipment to 95 percent maximum density, unless otherwise specified or shown in the Drawings.

General guidance and recommendations for permanent embankment fill provided in paragraphs below. Coordinate with geotechnical and structural reporting.

Delete paragraph below if not required for Project. If necessary, renumber.

J. Permanent Embankment Fill:

Insert appropriate facility, i.e., reservoir, pump station, etc.

1. On the sloping ground around the <_____>, the new embankment fill shall be placed in horizontal lifts on a continuous series of minimum [6] to [8] <___>-foot-wide horizontal benches excavated into the surface of the existing slope.

2. Fill slopes shall be slightly overbuilt and then trimmed back to final grade using a track hoe with a smooth-edged bucket.

3. The Engineer shall review the proposed placement of any fill and evaluate the subgrade prior to fill placement.

4. The proposed compaction equipment shall be approved by the Engineer prior to fill placement to evaluate loads on embedded walls.

5. Permanent embankment fill placed beyond [5] <___> feet of the embedded walls and beneath buildings, pavement, and other structures should be compacted to at least 95 percent of the maximum dry density.

6. Landscape fill shall be compacted to at least 90 percent of the maximum dry density as determined by ASTM D 698. Landscape fill should be no steeper then [3H:1V] <___>, unless shown otherwise.

K. Slope grade away from building minimum [2] <___> percent slope for minimum distance of [10] <___> feet, unless noted otherwise in the Drawings.

L. Make gradual grade changes. Blend slope into level areas.

M. Remove surplus backfill materials from Site in accordance with Section 31 23 16, Excavation.

3.5 FIELD QUALITY CONTROL

Coordinate with the Owner on payment for third party quality control testing. It is a requirement of the International Building Code (IBC) that the independent testing lab be hired by the Owner for all testing of structural subgrade and backfill under critical structures (reservoirs, pump stations, etc.). The Authority Having Jurisdiction (AHJ) makes this determination which is typically the Owner.

Select one of the two below.

A. All testing and reporting shall be conducted and completed by an independent laboratory provided by the Contractor.

******** [OR] ********

B. All testing and reporting shall be conducted and completed by an independent laboratory provided by the Owner. Initial testing will be paid for by the Owner. Subsequent testing after failure of initial acceptance testing shall be paid by the Contractor.

Commented [JF1]: @Jessica Wall these two need to be an either or choice for A. Format A as a note.

Select test standards referenced in the following paragraph appropriate for fill materials and Project requirements.

ASTM D1557 (AASHTO T180) or

ASTM D698 (AASHTO T99)

Consult geotechnical report. AASHTO T99 is testing standard.

C. Perform laboratory material tests in accordance with ASTM <_____> (AASHTO<_____>).

D. In-place compaction testing for structural fill material shall be performed at 2-foot elevation increments in the fill material with at a minimum of one test per each [2,500] <___> square feet of material placed. The Engineer shall be provided with the results of each compaction test at the time of testing.

E. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D6938.

2. Moisture Tests: ASTM D3017.

F. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest at the sole expense of the Contractor.

G. When testing of subgrade is not possible or feasible as detailed above, proof roll compacted fill surfaces under slabs-on-grade, pavers, paving, and as may be otherwise required by the Engineer.

3.6 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic.

3.7 SCHEDULE

For more complex projects, or at the direction of Owner, include schedule to identify location, fill material used (identify from lower to upper fill type), compacted thickness of each fill, and compaction expressed as percentage of maximum density and optimum moisture in comparison with specified test standards.

Consider the following examples when developing Project schedule. Delete subsection if not required for Project.

A. Interior Crawl Spaces:

1. Fill Type <_____>, <_____> inches thick, compact uniformly to [90] <_____> percent of maximum density.

2. Cover with Fill Type <_____>, [2] <_____> inches thick, compact uniformly to [95] <_____> percent of maximum density.

B. Interior Slab-On-Grade:

1. Fill Type <_____>, <_____> inches thick, compacted to [95] <_____> percent.

2. Cover with Fill Type <_____>, [2] <_____> inches thick, compact uniformly to [95] <_____> percent of maximum density.

C. Exterior Side of Foundation Walls [Retaining Walls] [and] [Over Granular Filter Material and Foundation Perimeter Drainage]:

1. Fill Type A2, [to subgrade elevation.] [<_____> [36 inches thick.], each lift, compact uniformly to [90] <_____> percent of maximum density.

D. Exterior Side of Retaining Walls and Valve Vault Walls:

1. Fill Type A2, to subgrade elevation <_____> thick, each lift, compact uniformly to <_____> percent of maximum density.

E. Underground Tanks:

1. Initial fill of Fill Type [A] [S] <_____>, <_____> inches thick, compacted to <_____> percent.

2. Remaining fill of Fill Type [S] [A] <_____>, [to subgrade elevation.] [<_____> thick.], compact uniformly to <_____> percent of maximum density.

F. Fill Under Grass Areas:

1. Fill Type <_____>, to [6] <_____> inches below finish grade, compact uniformly to <_____> percent of maximum density.

G. Fill Under Landscaped Areas:

1. Fill Type <_____>, to [12] <_____> inches below finish grade, compact uniformly to <_____> percent of maximum density.

H. Fill for Berming:

1. Fill Type <_____>, to [12] <_____> inches below finish grade, compact uniformly to <_____> percent of maximum density.

I. Fill for [French Drains] [Well Points]:

1. Fill Type <_____>, to <_____> inches below finish grade, compact uniformly to <_____> percent of maximum density.

J. Fill Under Interlocking Pavers:

1. Fill Type <_____>, to underside of sand leveling bed specified in Section <_____>, compact uniformly to <_____> percent of maximum density.

K. Fill Under [Asphalt] [Concrete] <_____> Paving:

1. Compact subsoil to [95] <_____> percent of its maximum dry density.

2. Fill Type <_____>, to <_____> inches below finish paving elevation, compact uniformly to <_____> percent of maximum density.

L. Planter Boxes:

1. Fill Type <_____>, to height of <_____> inches , [lightly] <_____> tamped.

M. Fill to Correct Over-excavation:

1. Lean concrete to minimum compressive strength of [1000] <_____> psi .

****** [OR] ******

2. Concrete as specified.

******** [OR] ********

3. Fill Type <_____>, flush to required elevation, compact uniformly to <_____> percent of maximum density.

N. Fill Over Drainage Piping Gravel Cover:

1. Fill Type <_____>, to <_____> inches below finish grade, compact uniformly to <_____> percent of maximum density.

O. Fill Over Excavation of <_____> Material:

1. Fill Type <_____>, to <_____> inches below finish grade, compact uniformly to <_____> percent of maximum density.

END OF SECTION

SECTION 31 25 00 – EROSION AND SEDIMENT CONTROLS

Some of the paragraphs may be deleted. When deleting, do not renumber all the paragraphs. Simply leave the section number and title as is, delete the text, and add the words "Not Used".

User selected information is provided for Oregon DEQ, Washington State Department of Ecology or "Other" to be completed as applicable for the project.

PART 1 GENERAL

1.1 SCOPE

A. This section covers the requirements for temporary and permanent erosion and sedimentation control necessary to prevent migration of sediment and silt laden water to adjacent surface water bodies and drainage structures.

B. The Contractor shall provide all materials, labor, and equipment necessary to install adequate erosion and sedimentation controls.

1.2 QUALITY CONTROL

The Owner will apply to the [Oregon Department of Environmental Quality (DEQ)], [Washington State Department of Ecology (Ecology)] or [Other] and obtain a [1200-C Erosion Control Permit], [Construction Stormwater General Permit], or [Other]. All fees and permit costs will be borne by the Owner. If Contractor proposes to modify the approved erosion control plan, the Contractor shall work with [DEQ], [Ecology], or [Other] to revise application/permit. Contractor shall obtain the final permit and shall be responsible for compliance with all permit provisions and shall accommodate all special inspections required thereof, all at no additional expense to the Owner beyond prices as bid.

A. In addition to the conditions of the Erosion Control Permits issued by [DEQ], [Ecology], or [Other] erosion control provisions shall conform to regulatory requirements of the following agencies.

1. Federal Clean Water Act – Section 402 and title 33, Sect 1251 et seq.

2. [Oregon Revised Statutes – Chapter 468B.]

3. [Revised Code of Washington – Chapter 90.48]

1.3 SUBMITTALS

A. Following the Preconstruction Conference, the Contractor shall request Owner to transfer permit to the Contractor by submitting a completed [1200-C Name Change and Permit Transfer Application], [Transfer of Coverage Construction Stormwater General Permit] or [Other] to [DEQ], [Ecology] or [Other]. The [1200-C], [Construction Stormwater General Permit], or [Other] permit will be transferred to Contractor who will have sole responsibility for compliance with all of the permit requirements and the day-to-day implementation of the Erosion and Sediment Control Plan.

B. Upon completion of and acceptance of all Work, Contractor shall submit Notice of Termination Application for NPDES General Permit to Discharge Storm Water Associated with Construction Activity to [**DEQ**], [**Ecology**], or [**Other**].

1.4 SCHEDULE

A. Required temporary erosion and sedimentation control Best Management Practices (BMPs) must be constructed and in operation prior to land clearing or other construction activities to ensure that sediment laden water does not leave the site.

B. Temporary sediment facilities shall be maintained in a satisfactory condition until such time that permanent ESC facilities are in place or sufficient vegetation has been established and potential for on-site erosion has passed.

C. The implementation, maintenance, replacement, and additions to erosion/sedimentation control systems shall be the responsibility of the Contractor.

PART 2 PRODUCTS

2.1 CHECK DAM SAND OR GRAVEL BAGS

A. Bags to be either burlap or woven “Geotextile” fabric filled with gravel or sand.

2.2 JUTE MATTING

A. Be of a uniform open plain weave of unbleached, single jute yarn treated with a fire-retardant chemical.

B. The yarn shall be of a loosely twisted construction and shall not vary in thickness by more than one-half of its normal diameter.

C. Furnished in rolled strips 48 inches wide by approximately 50 yards long.

D. Average weight of 0.92 pounds per square yard with an allowable tolerance of plus or minus 1 inch in width and 5 percent in weight.

2.3 FILTER FABRIC FENCE

A. Filter Fabric

1. Filter fabric for the erosion protection barriers shall be Mirafi 140, or equivalent.

B. Wire

1. Wire for the erosion protection barriers shall be 2 by 2 mesh, 12-gauge galvanized wire.

C. Support Posts

1. Support posts for the erosion protection barriers shall be minimum 2-inch by 2-inch, Douglas Fir No. 1, or better wood posts.

2.4 CLEAR PLASTIC COVERING

A. Clear plastic covering for protection of slopes and cuts shall meet the requirements of the ASTM D2103 for Polyethylene sheeting having a minimum thickness of 6 mil.

2.5 INLET PROTECTION

A. All new and existing stormwater inlets which collect stormwater runoff from a construction site shall be protected from sediment by the use of filters.

2.6 STABILIZED CONTRUCTION ENTRANCE

A. Wherever construction vehicles enter or leave a construction site, a Stabilized Construction Entrance is required.

PART 3 EXECUTION

3.1 EROSION CONTROL

A. Erosion control provisions shall meet or exceed the requirements of the local agency having jurisdiction.

B. When provisions are specified and shown on the drawings, they are the minimum requirements.

C. Contractor shall not permit sediment-laden waters to leave the site.

D. As construction progresses and seasonal conditions dictate, more siltation control facilities may be required. It shall be the responsibility of the Contractor to address new conditions that may be created and to provide additional facilities over and above minimum requirements as may be required.

E. Provide temporary erosion control measures to prevent erosion from piles of topsoil or fill material. Before completing the Contract, any areas of bare soil shall be permanently seeded.

F. Additional measures may be necessary depending on construction activity and weather. Contractor will be responsible for carrying out the erosion control provisions of the approved ESC Plan.

1. Keep streets and paved surfaces clean of mud and debris. Install gravel construction entrances as shown on the Plans and maintain them for the duration of the construction period.

3.2 SILTATION CONTROL

A. Siltation control is required. Check dams or silt fences may be placed in streams or ditches receiving stormwater from areas disturbed by construction.

3.3 FILTER FABRIC FENCES

A. Filter fabric fence shall consist of filter fabric fastened to wire fabric with staples or wire rings.

B. Wire shall be fastened to posts set at 6 foot-maximum centers.

C. Fabric shall be buried into ground a minimum of 4 inches to prevent silt from washing under fabric.

D. Fence shall be located to catch silt and prevent discharge to drainage courses.

3.4 EROSION CONTROL CHECK DAM

A. Sand or gravel filled bags shall be installed in drainage way to catch silt.

B. Spillway shall be lower than outer edge of dam. Leave a one sandbag gap in top row to provide spillway.

3.5 PLACING JUTE MATTING

A. Seed and fertilizer shall be placed prior to placing of matting.

B. Jute matting shall be unrolled parallel to the flow of water. Where more than one strip of jute matting is required to cover the given area, it shall overlap the adjacent mat a minimum of 4 inches. The ends of matting shall overlap at least 6 inches with the upgrade section on top.

C. The up-slope end of each strip of matting shall be staked and buried in a 6-inch-deep trench with the soil firmly tamped against the mat. Three stakes per width of matting (one stake at each overlap) shall be driven below the finish ground line prior to backfilling of the trench.

D. Engineer may require that any other edge exposed to more than normal flow of water or strong prevailing winds be staked and buried in a similar manner.

E. Check-slots shall be laced between the ends of strips by placing a tight fold of the matting at least 6 inches vertically into the soil. These shall be tamped and stapled the same as up-slope ends. Check-slots must be placed so that one check-slot or one end occurs within each 50 feet of slope.

F. Edges of matting shall be buried around the edges of catch basins and other structures as herein described. Matting must be spread evenly and smoothly and in contact with the soil at all points.

G. Matting shall be held in place by approved wire staples, pins, spikes, or wooden stakes driven vertically into the soil. Matting shall be fastened at intervals not more than 3 feet apart in three rows for each strip of matting, with one row along each edge and one row alternately spaced in the middle. All ends of the matting and check-slots shall be fastened at 6-inch intervals across their width. Length of fastening devices shall be sufficient to securely anchor matting against the soil and driven flush with the finished grade.

3.6 PLACING CLEAR PLASTIC COVERING

A. Clear plastic covering shall be installed on erodible embankment slopes.

B. The clear plastic covering shall be installed immediately after completion of the application of roadside seeding. It is the intent of this specification that clear plastic covering will be in place before the fall rainfall begins.

C. Maintain the cover tightly in place by using sandbags or ties on slopes with a minimum of 10-foot grid spacing in all directions. All seams shall be taped or weighted down full length. There shall be at least a 12-inch overlap of all seams.

D. Immediately repair all damaged areas.

3.7 EXISTING DRAINAGE FACILITIES

A. Should a storm sewer or culvert become blocked or have its capacity restricted due to siltation from Contractor's operations, the Contractor shall make arrangements with the jurisdictional agency for the cleaning of the facility at no additional expense to the Owner.

B. Contractor shall install catch basin inserts in existing catch basins in the vicinity of, or adjacent to, clearing or construction activities to prevent sediment from entering the on-site stormwater conveyance system.

3.8 DRAINAGE DIVERSION

A. Contractor may divert up-gradient surface runoff water around the site as required. Contractor will be responsible for routing diverted surface water to its original flow path downstream of the site and providing energy dissipation and/or dispersion as needed to mimic pre-diverted flow characteristics, as required by the Engineer.

B. Drainage shall be restored to condition existing prior to construction unless otherwise shown on the drawings.

END OF SECTION

SECTION 31 37 00 - RIP RAP

Some of the paragraphs may be deleted. When deleting, do not renumber all the paragraphs. Simply leave the section number and title as is, delete the text, and add the words "Not Used".

PART 1 GENERAL

1.1 SCOPE

This Section consists of furnishing and placing an erosion-resistant cover material for protecting slopes and basins at locations shown or as directed.

A. Related Sections:

1. Section 03 60 00, Grouting
2. Section 31 22 13, Rough Grading
3. Section 31 23 18, Rock Removal

1.2 DEFINITIONS

A. Filter Blanket - A layer of graded granular material placed between the area prepared for it and the riprap.

B. Grouted Riprap - Loose riprap with all or part of the spaces filled with Portland cement mortar.

C. Keyed Riprap - Loose riprap placed on prepared slope, riprap geotextile, or filter blanket, as specified, and keyed in place by slapping the surface with a piece of armor plating.

D. Loose Riprap - Specified classes of graded rock placed on prepared slope, riprap geotextile, or filter blanket, as specified.

E. Riprap Backing - An option of using either riprap geotextile or a filter blanket placed between the area prepared for it and the riprap.

F. Riprap Basin - Energy dissipater consisting of loose riprap placed at pipe outlets as specified.

G. Riprap Geotextile - A geotextile placed between the area prepared for it and the riprap.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Materials Source: Submit name of imported materials suppliers.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. Results of aggregate sieve analysis and standard proctor tests for all granular material.

PART 2 MATERIALS

2.1 RIPRAP GEOTEXTILE

Furnish riprap geotextile as shown in the Drawings.

2.2 RIPRAP REQUIREMENTS

A. General - Furnish rock for loose riprap meeting the following requirements:

1. Meet the test requirements of provided herein.

2. Be angular in shape. Thickness of a single rock shall not be less than 1/3 its length. Rounded rock will not be accepted unless authorized by the Engineer.

3. Meet the gradation requirements for the class specified.

4. Be free from overburden, spoil, shale, and organic material. Non-durable rock, shale, or rock with shale seams is not acceptable.

B. Test Requirements - Furnish the rock meeting the following test requirements:

Material Test	Requirement
Apparent Specific Gravity (AASHTO T 85)	2.50 Min.
% Absorption (AASHTO T 85)	6.0 Max.
Degradation (ODOT TM 208A)	
Passing No. 20 Sieve	35.0% Max.
Sediment Height	8.0" Max.
Soundness (AASHTO T 104)	
Average Loss of 2 1/2" - 1 1/2" and	
1 1/2" - 3/4" fraction after 5	16.0% Max.
alternations	

C. Gradation Requirements - Grade loose riprap by class and weight of rock according to the following:

Class 50	Class 100	Class 200	Class 700	Class 2000	
Weight of Rock (pounds)					Percent (by Weight)
50 - 30	100 - 60	200 -	700 -	2000 -	20.0
30 - 15	60 - 25	140	500	1400	30.0
15 - 2	25 - 2	140 - 80	500 -	1400 -	40.0
2 - 0	2 - 0	80 - 8	200	700	10.0 - 0
		8 - 0	200 - 20	700 - 40	
			20 - 0	40 - 0	

Uniformly grade each load of riprap from the smallest to the largest weight specified. Control of gradation will be by visual inspection.

1. Control Sample - If directed, provide, at a satisfactory location near the Project Site, a rock sample of at least 5 tons meeting the gradation for the class specified. This sample will be used as a frequent visual reference for judging the gradation of the riprap supplied.

2. Sampling and Testing Assistance - Any difference of opinion between the Engineer and the Contractor shall be resolved by dumping and checking the gradation of two random truckloads of rock. Mechanical equipment, a sorting site, and labor needed to assist in checking gradation shall be provided by the Contractor at no additional cost to the Owner.

D. Grouted Riprap

1. Furnish rock for grouted rip rap meeting the requirements of stated herein for class and size specified.

2. Furnish non-shrink Portland cement grout meeting the requirements of Section 03 60 00, Grouting.

E. Filter Blanket - Furnish filter blanket material meeting the following requirements according to riprap class:

Riprap Class	Filter Blanket
Class 2000	16-inch layer of Class 50 riprap conforming to the requirements of this section
Class 700	9-inch layer of 6-inch - 0 stone embankment meeting the test requirements of this section
Class 200	6-inch layer of 4-inch - 0 stone embankment meeting the test requirements of this section
Class 100	No filter blanket required
Class 50	No filter blanket required

PART 3 EXECUTION

3.1 PREPARATION

A. Remove brush, trees, stumps, and other organic material from slopes to be protected by riprap and dress to a smooth surface.

B. Remove all unsuitable material to the depth shown or directed and replace with approved material.

C. Compact filled areas as specified in Section 31 23 23, Fill.

D. Provide riprap protection as early as the structure foundation construction permits. Prepare the surfaces to be protected as shown.

E. Maintain the trench slopes, riprap geotextile, or filter blanket until the riprap is placed.

3.2 RIPRAP GEOTEXTILE

A. Install riprap geotextile as shown in the Drawings or as directed by the Engineer.

3.3 FILTER BLANKET CONSTRUCTION

A. If required, place the filter blanket on the prepared area to the full specified thickness in one operation, using methods which will not cause segregation.

B. The surface of the finished layer shall be reasonably even.

3.4 RIPRAP BACKING

A. When indicated on the Drawings, the Contractor shall have the option of placing either riprap geotextile or a filter blanket behind the riprap.

B. Install the backing per these specifications or as shown in the Drawings.

3.5 RIPRAP

A. General - Unless otherwise directed, place the riprap protection as the embankment is constructed. Its placement shall lag behind embankment construction only as necessary to allow proper embankment construction and prevent mixture of embankment and riprap material.

B. Loose Riprap - Place riprap on the prepared area:

1. With a clamshell, orange-peel bucket, skip, or similar approved device which will contain the riprap material to its final destination. Do not open the bucket until it has been lowered to the slope on which the material is being placed.

2. To its full course thickness in one operation.

3. According to the compaction requirements of Section 31 23 23, Fill if riprap is placed on geotextile

4. By methods that do not cause segregation of riprap or displace the underlying material.

5. To produce a compact riprap protection in which all sizes of material are placed in their proper proportion.

6. With some hand placing, or rearranging of individual stones by mechanical equipment, or some other approved means to provide a smooth finished surface.

Where filter material and/or riprap are placed under water, increase their thicknesses as shown or as directed.

C. Keyed Riprap - After placing loose riprap material, key the riprap into place by slapping the surface with a piece of armor plating (approximately 4 feet by 5 feet in size with a weight of approximately 5,000 pounds) or other approved means which will produce a nearly smooth surface.

D. Grouted Riprap - Place loose riprap material. If the depth specified for grouting is more than 12 inches, place the riprap in lifts of 12 inches or less and grout each lift before placing the next lift. Construct and grout the succeeding lifts before the grout in the previous lift has hardened.

Thoroughly moisten the stones and sluice any excess fines to the underside of the riprap before grouting. Deliver the grout to the place of final deposit by any means that will ensure uniformity and prevent segregation of the grout. Spade or rod the grout into the spaces to completely fill the voids in the riprap. Control pressure grouting and do not unseat the stones. Penetration of the grout shall be to the depth shown on the plans. If a rough surface is specified, brush the stone until 25 percent to 50 percent of the depth of surface stone is exposed. For a smooth surface, grout the crevices to within 5/8-inch of the surface.

Provide weep holes through the riprap as shown or as directed.

Place and cure grout according to 03 60 00, Grouting, except as provided above.

E. Riprap Basins - Excavate, backfill, and construct riprap basins, without a riprap geotextile or filter blanket, at pipe outlets with Class 50 riprap as shown or as directed.

3.6 MAINTENANCE

Maintain the riprap protection until accepted. Replace any material displaced by any cause at no additional cost to the Owner.

END OF SECTION

SECTION 31 50 00 - EXCAVATION SUPPORT AND PROTECTION

Some of the paragraphs may be deleted. When deleting, do not renumber all the paragraphs. Simply leave the section number and title as is, delete the text, and add the words "Not Used".

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes shoring and support systems of all types necessary to protect existing utility facilities and new utility facilities.

B. The Contractor is responsible for the selection and design of excavation support systems and the design of utility support systems in conformance with Federal, State, and City requirements and the minimum design criteria specified herein.

C. Temporary shoring is to be installed for protection of the existing trees to remain, structures to remain, buried utilities to remain, adjacent roadways and walkways, and surrounding properties.

D. Care must be taken during the planning and construction of earth support systems to minimize settlements and displacements of the shoring system itself and to surrounding properties.

E. Related Sections:

Edit or add to the following list of sections per the requirements of your project. If necessary, renumber.

1. Section 31 23 16, Excavation
2. Section 31 23 17, Trenching
3. Section 31 23 19, Dewatering
4. Section 31 23 23, Fill
5. Section 33 11 10, Water Utility Distribution and Transmission Piping.
6. Section 33 31 10, Sanitary Utility Drainage Piping.
7. Section 33 41 10, Storm Utility Drainage Piping.

1.2 DESIGN CRITERIA

A. Design excavation support systems and all components to support the earth pressures, unrelieved hydrostatic pressures, utility loads, equipment, traffic, railroad, and construction loads including impact, and other surcharge loads in such manner as will allow the safe and expeditious construction of the permanent structures to minimize ground movement or settlement, and to prevent damage to adjacent structures, roadways, railroads, and utilities.

B. Design support members to resist the maximum loads expected to occur during the excavation and support removal stages.

C. Design system so that water seepage is minimized. Provide dewatering and positive means for preventing sloughing and containing material behind lagging.

D. Design system to prevent sloughing and to contain running sand and silt behind the lagging.

E. Vertical support capacity shall be provided for wall systems and internal bracing elements for loads due to vertical force components and live loads on any portion of the system.

The following paragraph is a requirement for large-scale excavations and/or as recommended by the Structural Engineer. Additionally, common sense may dictate this is the only means for certain project elements to be safely installed.

F. Design calculations and shop drawings of all excavation support systems.

Insert appropriate state:

Oregon

Washington

Idaho

1. Calculations and shop drawings shall be made and stamped by a registered Professional Civil or Structural Engineer experienced in the design of excavation support systems in the State of <_____>.

Insert appropriate state:

Oregon

Washington

Idaho

2. Comply with the applicable requirements of OSHA and the <_____> equivalent Structural Specialty Code with respect to excavation and construction.

1.3 SUBMITTALS

A. Section 01 33 00, Submittals - Submittal Procedures: Requirements for submittals.

Choose one subsection B.

The following subsection is typically sufficient for specifying the requirements for the shoring systems used on most of our projects.

For more advanced systems, see the next subsection B.

B. Excavation Support Systems

1. Plans and details for trench and excavation support systems.

a. Shop drawings and supporting calculations shall meet the specified design criteria requirements and include the following:

1) Arrangement, size, and details for individual excavation support system.

2) Construction methods and sequencing to be used for the installation and removal of each excavation support system.

3) Contingency plan for alternative procedures to be implemented if the excavation support system is found to perform unfavorably or if obstructions are encountered in the installation.

2. Provide for Engineer review prior to the beginning of construction activities requiring such systems.

3. No excavations shall be started until the submittal review is complete.

4. Review by the Engineer of the submitted design shall not be construed as a detailed analysis of the adequacy of the support system, nor shall any provisions of the above requirements be construed as relieving overall responsibility and liability for the work.

The following paragraphs should be used to specify the requirements for more advanced systems.

Include Excavation Plan, Settlement Monitoring Plan, Contingency Plan, and Site Conditions Survey.

C. Excavation Support Systems

1. Plans and details for trench and excavation support systems.

Insert appropriate state:

Oregon

Washington

Idaho

a. Calculations and shop drawings shall be made and stamped by an <_____>-registered Professional Engineer experienced in the design of excavation support systems and shall comply with the applicable requirements of OSHA and the <_____> equivalent Structural Specialty Code with respect to excavation and construction.

1) Arrangement, size, and details for individual excavation support systems.

2) Construction methods and sequencing to be used for the installation and removal of individual excavation support systems.

b. Provide plans, details, and calculations for Engineer review prior to the beginning of construction activities requiring such systems.

c. Review by the Engineer of the submitted design shall not be construed as a detailed analysis of the adequacy of the support system, nor shall any provisions of the above requirements be construed as relieving overall responsibility and liability for the work.

Insert appropriate jurisdictional agency:

City of XXXX

County of XXX

2. Provide plans, details, and calculations for trench and excavation support systems to the <_____> as required to obtain all necessary construction permits.

3. No excavations shall be started until the submittal review is complete and proper permits are obtained.

D. Excavation Plan

1. Designed to prevent damage to existing and surrounding properties.

E. Settlement Monitoring Plan, to include the following:

1. Detailed location of settlement monitoring points shown on the Drawings.

Insert appropriate jurisdictional agency:

City

County

2. Reference benchmarks <_____> to be employed.

3. Survey procedures (including name of survey crew leader and equipment to be used).

4. Approach to recording surveyed readings and means of reporting of results to the Owner.

F. Contingency Plan

1. Provide alternative procedures to be implemented if the excavation support systems are found to perform unfavorably or if obstructions are encountered in the installation of excavation support systems.

2. Contingency plan is to demonstrate a preparedness to mitigate the effects of movement or settlement.

3. The following minimum requirements for a contingency plan are:

   a. Measures to be taken in order to protect existing facilities and neighboring properties from additional settlement or movement.

   b. Identification of all material, manpower, equipment, and other items to be available and onsite at all times while excavations and dewatering activities are ongoing and reasonably after the work has been completed.

G. Site Conditions Survey

1. Videotape surveys, photographs, and other data significant in noting the pre-construction conditions of the existing Project Site, as well as the pre-construction conditions of the neighboring properties and their existing structures.

2. Provide to the Owner for record purposes prior to, but not more than 3 weeks before, commencement of any construction activities.

3. A complete set of all photographs and survey data of the post-construction conditions shall be completed and submitted prior to final inspection by the Owner and Engineer.

1.4 QUALITY ASSURANCE

A. Contractor is solely responsible for quality assurance of temporary shoring.

B. At each excavation support system location, provide the following:

1. Continual verification system is planned, executed, and maintained in accordance with applicable codes, regulations, and good construction practice.

2. Systematic observation of suitability of shoring materials.

3. Installation, excavation, settlement, and lateral deflection monitoring.

4. Groundwater control.

5. Adjacent construction activities.

6. Other factors, as necessary.

Include the following paragraph if necessary.

C. Continually verify installation of the shoring is in conformance with the plans prepared by the Contractor's design engineers.

Include the following section only as required for the Project and the installation of advanced excavation support systems.

1.5 CONTRACTOR QUALIFICATIONS

A. The work of this Section shall be done by a firm specializing in this type of work. The firm shall:

1. Regularly and presently perform shoring installation as one of their principal services.

2. Have technical qualifications, experience, training, and facilities to properly install shoring.

3. Provide the services of a supervising engineer, registered in the State, with at least 5 years of experience in the design and construction of shoring walls.

4. A foreman or superintendent experienced in the installation and removal shoring walls shall be present while this work is performed.

1.6 PERMITTING

A. Secure all permits necessary to complete the requirements of this Section.

PART 2 PRODUCTS

2.1 GENERAL

A. Materials and equipment shall be safe and in good condition and shall conform to local, state, and federal codes.

PART 3 EXECUTION

3.1 GENERAL

A. Provide sheeting, shoring, and other protection and support systems wherever required, in accordance with current local, state, and federal laws, codes, and ordinances.

B. The Contractor is solely responsible for excavation protection and worker safety.

C. The Contractor shall be solely responsible for the protection of existing utilities and structures. Under no circumstance shall work threaten the integrity (physical and operational) of these utilities and/or structures.

3.2 EXCAVATION SUPPORT SYSTEMS

A. The excavation support systems shall not disturb the state of soil adjacent to the trench or excavation and below the excavation bottom.

B. Water control measures shall be provided at all times in accordance with the requirements specified in Section 31 23 19, Dewatering.

C. The support system shall extend below the main excavation bottom elevation to a depth adequate to prevent hydrostatic uplift, seepage and piping, and lateral movement and to adequately support applied vertical loads.

D. Damage to existing utilities or structures during installation of excavation support system shall be avoided. If damage occurs, it shall be repaired at no cost to the Owner and to the satisfaction of the utility owner.

E. A company representative from the excavation support system shall be onsite during initial setup of the system. Install excavation support system in strict conformance with the representative's recommendations.

3.3 CONTINGENCY PLAN IMPLEMENTATION

A. Excess movements or settlements: Work shall be stopped immediately and the causes of excess or detrimental movements evaluated if:

1. Damage is noted to existing site features or surrounding properties.

2. Shoring wall movements exceed the limits specified herein or per submitted calculations.

B. Immediately notify the Engineer and begin the implementation of the approved contingency plan to mitigate the effects of settlement or movement occurred.

3.4 REMOVAL OF SUPPORT SYSTEMS

A. Removal of excavation support systems shall be performed in a manner that does not disturb or damage adjacent new or existing structures or utilities.

B. Fill all voids immediately with specified backfill material.

C. All damage to property resulting from removal shall be promptly repaired at no cost to the Owner. The Engineer shall be the sole judge as to the extent and determination of the methods and materials for repair.

Include the following section only as required for the Project.

Recommended for projects with the need for multiple excavation support system installations.

3.5 SCHEDULE

A. A [tight sheet] excavation support system selected by the Contractor shall be provided for the excavation of the following structures, unless otherwise approved by the Engineer:

Name the structures that require the excavation supports system. Revise the following list as needed

1. Wet Well
2. Valve Vault
3. Meter vault

END OF SECTION