SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 – GENERAL

1.1 DESCRIPTION

A. The Work specified in this Section includes pavement cutting, trench excavation, shoring of excavations during construction, limits of the trench support work, backfilling and compaction.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Other Contract Documents, including Drawings and relevant Sections of the Standard Specifications apply to the Work specified herein.

B. Section 01 55 26 – Traffic Control

C. Section 33 33 00 – Sanitary Sewerage Utilities

1.3 REFERENCES

A. DPW Standard Specifications (SSDPWSF), latest version.

B. ANSI/ASTM C136 – Method for Sieve Analysis of Fine and Coarse Aggregates.

C. ANSI/ASTM D1557 – Test Methods for Moisture–Density Relations of Soils and Soil–Aggregate Mixtures Using 10 lb (4.54 kg) Rammer and 18 inch (457 mm) Drop.

D. ANSI/ASTM D5195 – Nuclear Test Method for Density of Soil.

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

F. DPW Order No. 187,005, “Regulations for Excavating and Restoring Streets in San Francisco”.

G. DPW Order No. 182,003, “Establishing Regulations And Guidelines For The Construction Of New Curb Ramps Or Reconstruction/Upgrade Of Existing Curb Remaps At Angular Returns When Street Excavation Occurs At the Angular Returns Or In The Crosswalk”

H. Article 2.4 of the Public Works Code, “Excavation in the Public Right–Of–Way”.

1.4 SUBMITTALS

A. Plans and calculations for the shoring system shall be submitted for review and approval prior to trench excavation. If such plans vary from the shoring standard established by the Construction Safety Orders, the plans shall be prepared by a Civil Engineer registered in the State of California. Approval shall not relieve the Contractor of responsibility to provide a satisfactory and safe shoring system. The cost of design services shall be borne by the Contractor.

B. Prior to commencing excavation or construction, submit dewatering plans compatible with the shoring system to the City Representative for review and approval.

1.5 POST-EXCAVATION REPAIR AND MAINTENANCE OBLIGATION OF CONTRACTOR (WARRANTY PERIOD)

A. Contractor is responsible to maintain, repair or reconstruct the site of the Excavation so as to maintain a condition acceptable to the City for a period of three (3) years following the date of acceptance of the work.

1.6 EXCAVATION/SHORING SUPPORT

A. The Contractor shall provide all engineering including design, details, and calculations, installation and construction of shoring, sheeting, and bracing necessary to support the sides of the excavation to prevent any movement which may damage adjacent pavements, utilities, or structures, damage or delay the work, or endanger life and health as required by OSHA and other applicable governmental regulations and agencies. All trench works shall also comply with the applicable provisions of California Labor Code Section 6705 and 6707.

B. The provisions specified herein shall complement, and not substitute for nor diminish, the obligations of the Contractor for providing a safe work area and for protecting the work, structures and other improvements.

C. Regardless of what shoring system is used, prevent ground loss along the project alignment. Cantilever type of shoring walls is not acceptable. No sloping/benching type shoring system is allowed. Steel shims or filler plates shall be installed to obtain a tight fit and bearing.

D. The Contractor shall be solely responsible for any damage to adjacent properties caused by his construction operations.

1.7 HANDLING OF GROUND WATER

A. The Contractor shall be responsible for the continuous control of ground water at

all times during the course of construction, including Saturdays, Sundays and holidays.

B. If required, dewatering Plan shall be designed, stamped, and signed by a licensed civil engineer registered in the State of California. By approving the plan, the City accepts no responsibility for the adequacy thereof nor for any damages to public or private property that may result. All such responsibility shall rest with the Contractor. The plan shall include detailed working drawings and pertinent descriptions of the proposed ground water control system including a schedule of installation and details of the system operation plan, contingency plans for interruption or failure of the proposed ground water control system, and disposal plan. Provisions shall also include removal of storm water or any other water that may enter into the excavations.

PART 2 – PRODUCTS

2.1 FILL MATERIALS

A. All fill materials shall be free of organic and deleterious materials and stock piling shall comply with the provisions of Section 700.06 of the SFDPW Standard Specifications.

B. Imported sand type or equivalent backfill will be free from rock, concrete, organic material and other objectionable material. Backfill material will have 100% passing the 3/8" sieve size, 93% to 100% passing the No. 4 sieve size and 0% to 10% passing the No. 200 sieve size. Samples approximately 50 pounds weight will be submitted to and approved by the DPW Material Testing Laboratory, 2027 Newcomb Avenue, San Francisco, prior to placement. Unacceptable material will be immediately removed from the site.

2.2 BEDDING MATERIAL

A. Bedding material for the new VCP and HDPE main sewers shall be crushed rock. Crushed rock shall comply with the requirements of Sections 703.05 and 712 of the DPW Standard Specifications and as shown on SW-Drawings.

2.3 MATERIALS FOR TRENCH SUPPORT SYSTEM

A. Steel sheet piling, if employed, shall be of rolled steel shapes of the continuous interlocking type forming a continuous wall when individual sheets are installed side by side. They shall be installed in a manner that their interlocking is kept continuous without separation at the joints. Sheet pilings, if used, shall not be installed by hard driving. Propose and submit for approval a suitable installation method, which will minimize the noise and vibrations. Other equivalent methods that will effectively prevent water leakage through the joint such as insitu-soil

cement mixing will be acceptable. The interlocking sheet piling and all accessories shall conform to the requirements of ASTM Designation A328.

B. Lagging members, if employed, shall be installed in accordance with approved design and in a manner which will prevent loss of ground. Where, in the judgment of the City Representative, the loss of ground cannot be prevented by wedging the lagging tight against the original ground, e.g., at the sandy non-cohesive soils, prevent the loss of ground by an approved method. This shall not be a cause for changed condition or for claims for extra by the Contractor.

C. All timber, lumber, and structural steel employed for the trench supporting system, whether new or used, shall be sound and free from defects that might impair their strength. Where sheet piles or soldier piles are to be removed, they may be removed after backfilling is completed. Voids left by such removal shall be immediately backfilled with an acceptable bode type structural mix ready onsite, at no extra cost to the project. The Contractor shall meet the requirements to control settlements and shall plan his/her operations accordingly.

D. All timber lagging left in place, shall be pressure treated with wood preservative in accordance with the applicable requirements of Section 415.05 of the Standard Specifications.

E. Except for bracing struts, allowable basic stresses for rolled steel sections, including sheetpiling, may be increased by 20% for all temporary shoring structures. Allowable basic stresses for all temporary shoring structures shall be in accordance with the latest AISC Code. Allowable stresses for struts shall not exceed those allowed by the AISC code for permanent structures. All welds shall be designed according to AISC code without any increase in the allowable stresses for temporary structures. Lagging and all timber structures shall be designed using allowable stresses determined by National Design Specifications In Wood Construction, latest edition. The duration of the load shall not be taken as less than three months.

F. Trench Shields shall not be used for shoring.

PART 3 – EXECUTION

3.1 EXAMINATION

A. The Contractor shall verify fill material to be reused, is acceptable.

3.2 PREPARATION

A. The Contractor shall identify limits Identify required lines, levels, contours and datum shown in the contract drawings.

B. The Contractor shall maintain and protect existing utilities remaining, which pass through the site.

C. The Contractor shall protect bench marks or monuments, existing structures, sidewalks and curbs from excavation equipment and vehicular traffic.

3.3 PAVEMENT CUTTING AND STREET EXCAVATION

A. Pursuant to Section 373 of the San Francisco Public Works Code, the Contractor may use concrete saw cutting or vibratory pavement breaker or equal.

B. No machine or device that breaks pavement by blows struck by a falling or driven hammer or weight will be allowed. Hoe–ram and trenching machines shall not be used for concrete street at the edge of pavement restoration. Such prohibition, however, shall not be construed as barring the use of hand tools or manually operated air tools such as jack hammers.

C. The use of the rock wheel cutter for street excavation is prohibited unless permitted by special order of the Director of Public Works for specific locations. If permitted, rock wheel cutter shall only be used to remove the pavement (concrete base and asphalt concrete wearing surface), and only after potholing has been done to determine the pavement thickness. Rock wheel cutters shall not be used on concrete streets, shall not be used as a trenching device, and shall not be used within 10 feet of a signalized intersection.

D. All areas of pavement to be cut shall be in neat and straight lines, and overcutting of lateral trenches will not be allowed. Dust control shall be provided by using non–potable water with the rock cutting wheel. Protection from flying rocks, debris, etc., shall be provided.

E. Excavation and backfill shall be in accordance with the requirements of Section 7 of the DPW Standard Specifications.

F. The pavement shall be restored in accordance with the requirements of Section 2 of the DPW Standard Specifications.

G. All City noise requirements shall be observed at all times.

H. Pavement base and asphalt concrete wearing surface restoration limits for trench excavation shall be in compliance with DPW Order No. 187,005.

I. All excavation that is performed within marked or unmarked crosswalks or at an angular return within the public right-of-way shall be in compliance with DPW Order No. 179,072 for a curb ramp evaluation and potentially a curb ramp construction or reconstruction / upgrade requirement.

3.4 TRENCH EXCAVATION

A. The Contractor shall excavate every type of material encountered within the limits of the Work to the lines, grades and elevations indicated on the Drawings and specified herein, except materials indicated on the Drawings or directed by the City to remain.

B. Unauthorized Excavation:

1. Unauthorized excavation will be excavation below indicated subgrade elevations or beyond indicated dimensions without specific instruction from the City.
2. Under footings, foundations or retaining walls:
   a. The Contractor shall fill unauthorized excavation by lowering the indicated bottom elevation of the footing or base to the excavation bottom, without altering the required top elevation.
   b. Lean concrete fill may be used to bring bottom elevations to proper position, subject to the City's approval.
3. Elsewhere, the Contractor shall backfill and compact unauthorized excavation as specified for authorized excavations, unless otherwise directed by the City.

C. Excavation of unsound subgrade material shall be in accordance with the requirements of Section 700.10 of the DPW Standard Specifications.

3.5 TRENCH SUPPORT WORK

A. Shoring of excavation during construction shall be in accordance with the requirements of Section 700.04 of the DPW Standard Specifications, and shall include adequate sheeting shoring and bracing etc. or equivalent method, for the protection of life and limb and conforming to applicable safety orders of OSHA and the State of California Division of Industrial Safety.

B. Section 6705 and 6707 of the California Labor Code shall apply to any excavation 5 feet or more in depth, constructed under this contract.

C. Sheet piling, lagging and bracing may be removed during backfilling shall be in accordance with Section 700 of the SFDPW Standard Specifications.

D. The width of the trench shall be in accordance with Section 700 of the SFDPW Standard Specifications.

3.6 REMOVAL OF WATER

A. Provide and operate equipment adequate to keep all excavations and trenches free

of water. Avoid settlement or damage to adjacent property. When dewatering the excavations, dewater from outside the structural limits and from a point below the bottom of the excavation when possible. Submit dewatering, contingency, and disposal plans as per Section 31 23 19 – Dewatering.

B. Placement of crushed rock bedding fill shall not alter the sewer alignment. Crushed rock bedding fill shall be placed as to ensure continuous contact with the sewer pipe.

3.7 BEDDING

A. Support the new sewer pipes during placement and compaction of crushed rock bedding fill.

B. The placement of crushed rock bedding fill will not alter the pipe alignment. Crushed rock bedding fill will be placed to ensure continuous contact with the pipes. Care will be taken to completely fill all spaces under the haunches.

3.8 BACKFILLING AND COMPACTION

A. Backfill excavations as promptly as progress of work permits and in accordance with all relevant requirements of Section 703, 712 and all other applicable sections of the SFDPW Standard Specifications.

B. Place crushed rock beneath and backfill material around structures. Do not begin backfill operations until concrete has achieved a minimum compressive strength of 3,000 psi.

C. Placement of CDF Bedding Material:

1. CDF bedding material placement will be at the discretion of the CDD Inspector. The CDF bedding material will be formed on all vertical sides. Placing CDF against sewer trench shoring to be removed or exposed soil will not be allowed. Any volume of CDF spillage due to improper form work will not be considered for payment and shall be removed prior to backfilling the trench.
2. The Contractor shall place the CDF prior to backfilling the sewer trench. Placing temporary backfill, and re-excavating the area at a later time to place CDF before final trench excavation is not allowed. If the water facility becomes damaged due to improper placement of CDF bedding prior to backfilling the sewer trench, then the Contractor will be held liable.

D. Compaction of fill and backfill materials shall be in accordance with the requirement of Section 707 and all other applicable sections of the SFDPW Standard Specifications.

Compact all materials by mechanical means in lifts not to exceed 8 inches unless permitted otherwise in writing by the City Representative. Flooding or jetting will not be permitted. If compaction tests indicate that compaction or moisture content is not as specified, material placement shall be terminated and corrective action shall be taken by the Contractor prior to continued placement.

E. Compact all fill materials to the following relative dry densities per ASTM D1557, D2922, D6938 or other reference standard acceptable to the City Representative:

1.	Asphaltic Concrete Pavement Subgrade Areas	95%
2.	Landscape Planting Areas	85%
3.	Structural Fill	95%
4.	Trench Backfill	90-95%*

*90% compaction from bottom of trench to within 4 ft of finish grade and 95% compaction for the remainder of the trench.

F. During compaction, protect the new and any existing pipes, and structural walls from damage due to the operation of compaction equipment. Do not operate earth-moving equipment within 5 feet of walls of concrete structures for the purpose of depositing or compacting backfill material. Compact backfill adjacent to concrete walls with hand-operated tampers or similar equipment that will not damage the structure.

3.9 REMOVAL OF WATER

A. The Contractor shall provide and operate equipment adequate to keep all excavations and trenches free of water. The Contractor shall avoid settlement or damage to adjacent properties. When dewatering the excavations, the Contractor shall dewater from outside the structural limits and from a point below the bottom of the excavation when possible. Dewatering, contingency and disposal plans will be submitted for approval by the City.

3.10 FIELD QUALITY CONTROL

A. The Contractor shall secure the Testing Agency's inspection and testing, and the City Representative's approval of testing results and visual inspection and approval for subgrades and fill layers before proceeding with construction thereon.

B. Fill and backfill materials shall be compacted to densities specified in the applicable provisions of Sections 703, 706, 707 and 709 of the SFDPW Standard Specifications.

C. If, based on reports from a Testing Laboratory, Subgrade or fills which have been placed are below specified requirements, provide additional compacting and retest at no cost to the City.

3.11 MAINTENANCE

A. The Contractor shall protect newly graded areas from traffic and erosion, and keep the areas free from trash and weeds. The Contractor shall repair and re-establish grades in settled, eroded and rutted areas to the specified tolerances.

B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, the Contractor shall scarify the surface, reshape and compact to the required density prior to further construction

END OF SECTION