SECTION 02310 - TUNNEL GROUNDWATER CONTROL

City of San Diego, CWP Guidelines

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

A. The WORK of this Section includes designing, furnishing, installing, maintaining, operating and removing systems required to control groundwater levels and hydrostatic pressures during tunnel and portal construction; disposing of pumped water; constructing, maintaining, observing, and removing of observation wells; and instrumentation for control of the system.

B. Dewatering shall include lowering the groundwater table and intercepting seepage which would otherwise emerge from the tunnel excavation; preventing loss of material from the tunnel excavation; and preventing rupture or heaving of the bottom of the tunnel excavation.

C. Instrumentation for control of the dewatering system shall include furnishing, installing, and operating observation wells as well as reading and logging of water levels in the wells.

1.2 RELATED SECTIONS

A. The WORK of the following Sections applies to the WORK of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

1. Section 01530 Protection of Existing Facilities
2. Section 02140 Dewatering
3. Section 02200 Earthwork
4. Section 02340 Boring and Jacking

1.3 STANDARD SPECIFICATIONS

A. Except as otherwise indicated in this Section of the Specifications, the CONTRACTOR shall comply with the Standard Specifications for Public Works Construction (SSPWC), as specified in Section 01090 - REFERENCE STANDARDS.

1.4 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

1. The proposed type of dewatering system, including relief of hydrostatic head and procedure for maintaining the tunnel and portal excavations in a dewatered and hydrostatically relieved condition.

2. Arrangement, location, and depths of the components of the system.

3. A complete description of equipment to be used, with installation, operation, and maintenance procedures.

4. Standby equipment and power supply.

5. Location, size, and construction details of berms, dikes, observation wells, sumps, and discharge lines, including discharge points and plans for removing system and restoration of the area disturbed by dewatering operations.

6. Types and sizes of filters.

7. Cement-bentonite grout mix and placing procedures.

8. Design calculations demonstrating adequacy of the selected system and equipment.

1.5 OBSERVATION, RECORDS AND SUBMITTALS

A. The CONTRACTOR shall furnish the CONSTRUCTION MANAGER with the following records:

1. The average flow rate and time of operation of each pump used in the dewatering system shall be observed and recorded daily. Where necessary, appropriate devices, such as flow meters for observing the flow rates, shall be provided. The data, on a form approved by the CONSTRUCTION MANAGER, shall be submitted daily during the period that the dewatering system is in operation.

2. The elevation of the groundwater in observation wells shall be observed and recorded daily during the period that the dewatering system is in operation. The depth to the bottom of each observation well shall be sounded on a weekly basis to assure that fine soil particles are not penetrating the screen to build up in the standpipe. Observation well records shall be submitted to CONSTRUCTION MANAGER within 24 hours of reading.

3. During the initial period of the dewatering, required observations shall be made on a daily basis. After the initial period, when dewatering operations have stabilized, observations can be made at longer intervals as approved by the CONSTRUCTION MANAGER.

1.6 PERMITS FOR DISCHARGE OF WATER

A. The CONTRACTOR shall obtain any permits required for discharge of water from dewatering operations. When water is to be diverted into a storm drain, settling basins or other approved facilities shall be provided as required to reduce the amount of fine particles which may be carried into the drain. If a storm drain becomes blocked or its capacity restricted due to dewatering operations, arrangements shall be made with the appropriate agency to clean the drain at no additional expense to the OWNER.

PART 2 -- PRODUCTS

2.1 DESIGN CRITERIA FOR DEWATERING SYSTEM

A. **General**: The CONTRACTOR shall furnish all pumps, pipes, appliances and equipment for dewatering in compliance with subsection 306-3.3 of SSPWC and as indicated herein.

B. **Objectives**: The CONTRACTOR shall design a dewatering system which will:

1. Lower the groundwater level in the ground to a level 2 feet below the bottom of the excavated tunnel invert.

2. Develop a substantially dry and stable subgrade for the performance of subsequent operations.

3. Result in no damage to adjacent properties, buildings, structures, utilities, and other work.

4. Not remove soil particles during pumping operations.

C. **Methods:** Methods may include sump pumping, single or multiple stage well point systems, eductor and ejector type systems, deep wells, and combinations thereof. It is the CONTRACTOR's responsibility to review and investigate the soils and groundwater conditions at the site and to determine the type or combination of methods necessary to provide the dewatering required to perform the WORK.

D. **Location:** The dewatering facilities shall be located only where they will not interfere with utilities and other construction work.

E. **Modifications:** Dewatering procedures which cause, or in the opinion of the CONSTRUCTION MANAGER threaten to cause, damage to new or existing facilities shall be modified so as to prevent further damage. The CONTRACTOR is responsible for determining and implementing any modifications, which shall be made at no additional expense to the OWNER.

PART 3 -- EXECUTION

3.1 DEWATERING

A. Dewatering operations shall be performed in compliance with SSPWC Subsection 306-3.3 and the following provisions.

B. Dewatering shall be accomplished in accordance with SSPWC subsection 306-3.3, the reviewed shop drawings and the requirements indicated herein. The CONSTRUCTION MANAGER shall be kept advised of any changes made to accommodate field conditions and, on completion of the dewatering system installation, shop drawings shall be revised and resubmitted.

C. Dewatering operations shall lower the groundwater level in excavations as required for prosecution of the WORK, and provide a stable, dry subgrade for the prosecution of subsequent operations.

D. The water level shall be maintained at such lower elevations until no danger to the tunnel and related facilities can occur because of buildup of excessive hydrostatic pressure, and in any event, the water level shall be maintained a minimum of 2 feet below the excavated tunnel invert and portal excavation until all tunnel or portal work has been satisfactorily completed, unless otherwise permitted by the CONSTRUCTION MANAGER.

[E. Dewatering operations shall be prosecuted 24 hours a day, 7 days a week. Qualified personnel shall be on-site at all times to monitor system operations and to perform maintenance as necessary and to keep the dewatering system in operation. The

responsible person in charge of the dewatering program shall be available for communication with the site personnel at all times, and shall be able to be on the site within one hour of being alerted, should the need arise.]

3.2 DRAINAGE

A. **Surface Drainage:** All precipitation, surface water, and groundwater shall be intercepted and diverted away from the excavations, observation wells and piezometer installations, through the use of dikes, curb walls, ditches, pipes, sumps, or other means.

B. **Drainage of Excavated Area:** Ditches of adequate size shall be provided and maintained to collect surface and seepage water which may enter the excavations. The water shall be diverted into sumps and drains, or pumped into drainage channels or storm drains, subject to the approval of the appropriate authority.

3.3 OBSERVATION WELLS

A. Observation wells shall be used as the primary basis for determining compliance with the dewatering requirements of this Section.

B. Up to [6] observation wells shall be installed at the locations, and to the depths indicated on the drawings. Existing wells may be used if available and appropriate.

C. Six-inch minimum diameter holes shall be drilled for observation wells, of the size and depth indicated, and cased with temporary casing. Bentonite slurry shall not be used in drilling holes for the observation wells. A log shall be made of the soils encountered during drilling. A copy of each log shall be delivered to the CONSTRUCTION MANAGER upon completion of each well.

D. All cased holes shall be flushed with clean water through an approved bit, until the discharge water is free of soil particles.

E. **Observation Well Construction:** Two-inch minimum inside diameter observation wells shall be constructed using slotted PVC well screen, filter sand, solid PVC casing, couplings, a pipe cap, and a locking hole cover. Two feet of filter sand shall be placed in the bottom of the drilled hole, followed by the well screen and surrounded with filter sand, as the temporary casing is carefully withdrawn, to within 10 feet of the top. The solid PVC casing and cap shall be inserted and the annular space filled with cement-bentonite grout in the top 10 feet. If the well is located in a paved area, a locking well cover and a suitable precast concrete vault shall be installed.

F. Maintenance of the observation wells is the responsibility of the CONTRACTOR.

G. Damaged or destroyed observation wells shall be replaced within 48 hours, unless otherwise approved by the CONSTRUCTION MANAGER, at no additional expense to the OWNER.

H. **Removal of Observation Wells:**

1. Observation wells shall be removed only with the permission of the CONSTRUCTION MANAGER.

2. Observation wells outside paved areas shall be removed by removing PVC pipe construction to a depth of 5 feet below finished surface grade. Using approved tremie methods, the observation wells shall be completely filled with non-shrink cement-bentonite grout. The excavation shall be backfilled and the surface restored to its original condition.

3. Observation wells in paved areas shall be removed by removing the vaults and hole covers to the pavement subgrade. The observation well shall be filled with cement-bentonite grout and the pavement patched in accordance with the requirements of Section 01530.

3.4 REMOVAL OF SYSTEM AND RESTORATION

A. When groundwater control is no longer necessary, the dewatering wells shall be abandoned in an approved manner, drain lines and connections removed and the ground surface restored to its original condition.

B. Dewatering wells and all construction facilities pertaining to dewatering shall be removed (to the depths indicated), filled with grout, and the surface restored as indicated in paragraph 3.3H.

** END OF SECTION **