

## 21.0 Potable Water Treatment System

This Section 21 includes the requirements for the Potable Water Treatment System Work for the EJMT DPHT Project. This Work shall be completed in accordance with the Contract Documents.

The Colorado Department of Transportation (CDOT) owns and operates a potable water treatment system (PWSID #CO0210009) serving the EJMT complex. The system is a non-transient, non-community, surface water treatment plant rated to serve a population of 50. The EJMT complex has two existing drinking water treatment plants, one in each portal of the tunnel. Both treatment systems draw raw water from an 8" fire water supply line that is fed by a 120,000-160,000 gallon water storage tank located outside the west EJMT portal. The 8" fire water line feeds two separate 3" lines that supply the bag filtration and chlorine disinfection systems. Both treatment facilities have miscellaneous isolation valves, pressure reducing valves (PRV), instrumentation, tanks, etc. CDOT estimates the flow rates to the west and east portals of EJMT is 3,000 GPD and 2,000 GPM, respectively. The water storage tank provides 60 psi of pressure to the west side of the tunnel and 100 psi to the east. Work will take place inside the existing water treatment areas at each portal. The system currently is in compliance with Colorado Department of Public Health and Environment (CDPHE) potable water system regulations. However, it requires upgrades to meet CDOT's long term operational and life cycle objectives.

The existing domestic water supply for the East Portal is located within the walkway on the roadway of the eastbound bore. The existing water supply line is combined with the existing supply to the hydrants. A new domestic water supply shall be provided from the West Portal, originating in the existing water treatment room and interconnected via the plenum with the water treatment room located in the East Portal. New domestic water piping shall extend through the roadway and fan deck levels, traversing the tunnel through the westbound bore plenum space.

### 21.1 Administrative Requirements

#### 21.1.1 Standards

The Contractor shall design and construct the Project in accordance with the requirements of the standards in the documents listed in Table 21-1 and those referenced in Book 3. The Contractor shall use the latest adopted edition at the time of the Proposal Due Date.

Table 21-1 Standards

Author or Agency	Title
Colorado Department of Public Health and Environment (CDPHE)	CDPHE Policy #5 - Design Criteria for Potable Water System
Colorado Department of Public Health and Environment (CDPHE)	CDPHE Regulation #11 - Primary Drinking Water Regulations
International Code Council (ICC)	International Plumbing Code, 2018

Author or Agency	Title
ICC	International Mechanical Code, 2018
National Fire Protection Association (NFPA)	NFPA 502 Standard for Road Tunnels, Bridges, and Other Limited Access Highways
American Water Works Association	C600 Installation of Ductile Iron Mains and Their Appurtenances
National Sanitation Foundation (NSF)	NSF 61 - Drinking Water System Components

## 21.2 Design Requirements

The Contractor shall permit, design, construct, and commission improvements to the existing water treatment system at EJMT. The improvements are intended to allow CDOT to provide safe and reliable drinking water service to the existing facilities as well as future capacity within the complex. The improvements shall be designed to provide a durable and reliable system that reduces CDOT long term operations and maintenance costs.

The Contractor shall remove all existing water treatment plant equipment from both the east and west water treatment plants.

The Contractor shall design the water treatment system to meet a 40 GPM instantaneous flow rate through the bag filters, UV system, and at each portal and 10,000 GPD demand to accommodate future CDOT needs at the EJMT. It is likely there will be negligible flow through the system during early morning hours, so Contractor shall consider the low flow condition 0 gpm recognizing that zero flow will only occur for a limited number of hours during the day.

Section 1.2.3 of CDPHE Policy #5, Design Criteria for Potable Water Systems, requires the following sampling for UV Reactors:

xii	Ultraviolet (UV)	<ul style="list-style-type: none"> <li>- Temperature</li> <li>- UV Transmittance (UVT) at 254 nm</li> <li>- Total Hardness</li> <li>- pH</li> <li>- Alkalinity</li> <li>- Total iron</li> <li>- Calcium</li> <li>- Total manganese</li> </ul>
-----	------------------	---

The facility's operator sampled for these items on January 12<sup>th</sup>, 2022, and will be taking more samples. The CDPHE requires two consecutive quarterly samples for these items, with one of the samples taken during the critical period. The critical period for this project will be spring runoff season. Therefore, at least one more set of samples will be

taken by CDOT during the second quarter of 2022 to satisfy the analytical testing requirements. Sample testing results can be found in the Reference Documents.

The Contractor shall submit a water treatment basis of design concept report to CDOT for Acceptance that provides a simpler and more reliable water treatment system while also incorporating an additional treatment barrier and redundancy provisions. The water treatment basis of design concept report shall include the following at a minimum:

- West Portal Facility
  - Install three new bag filter canisters that are compatible with Harmsco bag filters
  - Install a new skid downstream of the bag filters consisting of:
    - Two UV reactors
    - Raw & finished water turbidimeters including controller
    - Two magnetic flow meters
    - Sodium hypochlorite pump flow paced to flow meter
    - Chlorine residual meter
    - Automatic pressure gauge
    - Ability to send chlorinated water to the plenum by adjusting hand valves in the event the plenum water line needs to be disinfected as an O&M activity
    - PLC/HMI that monitors the system components listed above and exports data-alarms via cellular modem - protocol can be determined by skid manufacturer. The PLC/HMI shall have the ability to export the recorded data of the monitored system components via a thumb drive plugged in the control panel or HMI.
    - Any other items required for the system to function as intended and meet CDPHE redundancy requirements including programming and commissioning
  - Install disinfection contact piping for West Portal plumbing
- East Portal Facility:
  - Install a sodium hypochlorite feed pump flow paced off a flow meter
  - Install disinfection contact piping for east tunnel plumbing
  - Install a chlorine residual meter
  - Ability to flush the plenum water line and send the water in the line to the collection system
  - East portal equipment does not need to communicate with the equipment in the west portal

A preliminary process flow diagram depicting this basis of design is provided in the Reference Documents.

### 21.2.1 Piping and Materials

A new domestic water supply shall be provided from the West Portal, originating in the existing water treatment room and interconnected via the plenum with the water treatment room located in the East Portal. New domestic water piping shall extend through the roadway and fan deck levels, traversing the tunnel through the westbound bore plenum space.

All new piping and materials shall be suitable for domestic water use and in accordance with the International Plumbing Code, International Mechanical Code, NFPA 502, and NSF-61. The use of non-metallic piping is not permitted.

All new domestic water piping shall be independently supported from all other systems, including the existing fixed fire suppression system. New piping in the plenum shall not be installed on the plenum divider wall and shall not add additional loading to the plenum floor.

Piping shall be protected from freezing in all areas.

### 21.2.2 Design Deliverables

The Contractor shall submit the following deliverables to CDOT for Acceptance:

#### 21.2.2.1 CDPHE Construction Application

- A. Prepare a Construction Application Report as required by Colorado Department of Public Health and Environment (CDPHE) Policy #5, Design Criteria for Potable Water Systems and CDPHE Regulation # 11, Colorado Preliminary Drinking Water Regulations.
- B. The Construction Application shall address the applicable items in CDPHE Policy #5 Appendix B: Basis of Design Report Template, Drinking Water Design Submittal Safe Drinking Water Program.
- C. Any other applicable CDPHE regulations and policies.

#### 21.2.2.2 Final (100% Level) Plan Package

The Contractor shall prepare Final (100% Level) engineering drawings that conform to the following:

- A. Drinking water process engineering
- B. Electrical and instrumentation engineering for the proposed equipment
- C. The drawing set include the following at a minimum:
  - a. Process Flow Diagram
  - b. Hydraulic Profile
  - c. Design Criteria & Equipment Summary
  - d. Demolition Plan

- e. Treatment Building Process Equipment Layout
- f. Treatment Building Process Equipment Elevations
- g. Process Engineering Details
- h. Instrumentation Plan with Control Strategy including remote access of PLC controls.
- i. Pipe plan and profile drawings
- j. Electrical Legend and One Line Diagram
- k. Electrical Power Plan (for treatment equipment)
- l. Electrical Schedules
- m. Process and Instrumentation Diagrams

### **21.3 Construction Requirements:**

The Contractor shall complete the installation in accordance with the Contract Documents.

The Contractor shall maintain operation of the existing treatment system throughout construction or provide a temporary potable water supply that is equivalent, as determined by CDOT, to the existing system. The Contractor shall coordinate any treatment system shutdowns with CDOT per Book 2 Sections 1 and 18. Treatment shutdowns requests shall be submitted to CDOT for Approval a minimum of 7 Days in advance of the proposed shut down and shall not exceed 24 hours in duration, unless otherwise Approved by CDOT.

Existing raw water lines in the north and south tunnels shall be abandoned in place once the new raw water connections are established and water treatment plants are tested and commissioned. Abandoned water lines are to be disconnected and provided with a valve and cap where disconnected from existing system. Hydrant locations within the roadway in the North Tunnel shall be grout filled and roadway patched back to prevent any future maintenance issues. Signage indicating hydrant locations shall be removed. Hydrant location signage along the South Tunnel walkway shall be removed.

### **21.4 Testing and Commissioning**

#### **21.4.1 Testing**

##### **21.4.1.1 Construction Acceptance Test**

The Construction Acceptance Test shall be performed using the constructed system in the EJMT, at least 30 days prior to the Project Completion of the Project.

#### **21.4.2 Commissioning**

All mechanical, electrical, and software systems shall be tested as part of a complete commissioning program. Commissioning testing shall be performed in accordance with CDPHE and AWWA C600.

Commissioning tests shall include at a minimum the following elements:

- Component and equipment
- Communication links
- Status, control, alerts, and alarms
- Interfaces between subsystems
- Integration among new and existing subsystems

The Contractor shall complete commissioning of all systems for CDOT Acceptance prior to Project Completion.

The Contractor shall prepare and submit a Commissioning Test Plan and Schedule for Approval to CDOT a minimum 30 days before the start of any testing. The test plan shall be based on the technical specifications and performance characteristics of all devices, equipment, parts, assemblies, systems, subsystems, software and devices supplied and installed under this contract. Testing shall be carried out by the Contractor and witnessed and documented by CDOT.

All elements subject to testing shall be included in the testing schedule. A commissioning meeting shall be held 15 days prior to the scheduled start of testing to review the status of the testing and planning for future tests.

All commissioning documentation shall be submitted to CDOT for Acceptance following testing and prior to Project Completion.

### **21.4.3 Maintenance and Operations Training**

The Contractor shall provide Maintenance and Operations training a minimum of 30 days prior to Project Completion. The Contractor shall provide a Maintenance and Operations Training Plan and Syllabus 30 days prior to beginning training for review by CDOT. The training shall be conducted by the manufacturer's technical service personnel or factory authorized representatives for all of the systems installed in the EJMT.

The Contractor shall include in the training; operation instructions, theory of operation, system description, preventive maintenance procedures, troubleshooting and repair of all equipment specified herein. The Contractor shall include with the training all material and manuals required for each participant. Dedicated systems training for CDOT system administrators shall cover computer systems, hardware, communication networks, and software systems.

### **21.4.4 Manuals and Documentation**

The Contractor shall provide Maintenance and Operations Manual to CDOT for review and Approval 30 days prior to Project Completion. The Contractor shall provide five printed and bound copies and one electronic copy in native editable format of the final Maintenance and Operations Manual within 30 days after CDOT Approval. The Maintenance and Operations Manual shall include catalog cuts, final as-built shop

drawings, hardware and software instruction manuals for all systems supplied and installed, stored on USB memory, equipment maintenance, and recommended spare parts. Project Completion of Systems will not be provided until the Maintenance and Operations Manual has been Approved.

The Maintenance and Operations Manual shall include a complete parts list. The parts list shall include a list of all parts supplied under the Contract, down to the lowest level part or assembly that is user-replaceable. The parts list shall include part numbers, description, system application or use, manufacturer, and supplier. The parts list shall identify sole-source and proprietary parts. For all sole-source and proprietary parts, compatible or alternative parts shall be identified. The estimated service life of parts that have a service life less than 30 years shall be identified.

The Maintenance and Operations Manual shall include a complete consumable supplies list. The supplies list shall include a list of all materials required for routine maintenance of the equipment supplied under the Contract. The supplies list shall include material name, description, function, application rate and frequency, manufacturer, and supplier.

A CDPHE construction completion certificate shall be provided to CDOT for Acceptance prior to Project Completion.

## 21.5 Deliverables

At a minimum, the Contractor shall submit the following to CDOT for Review, Approval, and/or Acceptance:

**Table 21-2: Deliverables by the Contractor**

Deliverable	Review, Acceptance or Approval	Schedule
Water Treatment Basis of Design Concept Report	Acceptance	Within 60 Days after NTP1
CDPHE Construction Application	Review	With RFC Documents
Water Treatment System shutdown requests	Approval	7 Days prior to shutdown
Commissioning Test Plan and Schedule	Approval	30 Days prior to start of testing
Testing and Commissioning Report	Acceptance	After testing and prior to Project Completion
Maintenance and Operations Training Plan and Syllabus	Review	30 Days prior to training
Maintenance and Operations Manual	Review	30 Days prior to Project Completion

---

Deliverable	Review, Acceptance or Approval	Schedule
CDPHE Construction Completion Certification	Acceptance	Prior to Project Completion