TECHNICAL SUMMARY OF CHANGES

1) **CHANGES TO SPECIFICATIONS.** Attached hereto are [new revised and ~~deleted~~] sections to the specifications. Revision mark ***AMENDMENT 0003*** is shown on each revised page.

   A) REVISED SECTION.

   - Section 01 11 00 – SUMMARY OF WORK
     - 1.6 Any equipment, materials, and any temporary working structure in the lake and within the spillway may need to be removed if the lake is forecast to rise and result in an uncontrolled release from the spillway. If such removal is necessary, the Contractor shall temporarily plus any open borehole to the extent practicable to prevent the entry of overflowing spillway water.
     - 1.6 ~~The equipment in the lake may need to be removed if the lake is forecast to rise significantly with an uncontrolled release from the spillway.~~
     - 1.6 The Contractor will need to establish the maximum working lake level for equipment and any temporary working structure, as well as the necessary lead time to receive notice to evacuate any equipment and any temporary working structure. Longer lead times may result in "false alarm" type evacuation notifications where the high lake level and spillway flow are not realized. Shorter lead times will allow for more accurate forecasting.
   - Section 01 32 01.00 10 – PROJECT SCHEDULE
     - 3.1.2 Time Constraints

       All work shall be performed during the hours of 0730 AM to 1600 PM.
     - 3.1.3 Work Outside Regular Hours

       Work outside regular working hours requires Contracting Officer approval. Make application 15 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number, and project title. Based on the justification provided, the Contracting Officer may approve work outside regular hours. During periods of darkness, the work area shall be properly lighted, in full compliance with EM 385-1-1, and approved by the Contracting Officer. The Contractor shall also observe the Fatigue Management rules stated in EM 385-1-1.
   - Section 01 50 00 – TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
     - 3.5.8 Barge Mooring

Mooring a barge to the dam is allowed and is limited to the non-spillway monoliths. The barge shall be moored in such a way to not impart any vertical forces to the dam. Wind loads on the barge and equipment it carries will be transmitted to the dam and could be significant. The Contractor shall prepare an engineering analysis of the overall dam stability to include mooring forces with wind loads and submit the engineering analysis to the Contracting Office for AE and Government approval. The engineering analysis shall be sealed by a Professional Engineer licensed in the State of Virginia.

- Section 31 68 13 – SPILLWAY ANCHORS
  - 1.4.5.2 Regrouting Holes will be measured for payment based upon the number of cubic feet ~~94-pound bags~~ of cement grout that were actually injected into the anchor hole as specified.
  - 1.4.5.3 ~~Bags of cement (94 lbs).~~ Cubic feet.
- Section 33 51 43 – INSTRUMENTATION AND PERFORMANCE MONITORING OF STRUCTURES
  - 1.5.2.1 ~~b. Automated In-Place Inclinometer: probe, carrying case, cable, readout unit, and software.~~
  - 2.3.1 ~~Factory-calibration curves are required for each laser water level sensor, including individual gage factor and temperature correction factor.~~
  - 3.5.3.4 ~~e. Plot Automated Robotic Total Station Monitoring system data as x, y, z and resultant displacement versus time, and provide in tabular format.~~

2) <u>CHANGES TO DRAWINGS.</u> Attached hereto are revised drawing sheets. Revised sheets replace like numbered sheets. The revision tracker in the Title Block of each sheet is populated to reflect the current Amendment Number and issue date.

A) REVISED DRAWINGS (ISSUED). The following revised drawings replace the like numbered drawings and are issued herewith.

- Drawings revised in entirety based on the revised Bid Schedule.
  - C-400
    - Revised note 9 with temporary load statement.
      - ALL TEMPORARY LOADS FROM WORK PLATFORM BEARING AND OTHER TEMPORARY APPLICATIONS SHALL BE EVALUATED WITH ACI 381 (CURRENT EDITION) USING AN APPROXIMATE f'c = 3,375 PSI.

CHANGES TO SPECIFICATIONS

SECTION 01 11 00

SUMMARY OF WORK
02/24

PART 1 GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

1.1.1 Project Description

The work includes installation of spillway anchors and automated anchor load sensors. Also included are installation of inclinometers in monoliths 9 and 13 and automation of crack gauges and piezometers, and incidental related work.

1.1.2 Location

The work is located at the Philpott Lake Dam in Henry and Franklin Counties, Virginia which is approximately 7 miles north of Bassett, Virginia, as indicated on the drawings.

1.2 OCCUPANCY OF PREMISES

Philpott Dam will remain in operation throughout the duration of construction. The Government periodically requires access to service or inspect hydraulic steel structures stored in the dam crest. The Contractor shall not impede access to the hydraulic steel structure storage locations, hatches, or operational tracks during said periodic events. Furthermore, the Contractor shall coordinate with the Government and its contractors to accommodate access given a minimum of 30 days' notice provided by Government. The Contractor may be required to temporarily relocate equipment, move stored materials, and clear the roadway leading to the dam crest to facilitate these operations. The storage hatches are contained within Monoliths 7, 8, and 9. Any disruption of construction operations will be minimized. Access may be required for up to 5 business day increments per occurrence.

Before work is started, arrange with the Contracting Officer a sequence of procedure, means of access, space for storage of materials and equipment, and use of approaches, corridors, and stairways.

1.3 EXISTING WORK

Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.

Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, affected existing work must be in a condition equal to or better than that which existed before new work started.

1.4 LOCATION OF UNDERGROUND UTILITIES

Obtain digging permits prior to start of excavation, and comply with installation requirements for locating and marking underground utilities. Contact local utility locating service a minimum of 48 hours prior to

excavating, to mark utilities, and within sufficient time required if work occurs on a Monday or after a holiday. Verify existing utility locations indicated on contract drawings, within area of work.

Identify and mark all other utilities not managed and located by the local utility companies. Scan the construction site with Ground Penetrating Radar (GPR), electromagnetic, or sonic equipment, and mark the surface of the ground or paved surface where existing underground utilities or utilities encased in dam structures are discovered. Verify the elevations of existing piping, utilities,and any type of underground or encased obstruction not indicated, or specified to be removed, that is indicated or discovered during scanning, in locations to be traversed by piping, ducts, and other work to be conducted or installed. Verify elevations before installing new work closer than nearest manhole or other structure at which an adjustment in grade can be made.

1.4.1 Notification Prior to Excavation

Notify the Contracting Officer at least 48 hours prior to starting excavation work.

1.5 SALVAGE MATERIAL AND EQUIPMENT

Items designated by the Contracting Officer to be salvaged remain the property of the Government. Segregate, itemize, deliver and off-load the salvaged property at a location designated by the Government.

Maintain a list of material and equipment to be salvaged, and their storage location. Maintain property control records for material or equipment designated as salvage. Provide a system for property control in the salvage plan. Store and protect salvaged materials and equipment until disposition by the Contracting Officer.

AMENDMENT 0003

1.6 LAKE OPERATION INFORMATION

Philpott Lake operation information is discussed in the Water Control Plan for Philpott Lake dated June 1992 (minor editorial changes March 2004):

https://epec.saw.usace.army.mil>PhilpottWCP.pdf

In summary, it is the intent of the Water Control Plan to operate Philpott Dam to maintain the lake level at, or near, the guide curve elevation. The guide curve is at elevation 970.8 feet NAVD88 from October through January and at elevation 972.8 feet NAVD88 from April through July. The guide curve varies linearly between the two limits from February through March and from August through September.

The latest information including Project Description, Pertinent Data, Daily Operating Log Files, Daily Reservoir Reports, Projected Lake Levels during Flood Events, Recent Elevation and Flow Information, and Historic Lake Elevation, Inflow and Outflow data are provided on the following website:

https://epec.saw.usace.army.mil/roanphil.htm

The hydrograph of the daily midnight lake elevation data is provided on Attachment A.

The Philpott Pool Elevation Duration Curve is provided on Attachment B.

Data and information furnished or referred to above is for the Contractor's information. The Government shall not be responsible for any interpretation of, or conclusion drawn from the data or information by the Contractor.

Flood events, high flow rates, and high-water levels, as well as drought and low-water conditions may occur during construction. Therefore, the Government does not guarantee that water levels in the lake will not fluctuate accordingly.

~~The equipment in the lake and within the spillway may need to be removed if the lake is forecast to rise significantly with an uncontrolled release from the spillway.~~Any equipment, materials, and any temporary working structure in the lake and within the spillway may need to be removed if the lake is forecast to rise and result in an uncontrolled release from the spillway. If such removal is necessary, the Contractor shall temporarily plug any open borehole to the extent practicable to prevent the entry of overflowing spillway water.

The Contractor will need to establish the maximum working lake level for equipment and any temporary working structure, as well as the necessary lead time to receive notice to evacuate any equipment and any temporary working structure. Longer lead times may result in "false alarm" type evacuation notifications where the high lake level and spillway flow are not realized. Shorter lead times will allow for more accurate forecasting.

The Contractor shall submit the above information in the Construction Site Plan (01 50 00 TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS, paragraph CONSTRUCTION SITE PLAN)

AMENDMENT 0003

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

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SECTION 01 32 01.00 10

PROJECT SCHEDULE
08/23, CHG 1: 08/24

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AACE INTERNATIONAL (AACE)

AACE 29R-03	(2011) Forensic Schedule Analysis
AACE 52R-06	(2006) Time Impact Analysis - As Applied in Construction
AACE 84R-13	(2015) Planning and Accounting for Adverse Weather

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 67-17	(2017) Schedule Delay Analysis

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety -- Safety and Occupational Health (SOH) Requirements
ER 1-1-11	(2017) Administration -- Project Schedules

1.2 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Project Scheduler Qualifications; G

Preliminary Project Schedule; G

Initial Project Schedule; G

Periodic Schedule Update; G

1.3 PROJECT SCHEDULER QUALIFICATIONS

Designate an authorized representative to be responsible for the preparation of the schedule and all required updating and production of reports. The Designated Project Scheduler must have prepared and maintained at least three previous construction schedules for projects of

similar size and complexity to this contract, using Primavera P6.. Representative must have a comprehensive knowledge of CPM scheduling principles and application.

PART 2 PRODUCTS

2.1 SOFTWARE

The scheduling software utilized to produce and update the schedules required herein must be capable of meeting all requirements of this specification.

2.1.1 Government Default Software

The Government uses Primavera P6. Ensure exported schedule files are compatible with the version of P6 used by the Government.

2.1.2 Contractor Software

Scheduling software used by the contractor must be commercially available from the software vendor for purchase with vendor software support agreements available. The software routine used to create the required sdef file must be created and supported by the software manufacturer.

2.1.2.1 Primavera

If Primavera P6 is selected for use, provide the "xer" export file in a version of P6 importable by the Government system. Verify at the SEKO meeting which version of P6 is in use by the Government. Export the schedule in a version of P6 no newer than that used by the Government.

2.1.2.2 Other Than Primavera

If the Contractor chooses software other than Primavera P6, that is compliant with this specification, provide for the Government's use two licenses, two computers, and training for two Government employees in the use of the software. These computers will be stand-alone and not connected to Government network. Computers and licenses will be returned at project completion.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Prepare for approval a Project Schedule, as specified herein, pursuant to FAR Clause 52.236-15 Schedules for Construction Contracts. Show in the schedule the proposed sequence to perform the work and dates contemplated for starting and completing all schedule activities. The scheduling of the entire project is required. The scheduling of construction is the responsibility of the Contractor. Contractor management personnel must actively participate in its development. Subcontractors, and suppliers working on the project must also contribute in developing and maintaining an accurate Project Schedule. Provide a schedule that is a forward planning as well as a project monitoring tool. Use the Critical Path Method (CPM) of network calculation to generate all Project Schedules.

3.1.1 Scheduling Expectations Kickoff Meeting(SEKO)

In conjunction with the post award conference or pre construction

conference the Government and the Contractor will hold a separate and distinct Scheduling Expectations Kickoff Meeting(SEKO). The intent of this meeting is for the Government to review with the contractor the requirements of the scheduling specification, communicate the Government's expectations regarding schedule development and management, and answer any questions the Contractor may have regarding the schedule requirements.

AMENDMENT 0003

3.1.2 Time Constraints

All work shall be performed during the hours of 0730 to 1600.

3.1.3 Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Make application 15 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number, and project title. Based on the justification provided, the Contracting Officer may approve work outside regular hours. During periods of darkness, the work area shall be properly lighted, in full compliance with EM 385-1-1, and approved by the Contracting Officer. The Contractor shall also observe the Fatigue Management rules stated in EM 385-1-1.

AMENDMENT 0003

3.2 BASIS FOR PAYMENT AND COST LOADING

The schedule is the basis for determining contract earnings during each update period and therefore the amount of each progress payment. The aggregate value of all activities coded to a contract CLIN must equal the value of the CLIN. Match the progress payment "Pay Period Thru" date in RMS to the schedule data date.

3.2.1 Activity Cost Loading

Activity cost loading must be reasonable and without front-end loading. Activities with a negative cost loading is not allowed. Provide additional documentation to demonstrate reasonableness if requested by the Contracting Officer.

3.2.2 Cost Loading of Submittals

No costs are to be assigned to activities for the preparation, review, or approval of submittals, except as described under paragraph COST LOADING OF CLOSEOUT ACTIVITIES, paragraph AS-BUILT DRAWINGS, and paragraph O&M MANUALS.

3.2.3 Withholdings / Payment Rejection

Failure to meet the requirements of this specification may result in the disapproval of the preliminary, initial, or periodic schedule updates and subsequent rejection of payment requests until compliance is met.

In the event that the Contracting Officer directs schedule revisions and those revisions have not been included in subsequent Project Schedule revisions or updates, the Contracting Officer may withhold 10 percent of

pay request amount from each payment period until such revisions to the project schedule have been made.

3.3 PROJECT SCHEDULE DETAILED REQUIREMENTS

3.3.1 Level of Detail Required

Develop the Project Schedule to the appropriate level of detail to address major milestones and to allow for satisfactory project planning and execution. Failure to develop the Project Schedule to an appropriate level of detail will result in its disapproval. The Contracting Officer will consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

3.3.2 Activity Durations

Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Non-procurement activities Original Durations (OD) are not to exceed 20 workdays or 30 calendar days.

3.3.3 Procurement Activities

Include in the schedule activities associated with the critical submittals and their approvals, procurement, fabrication, and delivery of long lead materials, equipment, fabricated assemblies, and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days.

3.3.4 Mandatory Activities

Include the following activities in the initial project schedule and all updates.

a. Submission, review and acceptance of SD-01 Preconstruction Submittals (individual activity for each).

b. Submission, review and acceptance of features requiring design completion

c. Submission of mechanical/electrical/information systems layout drawings.

d. Submission and approval of O & M manuals.

e. Submission and approval of as-built drawings.

f. Submission and approval of DD1354 data and installed equipment lists.

g. Submission and approval of Dam Commissioning Plan, Controls testing plan, test data, and reports: Develop the schedule logic associated with testing and commissioning ~~ofinstrumentation~~of instrumentation to a level of detail consistent with the contract commissioning requirements. All tasks associated with testing and commissioning will be completed prior to submission of commissioning report and subsequent contract completion.

These activities may include but are not limited to: commissioning -functional performance testing, and performance verification

testing. Include other systems testing, if required. Include additional commissioning requirements noted elsewhere in the Contract as required in the schedule and discuss during the SEKO meeting, noted in paragraph SCHEDULING EXPECTATIONS KICKOFF MEETING (SEKO).

h. Contractor's pre-final inspection.

i. Correction of punch list from Contractor's pre-final inspection.

j. Government's pre-final inspection.

k. Correction of punch list from Government's pre-final inspection.

l. Final inspection.

3.3.5 Government Activities

Show in schedule, Government and other agency activities that could impact progress. These activities include, but are not limited to approvals, environmental permit approvals by State regulators, inspections, utility tie-in, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements.

3.3.6 Standard Activity Coding Dictionary

Use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11. This exact structure is mandatory. Develop and assign all Activity Codes to activities as detailed herein.

The SDEF format is as follows:

Field	Activity Code	Length	Description
1	WRKP	3	Workers per day
2	RESP	4	Responsible party
3	AREA	4	Area of work
4	MODF	6	Modification Number
5	BIDI	6	Bid Item (CLIN)
6	PHAS	2	Phase of work
7	CATW	1	Category of work
8	FOW	20	Feature of work*

*Some systems require that FEATURE OF WORK values be placed in several activity code fields. The notation shown is for Primavera P6. Refer to the specific software guidelines with respect to the FEATURE OF WORK field requirements.

3.3.6.1 Workers Per Day (WRKP)

Assign Workers per Day for all field construction or direct work activities, if directed by the Contracting Officer. Workers per day is based on the average number of workers expected each day to perform a task for the duration of that activity.

3.3.6.2 Responsible Party Coding (RESP)

Assign responsibility code for all activities to the Prime Contractor, Subcontractor(s) or Government agency(ies) responsible for performing the activity.

a. Activities coded with a Government Responsibility code include, but are not limited to: Government approvals, Government design reviews, environmental permit approvals by State regulators, Government Furnished Property/Equipment (GFP) and Notice to Proceed (NTP) for phasing requirements.

b. Activities cannot have more than one Responsibility Code. Examples of acceptable activity code values are: DOR (for the designer of record); ELEC (for the electrical subcontractor); MECH (for the mechanical subcontractor); and GOVT (for USACE).

3.3.6.3 Area of Work Coding (AREA)

Assign Work Area code to activities based upon the work area in which the activity occurs. Define work areas based on resource constraints or space constraints that would preclude a resource, such as a particular trade or craft work crew from working in more than one work area at a time due to restraints on resources or space. Examples of Work Area Coding include different areas within a floor of a building, different floors within a building, and different buildings within a complex of buildings. Activities cannot have more than one Work Area Code.

3.3.6.4 Modification Number (MODF)

Assign a Modification Number Code to any activity or sequence of activities added to the schedule as a result of a Contract Modification, when approved by Contracting Officer. Key all Code values to the Government's modification numbering system. An activity can have only one Modification Number Code.

3.3.6.5 Bid Item Coding (BIDI)

Assign a Bid Item Code to all activities using the Contract Line Item Number (CLIN) to which the activity belongs, even when an activity is not cost loaded. An activity can have only one BIDI Code.

3.3.6.6 Phase of Work Coding (PHAS)

Assign Phase of Work Code to all activities. Examples of phase of work are procurement phase and construction phase. Each activity can have only one Phase of Work code.

a. Code proposed fast track design and construction phases proposed to allow filtering and organizing the schedule by fast track design and construction packages.

b. If the contract specifies phasing with separately defined performance periods, identify a Phase Code to allow filtering and organizing the schedule accordingly.

3.3.6.7 Category of Work Coding (CATW)

Assign a Category of Work Code to all activities. Category of Work Codes include, but are not limited to construction submittal, procurement, fabrication, weather sensitive installation, non-weather sensitive installation, start-up, and testing activities. Each activity can have no more than one Category of Work Code.

3.3.6.8 Feature of Work Coding (FOW)

Assign a Feature of Work Code to appropriate activities based on the Definable Feature of Work to which the activity belongs based on the approved QC plan.

Definable Feature of Work is defined in Section 01 45 00 QUALITY CONTROL. An activity can have only one Feature of Work Code.

3.3.7 Contract Milestones and Constraints

Milestone activities are to be used for significant project events including, but not limited to, project phasing, project start and end activities, or interim completion dates. The use of artificial float constraints such as "zero free float" or "zero total float" are prohibited.

Mandatory constraints that ignore or affect network logic are prohibited. No constrained dates are allowed in the schedule other than those specified herein. Submit additional constraints to the Contracting Officer for approval on a case by case basis.

3.3.7.1 Project Start Date Milestone and Constraint

The first activity in the project schedule must be a start milestone titled "NTP Acknowledged," which must have a "Start On" constraint date equal to the date that the NTP is acknowledged.

3.3.7.2 End Project Finish Milestone and Constraint

The last activity in the schedule must be a finish milestone titled "End Project."

Constrain the project schedule to the Contract Completion Date in such a way that if the schedule calculates an early finish, then the float calculation for "End Project" milestone reflects positive float on the longest path. If the project schedule calculates a late finish, then the "End Project" milestone float calculation reflects negative float on the longest path.

3.3.7.3 Interim Completion Dates and Constraints

Constrain contractually specified interim completion dates to show negative float when the calculated late finish date of the last activity in that phase is later than the specified interim completion date.

3.3.7.3.1 Start Phase

Use a start milestone as the first activity for a project phase. Call the start milestone "Start Phase X" where "X" refers to the phase of work.

3.3.7.3.2 End Phase

Use a finish milestone as the last activity for a project phase. Call the finish milestone "End Phase X" where "X" refers to the phase of work.

3.3.8 Adverse Weather

Ensure anticipated adverse weather is accounted for in the Project Schedule. AACE 84R-13 provides methodologies for techniques in planning for adverse weather. The preferred methodology is the use of a weather calendar. If a method other than a weather calendar is proposed, discuss the reason during the SEKO meeting.

3.3.9 Calendars

Schedule activities on a Calendar to which the activity logically belongs. Develop calendars to accommodate any contract defined work period such as a 7-day calendar for Government Acceptance activities, concrete cure times, etc. Develop the default Calendar to match the physical work plan with non-work periods identified including weekends and holidays. Develop Seasonal Calendar(s) and assign to seasonally affected activities as applicable.

If a weather calendar is used its implementation and execution is to be in accordance with AACE 84R-13

3.3.10 Open Ended Logic

Only two open ended activities are allowed: the first activity "NTP Acknowledged" is to have no predecessor logic, and the last activity -"End Project" is to have no successor logic. Except as noted above, each activity must have at least a start-to-start or finish-to-start relationship with its predecessor and a finish-to-finish or finish-to-start relationship with its successor.

Predecessor open ended logic may be allowed in a time impact analyses upon the Contracting Officer's approval.

3.3.11 Default Progress Data Disallowed

Actual Start and Finish dates must not automatically update with default mechanisms included in the scheduling software. Updating of the percent complete and the remaining duration of any activity must be independent functions. Disable program features that calculate one of these parameters from the other. Activity Actual Start (AS) and Actual Finish (AF) dates assigned during the updating process must match those dates provided in the Contractor Quality Control Reports. Failure to document the AS and AF dates in the Daily Quality Control report will result in disapproval of the Contractor's schedule.

3.3.12 Out-of-Sequence Progress

Activities that have progressed before all preceding logic has been satisfied (Out-of-Sequence Progress) will be allowed only on a

case-by-case basis subject to approval by the Contracting Officer. Propose logic corrections to eliminate out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule. Address out of sequence progress or logic changes in the Narrative Report and in the periodic schedule update meetings.

3.3.13 Added and Deleted Activities

Do not delete activities from the project schedule or add new activities to the schedule without approval from the Contracting Officer. Activity ID and description changes are considered new activities and cannot be changed without Contracting Officer approval.

3.3.14 Original Durations

Activity Original Durations (OD) must be reasonable to perform the work item. OD changes are prohibited unless justification is provided and approved by the Contracting Officer.

3.3.15 Leads, Lags, and Start to Finish Relationships

Lags must be reasonable as determined by the Government and not used in place of realistic original durations, must not be in place to artificially absorb or create float, or to replace proper schedule logic.

a. Leads (negative lags) are prohibited.

b. Start to Finish (SF) relationships are prohibited.

3.3.16 Retained Logic

Schedule calculations must retain the logic between predecessors and successors ("retained logic" mode) even when the successor activity(s) starts and the predecessor activity(s) has not finished (out-of-sequence progress). Software features that in effect sever the tie between predecessor and successor activities when the successor has started and the predecessor logic is not satisfied ("progress override") are not be allowed.

3.3.17 Percent Complete

Update the percent complete for each activity started, based on the realistic assessment of earned value. Activities which are complete but for remaining minor punch list work and which do not restrain the initiation of successor activities may be declared 100 percent complete to allow for proper schedule management. Budgeted cost of activity is to be reduced by the amount needed to correct deficiency. The activity referenced in paragraph COST LOADING of CLOSEOUT ACTIVITIES must have its budgeted cost increased by this amount.

3.3.18 Remaining Duration

Update the remaining duration for each activity based on the number of estimated workdays it will take to complete the activity. Remaining duration may not mathematically correlate with percentage found under paragraph entitled Percent Complete. The remaining duration for unstarted activities are not to be less than its ~~orginal~~original duration.

3.3.19 Cost Loading of Closeout Activities

Cost load the "Correction of punch list from Government pre-final inspection" activity(ies) not less than 1 percent of the present contract value. Activity(ies) may be declared 100 percent complete upon the Government's verification of completion and correction of all punch list work identified during Government pre-final inspection(s).

3.3.19.1 As-Built Drawings

If there is no separate contract line item (CLIN) for as-built drawings, cost load the "Submission and approval of as-built drawings" activity not less than $35,000 or 1 percent of the present contract value, which ever is greater, up to $200,000. Activity will be declared 100 percent complete upon the Government's approval.

3.3.19.2 O & M Manuals

Cost load the "Submission and approval of O & M manuals" activity not less than $20,000. Activity will be declared 100 percent complete upon the Government's approval of all O & M manuals.

3.3.20 Early Completion Schedule and the Right to Finish Early

An Early Completion Schedule is an Initial Project Schedule (IPS) that indicates all scope of the required contract work will be completed before the contractually required completion date.

a. No IPS indicating an Early Completion will be accepted without being fully resource-loaded (including crew sizes and hours) and the Government agreeing that the schedule is reasonable and achievable.

b. The Government is under no obligation to accelerate work items it is responsible for to ensure that the early completion is met nor is it responsible to modify incremental funding (if applicable) for the project to meet the contractor's accelerated work.

3.4 PROJECT SCHEDULE SUBMISSIONS

Provide the submissions as described below. The data reports and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS. If the Contractor fails or refuses to furnish the information and schedule updates as set forth herein, the Contractor will be deemed not to have provided an estimate upon which a progress payment can be made.

Review comments made by the Government on the schedule(s) do not relieve the Contractor from compliance with requirements of the Contract Documents.

3.4.1 Preliminary Project Schedule Submission

Within 15 calendar days after the NTP is acknowledged, submit the Preliminary Project Schedule defining the planned operations detailed for the first 90 calendar days for approval. The approved Preliminary Project Schedule will be used for payment purposes not to exceed 90 calendar days after NTP. Completely cost load the Preliminary Project Schedule to balance the contract award CLINS shown on the Price Schedule. The Preliminary Project Schedule may be summary in nature for the remaining performance period. It must be early start and late finish constrained and

logically tied as specified. The Preliminary Project Schedule forms the basis for the Initial Project Schedule specified herein and must include all of the required plan and program preparations, submissions and approvals identified in the contract (for example, Quality Control Plan, Safety Plan, and Environmental Protection Plan) as well as design activities, planned submissions of all early design packages, permitting activities, design review conference activities, and other non-construction activities intended to occur within the first 90 calendar days. Government acceptance of the associated design package(s) and all other specified Program and Plan approvals must occur prior to any planned construction activities. Code activities that are summary in nature, after the first 90 calendar days, with the following activity codes: Bid Item (CLIN) code (BIDI), Responsibility Code (RESP), and Feature of Work code (FOW)..

3.4.2 Initial Project Schedule Submission

Submit the Initial Project Schedule for approval within 42 calendar days after notice to proceed is issued. The schedule must demonstrate a reasonable and realistic sequence of activities which represent all work through the entire contract performance period. No payment will be made for work items not fully detailed in the Project Schedule.

3.4.3 Periodic Schedule Updates

Update the Project Schedule on a regular basis, monthly at a minimum. Provide a draft Periodic Schedule Update for review at the schedule update meetings as prescribed in the paragraph PERIODIC SCHEDULE UPDATE MEETINGS. These updates will enable the Government to assess Contractor's progress.

a. Update information including Actual Start Dates (AS), Actual Finish Dates (AF), Remaining Durations (RD), and Percent Complete. Updated information is subject to the approval of the Government at the meeting.

b. AS and AF dates must match the date(s) reported on the Contractor's Quality Control Report for an activity start or finish.

3.5 SUBMISSION REQUIREMENTS

Submit the following items for the Preliminary Schedule, Initial Schedule, and every Periodic Schedule Update throughout the life of the project:

3.5.1 Electronic Scheduling Data

Provide electronic scheduling data containing the current project schedule and all previously submitted schedules in the format of the scheduling software (e.g. .xer). Also include the Narrative Report and all required Schedule Reports. The electronic file is to identify the type of schedule (Preliminary, Initial, Update), full contract number, Data Date and schedule file name. Each schedule must have a unique file name and use project specific settings. The file naming convention is to be determined at SEKO meeting.

3.5.2 Narrative Report

Provide a Narrative Report with each schedule submission. The Schedule Narrative Report is a "stand alone" report in PDF or Word format. Title

the report "Schedule Narrative Report". Show the Report date, schedule name, and contract number on the first page. Indicate who is responsible for the schedule update and narrative report. Provide a brief description of the Project Scope. The Narrative Report is expected to communicate to the Government the thorough analysis of the schedule output and the plans to compensate for problems, either current or potential, which are revealed through that analysis. Include the following information at a minimum in the Narrative Report:

a. Identify and discuss the work scheduled to start in the next update period.

b. Describe activities along the critical path in addition to activities on the next float path after the critical path.

c. Describe current and anticipated problem areas, delaying factors and their impact, and an explanation of corrective actions taken or required to be taken. Identify the party responsible for delay, if applicable.

d. Identify and explain why activities, based on their calculated late dates, should have either started or finished during the update period but did not.

e. Identify and discuss all schedule changes by activity ID and activity name including what specifically was changed and why the change was needed. Include at a minimum new and deleted activities, logic changes, duration changes, calendar changes, lag changes, resource changes, and actual start and finish date changes.

f. Identify and discuss out-of-sequence work.

g. If the longest path changes from a monthly update to the next, provide an explanation of the factors driving the change.

h. Respond to USACE Schedule Review Comments from the previous update(s).

3.5.3 Schedule Reports

The format, filtering, organizing, and sorting for each schedule report will be as directed by the Contracting Officer. Typically, reports contain Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float, Actual Start Date, Actual Finish Date, and Percent Complete. Provide the reports electronically in .pdf format. Provide 3 set(s) of hardcopy reports. The following lists typical reports that will be requested:

3.5.3.1 Activity Report

List of all activities sorted according to activity number.

3.5.3.2 Logic Report

List of detailed predecessor and successor activities for every activity in ascending order by activity number.

3.5.3.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. List activities which have the same amount of total float in ascending order of Early Start Dates. Do not show completed activities on this report.

3.5.3.4 Earnings Report by CLIN

A compilation of the Total Earnings on the project from the NTP to the data date, which reflects the earnings of activities based on the agreements made in the schedule update meeting defined herein. Provided a complete schedule update has been furnished, this report serves as the basis of determining progress payments. Group activities by CLIN number and sort by activity number. Provide a total CLIN percent earned value, CLIN percent complete, and project percent complete. The printed report must contain the following for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Earnings to Date, Earnings this period, Total Quantity, Quantity to Date, and Percent Complete (based on cost).

3.5.3.5 Scheduling and Leveling Report

Provide a Scheduling/Leveling Report generated from the current project schedule being submitted.

3.5.4 Network Diagram

The Network Diagram is required for the Preliminary, Initial and Periodic Updates. Depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.4.1 Continuous Flow

Show a continuous flow from left to right with no arrows from right to left. Show the activity number, description, duration, and estimated earned value on the diagram.

3.5.4.2 Project Milestone Dates

Show dates on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

3.5.4.3 Critical Path

Show all activities on the critical path. The critical path is defined as the longest path.

3.5.4.4 Grouping and Sorting

Group and sort activities as directed to assist in the understanding of the activity sequence. Typically, this flow will group activities by major elements of work, category of work, work area and/or responsibility.

3.5.4.5 Cash Flow / Schedule Variance Control (SVC) Diagram

With each schedule submission, provide a SVC diagram showing 1) Cash Flow

S-Curves indicating planned project cost based on projected early and late activity finish dates, and 2) Earned Value to-date.

3.6 PERIODIC SCHEDULE UPDATE

3.6.1 Periodic Schedule Update Meetings

Conduct periodic schedule update meetings for the purpose of reviewing the proposed Periodic Schedule Update, Narrative Report, Schedule Reports, and progress payment. Conduct meetings at least monthly within five days of the proposed schedule data date. Provide a computer with the scheduling software loaded and a projector which allows all meeting participants to view the proposed schedule during the meeting. The Contractor's authorized scheduler must organize, group, sort, filter, perform schedule revisions as needed and review functions as requested by the Contractor and/or Government. The Contractor scheduler must attend in person unless virtual attendance is approved by Contracting Officer. The meeting is a working interactive exchange which allows the Government and Contractor the opportunity to review the updated schedule on a real time and interactive basis. The meeting will last no longer than 8 hours. Submit schedule file and narrative to the Government a minimum of two workdays in advance of the meeting. The Contractor's Project Manager must attend the meeting with the authorized representative of the Contracting Officer. Superintendents, foremen and major subcontractors must attend the meeting as required to discuss the project schedule and work. Following the schedule update meeting, make corrections to the schedule and resubmit, following the required schedule naming convention. Include only those changes approved by the Government in the schedule review meeting. Only approved schedules may be used to generate invoices for payment.

3.6.2 Update Submission Following Progress Meeting

Submit the complete Periodic Schedule Update of the Project Schedule containing all approved progress, revisions, and adjustments, pursuant to paragraph SUBMISSION REQUIREMENTS not later than 4 workdays after the periodic schedule update meeting.

3.7 WEEKLY PROGRESS MEETINGS

Conduct a weekly meeting with the Government (or as otherwise mutually agreed to) between the meetings described in paragraph entitled PERIODIC SCHEDULE UPDATE MEETINGS for the purpose of jointly reviewing the actual progress of the project as compared to the as planned progress and to review planned activities for the upcoming two weeks. Use the current approved schedule update for the purposes of this meeting and for the production and review of reports. At the weekly progress meeting, address the status of RFIs, RFPs and Submittals.

3.8 REQUESTS FOR TIME EXTENSIONS

ASCE 67-17 provides delay analysis guidelines. If there is a conflict between the contract and guidance provided in ASCE 67-17, the contract will govern. Provide justification of delay to the Contracting Officer in accordance with the contract provisions and clauses for approval, within 10 days of a delay occuring. Also prepare a time impact analysis for each Government request for proposal (RFP).

3.8.1 Justification of Delay

Provide a description of the event(s) that caused the delay and/or impact to the work. As part of the description, identify all schedule activities impacted. Show that the event that caused the delay/impact was the responsibility of the Government. Provide a time impact analysis that demonstrates the effects of the delay or impact on the project completion date, or interim completion date(s). Evaluate multiple impacts chronologically; each with its own justification of delay. With multiple impacts consider any concurrency of delay. A time extension and the schedule fragnet becomes part of the project schedule and all future schedule updates upon approval by the Contracting Officer.

3.8.2 Changes That Do Not Cause Delay

If it is determined that a change does not constitute a schedule time extension, a fragnet as described in paragraph FRAGMENTARY NETWORK, is to be created and inserted into the Project schedule.

3.8.3 Time Impact Analysis (Prospective Analysis)

Submit requests for time extensions based on a prospective analysis if the work involved or the impact identified has not already occurred. Where the impact is ongoing a prospective analysis may be considered. However, the Government reserves the right to require a retrospective analysis be prepared after the impact has ended.

Prepare a time impact analysis for approval by the Contracting Officer based on industry recommended practice AACE 52R-06. Utilize a copy of the last approved schedule prior to the first day of the impact or delay for the time impact analysis. If Contracting Officer determines the time frame between the last approved schedule and the first day of impact is too great, prepare an interim updated schedule to perform the time impact analysis. Unless approved by the Contracting Officer, no other changes may be incorporated into the schedule being used to justify the time impact.

3.8.4 Forensic Schedule Analysis (Retrospective Analysis)

Submit requests for time extensions based on a retrospective analysis if the work involved or the impact identified has already occurred. The analysis must account for the actual performance of both the impacted work and all other contract work in the schedule.

If a methodology is chosen from AACE 29R-03, the method must adhere to the principles identified in ASCE 67-17. If there is a conflict with the methodology chosen from AACE 29R-03 and ASCE 67-17, ASCE 67-17 will govern. Choice of methodology should be discussed prior to submission to Government.

3.8.5 Fragmentary Network (Fragnet)

Prepare a proposed fragnet for time impact analysis consisting of a sequence of new activities that are proposed to be added to the project schedule to demonstrate the influence of the delay or impact to the project's contractual dates. Clearly show how the proposed fragnet is to be tied into the project schedule including all predecessors and successors to the fragnet activities. The proposed fragnet must be approved by the Contracting Officer prior to incorporation into the

project schedule.

3.8.6 Time Extension

The Contracting Officer must approve the Justification of Delay including the time impact analysis before a time extension will be granted. No time extension will be granted unless the delay consumes all available Project Float and extends the projected finish date ("End Project" milestone) beyond the Contract Completion Date. The time extension will be in calendar days.

Actual delays that are found to be caused by the Contractor's own actions, which result in a calculated schedule delay, are not a cause for an extension to the performance period, completion date, or any interim milestone date.

3.8.7 Impact to Early Completion Schedule

No extended overhead will be paid for delay prior to the original Contract Completion Date for an Early Completion IPS unless the Contractor actually performed work in accordance with that Early Completion Schedule. The Contractor must show that an early completion was achievable had it not been for the impact.

3.9 FAILURE TO ACHIEVE PROGRESS

Should the progress fall behind the approved project schedule for reasons other than those that are excusable within the terms of the contract, the Contracting Officer may require provision of a written recovery plan for approval. The plan must detail how progress will be made-up to include which activities will be accelerated by adding additional crews, longer work hours, extra workdays, etc.

3.9.1 Artificially Improving Progress

Artificially improving progress by means such as, but not limited to, revising the schedule logic, modifying, or adding constraints, shortening activity durations, or changing calendars in the project schedule is prohibited. Indicate assumptions made and the basis for any logic, constraint, duration, and calendar changes used in the creation of the recovery plan. Any additional resources, manpower, or daily and weekly work hour changes proposed in the recovery plan must be evident at the work site and documented in the daily report along with the Schedule Narrative Report.

3.9.2 Failure to Perform

Failure to perform work and maintain progress in accordance with the supplemental recovery plan may result in an interim and final unsatisfactory performance rating and may result in corrective action directed by the Contracting Officer pursuant to FAR 52.236-15 Schedules for Construction Contracts, FAR 52.249-10 Default (Fixed-Price Construction), and other contract provisions.

3.9.3 Recovery Schedule

Should the Contracting Officer find it necessary, submit a recovery schedule pursuant to FAR 52.236-15 Schedules for Construction Contracts.

3.10 OWNERSHIP OF FLOAT

Except for the provision given in the paragraph IMPACT TO EARLY COMPLETION SCHEDULE, float available in the schedule, at any time, belongs to the Project and is available for Contractor and Government use. This includes activity and project float. Activity float is the number of workdays that an activity can be delayed without causing a delay to the "End Project" finish milestone. Project float (if applicable) is the number of work days between the projected early finish and the "End Project" finish.

3.11 TRANSFER OF SCHEDULE DATA INTO RESIDENT MANAGEMENT SYSTEM

Ensure schedule data is uploaded to RMS. This data is additional supporting data in a form and detail required by the Contracting Officer pursuant to FAR 52.232-5 Payments under Fixed-Price Construction Contracts. The receipt of a proper payment request pursuant to FAR 52.232-27 Prompt Payment for Construction Contracts is contingent upon the Government receiving both acceptable and approvable hard copies and matching electronic versions of the application for progress payment.

3.12 PRIMAVERA P6 MANDATORY REQUIREMENTS

Ensure Primavera P6 settings provide a schedule capable of fulfilling the requirements of the contract. The following settings are mandatory and required in all schedule submissions to the Government:

a. Activity Codes must be Project Level, not Global or EPS level.

b. Calendars must be Project Level, not Global or Resource level.

c. Activity Duration Types must be set to "Fixed Duration & Units".

d. Percent Complete Types must be set to "Physical".

e. Time Period Admin Preferences must remain the default "8.0 hr/day, 40 hr/week, 172 hr/month, 2000 hr/year". Set Calendar Work Hours/Day to 8.0 Hour days.

f. Set Schedule Option for defining Critical Activities to "Longest Path".

g. Set Schedule Option for defining progressed activities to "Retained Logic".

h. Set up cost loading using a single lump sum non-labor resource. The Price/Unit must be $1/hr, Default Units/Time must be "8h/d", and settings "Auto Compute Actuals" and "Calculate costs from units" un-selected.

i. Activity ID's must not exceed 10 characters.

j. Activity Names must have a verb-noun structure and contain the most defining and detailed description within the first 30 characters.

k. The daily ending hour for all work calendars must be the same.

-- End of Section --

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SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
11/20, CHG 3: 08/24

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C511	(2017; R 2021) Reduced-Pressure Principle Backflow Prevention Assembly

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023) National Electrical Code
NFPA 241	(2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety -- Safety and Occupational Health (SOH) Requirements

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD	(2009; Rev 2012) Manual on Uniform Traffic Control Devices

VIRGINIA DEPARTMENT OF TRANSPORTATION (VDOT)

VWAPM	(2025, 11th Ed.) Virginia Work Area Protection Manual

1.2 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Site Plan; G

Traffic Control Plan; G

Haul Road Plan; G

Contractor Computer Cybersecurity Compliance Statements

Contractor Temporary Network Cybersecurity Compliance Statements

SD-06 Test Reports

Backflow Preventer Tests

SD-07 Certificates

Backflow Tester Certification

Backflow Preventers Certificate of Full Approval

1.3 CONSTRUCTION SITE PLAN

Prior to the start of work, submit for Government approval a site plan showing the locations and dimensions of temporary facilities (including layouts and details, equipment and material storage area (onsite and offsite), and access and haul routes, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Indicate if the use of a supplemental or other staging area is desired. Show locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas. Submit detail drawings, calculations, design loads, installation procedures, access limitations, equipment, and safety precautions for the work platform the will access the spillway work area. The work platform is to be designed by a Registered Professional Engineer.

1.4 BACKFLOW PREVENTERS CERTIFICATE

1.4.1 Backflow Tester Certificate

Prior to testing, submit to the Contracting Officer certification issued by the State or local regulatory agency attesting that the backflow tester has successfully completed a certification course sponsored by the regulatory agency. Tester must not be affiliated with a company participating in other phases of this Contract.

1.4.2 Backflow Prevention Training Certificate

Submit a certificate recognized by the State or local authority that states the Contractor has completed at least 10 hours of training in backflow preventer installations. The certificate must be current.

1.5 SEVERE WEATHER PLANNING

Based on the weather forecast for sustained winds of 50 knots (93 km/hr-58 mph) or greater, monitor weather conditions a minimum of twice a day and take appropriate actions according to the Severe Weather Plan in the accepted Accident Prevention Plan and instructions below. Unless otherwise directed by the Contracting Officer, comply with:

Monitor weather conditions a minimum of twice a day and take appropriate actions according to the approved Emergency Plan in the accepted Accident Prevention Plan, EM 385-1-1 Emergency Plan requirements and the instructions below.

Unless otherwise directed by the Contracting Officer, comply with:

a. Condition FOUR (Sustained winds of 58 mph or greater expected within 72 hours): Normal daily jobsite cleanup and good housekeeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the close of each work day. Maintain the construction site including storage areas, free of accumulation of debris. Stack form lumber in neat piles less than 3.3 feet high. Remove all debris, trash, or objects that could become missile hazards. Review requirements pertaining to "Condition THREE" and continue action as necessary to attain "Condition FOUR" readiness. Contact Contracting Officer for weather and COR updates and completion of required actions.

b. Condition THREE (Sustained winds of 58 mph or greater expected within 48 hours): Maintain "Condition FOUR" requirements and commence securing operations necessary for "Condition ONE" which cannot be completed within 18 hours. Cease all routine activities which might interfere with securing operations. Commence securing and stow all gear and portable equipment. Make preparations for securing buildings. Reinforce or remove formwork and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas. Contact Contracting Officer for weather and COR updates and completion of required actions. Review requirements pertaining to "Condition TWO" and continue action as necessary to attain "Condition THREE" readiness.

c. Condition TWO (Sustained winds of 58 mph or greater expected within 24 hours): Secure the jobsite, and leave Government premises.

d. Condition ONE. (Sustained winds of 58 mph or greater expected within 12 hours): Contractor access to the jobsite and Government premises is prohibited.

1.6 CYBERSECURITY DURING CONSTRUCTION

{For Reference Only: This subpart (and its subparts) relates to AC-18, SA-3, CCI-00258.} Meet the following requirements throughout the construction process.

1.6.1 Contractor Computer Equipment

Contractor owned computers may be used for construction. When used, contractor computers must meet the following requirements:

1.6.1.1 Operating System

The operating system must be an operating system currently supported by the manufacturer of the operating system. The operating system must be current on security patches and operating system manufacturer required updates.

1.6.1.2 Anti-Malware Software

The computer must run anti-malware software from a reputable software manufacturer. Anti-malware software must be a version currently supported by the software manufacturer, must be current on all patches and updates, and must use the latest definitions file. Computers which have connected to any other network since the last full antivirus scan must perform a

full antivirus scan prior to connection to the control system network or to the temporary contractor-installed IP network. Perform an antivirus scan on all removable media (e.g., external hard drives, CDs, DVDs, USB flash drives) prior to connecting to the control system environment.

1.6.1.3 Passwords and Passphrases

The passwords and passphrases for all computers must be changed from their default values. Passwords must be a minimum of eight characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

1.6.1.4 Contractor Computer Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Computer Cybersecurity Compliance Statements for each company using contractor owned computers. Contractor Computer Cybersecurity Compliance Statements must use the template published at https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-01-50-0 Each Statement must be signed by a cybersecurity representative for the relevant company.

1.6.2 Temporary IP Networks

Temporary Contractor-installed IP networks may be used during construction. When used, temporary contractor-installed IP networks must meet the following requirements:

1.6.2.1 Network Boundaries and Connections

The network must not extend outside the project site and must not connect to any IP network other than IP networks provided under this project or Government furnished IP networks provided for this purpose. Any and all network access from outside the project site is prohibited.

1.6.3 Government Access to Network

Government personnel, as defined, prescribed, and identified by the Contracting Officer, must be allowed to have complete and immediate access to the network at any time in order to verify compliance with this specification. If there is a Government agency responsible for network access, identify that agency.

1.6.4 Temporary Wireless IP Networks

1.6.4.1 Contractor Provided Wi-Fi Network

Provide standalone Wi-Fi network for authorized Government personnel. Network access must be available throughout the jobsite and for the entire Contract period. The Government will use the Wi-Fi service for coordination in the field and related activities. Do not attach or connect the temporary Wi-Fi network to Government networks or systems unrelated to construction activities.

Password information must adhere to requirements outlined in Paragraph PASSWORDS AND PASSPHRASES. Provide password and Wi-Fi network name (SSID) to the Contracting Officer for Government personnel access. Wi-Fi performance must be capable of handling bandwidth to support Government and Contractor activities, including drawing and model access onsite.

Provide a point of contact for reporting Wi-Fi outages.

1.6.4.2 Temporary Wireless IP Networks Security

In addition to the other requirements on temporary IP networks, temporary wireless IP (WiFi) networks must not interfere with existing wireless network and must use WPA2 security. Network names (SSID) for wireless networks must be changed from their default values.

1.6.5 Passwords and Passphrases

The passwords and passphrases for all network devices and network access must be changed from their default values. Passwords must be a minimum 8 characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

1.6.6 Contractor Temporary Network Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Temporary Network Cybersecurity Compliance Statements for each company implementing a temporary IP network. Contractor Temporary Network Cybersecurity Compliance Statements must use the template published at https://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/ufgs-01-50-0 Each Statement must be signed by a cybersecurity representative for the relevant company. If no temporary IP networks will be used, provide a single copy of the Statement indicating this.

PART 2 PRODUCTS

2.1 TEMPORARY SIGNAGE

2.1.1 Bulletin Board

Prior to the commencement of work activities, provide a clear weatherproof covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the Contract, Wage Rate Information poster, Safety and Health Information as required by EM 385-1-1 and other information approved by the Contracting Officer. Coordinate requirements herein with 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, and in location as approved by the Contracting Officer.

2.1.2 Project Identification Signs

The requirements for the signs, their content, and location are as indicated and as specified in Section 01 58 00 PROJECT IDENTIFICATION. Erect signs within 15 days after receipt of the notice to proceed. Correct the data required by the safety sign daily, with light colored metallic or non-metallic numerals.

2.1.3 Warning Signs

Post temporary signs, tags, and labels to give workers and the public adequate warning and caution of construction hazards according to the EM 385-1-1. Attach signs to the perimeter fencing every 150 feet warning the public of the presence of construction hazards. Signs must require unauthorized persons to keep out of the construction site. Correct the data required by safety signs daily. Post signs at all points of entry

designating the construction site as a hard hat area.

Provide signage to inform the traveling public on travel ways of any vehicles delivering materials and equipment to the site. Coordinate with the VDOT in reference to the work zones plan on State maintained roadways while operations are taking place. Work zones shall be in accordance with the Virginia Work Area Protection Manual (VWAPM).

Provide signage and/or buoys in waterways in the area and travel way to and from the staging area/boat ramp and/or mooring location for the use of a barge. Confirm work is in accordance with the USCG and/or the VA Department of Wildlife Resources.

2.2 TEMPORARY TRAFFIC CONTROL

2.2.1 Haul Roads

Construct access and haul roads necessary for proper prosecution of the work under this Contract in accordance with EM 385-1-1. Construct with suitable grades and widths; avoid sharp curves, blind corners, and dangerous cross traffic. Submit haul road plan for approval. Provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, must be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and haul roads are subject to approval by the Contracting Officer. Lighting must be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations.

2.2.2 Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Barricades are required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

2.3 FENCING

Provide fencing along the construction site and at all open excavations and tunnels to control access by unauthorized personnel. Safety fencing must be highly visible to be seen by pedestrians and vehicular traffic. All fencing must meet the requirements of EM 385-1-1. Remove the fence upon completion and acceptance of the work.

Laydown yards are not easily visible as the Dam is very remote.

2.3.1 Polyethylene Mesh Safety Fencing

Temporary safety fencing must be a high visibility orange colored, high density polyethylene grid, a minimum of 48 inches high and maximum mesh size of 2 inches. Fencing must extend from the grade to a minimum of 48 inches above the grade and be tightly secured to T-posts spaced as necessary to maintain a rigid and taut fence. Fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection.

2.3.2 Chain Link Panel Fencing

Temporary panel fencing must be galvanized steel chain link panels 6 feet high. Multiple fencing panels may be linked together at the bases to form long spans as needed. Each panel base must be weighted down using sand bags or other suitable materials in order for the fencing to withstand anticipated winds while remaining upright. Fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection.

2.3.3 Post-Driven Chain Link Fencing

Temporary post-driven fencing must be galvanized chain link fencing 6 feet high supported by an tightly secured to galvanized steel posts driven below grade. Fence posts must be located on minimum 10 foot centers. Posts may be set in various surfaces such as sand, soil, asphalt or concrete as necessary. Chain link fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection. Completely remove fencing and posts at the completion of construction and restore surfaces disturbed or damaged to its original condition. Locate and identify underground utilities prior to setting fence posts. Equip fence with a lockable gate. Gate must remain locked when construction personnel are not present.

2.4 TEMPORARY WIRING

Provide temporary wiring in accordance with EM 385-1-1, NFPA 241 and NFPA 70. Include monthly inspection and testing of all equipment and apparatus.

2.5 BACKFLOW PREVENTERS

Certificate of Full Approval from FCCCHR List, University of Southern California, attesting that the design, size and make of each backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. Certificate of Provisional Approval is not acceptable.

Reduced pressure principle type conforming to the applicable requirements AWWA C511. Provide backflow preventers complete with 150 pound flanged brass mounted gate valve and strainer, 304 stainless steel, internal parts.

PART 3 EXECUTION

3.1 EMPLOYEE PARKING

Construction Contract employees must park privately owned vehicles in an area designated by the Contracting Officer. Employee parking must not interfere with existing and established parking requirements of the Government installation.

3.2 AVAILABILITY AND USE OF UTILITY SERVICES

3.2.1 Temporary Utilities

Provide temporary utilities required for construction. Materials may be new or used, must be adequate for the required usage, not create unsafe conditions, and not violate applicable codes and standards.

3.2.2 Payment for Utility Services

a. The Government will make all reasonably required utilities available from existing outlets and supplies, as specified in the Contract. Unless otherwise provided in the Contract, the amount of each utility service consumed will be charged to or paid at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. Carefully conserve utilities furnished without charge.

b. Reasonable amounts of the following utilities will be made available without charge.

c. The point at which the Government will deliver such utilities or services and the quantity available must be coordinated with the Contracting Officer. Pay all costs incurred in connecting, converting, and transferring the utilities to the work. Make connections, including providing transformers; and make disconnections.

d. The Contractor must provide their own utilities.

3.2.3 Advance Deposit

An advance deposit for utilities consisting of an estimated month's usage or a minimum of $50.00 will be required. The last monthly bills for the fiscal year will normally be offset by the deposit and adjustments will be billed or returned as appropriate. Services to be rendered for the next fiscal year, beginning 1 October, will require a new deposit. Notification of the due date for this deposit will be mailed prior to the end of the current fiscal year.

3.2.4 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, notify the Contracting Officer, in writing, 5 working days before termination is desired. The Government will take a final meter reading, disconnect service, and remove the meters. Then remove all the temporary distribution lines, meter bases, and associated appurtenances. Pay all outstanding utility bills before final acceptance of the work by the Government.

3.2.5 Sanitation

Provide and maintain within the construction area minimum field-type sanitary facilities in accordance with EM 385-1-1. Locate the facilities behind the construction fence or out of the public view. Clean units and empty wastes at least once a week or more frequently into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Obtain approval from the system owner prior to discharge into a municipal, district, or commercial sanitary sewer system. Penalties or fines associated with improper discharge will be the responsibility of the Contractor. Coordinate with the Contracting Officer and follow station regulations and procedures when discharging into the station sanitary sewer system. Maintain these conveniences at all times. Include provisions for pest control and elimination of odors. Government toilet facilities will not be available to Contractor's personnel.

3.2.6 Telephone

Make arrangements and pay all costs for telephone facilities desired.

3.2.7 Fire Protection

Provide temporary fire protection equipment for the protection of personnel and property during construction. Remove debris and flammable materials weekly to minimize potential hazards.

3.3 TRAFFIC PROVISIONS

3.3.1 Maintenance of Traffic

a. Conduct operations in a manner that will not close a thoroughfare or interfere with traffic on railways or highways except with written permission of the Contracting Officer at least 15 calendar days prior to the proposed modification date, and provide a Traffic Control Plan for Government approval detailing the proposed controls to traffic movement for approval. The plan must be in accordance with State and local regulations and the MUTCD, Part VI. Contractor may move oversized and slow-moving vehicles to the worksite provided requirements of the highway authority have been met.

b. Conduct work so as to minimize obstruction of traffic, and maintain traffic on at least half of the roadway width at all times. Obtain approval from the Contracting Officer prior to starting any activity that will obstruct traffic.

c. Provide, erect, and maintain, at Contractor's expense, lights, barriers, signals, passageways, detours, Life Safety Signage, overhead protection, and other items that may be required by the authority having jurisdiction.

d. Provide cones, signs, barricades, lights, or other traffic control devices and personnel required to control traffic. Do not use foil-backed material for temporary pavement marking because of its potential to conduct electricity during accidents involving downed power lines.

3.3.2 Protection of Traffic

Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment the work, and the erection and maintenance of adequate warning, danger, and direction signs, will be as required by the State and local authorities having jurisdiction. Provide self-illuminated (lighted) barricades during hours of darkness. All personnel working in roadways will wear brightly-colored vests or other high visibility apparel in accordance with EM 385-1-1. Protect the traveling public from damage to person and property. Minimize the interference with public traffic on roads selected for hauling material to and from the site. Investigate the adequacy of existing roads and their allowable load limit. Contractor is responsible for the repair of damage to roads caused by construction operations.

3.3.3 Rush Hour Restrictions

Do not interfere with the peak traffic flows preceding and during normal operations for more than 5 minutes without notification to and approval by the Contracting Officer.

3.3.4 Dust Control

Dust control methods and procedures must be approved by the Contracting Officer. Coordinate dust control methods with 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

3.4 REDUCED PRESSURE BACKFLOW PREVENTERS

Provide an approved reduced pressure backflow prevention assembly at each location where the Contractor taps into the Government potable water supply.

Perform backflow preventer tests using test equipment, procedures, and certification forms conforming to those outlined in the latest edition of the Manual of Cross-Connection Control published by the FCCCHR Manual. Test and tag each reduced pressure backflow preventer upon initial installation (prior to continued water use) and annually thereafter. Tag must contain the following information: make, model, serial number, dates of tests, results, maintenance performed, and signature of tester. Record test results on certification forms conforming to requirements cited earlier in this paragraph.

3.5 CONTRACTOR'S TEMPORARY FACILITIES

Contractor is responsible for security of their property. Provide adequate outside security lighting at the temporary facilities. Trailers must be anchored to resist high winds and meet applicable state or local standards for anchoring mobile trailers. Coordinate anchoring with EM 385-1-1. The Contract Clause entitled "FAR 52.236-10, Operations and Storage Areas" and the following apply:

3.5.1 Administrative Field Offices

Provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will be available to the Contractor's personnel.

In the event a new building is constructed for the temporary project field office, it must be a minimum 12 feet in width, 16 feet in length and have a minimum of 7 feet headroom. Equip the building with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. Provide a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building must be waterproof, supplied with a heater, have a minimum of two doors, electric lights, a telephone, a battery-operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. Provide approved sanitary facilities. Screen the windows and doors and provide the doors with deadbolt type locking devices or a padlock and heavy-duty hasp bolted to the door. Door hinge pins must be non-removable. Arrange the windows to open and to be securely fastened from the inside. Protect glass panels in windows by bars or heavy mesh screens to prevent easy access. In warm weather, provide air conditioning

capable of maintaining the office at 50 percent relative humidity and a room temperature 20 degrees F below the outside temperature when the outside temperature is 95 degrees F. Unless otherwise directed by the Contracting Officer, remove the building from the site upon completion and acceptance of the work.

3.5.2 Quality Control Manager Records and Field Office

Provide on the jobsite an office with approximately 100 square feet of useful floor area for the exclusive use of the QC Manager. Provide a weathertight structure with adequate heating and cooling, toilet facilities, lighting, ventilation, a 4 by 8 foot plan table, a standard size office desk and chair, computer station, and working communications facilities. Provide either a 1,500 watt radiant heater and a window-mounted air conditioner rated at 9,000 Btus minimum or a window-mounted heat pump of the same minimum heating and cooling ratings. Provide a door with a cylinder lock and windows with locking hardware. Make utility connections. Locate as directed. File quality control records in the office and make available at all times to the Government. After completion of the work, remove the entire structure from the site.

3.5.3 Storage Area

Construct a temporary 6 foot high chain link fence around trailers and materials. Include plastic strip inserts, colored green or brown, so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Do not place or store trailers, materials, or equipment outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the installation boundaries. Trailers, equipment, or materials must not be open to public view with the exception of those items which are in support of ongoing work on the current day. Do not stockpile materials outside the fence in preparation for the next day's work. Park mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment within the fenced area at the end of each work day.

Keep fencing in a state of good repair and proper alignment. If the Contractor elects to traverse grassed or unpaved areas which are not established roadways with construction equipment or other vehicles, cover the grassed or unpaved areas with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation must be at the Contractor's discretion. Mow and maintain grass located within the boundaries of the construction site for the duration of the project. Grass and vegetation along fences, structures, under trailers, and in areas not accessible to mowers must be edged or trimmed neatly.

3.5.4 Supplemental Storage Area

Upon request, and pending availability, the Contracting Officer will designate another or supplemental area for the use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but will be within the installation boundaries. Maintain the area in a clean and orderly fashion and secured if needed to protect supplies and equipment. Utilities will not be provided to this area by the Government.

3.5.5 Appearance of Trailers

a. Trailers must be roadworthy and comply with all appropriate state and local vehicle requirements. Trailers which are rusted, have peeling paint or are otherwise in need of repair will not be allowed on Installation property. Trailers must present a clean and neat exterior appearance and be in a state of good repair.

b. Maintain the temporary facilities. Failure to do so will be sufficient reason to require their removal at the Contractor's expense.

3.5.6 Safety Systems

Protect the integrity of all installed safety systems or personnel safety devices. Obtain prior approval from the Contracting Officer if entrance into systems serving safety devices is required. If it is temporarily necessary to remove or disable personnel safety devices in order to accomplish Contract requirements, provide alternative means of protection prior to removing or disabling any permanently installed safety devices or equipment and obtain approval from the Contracting Officer.

3.5.7 Weather Protection of Temporary Facilities and Stored Materials

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

3.5.7.1 Building and Site Storm Protection

When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Government property. Precautions must include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Government property.

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3.5.8 Barge Mooring

Mooring a barge to the dam is allowed and is limited to the non-spillway monoliths. The barge shall be moored in such a way to not impart any vertical forces to the dam. Wind loads on the barge and equipment it carries will be transmitted to the dam and could be significant. The Contractor shall prepare an engineering analysis of the overall dam stability to include mooring forces with wind loads and submit the engineering analysis to the Contracting Office for AE and Government approval. The engineering analysis shall be sealed by a Professional Engineer licensed in the State of Virginia.

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3.6 GOVERNMENT FIELD OFFICE

3.6.1 Resident Engineer's Office

The Dam Site has available space to accommodate the Government Resident Engineer.

3.7 PLANT COMMUNICATIONS

Whenever the individual elements of the plant are located so that operation by normal voice between these elements is not satisfactory, install a satisfactory means of communication, such as telephone or other suitable devices and make available for use by Government personnel.

3.8 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, furnish and erect temporary project safety fencing at the work site. Maintain the safety fencing during the life of the Contract and, upon completion and acceptance of the work, remove from the work site.

3.9 CLEANUP

Remove construction debris, waste materials, packaging material and the like from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways must be cleaned away. Store all salvageable materials resulting from demolition activities within the fenced area described above or at the supplemental storage area. Neatly stack stored materials not in trailers, whether new or salvaged.

3.10 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and all other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence. Restore areas used during the performance of the Contract to the original or better condition. Remove gravel used to traverse grassed areas and restore the area to its original condition, including top soil and seeding as necessary.

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SECTION 31 68 13

SPILLWAY ANCHORS
11/20

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

Prior to commencing any work on the anchors, the Contractor, including all field personnel to be involved in drilling and installation of the anchors, must meet with the Contracting Officer to review the drawings and specifications, work plans, and submittals. The Drilling Program Plan, as defined in Specification Section 02 32 13 SUBSURFACE DRILLING AND SAMPLING, and anchor installation plan defined in paragraph 1.1.2.(e) of this specification shall be approved by the Government before beginning work.

1.1.1 General Requirements

Submit drawings and detailed installation procedures and sequences showing complete details of the installation procedure and equipment; steel bar and coupler materials; steel bar fabrication process; anchor fabrication; grouting methods; grout mix equipment; grout mix designs; anchor placement and installation; Class 1 full-encapsulation corrosion protection for bond length, stressing length and anchorage; anchorage and trumpet; stressing and testing procedures with lengths, forces, deformations, and elongations for the approval by the Contracting Officer. Shop drawings for anchors must include locations and details of the spacers, couplers, and centralizers. Once reviewed by the Contracting Officer, no changes or deviation from shop drawings will be permitted without further review by the Contracting Officer. The work includes design of the anchor head components fabrication and installation of the spillway anchor system. Install and fabricate the anchors as shown on the drawings. Prepare fabrication and installation drawings and an installation plan for approval. Spillway anchors must be threaded bar type.

1.1.2 Scope of Work

The bearing plate, trumpet and water-tight enclosure will be completely the Contractor's responsibility. General design criteria are shown on the drawings and stated in paragraph GENERAL REQUIREMENTS. The materials, stressing, load testing, and acceptance must be in accordance with PTI DC35.1 and these specifications.

a. Provide access to the spillway anchor locations as necessary for prosecution of the work. No separate payment will be made for cost of the temporary work.

b. Spillway anchors shall be threaded bar. The Contractor is responsible for following the requirements in Section 02 32 13 SUBSURFACE DRILLING AND SAMPLING of the Drilling Program Plan, design of the anchor head, water-tight enclosure, borehole testing, and determining drilling methods,. Submit design computations and data for the anchor head components.

c. Computations are to include drawings, design assumptions, calculations, and other information in sufficient detail to verify the design proposed. The design must be stamped and sealed by a licensed

Professional Engineer with proven experience in design of anchor components as stated in paragraph Qualifications. Include calculations for the stressing frames.

d. The Contracting Officer will approve the design calculations. Approval of the design calculations will not relieve the Contractor of responsibility for unsatisfactory performance of the installed anchors components. Furnish all design computations at least 30 calendar days prior to the proposed commencement of drilling. The complete design, including design computations, fabrication and installation drawings and installation plan, must be certified by a licensed Professional Engineer and must be submitted for approval.

e. Submit a plan for installing the spillway anchors for review and comment. The proposal must describe the sequence for installation and other restrictions as outlined on the drawings or specified. Determine the anchor installation procedures as part of the anchor design. Include the installation plan with descriptions of methods and equipment to be used for alignment checking of anchor holes. The completed anchor shall be filled with concrete cover as shown on the drawings.

1.1.3 Anchor Design

Spillway anchor locations and dimensions are shown on the drawings. The design load (DL) is 436 kips.

The loads used for Performance tests area:

PERCENT DESIGN LOAD	PERFORMANCE TEST LOAD
0.25 DL	110 kips
0.5 DL	220 kips
0.75 DL	330 kips
1.00 DL	436 kips
1.2 DL	525 kips
1.33 DL	580 kips
The adjusted lock-off load is 223 kips.	

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 301 (2020) Specifications for Structural Concrete

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 5CT	(2018) Casing and Tubing

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A53/A53M	(2024) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A500/A500M	(2023) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A536	(1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings
ASTM A572/A572M	(2021; E 2021) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A588/A588M	(2019) Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi Minimum Yield Point, with Atmospheric Corrosion Resistance
ASTM A709/A709M	(2021) Standard Specification for Structural Steel for Bridges
ASTM A722/A722M	(2015) Standard Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete
ASTM C33/C33M	(2024) Standard Specification for Concrete Aggregates
ASTM C109/C109M	(2023) Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens)
ASTM C150/C150M	(2024) Standard Specification for Portland Cement
ASTM C595/C595M	(2024) Standard Specification for Blended Hydraulic Cements
ASTM C1107/C1107M	(2020) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D1784	(2020) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

ASTM D1785	(2021) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D3350	(2021) Polyethylene Plastics Pipe and Fittings Materials
ASTM D4101	(2017) Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO ISO/IEC 17025	(2017) General Requirements for the Competence of Testing and Calibration Laboratories

POST-TENSIONING INSTITUTE (PTI)

PTI DC35.1	(2014) Recommendations for Prestressed Rock and Soil Anchors
PTI TAB.1	(2023) Post-Tensioning Manual

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 1110-2-3506	(2017) Engineering and Design -- Grouting Technology

1.3 SITE CONDITIONS

A dam stability report has been conducted at the site by the government and data is presented as reference information available upon request. One as-built drawing is included in the plan set. Additional as-built drawings are available upon request. While the spillway information is representative of conditions at the planned locations, local variations in the characteristics of the concrete materials may be anticipated. Local variations which may be encountered include, but are not limited to, fractures, and other discontinuities in the spillway structure. Such variations will not be considered as differing materially within the purview of the contract clauses, paragraph differing site conditions. Additional data are available for inspection as specified in the special contract requirements, paragraph physical data.

1.4 UNIT PRICES

1.4.1 Core Drilling in Concrete for Spillway Anchors

1.4.1.1 Payment

Payment will be made for costs associated with core drilling in concrete for spillway anchors including the work required to cut the anchor pocket in the spillway.

1.4.1.2 Measurement

Drilling Holes in concrete will be measured for payment to the nearest foot, based upon the linear feet of hole actually drilled in concrete in

accordance with the specifications including one anchor pocket per anchor.

1.4.2 Spillway Anchors

1.4.2.1 Payment

Payment will be made for the cost of providing the number, size, capacity, and length of anchors as indicated on the drawings. Include the cost of all necessary equipment, tools, material, labor and supervision required to: deliver, handle, install, grout, lock-off, cutoff, and backfill of the anchor pocket.

1.4.2.2 Measurement

Spillway Anchors will be measured for payment to the nearest foot, based upon the linear feet of anchor actually installed below the bearing plate in accordance with the specifications.

1.4.2.3 Unit of Measure

Linear foot.

1.4.3 Performance Tests

1.4.3.1 Payment

Payment will be made for costs associated with performing Performance Tests on anchors which are accepted.

1.4.3.2 Measurement

Performance Tests will be measured based upon the number of tests performed.

1.4.4 Watertightness Testing

1.4.4.1 Payment

Payment will be made for costs associated with Watertightness Testing.

1.4.4.2 Measurement

Watertightness Testing will be measured for payment based upon the number of watertightness tests actually performed at the direction of the Contracting Officer and in accordance with the specifications or as otherwise required.

1.4.4.3 Unit of Measure

Each.

1.4.5 Regrout for Anchors

1.4.5.1 Payment

Payment will be made for costs associated with regrouting Holes which fail watertightness testing.

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1.4.5.2 Measurement

Regrouting Holes will be measured for payment based upon the number of ~~94-pound bags~~cubic feet of cement grout that were actually injected into the anchor hole as specified.

1.4.5.3 Unit of Measure

~~Bags of cement (94 lbs)~~Cubic feet.

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1.4.6 Redrilling Grouted Holes

1.4.6.1 Payment

Payment will be made for costs associated with Redrilling Grouted Holes.

1.4.6.2 Measurement

Redrilling Grouted Holes will be measured for payment to the nearest foot, based upon the linear feet of hole actually drilled in grout in accordance with the specifications.

1.4.6.3 Unit of Measure

Linear foot.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Fabricator Qualifications; G

Installer Qualifications; G

Designer Qualifications; G

SD-02 Shop Drawings

Fabrication and Installation Drawings; G

SD-03 Product Data

Equipment

Installation Plan; G

SD-05 Design Data

Design Computations; G

Bearing Plate Design; G

Watertight Enclosure Design; G

SD-06 Test Reports

Prestressing Steel; G

Cement Grout Mixture Proportions; G

Alignment Checking; G

Water Filter Sampling; G

SD-07 Certificates

Prestressing Steel; G

Cement; G

Couplers; G

Bearing Plate; G

Corrosion Inhibiting Compound; G

SD-11 Closeout Submittals

Driller Logs

Anchor Records; G

1.6 QUALITY ASSURANCE

Submit anchor designer, fabricator and installer qualifications for approval in accordance with paragraph SUBMITTALS. The submittals must, where applicable, identify individuals who will be working on this contract and their relevant experience. No changes must be made in approved personnel without prior approval of the Contracting Officer.

1.6.1 Designer Qualifications

The anchors must be designed by Professional Engineers who have designed a minimum three rock anchors projects similar in size and scope to this project within the past ten years. The drawings and calculations must be signed by the Professional Engineer licensed in the Commonwealth of Virginia.

1.6.2 Fabricator Qualifications

The anchors must be fabricated by a manufacturer that has been in the practice of designing and fabricating rock anchors similar in size and scope to this project for at least ten years.

1.6.3 Installer Qualifications

Submit the qualifications and experience records for approval. In the experience record, identify all the individuals responsible for the anchors and must include a listing of projects of similar scope performed

within the specified period along with points of contact. Qualifications prior to the installation of any anchors specified in this section. The anchors must be installed by a firm which is regularly engaged in the installation of rock anchors and has at least ten years experience in the installation of similar anchors. The superintendent must have 10 years of experience installing ground anchors.

1.7 DELIVERY, STORAGE, AND HANDLING

Materials must be suitably wrapped, packaged or covered at the factory or shop to prevent being affected by dirt, water, oil, grease, and rust. Protect materials against abrasion or damage during shipment and handling. Place materials stored at the site above ground on a well-supported platform and covered with plastic or other approved material. Protect materials from adjacent construction operations. Grounding of welding leads to prestressing steel will not be permitted. Reject and remove from the site prestressing steel which is damaged by abrasion, cuts, nicks, heavy corrosions, pitting, excessive heat, welds or weld spatter. Inspect tendons prior to insertion into anchor holes for damage to corrosion protection. Repair any such damage in a manner recommended by the manufacturer and approved by the Contracting Officer. Lifting of pre-grouted tendons must be to manufacturers' recommendations and not cause excessive bending, which can debond the prestressing steel from the surrounding grout.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Prestressing Steel

Submit certified test reports for each heat or lot of prestressing steel materials delivered to the site. Submit electronic copies of mill reports and electronic copies of a certificate from the manufacturer stating chemical properties, ultimate strengths, yield strengths, modulus of elasticity, and any other physical properties needed for the required computations, for the type of steel furnished.

2.1.1.1 High-Strength Steel Bars

Bars used for post-tensioning shall have a minimum tension strength level of 150,000 psi. Bars that can not meet the requirements of item a. shall meet the requirements of item b.

a. Bars shall meet the requirements of ASTM A722/A722M Type II high-strength bars.

b. Bars shall be high strength steel that has been quenched and tempered to meet the manufacturing requirements of ASTM A722/A722M. Bars must be cold stretched to a minimum of 80 percent of the minimum ultimate tensile strength and then stress-relieved to produce the required tensile properties. Bars shall provide a minimum yield strengths of 120,000 psi. Testing shall be performed on finished bars after secondary processing has been completed. Bar deformations shall meet the requirements of ASTM A722/A722M, paragraph 10 “Requirements for Deformations”. Bars shall be tested by an ISO ISO/IEC 17025 certified laboratory that is independent of the manufacturer and accredited to perform the work. The following properties of the steel bars shall be submitted to ensure strength and strains meet or exceed the

requirements of ASTM A722/A722M steel.

(1) Representative stress-strain curve for full bar cross-section.

(2) Creep test data at 80% of ultimate tensile strength.

(3) Relaxation shall be 4% or less at 1000 hour with an initial load of 0.7 x ultimate tensile strength.

(4) Manufacturer's certificates that confirm the bars provided have the same alloy and same manufacturing process as tested bars.

2.1.2 Structural Steel

ASTM A36/A36M, ASTM A572/A572M, Grade 50 ASTM A588/A588M, ASTM A709/A709M, Grade 50.

2.1.3 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B.

2.1.4 Steel Tube

ASTM A500/A500M or API Spec 5CT, Grade N-80, Oil Field Seconds / Mill Secondary Tubing.

2.1.5 Ductile Iron Castings

ASTM A536.

2.1.6 Polyethylene Tubing

All polyethylene tubing shall be manufactured from virgin resins. Recycled polyethylene is not acceptable.

2.1.6.1 Smooth Polyethylene Tubing

ASTM D3350.

2.1.6.2 Corrugated Polyethylene Tubing

PTI DC35.1-14 Section 4.7, with minimum wall thickness shall be 0.06 inch at the thinnest section.

2.1.7 Smooth Polypropylene Tubing

ASTM D4101, designation PP 210 B5542-11.

2.1.8 Polyvinyl Chloride (PVC) Pipe

ASTM D1785, Schedule 40.

2.1.9 Polyvinyl Chloride (PVC) Tubing

2.1.9.1 Smooth Polyvinyl Chloride (PVC) Tubing

ASTM D1784.

2.1.10 Heat Shrinkable Sleeve

Radiation crosslinked polyolefin tube internally coated with an adhesive sealant and conforming to PTI DC35.1-14 Section 4.8.1.

2.1.11 Corrosion Inhibiting Compound

Corrosion inhibiting compounds must conform to the requirements of Section 4.6 of PTI DC35.1-14. Corrosion inhibiting gel that is in contact with the load cells shall be compatible with the instrumentation housing and electrical/communication system.

2.2 MANUFACTURED UNITS

2.2.1 Anchor Head

Anchor head must consist of steel bearing plate with nut, trumpet and corrosion protection. Submit bearing plate material and details.

Anchorage devices must be capable of developing 95 percent of the guaranteed ultimate strength of prestressing steel. The anchorage devices must conform to the static strength requirements of Section 3.1.6 (1) and Section 3.1.8 (1) and (2) of PTI TAB.1. Fabricate the trumpet used to provide a transition from the anchorage to the unbonded length corrosion protection from steel pipe or steel tube. The minimum wall thickness must be 0.125 inch for diameters up to 4 inches and 0.20 inch for larger diameters.

2.2.2 Load Cell

Requirements for the anchor load cells are found in Specification Section 33 51 43 INSTRUMENTATION AND PERFORMANCE MONITORING OF STRUCTURES.

2.2.3 Prestressing Steel Couplers

Prestressing steel couplers for bars must be capable of developing 100 percent of the minimum specified ultimate tensile strength of the prestressing steel. Submit certified test reports for couplers used for anchor connections. Electronic copies of mill reports and certificates from the manufacturer stating chemical properties, ultimate strengths, yield strengths, modulus of elasticity, and other physical properties shall be furnished to confirm couplers meet the same requirements as the anchor bar.

Class 1 Corrosion protection for couplers shall follow the requirements in PTI DC35.1-14 Section 5.4.6 Coupler Protection.

2.2.4 Centralizers and Spacers

Fabricate centralizers from plastic, steel or other approved material which is nondetrimental to the prestressing steel. Do not use wood. The centralizer must be able to support the tendon in the drill hole and position the tendon so a minimum of 0.5 inch of grout cover is provided. Centralizers and spacers must permit grout to freely flow up the drill hole.

2.2.5 Anchorage Covers

Fabricate anchorage covers as shown on the drawings. The material used

must not be subject to attack by cement, corrosion-inhibiting compounds or the environment. Securely attach the cover to the bearing plate. The cover is to be filled with corrosion-inhibiting gel and must form a permanent watertight enclosure for the anchorage device.

2.2.5.1 Watertight Enclosure Design

The Contractor shall design a watertight enclosure for submittal to the Contracting Officer. At a minimum, the enclosure shall be a circular flange with a minimum of 6 bolts, gasket material, and include an installation procedure. Cable runs through the enclosure shall be approved by the instrumentation manufacturer.

2.3 EQUIPMENT

The Contractor's Quality Control manager must verify that the equipment used on site is the same as the equipment submitted for approval. Submit catalog cuts, brochures, or other descriptive literature describing the equipment to be used for drilling, grouting, handling, and installing the spillway anchors. Submit sketches, drawings or details showing the access and temporary supports where required for the drilling equipment and stressing frames. Provide descriptions of stressing jacks, gages, dynamometers, load cells, or other devices for measuring stressing load, certified calibration records for each set of jacking equipment, and current testing curves for stress measurement gages which show that gages have been calibrated for the jacks for which they are used 30 days prior to the start of the testing operations.

2.3.1 Drilling Equipment

Provide drilling equipment suitable for advancing the drill tools to depths that are least 10 feet below the elevations and at the alignment shown on the drawing.

2.3.2 Grouting Equipment

2.3.2.1 Grout Mixer

High-speed shear mixer must conform to PTI DC35.1-14 Section 7.8.1.

2.3.2.2 Grout Pump

The grout pump must be of the positive displacement type, and must be capable of pumping at all flow rates below 20 gpm, must be capable of pumping at the pressure of at least 25 psi at zero flow rate. For neat cement grout, the pump must have a screen with 0.125 inch maximum clearance to sieve the grout before being introduced into the pump. Screens are not required for shear type mixers. Contractor may submit separate pumps for neat cement grouts and sanded grouts. The pumping equipment must have a pressure gage capable of measuring pressures of at least 150 psi or twice the required grout pressure, whichever is greater.

2.3.3 Stressing Equipment

Stressing equipment must be hydraulically operated and must have a capacity sufficient to stress the anchors to the specified Test Loads within the rated capacity in one stroke. Pumps must be capable of applying each load increment in less than 60 seconds and must be capable of maintaining the hydraulic pressure within 50 psi. The equipment must

permit stressing of the tendon in increments and raising or lowering the load in the tendon. Calibrate the equipment with an accuracy of ±1 percent and ensure that the calibration certificate and graphs shall be at the site. The production gage must have graduations of 100 psi or less. Maintain a second certified gage for periodic verification of the production gage. Provide a dial gage or approved device to measure total tendon elongation at each load increment to the nearest 0.001 inch. The dial gage must be capable of measuring the entire anchor movement without being reset. Verify the calibration of gages no more than 30 calendar days prior to commencing work under this contract and at six-month intervals throughout the period of use.

2.3.4 Testing Equipment

Provide testing equipment consisting of a hydraulic jack with calibrated pressure gage for applying the load and a dial gage or vernier scale to measure anchor movement. The ram travel of the stressing equipment must be not less than the theoretical elastic elongation of the total anchor length at the maximum Test Load. Graduate the pressure gage in 100 psi increments. Calibrate the stressing equipment and pressure gage as a unit no more than 30 calendar days prior to commencing work under this contract and at six-month intervals throughout the period of use. The movement measuring device shall be a temperature-compensating digital gauge and must have a minimum travel equal to the theoretical elastic elongation of the total anchor length at the maximum Test Load without resetting the device. To calibrate the load cells, a digital pressure gauge with accuracy of 0.1% is required. The digital gauge shall be used for the creep measurement.

2.4 GROUT

2.4.1 Cement

ASTM C150/C150M, Type I, II, or ASTM C595/C595M Type IL.

2.4.2 Water

Water used for drilling, flushing of spoils and water pressure testing may be lake water. Lake water shall be filtered as required to ensure total suspended solids are not more than 30 mg/L. Water Filter Sampling and testing is required once per week during the work. After final drilling, the borehole shall be washed with potable water using a minimum quantity of 3 times the borehole volume. Only potable water shall be used for mixing grout, cement, or any other backfill material. Potable water shall be fresh, clean, free from injurious amounts of sewage, oil, acid, alkali, salts, or organic matter.

2.4.3 Aggregates

Fine aggregate for sand-cement grout must conform to ACI 301 and ASTM C33/C33M for grout for backfilling holes. Aggregates must not contain substances which may be deleteriously reactive with alkalis in the cement.

2.4.4 Admixtures

Admixtures which control bleed, improve flowability, reduce water content and retard set may be used in the grout subject to the approval of the Contracting Officer. Any admixtures used must be compatible with the

prestressing steel and must be mixed in accordance with the manufacturer's recommendations.

2.4.5 Grout for Anchors

2.4.5.1 Cement Grout

Cement grout must conform to PTI DC35.1-14 Section 6.11 and Section 7.8.2.3. Submit cement grout mixture proportions.

Preproduction laboratory testing shall be performed and in accordance with PTI DC35.1 Section 7.8.2.1 and shall include strength tests, specific gravity, and bleed tests.

Preproduction field testing shall be performed using the equipment and materials proposed for production anchors. Compressive strength testing, specific gravity, and bleed tests shall be performed. The rate of gain of strength over a least 7 days shall be demonstrated.

Routine QA/QC testing shall include specific gravity testing for each batch.

Compressive strength test samples are required for each anchor from grout used within the bond length interval. Sufficient samples shall be collected by the independent testing agency to confirm the grout strength after 96 hours.

2.4.6 Sand-Cement Grout

Grout for waterproofing holes, grouting holes which fail the watertightness test, and for backfilling holes which are abandoned must consist of a mixture of portland cement, fine aggregate and water. Sand-cement grouts shall use paddle or drum mixers that provide the approved mix design fluidity and set performance. The grout mix proportions are the responsibility of the Contractor. Results of the watertightness testing shall be used to proportion a stable grout mix with suitable viscosity and negligible bleed that will reduce permeability in the borehole to allow anchor grout placement. Contractor shall follow the requirements of EM 1110-2-3506 for selecting and proportioning a grout mix and materials. Multiple grout mixes may be required. Submit the proposed mix design to the Contracting Officer for approval. The water content must be the minimum necessary for proper placement. Base the final proportions of materials on results of tests made on sample mixtures of grout. The minimum compressive strength of two-inch cubes, molded, cured, and tested in accordance with ASTM C109/C109M, must be 4,000 psi at the time of the performance test. The Contractor is responsible for taking, curing, and breaking of grout test cubes for determining mix design, and all testing must be done by an independent laboratory approved by the Contracting Officer.

2.4.7 Grout for Anchor Pads

Use nonshrink grout conforming to ASTM C1107/C1107M for leveling bearing plates.

2.5 TENDON FABRICATION

2.5.1 General

Fabrication of the anchors must be as recommended by the suppliers. Completely assemble anchors with all centralizers grout and vent tubes and corrosion protection prior to insertion into the hole. Protect, transport and store fabricated anchors in a manner to prevent contamination or damage to any components.

2.5.2 Tendon

Tendon material must be unblemished and free of pitting, nicks, grease, or injurious defects. When required to maintain the tendon location within the hole, provide centralizers at a maximum of 10 foot intervals center-to-center throughout the full anchor length. The entire bond length of the tendon must be free of dirt, lubricants, loose rust, corrosion-inhibiting coatings or other contaminants.

2.5.3 Bond Breaker

Bond breaker for free stressing length must consist of smooth polyethylene tubing, minimum wall thickness 0.06 inch, or smooth PVC tubing, minimum wall thickness 0.06 inch.

2.5.4 Vent Tubes

Vent tubes used during grouting operations, if necessary, must be any appropriate type for the job, as recommended by the supplier of the anchors.

2.5.5 Grout Tubes

Grout tubes must be polyethylene tubing or as recommended by the anchor manufacturer and approved by the Contracting Officer. Inside diameter of grout tubes must be adequate to fully grout the entire hole.

2.5.6 Corrosion Protection

Corrosion protection must be Class I protection in accordance with PTI DC35.1-14 Section 5.3. Anchor bars may be epoxy coated, but epoxy coating shall not be part of the corrosion protection system. Provide corrosion protection for the entire anchor and include anchorages covers and trumpets filled with corrosion inhibiting compound and encapsulation of the free stressing length and bond length.

2.5.6.1 Anchorage Protection

The trumpet must be sealed to the bearing plate and must overlap the free stressing length encapsulation by at least 4 inches. The trumpet and anchorage cover must be completely filled with corrosion inhibiting compound. Compound filled trumpets must have a permanent seal between the trumpet and the free length corrosion protection.

2.5.6.2 Free Stressing Length Encapsulation

Encapsulation for the anchor bar shall be continuous using the components of the bond length encapsulation. Encapsulation for the free stressing length shall be around the bond length encapsulation.

Encapsulation for free stressing length must consist of a sheath of smooth polyethylene tubing, minimum wall thickness 0.06 inch; smooth polypropylene tubing, minimum wall thickness 0.06 inch; smooth PVC tubing, minimum wall thickness 0.06 inch; steel pipe or tube with minimum wall thickness 0.20 inch. Sheathing shall be filled with grout and function as the bond breaker. Free stressing length encapsulation must extend at least 4 inches into the trumpet, but must not contact the bearing plate during testing and stressing of the tendon.

2.5.6.3 Bond Length Encapsulation

Bond length encapsulation must consist of grout-filled, corrugated polyethylene tubing, minimum wall thickness 0.060 inch or corrugated PVC tubing. Bond length encapsulation shall meet the requirements of PTI DC35 1-14 Section C5.4.4.1 Class 1 protection, except epoxy coated bars are not acceptable as part of the corrosion protection encapsulation. Minimum wall thickness of polyethylene tubing shall be 0.06 inches at the thinnest diameter.

2.6 TESTS, INSPECTIONS, AND VERIFICATIONS

Perform required material tests, on prestressing steel and accessories, by an approved laboratory to demonstrate that the materials are in conformance with the specifications. Test grout in accordance with ASTM C109/C109M. These tests will be at the Contractor's expense. Furnish to the Contracting Officer prestressing steel and coupler test results prior to beginning fabrication of any anchors and within 24 hours of testing.

PART 3 EXECUTION

3.1 DRILLING HOLES

3.1.1 General

The top of bond zone elevations and other physical conditions indicated on the drawings are the result of recommendations in the dam stability report. (See also paragraph "PROJECT SITE CONDITIONS"). Drill holes at the locations and inclinations shown and to the depths and diameters indicated on the drawings. The locations of the holes may be changed only as approved by the Contracting Officer. Any redesign of the anchored structure due to relocation of anchor holes must be performed by the Government. TheContractor must determine the drilling method to be used. Do not drill holes within 12 feet of a grouted hole until the grout has set at least 24 hours. Do not perform hydraulic water pressure testing and drilling simultaneously within a distance of 45 feet. Take care while drilling to avoid damage of any kind to the existing structures. Damages of any nature will be evaluated by the Contracting Officer and repairs or replacements must be made as required. Do not install anchor and grout more than 4-days after drilling the borehole or more than 4-days after redrilling the borehole if the original borehole required pregrouting due to failed watertightness test. Collect, recycle, or treat waste water and spoils from drilling operations and watertightness and testing; do not discharge directly into the water or on the ground. See also Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

3.1.2 Drilling Through Existing Structures

Drilling of boreholes shall not begin until all crack monitors have been installed in accordance with Specification 33 51 43 Instrumentation and Performance Monitoring of Structures.

Drill holes through existing structure by any method which does not cause damage to the surrounding structure. The Contractor is advised that foreign material, including metals and other materials remaining from original construction of the existing structure, may be encountered during drilling through existing structures.

3.1.3 Drilling in Spillway

Holes may be drilled by core drilling, rotary drilling, percussion drilling or down-the-hole hammer using equipment suitable for the intended purpose. The drilling method must not cause structural damage to existing structures. Modify drilling method if damage is observed. Core drilling or other method that leaves a smooth sidewall shall require a process to roughen the borehole through the bond zone length. Overdrilling of holes by a maximum of three feet beyond the required elevation will be permitted.

The Contractor shall observe the joint drain discharge into lower gallery during anchor hole drilling and water pressure testing. Observe joint drains within 50 feet of the hole during drilling and testing. If connection is observed at the joint drain discharge or upstream face, Contractor shall provide a thickened grout to prevent grout travel from the anchor hole to joint drain or upstream face.

Stop drilling and notify the Contracting Officer if there is fluid loss during drilling or if drilling fluid is observed at the upstream face.

3.1.4 Records

Submit driller logs and records as specified in paragraph Driller Logs. The presence of a Government inspector or the keeping of separate drilling records by the Contracting Officer must not relieve the Contractor of the responsibility for the work specified in this paragraph. Payment will not be made for any work for which the required records have not been furnished by the Contractor.

3.1.5 Alignment

3.1.5.1 Tolerances

The anchor hole must be located within 1 inch of the plan location. The entry angle must be within 1-inch horizontal for 60-inch vertical of the specified inclination. The straightness of the drilled hole must be within 1-inch in 25 feet of the theoretical alignment. Check tolerance for each anchor hole. If the hole alignment is not within these tolerances, notify Contracting Officer and perform corrective measures as directed. If tolerances cannot be maintained, then notify Contracting Officer.

3.1.5.2 Alignment Check

Check each drilled hole for alignment as specified herein upon completion of drilling and before commencement of any other work. Check direction and inclination of all anchor holes for each 5-foot intervals throughout

the hole. Checking the alignment of each anchor hole must be done by measuring the inclination of the actual drilled anchor hole center line in place with respect to the specified anchor center line. The specified anchor center line must consist of a single, straight, continuous line extending from the top of the hole to the required bottom elevation of the hole. Specified anchor centerlines must slope at the inclinations shown on the drawings. The Contracting Officer must have access to holes for alignment surveys that may include, but not be limited to, slope indicators or other down-the-hole equipment. Drill rods may be required to be removed from the hole or left in place as directed by the Contracting Officer. Holes, or portions of holes, which are out of alignment must be corrected or filled with cement grout having a water-cement ratio of 0.40 or sand-cement grout, and a new hole drilled as directed by the Contracting Officer. Slight adjustments to inclinations indicated on the drawings may be required, as directed by the Contracting Officer. The Contractor is responsible for all drilled holes until accepted by the Contracting Officer. Holes to replace incorrectly drilled holes must be drilled at no additional cost to the Government. All equipment for checking alignment of anchor holes must be operated by personnel experienced in the operation of such equipment.

3.1.5.3 Alignment Checking Equipment

Check alignment of holes by means of an optical televiewer, or equal equipment, and selected based on the maximum expected range of angle deviation to be measured.

3.1.6 Watertightness Testing

The full borehole length of all anchor holes must be watertightness tested in accordance with the procedures of PTI DC35.1, Section 7.5. Holes which have a water loss in excess of 2.5 gallons in ten minutes must be grouted as specified in paragraph Waterproofing Anchor Holes, and redrilled.

3.1.7 Waterproofing Anchor Holes

Anchor holes which fail the watertightness test must be tremie grouted with cement grout as specified in paragraph Grout for Waterproofing or Backfilling Holes. Grouted holes must be redrilled less than 48 hours after grouting.

3.2 INSTALLATION OF ANCHORS

3.2.1 General

The Contractor is responsible for each drilled hole until the anchor has been installed, grouted, stressed and accepted. Holes must be cleaned by pressurized air and/or potable water to remove drill cuttings.

3.2.2 Placing

All the equipment used in handling and placing the anchors must be such that it does not damage or deteriorate the prestressing steel, corrosion protection, or the anchorages. Each anchor must be inspected prior to insertion into the hole. Any damage to corrosion protection must be repaired prior to insertion or, if determined by the Contracting Officer to be not repairable, the anchor must be replaced. Insertion of anchors must be in accordance with PTI DC35.1.

3.2.3 Cement Grouted Anchors

Grouting equipment must be of type and capacity required for successful installation of the anchors. All anchors must use single stage grouting to encase the anchor. Grouting must be performed by a method in accordance with PTI DC35.1, paragraph 7.6. Grouting must commence at the bottom of the grout zone and proceed to the top of the zone. Grouting must be gravity flow.

3.2.4 Gravity Grouting

Gravity grouting must proceed from the bottom of the hole to the top of the hole. During the grouting operation all face drains within 50 feet of a borehole along the dam centerline shall be continually flushed with lake water. The flushing shall continue until the grout level has remained stable for one hour. Joint drain discharge outlets into the lower gallery shall be observed during the grouting. The outlets within 50 feet of the grouting operation shall be observed for grout. If grouting compromises a face drain, the anchor tendon will be removed from the hole and the grout will be removed from the hole. A method for regrouting the hole with a sanded grout will be approved by the Contracting Officer.

See the requirements in 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS for disposal of excess grout. The Contractor shall provide a sump pump to assist in collection of water from the drain sump. Water collected during the flushing shall be treated as Wastewater as defined in Section 01 57 19 paragraph 3.7.6 Wastewater.

3.2.5 Anchorage Installation

The load cell instrumentation, bearing plate and nut must be installed perpendicular to the tendon, within 5 degrees, and centered on the tendon without bending of the stressing steel. Corrosion protection must be maintained intact at the anchorage and any damage must be repaired prior to stressing.

3.3 STRESSING

3.3.1 General Requirements

After the anchor grout has been in place for a minimum of 96 hours and has reached a compressive strength of 4000 psi, as verified by grout cube break, the anchors must be stressed. Prior to stressing, surfaces upon which the stressing equipment is resting must be clean and the stressing equipment must be aligned as nearly with the center of the hole as possible. An Alignment Load of 10 percent of the Design Load must be applied to the anchor prior to setting dial gauges. Stress the anchor in accordance with the anchor manufacturer's recommendation, subject to the approval of the Contracting Officer. Design and Lock-off loads are given in paragraph DESIGN LOADS. Determine the lock-off procedure so that the lift-off results meet the acceptance criteria specified in paragraph Acceptance. The maximum stress must never exceed 80 percent of the guaranteed ultimate strength of anchor steel. The process of stressing the anchors must be so conducted that accurate elongation of the anchor steel can at all times be recorded and compared with the computations submitted to, and accepted by the Contracting Officer. Safety precautions must be taken to prevent workers from being behind or in front of the stressing equipment during stressing. Stressing of the anchors must be performed in a sequence submitted by the Contractor for review by the

Contracting Officer. All stressing must be done in the presence of a representative of the Contracting Officer. At no time during the stressing and testing of an anchor will the stressing equipment be disconnected from the temporary stressing head or anchor.

3.3.2 Lock-off

Lock off loads are to be applied in two equal increments in accordance with the schedule shown on the drawings. Lock off loads shall be scheduled only after all performance tests have been completed and results approved by the Contracting Officer.

After completion of the all required tests, the load must be returned to the Alignment Load and the specified Lock-off Load must be applied to the anchor. A lift-off test must be made to verify the load in the anchor tendon before the tendon is locked-off and the stressing equipment is removed. The lift-off reading must be within five percent of the specified lock-off load. If the lift-off reading is not within five percent of the specified lock-off load, the anchorage will be reset and another lift-off reading must be made. This procedure must be repeated until a satisfactory lift-off reading is obtained. Load reading from the Performance Test are to be used for instrumentation calibration in accordance with Section 33 51 43 paragraph CALIBRATION. After lock-off, the trumpet must be filled with corrosion inhibiting compound and the anchor head protective cap must be installed and the anchorage recess must be fully grouted flush with the adjacent surfaces.

3.4 FIELD QUALITY CONTROL

All anchors must be performance tested. During the stressing of each anchor, a record must be kept of gage pressure and of anchor elongation at each stage of stressing to the specified test or Lock-off Load, as applicable. The Test Load must not be exceeded. Provide a qualified engineer to evaluate the anchor test results and determine the acceptability of the anchors in accordance with the criteria indicated hereunder. Final acceptance of each anchor will be made by the Contracting Officer. All tests must be run in the presence of the Contracting Officer or his representative.

3.4.1 Performance Test

Performance test must consist of cyclically and incrementally loading and unloading the anchor, and must be conducted in accordance with PTI DC35.1, Paragraph 8.3.2. During the testing of each anchor, a record must be kept of gage pressure and of anchor elongation at each stage of stressing to each Test Load required by PTI DC35.1. Measurements of the elongation of prestressing steel must be made in accordance with PTI DC35.1. If the total movement at the end of 10 minutes at the Test Load exceeds 0.040 inch, the Test Load will be held an additional 50 minutes and the movement readings will be taken at the interval specified in PTI DC35.1, Paragraph 8.3.2. Test records, including plots and graphical analysis of test data, must be furnished upon acceptance of each performance tested anchor in accordance with paragraph SUBMITTALS.

3.4.2 Driller Logs

Submit the original handwritten log and electronic copies in typed format within two days of the completion of each hole. Keep accurate driller logs and records of all work accomplished under this contract and deliver

complete, legible copies of these logs and records to the Contracting Officer upon completion of the work or at such other time or times as he may be directed. All such records must be preserved in good condition and order by the Contractor until they are delivered and accepted, and the Contracting Officer will have the right to examine such records at any time prior to their delivery. Separate logs must be made for each hole. Use DRILLING LOG, ENG FORM 1836 and 1836A or other approved form which provides the required information for his logs. The following information must be included on the logs or in the records for each hole:

a. Hole number or designation and elevation of top of hole.

b. Inclination of the hole.

c. Make and manufacturer's model designation of drilling equipment.

d. Dates and time when drilling operations were performed.

e. Time required for drilling each run.

f. Depth and elevation of rod drops and other unusual occurrences.

g. Depths and elevations at which drill water is lost and regained and amounts.

h. Depth and elevation of bottom of hole, determined by measuring the drill steel length.

3.4.3 Anchor Records

Upon completion of installation of each anchor, the anchor records must be furnished to the Contracting Officer with watertightness test results and report of remedial action taken, top of bond zone elevation, bond length, free stressing length of anchor, grout mix, grouting pressure, grout volume, and a report of performance test results, and hole alignment surveys. The performance test, results must include measured lengths of drill holes and anchors, the loads and elongations recorded during testing, monitoring and stressing of the anchors, and graphs of test results.as specified in paragraph SUBMITTALS. In addition as-built drawings showing the completed installation of the anchors must be furnished upon completion of installation of all anchors.

3.5 ACCEPTANCE

3.5.1 General

Acceptance of anchors must be determined by the Contracting Officer. The following criteria will be used in determination of the acceptability of each anchor:

3.5.1.1 Creep

Creep movement must not exceed 0.040 inch at maximum Test Load during the first 10 minutes of the performance test. If the creep movement exceeds this limit, it must not exceed 0.080 inch at the maximum Test Load at the end of 60 minutes. If the creep movement exceeds 0.080 inch at the maximum Test Load at the end of 60 minutes, the anchor will be rejected.

Creep tests that are negative values during the first 10 minutes of the

maximum test load shall be invalidated and retested. The anchor shall be rejected if during the second test the rate of creep is not decreasing at the end of 60 minutes.

3.5.1.2 Movement

Apparent free length must be calculated from the observed elastic movement in accordance with PTI DC35.1, Section 8.6.2.

3.5.1.2.1 Minimum Apparent Free Length

The calculated free length must be not less than 80 percent of the designed free tendon length plus the jack length. If the anchor does not meet this criteria, the anchor must be restressed from the Alignment Load to the Test Load and the apparent free length must be recalculated. If the anchor does not meet this criteria after 3 attempts (original plus 2 restresses), the anchor will be rejected.

3.5.1.2.2 Maximum Apparent Free Length

The calculated free length must be not more than 100 percent of the designed free length plus 50 percent of the bond length plus the jack length. If the anchor does not meet this criteria, and the cause of the behavior is not investigated and explained to the satisfaction of the Contracting Officer, the anchor will be rejected.

3.5.1.3 Initial Lift-Off Reading

The initial lift-off reading must be within 2 percent of the specified Lock-off Load. If the anchor does not meet this criteria, the anchor must be adjusted as necessary and the lift-off reading must be repeated.

3.5.2 Replacement of Rejected Anchors

Any anchor that fails the performance test or is rejected by the Contracting Officer must be replaced. A replacement anchor, including a new anchor hole, must be provided by the Contractor at no expense to the Government. The location of the replacement anchor will be as directed by the Contracting Officer. Provide all materials, supplies, equipment, and labor necessary to provide a new anchor assembly to the satisfaction of the Contracting Officer. No drilling will be performed for a replacement anchor until the grouting of all anchors within 12 feet of the replacement anchor location has been allowed to set for at least 24 hours. Payment will not be made for rejected or failed anchors. Either remove failed anchors and thoroughly ream and clear the anchor hole or remove the load and cut the anchor and casing flush.

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SECTION 33 51 43

INSTRUMENTATION AND PERFORMANCE MONITORING OF STRUCTURES
05/22

PART 1 GENERAL

1.1 DESCRIPTION

Provide all labor, equipment, and materials for the installation and maintenance of performance monitoring instrumentation for the duration of the contract. Provide all labor, equipment, and materials for data collection, data management, interpretation, and reporting unless otherwise specified.

1.1.1 Instrumentation and Monitoring Plan

Develop an Instrumentation and Monitoring Plan that outlines the project performance monitoring requirements, recommended thresholds values and response actions, as well as roles and responsibilities based on the requirements of this scope.

1.1.2 Supervision and Quality Control

Provide supervision and quality control to assure the accuracy, quality, timeliness, and completeness of the work. Provide all related and miscellaneous components and appurtenances to make the specified systems complete and functional. Perform all work in strict accordance with this section of the specifications and the applicable contract drawings.

1.1.3 Scope of Work

The following tables summarize the instrumentation that is currently installed within the project area (Existing Instruments), instrumentation to be installed as part of the contract work (New Instruments), and instrumentation that is currently installed within the project area that is to be modified (Existing Instruments to be Modified).

Existing Instruments					
Instrument	Type	Model No.	Data Collection Method	Data Collection Frequency	Existing Quantity
Crack Meter	N/A	N/A	Manual	Bi-Monthly	22
Piezometer	Standpipe	N/A	Manual	Quarterly	13
Piezometer	Pneumatic	P-100			4
Tilt Sensor	N/A	N/A	Manual	N/A	3
Anchor Load Cell	N/A	N/A	Manual	Monthly	6

New Instruments to be Installed				
Instrument	Type	Data Collection Method	Data Collection Frequency	Quantity
Crack Meter	Displacement Transducer	Automated	Daily	22
Inclinometer Sensors	In-place MEMS	Automated	Once every 15-minute interval	188
Anchor Load Cell	Vibrating Wire	Automated	Daily	6
Anchor Load Sensor	Electromagnetic	Automated	Daily	6

Existing Instruments to be Modified		
General Description	Data Collection Method	Quantity
Retrofit existing standpipe piezometer with vibrating wire transducer	Automated	13
Retrofit existing pneumatic piezometers with datalogger	Automated	4

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D1785 (2021) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 802.11 (2020; BD 2022) Information Technology-Telecommunications and Information Exchange Between Systems Local and Metropolitan Area Networks - Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 3: Wake-Up Radio Operation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023) National Electrical Code

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 1110-2-1908	(2020) Instrumentation of Embankment Dams and Levees
ER 1110-1-1807	(2014) Drilling in Earth Embankment Dams and Levees

1.3 DEFINITIONS

1.3.1 Automated Data Acquisition System (ADAS)

An Automated Data Acquisition System (ADAS) is a system of electronic devices that automatically collect, process, store, and transmit measurements from instrument sensors. An ADAS may include, but is not limited to the following components: dataloggers, vibrating wire analyzer, RMU, RIO, multiplexer, power, and communication hardware and service. The system also includes enclosures and mounts, software, and transient voltage surge suppressors.

1.3.2 Readout Unit

A readout unit is a device used to display measurements from an instrument. Some readout units also have data collection capability. The readout unit may be portable and connected to instrument terminals when monitoring is required (e.g. notebook computer, datalogger, or a proprietary system), or may be an on-line connection (fixed line or wireless) to a remote monitoring system.

1.3.3 Data Collector

A data collector is a device used to collect, store, and transfer recorded data from an instrument. A data collector may be a portable device or be located in-place at the instrument location. Data collectors may be equipped with remote data access.

1.3.4 Data Logger

A data logger is a device that can perform measurements at a prescribed interval, process the data from raw values to engineering units, store time-stamped data, and communicate with other devices.

1.3.5 RMU

Remote monitoring unit (RMU) are electronic units comprised of a datalogger along with, but not limited to, associated power, communication equipment, and enclosure. They have both inputs to read sensors and outputs to control other devices. RMU can perform calculations, run programs that have been uploaded to it, and can interface with other RMUs and a central control unit via some means of communications. It can hold and store data and then transmit it upon individual data calls or can be retrieved by a remote server via FTP on an as needed basis. RMUs communicate via radio or some other method that designates them as remote from the central control unit.

1.3.6 RIO

A remote input output (RIO) unit is an automated measurement device without onboard data storage. It is comprised of a power supply, communication equipment (for transferring data to RMU), and enclosure. RIOs report instrumentation readings upon request from a RMU. A RIO unit may have a multiplexer attached to it.

1.3.7 Multiplexer

A multiplexer is a device used to allow several sensors to share one input channel of the RMU. This allows many more sensors to be read by one RMU. A multiplexer is used in conjunction with RMU software that controls which input channel is being read so that each sensor value is stored in the correct memory location.

1.3.8 Communications

Communications is a method used to allow two devices to "talk" to or exchange information with one another. This can be by wire, fiber optic cable, satellite, radio or other means. In every case there is a preferred "language" for sending the data. This is often referred to as the "protocol". The protocol may be different for each sending method.

1.4 QUALITY ASSURANCE

In addition to using the current state of practice in the field of geotechnical and structural instrumentation and all manufacturer's recommendations for installation and operation; the following Codes, standards, regulations, and references apply for all features of the instrumentation system with the most stringent being applicable: NFPA 70, EM 1110-2-1908.

1.5 MEASUREMENT AND PAYMENT

1.5.1 Method of Measurement

1.5.1.1 Readout Units

Readout unit quantities will be measured by each complete readout unit provided and any peripheral equipment or materials needed for them to perform their data collection function, such as batteries and terminal clips.

1.5.1.2 Data Collector

Data collector quantities will be measured by each complete data collector provided and any peripheral equipment or materials needed for them to perform their data collection function, such as batteries and terminal clips.

1.5.1.3 Instruments

For the following instruments a complete installation means: All materials necessary to provide a fully functioning unit to include, but not be limited to, connection to surfaces, wiring and or wireless communication equipment, enclosures, batteries, as required to fully function with the specified readout and/or data collector device.

a. Vibrating wire piezometer: by each complete installation. Each (EA)

b. Automated In-Place Inclinometer Casing: by the linear foot from the bottom cap to the ground surface. Any required length over a foot will be counted to the next foot for measurement. All materials for the installation to include casing, cap, grout, inclinometer sensors, and cable, and covers. Drilling of borehole is a separate pay item. Linear Foot (LF) per borehole location.

c. Crack Meter: by each complete installation. Each (EA)

d. Load cell: by each complete installation. Each (EA)

e. Electromagnetic Sensor: by each complete installation. Each (EA)

f. Signal Cable, Linear Foot (LF)

1.5.1.4 ADAS

The Automated Data Acquisition System (ADAS) includes all equipment, supplies, materials, and programming/configuration necessary for a fully functional ADAS which polls and communicates successfully with those data collection devices identified separately above and connects to the existing cloud-based USACE Monitoring Instrumentation Data Acquisition System (MIDAS). This item includes, but is not limited to, the following components:

a. Enclosures and mounts.

b. Data loggers.

c. RMU.

d. RIO.

e. Multiplexer.

f. Power.

g. Software.

h. Laptop computer

i. Transient voltage surge suppressors.

j. Communication hardware and services, including coordination with the Government and related costs to accommodate site data into the existing USACE MIDAS. The Government will be responsible for all MIDAS database and programming modifications.

1.5.1.5 General Instrumentation Requirements

General instrumentation requirements will be measured on a lump sum basis.

1.5.2 Basis of Payment

AMENDMENT 0003

1.5.2.1 Readout Units

Payment will be made at the Base Bid contract line item price for each readout unit listed below, which price will constitute full compensation for providing the readout unit including factory calibrations, pre installation acceptance testing, any peripheral equipment or materials needed for them to perform their data collection function, instruction manuals, and delivery to the Government as specified:

a. Vibrating Wire Piezometer: readout unit.

~~b. Automated In-Place Inclinometer: probe, carrying case, cable, readout unit, and software.~~

b. Crackmeter/Jointmeter: readout unit.

c. Load cells: readout unit.

d. Electromagnetic Load Sensors: readout unit.

AMENDMENT 0003

1.5.2.2 Instruments

Payment will be made at the Base Bid contract line item price for each instrument listed below, which price will constitute full compensation for all materials left in place, all cable, labor, tools and equipment, instruction manuals, pre installation acceptance testing, installation, post installation acceptance testing, installation of surface and other protection, determination of as-built location, and all incidentals necessary to complete the work in accordance with the plans and in every respect to the satisfaction of the Government:

a. Vibrating Wire Piezometer

b. Automated In-Place Inclinometer

c. Crackmeter

d. Load cell

e. Electromagnetic Load Sensor

1.5.2.3 ADAS

The Automated Data Acquisition System (ADAS) will be paid for at the base bid contract for each component, which will constitute full compensation for all materials left in place. This item includes all equipment, supplies, materials, programming/configuration, and labor to have a fully functional ADAS. This system must poll and communicate successfully with those data collection devices identified separately above (such as fully grouted piezometers, weather stations, etc.) and connect to the existing USACE MIDAS communication network. This item includes, but is not limited to, the following components:

a. Enclosures and mounts

b. Data loggers

c. RMU

d. RIO

e. Multiplexer

f. Power

g. Software

h. Architecture

i. Transient voltage surge suppressors

j. Communication hardware and services, including coordination with the Government and related costs to accommodate site data into the existing USACE MIDAS. The Government will be responsible for all MIDAS database and programming modifications

1.5.2.4 General Instrumentation Requirements

General instrumentation requirements provided will be paid for at the base bid contract lump sum price. This item includes the following:

a. Protecting and maintaining all instruments.

b. Repairing or replacing damaged instruments.

c. Storing and disposing of instruments.

d. Providing safe access to instruments for data collection by the Government.

e. Monitoring and data collection.

f. Interpreting data.

g. Presenting data.

h. All other items of work specified in this Section for which no separate bid item is provided.

1.5.2.5 Drilling Program Plan

A Drilling Program Plan shall be submitted in accordance with Section 02 32 13 INSTRUMENTATION HOLE DRILLING AND SAMPLING.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Instrumentation Specialist; G, RO

Instrumentation and Monitoring Plan; G, RO

Permit Documentation; G, RO

Backups, Archiving, And Disaster Recovery Plan; G, RO

Cellular Data Communications Viability Report; G, RO

Drilling Program Plan; G, RO

Grounding And Lightning Protection Plan; G, RO

Quick Reference Guide; G, RO

Web Interface; G, RO

SD-02 Shop Drawings

Instrument Modification Report; G, RO

SD-03 Product Data

In-Place Inclinometer; G, RO

Vibrating Wire Transducers; G, RO

Crack Meter; G, RO

Anchor Load Cells; G, RO

Electromagnetic Load Sensors; G, RO

Factory Test Reports; G, RO

Proprietary Data Determination Request; G, RO

Raw Data; G, RO

SD-05 Design Data

Method Statements; G, RO

Grout Mix Design; G, RO

SD-06 Test Reports

Pre-Installation Acceptance Tests; G, RO

Monitoring Data Reports; G, RO

Instrument Alert Assessment; G, RO

Action/Threshold Exceedance Report; G, RO

Installation Record; G, RO

SD-07 Certificates

Instrumentation Specialist Qualifications; G, RO

SD-08 Manufacturer's Instructions

Factory Test Reports; G, RO

SD-10 Operation and Maintenance Data

Installation; G, RO

Instrument Modification Report; G, RO

Operations Manual; G, RO

SD-11 Closeout Submittals

As-Built Drawings; G, RO

ADAS Final Report; G, RO

1.7 INSTRUMENTATION SPECIALIST

1.7.1 General

Acquisition of reliable and high-quality data is the primary objective of the instrumentation specialist. This individual must be retained by the contractor for the duration of the work. Approval of an equivalent backup is required prior to the start of the work. Duties of the instrumentation specialist include selection of the instruments to be purchased by the Contractor; installation, calibration, and maintenance of that specialized equipment in the field; and acquisition and reporting of readings. Supporting work, which does not require specialized skills, may be performed by the construction contractor.

1.7.2 Qualifications

The individual assigned as lead instrumentation specialist must be a registered Professional Engineer (PE) and recognized professional in the field of instrumentation and monitoring of geotechnical and hydraulic structures with over 10 years of work experience relevant to the scope and magnitude of work specified in this contract. An experienced alternate individual, not meeting the PE license requirement, may work under the direction and supervision of the PE to carry out all tasks of the instrumentation specialist, with exception of the selection of alert values, analysis of reported instrument readings, and directed response actions. A detailed, concise narrative describing the instrumentation specialist qualifications and relevant work completed by those experienced alternate individuals on a minimum of 3 projects, within the last 7 years, is required for Government review and approval. Likewise, equivalent backups meeting the aforementioned qualifications must be identified and included with the required submittal of the instrumentation specialist(s).

The responsibilities of the instrumentation specialist are selection of the instruments required for purchase for the work; installation, calibration, and performing necessary maintenance of that specialized equipment in the field; and compiling readings and reporting them. Supporting work, which does not require specialized skills, may be performed by the construction contractor, with prior approval of the Government.

1.7.3 Instrumentation and Monitoring Plan

An Instrumentation and Monitoring Plan must be prepared by the Instrumentation Specialist and submitted for Government approval a minimum of 30 days prior to any work being completed at the site. No physical work is to start at the site until this plan is approved by the Government. At a minimum, the Instrumentation and Monitoring Plan must address the following: responsibilities and authority for all phase of the monitoring program; types (including detailed manufacturer data), purpose, and location of each instrument; installation procedures (detailed below) and documentation; instrument reliability and limitations; operation and maintenance data including instrument details, their operation, maintenance procedures, calibration records, and safety guidelines, in accordance with manufacturer's requirements and EM 1110-2-1908; redundancy; backup instruments/parts; baseline data; procedures for ensuring data validity; data collection frequency; visual observation; data processing and reporting including example tables and plots; and threshold values and response actions.

Include detailed method statements for installation of each type of instrument. Method statements must list the sequence of carrying out the work and include such dimensioned sketches, completed using computer-aided design and drafting (CADD) software, as may be required to illustrate the spatial or temporal relationship of the various components of the work. The method statements must include:

a. Method of pre-installation acceptance tests.

b. Description of quality control procedures.

c. Full details of both type and quantity of any equipment to be used.

d. Drillhole diameter, drill casing size, the method and sequence of withdrawing drilling casing.

e. Method of cleaning the inside of casing, where applicable.

f. Specifications for proposed grout mixes, including commercial names, proportions of admixtures and water, mixing sequence, mixing methods and duration, pumping methods and tremie pipe type, size and quantity and means of grout quality control.

g. Depth increments for backfilling drillholes with sand and/ or granular bentonite.

h. Method of overcoming buoyancy of instrumentation components during grouting.

i. Method of sealing joints in pipes, tubes, and inclinometer casing to prevent ingress of grout.

j. Method of conducting post-installation acceptance tests.

k. Method of protecting instruments from damage.

l. Method of determining as-built locations.

m. Method of field calibration and maintenance of each type of instrument.

n. Calibration and maintenance schedule for each type of instrument.

o. Method of supplying power, when applicable.

p. Method of monitoring each type of instrument, including method of identifying and eliminating any reading errors.

q. Method of carrying out temperature corrections and/or barometric pressure corrections, when applicable.

r Method of data reporting for each type of instrument, including method of transmitting and storing data.

s. Drillhole record forms.

1.8 SEQUENCING AND SCHEDULING

1.8.1 Scheduling Work

Install instruments and receive Government concurrence on formal initial readings prior to the start of related construction activities as detailed in paragraph BASELINE READINGS.

1.9 DATA REQUIREMENTS

1.9.1 Data Ownership

All data generated on site by instrumentation, monitoring, construction equipment, sampling, testing, and other data associated with the construction of the project is the property of the Government. For any data the Contractor wishes to exclude from the system, submit a Proprietary Data Determination Request including detailed justification to the Government for determination of whether data can be classified as proprietary. No data source is exempt from these data requirements unless a specific exemption is requested of and granted by the Government. Do not allow "proprietary data" to impede the Government's ability to monitor construction, perform analyses, or evaluate the effectiveness of construction.

1.9.2 Data Integrity

Maintain the integrity of data such that records are accurate and internally consistent. Ensure that all data and records reflect the quality of the data gathered on the site and that all data is preserved and archived for future use.

1.9.3 Backups, Archiving, and Disaster Recovery

Minimize data loss by backup and archival of all digital and paper data records from the time of data generation until final data turnover. This includes having specific policies, workflows, and infrastructure in place to archive and have redundant backups on servers in either the cloud or multiple locations according to industry standard practice. Detail this information in a Backups, Archiving, and Disaster Recovery Plan submittal for Government review and approval prior to the start of work.

If a data loss occurs, the Contractor is responsible for regeneration of the data. Any data which is re-generated from a non-primary source must be clearly noted in the record shown in the EDB. Backup data within 24

hours of generation. Should a data loss occur, even if it is within this 24-hour window, the Contractor is responsible for all steps necessary to recover from this data loss and will receive no additional payment for these data recovery efforts.

1.9.4 Disclosure of Data or Advertisement of Project

Do not disclose any project data to third parties, and do not publish any data without prior written approval of the Government. This includes, but is not limited to, published papers or presentations to any third parties not associated with this contract.

1.10 DELIVERY, STORAGE, AND HANDLING

Deliver all instrumentation materials to the site in undamaged condition and store in an indoor, clean, dry, and secure storage space, that is approved by the Government, after receipt at the site and prior to installation. Instrument components must not be exposed to temperatures outside the manufacturer's stated working temperature range. The materials, instruments, and hardware must be stored, handled, and installed in such a manner as to preclude damage. The Contractor must restore or replace, at no cost to the Government, any items damaged or lost during storage, handling, or installation.

PART 2 PRODUCTS

2.1 GENERAL

All products in this section must conform to the requirements indicated on the Drawings, or specified herein, to adequately monitor the condition and record data to ensure performance parameters are met. A summary of existing instruments, including those to be modified, as well as new instruments to be installed as part of this contract are included in tabular format in paragraph DESCRIPTION above.

All products must be the standard products of a manufacturer regularly engaged in the manufacture of such.

All components provided for connection with an existing automated data acquisition system (ADAS) must function properly with that system, if it's specified to remain in operation, or with a new system, if one is specified for installation.

2.2 MATERIALS

2.2.1 General

All materials must conform to the Buy American Act. They must be new and meeting the requirements indicated on the drawings or referred to herein, and, when not covered thereby, materials and equipment of commercial grade quality suited to the intended use and as approved by the Government must be furnished. All materials must be compatible and match the existing equipment at the project location, if applicable. If multiples of the same instrument are required, use the same manufacturer for each.

2.2.2 Instrument Factory Calibration

A factory calibration must be conducted on all instruments at the place of manufacture prior to shipment. For each factory calibration include a

calibration curve with data points clearly marked and a tabulation of the data and required formulae for data reduction. Ensure each instrument is marked with a unique identification number or serial number. Provide the manufacturer's warranty for each instrument and readout unit. Submit required factory test reports which include testing results, observations, corrective actions, and recommendations to the Government for approval.

2.2.3 Concrete

Concrete used must be in accordance with Section 03 01 00 REHABILITATION OF CONCRETE.

2.2.4 Grout Mixture

Provide a cement-bentonite grout designed to match the properties of the surrounding in-situ materials, with respect to strength and deformation characteristics. Use Type I or II Portland cement. Marsh Funnel viscosity of the grout prior to placement must be between 50 and 60 seconds. Submit the proposed grout mix design to the Government for review and approval prior to start of the work.

2.2.5 Grout/Carrier Pipe (PVC)

Provide sacrificial grout/carrier pipe consisting of PVC conforming to the requirements of ASTM D1785 and as detailed on the drawings. Use PVC 1-1/4 inch Schedule 80 threaded pipe for all grout pipe and connections.

2.3 GROUNDWATER MONITORING

AMENDMENT 0003

2.3.1 Automated Vibrating Wire Piezometer

Provide small diameter vibrating wire transducers capable of being installed within a 3/4 inch diameter or less riser pipe, as indicated in the contract plans. Install all sensors in accordance with the manufacturer's recommendations. Perform operation and field calibration checks of all instruments. ~~Factory-calibration curves are required for each laser water level sensor, including individual gage factor and temperature correction factor.~~

AMENDMENT 0003

2.3.2 Automated Pneumatic Piezometer

Provide pressure transducer converter as recommended per the manufacturer and as indicated in the Contract Plans. Install all pressure transducers in accordance with the manufacturer's recommendations. Perform operation and field calibration checks of all instruments.

2.3.3 Packers

The Contractor shall provide and install packers as needed to facilitate the installation and use of piezometers.

2.4 DEFORMATION/DISPLACEMENT

2.4.1 Inclinometers

2.4.1.1 Automated In-Place Inclinometer (IPI)

Provide fiberglass inclinometer casing in 10-foot long sections with a minimum outside diameter of 2.75 inches. Provide casing section connections in accordance with the inclinometer manufacturer's recommendation. Ensure the casing has high quality flat surface grooves to permit free passage of the probe through curves in the casing without the wheel of the senor coming out of the groove. Casing anchors and grout valves are to be used if required. When grouting, the Contractor shall ensure that any adjacent drain holes are monitored for grout infiltration. A low permeable grout mixture shall be used to minimize the likelihood of grout infiltration into the drain system. Grouting will not be pressurized to prevent damage to surrounding concrete. In the upper three feet, a higher strength, shrinkage compensating grout shall be placed.

Document casing installation with traversing inclinometer and document two baseline readings prior to installation of IPIs. Baseline readings must be performed at least seven days after grouting the casing. Provide IPI sensors with an accuracy of plus or minus one percent of full scale. Replace casing that exceeds the accuracy of 3 degrees of vertical or spiral limitations of at the contractor's expense.

2.4.2 Crackmeter

Provide crackmeters consisting of a vibrating wire displacement transducer within a stainless steel telescopic body with two anchoring points. Vibrating wire crackmeters must measure over a range of 50 mm, with a total accuracy ranging from plus or minus 0.50 percent to 0.30 percent full scale depending on range capability of the instrument. The vibrating wire crackmeter's frequency range must be between 2250 - 3000 Hz and operable at temperatures ranging from minus 20 to plus 80 degrees Celsius.

2.5 LOAD/STRESS

2.5.1 Anchor Load Cells

Provide vibrating wire type load cells sized for the selected Spillway anchor and a rated load to 650 kips. Three VW gauges shall be installed in each load cell. Cable splicing is not permitted. Alternatively, based on the actual diameter of the object material being monitored, and on the manufacturer recommendations, the throat diameter may be as indicated by the Contractor. Provide centralizer bushings to center the load cell, if necessary. The load cell must be specially hardened to withstand embedment in concrete for long-term monitoring requirements.

2.5.2 Electromagnetic Load Sensors

Provide electromagnetic type load sensors sized for the selected anchor and rated load of 350 kips. Alternatively, based on the actual diameter of the object material being monitored, and on the manufacturer recommendations, the throat diameter may be as indicated by the Contractor.

2.5.3 Load Bearing Plates

Provide load cell and electromagnetic load sensor bearing plates in accordance with manufacturer's recommendations.

2.5.4 Calibration

Calibrate load cells under the following two conditions: 1) normal factory calibration of the load cell/sensor itself and 2) group or set calibration of the load cell/sensor with the bearing plates and lock-off assembly assigned to that load cell/sensor. Switching or transfer of bearing plates/lock-off assemblies is not allowed in the field without factory calibration.

2.5.5 Instrument Readout

Provide required readout device(s) and obtain initial, calibration, and subsequent manual readings of the sensor output. The readout device(s) must be compatible with the instrument and signal cables, and existing sensors and data logging equipment on site. Data formats must be .csv and compatible with MS Excel software.

2.6 SURFACE PROTECTION

Provide temporary or permanent surface protection in accordance with the plans. Use caution and provide all means necessary to protect the instrumentation from construction activity performed on the construction site. This includes monitoring settlement of fill material in and around the buried conduits, concrete protective blocks at the instrument heads, concrete pads, and related items. Immediately replace any instrumentation equipment that is damaged by construction activities including damage caused by settlement of backfill material due to improper placement or compaction. Access must be maintained to permit periodic measurements and observation by the Government.

Permanent surface protection for piezometers and inclinometers shall consist of stainless steel covers which provide complete protection to the instrument and a flush-mount surface level with the existing concrete surface and sized as indicated on Sheet B-501 of the Project Drawings.

2.7 INSTRUMENTATION ENTERPRISE DATABASE (EDB)

Set-up, maintain and update a documented SQL enterprise database (EDB) for the duration of the contract in which to store all automated data. This can be the same database as the project database if one is utilized.

Store the EDB on the Contractor's servers or the Contractor's cloud storage account for the duration of the contract. Update.csv files of the most current version of the database tables to the SFTP site by midnight daily. Update the most current version of these .csv files to the SFTP site at any time requested by the COR.

Make data available in HTTP (API) or sFTP for automated inclusion in external databases.

Import relevant hydrologic data using publicly available datasets such as USACE CWMS RADAR or Access2Water APIs.

Import all data for existing, active instrumentation in place prior to the

contract into the EDB. The Government will provide the data for this purpose. Replace all historical survey coordinates and station offsets in the EDB for any instrument locations surveyed as a part of this Contract. Ensure all coordinates in the EDB are in the project coordinate system utilizing the correct datums.

Upon completion of the contract and before final demobilization, submit to the Government the final EDB .csv files and EDB documentation prior to final payment.

2.8 AUTOMATED DATA ACQUISITION SYSTEM (ADAS)

Provide an Automated Data Acquisition System (ADAS) to collect, process, store and communicate data with other systems. This system is generally to be comprised of sensors/transducers, dataloggers, communications devices, and associated accessories - see contract drawings. Automatically read and store instrumentation data at preset time intervals and reading frequencies. Provide the capability to modify reading frequency and provide ability to increase reading frequency during a storm event. Automatically scan all instruments for threshold exceedance. Have the ability to trigger alarms based on any of the following types of conditions: static level exceedance, rate of change, moving window rate of change, and time delay with multiple values verification.

Furnish all components and complete installation of all system components, cable, conduit, instruments, transducers, sensors, enclosures, power connections, grounding, and miscellaneous items to make the ADAS completely operational. Submit system design and components for Government approval.

2.8.1 Data Loggers

Provide data loggers that are capable of reading vibrating wire and MEMs sensors, store data internally for 1000 readings, and communicate with compatible protocols. Data loggers must be compatible with data collection devices and other data loggers on site and be capable of storing at least 3 months data in local memory.

Program the data loggers to read the sensors. Annotate the programs with comments pertaining to its function. Data logger communications may be encrypted for security, but the program must be accessible by the Government on systems that will be owned or operated by the Government. Store programs on the data logger in non-volatile memory.

2.8.2 Enclosures

Provide enclosures to protect ADAS components from the environment. Properly size enclosures so components can be neat and organized. (Check NEC requirement for capacity). Enclosures must be stainless steel and rated NEMA Type 4X. For enclosures housing electronics, maintain a low humidity level within by using heaters. Heaters must maintain the interior temperature at least 5 degrees F above the ambient temperature and be thermostatically controlled to shut off at an interior temperature between 86 and 95 degrees F. For outdoor enclosures provide sun shades as shown on the drawings.

2.8.3 Conduit

Provide conduit for all power and instrument wiring. Provide conduit in

accordance with Section 26 20 00 Interior Distribution System. Surface conduit must be resistant to UV and rugged to minimize or eliminate damage.

2.8.3.1 Underground Conduit

Bury underground conduit 24 inches below the surface. Install in accordance with NEC regulations.

2.8.4 Locations

See drawings for locations of principal ADAS components.

2.8.5 RMU

Provide Remote Monitoring Unit(s) (RMU) as shown in the contract drawings. The RMU must poll sensors at a specified interval, record raw values, be capable of reducing raw values to engineering units, and communicate data to other systems.

2.8.6 RIO

Provide Remote Input Output (RIO) device(s), including associated equipment to establish wireless data links, as shown in the contract plans. Provide additional RIO devices as determined by the Instrumentation Specialist. The RIO must poll sensors, as requested by a RMU, and communicate raw values back to the RMU.

2.8.7 Vibrating Wire Analyzer

Provide vibrating wire analyzers that poll vibrating wire transducers and measure the resulting frequency and associated data. The analyzer may be a stand-alone unit or integrated into a datalogger but must have a communications method for transferring data to other devices. The vibrating wire analyzer must use a swept frequency method or Fourier transform and spectral analysis method to determine the frequency of the vibrating wire with an accuracy of plus or minus 0.05 percent or better and read the thermistor of equipped sensors.

2.8.8 Multiplexer

Provide multiplexers that are compatible with the new sensors/transducers and measurement devices on site.

2.8.9 Power

Size power supply batteries appropriately to power the equipment for 3 days without recharge. Power supply batteries must comprise a rechargeable battery or batteries, charge controller, and power source. Power source is the existing 120-volt ac, single-phase site utility power. Batteries must be of sealed lead acid chemistry.

2.8.10 Grounding

Grounding and lightning protection must be designed by an electrical engineer with experience in lightning protection. Include this design, with Professional Engineer's signature and stamp, in a Grounding and Lightning Protection Plan submitted for Government approved. Ground all enclosures and equipment that have grounding terminals. Install ground rods in accordance with the electrical engineer's recommendations

regarding construction, size, spacing and allowable resistance. Install and maintain the transient voltage surge suppressor in accordance with the Electrical Engineer's grounding and lightning protection plan. Special care should be taken to protect sensors that are grouted in a borehole, or other inaccessible sensors.

2.8.11 Communications

Provide wired and wireless (unlicensed spread-spectrum radio) communications between data logging devices and associated multiplexers and RIO devices.

If cellular data communications are deemed viable based on the results of the Cellular Data Communications Viability Report specified herein, provide wireless cellular data communications between the RMU and the existing USACE MIDAS data hosting service and between the RMU and the Web Interface specified in Part 3. Coordinate with and assist the Government in establishing a suitable cellular data service subscription with the Government's preferred cellular data service provider. Government will pay all initial and ongoing costs for this service. If cellular data communications are deemed not viable, coordinate and assist the Government in establishing a suitable, alternate means of data service to the site. Government will pay all initial and ongoing costs for the alternate service.

The URL for the USACE MIDAS database is "https://midas.sec.usace.army.mil/midas". Coordinate with the Government identities of all monitored points, polling and update frequencies, engineering units, alarm thresholds, communication parameters (IP and port addresses, etc.), required for the MIDAS interface with the Government. The Government contact is Scott Massa, email: daniel.s.massa@usace.army.mil.

2.8.11.1 Cellular Data Communications Viability Report

Conduct physical field testing using the Government's preferred cellular data carrier to determine viability of data service to the site. Testing shall be done from the dam deck at the proposed location of the cellular antenna using a radio transceiver and antenna similar to those proposed for the permanent installation. Testing must include actual internet data exchange with a sample web interface, measurements of bit- or packet-error rate (or similar parameter), measurements of received signal strength, calculation of fade margin with direct confirmation using antenna feedline attenuators, and calculation of path availability based on the testing. Fade margin and path availability shall be adjusted to accommodate the proposed cellular transceiver's sensitivity if it is different from that of the test unit. All test procedures shall be conducted on each of three consecutive days at different times: e.g., first day in the morning, second day at midday, third day late afternoon.

Cellular communications are considered viable if the average of all measured bit- or packet-error rates is below 10-5 (1 in 100,000) and the minimum calculated path availability is 99 percent or higher. Submit a report showing detailed results of all testing, including a narrative explaining each test, equipment used, and any special analysis software or web sites used.

If the cellular data communications are deemed "not viable," Contractor shall coordinate with the Government to select an alternate method of

communications, whether through a different cellular carrier or by using another technology, such as satellite-based internet.

2.8.12 Software

Provide instrumentation software that communicates with the automated data acquisition system suitable for installation on the Laptop Computer specified herein. The software must allow remote retrieval of data, updating of programs and configuration, and viewing of data from the automated systems.

Provide inclinometer software suitable for installation on the Laptop Computer specified herein that communicates with the manual traversing data collection device. The software must plot greater than three cumulative displacement plots referenced back to a baseline survey and allow for corrections of the data for spiral and bias.

2.8.13 Laptop Computer

Provide one laptop computer, which shall be a portable personal computer specifically provided to allow field interaction with the ADAS components and instrumentation specified in this section.

At a minimum, the laptop computer shall be loaded with the latest commercially available Microsoft "Windows" operating system and the instrumentation and inclinometer software specified in this section. The laptop shall be loaded with a commercially available web browser to allow connection to the web interface described in Part 3 of this section and other web-based data hosting sites. For cybersecurity reasons, the laptop computer must not connect to the USACE MIDAS at any time.

The laptop computer shall have a nominal 15-inch or larger active color matrix liquid crystal display, capable of displaying a minimum resolution of 1920 by 1080 pixels, and a dual-core, 64-bit processor operating at a minimum of 3.1 GHz. The laptop computer shall have, as a minimum, 250 GB solid-state hard drive, 16 GB of RAM, integral pointing device, serial port or external USB-type serial converter (if needed for datalogger or instrumentation communications), HDMI or DisplayPort video port for an external color monitor, IEEE 802.11 b/g/n WiFi capability, rechargeable battery, battery charger, compatible 10/100/1000Base-T network adapter, integrated audio, and two USB ports including at least one USB 3.0 port. The laptop computer shall be provided with the proper cables, adapters, media converters, and software required for its application.

2.8.14 Architecture

A notional ADAS architecture is shown on the drawings. The Instrumentation Specialist may modify the architecture to accommodate the ADAS equipment provided.

2.8.15 Wiring Diagram

Submit full color wiring diagrams of the ADAS enclosures in the ADAS Final Report. Conduit, trenching, and cabling locations must be surveyed during installation and survey used in preparation of the required as-built drawings submittal.

2.8.16 Instrumentation Schedule

Provide an instrumentation schedule which includes the unique identifiers for each instrument, instrument description, purpose, make, and models.

2.8.17 System Maintenance and Spare Parts

Provide all hardware and/or other necessary item(s) required to ensure the entire instrumentation and data acquisition/reporting system is functioning according to manufacturer's specifications, and for maintaining the system in satisfactory working order for the length of the contract. This includes appropriate spares for repairing or replacing inoperable or unreliable components according to the expected replacement rate in the list below, or as otherwise as directed by the contract. All system maintenance must be performed in accordance with the manufacturer's requirements and EM 1110-2-1908.

Before work begins, prepare a list of all extra components required for continuous operation of the system and quantities to be stockpiled on-site according to the estimated replacement rate per the manufacturer. Submit this list to the Government for approval. The items on the approved list must be made available at the site during the entire period of the delivery order. If a stockpiled item is used, it must be replaced immediately. In the event of a malfunction or breakdown beyond the frequency below or beyond the control of the Contractor, notify the Government of the nature of the malfunction or breakdown within 12 hours, and provide an estimate of when that part of the system will be back in service if the Government approves a replacement. Depending upon the status of the construction at that time, the Government will decide whether or not a manual backup system must be implemented by the Contractor.

Sensor or board replacements must be of the same model (manufacturer) and type as installed in the field at award of this contract unless a newer technology can be provided that meets the same or better requirements and performance. All deviations require approval of the Government prior to replacement. Replaced instrumentation components must be programmed and shown to functionally work with the system prior to Government acceptance.

PART 3 EXECUTION

3.1 PRE-INSTALLATION ACCEPTANCE TESTING

Perform pre-installation acceptance tests to ensure sensors and readout units are functioning correctly prior to installation. Blank pre-installation acceptance test record forms for each instrument type must be provided by the Instrumentation Specialist. For pre-installation acceptance tests, include relevant items from the following list:

a. Examine factory calibration curve and tabulated data to verify completeness.

b. Examine manufacturer's final quality assurance inspection checklist to verify completeness.

c. Check cable length.

d. Check serial numbers on instrument and cable.

e. Check, by comparing with procurement document, that model, dimensions, and materials are correct.

f. Perform resistance and insulation testing, according to criteria provided by the instrument manufacturer, using a gage insulation or circuit tester that applies two volts or less for resistance testing and 15 volts or less for insulation testing.

g. Verify that all components fit together in the correct configuration.

h. Check all components for signs of damage in transit.

i. Check that quantities received correspond to quantities ordered.

Repair or replace any instrument that fails the specified pre-installation acceptance test.

3.2 PRODUCT HANDLING

3.2.1 Transportation and Handling

Pack, transport, and handle all monitoring equipment in accordance with the manufacturer's instructions. Arrange deliveries of monitoring equipment with proper sequencing and scheduling in accordance with the approved Project Schedule. Coordinate deliveries to avoid conflict with work, conditions at the site, and availability of personnel and handling equipment.

3.2.2 Storage and Protection

Use all means necessary to protect monitoring equipment before, during, and after installation and to protect installed work and materials including existing instrumentation installed by others. Store all monitoring equipment in strict accordance with the manufacturer's recommendation with all labels and seals intact and legible. Arrange storage of monitoring equipment to permit access for inspection. Periodically inspect to assure monitoring equipment is undamaged and is properly maintained. Replace in kind any equipment lost, damaged or stolen due to negligence on the part of the Contractor at no additional cost to the Government.

3.3 INSTALLATION

3.3.1 General

Provide all labor, equipment, materials, and incidentals required to install and read the instruments as shown on the Contract Drawings. Install instruments in accordance with approved method statements and the manufacturer's recommendations. Cable splicing is not permitted. Upon completion of the installation, test each instrument in accordance with the recommendations of the manufacturer. The Contractor is solely responsible for installation and the performance of the instrumentation after installation. After installation replace any inoperative or poorly performing (not within an acceptable range/calibrations) instrumentation at no additional cost to the Government. Obtain all necessary permits and pay associated fees required to construct the project. Implement the terms and requirements of the permits. Submit Permit Documentation to the Government for record.

Artesian conditions, including pressures nearing full pool elevation, have been previously encountered in existing piezometers PZ-3, PZ-8, and PZ-14, while other existing piezometers have previously encountered more minor flowing conditions near gallery floor elevation. Contractor shall anticipate artesian groundwater conditions and be prepared to accommodate these pressures during installation.

3.3.2 Installation Plans

As outlined in paragraph INSTRUMENTATION AND MONITORING PLAN, detailed method statements for installation of each type of instrument must be submitted for Government review and approval prior to commencing installation.

3.3.3 Notification and Documentation

All installations may be monitored by the Government's Representative. Notify the Government Point of Contact at least 24 hours prior to the installation of each instrument. For each instrument installed, prepare, and submit an Installation Record in PDF format, including but not limited to items listed below. Enter all as-built metadata for each instrument into the enterprise database for the project detailed in paragraph AVAILABILITY OF MONITORING DATA.

3.3.4 Instrument Coordinates

Survey final location of all installed instruments utilizing the survey control precision and accuracy requirements required by this Contract. Provide easting and northing survey coordinates in accordance with the system and datums for the project. Provide all relevant elevations for installed components and sensing regions, and hole inclination and azimuth as directed by the Government. Ensure all station and offset measurements for new instruments utilize the established station line of the project.

3.3.5 Borehole Installations

Perform borehole drilling in accordance with the Section 02 32 13 SUBSURFACE DRILLING AND SAMPLING. No drilling work can occur on the dam until a Drilling Program Plan has been approved by the Government. Appendix B of ER 1110-1-1807 defines the format of the Drilling Program Plan.

Installation procedures for instruments in boreholes must be performed in such a manner that all steps in the procedure can be quality assured. For each hole, maintain a detailed log, recording conditions encountered. Prior to installing any instrument through drill casing or augers, thoroughly remove all cutting and material adhering to the inside of the casing or augers. Instrument installation in a borehole must be completed in a continuous operation. Partially completed instrument installations must not be left in unsupported boreholes overnight. For boreholes in which piezometers are to be installed, bentonitic drilling muds must not be used. For holes where instrument casing is installed, verify that the drilled hole within two degrees of vertical (plumb) throughout its length and is at the correct depth. Withdraw outer casing after instrument casing is installed and as the hole is being backfilled. Do not rotate the casing during removal. Steel outer casings remain the property of the Contractor. Fill annular void between drill hole and instrument casing as indicated. Backfill each instrument specifically as indicated in its installation specification below or as indicate on the drawings. Backfill

must be brought up in an equal fashion surrounding the instrument and/or casing. Measure the depth to fill surface as the work progresses (at top of each material increment) and confirm the depth reasonably matches the expected depth based on the volume of material placed. Record the backfill quantities on the installation record.

3.3.6 Gravity Grouting

Gravity grouting will be performed and must proceed from the bottom of the hole to the top of the hole. During the grouting operation, all face drains within 50 feet of a borehole along the dam centerline shall be continually flushed with lake water. The flushing shall continue until the grout level has remained stable for one hour. Joint drain discharge outlets into the lower gallery shall be observed during the grouting. The outlets within 50 feet of the grouting operation shall be observed for grout. If grouting compromises a face drain or joint drain, grouting will stop, and the grout will be removed from the hole. A method for re-grouting the hole with a sanded grout will be submitted for approval by the Contracting Officer.

See the requirements in Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS for disposal of excess grout. The Contractor shall provide a sump pump to assist in collection of water from the drain sump. Water collected during the flushing shall be treated as Wastewater defined in Section 01 57 19 paragraph 3.7.6 Wastewater.

3.3.7 Groundwater Monitoring

3.3.7.1 Vibrating Wire Piezometer

Vibrating wire transducers must be prepared and installed in accordance with the manufacturer's recommendations. Foundation Drains 14.2, 14.3, 14.4, and 15.1 are known to be interconnected with PZ-15. Contractor shall internally inspect these foundation drains and PZ-15 to consider the installation of packers for the use of PZ-15.

After completion of installation, take a baseline reading. A baseline reading will consist of the average of a minimum of three stable readings. Construct surface components and piezometer cable routing and burial as specified and/or shown on the drawings. Protect instrument cables from mechanical or weather related damage. Free ends of cables must be protected at all times. Accurately record and clearly mark the position of all buried cables. Install stainless steel flush-mount cover in accordance with paragraph SURFACE PROTECTION, level with the concrete surface to protect the top of instrument and cable. Include any issues or changes that occurred during the construction in the Installation Record submittal, along with all required installation documentation detailed in paragraph NOTIFICATION AND DOCUMENTATION.

3.3.7.2 Pneumatic Piezometer

Install pressure transducer converter per manufacturer's recommendations. Ensure that pressure transducer is compatible with selected data logger equipment and ensure that selected pressure transducer is rated for the historically observed pressure ranges of the existing piezometers. Calibrate the transducer to convert the pneumatic pressure to an electrical signal and perform calibration by applying known pressures and adjusting the transducer accordingly. Wire the transducer's analog output to the corresponding data logger and configure the data logger.

Pressurize the system and verify that the data logger is recording expected pressure values. Install stainless steel flush-mount cover in accordance with paragraph SURFACE PROTECTION, level with the concrete surface to protect the top of instrument and cable.

3.3.8 Deformation/Displacement

3.3.8.1 Inclinometer Casing and Sensors

Install inclinometer casing immediately after each boring is complete and flushed in accordance with Section 02 32 13 INSTRUMENTATION HOLE DRILLING AND SAMPLING to the design depth specified and as close to vertical as possible. Anchor casing prior to grouting to prevent excess deformation. Orient inclinometer casings such that one axis of the internal grooves are perpendicular to the dam axis. Maintain groove orientation throughout installation. During and after installation, casing groove spiral must not exceed one degree per 10 feet of length.

After completion of installation, complete a post-installation acceptance test to verify that there is no grout in the inclinometer casing, that groove orientation, spiral limitations, and verticality satisfy the specifications, and that the inclinometer probe tracks correctly in all four orientations. Perform a vertical survey of the installed inclinometer casing at 2-foot depth intervals using the standard probe, to determine the vertical profile of the casing, and develop an initial data set. Install stainless steel flush-mount cover in accordance with paragraph SURFACE PROTECTION, level with the concrete surface to protect the top of instrument and cable.

In-place Inclinometers shall be installed according to the manufacturer's recommendations. The sensors shall be oriented to that the primary (A) axis is perpendicular to the axis of the dam. Include any issues or changes that occurred during the construction in the Installation Record submittal, along with all required installation documentation detailed in paragraph NOTIFICATION AND DOCUMENTATION.

3.3.8.2 Crackmeters

Prior to crackmeter installation, the Contractor shall perform a walkthrough with a representative from the Government inspecting each crack to be monitored and reviewing previous data for each instrument. The Contractor shall confirm with the Government the location for each new automated crack meter placement, the range for each new instrument which should be sufficient for elongation and/or contraction, the setting distance for each instrument, and the path for cable routing, including where cuts into the existing concrete will be made.

Crackmeters shall be installed in accordance with manufacturers recommendations.

3.3.9 Load/Stress

3.3.9.1 Anchor Load Cells and Electromagnetic Load Sensors

Conduct a minimum of three sequential lift-off tests to determine the correlation between the actual hydraulic jack load and the measured load in the load cell/sensor following lock-off. Following lock-off and lift-off testing, read the load cell/sensor twice daily for a period of at least one week to document drift or changes in the load cell/sensor

readings. If readings do not stabilize within approximately 1 percent of the lock-off load, provide an assessment in writing for approval of the possible reasons for the drift and the results submitted. Contractor must not backfill around the load cells/sensor until drift characteristics have been documented, submitted in writing, and approved by the Government.

3.4 DATA COLLECTION

At a minimum, collect the following data as applicable to each type of instrument installed:

a. Instrument ID Name

b. Instrument Type

c. Date and Time

d. Reservoir Pool Elevation

e. Tailwater Elevation

f. Observer

g. Readout unit number and last calibration date if appropriate.

h. Readings

i. Visual Observations (e.g. loose mounting materials, rusting, battery leakage, UV damage to instrument, wire or casing)

j. Other pertinent data, including weather, temperature, construction activities, and any events that could influence change in the data.

3.4.1 Baseline Readings

Obtain initial readings from all instruments immediately after their installation and enough times (see reading frequencies in table of paragraph Frequency of Monitoring) before construction begins in order to verify that the instrument readings have stabilized, and initial (ambient) conditions are established. Collect initial or baseline readings for a minimum of 1 month. Evaluate baseline readings and determine the cause of any data anomalies recorded.

3.4.2 Frequency of Monitoring

The minimum frequency of monitoring presented herein (see table below) may be subject to adjustment in accordance with field behavior, or as requested by the Government. The frequency and extent of monitoring are subject to change in accordance with the threshold and limiting levels described herein or as established in the approved Instrumentation and Monitoring Plan.

Instrument Type	Data Collection Method	Reading Frequency (Minimum)
Crack Meters	Automated	Daily

Inclinometers	Automated	Daily
Piezometers	Automated	Hourly
Anchor Load Sensors (Vibrating Wire and Electromagnetic)	Automated	Daily

3.4.3 Instrumentation Metadata

At a minimum, collect the following data for each instrument installed and add to the appropriate table of the instrumentation EDB:

a. Instrument ID

b. Instrument type

c. Instrument manufacturer

d. Date of installation

e. Automation status

f. Instrument easting and northing coordinates in the same coordinate system and datums as existing instrumentation.

g. Instrumentation surface elevation

h. Instrument bottom of installation elevation

i. Top and bottom elevations of all instrument sensing zones (as applicable)

j. Top and bottom elevations of all relevant installed features (i.e. concrete, filter, sensors, standpipe)

3.4.4 Automated Data Acquisition System (ADAS)

3.4.4.1 Cyber Security Compliance (ECB 2018-11)

Automated data acquisition systems collect, process, store and transmit data. They are not SCADA systems and thus they will not control any critical infrastructure including but not limited to gates, valves, utilities, traffic control, security, fire, or life safety systems.

3.4.4.2 Programming

Programming of dataloggers must be performed in a logical, well-annotated way. Data logger communications may be encrypted for security, but the program must be accessible by the Government on systems that will be owned or operated by the Government. Provide a copy of the program with the code annotated. The annotations must be descriptive and explain the different sections and clearly define constants.

3.4.4.3 Testing

Install and test the automation system in the presence of the Government's designated representative.

3.4.4.4 Project Specific Operations Manual

Submit an operations manual including wiring diagrams, photos of the inside of each Data Logger, RIO, LMU, RMU, or other boxed transmission device as well as each instrument location with clear views of the instrument showing wiring and location of all components, cut sheets, calibration sheets, datalogger programs, component configuration settings, troubleshooting, as-built drawings, and maintenance requirements.

3.4.4.5 As-Builts

Provide as-built drawings including installation/construction diagrams as well as instrument locations, datalogger or other readout devices, conduit, trenching and cabling. In addition to full scale drawing as-builts required as part of the construction contract, include 11 x 17-inch size as-builts as an appendix in the Project Specific Operations Manual.

3.5 ANALYSIS, REPORTING, AND PRESENTATION OF MONITORING DATA

If not explicitly stated herein, analysis, reporting, and presentation of monitoring data must be consistent with the guidance provided in EM 1110-2-1908.

3.5.1 Analysis of Monitoring Data

Compare each acquired instrument reading with the previous readings of that instrument and the expected reading based on site conditions and in reference to baseline readings. Interpretation of data also includes making correlations between instrumentation data and specific construction activities. Determine whether the instrumentation response to construction activities is reasonable. Data interpretation and analysis should consider instrument precision levels and errors, data capturing errors and necessary corrections in accordance with the manufacturer's instructions. In addition, data analysis should consider connections to records of construction and weather-related activities at the site. Perform analyses in a timely manner to capture indications of distress development, the possible need for instrument maintenance, and to check for proper functioning. Determine if a threshold value has been exceeded, and if so, proceed in accordance with paragraph RESPONSE ACTIONS. If the comparison indicates that changes are not typical of previous changes, determine whether the reading is erroneous or legitimate. Erroneous readings include readings outside the accuracies, repeatability, standard deviations, and tolerances specified herein or as indicated by the manufacturer. Ensure, and document, proper quality control is being conducted on the analyses and results.

3.5.2 Monitoring Data Reports

Submit monitoring data reports, consisting of all processed instrumentation data converted to standard English units of measure, to the Government's Representative at defined intervals throughout the construction period. Include readings for all instruments. Readings are to be cumulative for the reporting period. NO DAILY AVERAGING OF

AUTOMATED DATA WILL BE ALLOWED.

a. For the duration of the contract, submit weekly Monitoring Data Reports within 24 hours from the last day covered in the report. Each report must include analysis of that week's data collection and findings in relationship to work performed on-site which may impact readings. Provide cumulative plots of data for the reporting period. Plotted values must be discrete - no daily averaging between successive data points. Reports may be requested at a higher frequency by the Government for special instrumentation evaluation purposes. Provide such reports following the same format as weekly reports or as directed by the Government's authorized representative.

b. Ensure all erroneous data is masked from plots, but it must remain in the raw data file and be flagged as erroneous data in the database within a specifically designated field.

c. Reduce all automated sensor readings in accordance with the manufacturer's recommendations and equations.

3.5.3 Presentation of Monitoring Data

3.5.3.1 Web Interface of Interactive and Static Reports of Data

Through the use of a secure web interface, establish interactive and static reports generated from the instrumentation data gathered at the site. This requirement is separate from the presentation of monitoring data using the existing USACE MIDAS. Modifications to the USACE MIDAS will be performed by the Government and those modifications may or may not be complete within this project's duration.

The interface must be intuitive, easy to navigate, and include all graphical plots and displays as detailed in this section. Thirty days prior to project completion, provide a presentation (for training purposes) of all components of the web interface for submittal approval by the Government.

3.5.3.2 Quick Reference Guide

Thirty days prior to project completion, produce and submit a digital and paper Quick Reference Guide for use of the website that meets the following minimum criteria:

a. Describes in detail the website structure and contents.

b. Describes in detail the location and steps to use the features and functionality.

c. Describes in detail how to download plots and other graphical displays.

d. Is designed in a simplified, indexed, and well-organized manner.

e. Includes web addresses of web-hosted sites in use, and POC information for administrators who can provide user-access to the Government.

3.5.3.3 Training

Thirty days prior to project completion, provide training sessions, on site or at the Government office - as coordinated with the Government, to

familiarize and train Government users on the web interface. Provide in-person and virtual options for attendees.

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3.5.3.4 Graphics

a. Reduce piezometric data to elevation in feet and plot it, along with headwater and tailwater elevations, versus time. The Y axis showing elevation must not be a dynamic axis. Plot values together on one scale range of the X axis.

b. Reduce alignment pin readings to total horizontal and vertical movement (in inches) from the initial positions and plot versus time.

c. Reduce and plot inclinometer data vs depth.

d. For weekly reports, the data plotted versus time must be shown in plots spanning the one-month report period, one year period, and lifetime period. Indicate on the plots maximum and minimum instrument readings spanning the life of the instrument. Include the following information for the reading data:

(1) instrument location number,
(2) date of reading,
(3) reduced readings,
(4) all remarks from any field observations,
(5) water elevation,
(6) other work completed within the vicinity plotted on the date in which it took place,
(7) excavation elevation near that instrument, and
(8) ambient temperature.

~~e. Plot Automated Robotic Total Station Monitoring system data as x, y, z and resultant displacement versus time, and provide in tabular format.~~

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3.5.3.5 Discussion

All automated data must include corrections for temperature and/or barometric pressures changes, as recommended by the manufacturer (and necessary for calculations). In all reports generated, include a written description of how the data was reduced, including any equations utilized.

3.6 AVAILABILITY OF MONITORING DATA

3.6.1 Website Access

3.6.1.1 Security Credentials

Provide 24/7 read access to the data to the Government, the Contractor, and any related subcontractors for the duration of this contract. Within 30 days of Notice to Proceed, provide the COR any necessary username and password or other security credential for access. For new personnel requested by the Government throughout the contract, grant access and provide security credentials within 48 hours of the request.

3.6.1.2 Data Update and Display

The website must update all automated data within 24 hours of data collection at a specific instrument. Plot scales, offset, and layouts must be editable by users, with the new selected defaults saved for each user.

Displays must include automatically updated plots from all instrumentation as outlined in ANALYSIS, REPORTING AND PRESENTATION OF DATA.

3.6.1.3 Site Operability and Useability

The website must be fully functional, current, easy to navigate, accessible through Government VPN, and complete with all instrumentation data available for retrieval by both automated and manual methods. Demonstrate the system to the Government prior to System/Website Training. If the website is not functional, with data available and easy to read, pertinent payments will be withheld until the issue is resolved and acceptable to the Government.

3.6.2 Raw Data

Furnish all collected data in a native CSV or TOA5 Data Format. Data must have, at a minimum, Instrument Id, timestamp, and value. Submit raw data files via the project SFTP within 24 hours of generation.

3.7 THRESHOLDS AND RESPONSE ACTIONS

3.7.1 Threshold Values

Monitor instrument readings against the Alert and Action Threshold Values as defined individually for instruments in the table below. The actions to be implemented when these Threshold Values are reached are referred to as Response Actions and are explained in paragraph RESPONSE ACTIONS. Threshold values must be identified on respective plots.

THRESHOLD AND ACTION VALUES				
Instrument Type	Instrument ID	Threshold Value	Action Value	Unit of Measure

Piezometer	PZ-1	984.4	1000	Elevation (ft)
	PZ-2	984.4	1000	
	PZ-3	984.4	1000	
	PZ-4	806.4	840.1	
	PZ-5	806.4	840.1	
	PZ-6	806.4	840.1	
	PZ-7	806.4	840.1	
	PZ-8	984.4	1000	
	PZ-9	806.4	840.1	
	PZ-10	806.4	840.1	
	PZ-11	806.4	840.1	
	PZ-12	806.4	840.1	
	PZ-13	806.4	840.1	
	PZ-14	984.4	1000	
	PZ-15	806.4	840.1	
	PZ-16	806.4	840.1	
	PZ-17	806.4	840.1	
In-Place Inclinometer	IPI-1	±0.5	±0.1	inch
	IPI-1A	±0.5	±0.1	
	IPI-2	±0.5	±0.1	
	IPI-2A	±0.5	±0.1	
Crack Meter	CM-1 through CM-22	±0.05	±0.10	inch
Anchor Load Sensor	M10-A1-NW through M12-A4-NW	40	120	kips per square inch

3.7.2 Response Actions

If an Alert Threshold Value is reached, the Contractor's Instrumentation Specialist must immediately evaluate the instrument response by collecting a manual reading if possible, and also in relation to weather and physical conditions at the location of the instrument and provide an update to the Contractor and Government.

Within 24 hours, analyze the instrument response and submit an Instrument Alert Assessment providing an assessment of the cause of the alert and predict further responses and their effect based on the trend to date. Include recommendation for any corrective action, if needed.

If a Threshold Value is reached, the Government must immediately be notified and the activity causing this change in value should be identified and the instrument should be continuously monitored. An Action/Threshold Exceedance Report documenting the incident including current work activities and potential cause(s) of the alarm. Construction activities may continue with close monitoring of the instrument.

If an Action Value is reached, the Contractor must immediately stop work, remove personnel from the affected work area, and implement the emergency response actions included in the Instrumentation and Monitoring Plan previously approved by the Government. The Instrumentation Specialist must immediately evaluate the instrument response with respect to physical conditions at the location of the instrument.

Submit a detailed Action/Threshold Exceedance Report documenting the site conditions, such as weather, and construction activities when the action value was reached, analysis of the cause(s) for exceedance, and recommendations for any corrective actions needed. Resume suspended activities only after receiving written instruction from the Government.

3.8 SYSTEM RELIABILITY

The entire instrumentation system including datalogging equipment, servers, sensors, wiring, etc. must be maintained at all times. If in the Government's opinion the instrumentation system is not functioning properly, as demonstrated by unreliable and/or questionable readings, all construction work must cease immediately and not resume until the system is performing as specified. No additional compensation will be made by the Government for any cessation of work. The Government will determine whether the performance of the instrumentation system is satisfactory to resume work.

3.9 MAINTENANCE AND REPLACEMENT

Before work begins on a delivery order, prepare a list of all extra components that are required for continuous operation of the system and quantities to be stockpiled on-site according to the estimated replacement rate per the manufacturer recommendation. Submit this list to the Government for approval. The items on the approved list must then be available at the site during the entire period of the delivery order. If a stockpiled item is used, immediately replace it with the same item that was used.

If an instrument is repaired, replaced, or moved subsequent to installation, record new: instrumentation type, as-built location, and calibration sheets. Submit an Instrument Modification Report to the Government detailing the reason the original instrument was altered and the date the new instrument was operational.

For the duration of the contract period, maintain all instrumentation installations in progress and all completed instrumentation installations. In the event of a malfunction or breakdown, notify the Government of the nature of the malfunction or breakdown within 12 hours of initial observation of its occurrence, and provide an estimate of when that part

of the system will be back in service if the Government approves a replacement. Depending upon the status of the construction at that time, the Government will determine whether a manual backup system must be implemented by the Contractor. If an instrument does not function properly for a cumulative total of 10 calendar days or more within any 30 consecutive calendar day period, the Contractor will not be provided the payment for item General Instrumentation Requirements until repairs have been made and approved by the Government.

3.10 PROJECT CLOSEOUT AND RESTORATION

Within 30 days upon completion of construction, as determined by the Contracting Officer, the Contractor must submit to the Government for review closeout submittals including As-built drawings for all instrumentation and the ADAS final report. Retrieve all removable equipment and backfill holes with an approved grout mix. Any protruding parts, which cannot be removed completely without damage to the structure must be cut off flush with the surface. Remove all sharp edges. Repair any damage to existing structures from removal of instrumentation devices to the satisfaction of the Government and at no additional cost to the Government.

-- End of Section --

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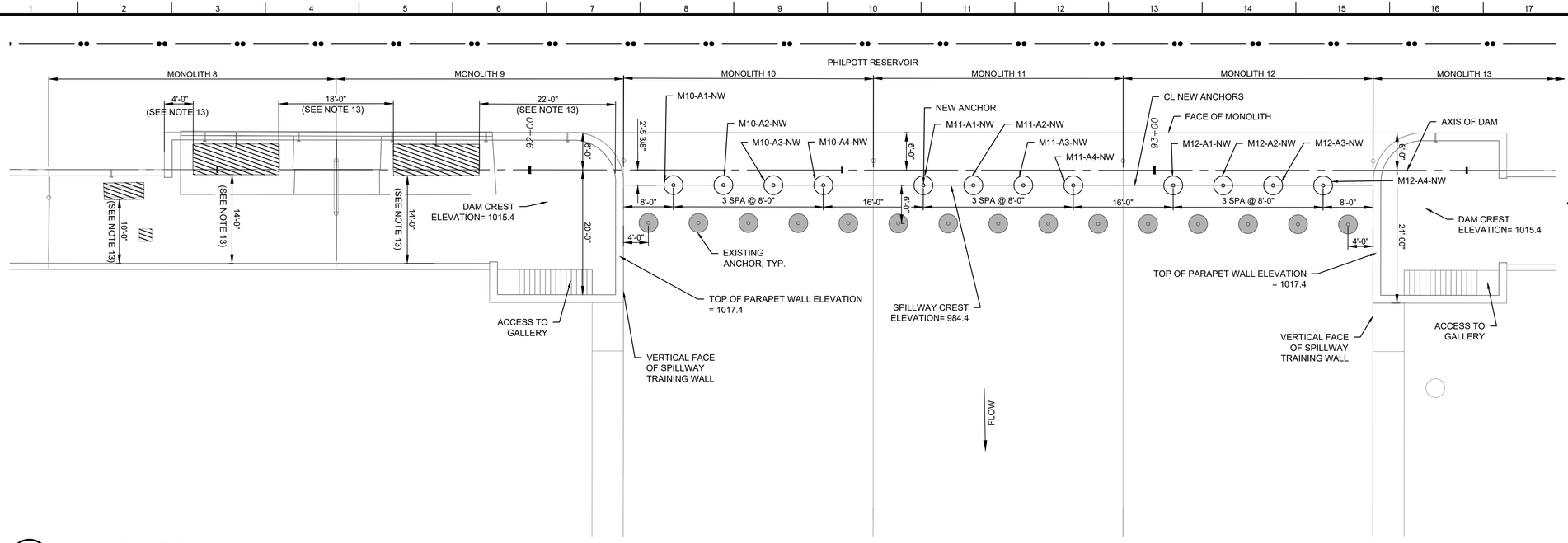

J1 ENLARGED SITE PLAN

SCALE: 1"=10'

GENERAL NOTES

1. SEE SHEET G-003 FOR LEGEND, SYMBOLS, ABBREVIATIONS, AND GENERAL NOTES.
2. SEE SHEET G-004 FOR PROJECT LOCATION AND VICINITY MAP.
3. SEE SHEET C-101 FOR EXISTING SURVEY CONTROL PLAN.
4. SEE SHEET C-102 FOR EXISTING CONDITIONS PLAN.
5. SEE SHEET C-103 FOR ACCESS ROUTE PLAN.
6. SEE SHEET C-104 FOR TEMPORARY LAYDOWN AREAS.
7. SEE SHEET C-105 FOR SITE LAYOUT PLAN.
8. SEE SHEET GC 201 B-0 FOR DAM PLAN, ELEVATIONS, AND SECTIONS.
9. ALL TEMPORARY LOADS FROM WORK PLATFORM BEARING AND OTHER TEMPORARY APPLICATIONS SHALL BE EVALUATED WITH ACI 318 (CURRENT EDITION) USING AN APPROXIMATE f'c = 3,375 PSI.
10. THE ELEVATIONS SHOWN ON THIS SHEET ARE SURVEY ELEVATIONS. SURVEY COMPLETED IN GRID SOUTH OF THE VIRGINIA STATE PLANE COORDINATE SYSTEM: HPGN (HARN) VIRGINIA STATE PLANES, SOUTH ZONE (HARN/VA.VA-SF) (NAD83). VERTICAL DATUM FOR THIS SURVEY IS HARN/VA (NAVD88)
11. LOCK-OFF LOADING SHALL NOT COMMENCE UNTIL ALL ANCHORS (12 TOTAL) HAVE BEEN INSTALLED AND ALL REQUIRED PERFORMANCE TESTING HAS BEEN COMPLETED IN ACCORDANCE WITH THE SPECIFICATIONS.
12. LOCK-OFF LOAD SEQUENCE
    A. THE LOCK-OFF LOAD SHALL BE APPLIED TO THE SPILLWAY IN TWO STAGES. EACH STAGE SHALL BE ONE-HALF OF THE DESIGN LOAD (DL).
    B. THE DESIGN LOAD IS PROVIDED IN SPECIFICATION 31 68 13.
    C. SEQUENCE FOR LOADING AT EACH STAGE
    M10-A1-NW
    M11-A1-NW
    M12-A1-NW
    M10-A2-NW
    M11-A2-NW
    M12-A2-NW
    M10-A3-NW
    M11-A3-NW
    M12-A3-NW
    M10-A4-NW
    M11-A4-NW
    M12-A4-NW
13. CONTRACTOR TO FIELD VERIFY DIMENSIONS TO HATCHES.
14. NO CRANE OUTRIGGERS ARE ALLOWED TO BE PLACED ON TOP OF ANY HATCH.

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE
1	SEE AMENDMENT 0003 FOR ADDITIONAL DETAILS	JUNE 2026

DESIGNED BY: J. BIRK
DRAWN BY: A. BESCHNETT
CHECKED BY: S. CALIENDO
SUBMITTED BY: M. PETERSEN
SIZE: ANSI D
ISSUE DATE: MARCH 2026
SOLICITATION NO.: W912PM26RA004
CONTRACT NO.: XXXXXXXXXXX
C-400.dwg

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT
69 DARLINGTON AVENUE
WILMINGTON, NC 28403

BLACK & VEATCH SPECIAL PROJECTS CORP.
6100 SPRINT PARKWAY - THIRD FLOOR
OVERLAND PARK KS 66211
03JT9

PHILPOTT DAM
ANCHORS AND INSTRUMENTATION

CIVIL
ENLARGED SITE PLAN

SHEET ID
C-400

READY TO ADVERTISE (RTA)

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