SECTION 31 32 24

VOID FILLING – DOWNSTREAM APRON DEMONSTRATION AND PRODUCTION AREAS

APPROVAL STATUS							
PREPARED BY:	GA	DATE	27July2021	CHECKED BY:	DD	DATE	27July2021
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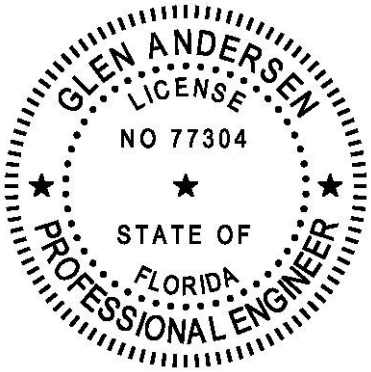
REVISION STATUS						
REV	ISSUED FOR	REVISED BY	CHECKED BY	APPROVAL	APPROVAL	DATE
0	Bidding					

Engineer's Seal



Digital Signature

DN: c=GB, l=Aberdeen, o=JOHN WOOD GROUP PLC, cn=Glen Andersen, email=glen.andersen@woodplc.com
Date: 2021.07.29 15:41:39 -04'00'

GLEN ANDERSEN P.E., STATE OF FLORIDA, PROFESSIONAL ENGINEER, LICENSE NO. 77304.

THIS ITEM HAS BEEN ELECTRONICALLY SIGNED AND SEALED BY GLEN ANDERSEN ON 29 JULY 2021, USING AN SHA-2 AUTHENTICATION CODE ISSUED BY DIGICERT.

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SECTION 31 32 24

VOID FILLING – DOWNSTREAM APRON DEMONSTRATION AND PRODUCTION AREAS

PART 1 GENERAL

1.1 GENERAL

A. Summary of Work: The work specified below includes tasks associated with filling voids below the downstream apron with a slurry of sand and polymer to provide bearing support for the downstream apron and stilling basin and allow the void network to continue to serve as an efficient underdrain while reducing further erosion/loss of material below the slabs.

B. Work will proceed with a demonstration area, followed by an evaluation and recommendation by the Engineer on proceeding with production void filling for the remainder of the downstream apron and the stilling basin slabs (refer to separate specification for void filling under the stilling basin floor slabs. This specification may be revised for production void filling by the Engineer after evaluation of the demonstration area.

C. Specialty Geotechnical Contractor: Nicholson Construction Company, Inc. has been identified as a specialty geotechnical contractor with previous project experience in void filling around sensitive structures using high permeability sands with polymer as specified below. Contact: Ryan Hall ryan.hall@nicholsonconstruction.com.

D. Responsibilities:

i. The Void Filling Subcontractor is responsible for tasks as outlined below, except for items specifically noted as responsibilities of either the Contractor or Engineer.

ii. The Contractor is responsible for:
   1. Excavating soil (SP or SP-SM) from the borrow area, stockpiling it near the work area, and providing BMPs for erosion and runoff protection in the borrow pit excavation and stockpile. See Plans for borrow pit and potential stockpile locations.
   2. Installing passive pressure relief wells with backflow preventers as provided in the plans and specifications and at locations specified by the Engineer.

iii. The Engineer is responsible for observing the void filling operations, issuing an assessment and recommendation for proceeding with production void filling, updating the specifications for production void filling as necessary, and providing locations for the pressure relief wells to the Contractor.

PART 2 PRODUCTS

2.1 MATERIALS

A. Slurry: A slurry of sandy soil (SP or SP-SM as specified herein), polymer, and water shall be used to fill voids beneath the slabs. The slurry shall consist of the following:
   i. Water: Water shall be from an on-site fire hydrant as designated by Lake Manatee County. Contractor secures permit from Manatee County for this water.
   ii. Polymer: Polymer shall be provided by the Void Filling Subcontractor. Polymer shall be a liquid fluid polymer certified to NSF/ANSI Standard 60, Drinking Water Treatment Chemicals. The Void Filling Subcontractor provides a material specification sheet to Lake Manatee County for approval at least 30 days prior to use in the slurry.
   iii. Sand:
      1. Excavate sand from a designated borrow area as identified in the Plans and use appropriate BMPs for the excavation. Sand shall be a sandy soil meeting the following requirements unless otherwise approved by the Engineer:
         a. Free of debris and organic matter;
         b. Have a maximum particle size of ¼ inch;
         c. 6% or less of fine-grained material (6% or less passing the #200 sieve and classifying as SP or SP-SM in accordance with the Unified Soil Classification System).
      2. Stockpile the sand near the work area (refer to Plans) and use appropriate BMPs for the stockpile. Upon completion of the work return unused sand to the borrow area.
      3. Take grab samples from the stockpile at a frequency corresponding to every 20 cubic yards of sand injected and shall have the following laboratory testing performed on each grab sample. The results of laboratory testing shall be provided to the Engineer.
         a. Grain size distribution (ASTM D6913)
         b. Organic content (ASTM D2974)

2.2 CORING AND SLURRY INJECTION EQUIPMENT

A. The Void Filling Subcontractor supplies all the equipment required to perform the work.

B. Gauges: The Void Filling Subcontractor provides gauges and other instrumentation to measure the following:
   i. Slurry pumping pressure at ground surface above the point of injection
   ii. Slurry flow rate
   iii. Volume of slurry pumped

C. Instrumentation: The Void Filling Subcontractor provides automated instrumentation to provide real-time measurements of slab heave during void filling operations. The instrumentation shall be capable of providing audible/visual alarms if excessive heave is detected.

PART 3 EXECUTION

3.1 EXECUTION

A. Excavation and Stockpiling of Sand: Excavate and stockpile sand as noted above.

B. Pre-Work Condition Survey: A Pre-Work Condition Survey shall be performed to document the surface condition of the slab and to check presence and thickness of voids in the work area:

i. Provide a survey of the slab surface elevations in the work area.
ii. The Engineer or their designated on-site representative provides high-resolution digital photographs to document the surface condition of the slab in the work area prior to injection.
iii. The Void Filling Subcontractor cores the slab at up to 10 locations designated by the Engineer. Core holes shall be at least 2 inches in diameter. The Engineer shall check for the presence and thickness of voids below the slab at the core hole locations.

C. Void Filling in the Demonstration Area: The Void Filling Subcontractor performs void filling below the downstream apron slab in the Demonstration Area shown on the Plans. This void filling shall be completed prior to installing the pressure relief wells with backflow preventors in the end sill of the stilling basin. This work shall consist of the following:

i. Slurry shall be pumped through injection points (core holes) under pressure. Vent points (core holes) surrounding the injection points shall be used to check for slurry advancement/return and to relieve uplift pressures on the underside of the slab.
ii. Sand Polymer Slurry shall be pumped into the voids at a target minimum equivalent dry unit weight of 115 lbs/ft^3 based on a 3-point moving average with not less than 110 lbs/ft^3 for any one sample.
iii. The Void Filling Subcontractor surveys core hole locations (injection and vent points) and assigns an identifying number.
iv. For each injection point, the Void Filling Subcontractor tracks thickness of the slab, injection pressures at the slab surface, volume of slurry pumped, vent point spacing from the injection point, and any measured heave of the slab during pumping.
v. Throughout void filling operations, the Void Filling Subcontractor maintains an automated motorized total station (AMTS) or equivalent means of providing real-time measurements of the slab surface elevation. The instrumentation shall be set up to provide a visual or audible alarm if measured top of slab elevations change by more than 0.1 inches beyond what is expected due to daily temperature variation.
vi. If slab heave is greater than 0.1 inches during pumping, the injection pressure, vent point spacing, and/or slurry mix shall be adjusted as necessary to provide filling of voids with minimal slab heave.
vii. Upon completion of the demonstration area, the Void Filling Subcontractor makes a visual assessment of each injection and observation core hole and injects additional sand/polymer slurry to fill any remaining voids (top-off).

viii. Upon completion of the void filling and topping off, the Void Filling Subcontractor shall inject a sufficient amount of bleach to cut the polymer and restore the permeability of the sand.

ix. Upon completion of void filling, core holes downstream of the Seepage Cutoff Wall shall be filled with non-shrinking neat grout. The core holes upstream of the Seepage Cutoff Wall shall left open for observation during construction to determine which of them will be fitted with passive pressure relief wells. This decision will be made by the Engineer once the contractor has completely encapsulated the downstream portion of the spillway with a jet grout/soil mixed seepage cutoff wall. After the locations for the pressure relief wells have been selected and these have been installed, the remaining core holes shall be filled with non-shrinking neat grout.

x. The Void Filling Subcontractor measures the moisture content and unit weight of the sand/polymer slurry and collects representative samples of the slurry mix at the injection point at least three times per day or every 20 cubic yards of slurry injected, whichever is more stringent. These are placed in 3” diameter concrete molds and capped to prevent moisture loss and submitted by the Contractor’s QC firm for laboratory moisture content, unit weight, and grainsize analyses in accordance with ASTM D6913 and ASTM D7263-21. The results are provided to the Engineer for review.

D. Post-Work Condition Survey for the Demonstration Area: Upon completion of void filling and topping-off in the demonstration area, a Post-Work Condition Survey is performed to document changes of the surface condition of the slab due to void filling:

i. Provide a repeat survey of the slab surface elevation in the work area.

ii. The Engineer or their designated on-site representative shall repeat the photographs taken for the Pre-Work Condition Survey.

iii. The Void Filling Subcontractor cores the slab at up to 10 locations designated by the Engineer. Core holes shall be at least 2 inches in diameter. The Engineer shall check for the presence and thickness of voids below the slab at the core hole locations. If voids are discovered, then the Void Filling Subcontractor fills these voids at no additional cost to the County.

E. Evaluation and Acceptance of Demonstration Area Void Filling:

i. The Void Filling Subcontractor submits an installation data report to the Engineer which shall include for each injection point, the injection pressure, nearest vent point spacing, slurry volume pumped, slurry mix ratio, equivalent dry density of the pumped slurry, and any measured slab heave during injection.

ii. The Engineer shall review data submitted by the Void Filling Subcontractor, the Pre- and Post-Work Condition Surveys, laboratory testing data, and provide an installation assessment and recommendations to Lake Manatee County on proceeding with void filling below the downstream apron and stilling basin slabs.

Production void filling shall not proceed without authorization from Lake Manatee County.

F. Production Void Filling: Production void filling for the downstream apron shall proceed upon completion and acceptance of the Demonstration Area, issuing of revisions to the specification by the Engineer, and following authorization from Manatee County. Production void filling shall proceed following the same steps as performed in the demonstration area.

G. Core Hole Grouting: See Item 3.C.viii above.

H. Pressure Relief Wells with Backflow Preventers: Upon completion of void filling and after the entire spillway is encased in a seepage cutoff barrier, the Engineer shall evaluate the quantity and location of weep holes required in the downstream apron slab and shall provide the locations to the Contractor at least 6 weeks prior to achieving substantial completion. Construct/install up to 12 weep holes with backflow preventers in the downstream apron as shown in the Plans.

-- End of Section --