ADDENDUM NO. 1

BID # 16016-3830

RICHLAND CREEK DAM AND RESERVOIR

PAULDING COUNTY BOARD OF COMMISSIONERS
DALLAS, GEORGIA

Bid Date & Time:	Friday, June 3, 2016 at 2:00 pm
Bid Location:	240 Constitution Boulevard, Dallas, Georgia 30132 Board of Commissioners Meeting Room

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The following hereby amends and/or modifies the Bid Documents issued for this project by Arcadis. All bidders are subject to the provisions of this Addendum. Bidders shall acknowledge receipt of this Addendum on the Bid Proposal form.

GENERAL

1. The Prebid Conference presentation and sign in sheets are included for information. Minutes of the Prebid Conference have been sent to attendees.

RESPONSES TO QUESTIONS RECEIVED THROUGH MAY 20, 2016

1. With regard to the Non-Collusion Affidavit for the Subcontractors to be submitted with the bid, is there a dollar value threshold that can be applied?
   a. Subcontractors expected to enter into agreements in excess of $100,000 will be required to submit the form with the bid documents. Prior to award, all Subcontractors will be required to submit the forms.
2. Multiple questions were received regarding discrepancies in Specification Section 11203 and the drawings related to the Outlet Structure.
   a. Specification Section 11203 and all drawings related to the Outlet Structure have been revised and are reissued with this Addendum.
3. Are borrow areas shown on C-204 and C-205 along the route of the “future access road” available for use?
   a. See revised Drawings C-204 and C-205 issued with this Addendum. Borrow Areas D, E, F, G and H are not available for use under this contract.
4. Geotechnical Boring data for bores No.24-38 shown on Sheets 2-CO3, 2-CO4, and 2-CO5 cannot be found in the Geotechnical Report.
   a. Details of these borings are contained in the Expanded Borrow Study dated July 10, 2015.
5. Can AutoCAD files for drawings 2-C13 and 2-C14 be provided to all bidders for quantity take offs?

   a. Yes they available on request subject to the conditions of the Electronic Release Agreement.
6. The AutoCAD file provided does not appear to represent the existing surveyed topo. Can we get an AutoCAD file that matches existing topo?
   a. Drawing 2-C10 represents the field surveyed condition for the dam footprint. 2-C10 file will be included.
7. Due to the large volume of excavation and stockpiling required, we will need additional areas within the pool limits to allow working platforms, staging excavations, etc. Please delineate these areas on the drawings and specify whether they will be timbered or cleared by others.
   a. The limits of timber harvest are delineated on the drawings. The Contractor may utilize any area within the pool limits for such activities as well as for providing office and storage trailers, staff parking, or equipment parking. Use of these areas is required to comply with all requirements of Permit No. SAS-2007-01410 and compliance with the requirements for sedimentation and erosion control.
8. Reference Table 00 41 13-A, Bid Schedule: Can additional unit price items related potential changes in quantity of materials be added to the Bid Schedule?
   a. No. Furnishing and placing these items are covered in Bid Item 201.
9. Multiple questions related to the Phase 4 drawings were raised.
   a. See reissued drawings.
10. How often does the composite sock check dam occur within the diversion ditches?
   a. Sock check dam spacing shall be the same as stone check dam spacing as specified in the Georgia Manual for Erosion and Sediment Control.
11. The emergency spillway within the sediment pond: are they grass lined or rip rap lined?
   a. Grass lined.
12. There is no dimension given for the cutoff trench under the outlet barrel for the sediment ponds. Please advise.
   a. Cutoff trench to be sized by contractor-minimum requirements shall be per Georgia Manual for Erosion and Sediment Control.
13. Are stream crossings to scale on the plan drawings?
   a. Stream Crossings are not to scale, rather represented by symbol. Refer to Table 1 – Riprap Apron for temporary stream crossing sizes.
14. Will the drilling and grouting between Station 2+00 and 9+00 be performed from the top of the grout cap that is to be constructed on top of the rock?
   a. Yes
15. Will the drilling and grouting between station 9+00 and 10+40 be performed from the grout cap?
   a. Yes. From Station 9+00 to 10+50
16. Will the drilling and grouting from Station 10+40 to 15+00be performed from existing grade?
   a. From Station 10+50 to 15+00 will be from existing grade or manmade grades associated with transitional sloped area where excavation is to be performed from natural ground to the top of rock at Station 10+50.
17. Will the drilling and grouting between Station 15+00 t 23+00 be performed from the platform to be constructed at elevation 850?
   a. Yes
18. Drawing number 2-C25: Please confirm that the spacing shown for grout holes on the

Grout Hole Layout-Plan vies is on the horizontal plane.

a. Yes

19. Specification section 02960, 3.05 KEY-IN requires the cutoff wall to be keyed-in a minimum of 3ft below the top of sound groutable rock. In addition, section 02960 3.01 EXAMINATION, states that the actual depth of the cutoff wall will be determined based on the depth to groutable rock plus a minimum of three feet of key-in, which implies that the excavation in rock could increase from what shown in the contract drawings. However, Table 00 41 13-A Bid Schedule, pay item 2.015 Cutoff Wall is the only pay item for the construction of the cutoff wall both in soil and rock.
    a. Would Paulding County consider to have a unit price for the cutoff wall construction in soil and a separate one for the cutoff wall construction in rock?
    b. Bid Item 2015A and 2015B have been added. See revised Section 01 13 22.
20. What would be the specific scope of work of the Barrier Specialist and what qualifications will be required for this position, e.g.: engineer/geologist, etc., beyond the 5 projects and 2 projects required in paragraph D of this section?
    a. No specific engineering or geology degree is required; however, we expect the person to have and demonstrate a working knowledge and background with geotechnical specialty construction.
21. Can the positions of CQC Manager and Barrier Specialist be covered by the same person assuming he/she complies with the requirements of paragraph D of this section?
    a. Yes.
22. Reference Section 02961 Verification Drilling and Testing, paragraph 1.05 B; What will be the quantity of verification drill holes?
    a. Contractor to assume 20 verification drill holes are included in Bid Item 2015. Bid Item 2015C has been added for additional verification holes.
23. Specification Section 01 22 13 Measurement and Payment, Article 2.013 Grout Placement, Paragraph B: Please identify the “top of the grout curtain”.
    a. Top of rock.
24. Specification Section 01 22 13 Measurement and Payment, Article 2.013 Grout Placement, Paragraph D: If only overburden drilling has been completed, will the square footage be measured from the ground surface to the bottom elevation of the drilled grout holes in the overburden?
    a. Square footage of the grout curtain is measured from the top of rock to the bottom of drilled grout holes. No separate payment will be made for drilling in overburden. Paragraph E has been added to Article 2.013 allowing development of an approved Schedule of Values to allow monthly payment for work prior to completed acceptance of the grout curtain.
25. Specification Section 02212 Pressure Grouting, Article 3.33.A.2: It appears all grouting will be performed downstage. Is this correct? What is the maximum stage length allowed to be drilled?
    a. Ascending or descending grouting with packers will be allowed. The maximum stage length is 20 feet.
26. Specification Section 02212 Pressure Grouting, Article 3.03.B.1: Can top hammer

(rotary percussion) with water flush/circulation drilling techniques be used for grout hole drilling?

a. Yes, provided drill hole accuracy is maintained and water flush provides positive removal of cuttings.

27. Specification Section 02212 Pressure Grouting, Article 3.03.C.5: Please provide parameters for the "grout mixture with properties similar to overburden soils."
    a. Provide a cement/bentonite blend with minimum 5% strain, non-slump and non-bleed.
28. Specification Section 02212 Pressure Grouting, Article 3.03.C.6: Since the annulus of the PVC standpipe is to be grouted per 3.33.C.5 how can the inner casing be pulled?
    a. See revised Section 02212 Pressure Grouting section included in this addendum.
29. Specification Section 02212 Pressure Grouting, Article 3.03.G.7: Reference to "gravity" grouting and 3.03.G.8 makes reference to the first 15 feet of grouting: is there a requirement perform gravity grouting of the first 15 feet?
    a. No. Delete the word "gravity". See revised Section 02212.
30. Specification Section 02212 Pressure Grouting, Article 3.03:D.2 b and c: Please clarify if holes are to be drilled at 15 or 20 degrees off vertical.
    a. Drilling angle will be determined in the field based on the inclination of the rock. The drilling angle is not expected to exceed 20 degrees.
31. Specification Section 02212 Pressure Grouting, Article 3.04.G: Is 20 feet the maximum stage length for upstage and downstage grouting?
    a. Yes.
32. Specification Section 02212 Pressure Grouting, Article 3.04.I.3: Is this water flushing of water pressure testing? Please clarify the requirements for water pressure testing. Please provide the pressure to be used for water pressure testing.
    a. Water is both flushing and pressure testing. Maximum water test pressure based on ½ psi per foot of overburden depth plus 1 psi per foot of groutable rock measured to the middle of the stage.
33. Specification Section 02212 Pressure Grouting, Article 3.04J.2.c: Initial Set: 3-6 hours. The initial set time is too short, under low grout take conditions, the grout will set in the grout line. Typically for thinner mixes, the initial set times are in the order of 12 to 18 hours. Please consider longer initial set times.
    a. See revised Section 02212.
34. Specification Section 02212 Pressure Grouting, Article 3.04.J.2.d: Final Set; 8 hours. This final set time is too short. Please consider longer final set time.
    a. See revised Section 02212.
35. Specification Section 02212 Pressure Grouting, Article 3.04.J.6: Please provide criteria to determine which grout mix to use and when to switch grout mixes.
    a. See revised Section 02212.
36. Specification Section 02212 Pressure Grouting, General: Who will be responsible for directing the grouting work?
    a. Specification is performance based and will be defined by an approved Grouting Work Plan.
37. Specification Section 02212 Pressure Grouting, General: Does the grouting sequence need to proceed from lowest to higher elevations?
    a. No. Refer to number 36.

38. Please specify where ditches VFA 1-3 occur. I am having trouble seeing where they are shown on the drawings.
    a. VFA 1-3 are shown on Sheet 4ESC-018.
39. The erosion control details drawings show that there are 5 pages of details. I only have 1-4 and is missing 5. Please advise.
    a. There are only 4 E&SC detail sheets.
40. Please provide the information for crossings 1-4.
    a. Missing information for culverts sizes and outlet protection dimensions for the stream crossings are provided in "Table 1 – Riprap Apron".

BIDDING REQUIREMENTS

A1-1 Section 00 11 13 – Advertisement for Bids

A. Reference Page 00 11 13-1
The time for receiving bids is changed to June 3, 2016 at 2:00 PM EDT.

A1-2 Section 00 41 13- Bid Form
Replace Table A with the attached Table A (Addendum No. 1)

A1-3 Section 00 45 19.23
Delete Non-collusion Affidavit of Subcontractor with attached Non-collusion Affidavit of Subcontractor (Addendum No. 1)

A1-4 Section 00 45 46 13
Replace Prime Contractors Work Authorization Certificate with the attached form "Contractor Affidavit under O.C.G.A. & 13-10-91(b)(1).

A1-5 Section 00 45 46.23
Delete form Affidavit Verifying Status for Paulding County Public Benefit Application in its entirety.

SPECIFICATIONS

A1-6 Section 01 11 13 – Summary of Work

A. Add the following:
Paragraph 1.8 Sequence of Construction:
B. Required Elements of Construction Sequence
1. Upon initiation of construction, Contractor must develop access to the reservoir pool area through Borrow Area A and Borrow Area 4. Access capable of allowing passage of over the road vehicles such as dump trucks and concrete delivery trucks must be maintained throughout construction by relocation of the haul road during borrow activities. Two stockpiles of material on the east side of Borrow Area A shall be utilized at the direction of

the Geotechnical Engineer. A third stockpile of topsoil will be left for use by the WTP Contractor.

2. Borrow Area 4 is to be rough graded to the contours shown on Dwg. 2-C07 to accommodate construction of the Reservoir Intake by the WTP Contractor. The rough grading of Borrow Area No. 4 is required to occur no later than April 30, 2017.
3. Because of the permanent access for electrical supply and raw water transmission, work in Borrow Area A must be completed no later than June 30, 2018. Borrow Area A will be left free draining with no slopes greater than 6 percent within the area disturbed by borrow activities.

B. Replace Paragraph 1.9 A with the following;
"A. Contractor will have full use of the Reservoir Pool area (below elevation 910) for storage and operations of workers. The Contractor shall delineate the 910 contour in the field and all operations shall take place within the area below 910. Use of any portion of the pool area will require compliance with all terms of USACE Permit No. SAS-2007-01410 and the requirements of the Georgia Manual for Erosion and Sediment Control."

C. Add Paragraph 1.9 C:
"C. Contractor's access to the site is generally limited to the Water Treatment Plant (WTP) Access Road shown on Drawing No. 2-CO1, through the WTP and thence through Borrow Area A and Borrow Area 4 (see Sequence of Construction above) and utilizing existing trails or constructed haul roads through the reservoir pool area. Limited access to the dam site is available from Old Dallas Road along the route of the existing trail for delivery of trailers, large equipment, pipe, concrete, quarried stone, grouting material, and cutoff wall material. The WTP contractor may utilize this entrance for delivery of concrete and large equipment for the reservoir intake and pumping station adjacent to Borrow Area No. 4 (see Dwg. 2-C02)."

A1-7 Section 01 22 13 Measurement and Payment
Replace Section 01 22 13 Measurement and Payment with attached "Section 01 22 13 Measurement and Payment, May 23, 2016."

A1-8 Section 02212 Pressure Grouting
Replace Section 02212 Pressure Grouting with attached "Section 02212 Pressure Grouting, May 23, 2016."

A1-9 Section 11203 Sluice Gates
Replace Section 11203 Sluice Gates with attached "Section 11203 Sluice Gates, May 23, 2016."

DRAWINGS

A1-10 Drawings reissued:

The following drawings are reissued with this addendum: 2-C03, 2-C04, 2-C05, 2-C06, 2-C07, 2-C08, 2-S03, 2-S04, 2-S06, 2-S07, 2-S08, 2-S09, 2-S14, 2-S15, 3-C01, 3-C02, 2-C03, 3-S01, 3-S02, 4-ESC04, 4-ESC06, 4-ESC07, 4-ESC-08, 4-ESC09, 4-ESC10, 4-ESC11, 4-ESC13, 4-ESC14, 4-ESC21, 4-ESC23 and 4-ESC24.

ARCADIS U.S., Inc.
By: John C. Dean, PE
Title: Project Manager

+ + END OF SECTION + +

Table 00 41 13-A
Bid Schedule
Richland Creek Reservoir

	Item	Description	Estimated Quantity	Unit	Unit Price	Total Price
SECTION 1:						
1	2.01	Base Bid complete as described in Section 01 22 13	1	LS	$	$
2	2.02	Mobilization	1	LS	$	$
3	2.03	Stream Diversion and Dewatering	1	LS	$	$
4	2.04	Stripping, Clearing and Grubbing Borrow Areas	100	Acre	$	$
5	2.05	Under Cut	86,500	CY	$	$
6	2.06	Left Abutment Excavation	234,000	CY	$	$
7	2.07	Right Abutment Excavation	291,100	CY	$	$
8	2.08	Difficult Excavation	1,250	CY	$	$
9	2.09	Rock Surface Preparation	28,000	SY	$	$
10	2.010	Dental Concrete	1,770	CY	$	$
11	2.011	Slurry Grout	1,630	CY	$	$
12	2.012	Grout Cap	1,200	CY	$	$
13	2.013	Grout Curtain	125,000	SF	$	$
14	2.014	Additional Grout Holes	21,000	LF	$	$
15	2.015A	Cutoff Wall in Overburden and Weathered Rock	93,000	SF	$	$
16	2.015B	Cutoff Wall in Groutable Rock	4,000	SF	$	$
17	2.016	Principal Outlet Pipe	1	LF	$	$
18	2.017	Principal Outlet Pipe Bedding-Additional Depth	1,070	CY	$	$
19	2.018	Principal Outlet Structure	1	LS	$	$
20	2.019	Drilled Piers	480	LF	$	$
21	2.020	Principal Outlet Structure Bridge	1	LS	$	$
22	2.021	Wave Protection	14,000	SY	$	$
23	2.022	Instrumentation	1	LS	$	$

Table 00 41 13-A
Bid Schedule
Richland Creek Reservoir

	Item	Description	Estimated Quantity	Unit	Unit Price	Total Price
24	2.023	Borrow Area Restoration	100	AC	$	$
25	2.024	Raw Water Pipeline	1	LS	$	$
26	2.025	Erosion & Sediment Control	1	LS	$	$
27	2.026	Silt Fence-Type C	30,000	LF	$	$
		Total, Section 1: _____dollars _____ cents (Total in Words)			**$ _____ (Total in Numerals)**	
SECTION 2 - ALLOWANCE ITEMS						
27	-	CONTINGENCY	1	LS	$ 1,500,000.00	$ 1,500,000.00
		Total, Section 2: _____dollars _____ cents (Total in Words)			**$ _____ (Total in Numerals)**	
		Grand Total: _____dollars _____ cents (Section 1, 2, and 3 Total in Words)			**$ _____ (Total in Numerals)**	

Required Named Subcontractors:

Specialtiy Grout Subcontractor:_____

Specialtiy Cutoff Wall Subcontractor:_____

TABLE 1 - RIPRAP APRON SUMMARY CHART (St)								
HEADWALL ID*	**PIPE DIAMETER / WEIR WIDTH (Do)**	**2-YR FLOW (During Construction) (cfs)**	**2-YR VELOCITY (During Construction) (fps)**	**RIPRAP SIZE (CALC/USE) (d50)**	**STONE DEPTH (D)**	**APRON LENGTH (La)**	**WIDTH OF APRON (W1)**	**WIDTH OF APRON (W2)**
Crossing 1	36"	111.04	9.12	0.7'/1.0'	2'	21'	EXTEND TO TOB	EXTEND TO TOB
Crossing 2	48"	214.18	10.16	1.2'/1.5'	3'	34'	EXTEND TO TOB	EXTEND TO TOB
Crossing 3a	48"	231.44	10.56	1.2'/1.5'	3'	34'	EXTEND TO TOB	EXTEND TO TOB
Crossing 3b	60"	432.15	12.43	1.4'1.5'	3'	42'	EXTEND TO TOB	EXTEND TO TOB
Crossing 4	36"	94.66	8.51	0.6'/1.0'	2'	20'	EXTEND TO TOB	EXTEND TO TOB

Paulding County Board of Commissioners

Contractor Affidavit under O.C.G.A. § 13-10-91(b)(1)

By executing this affidavit, the undersigned contractor verifies its compliance with O.C.G.A. § 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services on behalf of Paulding County Board of Commissioners has registered with, is authorized to use and uses the federal work authorization program commonly known as E-Verify, or any subsequent replacement program, in accordance with the applicable provisions and deadlines established in O.C.G.A. § 13-10-91. Furthermore, the undersigned contractor will continue to use the federal work authorization program throughout the contract period and the undersigned contractor will contract for the physical performance of services in satisfaction of such contract only with subcontractors who present an affidavit to the contractor with the information required by O.C.G.A. § 13-10-91(b). Contractor hereby attests that its federal work authorization user identification number and date of authorization are as follows:

_____
Federal Work Authorization User Identification Number

_____
Date of Authorization

_____
Name of Contractor

_____
Name of Project
Paulding County Board of Commissioners
Name of Public Employer

I hereby declare under penalty of perjury that the foregoing is true and correct.

Executed on _____, ___, 201__ in _____(city), _____(state).

_____
Signature of Authorized Officer or Agent

_____
Printed Name and Title of Authorized Officer or Agent

SUBSCRIBED AND SWORN BEFORE ME
ON THIS THE _____ DAY OF _____,201__.

_____
NOTARY PUBLIC

My Commission Expires:

_____

SECTION 00 45 19.23

NONCOLLUSION AFFIDAVIT OF SUBCONTRACTOR

State of _____

County of _____

_____, being first duly sworn, deposes and says that:

(1) He or she is _____ of _____,
(Owner, Partner, Officer, Representative, or Agent)
hereinafter referred to as the "Subcontractor";

(2) He or she is fully informed respecting the preparation and contents of the Subcontractor's Proposal submitted by the Subcontractor to _____, the Contractor for certain work pertaining to the following project in Paulding County, Georgia:

Richland Creek Dam and Reservoir

(3) Such Subcontractor's Proposal is genuine and is not a collusive or sham Proposal;

(4) Neither the Subcontractor nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly with any other Bidder, firm or person to submit a collusive or sham Proposal in connection with such Contract or to refrain from submitting a Proposal in connection with such Contract, or has in any manner, directly or indirectly, sought by unlawful agreement or connivance with any other Bidder, firm or person to fix the price or prices in said Subcontractor's Proposal, or to secure through collusion, conspiracy, connivance or unlawful agreement any advantage against the Paulding County Board of Commissioners or any person interested in the proposed Contract; and

(5) The price or prices quoted in the Subcontractor's Proposal are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affiant.

Signed:_____ Title:_____

Subscribed and sworn to before me, this _____day of _____, 20___.

_____
Notary Public

_____
My Commission Expires

(SEAL)

+ + END OF SECTION + +

SECTION 01 22 13

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 BID INFORMATION

A. The Bid Schedule lists each item of Work for which payment will be made. No payment will be made for any items other than those listed in the Bid Schedule.

B. Required items of Work and incidentals necessary for the satisfactory completion of the Work which are not specifically listed in the bid, and which are not specified in this section to be measured or to be included in one of the items listed in the Bid, shall be considered as incidental to the Work. All costs thereof, including Contractor's overhead costs and profit, shall be considered as included in the lump sum or unit prices bid for the various Bid Items. The Contractor shall prepare the Bid accordingly.

C. Payment will be made at the Contract price per unit indicated in the Bid with total price of the Contract being equal to the Total Bid, as specified and as modified, by extending unit prices multiplied by quantities as appropriate to reflect actual Work. Such price and payment shall constitute full compensation to the Contractor for furnishing all plant, labor, equipment, tools and materials, and for performing all operations required to furnish to the Owner the entire Project, complete in place, as specified and as indicated on the Drawings.

D. Work includes furnishing all plant, labor, equipment, tools, and materials and performing all operations required to complete the Work satisfactorily, in place, as specified, indicated on the Construction Drawings, or recommended by the Engineer.

E. Measurement of an item of Work will be by the unit indicated in the Bid Schedule.

1.02 MATERIALS STORED ON SITE

A. Copies of delivery tickets shall be submitted to the Engineer at the time of delivery to the storage area in order to permit inventory of materials.

B. An invoice from the supplier shall be furnished to the Engineer for each item or material for which payment is requested.

C. A Certificate of Insurance in the amount of 100% to the replacement value of materials or items shall be submitted in conformance with the applicable provisions of the General Conditions covering stored materials and equipment. Material shall be identified on the Insurance Certificate and the storage location shall be indicated.

D. Payment for Materials stored on site but not incorporated in the Work will be equal to the manufacturer's invoiced amount that is acceptable to the Engineer.

1.03 SCHEDULE OF VALUES

A. The Contractor shall submit a Schedule of Values for applicable Payment Items within 30 days after issuance of Notice to Proceed.

B. Identify each item with number and title of the major specification Section.

C. Revise schedule to list approved Change Orders, with each Application for Payment.

1.04 APPLICATIONS FOR PAYMENT

A. Submit five copies of each application.

B. Utilize list of Payment Items and Schedule of Values for tabulating items in each Application for Payment.

C. Include an updated Construction Schedule.

PART 2 - PAY ITEMS

2.01 BASE BID

A. The Base Bid shall include all items necessary for a complete in place Project in accordance with the Contract Documents not including the other items specifically listed on the Bid Schedule. The Base Bid includes but is not limited to all clearing, grubbing, stripping of the Dam Area, excavation (including borrow material) and placement of all fill material related to construction of the dam and appurtenances to the lines and grades shown on drawings, all internal drainage including filter material and piping, toe ditches, rock toe, stilling basin and outlet channel complete, external storm drainage complete as detailed on the drawings, top soil placement, grassing, project scheduling, traffic control and all other incidentals complete as specified or indicated on the Construction Drawings.

B. This item shall be paid on a Job basis. As a continuing process, the amount will be paid to the Contractor based on an agreed to Schedule of Values for the items of Work that comprise the Base Bid.

C. Monthly installments will be based on the percentage complete for each of the items of Work.

2.02 MOBILIZATION

A. Mobilization shall include shipment of all construction equipment and tools to the project site as required to perform the included Work. Installation and set up of any temporary utilities, sanitary facilities, field offices, storage buildings or other related structures or facilities shall be included. It shall include the purchase of contract bonds and insurance.

B. This item shall be bid on a one time, Lump Sum basis, payable upon completion of mobilization and request for payment as required herein. Total payment will be the Lump Sum contract price for Mobilization regardless of actual cost to the Contractor.

C. Payment of the Lump Sum amount for mobilization will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental for the general mobilization of the contractor’s personnel and equipment.

2.03 STREAM DIVERSION & DEWATERING

A. This item shall include all Work described in Section 02168 of these Specifications and the requirements shown on the Construction Drawings.

B. This Work shall include all temporary dikes, cofferdams, ditching, and diversions as required and approved via submittal for construction of the Project as well as all well points, pumping,

and draining necessary to maintain the working areas and borrow areas free from water, as well as removal and disposal of all debris and trash deposited within the limits of the work area.

C. This item will be full compensation for labor, tools, equipment, incidentals, and operations necessary for all Work associated with the installation, maintenance, and removal of all items necessary for Stream Diversion & Dewatering during the entire duration of the Project.

D. This item shall be paid on a Lump Sum basis. As a continuing process, the Lump Sum amount will be paid to the Contractor based on an agreed to Schedule of Values for the items of Work that comprise this item.

E. Monthly installments will be based on the percentage complete for each of the items of Work.

2.04 STRIPPING, CLEARING AND GRUBBING – BORROW AREAS

A. This item shall include all Work described in Sections 02110 and 02116 of these Specifications, the areas shown on the Construction Drawings as Borrow Areas, or as recommended by the Engineer, excluding the areas to be cleared under another pay item.

B. This item will be paid for by Unit Price that shall be full compensation for labor, tools, equipment, incidentals, and operations necessary to complete Stripping, Clearing and Grubbing within the Borrow Areas.

C. This item shall be paid on a Unit Price basis of the actual acres cleared and grubbed measured to the nearest 0.1 acre.

D. Surveys will be performed by a Registered Land Surveyor hired by the Contractor and acceptable to the Owner. The surveyed information and the computations used to determine these quantities for payment shall accompany each pay request. The computations shall be furnished in a legible and readily understood format and shall be approved and sealed by the Registered Land Surveyor.

2.05 UNDERCUT

A. This item will be paid for by Unit Price that shall be full compensation for labor, tools, equipment, incidentals, and operations necessary to complete the Work including excavation, loading, hauling, dumping, spreading, compacting, and disposal of unsuitable and/or excess material and replacing with suitable material.

B. The volume of this item is generally considered to be the excavated volume as specified, indicated on the Construction Drawings, or recommended by the Engineer within the horizontal limits of the floodplains as required for construction of the Work. The depth of excavation for this item is taken from the natural ground surface to the bottom of the excavation as recommended by the Engineer.

C. Measurement of excavation quantities will be based on the actual volume removed calculated by the Engineer with assistance from the Contractor, and agreed to by the Contractor at the end of each workday. No overlap of volume calculations due to the re-excavation of the temporary slopes created between adjoining individual undercut areas will be allowed. Essentially, the individual volume calculations will be based using the vertically projected footprint area at the base level of the individual undercut areas up to the original pre-excavation surface.

D. Over Excavating: Payment will not be made for over excavated work beyond that required by these Specifications and/or the Engineer, or for associated replacement materials.

E. This item will be measured to the nearest cubic yard.

2.06 LEFT ABUTMENT EXCAVATION

A. This item will be paid for by Unit Price that shall be full compensation for labor, tools, equipment, incidentals, and operations necessary to complete the Work including excavation, loading, hauling, dumping, spreading, compacting, and disposal of unsuitable materials and/or excess material.

B. The volume of this item is generally considered to be the excavated volume shown on the Construction Drawings within the left abutment beyond the floodplain as required for construction of the Work or recommended by the Engineer. The depth of excavation for this item is taken from the natural ground surface to the bottom of the excavation as recommended by the Engineer.

C. Measurement of excavation quantities will be based on the actual volume removed calculated by the average end area method using surveyed cross sections of the existing and excavated conditions.

D. The cross sections shall be taken perpendicular to the centerline at a sufficient number of stations to accurately measure the Work with the maximum distance between sections not to exceed 50 feet.

E. Surveys will be performed by a Registered Land Surveyor hired by the Contractor and acceptable to the Owner. The surveyed information and the computations used to determine these quantities for payment shall accompany each pay request. The computations shall be furnished in a legible and readily understood format and shall be approved and sealed by the Registered Land Surveyor.

F. Over Excavating: Payment will not be made for over excavated work beyond that required by these Specifications and/or the Engineer, or for associated replacement materials.

G. This item will be measured to the nearest cubic yard.

2.07 RIGHT ABUTMENT EXCAVATION

A. This item will be paid for by Unit Price that shall be full compensation for labor, tools, equipment, incidentals, and operations necessary to complete the Work including excavation, loading, hauling, dumping, spreading, compacting, and disposal of unsuitable materials and/or excess material.

B. The volume of this item is generally considered to be the excavated volume shown on the construction drawings within the right abutment beyond the floodplain as required for construction of the Work or recommended by the Engineer. The depth of excavation for this item is taken from the natural ground surface to the bottom of the excavation as recommended by the Engineer.

C. Measurement of excavation quantities will be based on the actual volume removed calculated by the average end area method using surveyed cross sections of the existing and excavated conditions.

D. The cross sections shall be taken perpendicular to the centerline at a sufficient number of stations to accurately measure the Work with the maximum distance between sections not to exceed 50 feet.

E. Surveys will be performed by a Registered Land Surveyor hired by the Contractor and acceptable to the Owner. The surveyed information and the computations used to determine these quantities for payment shall accompany each pay request. The computations shall be furnished in a legible and readily understood format and shall be approved and sealed by the Registered Land Surveyor.

F. Over Excavating: Payment will not be made for over excavated work beyond that required by these Specifications and/or the Engineer, or for associated replacement materials.

G. This item will be measured to the nearest cubic yard.

2.08 DIFFICULT EXCAVATION

A. This item shall include all Work described in Section 02229 of these Specifications and will be paid for by Unit Price that shall be full compensation for all labor, tools, equipment, incidentals, and operations necessary to complete excavations including excavation, backfilling, loading, hauling, dumping, spreading, conditioning, compacting, and disposal of unsuitable materials as recommended by the Engineer.

B. Measurement of the removal quantities will be based on the actual volume of material removed.

C. Measurement of the removal quantities will be based on volumes calculated by the average end area method using surveyed cross sections of the existing and excavated conditions with the maximum distance between sections not to exceed 25 feet.

D. The cross sections shall be taken perpendicular to the long axis of the excavation at a sufficient number of stations to accurately measure the Work.

E. Surveys will be performed by a Registered Land Surveyor hired by the Contractor and acceptable to the Owner. The surveyed information and the computations used to determine these quantities for payment shall accompany each pay request. The computations shall be furnished in a legible and readily understood format and shall be approved and sealed by the Registered Land Surveyor.

F. Over Excavating: Payment will not be made for over excavated work beyond that required by these Specifications and/or the Engineer, or for associated replacement materials.

G. This item will be measured to the nearest 0.1 cubic yard.

2.09 ROCK SURFACE PREPARATION

A. This item will be paid for by Unit Price that shall include all Work related to the Rock Surface Preparation prior to the placement of Earth Fill, Dental Concrete, Mass Concrete, Pipe Bedding, or Slurry Grout within the limits recommended by the Engineer including all labor, materials,

equipment, tools and all other items necessary to complete the work as specified and recommended by the Engineer.

B. The area of rock surface to receive treatment will be determined in the field by the Engineer and calculated by the Engineer with assistance from the Contractor, and agreed to by the Contractor at the end of each workday.

C. This item will be measured to the nearest square foot.

2.010 DENTAL CONCRETE

A. This item will be paid for by Unit Price that shall include all Work related to the mixing, conveying, placement, and curing of Dental Concrete within the limits recommended by the Engineer including all labor, materials, equipment, tools and all other items necessary to complete the Work as specified and recommended by the Engineer.

B. This item will be measured to the nearest 0.1 cubic yard of concrete placed based on the delivery tickets certified by the supplier.

2.011 SLURRY GROUT

A. This item will be paid for by Unit Price that shall include all Work related to the mixing, conveying, placement, and curing of Slurry Grout within the limits recommended by the Engineer including all labor, materials, equipment, tools and all other items necessary to complete the Work as specified and recommended by the Engineer.

B. This item will be measured to the nearest 0.1 cubic yard of grout placed based on the delivery tickets certified by the supplier.

2.012 GROUT CAP

A. This item will be paid for by Unit Price including all Work related to the Grout Cap including full compensation for all labor, concrete materials, equipment, transportation, formwork, falsework, placement accessories, consolidating and leveling, troweling, and curing as specified, indicated on the Construction Drawings, or recommended by the Engineer.

B. Measurement of the Grout Cap will be based on the actual volume of material installed.

C. Measurement of the Grout Cap will be based on volumes calculated by the average end area method using surveyed cross sections of the approved subgrade and constructed Grout Cap with the maximum distance between sections not to exceed 25 feet.

D. The cross sections shall be taken perpendicular to the long axis of the excavation at a sufficient number of stations to accurately measure the Work.

E. Surveys will be performed by a Registered Land Surveyor hired by the Contractor and acceptable to the Owner. The surveyed information and the computations used to determine these quantities for payment shall accompany each pay request. The computations shall be furnished in a legible and readily understood format and shall be approved and sealed by the Registered Land Surveyor.

F. This item will be measured to the nearest 0.1 cubic yard.

2.013 GROUT CURTAIN PLACEMENT

A. This item will be paid for by the Unit Price including full compensation for labor, tools, equipment, incidentals, and operations necessary for all Work associated with the installation of the grout curtain including mobilization, demobilization, grout hole drilling in both overburden and rock, grout hole water pressure testing, mix design for grout placement, placement of grout in both bedrock and overburden, grout hole camera survey, grout hole confirmation/verification, and automated grout control and data collection system as specified or recommended by the Engineer.

B. Measurement for this item shall be paid based on the total square feet of grout curtain placed measured on a vertical plane at the midpoint between the two rows of grout holes. Depth of the grout curtain is defined as bottom elevation of the drilled grout holes.

C. The unit price for this item should be based on the assumption that all primary and secondary grout holes shown on the plans will be placed; 33 per cent of the tertiary holes shown on the plans will be placed; and 15 percent of the quaternary holes shown on the plans will be placed. Should the total number of required grout holes exceed 684, additional work will be paid under Bid Item 2.014.

D. This item will be paid for to the nearest square foot of completed and accepted work.

E. Monthly payments for grouting will be paid in accordance with an approved Schedule of Values for the work.

2.014 GROUT HOLE DRILLING – ADDITIONAL IF REQUIRED

A. This item will be paid for by the Unit Price which shall include grout hole drilling through overburden and sound rock, setting casing, water testing, grout hole camera survey, grout hole confirmation/verification, grout placement, and automated grout control and data collection system.

B. This item will be measured to the nearest linear foot.

2.015A CUTOFF WALL IN OVERBURDEN

A. This item will include all Work related to the mobilization, demobilization, excavation, mix design, backfill mixing, conveying, and placement, sampling and testing including verification holes, and quality control of the Cutoff Wall placed in overburden and weathered rock within the limits indicated on the Construction Drawings and/or recommended by the Engineer including all labor, materials, equipment, tools, and all other items necessary to complete the Work as specified, indicated on the Construction Drawings, or recommended by the Engineer.

B. This item will be measured to the nearest square foot of Cutoff Wall as specified in Section 02960.

2.015B CUTOFF WALL IN GROUTABLE ROCK

A. This item will include all Work related to the mobilization, demobilization, excavation, mix design, backfill mixing, conveying, and placement, sampling and testing including verification holes, and quality control of the Cutoff Wall placed in overburden and weathered rock within the limits indicated on the Construction Drawings and/or recommended by the Engineer

including all labor, materials, equipment, tools, and all other items necessary to complete the Work as specified, indicated on the Construction Drawings, or recommended by the Engineer.

B. This item will be measured to the nearest square foot of Cutoff Wall as specified in Section 02960.

2.016 PRINCIPAL OUTLET PIPE

A. This item shall include all Work related to the Principal Outlet Pipe including the Principal Outlet Pipe, Mud Mat, and Pipe Bedding.

B. The Unit Price amount for this Work shall include all labor, materials, equipment, tools, testing, and all other items necessary for the Principal Outlet Pipe as specified or indicated on the Construction Drawings.

C. This item will be measured to the nearest linear foot.

2.017 PRINCIPAL OUTLET PIPE BEDDING – ADDITIONAL DEPTH

A. This item will be paid for by Unit Price including all Work related to the Principal Outlet Pipe Bedding Additional Depth including full compensation for all labor, concrete materials, equipment, transportation, formwork, falsework, joint fillers, placement accessories, consolidating and leveling, troweling, and curing as specified, indicated on the Construction Drawings, or recommended by the Engineer.

B. Measurement of the additional depth material will be based on the actual volume of material installed.

C. Measurement of the installed quantities will be based on volumes calculated by the average end area method using surveyed cross sections of the approved subgrade with the maximum distance between sections not to exceed 25 feet.

D. The cross sections shall be taken perpendicular to the long axis of the excavation at a sufficient number of stations to accurately measure the Work.

E. Surveys will be performed by a Registered Land Surveyor hired by the Contractor and acceptable to the Owner. The surveyed information and the computations used to determine these quantities for payment shall accompany each pay request. The computations shall be furnished in a legible and readily understood format and shall be approved and sealed by the Registered Land Surveyor.

F. Over Excavating: Payment will not be made for over excavated work or for replacement materials.

G. This item will be measured to the nearest cubic yard.

2.018 PRINCIPAL OUTLET STRUCTURE

A. This item shall include all Work related to the Principal Outlet Structure including the Principal Outlet Structure, Mud Mat, Wall Thimbles, Impact Wall Pipes, Operators, Sluice Gates, Telescoping Valves, Butterfly Valves, Ductile Iron Piping, Stems, Stem Guides, Orifice Plates, Automated Collection Unit, Trash Rack, Access Hatches, Aluminum Handrail, and Miscellaneous Metals as specified or indicated on the Construction Drawings.

B. The Lump Sum amount for this Work shall include all labor, materials, equipment, tools and all other items necessary for the Principal Outlet Structure as specified or indicated on the Construction Drawings.

C. This item shall be paid on a Lump Sum basis. As a continuing process, the Lump Sum amount will be paid to the Contractor based on an agreed to Schedule of Values for the items of Work that comprise this item.

D. Monthly installments will be based on the percentage complete for each of the items of Work.

2.019 DRILLED PIERS

A. This item shall include all Work described in Section 02380 of these Specifications, the requirements shown on the Construction Drawings, or as recommended by the Engineer.

B. This item will be paid for by Unit Price that shall be full compensation for all labor, tools, equipment, materials, test holes, incidentals, and operations necessary to complete the Work including rebar, concrete, and material placement.

C. This item will be measured to the nearest 0.1 linear foot of completed pier.

2.020 PRINCIPAL OUTLET STRUCTURE BRIDGE

A. This item shall include all Work related to the Principal Outlet Structure Bridge as shown on the Construction Drawings including the Bridge End Abutment, Bridge Intermediate Support, Drilled Piers, and Pre-Fabricated Bridge.

B. The Lump Sum amount for this Work shall include all labor, materials, equipment, tools and all other items necessary for the Principal Outlet Structure Bridge as specified and as indicated on the Construction Drawings.

C. This item shall be paid on a Lump Sum basis. As a continuing process, the Lump Sum amount will be paid to the Contractor based on an agreed to Schedule of Values for the items of Work that comprise this item.

D. Monthly installments will be based on the percentage complete for each of the items of Work.

2.021 WAVE PROTECTION

A. This item will be paid for by Unit Price that shall be full compensation for all labor, tools, equipment, materials, incidentals, and operations necessary to complete the Work including the riprap, stone filter, filter fabric, fine grading, and material placement as specified, indicated on the Construction Drawings, or recommended by the Engineer.

B. The payment of this item will be based on the area of Wave Protection actually installed. Any modifications to the area shown on the Construction Drawings will be agreed to in the field by the Engineer and Contractor.

C. The Engineer and Contractor shall complete measurements of the Work installed on a daily basis and agree on the pay quantities at the end of each workday.

D. This item will be measured to the nearest square yard.

2.022 INSTRUMENTATION

A. This item shall include all Work described in Section 15900 of these Specifications, the requirements shown on the Construction Drawings, or as recommended by the Engineer.

B. This item shall include all Work and equipment related to the Instrumentation including Control Monuments, Observation Wells, Foundation Monitors Type 1 and Type 2, and Slope Inclinometers.

C. The Lump Sum amount for this Work shall include all labor, materials, equipment, tools and all other items necessary for the Instrumentation as specified, indicated on the Construction Drawings, or recommended by the Engineer.

D. This item shall be paid on a Lump Sum basis. As a continuing process, the Lump Sum amount will be paid to the Contractor based on an agreed to Schedule of Values for the items of Work that comprise this item.

E. Monthly installments will be based on the percentage complete for each of the items of Work.

2.023 BORROW AREA RESTORATION

A. This item shall include all Work related to Borrow Area Restoration including final grading, preparation of subsoil, placing of topsoil, seedbed preparation, fertilizing, seeding, mulching, seed protection, maintenance, resowing, final clean up, and acceptance as specified or recommended by the Engineer.

B. The Unit Rate amount for this Work shall include all labor, materials, equipment, tools, and all other items necessary for the Borrow Area Restoration as specified or recommended by the Engineer.

C. Surveys will be performed by a Registered Land Surveyor hired by the Contractor and acceptable to the Owner. The surveyed information and the computations used to determine these quantities for payment shall accompany each pay request. The computations shall be furnished in a legible and readily understood format and shall be approved and sealed by the Registered Land Surveyor.

D. This item will be measured to the nearest 0.1 acre.

2.024 RAW WATER PIPELINE

A. This item shall include all Work related to the Raw Water Pipeline shown on the Phase 3 Construction Drawings including connection to the pipeline near GA Highway 61, approximately 1600 lf of 48-inch Class 150 Ductile Iron Pipe and fittings, the Baffle Chute, Riprap Channel, and culvert crossing the channel.

B. The Lump Sum amount for this Work shall include all labor, materials, equipment, tools, and all other items necessary for the Raw Water Pipeline as specified or required by the Construction Drawings.

C. This item shall be paid on a Lump Sum basis. As a continuing process, the Lump Sum amount will be paid to the Contractor based on an agreed to Schedule of Values for the items of Work that comprise this item.

D. Monthly installments will be based on the percentage complete for each of the items of Work.

2.025 EROSION & SEDIMENTATION CONTROL

A. This item will be full compensation for labor, tools, equipment, incidentals, and operations necessary of the Work consists of providing and maintaining temporary and permanent erosion and sediment control measures including but not limited to brush barriers, temporary sediment ponds, outlet protection, temporary stream crossings, temporary grassing, rock dams and check dams.Silt Fence Type C is not included and will be paid under pay item 2.026.

B. This item shall be paid on a Lump Sum basis. As a continuing process, the Lump Sum amount will be paid to the Contractor based on an agreed to Schedule of Values for the items of Work that comprise this item.

C. Monthly installments will be based on the percentage complete for each of the items of Work.

2.026 SILT FENCE – TYPE C

A. This item shall include all labor, materials, equipment, tools, and all other items necessary to install, maintain, and remove at the end of the project all Silt Fence Type C.

B. The payment of this item will be based on the Linear Footage of Silt Fence Type C actually installed. Any modifications to the area shown on the Construction Drawings will be agreed to in the field by the Engineer and Contractor.

C. The Engineer and Contractor shall complete measurements of the Work installed on a daily basis and agree on the pay quantities at the end of each workday.

D. Reinstallation: No payment will be made for reinstallation of silt fence damaged by the Contractor operations or lack of maintenance.

E. This item will be measured to the nearest Linear Foot.

END OF SECTION

SECTION 02212

PRESSURE GROUTING

PART 1 - GENERAL

1.01 SCOPE

A. This specification section includes the drilling for and the grouting of the bedrock beneath the dam and abutments as indicated on the Drawings, specified in these Specifications, or as recommended by the Geotechnical Engineer.

B. Specifications include initial foundation surface preparation, all tasks associated with drilling of soil overburden and foundation rock, washing and pressure testing of grout holes, all tasks associated with material testing, shipping, storage, mixing, injecting, and cleanup in preparation for subsequent construction activities.

1.02 RELATED WORK

A. Section 02010 Subsurface Conditions

B. Section 02222 Excavation

C. Section 02227 Treatment of Rock Surfaces

D. Section 02229 Difficult Excavation

E. Section 02960 Cutoff Wall

F. Section 03310 Cast In Place Concrete

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C70 (2006) Standard Test Method for Surface Moisture in Fine Aggregate

2. ASTM C91 (2005) Masonry Cement

3. ASTM C150/150M (2009) Standard Specification for Portland Cement

4. ASTM C494/C 494M (2010) Standard Specification for Chemical Admixtures for Concrete

5. ASTM C618 (2008a) Standard Specifications for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

6. ASTM C1064/C1064M (2011) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

7. ASTM C109/C109M (2011b) Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens)

8. ASTM C117 (2004) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing

9. ASTM C128 (2012) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate

10. ASTM C191 (2008) Standard Test Method for Time of Setting Hydraulic Cement by Vicat Needle

11. ASTM C31/C31M (2010) Standard Practice for Making and Curing Concrete Test Specimens in the Field

12. ASTM C87/C87M (2010) Effect of Organic Impurities in Fine Aggregate on Strength of Mortar

13. ASTM C940 (2010a) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory

14. ASTM D422 (1963; R 2007) Particle-Size Analysis of Soils

15. ASTM D4221 (2011) Standard Test Method for Dispersive Characteristics of Clay Soil by Double Hydrometer

16. ASTM D4318 (2010) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

17. ASTM D6910/D6910M (2009) Standard Test Method for Marsh Funnel Viscosity of Clay Construction Slurries

1.04 DEFINITIONS

A. Weathered Overburden Materials: Engineered/Man-made soil fill materials, residual soils and partially weathered rock materials located above the top of sound (groutable) rock.

B. Bedrock: Comprised primarily of Mica Schist inter-bedded with Phyllite and Paragneiss containing secondary Biotite, Muscovite, Chlorite and Pyrite minerals. The top of bedrock shall be defined as the depth at which sound (groutable) rock materials are encountered that exhibit SPT values of greater than 50/2" (greater than 50 blows for less than 2 inches of penetration).

C. Stage: A partial or complete depth range in a hole.

D. Stage Grouting (Descending): Grouting by drilling a hole to a limited depth, grouting at that depth, cleaning the hole by washing or other suitable means before the grout has set sufficiently to require re-drilling, letting the grout surrounding the hole take initial set, drilling the hole to another limited depth and grouting, and thus continuing in as many stages of drilling and grouting as may be necessary to secure a satisfactory job of grouting.

E. Packer Grouting (Ascending): Grouting by drilling a hole to full depth in one operation and grouting at different depths by means of a packer set at the required depths.

F. Split-Spacing Method: A procedure of locating an additional grout hole intermediate between two previously drilled and grouted holes.

G. Curtain Grouting: A procedure consisting of pressure grouting deep holes drilled into the dam foundation to form a low hydraulic conductivity barrier and effectively seal seams, fissures, fault zones or cavities.

H. Net Take: Volume of grout (regardless of proportions) pumped into bedrock, exclusive of grout in grouting apparatus and spillage, as measured by flow meters in the grouting system and applicable deductions of grout volumes.

I. Blanket Grouting: A procedure consisting of low pressure grouting of shallow holes drilled on relatively close spacing and grid pattern for the purpose of strengthening and creating a low permeability area or zone. This procedure may also be used to seal the upper bedrock prior to performing Curtain Grouting.

1.05 QUALIFICATIONS

A. Because of the specialized nature of the grouting, a company specializing in pressure grouting of bedrock materials shall be engaged to perform this project. The company must demonstrate their knowledge and experience of grout curtain construction and successful execution of all facets of work associated with grout curtain construction. The specialty contractor must have been in business performing these services for at least five (5) consecutive years and show successful completion of at least ten comparable projects. The project names, locations, scope of work performed, project bid and final costs, and the name and contact information of the owner's representative knowledgeable of the work performed shall be provided for the most recent five projects. Competent consultant advice and qualified supervision of the work is imperative. Resumes for the consultant, overall project supervisor, drilling superintendent, grouting superintendent, QC manager, and project manager in responsible charge of critical aspects of the work shall have at least five (5) years' experience in grouting and have completed at least three (3) projects of similar scope and complexity in these capacities.

B. The Owner and Engineer shall have the right to make inquiries concerning the experience and project performance of the consultant and supervisor proposed for the work and shall have the right to disapprove these persons in the event these inquiries reveal evidence of unsatisfactory performance.

1.06 SUBMITTALS

A. General

1. Drilling Equipment/Procedures: Submit for review detailed descriptions of equipment and procedures for drilling overburden soil and foundation rock, and provide examples of daily drilling logs and profiles. Submittal should provide Contractor's means and methods for control of drilling fluids, spoils, cuttings and runoff from the drilling sites.

2. Grout Apparatus/Procedures/Monitoring: Submit for review a description of all relevant water flushing, pressure testing, and grouting equipment and proposed circulation system, grout mixing, and injection procedures. Submit a calibration curve for each flow meter and pressure gage used. Curves shall be certified by an independent testing laboratory within the last 3 months.

3. Quality Control Plan: Submit for review a Quality Control Plan for all aspects of the curtain grouting program to include grout rheology testing, frequency of testing, and field monitoring during grout production and placement.

4. Data Management System: An Automated Data Management System (ADMS) is required to collect, display and analyze all injection data so that informed decisions can be accomplished in real time. The ADMS must be able to show Lugeon Values (for water testing) and Apparent

Lugeon Values (for grouting) in real time. Submit for review a description of the automated in-real-time grouting/water pressure testing, monitoring, and data collection system. The submittal should include all necessary equipment, materials, and computer hardware and software. Examples of data output should be provided.

5. Grouting Work Plan: As part of the Grout Work Plan, submit a Dam Survey Plan showing the locations and widths of existing cracks in the bedrock surface as specified in Section 02227 – Treatment of Rock Surfaces, Section 1.03.C with the marked locations of the specified primary and secondary grout holes. The Grout Work Plan should include the sequencing of drilling for overburden and rock, grouting of casing, flushing and water testing, curtain grouting, verification drilling and testing, and final cleanup in preparation for subsequent construction activities. Use the dam baseline stationing and offsets there from for reference. Submit the Grout Working Plan for approval prior to drilling grout holes. Revise the plan for relocated grout hole locations as applicable.

6. Certificates of Conformance: Submit certificates from manufacturers attesting that materials used meet specified requirements. Descriptive information on packages will be accepted in lieu of such certificates.

7. Contractor-Furnished Grout Mix Design: The Contractor shall submit a mix design for each type of grout proposed for approval.

8. Summary of Measurements: Provide a summary report of all field logs and grouting data described in this Section.

B. Drilling and Grouting

1. Drilling Logs: Prepare signed field logs for drilling each grout hole. Submit logs for completed holes the following work day. Each log shall include the following data:

Operation	Data
General	Hole identification, location, surface elevation, date(s), method and speed of drilling, type of bit and drill rig used.
Drilling	Hole diameter(s) and depth(s), method and speed of drilling, type of bit and drill rig used.
Findings	Material encountered, presence of voids, jointing or discontinuities, free surface height of water, any unusual or noteworthy occurrences.

2. Flushing Logs and Plan: Prepare signed field logs for each flushing operation of grout holes. Logs shall include the following data:

Operation	Data
General	Water pressures and equipment used, date and duration of test, weather conditions.
Observation	Holes interconnected by flushing, description of amount and color of water flushed out of holes, duration and rate(s) of flushing.

Mark the Dam Survey Plan with holes interconnected by flushing. Submit flushing logs and marked plan prior to grouting.

3. Grouting Logs

Operation	Data
General	As specified for drilling logs.
Pumping	Start and stop time and duration of pumping, volume pumped into each hole and maximum pressure, consistency and proportions of grout, method and position of sealing hole, or other actions required.
Observation	Vent holes and other locations (if any) from which grout emerged. Mark the Dam Survey Plan with holes interconnected by grouting.
Termination	Reason for termination of grouting, net take.

4. Water Test Logs: Prepare field logs for cleaning out, water testing, and backfilling each grout hole. The logs shall include the following data:

Operation	Data
General	As specified for Drilling Logs.
Clean Out	As specified for Drilling Logs under drilling operation and observations.
Water Testing	As specified for Grouting Logs under pumping operations, observations and terminations.
Backfilling	As specified for Grouting Logs under pumping operations.

1.07 DELIVERY AND STORAGE

A. Sufficient quantity of all materials shall be on hand to insure that grouting operations will not be interrupted or delayed.

B. Cement and Bentonite:

1. Store bagged cement and bentonite upon delivery in a weatherproof structure. Bags should be labeled to identify date of delivery, mill certifications and any other pertinent tracking information.

2. Elevate bags above ground.

3. Store bulk materials in air tight and weatherproof containers.

4. All cement and bentonite shall be free of lumps at their time of mixing.

C. Aggregate: Store fine aggregate on a clean hard surface and cover to prevent dusting.

D. Admixture: Store approved admixtures in a protected and temperature regulated area.

PART 2 - PRODUCTS

2.01 GROUT

1. Portland Cement: Fine ground to pass in wet mix through a mechanically vibrated 100 mesh screen.

2.02 BENTONITE

A. High sodium, Wyoming grade bentonite.

2.03 POZZOLAN

A. Pozzolans shall be Type F fly ash conforming to standard chemical and physical requirements for ASTM C618.

2.04 WATER

A. The Contractor is responsible for providing sufficient quantities of potable water to the site for use in the grout mix/pressure grouting program. If on-site water is to be used in the grouting program, the Contractor is responsible for performing water quality testing to determine its suitability and treatment as needed.

2.05 FINE AGGREGATE

A. Masonry Aggregate ASTM C144.

2.06 ADMIXTURES/ADDITIVES

A. No admixtures/additives are specified.

B. Admixtures/Additives include, but are not limited to the following: superplasticizers, high range water reducing admixtures, viscosity modifiers, anti-washout admixtures, and bentonite. If the Contractor proposes to use an additive that is not specified, then Geotechnical Engineer approval is required for the material and its property qualities.

C. Admixtures/Additives shall be furnished in containers that are adequate for the purposes at hand, and in containers of suitable volume to allow measurement and dispensing on a production basis without delay or error.

D. All admixtures/additives shall have certification from the manufacturer.

E. When multiple admixtures/additives are used in a grout mix, all of the admixtures must be certified by the Contractor as compatible with each other and the other ingredients in the mix.

2.07 BALANCED STABLE GROUT MIXES

A. Grout mixes for use on this project shall be designed by the Contractor and submitted to the Geotechnical Engineer for approval.

B. Grout mixtures used should be a homogenous, balanced blend of water and cement combined with select additives and admixtures to produce a product that experiences minimal to no bleed and maintains a constant rheology (viscosity, cohesion, pressure filtration) during placement.

C. The mix design shall include a range of pumpable grout mixes for open and tight grouting conditions using cement and bentonite with and without fine aggregate.

PART 3 - EXECUTION

3.01 EXAMINATION

A. The Contractor shall verify the existing conditions.

B. Identify required lines, levels, contours, and datum locations.

3.02 PREPARATION

A. The Contractor will take all necessary precautions to prevent damage to otherwise suitable foundation materials for the specified construction. Site preparation activities will also include the construction of a concrete Grout Cap where sound (groutable) rock is exposed at grade. Any damages caused by the Contractor or his subcontractors shall be repaired to the satisfaction of the Geotechnical Engineer at no additional cost to the Owner.

3.03 EQUIPMENT

A. General

1. Grout Apparatus used for curtain grouting shall be circulating system in conjunction with sufficient valves, meters, fittings, lines and accessories to perform the required work and obtain the desired results and specified data.

2. Stage Grouting (Descending) and/or Packer Grouting (Ascending) are allowed. Descriptions provided herein are more specific to Stage Grouting. The Contractor's Grouting Work Plan should describe their procedures for both methods and the conditions where each would be appropriate or preferred.

3. Sanded grout may be directed and that all equipment used shall be capable of performing the required work using this material.

B. Grout Hole Drilling in Rock

1. Grout hole drilling in rock shall be performed with water actuated down-the-hole hammers, standard rotary diamond drills or other approved equal.

2. Drilling with air circulation down-the-hole techniques will not be permitted.

3. The drilling equipment shall be proven capable of drilling a borehole at the required angle from vertical, to the required drill depth, and produce grout hole suitable for accepting grout.

4. Supplies shall include all coring and non-coring bits, drill rods, tools, core barrels, casing, piping, pumps, other equipment, water, and power to accomplish the required drilling.

5. All drilling rigs and pumps shall be equipped with calibrated pressure gages.

6. All drilling, water pressure testing and grouting equipment used shall be of a type, capacity, and mechanical condition suitable for performing the work, as determined by the Geotechnical Engineer.

7. The power and equipment and the layout thereof shall meet all applicable requirements of local, State, and Federal regulations and codes, both safety and otherwise.

C. Grout Hole Drilling through Weathered Overburden Materials

1. Grout hole drilling through weathered overburden materials shall be accomplished in general accordance with USACOE Document ER 1110-1-1807 Drilling in Earth Embankment Dams and Levees, dated 31 December 2014.

2. Displacement bits will not be permitted for drilling holes in the overburden.

3. Overburden drilling shall maintain orientation tolerances through materials including but not limited to clay, silt, sand, partially weathered rock, rock lenses/boulders.

4. Samples of the overburden may be taken during drilling, but are not required.

5. The outer drill casing shall have a nominal outside diameter of 6 inches and shall be seated into the top of sound (groutable) rock a maximum of 1.5 foot. A PVC inner casing should then be installed through the drill casing and the annulus grouted in place using an approved grout mixture with properties similar to the overburden soils as the outer casing is withdrawn. The PVC pipe should be rigid and strong enough to then be used to allow subsequent rock drilling and grouting operations. At the completion of the grouting, the PVC casing shall be grout filled with an approved grout mixture with properties similar with the overburden soils.

6. Backfilling of holes in overburden materials shall be accomplished by injection of overburden grout through a tremie pipe or hose inserted to a depth of 1 foot below top of rock.

7. The backfill or grout mix should be changed to an appropriate mix that approximates the properties of the undisturbed weathered overburden materials.

8. The estimated quantity for backfill grout shall always be calculated and compared to the theoretical hole volume.

D. Mixing and Pumping Equipment

1. Mixing and Pumping Equipment shall be capable of supplying, mixing, and pumping the required quantities of grout at the specified consistency.

2. Provide a minimum pumping capacity of 30 gpm at a pressure of 100 psi measured at the top of the grout holes.

3. Pumps shall be of the helical screw type (Moyno type).

4. The grout mixer shall be high speed (colloidal) type.

5. The water system shall be installed so that water can be metered into each tank. Water meters shall read in tenths of a cubic foot.

6. The mixer shall be arranged to discharge grout into a suitable mechanically agitated sump. At no time shall the agitator be located more than 500 feet from the hole being grouted.

7. A suitable water connection shall be provided on the intake of the grout pump to facilitate flushing of the system and injection of water into the grout holes.

E. Packers

1. Packers shall be expanding membrane pneumatic packers to seal pipes into grout holes. Packers shall be capable of withstanding a water pressure of 150 psi without leakage.

2. The packers shall be instrumented in both single and double configurations and capable of measuring fluid pressure below, immediately above the packer, above the upper packer or between the packers (double configuration).

3. The downhole sensors should be compatible and readable in-real-time within the automated grout monitoring and data collection system.

F. Flowmeters and Pressure Gages

1. Flowmeters and Pressure Gages in quantity and type approved by the Geotechnical Engineer shall be provided to measure the volume and pressure of grout pumped into the grout holes.

2. The meters and gages shall be capable of performing under the pressures and grout consistencies used, and shall measure volumes to 0.018 cubic feet/minute (0.5 liters/minute), and pressures to one psig.

3. As a minimum, all flow meters and pressure gages shall be checked/tested against their standards for accuracy at least once per week.

G. Data Management System

1. An automated grouting/water pressure testing monitoring and data collection system shall be provided, set up, maintained, and operated during all water testing and curtain grouting procedures.

2. The automated grout system equipment shall include all necessary equipment, materials, computer hardware, and software.

3. The system shall be used during all water pressure testing and grouting.

4. As-Built grouting and water pressure testing profiles and drawings, and grouting summaries plots shall be provided in an Adobe PDF. Individual stage records are to be submitted to the Geotechnical Engineer daily. Record drawings and summaries are to be submitted to the Geotechnical Engineer weekly.

5. Water pressure testing shall be monitored by the system, it shall record and display in-real-time the pressure and flow rate of water into the rock and display the Lugeon value. All pressures shall be calculated from the stage midpoint.

6. The grouting program shall be directed based on pressure and flow data acquired in-real-time and recorded by the automated system. All pressures shall be calculated from the stage midpoint.

7. At a minimum during pressure grouting, the system shall measure, record, and graphically display in-real-time the following:

    (a) Total Volume of grout placed in the rock

(b) Gage and Effective pressures (calculated and measured)

(c) Holding and Back pressures

(d) Target Pressure shown as a continuous dotted line

(e) Rate of Injection (shown in volume per time)

(f) Apparent Lugeon value

(g) Start and Stop times of Grout Injection

(h) Type and Volume of Grout Mix

8. The allowable effective pressure shall not be shown varying on the trend plots; it shall be shown as calculated from the specified gravity pressure for the first 15 feet of grouting and using 0.5 psi per linear foot of overburden and 1.0 psi per linear foot of rock measured vertically from the top of the holes for the subsequent stages. The allowable effective pressure does not change in a stage and shall be shown as constant on the grout trend plots.

9. Effective grouting pressure shall be calculated based on pressures in the grouting zone, considering in-situ water pressure, weight of grout column, and estimated head losses and shall be measured in the ground with the use of an instrumented packer.

10. The output from the automated system shall as a minimum include:

(a) Hole Stations

(b) Testing interval or stage data with reference to depth and elevation;

(c) Pressure testing results from each stage in modified Lugeon values;

(d) Target Pressure for the stage;

(e) Grout Take for each mix used in each stage;

(f) Volume of cement solids injected in the hole for each stage;

(g) Grouting time for each stage (hr:min:sec);

(h) Refusal report graphs showing injection rates, pressures, holding pressure, back pressure, and Apparent Lugeon values.

11. The collected data shall be reduced to account for correction factors and field parameters, such as pressure head losses; actual depth of the stage being grouted; groundwater level; and pressure measurements; and mix properties when switching from one mix to another without interfering with, pausing, or stopping the flow of grout into the hole.

12. The system shall be capable of producing data in electronic and hard copy format.

13. The Contractor shall provide an updated daily electronic grout profile to the Geotechnical Engineer at the beginning of each daily shift.

14. The Contractor shall provide updated hard copy drilling, water testing and grout profiles to the Geotechnical Engineer on a weekly basis or at any time during the course of the work as requested.

15. Tests of the automated grouting monitoring and data collection system shall be conducted by the operator(s) who shall be using the equipment during production grouting prior to production grouting to verify the devices and system are functioning properly and the system is accurately receiving and recording the data.

16. System calibration reports shall be provided by the Contractor for the automated grouting monitoring and data collection system and all related equipment not less than 3 working days prior to the commencement of water pressure testing or grouting using the equipment. The system shall be, at a minimum, checked and recalibrated weekly in conjunction with the Contractor's Quality Control Plan and at any time during the work as directed by the Geotechnical Engineer. Equipment shall be checked at the beginning of each shift of operation to verify gages are reading zero during no pressure and no flow conditions and also at intended grout or water pressure testing pressures to be used during that day, and a check of measured flow and pressure versus equipment readout shall be performed daily or at any time as recommended by the Geotechnical Engineer. The mid-range of the gauges used for testing should be close to the anticipated gauge pressures for this work.

17. Automated grouting monitoring and data collection system operator shall be present during all grouting and pressure testing and shall be familiar with all functions of the equipment.

3.04 GROUTING PROCEDURES

A. The purpose of the grouting program shall be to limit seepage under the dam by pressure grouting voids and cracks within the bedrock before placement of embankment fill. Grouting shall be performed as specified and shall comprise grouting in stages along two rows of primary and then secondary holes followed by confirmation/verification hole testing. Additional tertiary and quaternary holes shall be made and grouted between the primary and secondary holes as recommended by the Geotechnical Engineer, or determined based on grout takes or water testing verification. The target residual permeability of the grout curtain is less than or equal to (≤) 2 Lugeons and will be assessed by multi-pressure water testing in verification holes drilled at no more than 50 feet on centers along the curtain.

B. Grouting procedures shall be executed as indicated and specified herein. The procedures may be modified as field conditions dictate and as approved by the Geotechnical Engineer. The procedures shall include, but not be limited to the following:

	Procedure		Description
1.	Preparation of Rock Surfaces	1.	Clean rock surface and exposed cracks, map cracks as recommended by Geotechnical Engineer.
		2.	Construct Grout Cap in accordance with Section C below.
		3.	Provide submittals.
2.	Drill Overburden and Set	1.	Drill and set casing per Section 3.03.B.

	Procedure		Description
	Temporary Casing		
3.	Primary & Secondary Grouting Stage one	1.	Drill and clean out all holes to stage one depths as specified.
		2.	Assemble grout apparatus.
		3.	Flush between holes and perform water testing.
		4.	Pressure grout.
4.	Primary & Secondary Grouting - Stage two, three, etc.	1.	Redrill and clean out all holes to depths as specified.
		2.	Flush between holes and perform water testing.
		3.	Pressure grout.
		4.	Clean out holes.
5.	Pressure Test Confirmation Holes after Completion of each 100 feet continuous Grout Curtain	1.	Water test each hole.
		2.	Backfill or leave hole open as recommended by Geotechnical Engineer.
		3.	Pressure grout.
		4.	Perform same for remaining stage depths.
6.	Succeeding Grout Holes	1.	Repeat Steps 2, 3, 4, & 5

C. Grout Cap

1. A grout cap shall be constructed as indicated on the Drawings at locations where grouting from top of bedrock or as recommended by the Geotechnical Engineer.

2. Grout Cap shall be Class B Concrete.

3. The rock foundation for the cap shall be cleaned of loose material in accordance with Section 02227 – Treatment of Rock Surfaces.

4. The concrete shall be maintained in a moist condition for a curing period of at least 7 days after it is placed.

5. Drilling and grouting shall not be performed prior to the end of the 7 day curing period.

D. Drilling Grout Holes in the Bedrock

1. Grout Hole Spacing:

   (a) Primary holes shall be in two rows, spaced 4-feet or 5 feet on either side of the dam baseline where specified, and have a maximum spacing of 20-feet along the baseline.

   (b) Secondary holes shall be split spaced between the Primary holes in both rows.

(c) Tertiary and quaternary holes will be split spaced following Confirmation testing as needed or as recommended by the Geotechnical Engineer.

(d) Hole spacing may be modified by the Geotechnical Engineer after reviewing the character and distribution of joints in the rock surface.

2. Grout Hole Drilling:

(a) Make grout holes two and one-half inch minimum diameter.

(b) Upstream row of holes shall be installed between 15 to 20 degrees of vertical along the baseline, as recommended by the Geotechnical Engineer based on the Dam Survey Plan.

(c) Downstream row of holes shall be installed between 15 to 20 degrees of vertical in the opposite direction along the baseline, as recommended by the Geotechnical Engineer.

(d) Rock drilling shall be accomplished using a water actuated down hole hammer and/or rotary methods with water flush only. No percussion rotary-air drilling methods will be allowed. The drilling/coring method shall meet the borehole deviation requirements, maintain the correct orientation, and permit subsequent drilling to proceed within tolerances through overburden and rock materials, or the method shall be revised and boreholes replaced at the expense of the Contractor.

(e) The Contractor shall drill grout holes at the locations, inclinations, directions, and to the depths as shown in the Drawings or as recommended by the Geotechnical Engineer. The top of hole locations shall be within 0.25-foot (location of the top center of borehole) of the planned location. Subsequent grout hole drilling should not be performed until grouting operations (both rows) have progressed at least 60 feet from planned subsequent phase drilling locations.

(f) The Contractor shall exercise care in the alignment of the drilling equipment to ensure that the initial alignment of the hole is within one degree of his theoretical alignment in both direction and inclination. Following the initial setup the Contractor shall use such methods as are necessary to ensure that the alignment and inclination of the rig does not change beyond the one degree tolerance during the drilling of the hole. At least 10 percent of the grout holes shall be surveyed using an approved downhole deviation tool to verify the drilled hole location and accuracy of placement. Failure to meet the drilled hole accuracy will necessitate changes to the drilling procedures to meet the specified tolerances and more frequent testing as requested by the Geotechnical Engineer until the contractor can demonstrate that the drilling processes are routinely in tolerance.

(g) The hole shall be washed to retrieve clear water return between each pull or run, before the tools are either pulled or added.

(h) Rod dope, grease, or other lubricants shall be sparingly used on drill rods or in the drill holes.

(i) Case drill holes through overburden to top of sound (groutable) rock as required or recommended by Geotechnical Engineer. Casings shall be installed in general accordance with USACOE ER-1110-1-1807. Overburden holes shall be properly

abandoned and backfilled using low permeability/high strain materials, not cement grout.

E. Grout hole drilling in rock, pressure washing, water pressure testing, and grouting shall not be performed simultaneously on two holes within 60 feet of each other. Grout operations including pressure washing, water pressure testing, and grouting can be performed between 20 and 60 feet away from a hole which has been grouted and the grout has been allowed to harden for 24 hours. After the grout has hardened for a total of three days, work can be done on a hole 10 to 20 feet away. After the grout has set for a total of seven days, work can be done on holes closer than 10 feet. All distances shall be measured from the center of the grout hole at the closest points along the lengths of the holes. Distances may be adjusted based on field conditions encountered.

F. No samples are required from overburden or bedrock drilled. Report any unusual drilling occurrences to the Geotechnical Engineer.

G. Each stage shall be no deeper than 20 feet measured along the length of the hole in rock as approved by the Geotechnical Engineer. If overburden is drilled, the depth of overburden drilled is not included in the measurement of stage depth. The maximum anticipate Grout Curtain depth is shown in the Drawings. Where conditions are encountered at the scheduled bottom of hole depth that would indicate grout takes are likely, then the drilling shall continue until the hole penetrates a minimum of 5feet of good rock where minimal grout takes are anticipated, or until cessation of drilling is recommended by the Geotechnical Engineer.

1. Cleanout: Remove all debris from the grout holes at the end of drilling. Plug tops of holes with removable seals to prevent debris from entering holes subsequent to cleanout.

2. All grout holes that are damaged to the extent that they do not allow adequate grouting shall be nonconforming and shall be replaced at the Contractor's expense.

H. Set Up Grout Apparatus

1. Provide mixers, hoppers, pumps, power, piping, fittings, gauges and incidental equipment for grouting. Assemble grout apparatus and pressure test with water. Seal all leaks in the grouting apparatus.

2. All hole locations shall have a sealed standpipe extending at least 1 foot above the grout cap. The standpipe shall be fitted with either a push on or threaded cap.

I. Water Flush

1. Immediately before the grouting of each stage of any hole, the holes shall be flushed and tested thoroughly with clean water under pressure. Following the flushing process, each grout hole shall be pressure tested with a pump capable of supplying a pressure equal to the grouting pressure for the stage.

2. Start with primary holes open and cleaned.

   (a) Apply an air/water mixture proportioned 50/50 percent by volume under surging pressure to one hole at a time. Set packers to isolate the stage being flushed and pressure tested. Note adjacent holes from which the air/water mixture and debris vent. If practical, cap and/or packer adjacent connected holes to minimize cross flushing.

(b) Map and submit a plan showing interconnected holes.

(c) If capping or packer of interconnected holes is not practical, wash between interconnected holes by alternately forcing water from one hole to another. Repeat three cycles at each pair of interconnected holes. Record pressures and water volumes used for each hole.

3. For each flushing operation described above apply pressure to each hole for a minimum of ten minutes and as long as there is any increase in the rate at which water is taken, such increase indicating that additional fractures and openings are being reached by the flushing operation. Build up to but do not exceed the pressure specified for the corresponding stage grouting. Holes in which the required pressure cannot be reached shall be flushed as long as there is any increase in the rate of flow or drop in pressure when the pump is delivering a capacity flow. Open holes in which no pressure can be built up shall be washed for such period of time as fracture filling material is being removed, as determined by the escape of such material through surface openings or other grout holes.

4. Record flows and pressures at 1-minute intervals.

J. Pressure Grouting

1. Sequence: Drill, flush and grout all Primary grout holes (both rows) before drilling and grouting each subsequent phase (Secondary, Tertiary, and Quaternary) grout holes. Each phase of grouting shall be advanced and completed at least 60 feet beyond the planned subsequent phase grout holes to minimize venting between adjacent holes.

2. Mix Control: Contractor to propose mix designs to the Geotechnical Engineer which will satisfy the following criteria:

(a) Bleed: 1%

(b) Pressure Filtration Coefficient: 0.05 minimum to 0.5

(c) Initial Set: 8-12 hours

(d) Final Set: 18 hours

(e) Marsh Viscosity:

(i) Mix A: 35 seconds

(ii) Mix B: 40-45 seconds

(iii) Mix C: 50-60 seconds

(iv) Mix D: 80 seconds

(v) Mix E: Sanded Mix

3. Grout Pressure: Use a maximum pressure of 1/2 psi per foot of overburden depth plus 1 psi per foot of groutable rock depth as measured from the ground surface to the midpoint of the stage being grouted. If necessary, to relieve premature stoppage, periodic applications of water under pressure shall be made. Under no conditions shall the pressure or rate of pumping be

increased suddenly. The maximum grout injection rate shall be 25 gpm. As a safeguard against rock displacement, or while grout leaks are being caulked, the Geotechnical Engineer may require the reduction of the pumping pressure, intermittent pumping, or the discontinuance of pumping.

4. Circulation: The grouting construction equipment and lines shall be prevented from becoming fouled by the constant circulation of grout and by the periodic flushing of the system with water. Flushing shall be done with the grout intake valve closed, the water supply valve open, and the pump running at full speed. During grouting, the Contractor shall provide for disposal of wash and wastewater and shall remove waste grout caused by his operation.

5. Sealing cracks: If during the grouting of any hole, grout is found to flow from points in the surface, such flows or leaks shall be plugged or caulked by the Contractor where practicable as recommended by the Geotechnical Engineer. Note the location of such joints on the crack survey plan.

6. Termination: The Contractor will progress through these mixes by real time analysis of the evolution of the Apparent Lugeon for each stage. Stage refusal will be at a flow rate of 1 gallon per minute sustained over a 3-minute hold period, at the target effective pressure.

7. Set Time: No drilling, testing, or flushing shall be done within a radius of 20 feet of a freshly grouted hole until at least 24 hours has elapsed since grouting said hole. Holes to be redrilled shall set at least 24 hours before redrilling is begun.

K. Tertiary and Quaternary Hole Grouting

1. If, in the opinion of the Geotechnical Engineer, further grouting is required, tertiary and quaternary hole grouting shall be performed. The tertiary and quaternary grout holes and those primary and secondary holes which showed significant water testing takes, as determined by the Geotechnical Engineer, shall be worked together as grout and vent holes during flushing and grouting operations. It is anticipated that tertiary and quaternary grouting will be performed in areas of high primary and secondary grout hole takes.

L. Water Testing

1. Confirmation/Verification holes will be drilled and tested along the baseline at a maximum of 50 foot spacing as recommended by the Geotechnical Engineer once the primary and secondary holes have been completed. Holes shall be drilled to the average depth of the adjacent primary and/or secondary grout holes.

2. Apply the average maximum final stage water pressure specified for the adjacent primary and/or secondary grout holes at the top of each stage of confirmation/verification hole. Increase pressure in four increments of five minutes minimum duration each, or until the rate of water flow stabilizes, whichever is longer. Record and submit results.

3. Grout Curtain closure (refusal) criteria of 2 Lugeons or less is required. If the water testing exceeds this amount, tertiary and quaternary grout holes may be required as recommended by the Geotechnical Engineer. To calculate the Lugeon value, the effective pressure in the middle of the test stage will be calculated based on the following: Gage Pressure Head + Head Difference from the middle of the test stage to the gage elevation - the head difference from the middle of the test stage to the top of the piezometric surface.

4. Additional confirmation holes may also be required as recommended by the Geotechnical Engineer.

M. Blanket Grouting

1. It is anticipated that some shallow hole blanket grouting may be performed where the near surface rock is highly jointed and permeable. The need for blanket grouting will be determined by the Geotechnical Engineer during site preparation activities.

N. Cleanup

1. Remove all grout apparatus at the completion and acceptance of grout work. This includes removing grout standpipes, debris and grout from working surfaces.

2. Clean out all grout holes and backfill with 1,000 psi non shrink grout level with the working surface.

END OF SECTION

SECTION 11203

SLUICE GATES

PART 1 - GENERAL

1.01 SCOPE

A. This section includes all labor, materials, tools, equipment and related items required to furnish and install heavy-duty sluice gates as indicated on the Drawings or specified in these Specifications.

B. Each gate shall be furnished and installed complete with anchor bolts, operating stem, gate lift operator, and other appurtenances as specified or needed to make a complete and operable installation.

1.02 RELATED WORK

A. Section 03600 Grouting

B. Section 05120 Structural and Miscellaneous Metals

C. Section 05501 Anchor Bolts

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. American Water Works Association (AWWA):

1. AWWA C560 – Standard for Cast-Iron Sluice Gates

B. American Society for Testing and Materials (ASTM):

1. ASTM A276 - Stainless and Heat-Resisting Steel Bars and Shape

2. ASTM A436 - Standard Specification for Austenitic Gray Iron Castings

3. ASTM D 2000 - Standard Classification System for Rubber Products in Automotive Applications

C. American National Standards Institutes (ANSI):

1. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings

2. ANSI B46.1 - Surface Texture and Gaging for Screw Threads

1.04 QUALIFICATIONS

A. All sluice gates shall be furnished by a manufacturer fully experienced, (minimum 5 years), reputable and qualified in the manufacture of the materials to be furnished.

B. Sluice gates shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

1.05 SUBMITTALS

A. Shop Drawings:

1. Fabrication, assembly and installation diagrams.

2. Setting drawings, templates, and directions for the installation of anchor bolts and other anchorages.

B. Product Data:

1. Manufacturer's literature, illustrations, specifications and engineering data.

2. Lubricant Specification: Furnish a lubricant specification for the type and grade necessary to meet the requirements of the equipment.

C. Support Design Information:

1. Submit for record purposes only weight of each sluice gate and expected opening and closing thrust loads on the supporting structure.

D. Shop Test Results:

1. Submit results of required shop tests.

E. Field Test Results:

1. Submit a written report giving the results of required field tests.

F. Operation and Maintenance Data:

1. Submit complete Installation, Operation and Maintenance Manuals, including, test reports, maintenance data and schedules, description of operation, and spare parts information.

PART 2 - PRODUCTS

2.01 GENERAL

A. Gates, stems, lifts and other appurtenances shall be the size, type, material and construction as shown on the drawings and specified herein.

B. Sluice gates shall be as manufactured by Rodney Hunt, Waterman or approved equal.

C. Sluice gates shall be the rising stem type with manual operators, flat back mounted on wall thimbles or flanged wall pipe as indicated in the Drawings and of the sizes and rated seating and unseating heads as follows:

Sluice Gate ID	Structure Centerline Elevation	Size (inches) Shape	Seating Head (feet)	Unseating Head (feet)
SG1	Principal Outlet Structure Elev. 849.00 ft.	6 Round	70	0
SG2	Principal Outlet Structure Elev. 844.00 ft.	6 Round	70	0
SG3	Principal Outlet Structure Elev. 815.50 ft.	60x60 Square	110	0

D. All component parts shall be of the type of material shown, and interchangeable where size and material are the same without grinding, chipping or special fitting in the field.

E. All mating and sliding parts shall be fully machined.

F. All sluice gate parts, including lift, shall be designed for the heads shown with a minimum safety factor of 5.

G. All materials used in the construction of the gate and appurtenances shall be the best suited for the application and shall be as follows:

Gate Part or Item	#2 Stainless Steel Trim	ASTM Standard Number
Anchor Bolts & Nuts	18-8 Stainless (4)	276-Type 316
Frame, Slide and Guide Rails	Austenitic Gray Iron (Ni-Resist)	A-436-Type 2
Seating Faces	18-8 Stainless (2)	276-Type 316
Wedges	18-8 Stainless (3)	276-Type 316
Fasteners	18-8 Stainless (4)	276-Type 316
Stem Block	Austenitic Gray Iron (Ni-Resist)	A-436-Type 2
Sill Plate	Austenitic Gray Iron (Ni-Resist)	A-436-Type 2
Seal	Rubber	D 2000
Retainer	18-8 Stainless (1)	276-Type 316
Yoke	Austenitic Gray Iron (Ni-Resist)	A-436-Type 2
Stem	18-8 Stainless (1)	276-Type 316

2.02 FRAME AND GUIDE RAILS

A. The frame and guide rails shall be of cast iron and cast integrally and shall be machined on all bearing and contact surfaces.

B. Frame and guides shall be designed for the maximum head indicated with a minimum safety factor of 5 with respect to tensile, compressive and shear strength.

C. Guides shall be of such length as to support at least one-half of the vertical height of the slide when in the open position.

2.03 SLIDE

A. The slide shall be made of cast iron, with strengthening ribs where required, and a reinforced section to receive the seating faces.

B. The slide shall be designed for the maximum head indicated with a minimum safety factor of 5 with respect to tensile, compressive and shear strength.

C. The slide shall have tongues on each side extending its full length, and these tongues shall be accurately machined on contact surfaces.

D. Surfaces of the slide that come in contact with the seat facings and wedges shall be accurately machined. The maximum allowable clearance between the slide and slide guide shall be 1/16 inch.

E. A thrust-nut pocket shall be provided above the horizontal centerline of the slide reinforced by ribs. The thrust-nut pocket shall be drained.

2.04 SEATING FACES

A. Seating faces shall be made of strips of rolled or extruded stainless steel. They shall be firmly secured in finished grooves in the frame and slide faces in such a way as to insure that they will remain in place, free from distortion and loosening during the life of the sluice gate.

B. These faces shall be of ample section and so finished that the maximum clearance between the seating surfaces, with the slide in the closed position shall be 0.004 inches.

2.05 SEALS

A. Resilient seals for flush-bottom gates shall be of natural or synthetic rubber.

B. Reclaimed rubber shall not be used.

C. Rubber compounds shall contain no more than 1.5 part of wax per 100 parts of rubber hydrocarbon.

D. Rubber compounds shall be free of vegetable oils, vegetable-oil derivatives, animal fats, and animal oils.

E. Rubber seals shall be resistant to microbiological attack, copper poisoning and ozone attack.

F. Design of the seal should be such as to provide tight shutoff.

G. Seals shall be mounted on the slide and shall be securely held in place with a retainer bar bolted to the slide leaving an unobstructed flush invert.

2.06 THRUST NUT

A. Gate shall be provided with a thrust nut for connecting the stem to the slide. It shall be of ample design to take the thrust developed during gate operation under the maximum operating head condition loads with a safety factor of 5 in opening and closing direction.

B. The thrust nut and slide shall be constructed to prevent turning off the thrust nut in the pocket in the slide.

2.07 WEDGING DEVICES

A. Sluice gate shall be equipped with adjustable side-wedging devices to provide contact between the slide and frame facings when the gate is in closed position.

B. All faces shall be accurately machined to give maximum contact and wedging action.

C. Wedges shall be fully adjustable and so designed that they will remain in the fixed position after adjustment.

2.08 ASSEMBLY BOLTS, STUDS, NUTS AND ANCHOR BOLTS

A. All assembly bolts, studs, nuts, and anchor bolts shall be of such size and spacing as required to provide for the design forces with a safety factor of 5.

B. Bolting on circular flanged-back gates shall mate with 125-pound drilling as specified in ANSI B16.1.

C. An adequate number of holes shall be provided in the flange on the back of the gate to prevent leakage under the design heads and to resist the shearing action caused by closing and opening forces.

2.09 WALL THIMBLES

A. Wall thimbles shall be made of austenitic gray iron (Ni-Resist) and shall be furnished by the gate manufacturer.

B. The wall thimble shall provide a rigid mounting designed to prevent warping of the gate frame during installation.

2.010 STEMS AND STEM COUPLINGS

A. Operating stems shall be of a size to safely withstand, without buckling or permanent distortion, stresses induced by normal operating forces.

B. Stems shall be fabricated from round bar stock of stainless steel and shall be provided with 29 degrees modified or full acme threads.

C. Stems composed of 2 or more sections shall be joined by stainless steel couplings threaded and keyed to stems, or couplings of the same material as the stems, pinned, bolted or welded and pinned to the stems.

2.011 STEM GUIDES

A. Stem guides shall be austenitic gray iron (Ni-Resist), with stainless steel bushings, and mounted on cast brackets.

B. Guides shall be adjustable in two directions and shall be so constructed that when properly spaced they will hold the stem in alignment and still allow enough play to permit easy operation.

C. Stem guide spacing shall be as recommended by the manufacturer, but in no case shall it exceed an l/r ratio of 200.

D. Brackets shall be attached to the wall by anchor bolts of sufficient strength to prevent twisting or sagging under load.

2.012 MANUAL OPERATOR FLOOR STANDS

A. Manual operation shall be by crank-operated floor stands or as shown on the plans.

B. Crank-operated type shall have gear reduction depending upon the lifting capacity required.

C. Each type shall be provided with a threaded cast bronze lift nut to engage the operating stem.

D. Tapered roller bearings shall be provided above and below a flange on the operating nut to support both opening and closing thrusts.

E. Floor stands shall operate the gates with not greater than a 40-pound pull on the crank.

F. Gears, where required, shall be steel or cast iron with machine-cut teeth designed for smooth operation.

G. The pinion shafts on crank-operated floor stands, either single or double, shall be supported on tapered roller bearings or needle bearings.

H. All components shall be totally enclosed in a cast iron case and cover.

I. Positive mechanical seals shall be provided on the operating nut and the pinion shafts where they extend from the cast iron case or gear box to retain lubricant and to exclude moisture and dirt.

J. Lubricating fittings shall be provided for the lubrication of all gears and bearings.

K. The removable crank shall be cast iron with a revolving brass grip.

L. Floor stands shall include a cast iron pedestal design to position the input shaft approximately 36 inches above the operating floor.

2.013 WORKMANSHIP

A. All parts in the sluice gate and accessories shall be accurately machined on mating and bearing surfaces.

B. All like parts, except the bronze seating surfaces shall be interchangeable so that replacement parts can be furnished at any time and attached in the field with a minimum of fitting, chipping or re-machining.

C. All parts shall conform to design dimensions and shall be free of defects of material and workmanship.

D. All attaching bolt holes shall be drilled accurately to layout indicated on the drawings.

E. All casting shall be clean and sound without defect capable of impairing their functions.

F. The seating facings shall be machined to a finish of 63 micro-inch. The applicable standard is ANSI B46.1.

G. All mating surfaces, such as guides-to-frame and frame-to-wall thimble, shall be machined flat.

2.014 SHOP TESTING

A. Before the final assembly, all seating and wedging surfaces shall be thoroughly cleaned of all foreign materials and final adjustments made.

B. With the gate fully closed, clearance between the seating faces shall be checked with a 0.004 inch thickness gauge. If this thickness gauge can be inserted between seating faces, wedging devices must be readjusted or the gate slide or gate frame or both re-machined, until insertion is no longer possible.

C. In the event of re-machining, clearances will again be checked as stated above.

D. After completion, all seating and wedging surfaces shall be thoroughly cleaned of all foreign materials and final adjustments made.

E. The sluice gate shall then be shop operated from the fully-closed to the fully-open position to verify that the assembly is workable.

PART 3 - EXECUTION

3.01 STORAGE AND INSTALLATION

A. Sluice gates and equipment shall be stored and installed in accordance with the installation manual furnished by the gate manufacturer.

B. After installation, the completely assembled gate, stem, guides and lift shall be operated through one full cycle to demonstrate satisfactory operation.

C. Such adjustments as necessary will be made until operation is approved by the Engineer.

D. The gate shall be subjected to leakage tests and pass the standard requirements for maximum leakage as specified in AWWA C560.

END OF SECTION

RICHLAND CREEK RESERVOIR
Water for Today and Tomorrow

Prebid Conference

Project Title: RCWSP #3_Reservoir
Meeting Location: Wayne Kirby Community Center, Burnt Hickory Park

Date: May 5, 2016
Time: 10:00 a.m.

Name	Initials	Company	Contact Number	Email Address
Bob Faulhaber		Bauer	931-252-0818	bfaulhaber@bauerfoundations.com
Joe Nichols		"	813-333-3131	jnichols@bauer-foundations.com
John Dean		Arcadis	770 431 2666	John.Dean@Arcadis.com
Andy O'Keeffe		Kiewit	7704872300	andy.okeeffe@kiewit.com
Kerry Brown		Paulding Co.	6782244032	Kbrown@paulding.gov
Laurie Ashmore		Paulding Water		
Michel Gavillet		Kiewit	201 571-2894	michel.gavillet@kiewit.com
HEATH STONE		PHILLIPS & JORDAN	865-392-3057	HSTONE@PANDJ.COM
Robert L Allen		Phillips & Jordan	865-313-0986	rallen@pandj.com
Orrin Ladd		Mi-con	920-539-1422	oladd@Michels.us
Keith Scarbrough		BRAD Cole	7-834-4681	keiths@bradcoleconstruction.co.
Brad Cole		Brad Cole	"	bradc@ "

NAME	COMPANY	CONTACT #	EMAIL
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CLAY RATHBUN	Terra Firma	913 669-6780	Clay@terrafirmaconstruction.com
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JOHN OSTERLAND	PLATEAU EXCAVATION	404 502-7346	josterland@plateauexcavation.com
Fabio Santillan	Treviicos	(785) 4106831	fsantillan@treviicos.com
Rick Herter	CJ Mahan	(614) 314-5826	Rherter@cjmahan.com
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TOM EALEY'S	A.S.I Const	719 248 5654	TEALEY'S@ASICONSTRUCTUS.COM
Joe Gaskin	Brendis	770 368-1625	joe.gaskin@brendis.com
LORI CRAMM	BROWN AND CALDWELL	678-296-2915	LCRAMM@BROWNCALD.COM
KELLY COMSTOCK	BROWN AND CALDWELL	770.673.3669	KCOMSTOCK@BROWNCALD.COM

NAME	COMPANY	CONTACT #	EMAIL
Jim McCombs	Cascade	740.350.6611	jmccombs@cascade-env.com
Steve Stratton	cascade	6144021808	sstratton@cascade-env.com
Peter Moretti	Geo-Solutions	724-335-7774	pmoretti@geo-solutions.com
Joe Schiavone	THalle Const.	919-201-2134	JSCHIAVONE@THALLE.com

RICHLAND CREEK RESERVOIR

Water for Today and Tomorrow

Paulding County, Georgia

Richland Creek Reservoir Project

Prebid Conference
May 5, 2016

1. Introductions

Laurie Ashmore | Paulding County Water System

2. Sign-in Sheet

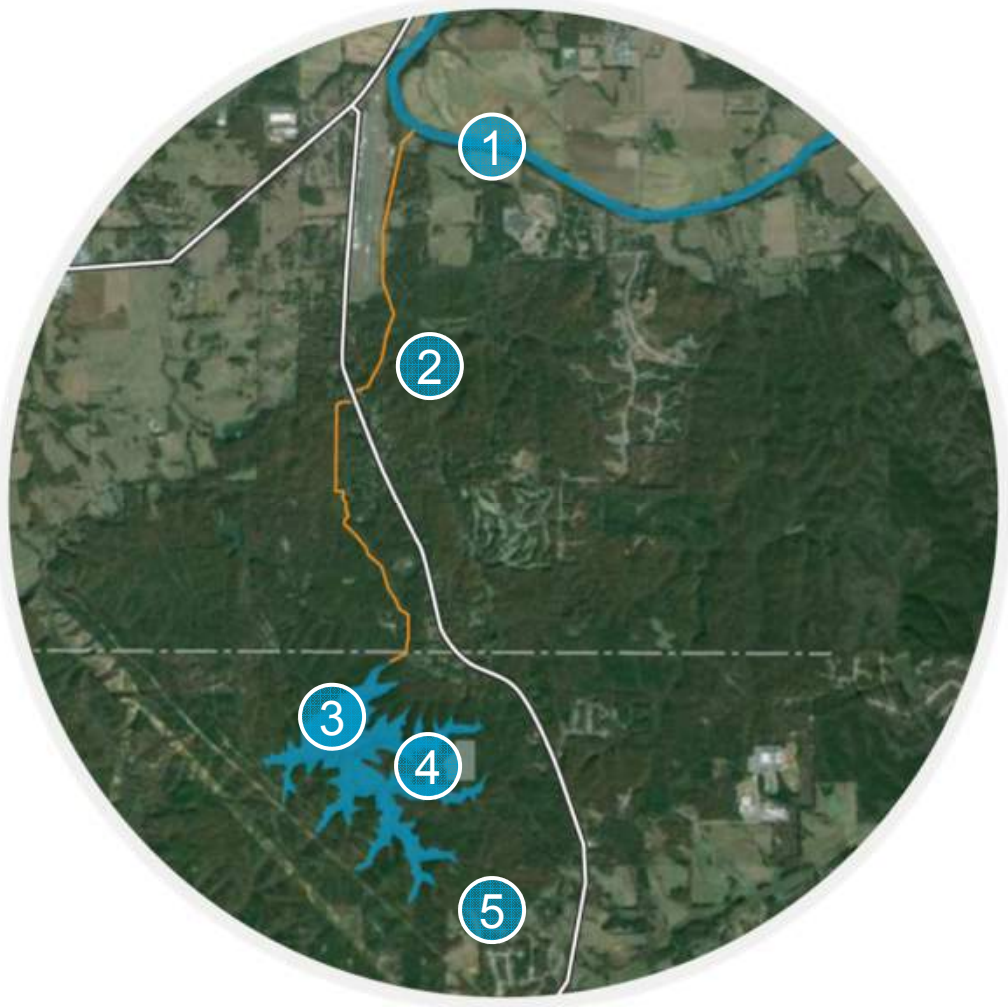
Kelly Comstock | Brown and Caldwell

3. Overview of Program

Kelly Comstock | Brown and Caldwell

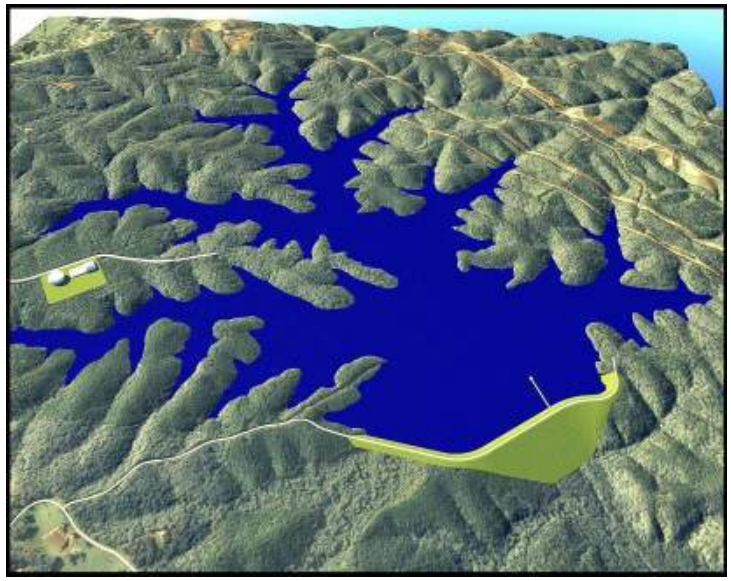
Richland Creek Water Supply Program Elements

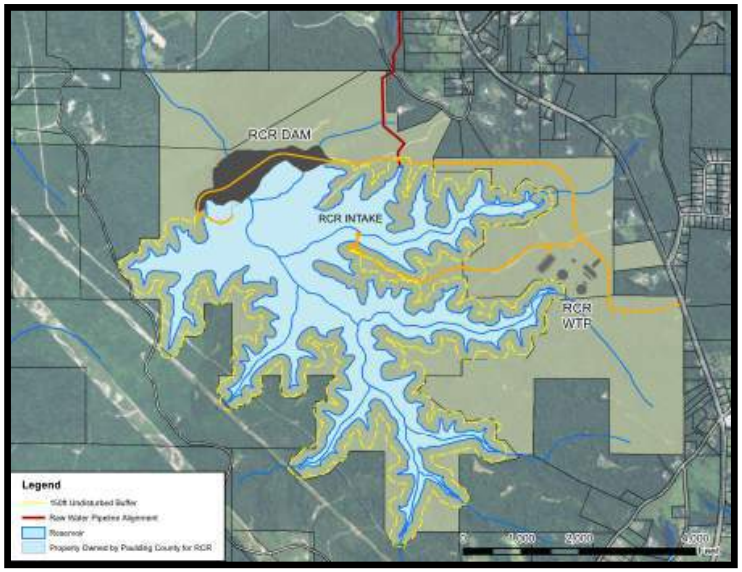
1. River Intake and Pump Station
2. Raw Water Pipeline
3. Dam and Reservoir
4. Water Treatment Plant, Reservoir Intake and Pump Station
5. Distribution System Improvements



Richland Creek Reservoir

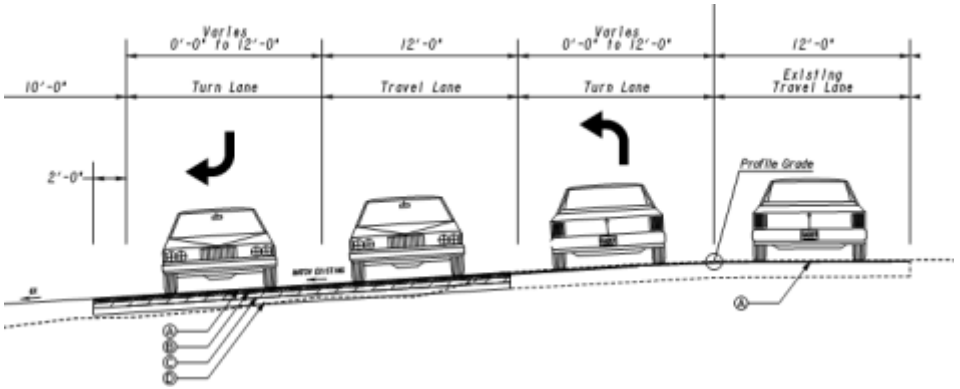
- 305 acre, 3.4 BG
- Passive recreation will be allowed
- Boat ramp and dock for public access
- Adjacent park
- 150 ft undisturbed buffer around reservoir



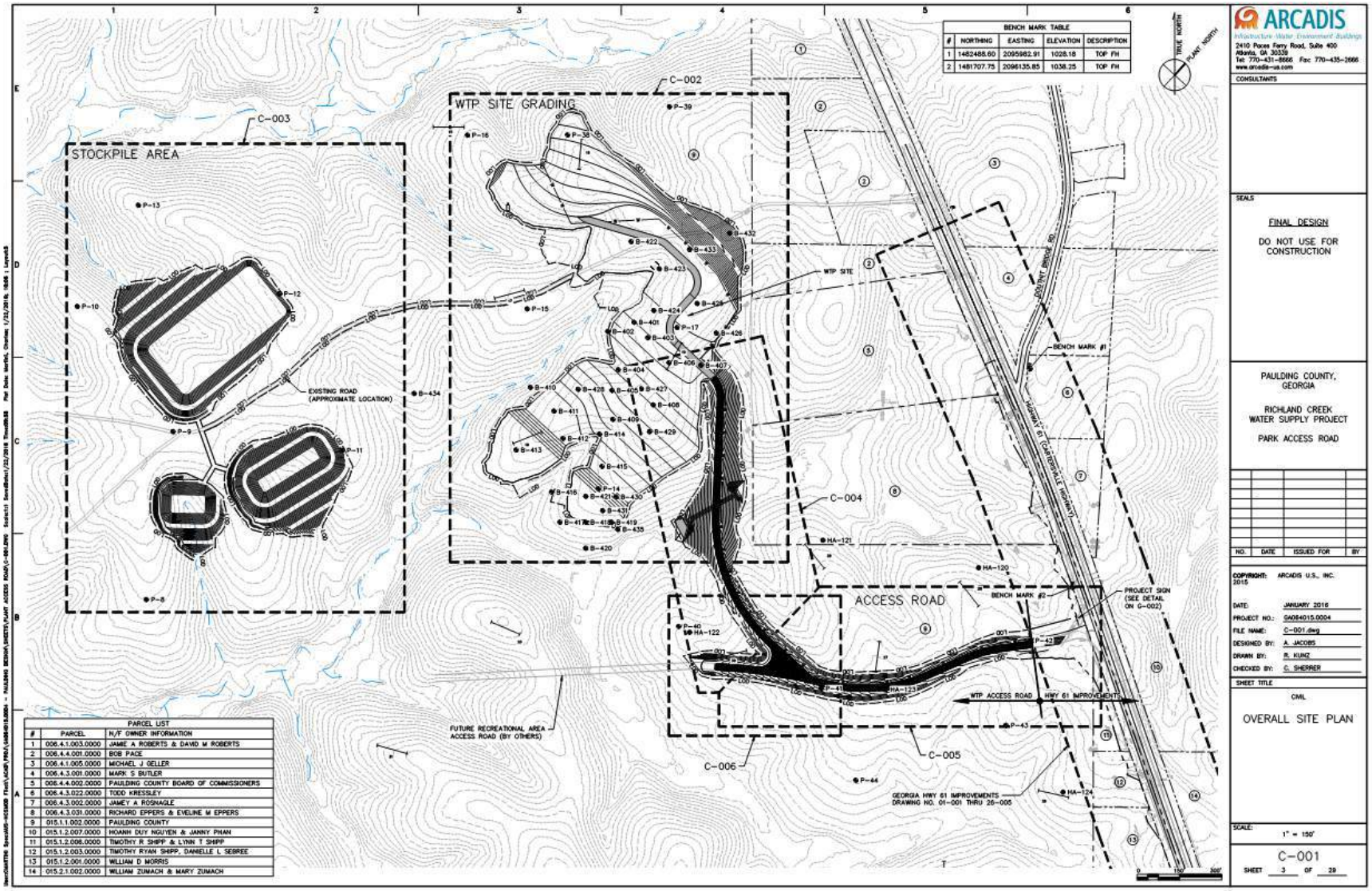


Initial Site Preparation Contract

- Hwy 61 intersection improvements (turning lane and acceleration / deceleration lane)
- Entrance road to be ready for WTP and Reservoir contractors
- Stockpiling of soil from WTP site
- Being completed by Brad Cole Construction

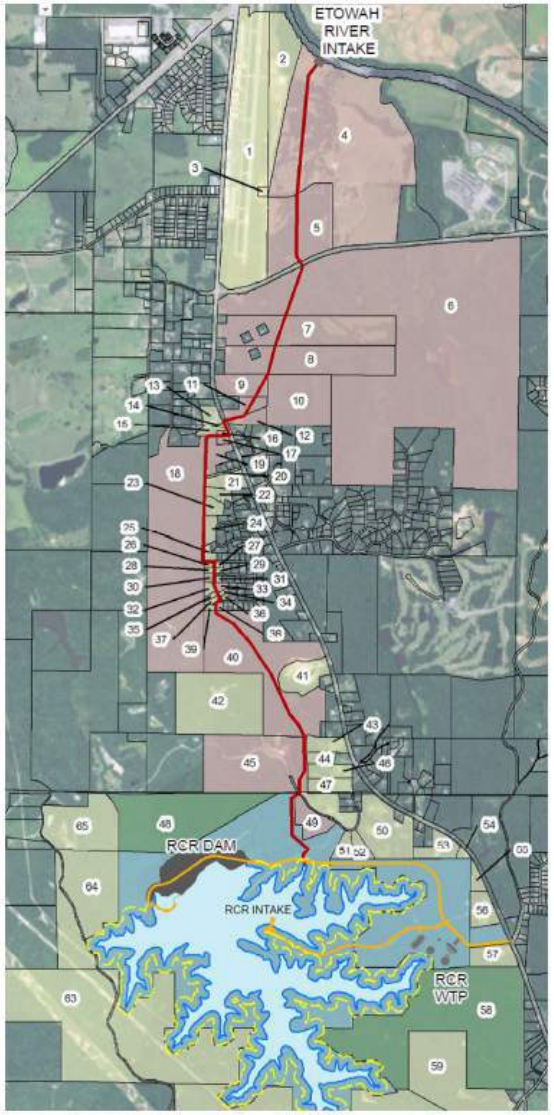


Initial Site Preparation Contract



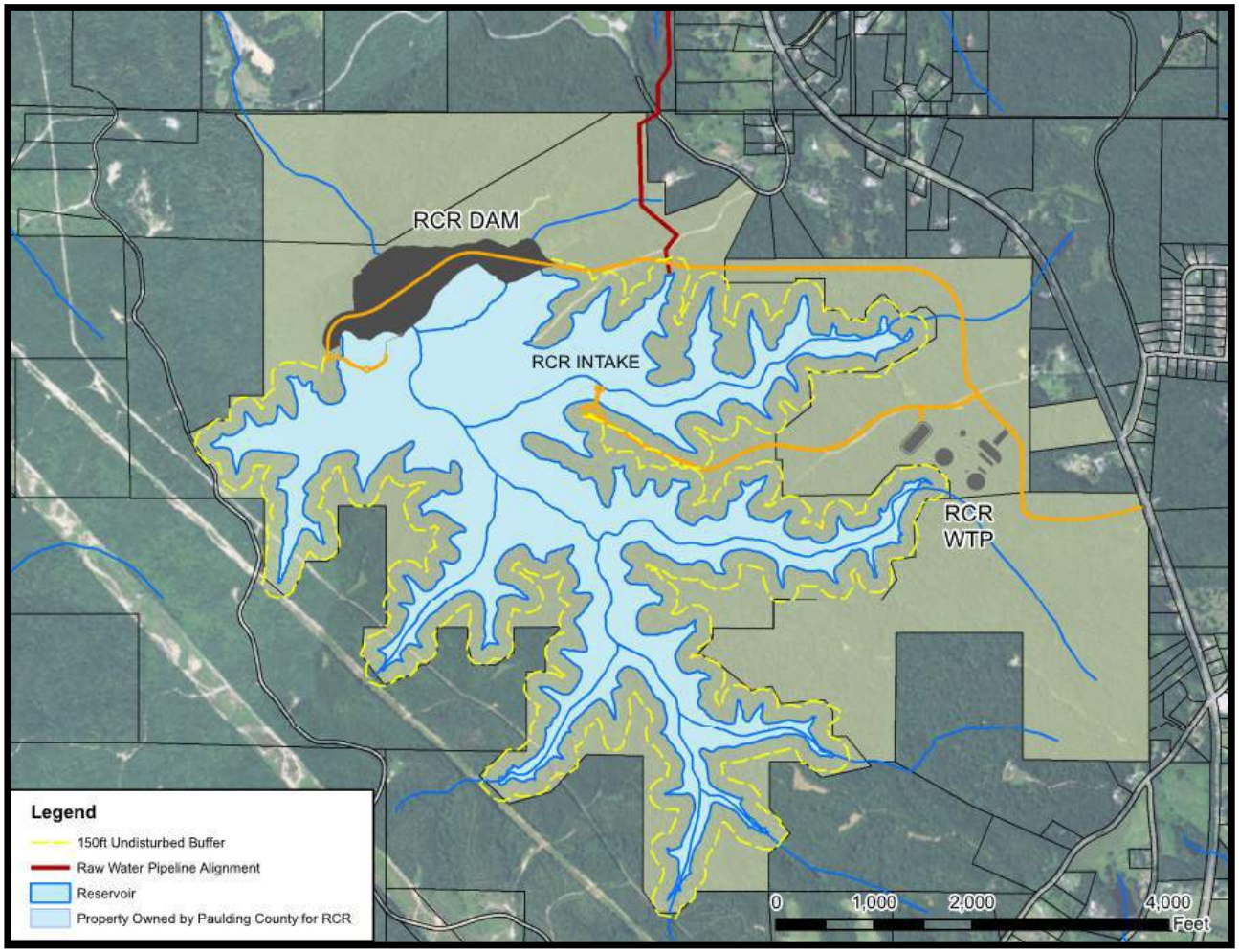
Raw Water Pipeline

- 48” raw water pipeline from the Etowah River Pump Station
- Being completed by Garney Construction
- Connection point at Old Dallas Road



Richland Creek Reservoir Buffer Requirements

- 150 ft undisturbed buffer must be maintained



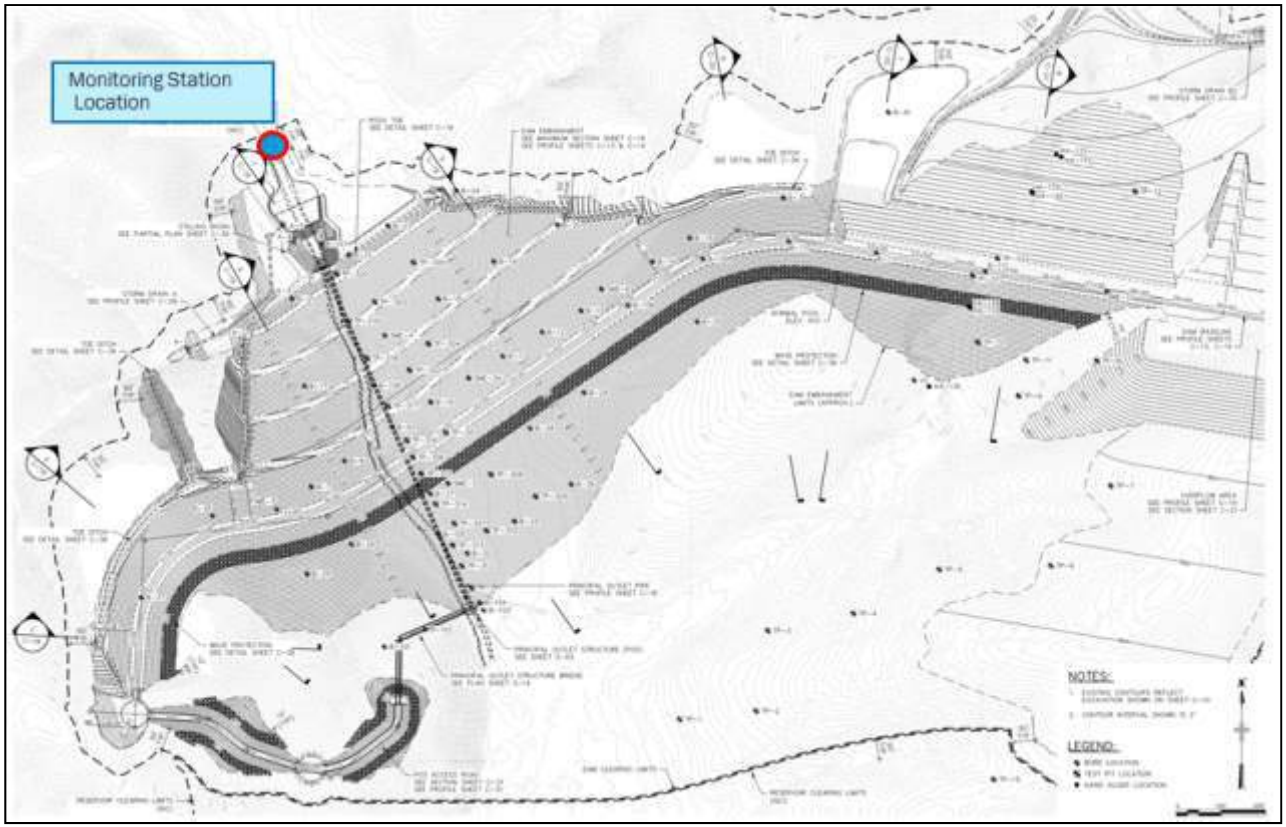
404 Permit Requirements
USGS Monitoring Station Installed and Online

Required by Permit to be installed in advance of any construction activity

Continuous flow and water quality analysis

Installed by USGS

- pH
- Turbidity
- Temperature
- DO
- Conductivity



Elevated Monitoring Station Tower

Gage and Probe Installation in Richland Creek

Instrumentation Enclosure and Solar Array

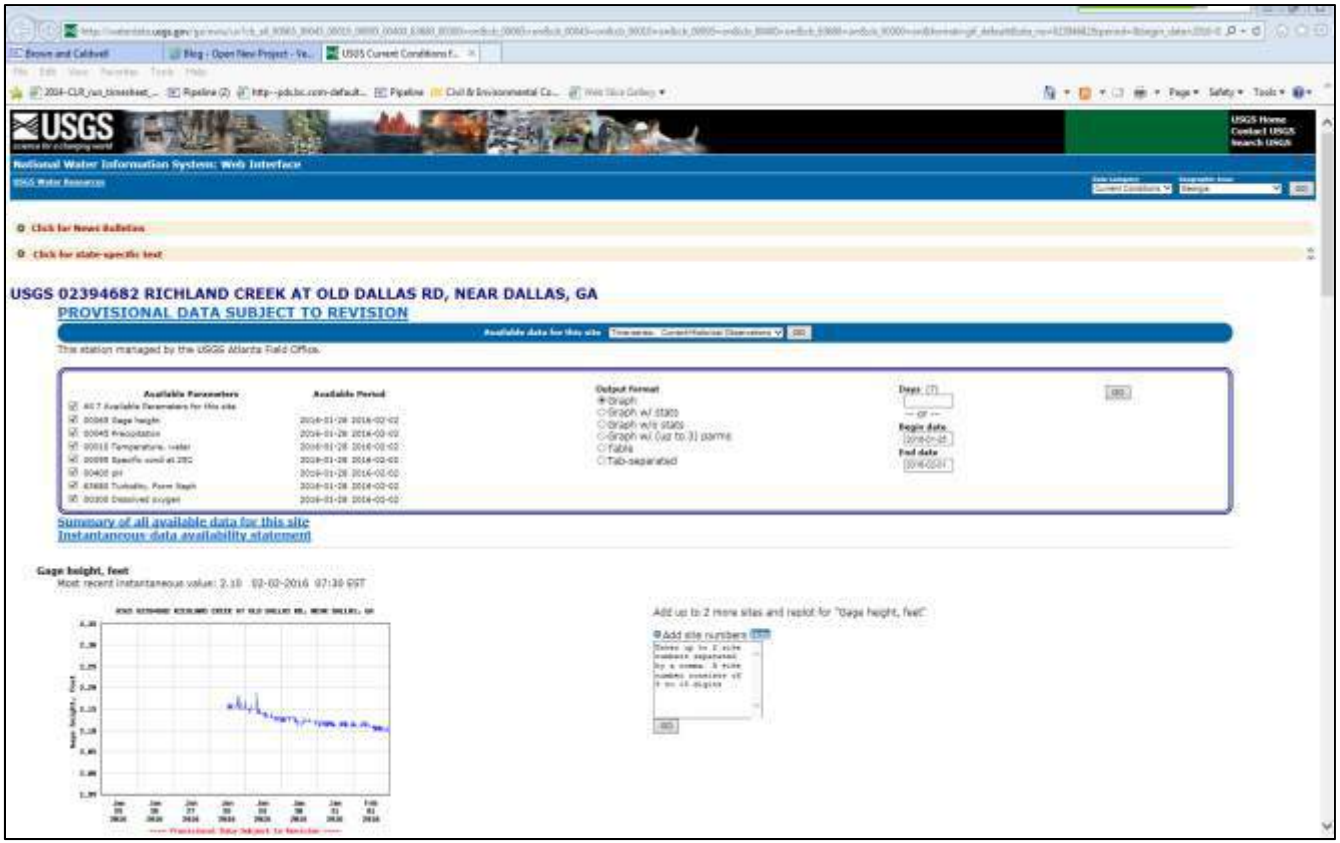
Instrumentation Within Secure Enclosure

Satellite Communication System for Station

USGS Monitoring Station Installed and Online

Continuous Data available online through USGS website

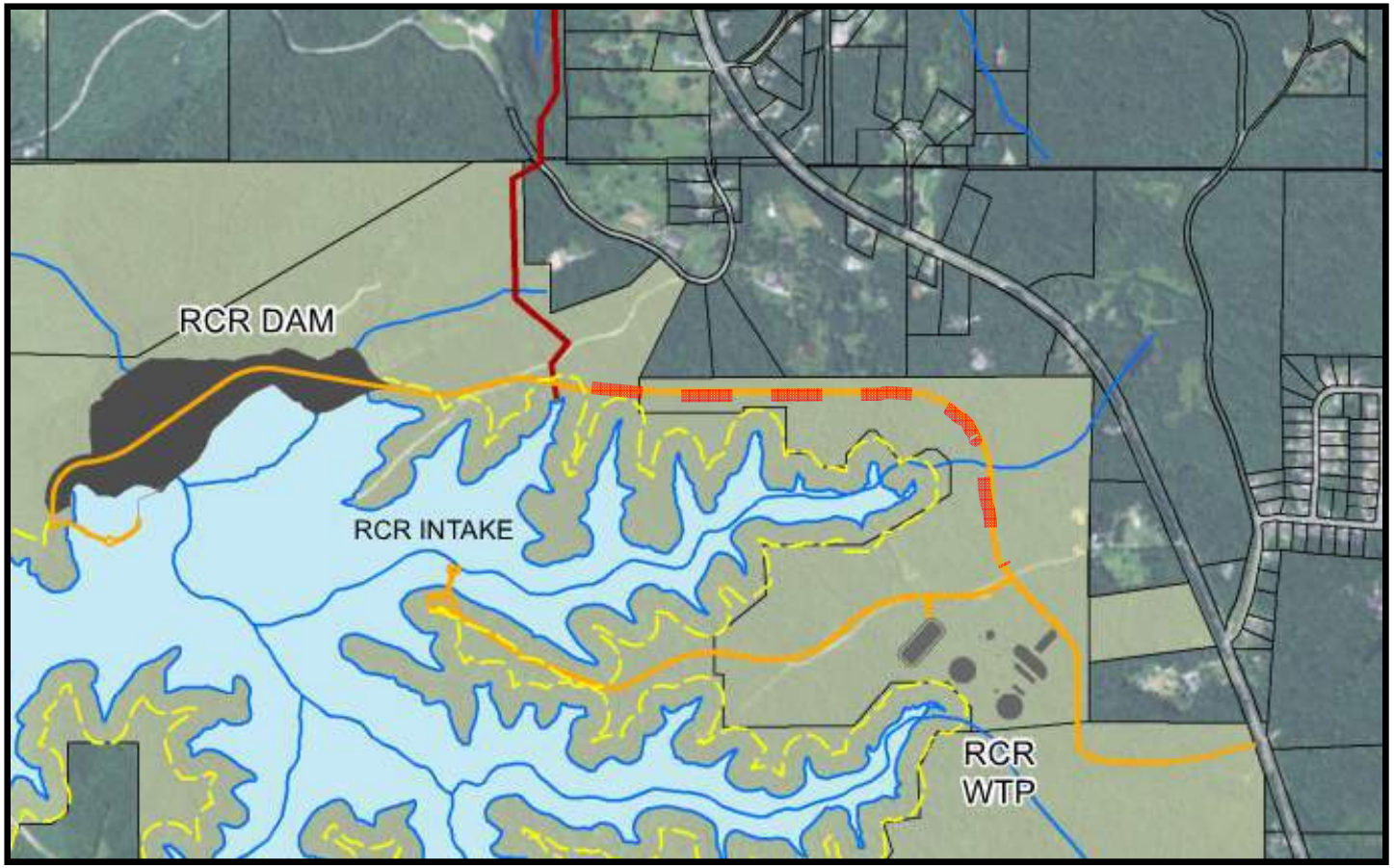
System allows for custom tracking setpoint and cell phone alarm



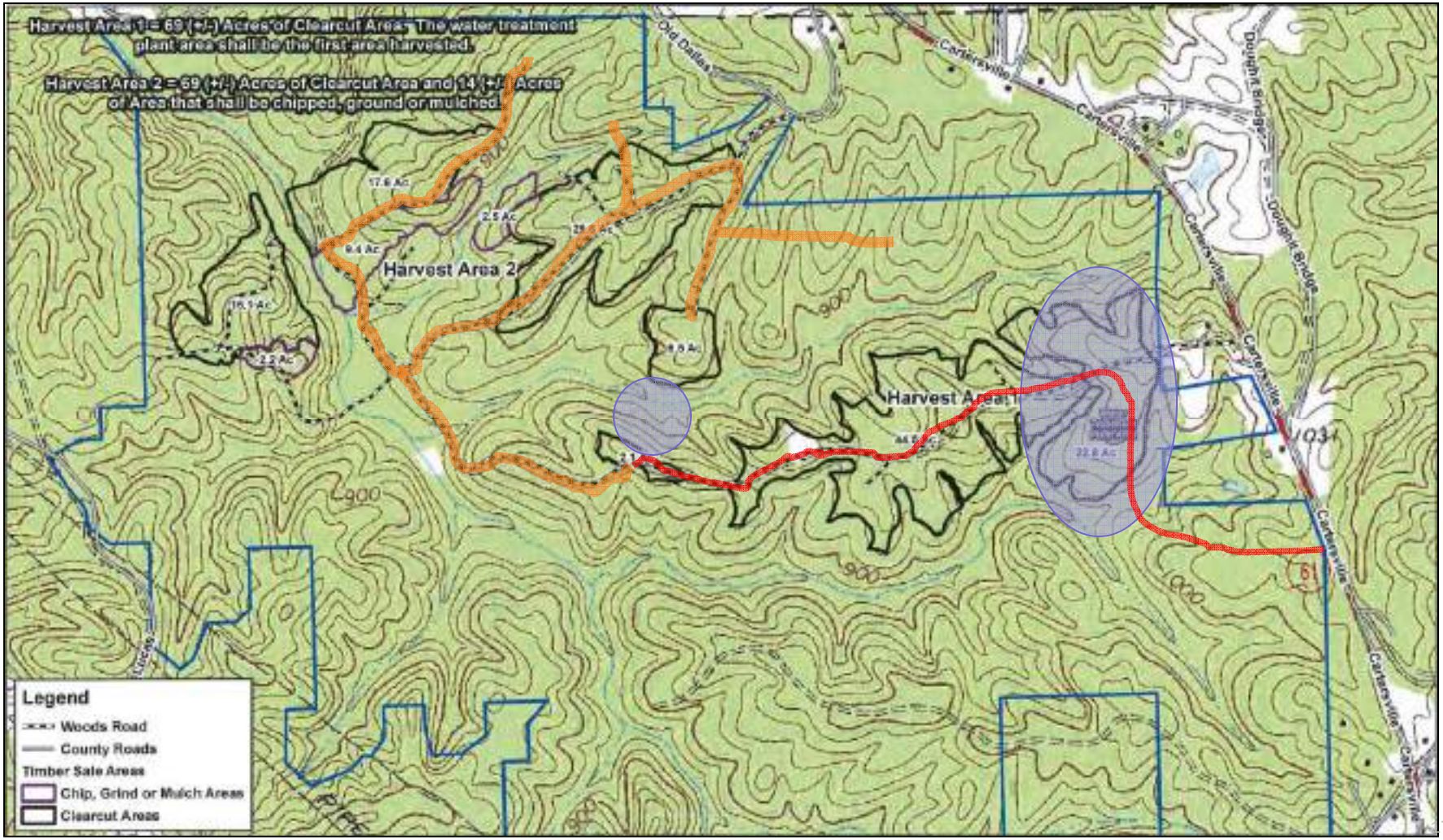
4. Staging, Access, Parking, Use of Facilities

Kelly Comstock | Brown and Caldwell

Richland Creek Reservoir Access



Planned Reservoir Contractor Access to Borrow Areas



5. Overview of Project

Jeff Powers | Hazen and Sawyer
Craig Robinson | Piedmont Geotechnical Consultants

6. Addenda

John Dean | ARCADIS

7. Bid Date and Time

John Dean | ARCADIS

Questions

Due May 23, 2016

Kelly Comstock, P.E.
RCR Program Manager
Brown and Caldwell
990 Hammond Drive Suite 400
Atlanta, GA 30328
Email: Kcomstock@brwncald.com
Phone: (770) 673-3669
Fax: (770) 369-9495

8. Completion Time and Project Schedule

John Dean | ARCADIS

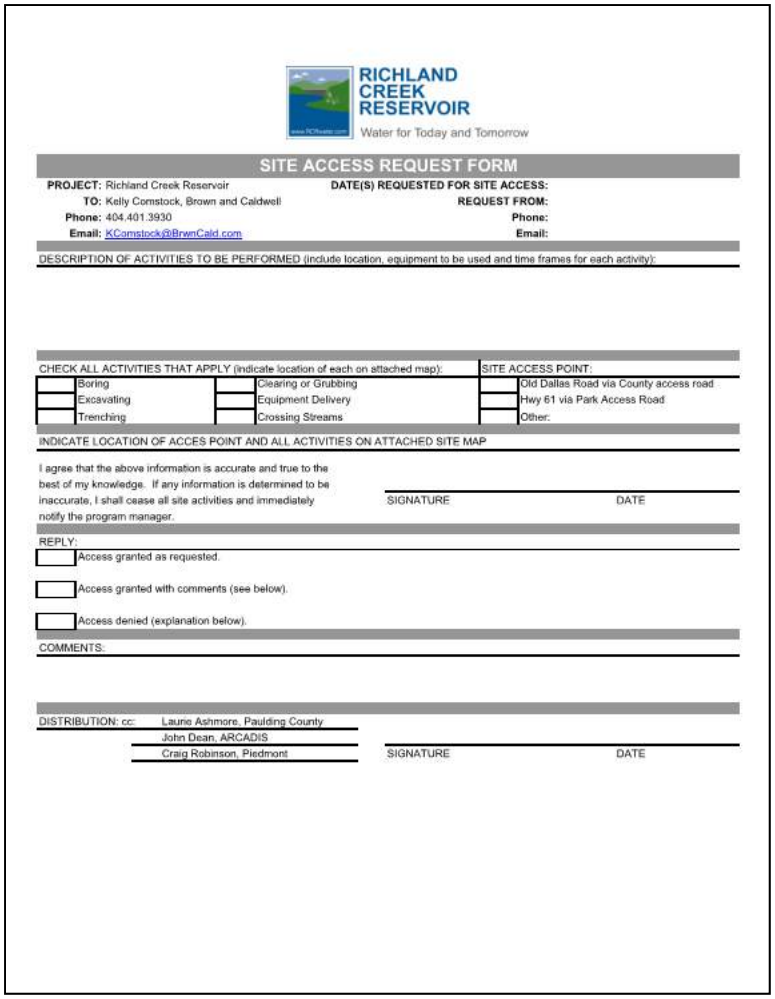
9. Safety

Joe Gaskin | ARCADIS

10. Site Examination

Kelly Comstock | Brown and Caldwell

Site Access Request Form



RICHLAND CREEK RESERVOIR
Water for Today and Tomorrow

SITE ACCESS REQUEST FORM

PROJECT: Richland Creek Reservoir
TO: Kelly Comstock, Brown and Caldwell
Phone: 404.401.3930
Email: KComstock@BrwnCald.com

DATE(S) REQUESTED FOR SITE ACCESS:
REQUEST FROM:
Phone:
Email:

DESCRIPTION OF ACTIVITIES TO BE PERFORMED (include location, equipment to be used and time frames for each activity):

CHECK ALL ACTIVITIES THAT APPLY (indicate location of each on attached map):				SITE ACCESS POINT:	
	Boring		Clearing or Grubbing		Old Dallas Road via County access road
	Excavating		Equipment Delivery		Hwy 61 via Park Access Road
	Trenching		Crossing Streams		Other:

INDICATE LOCATION OF ACCES POINT AND ALL ACTIVITIES ON ATTACHED SITE MAP

I agree that the above information is accurate and true to the best of my knowledge. If any information is determined to be inaccurate, I shall cease all site activities and immediately notify the program manager.

SIGNATURE DATE

REPLY:

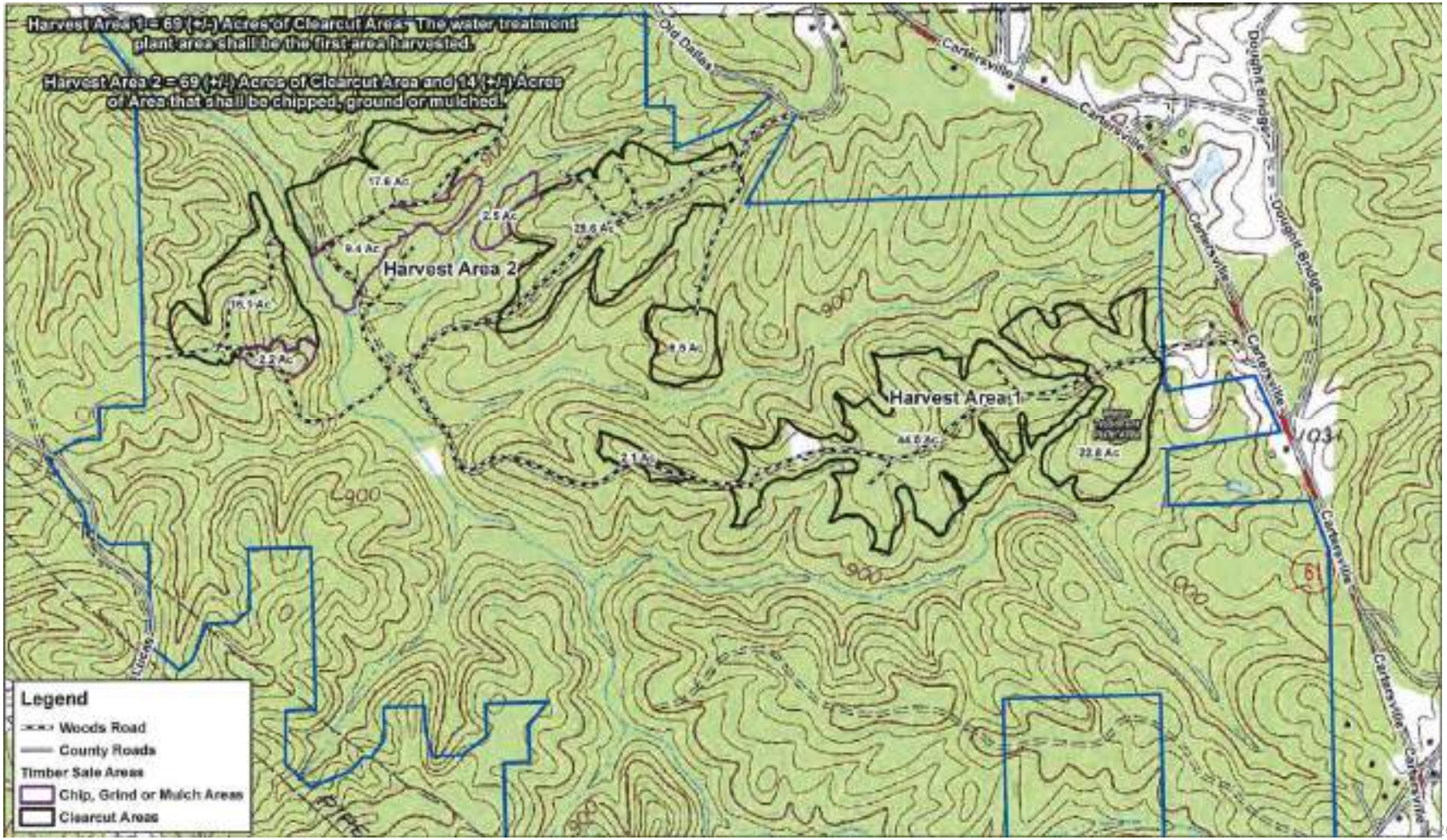
- ☐ Access granted as requested.
- ☐ Access granted with comments (see below).
- ☐ Access denied (explanation below).

COMMENTS:

DISTRIBUTION: cc: Laurie Ashmore, Paulding County
John Dean, ARCADIS
Craig Robinson, Piedmont

SIGNATURE DATE

Richland Creek Reservoir Site Access



11. Required Bid Submittals

John Dean | ARCADIS

12. Bid Form

John Dean | ARCADIS

13. Bidders' Qualifications

John Dean | ARCADIS

14. Open Floor

John Dean | ARCADIS

15. Adjourn