### FINAL TECHNICAL REPORT

## USGS NGWMN Grant G19AC00280 11/15/2019 - 11/14/2021

# Wells and Transboundary Conditions at

# D. F. Walker Elementary School (Chowan County, NC)

### **Prepared by**

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#### Overview of Work Planned and Accomplished

On 9/24/2019, the North Carolina Division of Water Resources (DWR) was awarded a \$57,666 grant (G19AC00280) in support of the USGS National Ground-Water Monitoring Network (NGWMN). During the two-year grant period from 11/15/2019 to 11/14/2021, funding was used to install a multi-well groundwater monitoring station at D. F. Walker Elementary School (DFWS) located at 125 Sandy Ridge Rd in Edenton, Chowan County, NC 27932. DWR completed the DFWS project during the period 6/14/2021 to 6/28/2021 at a cost of \$57,666 or \$104.85 per foot.

State matching funds expended by DWR during the grant period consisted of \$57,666 for two replacement wells at DWR's Chinquapin Elementary School monitoring station in Duplin County, NC, at an average cost of \$87.57 per foot.

Wells constructed with grant funds and state matching funds have been added to the state well network and NGWMN.

#### <u>Description of Work Accomplished under Each Objective</u>

During 2021, three monitoring wells were installed at DFWS by Toano Well and Pump Service, Inc. of Toano, VA, using a mud rotary drilling rig and water-based drilling fluid. Consisting of three wells 30, 195 and 325 feet (ft) deep, the station fills an important data gap within the Albemarle-Tidewater area of northeastern North Carolina. With well screens set in the Surficial, Yorktown, and Beaufort aquifers, the station will aid in resolving transboundary issues related to regional groundwater use and correlation of these hydrogeologic units throughout the region. Drilling cost increases at the time of contract renewal resulted in DWR having to submit at grant modification request to USGS. This modification reduced the number of wells drilled from four to three. As a result, a Castle Hayne aquifer well was not drilled.

The three wells were installed in line with one another at 20 ft spacing. In the deepest well (325 ft), drill cuttings were sampled and described at ten-foot intervals and geophysical logs consisting of gamma, spontaneous potential, single point resistivity, and 16" and 64" normal resistivity were made by the driller using Century logging equipment.

Each well was completed with 4" poly-vinyl chloride (PVC) well casing and 10 ft of stainless steel or PVC screen followed by a 5 ft section of blank casing and cap. In addition, the two deepest wells were installed with approximately 30 ft of 10" PVC surface casing. Each well was terminated approximately 2.5 ft above grade and protected by a 6" steel casing, locking cap, and 2 ft by 2 ft concrete pad. The wells were then developed by the driller using compressed air injected until water from each well ran clear.

Following well completion, DWR field staff purged each well, measured water levels and water quality field parameters, surveyed casing elevations, and installed water level data loggers. The wells were then added to the state well network and NGWMN at www.ncwater.org/gwmb and https://www.usgs.gov, respectively.

Figures and photographs for the project are provided in Appendix A. These include site maps, geophysical and lithologic logs, well hydrographs, and potentiometric surface maps. Details for each of the grant-funded and state match-funded wells are tabulated in Appendix B in Table 1. State-required GW-1 well construction records are provided in Appendix C for the grant-funded wells, and DWR's data management plan for data collection, quality control, and storage procedures is provided in Appendix D.

#### **Description of Work Accomplished with DWR Matching Funds**

During 2020, two replacement wells were installed at Chinquapin Elementary School at a cost of \$73,030. Of this amount, \$57,666 was applied as an in-kind services match to federal funding. The Chinquapin wells included a Surficial aquifer and Cretaceous Lower Cape Fear aquifer well installed to depths of 34 and 800 ft, respectively. Drilling services were provided by A. C. Schultes of the Carolinas. Well construction, sampling, logging, datalogger installation, and other tasks were performed in the same manner as at DFWS. Data for the Chinquapin wells is accessible through both the NGWMN Registry and DWR websites.

#### Work Done As Data Provider in Support of NGWMN

Work completed has consisted of well drilling under Objective 5.

#### **Data Collection and Drilling Activities Completed**

Data collection and drilling activities is discussed in previous sections describing work accomplished.

#### Table of New or Replacement Wells Added to the NGWMN

The three new and two replacement wells installed during this project are listed in Table 1 of Appendix B.

#### **Well Construction Details**

Well construction details are provided in the GW-1 Well Construction Records in Appendix C.

#### **Methods Used for Data Collection**

Methods used for data collection are provided in the Data Management Plan in Appendix D.

#### <u>Procedures Used to Quality Assure Data Prior to Entry Into NGWMN</u>

Data quality assurance procedures are provided in the Data Management Plan in Appendix D.

#### **Updates to Web Services**

In 2020, DWR advised USGS that it had shifted to a new server with separate domain for web services.

#### **Problems Serving Data to the NGWMN Data Portal**

There have been no problems serving data to the NGWMN portal.

#### **Setting and Hydrogeology of DFWS Monitoring Station**

The DFWS groundwater monitoring station is situated in the northeastern coastal plain physiographic province at latitude 36.165368 and longitude -76.650354. Site elevation is approximately 37.94 ft above mean sea level (MSL). Relative to nearby points of reference, the DFWS monitoring station is located approximately 50 miles west of the Atlantic Ocean and 27 miles south of the North Carolina - Virginia state line.

The general region where the DFWS station is located is referred to in this report as the Albemarle-Tidewater area and consists of northeastern North Carolina and southeastern Virginia. The general boundaries of the Albemarle-Tidewater area are the James River and Chesapeake Bay to the north, the Atlantic Ocean to the east, the Albemarle Sound to the south, and the Chowan and Blackwater Rivers to the west. Elevation of the Albemarle-Tidewater area generally increases from east to west ranging from sea level to nearly 100 ft above sea level. The terrain within the area is generally broad and flat to the east becoming dissected and gently rolling to the west.

The geology of the area consists of Recent to Cretaceous coastal plain sediments which dip and thicken eastward. The estimated depth to bedrock at the DFWS well station is 1,930 ft deep (-1892 ft MSL). Based on well records, basement bedrock consists of igneous and metamorphic bedrock, and in localized areas, Triassic basin sediments. The geology of the Albemarle-Tidewater area is complicated by multiple marine transgression and regression events, and structural and stratigraphic complexities related to the Chesapeake Bay impact crater of 35 million years ago.

Principal Aquifers within the Albemarle-Tidewater area consist of the Surficial, Castle Hayne, and Northern Atlantic coastal plain aquifer systems, the latter of which includes the Beaufort, Upper Cape Fear, and Lower Cape Fear North Carolina aquifers. The DFWS wells monitor the Surficial, Yorktown, and Beaufort aquifers and reach total depths of 30, 195, and 325 ft, respectively.

Within the Albemarle-Tidewater area, chlorides and other dissolved solids generally increase in all aquifers with increasing depth and proximity to the Atlantic Ocean. Groundwater quality in the three aquifers at DFWS was tested in August 2021 for chlorides, specific conductance, salinity, and pH. Chloride levels were detected in the Beaufort well at 53 mg/l but were below detection limits of 32 ppm in the shallower Surficial and Yorktown wells. Test results are provided in Table 1.

#### **Regional Hydrogeology and Transboundary Conditions**

The Albemarle-Tidewater area lies in the Northern Atlantic Coastal Plain. Within this area, aquifer names used in North Carolina, Virginia, and by the USGS often vary, as shown in Table 1. The absence of consistent, uniform naming conventions frequently makes correlating geologic and hydrologic units across state boundaries difficult. It is anticipated that the geologic and water level data from the new DFWS wells will aid in resolving such transboundary conditions within the Albemarle-Tidewater area.

#### **Acknowledgements**

Special thanks are extended to the Edenton-Chowan Schools Board of Education, especially Gene Jordan, Chair, and Dr. Michael Sasscer, Superintendent, for their support and access to the D. F. Walker Elementary School well drilling site. Additional thanks are extended to David Tawes, Director, Chowan County Water Department for overall support and assistance with the project.

#### Disclaimer

The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. Geological Survey. Mention of trade names or commercial products does not constitute their endorsement by the U.G. Geological Survey.

#### Copies for USGS

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#### References

- 1) Subcommittee on Ground Water of the Advisory Committee on Water Information, 2009 (revised 2013), A national framework for ground water monitoring in the United States: Advisory Committee on Water Information, accessed January 2017, at https://acwi.gov/sogw/ngwmn\_framework\_report\_july2013.pdf.
- 2) G19AC00280 Cooperative Agreement Grant Proposal, NCDWR, 2019, and Grant Modification, 2021.
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- 4) https://cida.usgs.gov/ngwmn/
- 5) http://www.ncwater.org/gwmb
- 6) Lautier, Jeff C., 1998, Hydrogeologic Framework and Ground Water Resources of the North Albemarle Region, North Carolina: NC Department of Environment and Natural Resources, Division of Water Resources, 61 p.
- 7) Status of Virginia's Water Resources, October 2018, A Report on Virginia's Water Resources Management Activities, Virginia Department of Environmental Quality, Commonwealth of Virginia, 49 p.
- 8) McFarland, E. Randolph and T. Scott Bruce, 2006, The Virginia Coastal Plain Hydrogeologic Framework, U. S. Geological Survey Professional Paper 1731, 119 p.
- 9) Trapp, Henry, Jr., and Marilee A. Horn, 1997, Ground Water Atlas of the United States, Hydrologic Investigations Atlas 730-L, Segment 11 Delaware, Maryland, New Jersey, North Carolina, Pennsylvania, Virginia, West Virginia: U.S. Geological Survey, --p. (https://pubs.usgs.gov/ha/730l/report.pdf).

# Appendix A Figures and Photographs

Figure 1. During 2020-2021, three wells were installed at DF Walker Elementary School with USGS funds (G19AC00280) and two wells were installed at Chinquapin Elementary School with NC DWR matching funds. These wells are now included in the National Ground-Water Monitoring Network (NGWMN).

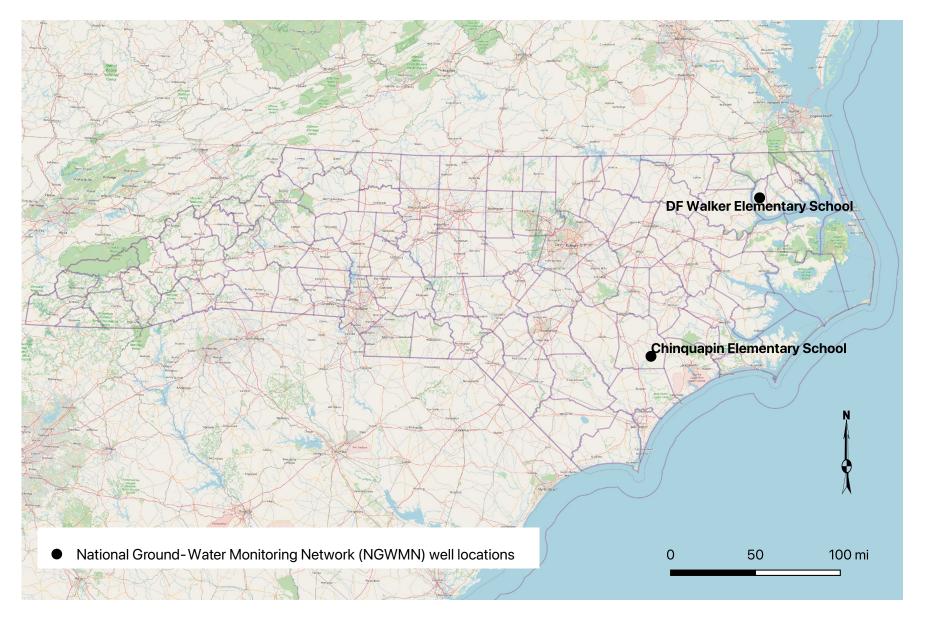
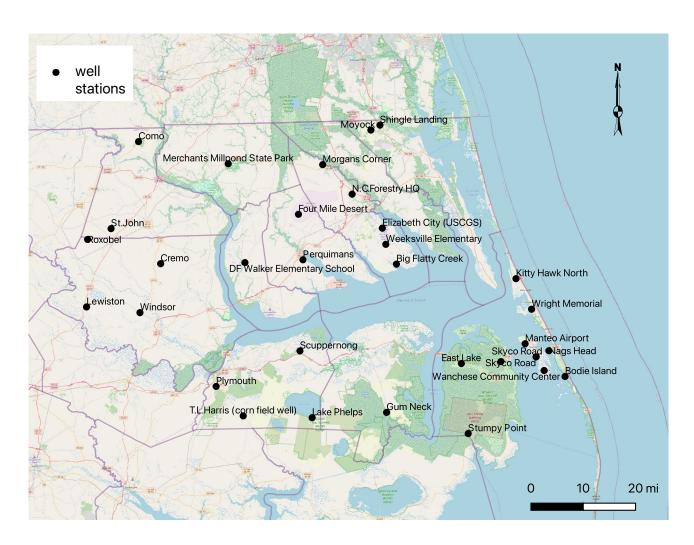
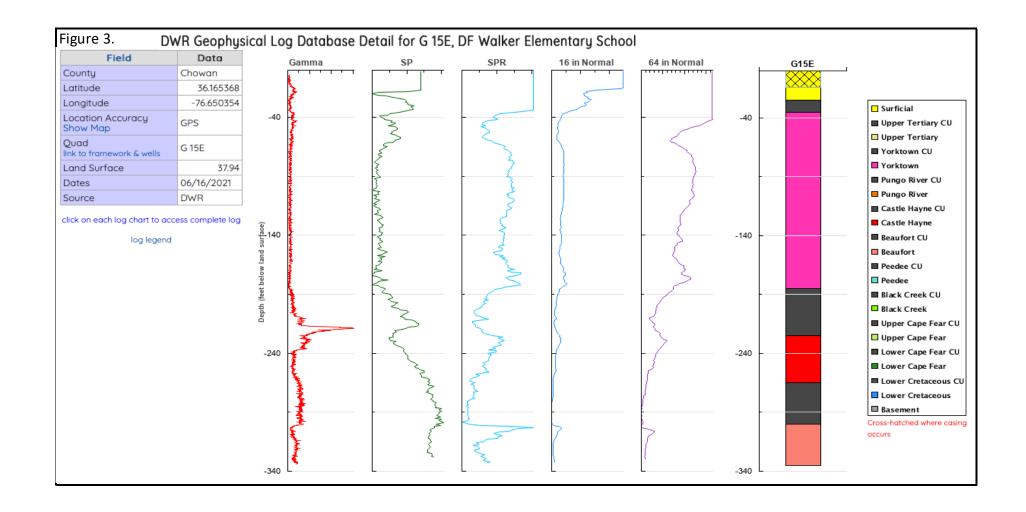


Figure 2. Inset map showing NC DWR well stations in the Albemarle-Tidewater area of northeastern North Carolina. Well stations installed with NGWMN funds include Merchants Millpond State Park, Shingle Landing, and DF Walker School.







#### Figure 4. Lithologic Log

Quad G 15E Well Name DF Walker School County **Chowan** Lat 36.165500 Lon 76.650500 Driller Toano Well and Pump Service Inc. Log Toano Well and Pump Service Inc. TD (ft) 37 +- (37.94) Elevation (ft)

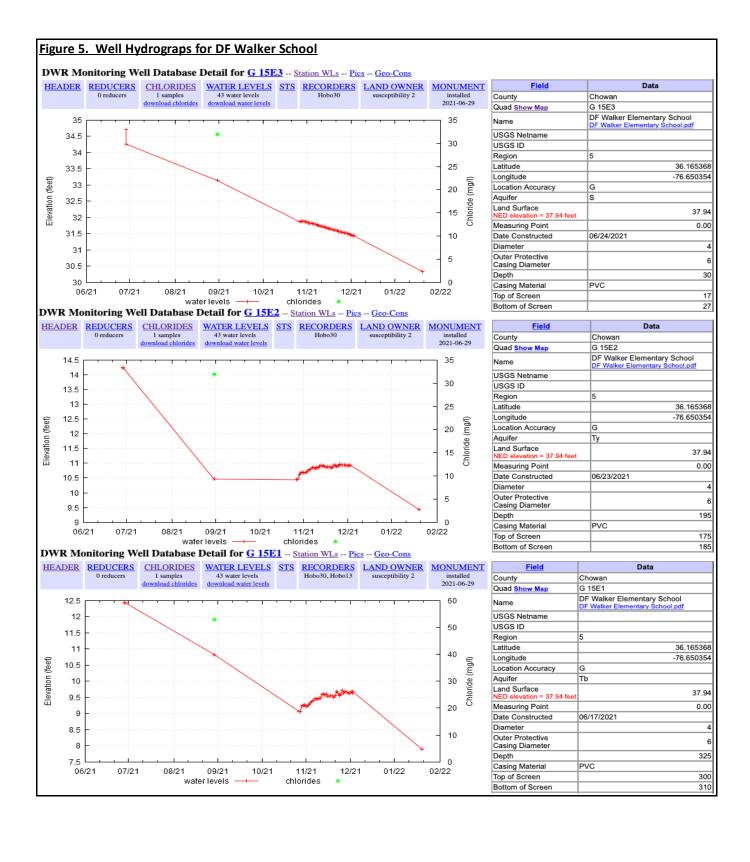
Depth (ft)			<u>Lithology</u>	<u>Lithologic Description</u>	<u>Color</u>	Munsell Color	Formation Top	Well, TD, aquif, csg, scr
0	-	15	SAND	loose	dk yel brn	10 YR 4/2	S @ land surf	surficial well (TD 30)
15	-	25	SILT and CLAY		ol gy	5Y 4/1		4" pvc scr (17-27)
25	-	35	SAND	vc sd with silt, loose	med gy	N4		
35	-	170	SAND with silt	vc sd with silt, friable to loose, calc cmt, abun shell frags, occ pyr and lig, i/b slt and cly	ol gy	5GY 4/1	Ty at 35'	
170	-	185	SANDY LIMESTONE	sdy Is or limey sst with cly, slt, and abun shell frags (basal Yorktown)	"	II .		Ty/Tch well (TD 195)
185	-	237	CLAY	calc cly; abun i/b shell frags beginning at 219; fish vertabrae and shark teeth at 220-230	"	II .		4" ss scr (175-185)
				with drill chatter and high gamma spike at 227.	п	m .	Tch @ 225' +- p	er geophysical log
237	-	270	SILT	calc silt with abun loose vf and coarser i/b qtz sd and vf black specks	п	m .	Tch/Tb boundar	ry unclear based on cuttings;
270	-	300	CLAY	calc cly with first occurrence of abun globular glauc (assumed glauc and not phosphate	п	m .		Tch not screened due to
				because of low gamma response)	п	m .		drill cost increase
300	-	335	LIMESTONE	sdy Is or limey sst, hd, with abun globular, black, vitreous-subvitreous glauc and abun	yel gy to It ol brn	5Y 7/2, 5Y 5/6	Tb @ 265'	Tb well (TD 335)
				shell frags; hd band at 305; wh to yel gy from 300-310;				14 ft outer csg (10")
				becoming It ol brn as depth increases; note significant color change at top of interval				4" ss scr (300-310)

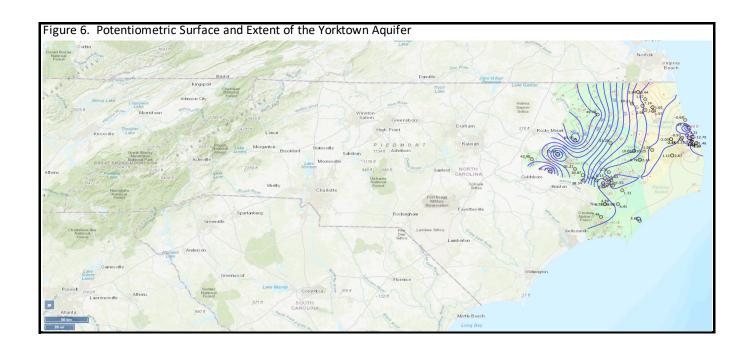
#### Comments:

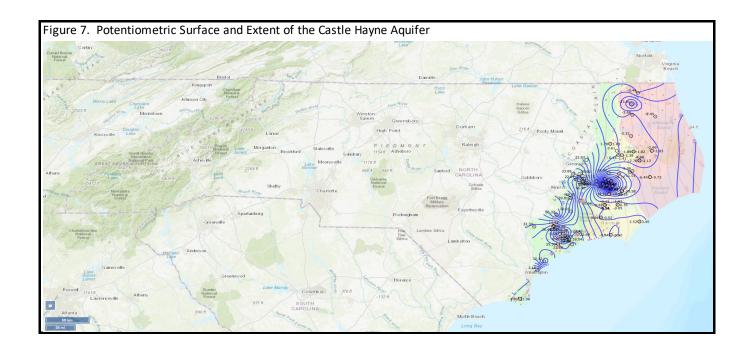
log describes bulk lithology and color when wet

csg grouted with bentonite (not cmt)

Ty=Yorktown
Tch=Castle Hayne
Tb=Beaufort







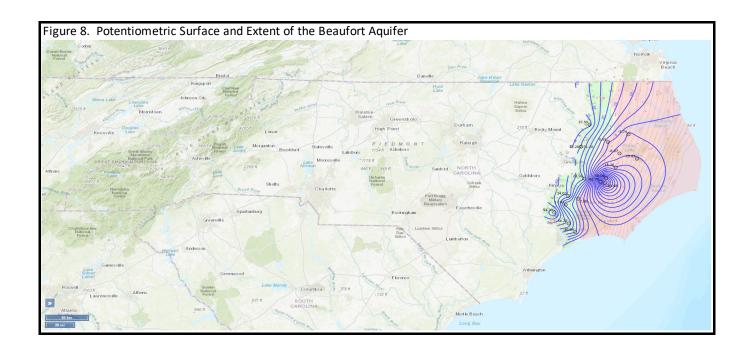


Photo 1. Aerial view of D. F. Walker Elementary School. The three monitoring wells are located on the east side of the property in the area marked by the yellow pin.



Photo 2. The three monitoring wells at D. F. Walker Elementary School.



# **Appendix B**

**Tables** 

Table 1. List of Wells																							
							Screen Bottom	NC Aquifer	NC Aquifer		Principal Aquifer	National Aquifer		Well Replaced and Gap	NGWMN Well	Well Cost per	Average Well La	atest Water Level V	Vater Level	Chloride	Chloride	 	
NGWMN ID	Name	County	Funding Source	Elevation (ft)	Depth (ft)	(ft)	(ft)	Code	Name	VA Aquifer Name	Code	Code	Principal Aquifer System	Filled	Replaced	Foot	Cost	(ft)	Date	(ppm)	Date	Latitude	Longitude
			,						,		1	,			,								
NCDWR:G15E3	DF Walker Elementary School			37.94		17	27	S	Surficial	Surficial	S	S100SURFCL	Surficial	Filled S gap in county	None	\$104.85		7.61	1/20/22				8 -76.650354
NCDWR:G15E2	DF Walker Elementary School			37.94	195	175	185	Ty	Yorktown	Yorktown-Eastover	NACP	S100NATLCP	Northern Atlantic Coastal Plain	Filled Ty gap in county	None	\$104.85	\$20,445.22	28.51	1/20/22				8 -76.650354
NCDWR:G15E1	DF Walker Elementary School	Chowan	USGS G19AC00280	37.94	325	300	310	Tb	Beaufort	Aquia	NACP	S100NATLCP	Northern Atlantic Coastal Plain	Filled Tb gap in county	None	\$104.85	\$34,075.36	30.05	1/20/22	<32	8/31/21	36.165368	8 -76.65035
Total					550												\$57,666.00						
NCDWR:W29D11	Chinquapin Elementary School	Dunlin	NC DWR match	42.44	34	19	29	S	Surficial	Surficial	5	S100SURFCL	Surficial	Replaced failed well	W29D9	\$87.57	\$2,977.24	7.60	10/26/21	<32	6/10/20	34.82592	3 -77.816446
NCDWR:W29D12	Chinquapin Elementary School			pending	800	624	644	Klcf	Lower Cape Fear	Potomac	NACP		Northern Atlantic Coastal Plain		None	\$87.57	\$70,052.76	-13.56	10/26/21		6/10/20		3 -77.81644
Total					834	•	•				•		•				\$73,030.00		•				

Notes and abbreviations

ft <32 water level in feet above or below marked measuring point (typically top of well casing); negative value indicates water level is above marked measuring point chloride detection limit (part per million, ppm)

Unit drilling costs based on payment invoices as follows: DF Walker School total cost =\$57,666 Chinquapin total cost =\$73,030

# Appendix C GW-1 Well Construction Records

1. Well Contractor Information:											
Charles N Dozier		14. W	ATE	R ZONE	S			1997/S-1944		AUSELION DANSE	aro I Charles por la Charles
Well Contractor Name		FROM		TO		DESCRIPT	ION				
4088-A		20	ft.	30	ft.	Sand					
NC Well Contractor Certification Number			ft.		ft.	<u> </u>					
Toano Well and Pump Service Inc		FROM	TER	TO	G (for	multi-cased v	wells)	OR LIN	ER (if ap		) ERIAL
Company Name			ft.		ft.		in.				
2. Well Construction Permit #:		16. IN	NER	CASING	GORT	UBING (geo	therm	al close		MATE	ERIAL
List all applicable well construction permits (i.e. UIC, County, State, Variance, etc.)		+2.5	ft.	20	ft.	4	in.	SDR17		PVC	ERIAL
3. Well Use (check well use):		\ <u>\</u>	ft.		ft.		in.				
Water Supply Well:		17. SC	REE								
Agricultural Municipal/Public		FROM 20	ft.	TO 30	ft.	DIAMETER in.		T SIZE	THICK	NESS	MATERIAL
Geothermal (Heating/Cooling Supply) Residential Water Supply (s	single)		ft.		ft.	in.	0.02	0			PVC
Industrial/Commercial Residential Water Supply (s	shared)	18. GR									
Irrigation Non-Water Supply Well:		FROM		то	64	MATERIAI	L	EMP	LACEMEN	T METI	HOD & AMOUNT
Monitoring Recovery		15	ft.	0	ft.	Hole Plug		Pour fre	om top shaking p	oipe and prob	ing with tremmi
Injection Well:			ft.		ft.			1			
Aquifer Recharge Groundwater Remediation			ft.		ft.		100000		-,		
Aquifer Storage and Recovery Salinity Barrier		19. SA FROM	ND/G	TO	PACE	(if applicab			EMPLAC	EMENT	METHOD
Aquifer Test Stormwater Drainage		30	ft.	15	ft.	#3 Silica sa	nd		Tremmie		
Experimental Technology Subsidence Control			ft.		ft.					11	A A A A A A A A A A A A A A A A A A A
Geothermal (Closed Loop)		20. DR FROM	ILLI	NG LOC	G (attac	h additional	sheets	if nece	ssary)		
Geothermal (Heating/Cooling Return) Other (explain under #21 R	emarks)	0	ft.	10	ft.	Orange Sai		olor, hard	iness, soil/r	ock type,	grain size, etc.)
4. Date Well(s) Completed: 06/25/2021 Well ID# G15E3		10	ft.	30	ft.	Blue Clay v		nd and sl	hell		
5a. Well Location:			ft.		ft.						
NCDENR			ft.		ft.						
Facility/Owner Name Facility ID# (if applicable)			ft.		ft.						
125 SANDY RIDGE ROAD, EDENTON, NC 27932			ft.		ft.			27		.0	
Physical Address, City, and Zip			ft.		ft.						
Chowan		21. RE	MAR	RKS							
County Parcel Identification No. (P	IN)	-									
5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees (if well field, one lat/long is sufficient)	rees:	22. Cer	tific	ation:							
36.1653162 <sub>N</sub> -76.6502900	w	M		~	K	2				07/	/14/2021
6. Is(are) the well(s) Permanent or Temporary		Signatur							2	Date	
7. Is this a repair to an existing well: Yes or No		By signi with 15A	ng thi	is form, . 1C 02C .	I herebj 0100 or	y certify that · 15A NCAC	the we	ell(s) wa 1200 Wel	is (were) o Il Construc	onstruction Sta	ted in accordance indards and that a
If this is a repair, fill out known well construction information and explain the nature	of the					rovided to the					
repair under #21 remarks section or on the back of this form.						ional well o					
8. For Geoprobe/DPT or Closed-Loop Geothermal Wells having the sar construction, only 1 GW-1 is needed. Indicate TOTAL NUMBER of wells						this page to may also at					e details or wel sary.
drilled:		<b>SUBM</b>	ITT.	AL INS	TRUC	CTIONS					
9. Total well depth below land surface:  For multiple wells list all depths if different (example-3@200' and 2@100')	(ft.)	24a. Fo	or A	ll Well	<u>s</u> : Su followi	bmit this f	orm v	within 3	30 days	of com	pletion of wel
10. Static water level below top of casing: 3  If water level is above casing, use "+"	(ft.)			ivision (	of Wat	ter Resourc					
11. Borehole diameter: 10 (in.)		24h F	r In						en sem		address in 24
12. Well construction method: (i.e. auger, rotary, cable, direct push, etc.)		above,	also	submit	one co	opy of this	form	within	30 days	of con	pletion of wel
FOR WATER SUPPLY WELLS ONLY:		Div	sion			sources, Un Service Cen					ol Program,
13a. Yield (gpm) Method of test:		24c. <u>F</u> o	r W	ater Su	ipply o	& Injection	Wel	ls: In	addition	to send	ling the form to
13b. Disinfection type: Amount: t				24c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county							
		where c	onst	ructed.							

For Internal Use Only:

WELL CONSTRUCTION RECORD (GW-1)

For Internal Use Only:	WELL CONSTRUCTION R	RECORD (GW-1)	For	Inter	nal Us	se Onl	V.					
Well Countread Certification Number   Countread Certification Nu				111001		o om	y -					
Well Countread Certification Number   Countread Certification Nu	Charles N Dozier		<u> </u>							-		
ACREATION NO. Well Constructed Certification Number  TOANO Well and Pump Service Inc.  Company Name  2. Well Construction Pumil #:  15. SURFER CANNING for manufacture with the construction paramits (in . 16.						ES	DESCRIP	TION				
Section   Compared Certification Number   Compared Name   Co	4088-A		180	ft.	192	ft.	Olim-in State	11011				
Source   Company Name   Service   Inc.   Company Name   Service   Service   Company Name   Ser	NC Well Contractor Certification Number			ft.		ft.						
1.		Inc	15. 0	UTER	CASIN	NG (for	multi-cased	wells)	OR LINI	ER (if ap	plicable	)
2. Well Construction Permit #:		· IIIC	FROM		10	ft.	DIAMETE		THICK	NESS	MAT	ERIAL
3. Well Life (check well use):    Water Supply Well:   Municipal/Public Geothermal (Heating/Cooling Supply)   Mesidential Water Supply (pingle)   Industrial/Commercial   Municipal/Public Geothermal (Heating/Cooling Supply)   Mesidential Water Supply (pingle)   Industrial/Commercial   Municipal/Public Geothermal (Heating/Cooling Supply)   Mesidential Water Supply (pingle)   Mesidential Wa	51-51-51-51-51-51-51-51-51-51-51-51-51-5		16. IN	NER	CASIN	G OR T	TUBING (geo	othern	nal closed	-loop)		
3. Well Lise (check well use):	List all applicable well construction permits (i.e.	UIC, County, State, Variance, etc.)	FROM	1	ТО		DIAMETE	R	THICK	NESS		ERIAL
Water Supply Well:			-	ft.							PVC	
Agricational   Geothermal (Heating/Cooling Supply)   Residential Water Supply (single)   Residential Water Resource of the Residential Water Supply (single)   Residential Water Resource of the Residential Water Resource Supply (single)   Residential Water Resource Supply (sing							4	Nave vite	SCH 40		Stainle	ess Steel
Goothermal (Heating/Cooling Supply)   Residential Water Supply (single)   Indisstrial/Commercial   Intrigution   Recovery   Indistrial/Commercial   Intrigution   Recovery   Indistrial/Commercial   Recovery   Aquifer Feet   Indistrial   Residential Water Supply (single)   Indistrial/Commercial   Recovery   Aquifer Feet   Indistrial   Residential Water Supply (single)   Indistrial   Residential Water Supply (single)   Indistrial   Recovery   Indistrial   Residential Water Supply (single)   Indistrial   Recovery   Indistrial   Residential Water Supply (single)   Indistrial   Indistrial   Residential Water Supply (single)   Indistrial   Indistrial		Municipal/Public			2000	C.		SLO	T SIZE	THICK	NESS	MATERIAL
Indigation   Residential Water Supply (shared)   Imrigation   Recovery   Indigation   Indi	Geothermal (Heating/Cooling Supply)	10 <del>000000</del>	180		190		4	0.02	20			Stainless Steel
PROM   TO   MATERIAL   EMPLACEMENT METHOD & AMOUNT   Trenmine	_		19 (			11.	ın.	CSTREET, CO.				
Monitoring				1	то		MATERIA	L	EMPL	ACEMEN	T METI	HOD & AMOUNT
Aquifer Storage and Recovery   Salminy Barrier   Stormwater Draininge   Stormwater Draininge   Submidence Control   Submidence Control   Stormwater Draininge   Submidence Control   Submidence Control   Stormwater Draininge   Stormwa		<b>D</b> p	175		0	ft.	Well Grout	DF				
Aquirer Rectange   Somwater Drainage   Subsidence Control   Subsidence		Recovery	-	ft.		ft.						
Aquifer Test		Groundwater Remediation						13000				
Aquire Test	<u> </u>	Salinity Barrier	19. SA	IND/G	RAVEI TO	L PACI				EMPLAC	EMENT	METHOD
Geothermal (Closed Loop)	I		195	ft.	175	ft.	#3 Silica sa	nd				MOTHOD
Geothermal (Heating/Cooling Return) Other (explain under #21 Remarks)  4. Date Well(s) Completed: 06/25/2021 Well D# G15E2  5a. Well Location:  NCDENR  Facility ID# (if applicable)  125 SANDY RIDGE ROAD, EDENTON, NC 27932  Physical Address, City, and Zip  Chowan  County  Parcel Identification No. (PIN)  5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:  (if well field, one lat/long is safficient)  36. 1653706 N 7-6.6503383 W  6. Is(are) the well(s) Permanent or Temporary  7. Is this a repair to an existing well: Yes or No. (If his is a repair to an existing we		Subsidence Control		ft.		ft.					<del></del>	
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Seality/Owner Name   Facility ID# (if applicable)			-	ft.		ft.						
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125 SANDY RIDGE ROAD, EDENTON, NC 27932   ft.   ft.   ft.	Facility/Owner Name	Facility ID# (if applicable)		ft.		ft.						
Physical Address, City, and Zip   Chowan	125 SANDY RIDGE ROAD, ED			ft.		ft.					***	
Chowan  County  Parcel Identification No. (PIN)  5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:  (if well field, one lat/long is sufficient)  36.1653706  N -76.6503383  W  6. Is(are) the well(s) Permanent or Temporary  7. Is this a repair to an existing well: Yes or No.  If this is a repair, fill out known well construction information and explain the nature of the repair under sill 2! remarks section or on the back of this form.  8. For Geoprobe/DPT or Closed-Loop Geothermal Wells having the same construction, only 1 GW-1 is needed. Indicate TOTAL NUMBER of wells drilled:  9. Total well depth below land surface: 195  For multiple wells list all depth sif different (example-3@200' and 2@100')  10. Static water level below top of casing: (ft.) If water level is above casing, use "+"  11. Borehole diameter: 10  (i.e. auger, rotary, cable, direct push, etc.)  FOR WATER SUPPLY WELLS ONLY:  13a. Yield (gpm) Method of test: Amount:    Continue of Certified Well Contractor   O7/14/2021				ft.		ft.						
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5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees:  (if well field, one lat/long is sufficient)  36. 1653706	County	Parcel Identification No. (PIN)							M. C. De Aug. S. P. S. S. S. S.			
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23. Site diagram or additional well details:  8. For Geoprobe/DPT or Closed-Loop Geothermal Wells having the same construction, only 1 GW-1 is needed. Indicate TOTAL NUMBER of wells drilled:  9. Total well depth below land surface:  195  10. Static water level below top of casing:  11. Borehole diameter:  12. Well construction method:  (i.e. auger, rotary, cable, direct push, etc.)  FOR WATER SUPPLY WELLS ONLY:  13a. Yield (gpm)  Method of test:  Amount:  23. Site diagram or additional well details:  You may use the back of this page to provide additional well site details or well construction details. You may also attach additional pages if necessary.  SUBMITTAL INSTRUCTIONS  24a. For All Wells:  Submit this form within 30 days of completion of well construction to the following:  Division of Water Resources, Information Processing Unit,  1617 Mail Service Center, Raleigh, NC 27699-1617  24b. For Injection Wells:  1636 Mail Service Center, Raleigh, NC 27699-1636  Division of Water Resources, Underground Injection Control Program,  1636 Mail Service Center, Raleigh, NC 27699-1636  24c. For Water Supply & Injection Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county health department of the county health department of the county whealth department of the county health department of the county whealth department of the county whealth department of the county whealth department of the county health department of the county whealth department of the county health department of the county was also additional well details. You may also attach additional well details. You may use the	7. Is this a repair to an existing well:	Yes or No	with 152	4 NCA	C 02C . 0	0100 or	15A NCAC (	02C.0.	200 Well	(were) co Construct	instructe ion Star	ed in accordance adards and that a
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13b. Distriction type:   completion of well construction to the county health department of the county		iction of test.	the add	iress(e	s) abo	ve, als	so submit o	one co	opy of t	his forn	n with	in 30 days of
	13b. Disinfection type:	_ Amount:	comple	tion o	f well	constr	uction to th	ne cou	inty hea	lth depa	rtment	of the county

### ADDITIONAL DRILL LOG:

## Well Construction Permit #: G15E2 D.F. WALKER ELEMENTARY SCHOOL

125 Sandy Ridge Road Edenton, NC 27932

			acritori,	140 27 332
FROM:		TO:		DESCRIPTION
0	FEET	10	FEET	ORANGE SAND
10	FEET	30	FEET	BLUE CLAY, SHELLS AND SAND MIX
30	FEET	40	FEET	BLUE AND BROWN CLAY
40	FEET	50	FEET	GREEN CLAY WITH SAND AND SHELL
50	FEET	60	FEET	BLUE CLAY WITH SAND AND SHELL
60	FEET	80	FEET	SHELL AND SAND
80	FEET	90	FEET	CEMENTED FORMATION
90	FEET	100	FEET	SHELL MATERIAL
100	FEET	110	FEET	HRD ROCK AND SHELL FORMATION
110	FEET	120	FEET	SHELLS AND SAND
120	FEET	130	FEET	GREEN CLAY, SHELLS AND SAND
130	FEET	140	FEET	GREEN CLAY, SHELLS AND SAND
140	FEET	150	FEET	SHELL AND BLACK SAND
150	FEET	160	FEET	BLUE CALY, SHELLS AND SAND
160	FEET	170	FEET	BLUE CLAY, SHELLS AND SAND MIX
170	FEET	180	FEET	SAND AND SHELL

1. WATE Contractor Information:	WELL CONSTRUCTION I	RECORD (GW-1)	Fo	r Inte	rnal II	se Onl	X7*				
Charles N Dozjer  Well Connector Currentes Number  No. Well Connector Certification Number  Company Name  (25 S ADD Purp Service in Connector Company Number  Company Name  (25 S ADD Purp Service in Connector Company Number  (25 S ADD Purp Service in Connector Company Number  (25 S ADD Purp Service in Connector Company Number  (25 S ADD Purp Service in Connector Company Number Company Number Connector Company Connector Company Number Connector Company Connector Connector Company Connector Company Connector Company Connector Connector Company Connector Connec			10	1 11110	anai O	se Om	у.				
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South Residence   Company Name   C	NC Well Contractor Certification Number			ft.		ft.					
Compared Name   Compared Nam		e Inc	15. (	OUTE	R CASI	NG (for	multi-cased	wells)	OR LINE		
Second contraction   Permit #1.   Carl   County   State.   Permit #1.   Carl						ft.					
List of largehiche well use):   See   Market	C1EI	E1	16. I	NNER	CASIN	IG OR T	UBING (ge	othern	al closed-	-loop)	
3. Well Use (check well use):  Water Supply Well:  Agricultural  Geothermal (Hearing-Cooling Supply)  Residential Water Supply (single):  Irrigation  Non-Water Supply Well:  Meniorized Public  Agrifed Rechange  Agrifed Rechange  Agrifed Rechange  Agrifed Storage and Recovery  Salaring Barrier  Salaring Barrier  Agrifed Storage and Recovery  Salaring Barrier  Salaring Ba	List all applicable well construction permits (i.e.	e. UIC, County, State, Variance, etc.)				ft.	The Assessment of the State of				
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Geothermal (Heating Cooling Supply)   Residential Water Supply (single)   Residential Water Supply (	Agricultural	Municipal/Public				EL.			JAN 19 19 19	THICKNESS	MATERIAL
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PRON		Residential Water Supply (shared)	18. G		Γ	10.					
Moniforing			FROM	M	ТО	-	MATERIA	L	EMPLA	ACEMENT ME	THOD & AMOUNT
Injection Well:   Aquifer Recharge	✓ Monitoring	Recovery	305		0		WEII Grout	DF	Tremm	ie	
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Experimental Technology	The state of the s		FROM	NI .	TO	LTACE				EMPLACEME	NT METHOD
Geothermal (Closed Loop)	5 1185 00000000		330		305	ft.	#3 Silica sa	nd	Т	remmie	
Geothermal (Heating/Cooling Return) Other (explain under #21 Remarks)  4. Date Well(s) Completed: 06/25/2021 Well ID# G15E1  5a. Well Location:  NC DENR  Facility (Dw/ (if applicable)  125 SANDY RIDGE ROAD, EDENTON, NC 27932  Physical Address, City, and Zip  Chowan  County  Parcel Identification No. (PIN)  St. Latitude and longitude in degrees/minutes/seconds or decimal degrees: (if well field, one lar/long is sufficient)  36. 1655018  76. 6504171  W  6. Is(are) the well(s) Permanent or Temporary  7. 1s. this a repair to an existing well: Yes or No. (Whis is a repair) flow an existing well: Yes or No. (Whis is a repair) flow to home well construction information and explain the nature of the repair under #21 flowed below land surface: 325  8. For Geoprobe/DPT or Closed-Loop Geothermal Wells having the same construction, only 1 GW-1 is needed. Indicate TOTAL NUMBER of wells will indicate TOTAL NUMBER of wells drilled:  9. Total well depth below land surface: 325  (It.)  10. Static water level below top of casing: (It.)  11. Borchole diameter: 10  (in.)  12. Well construction method: (In.)  13. Yield (gpnn) Method of test: Amount: Simplified on the county of this form within 30 days of completion of well construction to the following: Division of Water Resources, Underground Injection Control Program, 1636 Mail Service Center, Raleigh, NC 27699-1637  24c. For Water Supply Wells on addition to sending the form to the address in 24 above, also submit one copy of this form within 30 days of completion of we construction to the following: Division of Water Resources, Underground Injection Control Program, 1636 Mail Service Center, Raleigh, NC 27699-1637  24c. For Water Supply Wells: In addition to sending the form to the address(es) above, also submit one copy of this form within 30 days of completion of the county health department of the county health depart		DOWN THE PROPERTY OF THE PROPE									
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nc DENR  Facility/Owner Name Facility ID# (if applicable)  125 SANDY RIDGE ROAD, EDENTON, NC 27932  Physical Address, City, and Zip Chowan  County Parcel Identification No. (PIN)  Sb. Latitude and longitude in degrees/minutes/seconds or decimal degrees: (if well field, one lat/long is sufficient)  36. 1655018  n −76.6504171  W  6. Is(are) the well(s) Permanent or □Temporary  7. Is this a repair to an existing well: □Yes or ☒No If his is a repair, Ill out known well construction information and explain the nature of the repair under #21 In Energy Certify: that the well(s) was (were) constructed in accordance with the nature of the repair under #21 In Energy Certify: hat the well(s) was (were) construction Sandards and that opp of this record has been provided to the well owner.  22. Certification:  12. Certification:  12. Site diagram or additional well details: You may use the back of this page to provide additional well set details or we construction of the well owner.  23. Site diagram or additional well details: You may use the back of this page to provide additional pages if necessary.  13. Static water level below top of casing: (It.)  14. For Multerlevel is above easing, use "+"  15. For multiple wells in addition to sending the form to the address in 24 above, also submit one copy of this form within 30 days of completion of we construction to the following:  14. For Multerlevel level below top of casing: (It.)  15. For WATER SUPPLY WELLS ONLY:  15. For Water Resources, Underground Injection Control Program, 1636 Mals Service Center, Raleigh, NC 27699-1636  24c. For Water Supply & Injection Wells: In addition to sending the form to the address(ss) above, also submit one copy of this form within 30 days of completion of well construction of well construction to the collowing:  15. For Water Supply & Injection Wells: In addition to sending the form to the address(ss) above, also submit one copy of this form within 30 days of completion of well construction of well control the address(ss) above, also submi	4. Date Well(s) Completed: 00/25/202	Well ID# G15E1		ft.		ft.					
Facility/Owner Name Facility/Owner Name Facility/D# (if applicable)  125 SANDY RIDGE ROAD, EDENTON, NC 27932  Physical Address, City, and Zip Chowan  County Parcel Identification No. (PIN)  5b. Latitude and longitude in degrees/minutes/seconds or decimal degrees: (if well field, one lat/long is sufficient)  36.1655018  N -76.6504171  W  6. Is(are) the well(s) Permanent or Temporary  7. Is this a repair to an existing well: Yes or No If his is a repair, fill out known well construction information and explain the nature of the repair under \$12\$ remarks section or on the back of this form.  8. For Geoprobe/DPT or Closed-Loop Geothermal Wells having the same construction, only 1 GW-1 is needed. Indicate TOTAL NUMBER of wells drilled:  9. Total well depth below land surface: 325  (It.)  10. Static water level below top of casing: (It.)  11. Borehole diameter: 10  (In.)  12. Well construction method: Mud Rortary  (is. auger, rotary, cable, direct push, etc.)  13. Yield (gpm) Method of test: 13. Well (gpm) Method of test: 13. Disinfection type: Amount: 14. Mount: 15. Disinfection type: Amount: 15. Disinfection type: 15. Disinfection type				ft.		ft.		-			
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13a. Yield (gpm) Method of test: 24c. For Water Supply & Injection Wells: In addition to sending the form the address(es) above, also submit one copy of this form within 30 days of completion of well construction to the county health department of the county health department health department health department health department health department health department hea	FOR WATER SUPPLY WELLS ONLY	:	Div	ision	of Wat	er Res	ources, Un	dergro	ound Inj	ection Cont	rol Program,
the address(es) above, also submit one copy of this form within 30 days or completion of well construction to the county health department of the county healt					1636	Mail S	ervice Cen	ter, R	aleigh, N	C 27699-16	36
Amount: completion of well construction to the county health department of the county		Viethod of test:	the add	or Wa	es) abo	ove ale	Injection	Wells	In add	lition to sen	ding the form to
	13b. Disinfection type:	Amount:	completion of well construction to the county health department of the county								

# ADDITIONAL DRILL LOG:

# Well Construction Permit #: G15E1 D.F. WALKER ELEMENTARY SCHOOL 125 Sandy Ridge Road Edenton, NC 27932

TO: 10	FEET	DESCRIPTION
	FEET	
30		ORANGE SAND
50	FEET	BLUE CLAY, SHELLS AND SAND MIX
40	FEET	BLUE AND BROWN CLAY
50	FEET	GREEN CLAY WITH SAND AND SHELL
60	FEET	BLUE CLAY WITH SAND AND SHELL
80	FEET	SHELL AND SAND
90	FEET	CEMENTED FORMATION
100	FEET	SHELL MATERIAL
110	FEET	HRD ROCK AND SHELL FORMATION
120	FEET	SHELLS AND SAND
130	FEET	GREEN CLAY, SHELLS AND SAND
140	FEET	GREEN CLAY, SHELLS AND SAND
150	FEET	SHELL AND BLACK SAND
160	FEET	BLUE CALY, SHELLS AND SAND
170	FEET	BLUE CLAY, SHELLS AND SAND MIX
180	FEET	SAND AND SHELL
190	FEET	LIMESTONE ROCK
200	FEET	GREEN CLAY
210	FEET	GREEN CLAY
220	FEET	GREEN SILTY CLAY
230	FEET	GREEN SILTY CLAY
240	FEET	SILTY CLAY AND SHELL MIX
260	FEET	GREEN SILT AND SHELL
270	FEET	BLUE AND GREEN CLAY
300	FEET	BLACK SAND
310	FEET	SAND AND SHELL
330		BROWN SHELL
	50 60 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 260 270 300 310	40 FEET 50 FEET 60 FEET 80 FEET 90 FEET 110 FEET 110 FEET 110 FEET 110 FEET 130 FEET 140 FEET 150 FEET 170 FEET 180 FEET 190 FEET 200 FEET 210 FEET 220 FEET 230 FEET 240 FEET 270 FEET 300 FEET 300 FEET

# Appendix D Data Management Plan

### **NC DWR Data Management Plan**

Effective: January 1, 2022

Project: All DWR Operations and DWR-USGS Cooperative Agreements

for the National Ground-Water Monitoring Network (NGWMN)

Contacts: <u>USGS</u>

Daryll Pope, Tel (804) 261-2630/(609) 462-7119, dpope@usgs.gov

Candice Hopkins, Tel (208) 387-1331, chopkins@usgs.gov

**NC DWR** 

Mark Durway, (919) 707-9018, mark.durway@ncdenr.gov

Susan Laughinghouse, (252) 229-3349, susan.laughinghouse@ncdenr.gov

Budget: State and USGS Funding Sources

#### Types of Data Collected

Four data types are routinely collected by the NC DWR Groundwater Management Branch (GWMB). These data types consist of groundwater levels, groundwater quality analyses, well drilling data, and locational data. Currently, NC DWR provides persistent data to the NGWMN from over 600 wells. Nine USGS Principal Aquifers located in the North Carolina coastal plain, piedmont, and mountains are monitored by these wells.

Groundwater levels will be acquired hourly or at other regular intervals, validated, and downloaded to the appropriate NC DWR database. Water quality data will be collected at less frequent intervals and will consist primarily of chloride concentrations from discrete depth intervals within the aquifer.

Drilling data consisting of lithology, geophysical logs, and well construction specifications will be acquired during the drilling and well completion process. Lithology will be determined from rock cuttings collected at 10 ft intervals during well drilling. Lithologic data and well specifications including total depth, casing and screen dimensions, and other information will be used to produce a drilling log once the well has been completed. The geology of the well will be further evaluated after the well has been drilled to total depth using open-hole geophysical logging techniques. The geophysical data will be used to produce the following geophysical logs: gamma, spontaneous potential (SP), single-point resistivity (SPR), 16" normal resistivity, 64" normal resistivity. Lithologic descriptions, geophysical logging, drilling, and well completion will be overseen by a geologist and drilling will be performed by a certified well contractor in accordance with state requirements.

Accuracy of locational data will be accomplished using survey grade GPS equipment to determine latitude, longitude, and altitude. Accuracy and geodetic reference systems used by NC DWR are state plane coordinates and latitude/longitude (<0.05 ft), altitude (<0.1 ft), horizontal datum (NAD83), and altitude datum (NAVD88).

#### **Data and Metadata Standards**

NC DWR stores data in the following databases:

<u>Data Type</u> <u>Database Tables</u>

Groundwater Levels gwb.dwr, gwb.dwrwatlev, gwb.dwrwatlevhourly

Groundwater Quality gwb.dwrchloride

Well Logs gwb.logs, gwb.logdata, gwb.resstafr

Location, Latitude/Longitude, Altitude gwb.dwr

The NC DWR groundwater monitoring network uses the MariaDB database management platform. This platform is supported by branch and division level IT staff. The NC DWR Groundwater Monitoring Branch website is hosted by Apache web server. Internal database tables are used to maintain database quality control and allow for editing. Water level data meeting standards are unloaded to public tables listed above.

#### Policies for Access and Sharing

Project data collected will be available through the NGWMN Data Portal without restriction.

#### Policies and Provisions for Re-Use and Re-Distribution

There will be restriction on the use of the data through the portal. Any data obtained through the portal and redistributed is expected to cite the original source of the data as NC DWR through this USGS/NGWMN Cooperative.

#### Plans for Archiving and Preservation of Access

Paper copies of field data will be scanned and stored by NC DWR and will be included in regular system backups. This data and all databases will be backed up at least weekly.

#### <u>Project Personnel and Qualifications</u>

GWMB staff oversee project management, supervision and administration, procurement, data collection and analysis, and reporting. Project staff and their qualifications are:

Mark Durway, PG, NC DWR GWMB Hydrogeologist Susan Laughinghouse, PG, NC DWR GWMB Monitoring Unit Head Kevin McVerry, NC DWR GWMB Environmental Specialist Nathaniel C. Wilson, PG (Retired/Consultant), Former Head, NC DWR GWMB Mark Durway is a licensed geologist in NC and Louisiana and has BS and MS degrees in geology from Guilford College and NCSU. He has oil and gas experience with Core Laboratories and Halliburton, regulatory and resource management experience with the NC Superfund Program, Petroleum UST Program and Division of Water Resources, and private sector experience as an environmental consultant. His current position as GWMB hydrogeologist includes all aspects of data review and interpretation, groundwater use and availability studies, drilling oversight, grant and contract procurement, and reporting.

Susan Laughinghouse is a licensed geologist in NC and has BS degree in geology from East Carolina University. She has regulatory and resource management experience with the NC Division of Water Resources, and private sector experience as an environmental consultant. Her current position as GWMB Monitoring Unit Head includes all aspects of operation and maintenance of the state well network, data collection and entry, well procurement and drilling contracts, access agreements and reporting, and staff supervision.

Kevin McVerry is an Environmental Specialist with a BA in geology from NCSU. He has regulatory and resource management experience with the NC Division of Water Resources and the NC Division of Coastal Management, and private sector experience as an environmental consultant. His current position as GWMB geologist/hydrogeologic field technician involves all aspects of well network maintenance and data collection and serving as team leader on special projects.

Nat Wilson, PG, is a licensed geologist and has BS and MS degrees in geology from Middlebury College and University of Oregon. His qualifications include a combination of education, licensing, and experience in the fields of geology, hydrology, computer programming, and data analysis. He served as GWMB Branch Head for 20 years during which time he created the existing map interface, website, and numerous applications and tables which define the state Groundwater Management Branch. He has over 20 years of experience developing complex groundwater database programs and websites. He retired from DWR in December 2020 after a total of 34 years with the state and currently works as an independent consultant.