

Well No.	Yr. drilled	Total depth (ft)	Diameter (in.)	Type of finish	Screened intervals (ft)	Elevation (msl)	Water level (ft below surf)
M-142	1942	69	8	Open hole	--	17*	33 P
M-161	1983	250	--	Gravel pack	--	20*	17.4 18.2
M-168	1953	151	8	Screen	46-61 76-86 137-142	19*	11.4
M-197	1971	200	8	Screen	54-64 76-92 124-129 136-145	20.6	14.1 9.1
M-243	--	95	8	Gravel pack	60-65 75-90	22.5	--
M-267	1981	150	8	Gravel pack	50-70 125-145	17*	13.6 61 P
M-628	1942	67	8	Open hole	43-67 (Open hole)	15*	11.5 7.4
M-629	1975	70	--	--	--	16*	11.4 33 P
M-630	--	80	--	--	--	17*	12.2 42 P
MCAS-106	1954	179	8" --	--	--	17*	15.6 26 P
MCAS-131	--	200 ✓	8" --	--	--	17*	15.0 17.3
MCAS-203	--	173 ✓	8" --	--	--	17*	14.4 33 P
MCAS-4140	--	193 --	8" --	--	--	22*	20.3 34.0
MCAS-4150	--	193 --	8" --	--	--	21*	25 P
MCAS-5001	--	193 ✓	8" --	--	--	21*	34 P
MCAS-5009	--	196 ✓	8" --	--	--	20*	66 P
NC-52	1941	70	--	Open hole	25-66	17*	66 P 4.4
RR-45	1942	130	8	Gravel hole	75-80 90-95 105-115 125-130	56*	49.6 53.2
RR-47	1943	85	8	Gravel pack	71-81	50*	57 P 49.2

unk/183 gpd
unk/310 gpd
unk/220 gpd
unk/110 gpd
unk/128 gpd
unk/130 gpd
unk/111 gpd

MCAS 190
191

140 8"
180 8"

0000002022
unk/190 gpd
unk/251 gpd

* elevation estimated from USGS topographic map

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Well No.	Yr. drilled	Total depth (ft)	Diameter (in)	Type of finish	Screened intervals (ft)	Elevation (msl)	Water level (ft below surf)
RR-97	1977	200	8	--	45-60	56*	51 P
					80-100		51 P
RR-97A	--	437	8	--	365-395	56*	36.5
					415-425		
RR-229	1983	253	10	Gravel pack	190-210	31*	21.1
					223-233		22.9
					247-252		
TC-100	1941	67	18	Open hole	--	19.5	6.1
							3.9
TC-104	1941	182	10	Open hole	107-182	18.4	14.4
					(Open hole)		
TC-190	1978	180	--	Screen	130-140	28*	42 P
					150-180		28 P
TC-191	1977	180	--	Screen	130-140	27*	26.5
					150-180		52 P
TC-201	1941	68	8	Gravel pack	46-66	33*	20.5
							11.3
TC-202	1942	80	8	Screen	35-40	20.9	5.0
					45-50		
					55-60		
					65-70		
					75-80		
TC-325	1980	--	--	--	--	21*	49.0
TC-502	1941	184 ✓	10	Open hole	110-184	19*	24 P
					(Open hole)		
TC-504	1942	113	8	Gravel pack	50-60	24*	48 P
					75-85		48 P
TC-600	1942	70 ✓	8	Gravel pack	48-70	19*	37 P
							6.0
TC-604	1942	113 ✓	8	Screen	45-50	26.5	4.4
					60-65		37 P
					82-87		
					97-102		
					108-113		
TC-700	1941	76 ✓	18	Open hole	27.5-76	22.1	38 P
					(Open hole)		38 P
TC-901	1941	77	8	Screen	46-56	21.4	4.3
					66-76		6.9
TC-1000	1942	137 153	8	Gravel pack	86-96	35*	38 P
					116-136		38 P
TC-1001	1942	100 ✓	8	Gravel pack	70-100	32.7	9.5
TC-1251	1975	240 155	--	Screen	120-140	20*	27 P
				Closed	160-170		27 P

110 ft / 400 gpm
48 ft / 104 gpm
45 ft / 154 gpm
27 1/2 ft / 125 gpm
86 ft / 104 gpm
70 ft / 100 gpm
Unit / 175 gpm

CLW

* elevation estimated from USGS topographic map 0000002023

Well No.	Yr. drilled	Total depth (ft)	Diameter (in)	Type of finish	Screened intervals (ft)	Elevation (msl)	Water level (ft below sur _{face})
TC-1253	1975	250 ✓	--	Screen	120-135 155-170	22*	32 P 32 P 16.6
TC-1254	1975	195 ✓	--	Screen	118-122 145-160	27*	32 P 32 P
TC-1255	1975	250 ✓	--	Screen	124-132 156-166 180-190	31*	58 P 58 P 21.0
TC-1255	--	204 ✓	--	Screen	124-134 154-164 182-192	31*	54 P 54 P 23.0
TT-23	1964	263	--	--	--	24*	14.5 22.4
TT-25	1980	200	8	Gravel pack	70-95 155-170	31*	20.8 28.7
TT-26	1958	100	--	--	--	31*	20.0 26.6
TT-31	1973	94	--	--	--	25*	20.5 25.9
TT-52	1961	98	--	--	--	24*	19.9 23.2
TT-53	1961	90	10	Gravel pack	45-49 50-54 55-59 60-65 71-73	24*	14.9 18.2
TT-54	1961	104	--	--	--	18*	15.4 21.8
TT-67	1972	98	--	--	--	26*	19.1 58 P
Test Wells							
ON-OT1-67	1967	1,400	9 to 6	Open test hole	--	62*	--
ON-OT1-66	1966	1,681	8 to 6	Open test hole	--	30*	--
ON-OT-22	--	1,249	--	Open test hole	--	66*	--
ON-T2-87	1987	260	5	Open test hole	--	20*	--
OW-2	--	90	4	--	--	11*	4.0 5.7
OW-3	--	75	4	--	--	23*	11.7 6.8

50/128 gpm
unk/100 gpm
unk/50 gpm
60 ft/108 gpm

CLW

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* elevation estimated from USGS topographic map

Well No.	Yr. drilled	Total depth (ft)	Diameter (in)	Type of finish	Screened intervals (ft)	Elevation (msl)	Water level (ft below surf)
OW-4	--	106	4	--	--	18*	4.3 18.5
OW-5	--	110	4	--	90-100	26*	17.5 17.6
T-1	1959	477	--	Open test hole	--	30*	--
T-2	1959	240	--	Open test hole	--	29*	--
T-3	1959	232	--	Open test hole	--	31*	--
T-4	1959	262	--	Open test hole	--	26*	--
T-5	1959	232	--	Open test hole	--	15*	--
T-6	1959	202	--	Open test hole	--	34*	--
T-7	1959	225	--	Open test hole	--	26*	--
T-8	1959	500	--	Open test hole	--	20*	--
T-9	1959	177	8	Gravel pack	37-42 50-60 68-72 83-88 120-127 135-140 162-167 172-177	28*	5.4 9.6
T-10	1959	250	--	Open test hole	--	25*	--
T-11	1959	202	--	Open test hole	--	25*	--
T-12	1959	352	--	Open test hole	--	6*	--
T-13	1959	250	--	Open test hole	--	19*	--
T-14	1959	200	--	Open test hole	--	20*	--
T-15	1959	477	--	Open test hole	--	15*	--
T-18	1959	302	--	Open test hole	--	52*	--
T-19	1959	161	--	Open test hole	--	55*	--

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* elevation estimated from USGS topographic map

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Well No.	Yr. drilled	Total depth (ft)	Diameter (in)	Type of finish	Screened intervals (ft)	Elevation (msl)	Water level (ft below surf)
T-20	1959	121	--	Open test hole	--	41*	--
T-21	1959	120	--	Open test hole	--	31*	--
T-22	1959	161	--	Open test hole	--	23*	--
X(1950)	--	33	18	Open hole	--	23*	8.5
X-24,C-2	1972	240	6	--	--	26*	18?
X-24,S-1	1987	90	4	Screen	80-90	23*	15.0
X-24,S-2(X)	1986	1,526	--	Open test hole	--	23*	--
X-24,S-2a	1987	918	8 to 4 to 2.5	Screen	908-918	23*	14.8
X-24,S-4	1987	527	8 to 4 to 2.5	Screen	517-527	23*	19.0
X-24,S-5	1987	295	4 to 2.5	Screen	285-295	23*	20.5
X-24,S-6	1987	130	6	Screen	120-130	23.47	18.2 17.0
X-24,S-7	1987	40	4	Screen	30-40	23*	17.8
X-25,b-16	1978	185	4	Open test hole	--	15*	--
X-25,M-2	1968	156	--	--	--	15*	--
Y-25,Q1	1982	80	4	Screen	58-80	67*	31.6
Y-25,Q2(X)	1982	1,355	5.5	Open Test hole	--	67*	--
Y-25,Q3	1982	240	4	Screen	150-240	66.83	34.8 33.4
Y-25,Q4	1982	550	8 to 2	Screen	525-550	7*	39.9
Y-25,Q6	1982	23	4	Screen	18-22	67*	10.4
VPI-15	1978	1,678	2.5	Cased to total depth	No openings to aquifer	30*	Casing full of water
VPI-15A	1979	1,575	4	Cased to total depth	No openings to aquifer	26*	Casing full of water
Z-5	1957	246	--	--	--	--	CLW

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* elevation estimated from USGS topographic map

Appendix B

Naval Facilities Engineering Command
Guide Specification for Water Supply Wells
Constructed at MCB

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SECTION 02670

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DEPARTMENT OF THE NAVY NFGS-02670C
NAVAL FACILITIES 30 June 1991
ENGINEERING COMMAND
GUIDE SPECIFICATION Superseding NFGS-02670B (03/91)

NFGS-02670C

ROTARY-DRILLED WATER WELL

*
* Preparing Activity: PACNAVFACENGCOM *
*
* Typed Name & Reg. Signature Date *
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DEPARTMENT OF THE NAVY NFGS-02670C
NAVAL FACILITIES 30 June 1991
ENGINEERING COMMAND
GUIDE SPECIFICATION Superseding NFGS-02670B (03/91)

SECTION 02670

ROTARY-DRILLED WATER WELL
06/91

NOTE: This guide specification covers the requirements for rotary-drilled water wells (consolidated or unconsolidated) using conventional fluid rotary drilling or reverse circulation drilling.

NOTE: This revision "C" to NFGS-02670 follows a complete review of the previous version. The text is revised throughout, according to that review.

NOTE: See Note A located at rear of text.

PART 1 GENERAL

1.1 SUMMARY

NOTE: The article "Summary" is not used by the Naval Facilities Engineering Command, except in specialized cases. Delete this article when editing for project specifications.

1.2 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|--------------|------------------------------------------------------------------------------------|
| ANSI B1.20.1 | 1983 Pipe Threads, General Purpose (Inch)
(ANSI/ASME B1.20.1) |
| ANSI B40.1 | 1985 Gauges - Pressure Indicating Dial
Type - Elastic Element (ANSI/ASME B40.1) |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|-----------|-------------------------------------------------------------------------------------|
| ASTM A 53 | 1990 (Rev. B) Pipe, Steel, Black and
Hot-Dipped, Zinc-Coated Welded and Seamless |
|-----------|-------------------------------------------------------------------------------------|

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ASTM B 88 1989 Seamless Copper Water Tube
 ASTM C 150 1989 Portland Cement
 ASTM C 494 1990 Chemical Admixtures for Concrete

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C206 1988 Field Welding of Steel Water Pipe
 AWWA C651 1986 (Addendum 1990) Disinfecting Water Mains
 AWWA C700 1990 Cold-Water Meters-Displacement Type, Bronze Main Case, First Edition
 AWWA C701 1988 Cold-Water Meters-Turbine Type for Customer Service
 AWWA C702 1986 Cold-Water Meters-Compound Type

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 570/9-75-001 Water Well Construction Practices

1.3 SUBMITTALS

 NOTE: Where a "G" in asterisk tokens follows a submittal item, it indicates Government approval for that item. Add "G" in asterisk tokens following any added or existing submittal items deemed sufficiently critical, complex, or aesthetically significant to merit approval by the Government. Submittal items not designated with a "G" will be approved by the CQC organization.

Submit the following in accordance with Section 01300, "Submittals."

1.3.1 SD-04, Drawings

 NOTE: Edit the submittal requirements based on the type of well (consolidated or unconsolidated). If the specification is written for a consolidated well, delete the well components which are not normally required in consolidated formations, such as inner casing, well screen, and gravel fill.

a. Rotary-drilled water well

1.3.1.1 Required Drawings

Submit drawings or catalog cuts showing rotary-drilled water well components and details of well casings, well screens, air lines, and gages. Detail drawings or catalog cuts shall be accompanied by a cross section showing the relative size, location, and spacing of the well components such as the hole size, outer casing, [inner casing,] [well screen,] [gravel

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filter,] air line and gage, and grout.

1.3.2 SD-08, Statements

- a. Water disposal methods
- b. Gravel placement equipment list
- c. Gravel placement methods

1.3.3 SD-12, Field Test Reports

- a. Test hole
- b. Pump test
- c. Water analysis
- d. Plumbness and alignment test

1.3.3.1 Test Hole Reports

NOTE: Natural-gamma logging records the amount of natural-gamma radiation emitted by earth materials. Caliper logging records the average borehole diameter. Verify that natural-gamma logging and caliper logging are required in the geographical region of the project.

Upon completion of test hole, provide recommendations for permanent wells and submit data obtained [at each well site], in triplicate. Include with the recommendations the appropriate depth, details of construction, length and location of screens, screen openings, gravel size, grout, and an estimation of the quantity of water that can be obtained from each water-bearing stratum and from each completed well. Submit electric log, a drillers log drawn to scale with coarseness and fineness modulus of each strata, time penetration log (time to drill through each formation), [caliper log] [natural-gamma log], and sieve analysis to substantiate recommendations.

1.3.4 SD-13, Certificates

NOTE: Edit the submittal requirements based on the type of well (consolidated or unconsolidated). If the specification is written for a consolidated well, delete the well components which are not normally required in consolidated formations, such as inner casing, well screen, and gravel fill.

- a. Casings
- b. Cement
- c. Air line
- d. Air gage

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- e. Drilling mud
- f. Water meter
- [g. Screens]
- [h. Gravel]

1.3.5 SD-16, Sample Panels

- a. Test hole

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact. Replace defective or damaged materials with new materials.

1.5 GENERAL REQUIREMENTS

Provide each system complete and ready for operation. Each system, including equipment, materials, installation, and workmanship shall be in accordance with EPA 570/9-75-001, except as modified herein. In the manual referred to herein, the advisory provisions shall be considered mandatory, as though the word "shall" has been substituted for the word "should" wherever it appears. Reference to the "Project Representative" and the "Owner" shall be interpreted to mean the Contracting Officer. [Other applicable requirements are included under Section [____], ENVIRONMENTAL PROTECTION.]

PART 2 PRODUCTS

2.1 MATERIALS

Shall conform to the respective specifications and other requirements as specified herein.

2.1.1 Casings

 NOTE: See Note B located at rear of text.

 NOTE: In unconsolidated formations where inner casings are required, the inside diameter of the outer casing shall be a minimum of 3.0 inches larger than the outside diameter of the inner casing, and the drill hole shall be slightly larger than the outside diameter of the outer casing. In consolidated formations where inner casings are not required, the drill hole shall be a minimum of 3.0 inches larger in diameter than the outside diameter of the outer casing.

ASTM A 53; [black steel pipe] [zinc-coated steel pipe] outer casing, [____] nominal diameter, [____] wall thickness, [black steel pipe] [zinc-coated steel pipe] inner casing, [____] nominal diameter, [____]

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wall thickness. Provide casings with [screwed] [or] [welded] joints.

2.1.2 Well Screens

NOTE: See Note C located at rear of text.

Type 304 or 316 stainless steel, [] inside diameter, [] type. Provide screens with adequate strength to resist external forces, both during and after installation. Length shall be [] [as required to provide the quantity of water specified]. Water velocity through openings shall not exceed 0.1 foot per second. Determine the well screen openings from an analysis of the sand in the water-bearing strata. Provide joints of the same material as the screen, with either threaded rings or butt-type welding rings.

2.1.3 Filter Gravel

NOTE: See Note D located at rear of text.

Provide clean, round, hard, water-worn [quartz or granite] [] with less than 5 percent feldspar, no fossils, carbonate, or organics, and of proper size and gradation to allow free flow of water in the well and prevent the infiltration of sand. The Contracting Officer will select gravel size, based upon the analysis of the sand in the water-bearing strata. Sterilize gravel with 20 ppm of free available chlorine for a minimum of 2 hours before using.

2.1.4 Grout

Provide neat cement grout, Type I or II portland cement conforming to ASTM C 150, and water. The mixed grout shall contain no more than 7 gallons of water per bag (1.0 cubic foot or 94 pounds) of cement.

2.1.4.1 Admixtures

ASTM C 494.

2.1.5 Air Line

ASTM B 88, Type K, copper tube, [] inch diameter.

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2.1.6 Air Gage

ANSI B40.1.

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2.1.7 Water Meter

AWWA C700 displacement type, AWWA C701 turbine type, or AWWA C702 compound type.

2.1.8 Drilling Mud

Provide a fluid composed of water and bentonite clay, readily thinned with commercial mud thinners or biodegradable polymer mud which will break down naturally. The specific gravity and the character of the mud-laden fluid shall be such that the production of the aquifers will not be impaired.

Drilling mud shall be prechlorinated with 20 ppm free available chlorine for a minimum of 2 hours.

2.1.9 Auxiliary Equipment

Provide discharge piping to dispose of pumped water during developing and testing of well. Locate the discharge piping a sufficient distance from each well to prevent flooding of the site and flow back into the well, as approved by the Contracting Officer.

PART 3 EXECUTION

3.1 TEST HOLE

NOTE: If the test hole is to be used as a permanent project well, it shall meet the requirements and characteristics as set forth for the permanent well. Specify minimum diameter and minimum depth of the test well. The minimum test hole diameter for logging with electric logs is 6 inches.

Drill a test hole at the well site before construction of the permanent well is started. Test hole shall be of sufficient size to obtain information required for the construction of the permanent well. The location, size of well, and method of drilling must be approved before work is started. Test hole shall be not less than [6] [] inches in diameter and not less than [] feet deep. Keep an accurate log and record of material drilled through and the depths at which changes in formation occur. Do not construct the permanent well until data submitted for test hole has been analyzed and approved by the Contracting Officer. Should the data obtained from any test hole indicate unfavorable conditions, exploration shall be continued at other locations approved by the Contracting Officer until a suitable well site is located. In the event additional test holes are required and approved, the contract price and time for completion will be adjusted in accordance with the contract. A test hole may be incorporated into the finished construction provided it meets the requirements for a finished well. Seal test holes not used in finished construction as recommended in Article 56 of EPA 570/9-75-001 and as approved by the Contracting Officer.

3.2 WELL CONSTRUCTION

The depth of the permanent well and number of screens provided shall be adequate to produce a guaranteed capacity of [] gallons per minute of clear, potable water. Methods of construction include using drilling mud for conventional fluid rotary drilling or reverse circulation drilling.

3.2.1 Drilling

NOTE: In unconsolidated formations where inner casings are required, the inside diameter of the outer casing shall be a minimum of 3.0 inches larger than the outside diameter of the inner casing, and the diameter of the drill hole shall be slightly larger than the outside diameter of the outer casing. In consolidated formations where inner casings are not required, the drill hole shall be a

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minimum of 3.0 inches larger in diameter than the outside diameter of the outer casing.

Drill a hole [_____] inches in diameter to a minimum depth of [_____] feet and to additional depths as required to produce the flow capacity required.

3.2.2 Outer Casing, [Inner Casing,] and Well Screen

NOTE: When inner casings are not required, use first optional wording. When inner casings are required, delete first optional wording and use second optional wording.

Install the outer casing concentrically in the drilled hole and extend the casing down to a minimum depth of [_____] feet. [Provide welded joints in accordance with AWWA C206.] [Provide threaded joints in accordance with ANSI B1.20.1.] [Fill the void between the outer casing and the drilling hole with neat cement grout to seal the outer casing to the wall of the drilled hole.] [Install the inner casing and well screens concentrically in the outer casing and drill hole. Fill the void between the outer casing and the inner casing with neat cement grout to seal the inside wall of the outer casing to the outside wall of the inner casing.] Provide centralizers at the bottom of the casing and at other critical grouting points such as zones of unsuitable water quality. Grout casing from the bottom upward to effectively seal the annular void. Inject grout using a tremie pipe sealed to the well casing at the surface. Provide sufficient screens at the water bearing layer to be developed to secure available flow. Seal the bottom of the deepest screen with a threaded or welded plug, consisting of the same material and thickness as the screen body, or a welded plate, consisting of the same material and thickness as the screen body or casing.

3.2.3 Well Development

Set the casing[s] and allow the neat cement grout to harden a minimum of 72 hours prior to well development. Provide well development in accordance with Article 52 of EPA 570/9-75-001, except explosives will not be permitted. Furnish pumps, compressors, plungers, bailers, and other equipment required to fully develop the well for the maximum yield of water per foot of drawdown and to limit sand intrusion during the life of the well. Underream the sand strata to a diameter 16 inches greater than the outside diameter of the casing attached to the well screens. Extend the underream continuously through the entire depth of the water bearing strata. Pump the well free of sand, mud, drillings, and other foreign matter. Maximum sand concentration at the completion of well development shall be 2.0 ppm.

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3.2.4 Gravel Envelope

Following completion of the underream, fill the entire annular space between the screen and the outside wall of the underreamed hole with gravel. The gravel envelope shall extend from a point equal in distance to 2.5 times the largest diameter of the underreamed hole below the lowest screen and the same distance above the highest screen. Disinfect and place the gravel with a tremie pipe in accordance with Articles 54 and 50 of EPA 570/9-75-001. Control speed of gravel placement to prevent bridging and to allow for settlement of the gravel. Gravel placement

equipment and gravel placement methods shall be approved by the Contracting Officer prior to commencement of work.

3.2.5 Disinfection

Disinfect well, equipment, and material in accordance with Article 54 of EPA 570/9-75-001 and as specified herein. Portions of the well above the water level shall be maintained in a wet condition with a minimum of 50 ppm of free available chlorine for a period of not less than 30 minutes. A stock chlorine solution sufficient to produce 50 ppm of free available chlorine throughout the water in the well shall be added to the well at different water level intervals from top to bottom and then agitated to distribute the chlorine solution evenly throughout the well. The chlorine shall remain in the well for a minimum of 12 hours. After the 12-hour period, pump the well free of chlorine. Disinfect piping in accordance with AWWA C651.

3.2.6 Sanitary Seal

Provide a sanitary seal for the well to prevent contamination until the pump foundation and pump are installed on the well.

3.2.7 Abandoning Existing Wells

Abandon and seal existing wells in accordance with Article 56 of EPA 570/9-75-001 and as specified herein. Sealing shall consist of a permanent bridge neat cement seal directly above the lowest aquifer, intermediate neat cement seals between water bearing formations, and uppermost aquifer neat cement seal placed above the uppermost aquifer and the top of the well. Provide disinfected aquifer fill materials consisting of [sand and gravel between sealed layers] [as indicated].

3.3 WASTE DISPOSAL

Dispose of waste materials and soil removed from the drilled holes [by removal from the limits of Government property] [by deposition on Government property, as directed by the Contracting Officer] [as indicated].

3.4 FIELD SAMPLING AND TESTING

3.4.1 Material Samples

During drilling of test hole, take samples of materials found in each soil stratum. Preserve samples in approved containers furnished by the Contractor. In addition, take samples at 5-foot intervals below the static water level to ensure that changes in sand size are noted. Label samples to show depth below ground surface and thickness of the stratum from which the samples were obtained. Describe water-bearing strata in detail as to whether material is loose or compact, the color of material, and if gravel, whether it is water worn or angular. The presence of clay must be noted. Provide a sieve analysis for soil samples in each soil stratum.

3.4.2 Water Quality Determination

During drilling of test hole, collect, and have analyzed by a Government-approved testing laboratory, representative water samples from water-bearing strata to accurately show the quality of water from each stratum. Perform water sampling in accordance with Article 45 of the EPA 570/9-75-001. Include bacteriological and physical-chemical

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analysis, and further include field and routine analysis data contained in Parts I and III of DD Form 710, Physical and Chemical Analysis of Water, which accompanies this specification. In addition, analyze the water for any additional suspected minerals or contaminants which would make it unfit for human consumption, such as nitrate, fluoride, mercury, or any other contaminants.

3.4.3 Electric Log

Upon completion of test hole, furnish a complete electric log indicating spontaneous potential through the use of long and short normal resistivity logging of formations.

3.4.4 Pump Test

NOTE: The temporary pump capacity shall be a minimum of 160 percent of the guaranteed capacity rate.

Upon completion of the permanent well, provide a temporary pump, meter, air gage, and air line in the well for measuring the flow and drawdown. The temporary pump shall have a capacity of not less than [] gallons per minute. After determining the static water level in the well, begin pumping at a rate equal to 60 percent of the guaranteed capacity rate and check the drawdown at 15-minute intervals until drawdown stabilizes. Measure drawdown using the air line method. Continue pumping at that rate for 2 hours and check the water level at 30-minute intervals. Increase pumping rate in uniform increments of 20 percent of the guaranteed capacity rate and repeat described procedure at each increment of increased rate until the capacity of the well is determined or the 160 percent increment of the guaranteed capacity rate is reached. The capacity of the well shall be the flow obtained at a drawdown level 10 feet above the top of the uppermost screen. After determining the safe maximum yield of the well, conduct a continuous 24-hour pump test at that rate and check the drawdown at hourly intervals. Provide pipe and ditches to drain the water from the well site. Submit water disposal methods to the Contracting Officer for approval. Furnish a complete written log of the pump test, showing static water level, pumping rate, and drawdown at the specified intervals. Remove air line at completion of pump test. At the end of the 24-hour test and disinfection procedure, submit water samples to an approved testing laboratory for complete chemical and bacteriological analysis. Furnish additional samples as required by Contracting Officer.

3.4.5 Well Plumbness and Alignment Test

Upon completion of the permanent well, provide a well plumbness and alignment test using a plummet in accordance with Article 51 of the EPA 570/9-75-001. Perform the test on the entire depth of the well. The plumb or dummy shall move freely through the entire depth of the well. The well shall not vary from the vertical in excess of two-thirds of the smallest inside diameter of that part of the well being tested per 100 feet of depth. Correct defects in plumbness and alignment, and repeat test until the work is in compliance with contract requirements.

-- End of Section --

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CRITERIA NOTES

NOTE A: Drawings should include the following and any other information necessary to indicate layout and general configuration of the well.

Diameter of drilled hole

Casing sizes - outside casing, inside casing

Well screen size

Minimum depth of outer casing and minimum depth of well screen

Limits of gravel envelope around inside casing and screens

Limits of neat cement grout around outer casing

Location of air line and altitude gage

Type of cap, cover, or seal required at top of well

Required well capacity in gallons per minute

NOTE B: Delete the requirements for inner casings if the specification is written for a consolidated well and it is known that inner casings are not required. Approximate well casing size should be two sizes larger than the nominal diameter of the pump. Under no circumstances should the well casing size be less than one nominal size larger than the pump bowls. Zinc coating of casing may be omitted where water is not severely corrosive or where casing size is beyond the range of economical zinc coating. Welded joints are recommended for pipe larger than 20 inches in diameter, as well as for smaller pipe where necessary, to obtain proper clearance and maintain uniform grout thickness.

NOTE C: Delete the requirements for well screens if the specification is written for a consolidated well and it is known that well screens are not required. If the specification is written for an unconsolidated well, include appropriate data for the well screen such as inside diameter and type, e.g., perforated tube, continuous or noncontinuous slot, shutter, bar, or wire wound. Well screen efficiency and strength shall be considered in screen selection. Generally, screens should have long, narrow, continuous, horizontal slots larger on the inside than on the outside for optimum efficiency. Longer screens are required where slots are noncontinuous. Screen open areas and efficiencies are more limited in perforated, slotted, shutter, and bar screens. Shutter type screens are particularly appropriate for deeper wells, where additional strength is required.

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Perforated pipe base screens are appropriate in special cases where it may be necessary to drive or spud the screen into the ground.

NOTE D: Quartz and granite are common filter gravel materials, however, verify the type of filter materials locally available. Delete the requirements for gravel if the specification is written for a consolidated well and gravel is not required. The type and size of gravel depends on the formation to be developed. The gravel size should not be specified but should be recommended by the Contractor and determined by the Contracting Officer based on analysis of sand in the water-bearing strata.

NOTE E: Suggestions for improvement of this specification will be welcomed using the "Agency Response Form" located in SPECSINTACT under "System Directory" or DD Form 1426. Suggestions should be forwarded to:

Commanding Officer
Naval Construction Battalion Center
Civil Engineer Support Office
Code DSO3
Port Hueneme, CA 93043-5000

-- End --

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Appendix C

North Carolina Construction Standards for Public Water Supply Wells

(Source: NCAC Title 15A Subchapter 18C Sections .0100 through .2000
Current through, January 1, 1991)

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SECTION .0400 - WATER SUPPLY DESIGN CRITERIA

Rules .0401 - .0408 of Title 15A Subchapter 18C of the North Carolina Administrative Code (T15A.18C .0401 - .0408); has been transferred and recodified from Rules .1001 - .1008 Title 10 Subchapter 10D of the North Carolina Administrative Code (T10.10D .1001 - .1008), effective April 4, 1990.

.0401 MINIMUM REQUIREMENTS

The design criteria given in this Section are the minimum requirements for approval of plans and specifications of community water systems by the Division of Environmental Health, Department of Environment, Health, and Natural Resources. The Department provides additional guidelines for design of water systems in 15A NCAC 18C .0500 - .1000.

*History Note: Authority G.S. 130A-315; 130A-317; P.L. 93-523;
Eff. January 1, 1977;
Readopted Eff. December 5, 1977;
Amended Eff. September 1, 1979.*

.0402 WATER SUPPLY WELLS

(a) Well Construction. The construction of water supply wells shall conform to well construction regulations and standards of the Division of Environmental Management, N.C. Department of Environment, Health, and Natural Resources.

(b) Upper Terminal of Well. The well casing shall neither terminate below ground nor in a pit. The pump pedestal for above ground pumps of every water supply well shall project not less than six inches above the concrete floor of the well house, or the concrete slab surrounding the well. The well casing shall project at least one inch above the pump pedestal. For submersible pumps the casing shall project at least six inches above the concrete floor or slab surrounding the well head.

(c) Sanitary Seal. The upper terminal of the well casing shall be sealed watertight with the exception of a vent pipe or vent tube having a downward-directed, screened opening.

(d) Concrete Slab or Well House Floor. Every water supply well shall have a continuous bond concrete slab or well house concrete floor extending at least three feet horizontally around the outside of the well casing. Minimum thickness for the concrete slab or floor shall be four inches.

(e) Sample Tap and Waste Discharge Pipe. A water sample tap and piping arrangement for discharge of water to waste shall be provided.

(f) Yield.

(1) Wells shall be tested for yield and drawdown. A report or log of a least a 24-hour drawdown test to determine yield shall be submitted to the Division of Environmental Health for each well.

(2) Wells shall be located so that the drawdown of any well will not interfere with the required yield of another well.

(3) The combined yield of all wells of a water system shall provide in 12 hours pumping time the average daily demand as determined in subparagraph (f) (7).

(4) The capacity of the permanent pump to be installed in each well shall not exceed the yield of the well as determined by the drawdown test.

(5) A community water system using well water as its source of supply and designed to serve 50 or more residences or connections shall provide at least two wells. In lieu of a second well, another approved water supply source may be accepted.

(6) A totalizing meter shall be installed in the piping system from each well.

(7) The well or wells serving a mobile home park shall be capable of supplying an average daily demand of 250 gallons per day per connection. The well or wells serving residences shall be capable of supplying an average daily demand of 400 gallons per day per connection.

(g) Initial Disinfection of Water Supply Well. All new wells, and wells that have been repaired or reconditioned shall be cleaned of foreign substances such as soil, grease, and oil, and then shall be disinfected. A representative sample or samples of the water (free of chlorine) shall be collected and submitted to an approved laboratory for bacteriological analyses. After disinfection the water supply shall

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not be placed into service until bacteriological test results of representative water samples analyzed in an approved laboratory are found to be satisfactory.

(h) Initial Chemical Analyses. A representative sample of water from every new water supply well shall be collected and submitted for chemical analyses to the Division of Laboratory Services or to a laboratory approved by the Division. The results of the analysis must be satisfactory before the well is placed into service.

(i) Continuous Disinfection. Equipment designed for continuous application of chlorine or hypochlorite solution or some other approved and equally efficient disinfectant shall be provided for all well water supplies introduced on or after January 1, 1972. Equipment for determining residual chlorine concentration in the water shall be specified.

*History Note: Authority G.S. 130A-315; 130A-317; P.L. 93-523;
Eff. January 1, 1977;
Readopted Eff. December 5, 1977;
Amended Eff. September 1, 1990; January 1, 1986; March 31, 1980;
September 1, 1979.*

.0403 SURFACE WATER FACILITIES

(a) Unimpounded Stream. Both the minimum daily flow of record of the stream and the estimated minimum flow calculated from rainfall and run-off shall exceed the maximum daily draft for which the water treatment plant is designed with due consideration given to requirements for future expansion of the treatment plant.

(b) Pre-settling Reservoirs. Construction of a pre-settling or pre-treatment reservoir shall be required where excessive bacterial concentrations or wide and rapid variations in turbidity and/or chemical qualities occur.

(c) Impoundments. Raw water storage capacity shall be sufficient to reasonably satisfy the designed water supply demand during periods of drought.

(d) Clearing of Land for Impoundment. The area in and around the proposed impoundment of class I and class II reservoirs shall be cleared as follows:

(1) The area from two feet above and five feet below the normal full level of the impoundment shall be cleared and grubbed of all vegetation and shall be kept cleared until the reservoir is filled, provided that the area two feet above the normal full level may be reduced if the clearing at that elevation would exceed a horizontal distance of 50 feet from the full level. Secondary growth should be removed periodically and in all cases prior to flooding. A margin of at least 50 feet around the impoundment shall be owned or controlled by the water supplier.

(2) The entire area below the five foot water depth shall be cleared and shall be kept cleared of all growth of less than six inches in diameter until the reservoir is filled. Stumps greater than six inches in diameter may be cut off at ground level.

(3) All brush, trees, and stumps shall be burned or removed from the watershed.

(e) Intakes, Pumps, Treatment Units, and Equipment. Raw water intakes, pumps, treatment units and equipment shall be designed to provide water of potable quality meeting the water quality requirements stated in Section .1500 of this Subchapter.

*History Note: Authority G.S. 130A-315; 130A-317; P.L. 93-523;
Eff. January 1, 1977;
Readopted Eff. December 5, 1977.
Amended September 1, 1990.*

.0404 WATER TREATMENT FACILITIES

(a) Mixing and Dispersion of Chemicals. Provisions shall be made for adequate mixing and dispersion of chlorine and other chemicals applied to the water. There shall be provided a minimum of 20 minutes chlorine contact time prior to pumping the water to the distribution system.

(b) Chemical Feed Machines

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TITLE 15A - DEPARTMENT OF ENVIRONMENT, HEALTH, AND NATURAL RESOURCES

Notice is hereby given in accordance with G.S. 150B-21.2 that the EHNR - Division of Environmental Management intends to amend rules cited as 15A NCAC 2C .0101 - .0103, .0105, .0107 - .0114, .0116, .0118 - .0119; 2L .0107.

The proposed effective date of this action is September 1, 1992.

The public hearings will be conducted at the following locations, dates and times:

NEW BERN
May 18, 1992
7:00 p.m.
Superior Court, 2nd Floor
Craven County Courthouse

RALEIGH
May 26, 1992
7:00 p.m.
Ground Floor Hearing Room
Archdale Building
512 N. Salisbury Street

HICKORY
May 28, 1992
7:00 p.m.
Auditorium
Catawba Valley Community College

Reason for Proposed Action: 15A NCAC 2C .0101 - .0103, .0105, .0107 - .0114, .0116, .0118 - .0119. The proposed amendments to 15A NCAC 2C will amend the Well Construction Rules regarding permit requirements, variances, casing installation and grouting, and reporting; and will establish fees for well driller registration. 15A NCAC 2L .0107. Modify compliance boundary requirements so that permittees can maintain fixed boundary after subdivision/conveyance of property.

Comment Procedures: All persons interested in these matters are invited to attend the public hearing. Written comments may be presented at the public hearing or submitted through May 31, 1992. Please submit comments to Mr. David Hance, Division of Environmental Management, Groundwater Section, P.O. Box 29535, Raleigh, NC 27626-0535, (919) 733-3221. Please notify Mr. Hance prior to the public hearing if you desire

to speak. Oral presentation lengths may be limited depending on the number of people that wish to speak at the public hearing.

IT IS VERY IMPORTANT THAT ALL INTERESTED AND POTENTIALLY AFFECTED PERSONS, GROUPS, BUSINESSES, ASSOCIATIONS, INSTITUTIONS OR AGENCIES MAKE THEIR VIEWS AND OPINIONS KNOWN TO THE DEPARTMENT THROUGH THE PUBLIC HEARING AND COMMENT PROCESS, WHETHER THEY SUPPORT OR OPPOSE ANY OR ALL PROVISIONS OF THE PROPOSED RULES.

CHAPTER 2 - ENVIRONMENTAL MANAGEMENT

SUBCHAPTER 2C - WELL CONSTRUCTION STANDARDS

SECTION .0100 - CRITERIA AND STANDARDS APPLICABLE TO WATER-SUPPLY AND CERTAIN OTHER TYPE WELLS

.0101 GENERAL PROVISIONS

(a) Authorization. The North Carolina Environmental Management Commission is required, under the provisions of Chapter 87, Article 7, Section 87, General Statutes of North Carolina (short title: North Carolina Well Construction Act) to adopt appropriate rules and regulations governing the location, construction, repair, and abandonment of wells, and the installation and repair of pumps and pumping equipment.

(b) Purpose. Consistent with the duty to safeguard the public welfare, safety, health, and to protect and beneficially develop the ground water resources of the state, it is declared to be the policy of this state to require that the location, construction, repair and abandonment of wells, and the installation of pumps and pumping equipment conform to such reasonable standards and requirements as may be necessary to protect the public welfare, safety, health, and ground water resources.

Statutory Authority G.S. 87-87.

.0102 DEFINITIONS

As used herein, unless the context otherwise requires:

- (1) "Abandon" means to discontinue the use of and to seal the well according to the requirements of Rule .0113 of this Section.
(2) "Access port" means an opening in the well casing or well head installed for the primary purpose of determining the position of the water level in the well.
(3) "Agent" means any person who by [unclear] and legal agreement with a well owner has authority to act in his behalf in executing applications for permits. [unclear]

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either general agent or a limited agent authorized to do one particular act.

- (4) "ASTM" means the American Society for Testing and Materials.
- (5) ~~(4)~~ "Casing" means pipe or tubing constructed of specified materials and having specified dimensions and weights, that is installed in a borehole, during or after completion of the borehole, to support the side of the hole and thereby prevent caving, to allow completion of a well, to prevent formation material from entering the well, to prevent the loss of drilling fluids into permeable formations, and to prevent entry of undesirable water.
- (6) ~~(5)~~ "Commission" means the North Carolina Environmental Management Commission or its successor, unless otherwise indicated.
- (7) ~~(6)~~ "Consolidated rock" means rock that is firm and coherent, solidified or cemented, such as granite, gneiss, limestone, slate or sandstone, that has not been decomposed by weathering.
- (8) ~~(7)~~ "Contamination" means the act of introducing into water foreign materials of such nature, quality, and quantity as to cause degradation of the quality of the water.
- (9) "Department" means the Department of Environment, Health, and Natural Resources.
- (10) ~~(8)~~ "Designed capacity" shall mean that capacity that is equal to the rate of discharge or yield that is specified prior to construction of the well.
- (11) ~~(24)~~ "Director" means the Director of the Division of Environmental Management
- (12) ~~(25)~~ "Division" means the Division of Environmental Management.
- (13) ~~(9)~~ "Domestic use" means water used for drinking, bathing, household purposes, livestock or gardens.
- (14) "GPM" and "GPD" mean gallons per minute and gallons per day, respectively.
- (15) ~~(10)~~ "Grout" shall mean and include the following:
- (a) "Neat cement grout" means a mixture of not more than six gallons of clear, non-polluted water to one 94 pound bag of portland cement. Up to five percent, by weight, of bentonite clay may be used to improve flow and reduce shrinkage.
- (b) "Sand cement grout" means a mixture of not more than two parts sand and one part cement and not more than six gallons of clear, non-polluted water per 94 pound bag of portland cement
- (c) "Concrete grout" means a mixture of not more than two parts gravel to one part cement and not more than six gallons of clear, non-polluted water per 94 pound bag of portland cement. One hundred percent of the gravel must pass through a one-half inch mesh screen.
- (d) "Gravel cement grout, sand cement grout or rock cutting cement grout" means a mixture of not more than two parts gravel and sand or rock cuttings to one part cement and not more than six gallons of clear, non-polluted water per 94 pound bag of portland cement.
- (e) "Bentonite grout" means the mixture of no less than one and one-half pounds of commercial granulated bentonite with sufficient clear, non-polluted water to produce a grout weighing no less than eleven (11) pounds per gallon of mixture. Non-organic, non-toxic substances may be added to improve particle distribution and pumpability. Bentonite grout may only be used in those instances where specifically approved in this Section.
- (f) "Specialty grout" means a mixture of non-organic, non-toxic materials with characteristics of expansion, chemical-resistance, rate or heat of hydration, viscosity, density or temperature-sensitivity applicable to specific grouting requirements. Specialty grouts may not be used without prior approval by the Director.
- (16) ~~(11)~~ "Liner pipe" means pipe that is installed inside a completed and cased well for the purpose of sealing off undesirable water or for repairing ruptured or punctured casing or screens.
- (17) ~~(12)~~ "Monitoring well" means any well constructed for the primary or incidental purpose of obtaining subsurface samples of groundwater water or other liquids for examination or testing, or for the observation or measurement of groundwater levels. This definition excludes lysimeters, tensiometers, and other devices used to investigate the characteristics of the unsaturated zone.
- (18) ~~(13)~~ "Observation well" means any well constructed for the purpose of obtaining groundwater level information only.
- (19) ~~(14)~~ "Owner" means any person who holds the fee or other property rights in the well being constructed. A well is real property and its construction on land rests ownership in the land owner in the absence of contrary agreement in writing.
- (20) ~~(22)~~ "Pitless adapter unit or pitless units" are devices specifically manufactured to the standards specified under Rule .0107(i) ~~(4)~~ (5) of this Section for the purpose of allowing a subsurface lateral connection between a well and plumbing appurtenances.
- (21) ~~(15)~~ "Public water system"

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- (a) "Public water system" means a water system as defined in 15A NCAC 18C .0702 (Rules Governing Public Water Supplies) for the provision, to the public, of piped water for human consumption if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. Such term includes:
 - (i) any collection, treatment, storage, and distribution facility under control of the operator of such system and used primarily in connection with such system; and
 - (ii) any collection or pre-treatment storage facility not under such control which is used primarily in connection with such system.
- (b) A public water system is either a "community water system" or a "non-community water system":
 - (i) "Community water system" means a public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.
 - (ii) "Non-community water system" means a public water system which is not a community water system.
- (21) (16) "Recovery well" means any well constructed for the purpose of removing contaminated groundwater or other liquids from the subsurface.
- (22) "Settleable solids" means the volume of solid particles in a well-mixed one liter sample which will settle out of suspension, in the bottom of an Imhoff Cone, after one hour.
- (23) (17) "Site" means the land or water area where any facility, activity or situation is physically located, including adjacent or nearby land used in connection with the facility, activity or situation.
- (24) (18) "Specific capacity" means the yield of the well expressed in gallons per minute per foot of draw-down of the water level (gpm/ft.-dd).
- (25) (19) "Static water level" means the level at which the water stands in the well when the well is not being pumped and is expressed as the distance from a fixed reference point to the water level in the well.
- (26) "Suspended solids" means the weight of those solid particles in a sample which are retained by a standard glass microfiber filter, with pore openings of one and one-half microns, when dried at a temperature of 103 to 105 degrees Fahrenheit.
- (27) "Temporary well" means a monitor well, or a well that is constructed to determine aquifer characteristics, and which will be properly abandoned or converted to a permanent well within five days (120 hours) of completion of drilling of the borehole.
- (28) "Turbidity" means the cloudiness in water, due to the presence of suspended particles such as clay and silt, that may create esthetic problems or analytical difficulties for contamination. Turbidity measured in Nephelometric Turbidity Units (NTU) is based on a comparison of the cloudiness in the water with that in a specially prepared standard.
- (29) "Well" means any excavation that is cored, bored, drilled, jetted, dug or otherwise constructed for the purpose of locating, testing, developing, draining or recharging any groundwater reservoirs or aquifer, or that may control, divert, or otherwise cause the movement of water from or into any aquifer. Provided, however, this shall not include a well constructed by an individual on land which is owned or leased by him, appurtenant to a single-family dwelling, and intended for domestic use (including household purposes, farm livestock or gardens).
- (30) (20) "Well capacity" shall mean the maximum quantity of water that a well will yield continuously.
- (31) (21) "Well head" means the upper terminal of the well including adapters, ports, valves, seals, and other attachments.
- (32) (22) "Well system" means two or more wells serving the same facility.

Statutory Authority G.S. 87-85; 87-87; 143-214.2, 143-215.3.

.0103 REGISTRATION

- (a) Well Driller Registration:
 - (1) Every person, firm or corporation engaged in the business of drilling, boring, coring or constructing wells in any manner with the use of power machinery in the state shall register annually with the department.
 - (2) Registration shall be accomplished, during the period from January 1 to January 31 of each year, by completing and submitting to the department a registration application form provided by the department for this purpose.
 - (3) A non-refundable processing fee, in the form of a check or money order made payable to N.C. Department of Environment, Health, and Natural Resources shall be submitted with each registration application form. Fees for the year in which the registration will be valid, are as follows:
 - (A) For renewal of registration by any person, firm or corporation having registered

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at any time during the five calendar years prior to the date of application:

(i) fifty dollars (\$50.00) for applications postmarked prior to February 1; and

(ii) sixty dollars (\$60.00) for application postmarked after January 31.

(B) For registration by any person, firm or corporation that did not register at any time during the five calendar years prior to the date of application:

(i) fifty dollars (\$50.00) for applications postmarked prior to February 1; or

(ii) for each succeeding calendar month after January, the fee shall be reduced by three dollars (\$3.00) from that due in the proceeding month. As examples, the fee for applications postmarked February 1 through 29 would be forty-seven dollars (\$47.00), while the fee for applications postmarked November 1 through 30 would be twenty dollars (\$20.00).

(4) An application is incomplete until the required processing fee has been received. Incorrect or incomplete applications may be returned to the applicant.

(5) Upon receipt of a properly completed application form, the applicant will be issued a certificate of registration.

(b) Pump Installer Registration:

(1) All persons, firms, or corporations engaged in the business of installing or repairing pumps or other equipment in wells shall register bi-annually with the department.

(2) Registration shall be accomplished, during the period from April 1 to April 30 of every odd-numbered year, by completing and submitting to the department a registration form provided by the department for this purpose.

(3) Upon receipt of a properly completed application form, the applicant will be issued a certificate of registration.

Statutory Authority G.S. 87-87; 143-21.3 (a) (10), 143-355 (e).

.0105 PERMITS

(a) It is the finding of the Commission that the entire geographical area of the state is vulnerable to groundwater pollution from improperly located, constructed, operated, altered, or abandoned non-water supply wells and water supply wells not constructed in accordance with the standards set forth in Rule .0107 of this Section. Therefore, in order to insure reasonable protection of the groundwater resources, prior permission from the Division must be obtained for the construction of the types of wells enumerated in Paragraph (b) of this Rule.

(b) No person shall locate or construct any of the following wells until a permit has been issued by the Director.

(1) any water-well or well system with a design capacity of 100,000 gallons per day (gpd) or greater;

(2) any well added to an existing system where the total design capacity of such existing well system and added well will equal or exceed 100,000 gpd;

(3) any test well if the design capacity of the production well or well system will be 100,000 gpd or greater;

(3) (4) any monitoring well, constructed to assess the impact of an activity not permitted by the state, when installed on property other than that on which the unpermitted activity took place;

(4) (5) any recovery well;

(5) (6) any well intended for the recovery of minerals or ores;

(7) any geophysical exploration well;

(6) (8) any oil or gas exploration or recovery well;

(7) (9) any well for recharge or injection purposes;

(10) any cathodic protection well;

(8) (11) any well with a design deviation from the standards specified under the rules of this Subchapter.

(e) Monitoring wells associated with a wastewater treatment and disposal facility for which a permit must be obtained from the department may be permitted as part of that facility, provided, however, that the permit applicant comply with all provisions of this Subchapter including construction standards and reporting requirements.

(c) (4) The Commission Director may delegate, through a Memorandum of Agreement, to another state governmental agency, the authority to permit wells that are an integral part of a facility requiring a permit from the agency. Provided, however, that the permittee comply with all provisions of this Subchapter, including construction standards and the reporting requirements as specified in Rule .0114. In the absence of such agreement, all wells specified in Paragraph (b) of this Rule require a well construction permit in addition to any other permits.

(d) (e) An application for a permit shall be submitted by the owner or his agent, in duplicate to the department on forms furnished by the department, and shall include the following: In the event that the permit applicant is not the owner of the property on which the well or well system is to be constructed, the permit application must contain written approval from the property owner and a statement that the applicant assumes total responsibility for ensuring that the well(s) will be located, constructed, main-

tained and abandoned in accordance with the requirements of this Subchapter.

(e) The application shall be submitted in duplicate to the Division, on forms furnished by the Division, and shall include the following:

- (1) For all wells:
 - (A) the owner's name (facility name);
 - (B) the owner's mailing address (facility address);
 - (C) description of the well type and activity requiring a permit;
 - (D) facility location (map);
 - (E) site plan showing location of all sources or potential sources of groundwater contamination and locations of proposed wells; a map of the facility and general site area, to scale, showing the locations of:
 - (i) all property boundaries, at least one of which is referenced to a minimum of two landmarks such as identified roads, intersections, streams or lakes;
 - (ii) all existing wells, identified by type of use, within the property boundaries;
 - (iii) the proposed well or well system;
 - (iv) any test borings; and
 - (v) all sources of known or potential groundwater contamination (such as septic tank systems; pesticide, chemical or fuel storage areas; animal feedlots; landfills or other waste disposal areas) within 500 feet of the proposed well site;
 - (F) location and description of existing wells on the same site or within the same well system; the well drilling contractor's name, if known.
 - (G) location of any test borings;
 - (H) construction diagram of the proposed wells well(s) including specifications describing all materials to be used, methods of construction and means for assuring the integrity and quality of the finished well(s).
- (2) For water supply wells or well systems with a designed capacity of 100,000 gpd or greater the application shall include, in addition to the information required in Subparagraph (c)(1) of this Rule: the application shall include:
 - (A) the number, yield and location of existing wells in the system;

(B) the design capacity of the proposed well(s);

(C) any other information that the department Division may reasonably deem necessary.

- (3) For those monitoring wells and recovery wells with a design deviation from the specifications of Rule .0108 of this Section, in addition to the information required in Subparagraph (e)(1) of this Rule:

(A) a description of the subsurface conditions sufficient to evaluate the site. Data from test borings, wells pumping tests, etc., may be required as necessary;

(B) a description of the quantity, character and origin of the contamination;

(C) a justification for the necessity of the design deviation; and

(D) ~~(C)~~ any other information that the department Division may reasonably deem necessary.

- (4) For those recovery wells with a design deviation from the specifications in Rule .0108 of this Section, in addition to the information required in Subparagraph (e)(1) and Parts (c)(3)(A), (B) and (C) of this Rule, the application shall describe the disposition of any fluids recovered if the disposal of those fluids will have an impact on any existing wells other than those installed for the express purpose of measuring the effectiveness of the recovery well(s).

(f) In the event of an emergency, monitoring wells and/or recovery wells may be constructed after verbal approval is provided by the Director or his delegate. After the fact After-the-fact applications shall be submitted by the driller or owner within ten days after construction begins. The application shall include construction details of the monitoring well(s) and/or recovery well(s).

(g) It shall be the responsibility of the well owner or his agent to see that a permit is secured prior to the beginning of construction of any well for which a permit is required under the rules of this Subchapter.

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.0107 STANDARDS OF CONSTRUCTION: WATER-SUPPLY WELLS

(a) Location.

- (1) The well shall not be located

(A) in an area not generally subject to flooding. Areas which have a propensity for flooding include those with concave slope, alluvial or colluvial soils, gullies, depressions, and drainage ways;

(B) at a minimum horizontal distance of 50 feet from any water-tight sewage and liquid waste collection facility (such as cast iron pipe) except in the case of wells intended for a single family dwelling where it is not feasible to obtain 50 feet separation between a well and a water-tight liquid waste collection facility because of lot size or other fixed conditions, the horizontal separation distance shall be the maximum feasible distance, but in no case less than 25 feet; provided

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the sewer line is constructed of leak-proof pipe, such as cast iron pipe, with leaded or mechanical joints;

(C) at a minimum horizontal distance of 100 feet from any other sewage or liquid waste collection or disposal facility (such as a septic tank and drain fields) and any other source of existing or potential pollution or contamination, except in the case of wells intended for a single family dwelling where it is not feasible to obtain 100 feet horizontal separation between a well and a source because of lot size or other fixed conditions, the separation distance shall be maximum feasible distance, but in no case less than 50 feet.

(2) The minimum horizontal separation between a well intended for a single-family residence or other non-public water system, and potential sources of groundwater contamination shall be as follows unless otherwise specified:

(A) Septic tank and drainfield	100 ft.
(B) Other subsurface ground absorption waste disposal system.....	100 ft.
(C) Industrial or municipal sludge-spreading or wastewater-irrigation sites	100 ft.
(D) Water-tight sewage or liquid-waste collection or transfer facility	50 ft.
(E) Other sewage and liquid-waste collection or transfer facility	100 ft.
(F) Cesspools and privies	100 ft.
(G) Animal feedlots or manure piles.....	100 ft.
(H) Fertilizer, pesticide, herbicide or other chemical storage areas.....	100 ft.
(I) Non-hazardous waste storage, treatment or disposal lagoons.....	100 ft.
(J) Sanitary landfills.....	500 ft.
(K) Other non-hazardous solid waste landfills	100 ft.
(L) Animal barns	100 ft.
(M) Building foundations.....	50 ft.
(N) Surface water bodies.....	50 ft.
(O) Chemical or petroleum fuel underground storage tanks regulated under 15A NCAC 2N:	
(i) with secondary containment	50 ft.
(ii) without secondary containment.....	100 ft.
(P) All other sources of groundwater contamination.....	100 ft.

(3) For a well serving a single-family dwelling where lot size or other fixed conditions preclude the separation distances specified in Subparagraph (a)(2) of this Rule, the required separation distances may be reduced to the maximum possible but in no case less than the following:

(A) Septic tank and drainfield	50 ft.
(B) Water-tight sewage or liquid-waste collection or transfer facility	25 ft.
(C) Building foundations.....	25 ft.
(D) Cesspool or privies.....	50 ft.

(4) A well or well system, serving more than one single-family dwelling but with a designed capacity of less than 100,000 gpd, must meet the separation requirements specified in Subparagraph (a)(2) of this Rule;

(5) A well or well system with a designed capacity of 100,000 gpd or greater must be located a sufficient distance from known or anticipated sources of groundwater contamination so as to prevent a violation of applicable groundwater quality standards, resulting from the movement of contaminants, in response to the operation of the well or well system at the proposed rate and schedule of pumping;

(6) ~~(2)~~ Actual separation distances must conform with the more stringent of applicable federal, state and local requirements;

(7) ~~(3)~~ Wells drilled for public water supply systems regulated by the Department of Human Resources Division of Environmental Health shall meet the siting and all other requirements of that department. Division.

(b) Source of water.

(1) The source of water for any well intended for domestic use shall not be from a water bearing zone or aquifer that is known to be contaminated;

(2) In designated areas described in Rule .0117 of this Section, the source shall be greater than 35 feet;

(3) In designated areas described in Rule .0116 of this Section, the source may be less than 20 feet, but in no case less than 10 feet; and

(4) In all other areas the source shall be at least 20 feet below land surface.

(c) ~~(b)~~ Drilling Fluids and Additives. Drilling Fluids and Additives shall be materials specified for use and not contain organic or toxic substances and may be comprised only of:

(1) the formational material encountered during drilling; or

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(2) materials manufactured specifically for the purpose of borehole conditioning or water well construction, and approved by the Division.

(d) ~~(e)~~ Casing.

(1) If steel casing is used, then:

(A) The casing shall be new, seamless or electric-resistance welded galvanized or black steel pipe. Galvanizing shall be done in accordance with requirements of ASTM A-120.

(B) The casing, threads and couplings shall meet or exceed the specifications of ASTM A-53, A-120 or A589.

(C) The minimum wall thickness for a given diameter shall equal or exceed that specified in Table 1.

TABLE 1: MINIMUM WALL THICKNESS FOR STEEL CASING:

Nominal Diameter (in.)	Wall Thickness (in.)
For 3-1/2" or smaller pipe, schedule 40 is required	
4	0.142
5	0.156
5-1/2	0.164
6	0.185
8	0.250
10	0.279
12	0.330
14 and larger	0.375

(D) Stainless steel casing, threads, and couplings shall conform in specifications to the general requirements in ~~ANSI~~ ASTM A-530 and also shall conform to the specific requirements in the ASTM standard that best describes the chemical makeup of the stainless steel casing that is intended for use in the construction of the well;

(E) Stainless steel casing shall have a minimum wall thickness that is equivalent to standard schedule number 10S;

(F) Steel casing shall be equipped with a drive shoe if the casing is seated in a consolidated rock formation and for any other wells if the casing is driven. The drive shoe shall be made of forged, high carbon, tempered seamless steel and shall have a beveled, hardened cutting edge. A drive shoe will not be required for wells in which the grout surrounds and extends the entire length of the casing.

(2) If Thermoplastic Casing is used, then:

(A) the casing shall be new;

(B) the casing and joints shall meet or exceed all the specifications of ASTM F-480-81, except that the outside diameters will not be restricted to those listed in F-480;

(C) the maximum depth of installation for a given SDR or Schedule number shall not exceed that listed in Table 2;

Editor's Note: This Table has been moved from Part (e)(1)(C) in this Rule. The amendments to the table are shown below. The table is shown as deleted from Part (c)(1)(C).

TABLE 2: Maximum allowable depths (in feet) of Installation of Thermoplastic Water Well Casing

Nominal Diameter (in inches)
Schedule

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number-	2	2.5	3	3.5	4	5	6	8	10	12	14	16
Schedule 40-	485	635	415	315	253	180	130	85	65	65	50	50
Schedule 80-	1460	1685	1170	920	755	550	495	340	290	270	265	255

SDR Number	All Diameters (in inches)
SDR 41	20
SDR 32.5	50
SDR 27.5	80 100
SDR 26	95
SDR 21	185
SDR 17	355
SDR 13.5	735

- (D) The top of the casing shall be terminated by the drilling contractor at least twelve inches above land surface;
- (E) For wells in which the casing will extend into consolidated rock, thermoplastic casing shall be equipped with a section of steel casing at least three feet in length, or other device approved by the Director, sufficient to protect the physical integrity of the thermoplastic casing during the processes of seating and grouting the casing and subsequent drilling operations.
- (3) In constructing any well, All water-bearing zones that are known to contain containing polluted, saline, or other non-potable water, that are encountered or penetrated during drilling, shall be adequately cased and cemented off so that pollution of the overlying and underlying groundwater zones will not occur.
- (4) Every well shall be cased with so that the bottom of the casing extending extends to a minimum depth as follows:
- (A) Wells located within the area described in Rule .0117 of this Subchapter Section shall be cased from land surface to a depth of at least 35 feet;
- (B) Wells located within the area described in Rule .0116 of this Subchapter Section shall be cased from land surface to a depth of at least 10 feet;
- (C) Wells located in any other area shall be cased from land surface to a depth of at least 20 feet.
- (5) The top of the casing shall be terminated by the drilling contractor at least 12 inches above land surface.
- (6) The casing in wells constructed to obtain water from a consolidated rock formation shall be:
- (A) adequate to prevent any formational material from entering the well in excess of the levels specified in Paragraph (i) of this Rule; and
- (B) Firmly seated at least one foot into the rock, and
- (i) sealed with grout at least one foot into the rock; or
- (ii) sealed by some other method, approved by the Director, that will provide equal protection against the entrance of formation material or contaminants one foot below the top of the consolidated rock.
- (7) The casing in wells constructed to obtain water from an unconsolidated rock formation (such as gravel, sand or shells) shall extend at least one foot into the top of the water-bearing formation.
- (8) Upon completion of the well, the well casing shall be sufficiently free of obstacles as necessary to allow for the installation and proper operation of pumps and associated equipment.
- (e) (d) Grouting.
- (1) Casing shall be grouted to a minimum depth of twenty feet below land surface except that:

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- (A) In those areas designated by the Director to meet the criteria of Rule .0116 of this Subchapter Section, grout shall extend to a depth of two feet above the screen or, for open end wells, to the bottom of the casing, but in no case less than 10 feet.
- (B) In those areas designated in Rule .0117 of this Subchapter, Section, grout shall extend to a minimum of 35 feet below land surface.
- (C) The casing shall be grouted as necessary to seal off all aquifers or zones with water of a poorer quality than that of the producing zone(s).

TABLE 2: Maximum allowable depths (in feet) of Installation of Thermoplastic Water Well Casing

Schedule number	Nominal Diameter											
	2	2.5	3	3.5	4	5	6	8	10	12	14	16
Schedule 40	485	635	415	315	253	189	130	85	65	65	50	50
Schedule 80	1460	1685	1170	920	755	550	495	340	290	270	265	255
SDR Number	All Diameters											
SDR 41	20											
SDR 32.5	50											
SDR 27.5	80											
SDR 26	95											
SDR 21	185											
SDR 17	355											
SDR 13.5	735											

(2) For large diameter wells, commonly referred to as "bored" wells, cased with concrete pipe or ceramic tile, the following shall apply:

- (A) The diameter of the bore hole shall be at least six inches larger than the outside diameter of the casing;
- (B) The annular space around the casing shall be filled with a cement-type grout to a depth of at least 20 feet, excepting those designated areas specified in Rules .0116 and .0117 of this Section. The grout shall be placed in accordance with the requirements of this Paragraph.
- (3) For any well constructed to obtain water from consolidated rock, the well casing shall be grouted, using a cement type grout, to a height of five feet above the intersection of the casing and the consolidated rock.
- (4) Bentonite grout may only be used in that portion of the borehole that is below the water table throughout the year.
- (5) Grout shall be placed around the casing by one of the following methods:
- (A) Pressure. The annular space between the casing and the formation shall be a minimum of 1.5 inches. Grout shall be pumped or forced under pressure through the bottom of the casing until it fills the annular area around the casing and overflows at the surface.
- (B) Pumping. The annular space between the casing and formation, shall be a minimum of 1.5 inches. Grout shall be pumped into place through a hose or pipe extended to the bottom of the annular space which can be raised as the grout is applied. The grout hose or pipe should remain submerged in grout during the entire application.

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- (C) Other. The annular space around the casing shall be a minimum of three inches. The annular space shall be completely filled with grout by any method that will insure completed filling of the space; provided the annular area does not contain water. If the annular area contains water it shall be dewatered or the grout shall be placed by either the pumping or pressure method. Grout may be emplaced in the annular space, by gravity flow through a pipe, to a maximum depth of 20 feet below land surface.
- (6) ~~(3)~~ If an outer casing is installed, it shall be grouted by either the pumping or pressure method.
- (7) ~~(4)~~ All grout mixtures shall be prepared prior to emplacement.
- (8) ~~(5)~~ The well shall be grouted within five working days after the casing is set.
- (9) ~~(6)~~ No additives which will accelerate the process of hydration shall be used in grout for thermoplastic well casing.
- (10) Where grouting is required by the provisions of this Section, the grout shall extend outward from the casing wall to a minimum thickness equal to either one-third of the diameter of the outside dimension of the casing or two inches, whichever is greater, excepting, however, that large diameter bored wells shall meet the requirements of Subparagraph (e)(2) of this Rule.
- (f) ~~(e)~~ Well Screens.
- (1) The well, if constructed to obtain water from an unconsolidated rock formation, shall be equipped with a screen that will adequately prevent the entrance of formation material into the well after the well has been developed and completed by the well contractor.
- (2) The well screen be of a design to permit the optimum development of the aquifer with minimum head loss consistent with the intended use of the well. The openings shall be designed to prevent clogging and shall be free of rough edges, irregularities or other defects that may accelerate or contribute to corrosion or clogging.
- (3) Multi-screen wells shall not connect aquifers or zones which have differences
- ~~(A) in water quality which would result in contamination of any aquifer or zone.~~
- ~~(B) in water levels that would result in depletion of water from any aquifer or zone or significant change in head in any aquifer or zone.~~
- (g) ~~(f)~~ Gravel- and Sand- Packed Wells.
- (1) In constructing a gravel- or sand- packed well.
- (A) The gravel packing material shall be composed of quartz, granite, or similar rock material and shall be clean, rounded, of uniform size, water-washed and free from clay, silt, or other deleterious material.
- (B) The size of the gravel packing material shall be determined from a grain size analysis of the formation material and should be compatible with the grain size of the aquifer. shall be of a size sufficient to prohibit the entrance of formation material into the well in concentrations above those permitted by Paragraph (h) of this Rule.
- (C) The gravel packing material shall be placed in the annular space around the screens and casing by a fluid circulation method, preferably through a conductor pipe or to insure accurate placement and avoid bridging.
- (D) The gravel packing material shall be adequately disinfected
- (E) For gravel -or sand- packed wells in which an outer casing, that is grouted its entire length, does not extend to the top of the producing zone, a neat cement plug of at least 10 feet in vertical thickness shall be placed in the annular area between the inner casing and formation opposite the first clay above the top screen. The remaining space shall be filled with grout or clay except the upper 20 feet, which shall be filled with grout.
- (F) Centering guides must be installed within five feet of the top packing material to ensure even distribution of the packing material in the borehole.
- (2) The gravel pack packing material shall not connect aquifers or zones which have differences
- ~~(A) in water quality that would result in deterioration of the water quality in any aquifer or zone.~~
- ~~(B) in water levels that would result in depletion of water from any aquifer or zone or significant change in head in any aquifer or zone.~~
- (h) ~~(g)~~ Large Diameter Wells
- (1) A large diameter well cased with concrete pipe and commonly referred to as a "bored" well, may be constructed.
- (2) If the casing joints are not sealed, the construction shall be as follows:
- (A) The bore hole shall have a minimum diameter of six inches larger than the outside diameter of the casing.
- (B) The annular space around the casing shall be filled with neat cement, sand cement or concrete grout to a depth of at least 20 feet below land surface. The grout shall be placed in accordance with requirements of Rule .0107 (d)(3) of this Subchapter.
- (C) The annular space around the casing below the grout shall be filled with sand or gravel.

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- (D) The gravel pack material shall be composed of quartz, granite, or similar rock material and shall be clean, rounded, uniform, water-washed and free from clay, silt, or other deleterious material.
- (E) The gravel shall be adequately disinfected.
- (3) If the casing joints are sealed, the bore hole shall have a minimum diameter of six inches larger than the outside diameter of the casing to a depth of at least 20 feet below the land surface. The annular space around the casing shall be filled with neat or sand-cement grout to a depth of at least 20 feet below land surface.
- (4) The well head shall be completed in the same manner as required for other water supply wells.
- (h) Well Development.
- (1) All water supply wells shall be properly developed by the well driller;
- (2) Development shall include removal of formation materials, mud, drilling fluids and additives. A total suspended solids concentrations of less than 5 milligrams per liter of formation materials is considered acceptable, such that the water contains no more than:
- (A) five milligrams per liter (19 milligrams per gallon) of scilicet solids; or
- (B) ten NTUs of turbidity as suspended solids.
- (i) Well Head Completion.
- (1) Access Port. Every water supply well and such other wells as may be specified by the Commission shall be equipped with a usable access port or air line. The access port shall be at least one half inch inside diameter opening so that the position of the water level can be determined at any time. Such port shall be installed and maintained in such manner as to prevent entrance of water or foreign material.
- (2) Well Contractor Identification Plate.
- (A) An identification plate, showing the drilling contractor and registration number and the information specified in Part (i)(2)(E) of this Rule, shall be installed on the well within 24 72 hours after completion of the drilling.
- (B) The identification plate shall be constructed of a durable weatherproof, rustproof metal, or equivalent material approved by the Director.
- (C) The identification plate shall be securely permanently attached to the well casing or enclosure floor around the casing where it is readily visible.
- (D) The identification plate shall not be removed from the well casing or enclosure floor by any person.
- (E) The identification tag plate shall be stamped with a permanent marking within 30 days of completion of drilling to show the:
- (i) total depth of well;
- (ii) casing depth (ft.) and inside diameter (in.);
- (iii) screened intervals of screened wells;
- (iv) gravel packing interval of gravel- or sand- packed wells;
- (v) yield, in gallons per minute (gpm), or specific capacity in gallons per minute per foot of drawdown (gpm/ft-dd); and
- (vi) static water level and date measured;
- (vii) drilling contractor and registration number;
- (viii) (vii) date well completed.
- (3) Pump Installer Identification Plate.
- (A) An identification plate, displaying the name and registration number of the pump installation contractor, shall be permanently attached to either the aboveground portion of the well casing, or the enclosure floor if present, within 72 hours after completion of the pump installation;
- (B) The identification plate shall be constructed of a durable waterproof, rustproof metal, or equivalent material approved by the Director;
- (C) The identification plate shall not be removed from the well casing or enclosure floor by any person, and
- (D) The identification plate shall be stamped with a permanent marking to show the:
- (i) date the pump was installed;
- (ii) the depth of the pump intake; and
- (iii) the horsepower rating of the pump.
- (4) (3) Valved flow. Every artesian well that flows under natural artesian pressure shall be equipped with a valve so that the flow can be completely stopped. Well owners shall be responsible for the operation and maintenance of the valve.
- (5) (4) Pitless adapter adapters or pitless units shall be allowed as a method of well head completion under the following conditions:

- (A) The pitless adapter unit device be of standard design and manufactured specifically for the purpose of water well construction;
- (B) the unit shall meet industry standards for strength and water tightness. Design, installation and performance standards shall be those specified in PAS-1 (Pitless Adapter Standard No. 1) as adopted by the Water System Council's Pitless Adapter Division;
- (C) The unit pitless device will be compatible with the well casing;
- ~~(D)~~ the unit be joined to the well casing be either a threaded coupling or welded joint;
- ~~(D)~~ ~~(E)~~ The top of the unit pitless device shall be extend at least 8 inches above land surface;
- ~~(E)~~ ~~(F)~~ The unit pitless device shall have an access port.
- (5) All openings for piping, wiring, and vents shall enter into the well at least eight inches above land surface, except where pitless adapter adapters or pitless units are used, and shall be adequately sealed to preclude the entrance of contaminants into the well.

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.0108 STANDARDS OF CONSTRUCTION:

WELLS OTHER THAN WATER SUPPLY

(a) No well shall be located, constructed, operated, or repaired in any manner that may adversely impact the quality of groundwater. Any test holes and borings hole or boring shall be permanently abandoned by the driller in accordance with Rule .0113 of this Section within two days after drilling or two days after testing is complete, whichever is least restrictive; except in the case that a test well is being converted to a production well, in which case conversion shall be completed within 30 days.

(b) Injection wells shall conform to the standards set forth in Section .0200 of this Subchapter.

(c) Monitoring wells and recovery wells shall be located, designed, constructed, operated and abandoned with materials and by methods which are compatible with the chemical and physical properties of the contaminants involved, specific site conditions and specific subsurface conditions. Specific construction standards will be itemized in the construction permit, if such a permit is required, but the following general requirements will apply:

(1) For wells from which samples of groundwater or other liquids will be obtained for the purpose of examination or testing, or for the recovery of polluted groundwater:

- (A) ~~(1)~~ The borehole shall not penetrate to a depth greater than the depth to be monitored or the depth from which contaminants are to be recovered.
- (B) ~~(2)~~ The well shall not hydraulically connect separate aquifers.
- (C) ~~(3)~~ The construction materials shall be compatible with the contaminants to be monitored or recovered
- (D) ~~(4)~~ The well shall be constructed in such a manner that water or contaminants from the land surface cannot migrate along the borehole annulus into gravel pack, the packing material or well screen area.

~~(E)~~ ~~(5)~~ When a gravel pack is Packing material placed around the screen a seal shall be installed above the gravel. shall extend to a depth at least one foot above the top of the screen. A one foot thick seal, comprised of bentonitic clay or other material approved by the Director, shall be emplaced directly above and in contact with the packing material.

~~(F)~~ ~~(6)~~ Grout shall be placed in the annular space between the casing and the borehole wall from land surface to a depth within two feet above the top of the well screen the top of the clay seal or to the bottom of the casing for open end wells.

~~(G)~~ ~~(7)~~ All wells shall be secured to reasonably insure against unauthorized access and use.

~~(H)~~ ~~(8)~~ All wells shall be afforded reasonable protection against damage during construction and use.

~~(I)~~ ~~(9)~~ Any wells which are flowing artesian wells shall be valved so that the flow can be regulated.

~~(J)~~ The well casing shall be terminated no less than 12 inches above land surface datum unless both of the following conditions are met:

(i) site-specific conditions directly related to business activities, such as vehicle traffic, would endanger the physical integrity of the well, and

(ii) the well head is completed in such a manner so as to preclude surficial contaminants from entering the well.

~~(K)~~ ~~(10)~~ Each well shall have permanently affixed an identification plate constructed of a durable material and shall contain the following information:

- (i) ~~(A)~~ drilling contractor name and registration number;
- (ii) ~~(B)~~ date well completed,
- (iii) ~~(C)~~ total depth of well;
- (iv) ~~(D)~~ a warning that the well is not the for water supply and that the

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groundwater may contain hazardous materials; and

(v) ~~(L)~~ depth(s) to screen(s).

(L) Each well shall be developed such that the level of turbidity or settleable solids does not preclude accurate chemical analyses of any fluid samples collected.

(2) For any well which will only be used to measure groundwater levels, the following general requirements will apply:

(A) The borehole shall not penetrate to a depth greater than the depth at which fluid elevation measurements will be made;

(B) The well shall not hydraulically connect separate aquifers;

(C) The well shall be constructed in such a manner that water or contaminants from the land surface cannot migrate along the borehole channel into the packing material or well screen areas;

(D) Grout shall be placed in the annular space between the casing and the borehole from land surface to the clay seal above the packing material or to the bottom of the casing for open end wells;

(E) Unless the wells will not be left unattended, such as during a well capacity or aquifer capacity test, all wells shall be secured to reasonably insure against unauthorized access and use;

(F) All wells shall be afforded reasonable protection against damage during construction and use;

(G) Any well which is a flowing artesian well shall be valved such that flow can be regulated;

(H) The well casing shall be terminated no less than 12 inches above land surface datum unless both of the following conditions are met:

(i) site-specific conditions related to business activities, such as vehicle traffic, would endanger the physical integrity of the well, and

(ii) the well head is completed in such a manner so as to preclude surficial contaminants from entering the well.

(I) An identification plate constructed of a rustproof, durable material shall be permanently affixed to the well and shall contain the following information

(i) drilling contractor name and registration number,

(ii) date well completed,

(iii) total depth of well,

(iv) a warning that the well is not a water supply well and that the groundwater may contain contaminants

(d) Observation Wells. Wells constructed for the purpose of monitoring or testing for the

presence of liquids associated with tanks regulated under 15A NCAC 2N (Criteria and Standards Applicable to Underground Storage Tanks) shall be constructed in accordance with 15A NCAC 2N .0504.

(H) shall be cased as specified in .0107(e) of this Subchapter unless otherwise approved by the department.

(2) shall be grouted to within two feet of the well screens or, for open end wells, to the bottom of the casing unless otherwise approved by the department.

(e) Wells constructed for the purpose of monitoring for the presence of vapors associated with tanks regulated under 15A NCAC 2N shall:

(1) be constructed in such a manner as to prevent the entrance of surficial contaminants or water into or alongside the well casing; and

(2) be provided with a lockable cap in order to reasonably insure against unauthorized access and use.

(f) Temporary wells and all other non-water supply wells shall be constructed in such a manner as to preclude the vertical migration of contaminants within and along the borehole channel.

(g) For sand-or gravel-packed wells, centering guides must be installed within five feet of the top of the packing material to ensure even distribution of the packing material in the borehole.

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.0109 PUMPS AND PUMPING EQUIPMENT

(a) The pumping capacity of the pump shall be consistent with the intended use and yield characteristics of the well.

(b) The pump and related equipment for the well shall be conveniently located to permit easy access and removal for repair and maintenance.

(c) The base plate of a pump placed directly over the well shall be designed to form a watertight seal with the well casing or pump foundation.

(d) In installations where the pump is not located directly over the well, the annular space between the casing and pump intake or discharge piping shall be closed with a watertight seal preferably designed specifically for this purpose.

(e) The well shall be properly vented at the well head to allow for the pressure changes within the well except when a suction lift type pump is used.

(f) A hose bibb shall be installed at the well head by the person installing the pump for obtaining water samples. In the case of offset jet pump installations the hose bibb shall be installed on the return (pressure) side of the jet pump piping.

(g) A priming tee shall be installed at the well head in conjunction with offset jet pump installations.

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(h) Joints of any suction line installed underground between the well and pump shall be surrounded by six inches of cement, or encased in a larger pipe that is sealed at each end.

(i) The drop piping and electrical wiring used in connection with the pump shall meet all applicable underwriters specifications. ~~acceptable to the department.~~

(j) Contaminated water shall not be used for priming the pump.

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.0110 WELL TESTS FOR YIELD

(a) Every water supply well shall be tested for capacity by a method and for a period of time acceptable to the department.

(b) The permittee may be required as a permit condition to test any well for capacity by a method stipulated in the permit.

(c) Standard methods for testing domestic well capacities include:

(1) Pump Method

(A) select a permanent measuring point, such as the top of the casing;

(B) measure and record the static water level below or above the measuring point prior to starting the pump;

(C) measure and record the discharge rate at intervals of 10 minutes or less;

(D) measure and record water levels using a steel or electric tape at intervals of 10 minutes or less;

(E) continue the test for a period of at least one hour;

(F) make measurements within an accuracy of plus or minus 0.25 of a foot, an inch.

(2) Bailer Method

(A) select a permanent measuring point, such as the top of the casing;

(B) measure and record the static water level below or above the measuring point prior to starting the bailing procedure;

(C) bail the water out of the well as rapidly as possible for a period of at least one hour; determine and record the bailing rate in gallons per minute at the end of the bailing period;

(D) measure and record the water level immediately after stopping bailing process.

(3) Air Rotary Drill Method

(A) measure and record the amount of water being injected into the well during drilling operations;

(B) measure and record the discharge rate in gallons per minute at intervals of one hour or less during drilling operations;

(C) after completion of the drilling, continue to blow the water out of the well for at least 30 minutes and measure and record the discharge rate in gallons per

minute at intervals of 10 minutes or less during the period;

(D) measure and record the water level immediately after discharge ceases.

(4) Air Lift Method

(A) Measurements shall be made through a pipe placed in the well;

(B) The pipe shall have a minimum inside diameter of at least five-tenths of an inch and shall extend from top of the well head to a point inside the well that is below the bottom of the air line;

(C) Measure and record the static water level prior to starting the air compressor;

(D) Measure and record the discharge rate at intervals of 10 minutes or less;

(E) Measure and record the pumping level using a steel or electric tape at intervals of 10 minutes or less;

(F) Continue the test for a period of at least one hour.

(d) Public, Industrial and Irrigation Wells. Every public, industrial and irrigation well upon completion, shall be tested for capacity by the drilling contractor (except when the owner specifies another agent) by the following or equivalent method:

(1) The water level in the well to be pumped and any observation wells shall be measured and recorded prior to starting the test.

(2) The well shall be tested by a pump of sufficient size and lift capacity to satisfactorily test the yield of the well, consistent with the well diameter and purpose.

(3) The pump shall be equipped with sufficient throttling devices to reduce the discharge rate to approximately 25 percent of the maximum capacity of the pump.

(4) The test shall be conducted for a period of at least 24 hours without interruption and shall be continued for a period of at least four hours after the pumping water level stabilizes (ceases to decline). When the total water requirements for wells other than public, community or municipal supply wells are less than 100,000 gpd, the well shall be tested for a period and in a manner to satisfactorily show the capacity of the well, or that the capacity of the well is sufficient to meet the intended purpose.

(5) The pump discharge shall be set at a constant rate or rates that can be maintained throughout the testing period. If the well is tested at two or more pumping rates (a step-drawdown test), the pumping water level shall be stabilized for a period of at least four hours for each pumping rate

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- (6) The pump discharge rate shall be measured by an orifice meter, flowmeter, weir, or equivalent metering device. The metering device shall have an accuracy within plus or minus five percent.
- (7) The discharge rate of the pump and time shall be measured and recorded at intervals of 10 minutes or less during the first two hours of the pumping period for each pumping rate. If the pumping rate is relatively constant after the first two hours of pumping, discharge measurements and recording may be made at longer time intervals but not to exceed one hour.
- (8) The water level in each well and time shall be measured and recorded at intervals of five minutes or less during the first hour of pumping and at intervals of 10 minutes or less during the second hour of pumping. After the second hour of pumping, the water level in each well shall be measured at such intervals that the lowering of the pumping water level does not exceed 0.25 of a foot or three inches an inch between measurements.
- (9) A reference point for water level measurements (preferably the top of the casing) shall be selected and recorded for the pumping well and each observation well to be measured during the test. All water level measurements shall be made from the selected reference points.
- (10) All water level measurements shall be made with a steel or electric tape or equivalent measuring device.
- (11) All water level measurements shall be made within an accuracy of plus or minus 0.25 of a foot or three inches. (three inches).
- (12) After the completion of the pumping period, measurements of the water level recovery rate, in the pumped well, shall be made for a period of at least two hours in the same manner as the drawdown.

Statutory Authority G.S. 87-87; 87-88.

.0111 DISINFECTION OF WATER SUPPLY WELLS

All water supply wells shall be disinfected upon completion of construction, maintenance, repairs, pump installation and testing as follows:

- (1) Chlorination.
 - (a) ~~(+)~~ Chlorine shall be placed in the well in sufficient quantities to produce a chlorine residual of at least 100 parts per million (ppm) in the well. A chlorine solution may be prepared by dissolving high test calcium hypochlorite (trade names include HTH, Chlor-Tabs, etc.) in water. About 0.12 percent available chlorine is needed

per 100 gallons of water for 100 ppm chlorine residual. As an example, a well having a diameter of six inches, has a volume of about one and five-tenths gallons per foot. If the well has 200 feet of water, the minimum amount of hypochlorite required would be 0.36 lbs. (1.5 x 200 feet = 300 gallons, 0.12 lbs. per 100 gallons, 0.12 x 3 = 0.36 lbs.)

- (b) ~~(+)~~ The chlorine shall be placed in the well by one of the following or equivalent methods:
 - (i) ~~(+)~~ Chlorine tablets may be dropped in the top of the well and allowed to settle to the bottom.
 - (ii) ~~(b)~~ Chlorine solutions shall be placed in the bottom of the well by using a bailer or by pouring the solution through the drill rod, hose, or pipe placed in the bottom of the well. The solution shall be flushed out of the drill rod, hose, or pipe by using water or air.
- (c) ~~(+)~~ Agitate the water in the well to insure thorough dispersion of the chlorine.
- (d) ~~(+)~~ The well casing, pump column and any other equipment above the water level in the well shall be thoroughly rinsed with the chlorine solution as a part of the disinfecting process.
- (e) ~~(+)~~ The chlorine solution shall stand in the well for a period of at least 24 hours.
- (f) ~~(+)~~ The well shall be pumped until the system is clear of the chlorine before the system is placed in use.
- (7) A sample of the water should be analyzed and found safe for human consumption.
- (2) Other materials and methods of disinfection may be used upon prior approval by the Director.

Statutory Authority G.S. 87-87; 87-88.

.0112 WELL MAINTENANCE: REPAIR: GROUNDWATER RESOURCES

(a) Every well shall be maintained in a condition whereby it will conserve and protect the ~~ground water~~ groundwater resources, and whereby it will not be a source or channel of contamination or pollution to the water supply or any aquifer.

(b) All materials used in the maintenance, replacement, or repair of any well shall meet the requirements for new installation.

(c) Broken, punctured or otherwise defective or unserviceable casing, screens, fixtures, seals, or any part of the well head shall be repaired or replaced, or the well shall be properly abandoned.

(d) National Science Foundation (NSF) approved PVC pipe rated at 160 PSI may be used for liner casing. The annular space around the

liner casing shall be at least five-eighths inches and shall be completely filled with neat-cement grout.

Statutory Authority G.S. 87-87; 87-88.

.0113 ABANDONMENT OF WELLS

(a) Any well which has been abandoned, either temporarily or permanently, shall be abandoned in accordance with one of the following procedures:

(1) Procedures for temporary abandonment of wells:

(A) Upon temporary removal from service or prior to being put into service, the well shall be sealed with a water-tight cap or seal compatible with casing and installed so that it cannot be removed easily by hand.

(B) The well shall be maintained whereby it is not a source or channel or contamination during temporary abandonment.

(C) Every temporarily abandoned well shall be protected with a casing.

(2) Procedures for permanent abandonment of wells:

(A) All casing and screen materials may be removed prior to initiation of abandonment procedures if such removal will not cause or contribute to contamination of the groundwaters. Any casing not grouted in accordance with Rule .0107 Paragraph (d) of this Section shall be removed or properly grouted.

(B) The entire depth of the well shall be sounded before it is sealed to ensure freedom from obstructions that may interfere with sealing operations.

(C) The well shall be thoroughly disinfected prior to sealing.

(D) In the case of gravel-packed wells in which the casing and screens have not been removed, neat-cement shall be injected into the well completely filling it from the bottom of the casing to the top.

(E) "Bored" wells shall be completely filled with cement grout, dry clay or material excavated during drilling of the well and then compacted in place.

(F) Wells, other than "bored" wells, constructed in unconsolidated formations other than "bored" wells shall be completely filled with cement grout by introducing it through a pipe extending to the bottom of the well which can be raised as the well is filled.

(G) Wells constructed in consolidated rock formations or that penetrate zones of consolidated rock may be filled with cement, sand, gravel or drill cuttings opposite the zones of consolidated rock. The

top of the sand, gravel or cutting fill shall be at least five feet below the top of the consolidated rock. The remainder of the well shall be filled with cement grout only.

(H) Test wells less than 20 feet in depth which do not penetrate the water table shall be abandoned in such manner as to prevent the well from being a channel allowing the vertical movement of water or a source of contamination to the groundwater supply. Test wells or borings that penetrate the water table shall be abandoned by completely filling with cement grout.

(b) Any well which acts as a source or channel of contamination shall be repaired or permanently abandoned within 30 days of receipt of notice from the department.

(c) The drilling contractor shall permanently abandon any well in which the casing has not been installed or from which the casing has been removed, prior to removing his equipment from the site.

(d) The owner shall be responsible for permanent abandonment of a well except:

(1) As otherwise specified in these Regulations, Rules; or

(2) If well abandonment is required because the driller improperly locates, constructs, or completes the well.

Statutory Authority G.S. 87-87; 87-88.

.0114 DATA AND RECORDS REQUIRED

(a) Well Cuttings.

(1) Samples of formation cuttings shall be collected and furnished to the Department Division from all wells when such samples are requested by the Department Division.

(2) Samples or representative cuttings shall be obtained for depth intervals of 10 feet or less beginning at the land surface. Representative cuttings shall also be collected at depths of each significant change in formation.

(3) Samples of cuttings shall be placed in containers furnished by the Department Division and such containers shall be filled, sealed and properly labeled with indelible-type markers, showing the well owner, well number if applicable, and depth interval the sample represents.

(4) Each set of samples shall be placed in a suitable container(s) showing the location, owner, well number if applicable, driller, depth interval, and date.

(5) Samples shall be retained by the driller until delivery instructions are received from the Department Division or for a period of at least 60 days after the well

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record form (GW-1), indicating said samples are available, has been received by the ~~department~~ Division.

- (6) The furnishing of samples to any person or agency other than the ~~department~~ Division shall not constitute compliance with the department's request and shall not relieve the driller of his obligation to the department.

(b) Reports.

- (1) Any person completing or abandoning any well shall submit to the Division a record of the construction or abandonment. ~~on forms provided by the department.~~ For public water supply wells, a copy of each completion or abandonment record shall also be submitted to the Health Department responsible for the county in which the well is located. The record shall be on forms provided by the Division and shall include certification that construction or abandonment was completed as required by these Regulations, Rules, the owner's name and address, well location, diameter, depth, yield, and any other information the department Division may reasonably require.
- (2) The certified record of completion or abandonment shall be submitted ~~to the department~~ within a period of thirty days after completion or abandonment.
- (3) The furnishing of records to any person or agency other than the Division shall not constitute compliance with the reporting requirement and shall not relieve the driller of his obligation to the Department.

Statutory Authority G.S. 87-87; 87-88.

.0116 DESIGNATED AREAS: WELLS CASED TO LESS THAN 20 FEET

(a) In some areas the best or only source of potable water supply exists between ten and twenty feet below the surface of the land. In consideration of this, the Director may designate areas of the state where wells may be case cased to a depth less than twenty feet. To make this determination, the Director will find:

- (1) that the only or best source of drinking water exists between a depth of ten and twenty feet below the surface of the land;
- (2) that utilization of said source of water is in the best interest of the public.

(b) The following areas are so designated:

- (1) in Currituck County on Terres Quarter Island and in an area between the sound and a line beginning at the end of SR 1130 near Currituck Sound, thence north to the end of SR 1133, thence north to the end

of NC 3 at the intersection with the sound;

- (2) on the Outer Banks from the northern corporate limit of Nags Head on Bodie Island, south to Ocracoke Inlet;
- (3) all areas lying between the Intercoastal Waterway and the ocean from New River Inlet south to New Topsail Inlet;
- (4) all areas lying between the Intercoastal Waterway and the ocean from the Cape Fear River south to the South Carolina line.

(c) In all other areas, the source of water shall be at least 20 feet below land surface, except when adequate quantities of potable water cannot be obtained below a depth of twenty feet, and at sites not within areas designated in Subparagraph (b) of this Rule the source of water may be obtained from unconsolidated rock formations at depths less than twenty feet provided that:

- (1) the well driller can show to the satisfaction of the ~~department, Division~~ that sufficient water of acceptable quality is not available to a minimum depth of fifty feet; and
- (2) the proposed source of water is the maximum feasible depth above fifty feet, but in no case less than ten feet.
- (3) the regional ~~or central~~ office of the department shall be notified prior to the construction of a well obtaining water from a depth between 10 and 20 feet below land surface.

Statutory Authority G.S. 87-87.

.0118 VARIANCE

(a) The Director may grant a variance from any construction standard under the rules of this Section. Any variance will be in writing, and may be granted upon oral or written application to the Director, by the person responsible for the construction of the well for which the variance is sought, if the Director finds facts to support the following conclusions:

- (1) that the use of the well will not endanger human health and welfare or the groundwater;
- (2) that construction in accordance with the standards was not technically feasible in such a manner as to afford a reasonable water supply at a reasonable cost.

(b) The Director may require the variance applicant to submit such information as he deems necessary to make a decision to grant or deny the variance. The Director may impose such conditions on a variance or the use of a well for which a variance is granted as he deems necessary to protect human health and welfare and the groundwater resources. The findings of fact

supporting any variance under this Rule shall be in writing and made part of the variance.

(c) A variance applicant who is dissatisfied with the decision of the Director may commence a contested case by filing a petition under G.S. 150B-23 within 60 days after receipt of the decision.

Statutory Authority G.S. 87-87; 87-88; 150B-23.

.0119 DELEGATION

(a) The Director is delegated the authority to grant permission for well construction under G.S. 87-87.

(b) The Director is delegated the authority to give notices and sign orders for violations under G.S. 87-91.

(c) The Director is delegated the authority to request the Attorney General to institute civil actions under G.S. 87-95.

(d) The Director is authorized to subdelegate to an official of the Division, the granting of a variance from any construction standard, or the approval of alternate construction methods or materials, specified under the Rules of this Section.

Statutory Authority G.S. 143-215.3(a)(1).

SUBCHAPTER 2L - GROUNDWATER CLASSIFICATION AND STANDARDS

SECTION .0100 - GENERAL CONSIDERATIONS

.0107 COMPLIANCE BOUNDARY

(a) For disposal systems permitted prior to December 30, 1983, the compliance boundary is established at a horizontal distance of 500 feet from the waste boundary or at the property boundary, whichever is closer to the source.

(b) For disposal systems permitted on or after December 30, 1983, a compliance boundary shall be established 250 feet from the waste boundary, or 50 feet within the property boundary, whichever point is closer to the source.

(c) The boundary shall be established by the Director at the time of permit issuance. Any sale or transfer of property which affects a compliance boundary shall be reported immediately to the Director, ~~and the compliance boundary re-established accordingly.~~ For disposal systems which are not governed by Paragraphs (e) or (f) of this Rule, the compliance boundary affected by the sale or transfer of property will be re-established consistent with Paragraphs (a) or (b) of this Rule, whichever is applicable.

(d) For disposal systems permitted or re-permitted after January 1, 1993, no water supply wells shall be constructed or operated within the compliance boundary.

(e) For disposal systems permitted or re-permitted after January 1, 1993, a permittee shall not

transfer land within an established compliance boundary unless:

(1) the land transferred is serviced by a community water system as defined in 15A NCAC 18C, the source of which is located outside the compliance boundary; and

(2) the deed transferring the property:

(A) contains notice of the permit, including the permit number, a description of the type of permit, and the name, address and telephone number of the permitting agency; and

(B) contains a restrictive covenant running with the land and in favor of the permittee and the State, as a third party beneficiary, which prohibits the construction and operation of water supply wells within the compliance boundary; and

(C) contains a restrictive covenant running with the land and in favor of the permittee and the State, as a third party beneficiary, which grants the right to the permittee and the State to enter on such property within the compliance boundary for groundwater monitoring and remediation purposes.

(f) If at the time a permit is issued or reissued after January 1, 1993, the permittee is not owner of the land within the compliance boundary, it shall be a condition of the permit issued or renewed that the landowner of the land within the compliance boundary other than the permittee execute and file in the Register of Deeds in the county in which the land is located, an easement running with the land which:

(1) contains:

(A) either a notice of the permit, including the permit number, a description of the type of permit, and the name, address and telephone number of the permitting agency; or

(B) a reference to a notice of the permit with book and page number of its recordation if such notice is required to be filed by statute;

(2) prohibits the construction and operation of water supply wells within the compliance boundary; and

(3) reserves the right to the permittee and the State to enter on such property within the compliance boundary for groundwater monitoring and remediation purposes.

(g) (4) The boundary shall form a vertical plane extending from the water table to the maximum depth of saturation.

(h) (e) For ground absorption sewage treatment and disposal systems which are permitted under 40 NCAC 40A .4900, 15A NCAC 18A .1900, the compliance boundary shall be established at the property boundary.

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(i) ~~(f)~~ Penalties authorized pursuant to G.S. 143-215.6(a)(1)a. will not be assessed for violations of water quality standards within a compliance boundary unless the result of violations of permit conditions or negligence in the management of the facility.

(i) ~~(e)~~ The Director shall require:

- (1) that permits for all activities governed by G.S. 143-215.1 be written to protect the quality of groundwater established by applicable standards, at the compliance boundary;
- (2) that recommendations be made to ensure compliance with the applicable level of standards at the compliance boundary on all permit applications received for review from other state agencies;
- (3) that necessary groundwater quality monitoring shall be conducted within the compliance boundary; and
- (4) that a contravention of standards within the compliance boundary resulting from

activities conducted by the permitted facility be remedied through clean-up, recovery, containment, or other response when any of the following conditions occur:

- (A) a violation of any standard in adjoining classified waters occurs or can be reasonably predicted to occur considering hydrogeologic conditions, modeling, or other available evidence;
- (B) an imminent hazard or threat to the public health or safety exists or can be predicted; or
- (C) a violation of any standard in groundwater occurring in the bedrock other than limestones found in the Coastal Plain sediments.

Statutory Authority G.S. 143-215.1 (b); 143-215.3 (a) (1); 143B-282.

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Appendix E

Location and Tank Contents of 458 Underground Storage Tanks at MCB
(Modified from Geraghty and Miller, Inc., 1990)

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Building/Tank ID Number	Map Coordinates key/coord.	Tank Capacity (gallons)	Tank Contents	distance to nearest well (ft)
0001	F7/F5X76	250	DIESEL FUEL	3000
0020-1	F7/F5X76	500	DIESEL FUEL	3000
0020-2	F7/F5X76	500	GAS/EMP	3000
0020-3	F7/F5X76	500	GAS/EMP	3000
0021-1	G8/G5X82	250	GAS/REG	4000
0024	F7/F1X73	1,000	HO/#2FO	5300
0025-1	F7/F3X76	?	UNK/SOLVENT	2000
0025-2	F7/F3X76	?	UNK/SOLVENT	2000
0025-3	F7/F3X76	?	UNK/SOLVENT	2000
0025-4	F7/F3X76	?	UNK/SOLVENT	2000
0025-5	F7/F3X76	?	UNK/SOLVENT	2000
0025-6	F7/F3X76	?	UNK/SOLVENT	2000
0025-7	F7/F3X76	?	UNK/SOLVENT	2000
0025-8	F7/F3X76	?	UNK/SOLVENT	2000
0025-9	F7/F3X76	?	UNK/SOLVENT	2000
0031/S-715	F7/F1X72	1,000	GAS	7200
0032-1	G8/G5X82	2,000	HO/#2FO	4000
0032-2	G8/G5X82	500	GAS/REG	4000
0033	B8/B3X81	550	HO/#2FO	4000
0040-1	C7/C2X76	2,000	HO/#2FO	500
0040-2	C7/C2X76	3,000	HO/#2FO	500
0045-1	B7/B1X75	1,000	UO/EMPTY	1500
0045/S-941-1	B7/B1X75	4,000	DIESEL FUEL	1500
0045/S-941-2	B7/B1X75	550	GAS	1500
0207	F7/F5X75	500	HO/#2FO	3000
0331	G7/G2X76	500	HO/#2FO	3000
0333-A	G7/G2X76	500	HO/KERO	3000
0333-B	G7/G2X76	500	HO/KERO	3000
0333-C	G7/G2X76	?	HO/#2FO	3000
0340-1	G7/G2X75	500	HO/#2FO	3500
0344-1	G7/G1X76	500	HO/#2FO	2500
0599-1	G8/G3X84	550	HO/KERO	2750
0600	G6/C1X61	500	UO	7000
0728-1	F7/F1X72	550	WASTE OIL/WATER	7200
0728-2	F7/F1X72	500	HO/#2FO	7200
0738-1	F8/F2X86	1,000	HO/#2FO	1000
0738-2	F8/F2X86	275	UNK/EMP	1000
0812-1	B8/B3X81	275	HO/#2FO	420
0820-1	D7/D3X74	10,000	DF	3700

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Building/Tank ID Number	Map Coordinates key#/coord.	Tank Capacity (gallons)	Tank Contents	distance to nearest well (ft.)
0820-2	D7/D3X74	10,000	GAS/SUPER UNLEADE	3700
0820-3	D7/D3X74	10,000	GAS/UNLEADED	3700
0820-4	D7/D3X74	10,000	GAS/REGULAR	3700
0901	F8/F2X86	2,000	UO/HYD	600
0903-1	F8/F2X86	550	HO/KERO	400
0907-1	F8/F4X86	550	HO/KERO	1250
0913/S-947-1	F8/F2X86	550	UO	800
0913/S-947-2	F8/F2X86	550	UO	800
1002-4	F8/F3X85	2,864	HO/KERO	1300
1002-5	F8/F3X85	2,644	HO/KERO	1300
1002-A	F8/F3X85	1,000	GAS	1300
1002-B	F8/F3X85	1,000	UNKNOWN	1300
1002-C	F8/F3X85	1,000	UNKNOWN	1300
1002-D	F8/F3X85	1,000	GAS	1300
1002-E	F8/F3X85	1,000	UNKNOWN	1300
1002/S-1023	F8/F3X85	12,000	GAS	1300
1002/S-1024	F8/F3X85	15,000	GAS	1300
1002/S-1025	F8/F3X85	12,000	GAS	1300
1002/S-1026	F8/F3X85	15,000	GAS	1300
1002/S-1027	F8/F3X85	15,000	GAS	1300
1002/S-1028	F8/F3X85	15,000	GAS	1300
1002/S-1029	F8/F3X85	15,000	GAS	1300
1002/S-1030	F8/F3X85	12,000	HO/KERO	1300
1002/S-1031	F8/F3X85	15,000	GAS	1300
1002/S-1032	F8/F3X85	12,000	HO/KERO	1300
1002/S-1033	F8/F3X85	12,000	GAS	1300
1002/S-1034	F8/F3X85	12,000	HO/KERO	1300
1002/S-1035	F8/F3X85	15,000	HO/KERO	1300
1002/S-1036	F8/F3X85	15,000	HO/KERO	1300
1100-1	F8/F2X84	1,000	GAS	500
1100-2	F8/F2X84	?	UNK/GAS/DIESEL	500
1100-3	F8/F2X84	?	UNK/GAS/DIESEL	500
1100-4	F8/F3X84	?	UNK/GAS/DIESEL	500
1101-1	F8/F3X84	560	DF	1100
1101-2	F8/F3X84	1,000	DF	1100
1101-3	F8/F3X84	500	DF	1100
1106	F8/F3X85	500	UO	2000
1205/S-1213-1	F8/F4X85	500	UO/EMP	2000
1308	F8/F4X84	275	HO/#2FO	UNKNOWN

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Building/Tank ID Number	Map Coordinates key/coord.	Tank Capacity (gallons)	Tank Contents	distance to nearest well (ft)
1310-1	F8/F4X84	550	UO/EMP	1900
1310-2	F8/F4X84	275	HO/#2FO	1900
1401	F8/F4X83	?	HO/#2FO	1200
1402-1	F8/F4X83	1,000	HO/#2FO	1000
1402-2	F8/F4X83	1,000	HO/#2FO	1000
1406-1	F8/F4X83	275	HO/#2FO	UNKNOWN
1406/S-1416	F8/F4X84	600	UO	1600
1413	F8/F4X84	550	HO/#2FO	1500
1450-1	F8/F5X85	6,000	DF	3300
1450-2	F8/F5X85	6,000	DF	3300
1450-3	F8/F5X85	6,000	DF	3300
1450-4	F8/F5X85	6,000	DF	3300
1450-5	F8/F5X85	400	UO	3300
1450-6	F8/F5X85	700	UO	3300
1450-7	F8/F5X85	400	UO	3300
1501-1	F8/F4X83	1,000	HO/#2FO	1200
1502-1	F8/F4X83	550	UO/EMP	1300
1502-2	F8/F4X83	?	UNK/GAS/DF	1300
1502-3	F8/F4X83	?	UNK/GAS/DF	1300
1505	F8/F5X84	275	HO/#2FO	1100
1505/S-1508	F8/F5X84	600	UO/EMP	1100
1601	F8/F5X83	1,500	UO/EMP	800
1604/S-1616	F8/F5X83	600	UO	800
1607	F8/F5X83	500	UO	800
1613-1	F8/F4X82	10,000	GAS/REG	550
1613-2	F8/F4X82	10,000	GAS/REG	550
1613-3	F8/F4X82	30,000	GAS/SUNL	550
1613-4	F8/F4X82	30,000	GAS/UNL	550
1613-5	F8/F4X82	500	UO	550
1736-1	F8/F5X82	?	UO	500
1750-1	G8/G1X83	1,000	UO	1100
1750-2	G8/G1X83	1,000	UO	1100
1755/S-1758-1	G8/G1X84	1,000	UO	1100
1765	G8/G1X82	1,000	HO/#2FO	1200
1775-1	G8/G2X84	6,000	GAS	1500
1775-2	G8/G2X84	6,000	DF	1500
1775-3	G8/G2X84	1,000	UO	1500
1775-4	G8/G2X84	1,000	UO	1500
1775-5	G8/G2X84	1,000	UO	1500

CLW

Building/Tank ID Number	Map Coordinates key#/coord.	Tank Capacity (gallons)	Tank Contents	distance to nearest well (ft)
1780-1	G8/G2X84	1,000	UO	1700
1780-2	G8/G2X84	1,000	UO	1700
1804/S-1856-1	G8/G2X83	600	UO	1500
1804/S-1856-2	G8/G2X83	600	UO	1500
1804/S-1856-3	G8/G2X83	600	UO	1500
1804/S-1856-4	G8/G2X83	600	UO	1500
1804/S-1856-5	G8/G2X83	600	UO	1500
1804/S-1856-6	G8/G2X83	600	UO	1500
1812	G8/G3X83	550	HO/#2FO	UNKNOWN
1815/S-1813-1	G8/G2X83	10,000	DF	1600
1815/S-1813-2	G8/G2X83	10,000	DF	1600
1841-1	G8/G3X84	500	UO/EMP	2400
1841-2	G8/G3X84	200	UO/EMP	2400
1841/S-1840-1	G8/G3X84	30,000	GAS	2400
1841/S-1840-2	G8/G3X84	30,000	DF	2400
1841/S-1840-3	G8/G3X84	10,000	DF	2400
1841/S-1840-4	G8/G3X84	5,000	GAS	2400
1841/S-1840-5	G8/G3X84	6,000	DF	2400
1854-1	G8/G3X84	2,000	UO	2500
1854-2/S1876	G8/G3X84	30,000	DF	2500
1854-3/S1876	G8/G3X84	30,000	DF	2500
1854-4	G8/G3X84	1,000	UO	2500
1854-5/S1875	G8/G3X84	6,000	DF	2500
1854-6/S1875	G8/G3X84	6,000	DF	2500
1860-1	G8/G3X83	550	UO	2000
1880-1	G8/G3X83	10,000	DF	2000
1880-2	G8/G3X83	6,000	DF	2000
1880-3	G8/G3X83	1,000	UO	2000
1915	C5/C3X56	3,000	HO/#2FO	7500
1919-1	E6/E2X66	500	HO/#2FO	6600
1919-2	E6/E2X66	500	HO/#2FO	6600
1919-3	E6/E2X66	1,000	GAS (UNLEADED)	6600
1932-2	C5/C2X56	500	DF	7900
1932/S-1920	C5/C2X56	1,000	GAS	7900
1938	D6/D2X63	250	HO/#2FO	3500
1943	E7/E2X72	7,500	HO/#2FO	7100
2615/S-2637-1	D6/D1X63	15,000	HO/#6FO	3500
2615/S-2637-2	D6/D1X63	15,000	HO/#6FO	3500
5400	C7/C4X75	10,000	HO/#2FO	800

CLW

Building/Tank ID Number	Map Coordinates key#/coord.	Tank Capacity (gallons)	Tank Contents	distance to nearest well (ft)
A-0002	M6/M3X65	500	UO/EMP	3700
A-0010;/SA-26	M6/M3X65	1,500	UO/EMP	4200
A-0012;/SA-30-1	M6/M3X65	500	GAS	3800
A-0012;/SA-30-2	M6/M3X65	2,000	DF	3800
A-0047-1	M6/M3X65	?	UO	4000
A-0047-2	M6/M3X65	2,000	UO	4000
A-0047-3	M6/M3X65	30,000	DF	4000
A-0047-4	M6/M3X65	5,000	GAS	4000
A-0047-5	M6/M3X65	10,000	HO/#2FO	4000
A-0047;/SA-21	M6/M3X65	30,000	DF	4000
BA-0130-1	P11/P2X113	1,000	DF	4200
BA-0130-2	P11/P2X113	1,000	GAS	4200
BA-0130-3	P11/P2X113	500	UO/EMP	4200
BA-0130;/SBA-132	P11/P2X113	500	UO/EMP	4200
BA-0138-1	N11/N3X113	550	GAS	400
BA-0138-2	N11/N3X113	550	HO/#2FO	400
BB-0004;/SBB-204	N7/N3X73	500	DF	2250
BB-0007-1	N7/N2X72	?	PROPANE	1300
BB-0009-1	N7/N2X72	10,000	HO/#6FO	1200
BB-0009-2	N7/N2X72	10,000	HO/#6FO	1200
BB-0009-3	N7/N2X72	10,000	HO/#6FO	1200
BB-0009-4	N7/N2X72	550	UO	1200
BB-0009-5	N7/N2X72	?	UO	1200
BB-0014;/SBB-1	N7/N2X72	550	DF	1500
BB-0030;/SBB-99-1	M7/M5X73	1,000	GAS	420
BB-0030;/SBB-99-2	M7/M5X73	2,000	GAS	420
BB-0046	M6/M5X65	1,000	GAS	3000
BB-0048	M7/M4X71	2,500	HO/#2FO	1100
BB-0049	M7/M4X72	2,500	HO/#2FO	800
BB-0051-1	M7/M5X73	300	UO/EMP	1000
BB-0051-2	M7/M5X73	300	UO	1000
BB-0052;/SBB-70	N7/N1X73	5,000	DF	1100
BB-0071-1	M7/M5X73	500	UO/EMP	650
BB-0071-2	M7/M5X73	500	HO/#2FO	650
BB-0071-3	M7/M5X73	500	HO/#2FO	650
BB-0071-4	M7/M5X73	500	HO/#2FO	650
BB-0071-5	M7/M5X73	500	HO/#2FO	650
BB-0071-6	M7/M5X73	500	HO/#2FO	650
BB-0101-1	N7/N2X73	2,500	DF	1300

CLW

Building/Tank ID Number	Map Coordinates key#/coord	Tank Capacity (gallons)	Tank Contents	distance to nearest well (ft)
BB-0101-2	N7/N2X73	500	GAS	1300
BB-0177-1	N7/N1X72	6,000	GAS/SUNL	350
BB-0177-2	N7/N1X72	6,000	GAS/UNL	350
BB-0177-3	N7/N1X72	6,000	GAS/REG	350
BB-0177-4	N7/N1X72	1,000	WATER/WASTE OIL	350
BB-0177-5	N7/N1X72	600	HO/#2FO	350
BB-0190-1	N7/N1X72	550	HO/#2FO	200
BB-0190-2	N7/N1X72	550	DIESEL	200
CG-0001	B1/B4X14	500	UO	1200
FC-0040-1	G9/G3X94	6,000	GAS	275
FC-0040-2	assist94	6,000	DF	275
FC-0040-3	G9/G3X94	1,000	UO	275
FC-0045	G9/G3X94	550	UO	?
FC-0101/SFC-103	G9/G4X91	550	UO	600
FC-0102/SFC-104	G9/G4X91	1,000	UO	600
FC-0120	G8/G4X86	1,000	WASTE OIL	300
FC-0120/SFC-122-1	G8/G4X86	10,000	GAS	300
FC-0120/SFC-122-2	G8/G4X86	10,000	DF	300
FC-0190-1	G9/G4X91	500	UO	800
FC-0190-2	G9/G4X91	500	ACID/BAT	800
FC-0200-1	G9/G4X92	5,000	GAS	1400
FC-0200-2	G9/G4X92	20,000	DIESEL FUEL	1400
FC-0200-3	G9/G4X92	20,000	DIESEL FUEL	1400
FC-0200-4	G9/G4X92	20,000	DIESEL FUEL	1400
FC-0200/SFC-204	G9/G4X92	550	UO	1400
FC-0200/SFC-205	G9/G4X92	1,000	UO	1400
FC-0202-1	G9/G4X91	10,000	HO/#2FO	1300
FC-0230-1	G9/G5X91	2,500	DIESEL FUEL	1300
FC-0230-2	G9/G5X91	2,500	DIESEL FUEL	1300
FC-0230-3	G9/G5X91	550	UO	1300
FC-0241-1	G9/G5X92	6,000	DIESEL FUEL	1300
FC-0241-2	G9/G5X92	6,000	GAS/UNL	1300
FC-0241-3	G9/G5X92	1,000	HO/KERO	1300
FC-0251-1	G9/G5X92	2,000	UO	950
FC-0251-2	G9/G5X92	5,000	DIESEL FUEL	950
FC-0251-3	G9/G5X92	5,000	GAS	950
FC-0255-1	G9/G5X92	10,000	DIESEL FUEL	500
FC-0255-2	G9/G5X92	6,000	GAS	500
FC-0255-3	G9/G5X92	6,000	GAS	500

CLW

Building/Tank ID Number	Map Coordinates key#/coord.	Tank Capacity (gallons)	Tank Contents	distance to nearest well (ft)
FC-0260	H9/H1X92	2,000	HO/DIESEL FUEL	1600
FC-0263-1	H9/H1X92	6,000	DIESEL FUEL	900
FC-0263-2	H9/H1X92	6,000	GAS	900
FC-0263-3	H9/H1X92	6,000	DIESEL FUEL	900
FC-0263-4	H9/H1X92	6,000	GAS	900
FC-0263-5	H9/H1X92	1,000	UO	900
FC-0270-1	G9/G5X93	2,500	UO	300
FC-0270-2	G9/G5X93	2,500	UO	300
FC-0270-3	G9/G5X93	10,000	DIESEL FUEL	300
FC-0270-4	G9/G5X93	4,000	DIESEL FUEL	300
FC-0281-1	G9/G4X93	6,000	DIESEL FUEL	875
FC-0281-2	G9/G4X93	6,000	GAS	875
FC-0364	H8/H2X86	500	DIESEL FUEL	2000
FC-0739/;SGP-16	G8/G4X86	600	UO/EMP	750
G-0480	A2/A4X25	550	HO/#2F0	1800
G-0650-1	A2/A5X25	550	UO	1800
G-0650-2/;SG649	A2/A5X25	?	UO	1800
H-0001-1	F6/F2X65	1,000	#2 FUEL OIL	9000
H-0001-2	F6/F2X65	?	HO/#2F0	9000
H-0018	F6/F2X65	10,000	GAS/LEAD	9000
H-0018/;H-112	F6/F2X65	?	UO	9000
H-0019-1	F6/F2X65	15,000	HO/#6F0	9000
H-0019-2	F6/F2X65	15,000	HO/#6F0	9000
H-0019-3	F6/F2X65	15,000	HO/#6F0	9000
H-0030/;H-124	F7/F1X71	560	HO/#2F0	7000
H-0030/;H-125	F7/F1X71	560	HO/#2F0	7000
H-0120	F6/F1X65	1,000	HO/#2F0	9000
HP-0100-1	F7/F2X74	10,000	DIESEL FUEL	4200
HP-0100-2	F7/F2X74	2,000	GAS	4200
HP-0100-3	F7/F2X74	550	UO	4200
HP-0825	D7/D1X74	10,000	HO/#2F0	1400
LCH-4015-1	B8/B3X82	12,000	GAS/EMP	1200
LCH-4015-2	B8/B3X82	12,000	GAS/EMP	1200
LCH-4015-3	B8/B3X82	12,000	GAS/EMP	1200
LCH-4015-4	B8/B3X82	2,500	DF/EMP	1200
LCH-4022	B8/B3X82	2,500	HO/#2F0	1200
LCH-4025	B8/B3X82	1,000	HO/#2F0	1300
LCH-4027	B8/B2X82	?	UNKNOWN	9800
LCH-4034-1	B8/B3X82	10,000	GAS	?

CLW

0000002071

Building/Tank ID Number	Map Coordinates key#/coord.	Tank Capacity (gallons)	Tank Contents	Distance to nearest well (ft.)
LCH-4034-2	B8/B3X82	10,000	GAS	?
LCH-4034-3	B8/B3X82	2,000	DIESEL FUEL	?
M-0090	B4/B3X46	500	UO	9800
M-0090/;SM-0195-1	B4/B3X46	5,000	DF	9800
M-0090/;SM-0195-2	B4/B3X46	5,000	DIESEL FUEL	9800
M-0101	B4/B2X46	500	UO/EMP	9700
M-0101/;SM-0191-1	B4/B2X46	550	GAS	9700
M-0101/;SM-0191-2	B4/B2X46	550	DIESEL FUEL	9700
M-0119/;SM-193	B4/B3X46	1,000	GAS	9800
M-0171-1	B4/B1X45	5,000	GAS/EMP	9700
M-0171-2	B4/B1X45	5,000	GAS/EMP	9700
M-0171-3	B4/B1X45	5,000	GAS/EMP	9700
M-0178	B4/B1X45	275	GAS/EMP	UNKNOWN
M-0214	B4/B4X44	550	HO/KERO	13200
M-0230-1/;SM-269-1	B4/B4X44	15,000	HO/DIESEL FUEL	13200
M-0230-2/;SM-269-2	B4/B4X44	15,000	HO/DIESEL FUEL	13200
M-0232	B4/B5X44	550	HO/KERO	14200
M-0233	B4/B5X44	550	HO/KERO	14200
M-0234	B4/B5X44	550	HO/KERO	14200
M-0235	B4/B5X44	550	HO/KERO	14200
M-0236	C4/C1X44	550	HO/KERO	14200
M-0255	B4/B4X44	550	HO/KERO	13200
M-0612	A5/A5X51	500	HO/KERO	7500
M-0625-1	A5/A5X52	550	UO	7500
M-0625-2	A5/A5X52	20,000	HO	7500
M-0625-3	A5/A5X22	30,000	HO	7500
NH-0100/;101	B7/B4X73	20,000	HO/#2FO	2100
NH-0100/;102	B7/B4X73	20,000	HO/#2FO	2100
NH-0100/;103	B7/B4X73	20,000	HO/#6FO	2100
NH-0100/;104	B7/B4X73	20,000	HO/#6FO	2100
NH-0118-1	B7/B4X74	10,000	GAS/UNL	2300
NH-0118-2	B7/B4X74	2,000	HO/#2FO	2300
NH-0118-3	B7/B4X74	200	UO	2300
NH-0120	C7/C1X73	1,000	HO/#2FO	2300
PT-0005	E8/E5X83	500	HO/#2FO	2500
PT-0039-1	E7/E4X76	1,000	PEST/WAT	5000
PT-0039-2	E7/E4X76	1,000	PEST/WAT	5000
RR-0014/;SRR-80	M2/M2X26	600	UO/EMP	700
RR-0015-1	M2/M2X26	500	UO	400

CLW

Building/Tank ID Number	Map Coordinates key#/coord.	Tank Capacity (gallons)	Tank Contents	distance (to nearest well (ft))
RR-0015-2	M2/M2X26	1,000	DIESEL FUEL	400
RR-0015-3	M2/M2X26	10,000	HO	400
RR-0015-4	M2/M2X26	10,000	HO	400
RR-0015-5	M2/M2X26	10,000	HO	400
RR-0015/SRR-84	M2/M2X26	10,000	GAS	400
RR-0017	M2/M2X26	?	HO/#2FO	350
RR-0020	M2/M2X31	?	HO/#2FO	600
RR-0022	M2/M2X32	?	HO/#2FO	1450
RR-0024	M2/M2X32	?	HO/#2FO	2300
RR-0072-3	M2/M2X26	5,000	GAS	1200
RR-0072-2	M2/M2X26	5,000	GAS	1200
RR-0072-1	M2/M2X26	4,000	GAS/LEAD/EMP	1200
RR-0085-1	M2/M3X26	500	HO/#2FO	475
RR-0085-2	M2/M3X26	500	GAS/EMP	475
SH-0008	J9/J2X96	750	HO/#2FO	3000
TC-0470	A2/A5X25	550	UO	2200
TC-0474	A2/A4X25	550	UO	2300
TC-0647	A3/A5X31	500	#2FO	3700
TC-0647/STC-567	A3/A5X31	500	HO/#2FO	3700
TC-0774	B2/B1X25	600	UO/EMP	2200
TC-0865/STC-868	B2/B2X25	550	UO	2500
TC-0912-1	B2/B2X23	6,000	GAS	130
TC-0912-2	B2/B2X23	4,000	GAS	130
TC-0912-3	B2/B2X23	6,000	GAS	130
TC-0912-4	B2/B2X23	550	HO/#2FO	130
TC-0912-5	B2/B2X23	550	UO	
TC-0942	B2/B2X24	550	UO	1350
TC-1251	B2/B4X24	1,000	DIESEL FUEL	20
TC-1255	B2/B4X21	?	DIESEL FUEL	20
TC-1500	B2/B5X24	7,500	HO/#2FO	800
TP-0447/STP-446	E8/E5X86	12,000	UO/JP-5	800
TP-0457	E8/E5X86	2,000	HO/#2FO	750
TT-0035	B6/B2X63	600	HO/#2FO	5000
FT-0038	B6/B1X66	1,000	HO/#2FO	200
TT-0038/STT-39-A	B6/B1X66	1,000	2# DIESEL	200
TT-0044	B6/B2X64	1,000	HO/#2FO	1900
TT-0048-1	A6/A5X63	1,000	HO/#2FO	2500
TT-0048-2	A6/A5X63	6,000	HO/#2FO	2500
TT-0049/STT-69	A6/A4X66	1,000	GAS	100

CLW

Building/Tank ID Number	Map Coordinates key#/coord.	Tank Capacity (gallons)	Tank Contents	distance to nearest well (ft)
TT-0060	A6/A4X66	10,000	HO	UNKNOWN
TT-2453-1	B6/B1X64	0	NA	1100
TT-2453-2	B6/B1X64	0	NA	1100
TT-2453-3	B6/B1X64	0	NA	1100
TT-2453-4	B6/B1X64	0	NA	1100
TT-2453-5	B6/B1X64	7	UO	1100
TT-2453-6	B6/B1X64	7	HO/#2FO	1100
TT-2455	B6/B1X64	1,000	HO/#2FO	1100
TT-2457	B6/B1X64	1,000	HO/#2FO	1100
TT-2459	B6/B1X64	300	HO/#2FO	1100
TT-2461	B6/B1X64	300	HO/#2FO	1100
TT-2463	B6/B1X64	300	HO/#2FO	1100
TT-2465-1	B6/B1X64	300	HO/#2FO	1100
TT-2465-2	B6/B1X64	300	HO/#2FO	1100
TT-2467	B6/B1X64	300	HO/#2FO	1100
TT-2469	B6/B1X64	300	HO/#2FO	1100
TT-2471	B6/B1X64	300	HO/#2FO	1100
TT-2473	B6/B1X64	300	HO/#2FO	1100
TT-2475	B6/B1X64	500	HO/#2FO	1100
TT-2477	B6/B1X64	7	HO/#2FO	1100
TT-2478-1	B6/B1X64	10,000	GAS	1100
TT-2478-2	B6/B1X64	10,000	GAS	1100
TT-2478-3	B6/B1X64	10,000	GAS	1100
TT-2478-4	B6/B1X64	1,000	DIESEL FUEL	1100
0061	F8/F3X81	7	HO	UNKNOWN
TC-0773	B2/B1X25	500	UO/EMP	UNKNOWN
M-0625-4	A5/A5X22	500	UO	UNKNOWN
M-0231	B4/B4X44	500	PROPANE	UNKNOWN
M-0178-2	B4/B1X45	1,000	PROPANE	UNKNOWN
1700	F8/F4X82	500	UO	UNKNOWN
H-0028	F6/F1X66	7	UNKNOWN/OIL	UNKNOWN
0712	C8/C8X82	550	HO/UNK	UNKNOWN

Marine Corps Air Station

AS-0109/SAS-157	B2/B5X25	7	UO	500
AS-0110	B2/B4X25	2,000	#2FO	200
AS-0114	B2/B5X25	550	UO	250
AS-0118	B2/B5X25	1,000	UO (WASTE OIL)	300

CLW

Building/Tank ID Number	Map Coordinates key#/coord.	Tank Capacity (gallons)	Tank Contents	distance to nearest well (ft)
AS-0122	B2/B5X26	?	HO/#2FO	550
AS-0136	C2/C1X25	100,000	JP-5	1175
AS-0137	C2/C1X24	50,000	JP-5	1175
AS-0138	C2/C1X24	50,000	JP-5	1300
AS-0140	C2/C1X25	10,000	NA	1300
AS-0141	C2/C1X25	10,000	UNKNOWN/EMPTY	1200
AS-0142	C2/C1X25	10,000	GAS	950
AS-0150	C2/C1X25	105,000	JP-5	1100
AS-0151	C2/C1X25	50,000	JP-5	1100
AS-0154	C2/C1X25	120,000	JP-5	1100
AS-0410-1	C2/C1X26	4,000	GAS (UNLEADED)	350
AS-0410-2	C2/C1X26	4,000	GAS	350
AS-0410-3	C2/C1X26	4,000	GAS	350
AS-0410-4	C2/C1X26	4,000	GAS	350
AS-0410-5	C2/C1X26	4,000	GAS	350
AS-0410-6	C2/C1X26	4,000	GAS/EMPTY	350
AS-0410-7	C2/C1X26	200	UO	350
AS-0427	C3/C2X32	280	DIESEL FUEL	2000
AS-0507	C3/C4X31	20,000	JP-5	2970
AS-0508-1	C3/C4X31	20,000	JP-5	2970
AS-0508-2	C3/C4X31	750	JP-5/WAT	3000
AS-0511-1	C3/C4X31	20,000	JP-5	3600
AS-0511-2	C3/C4X31	20,000	JP/5	3600
AS-0511-3	C3/C4X31	1,000	WASTE WATER & JP/5	3600
AS-0511-4	C3/C4X31	1,000	WASTE WATER & JP/5	3600
AS-0522	C2/C5X26	300	UO	2700
AS-0526	C2/C4X26	20,000	NA	UNKNOWN
AS-0527-1	C2/C4X26	20,000	NA	UNKNOWN
AS-0527-2	C2/C4X26	1,000	NA	UNKNOWN
AS-0546	C3/C4X31	590	UO	3600
AS-0547	C3/C4X31	590	UO	3600
AS-0548	C3/C4X31	590	UO	3600
AS-0549	C3/C4X31	590	UO	3600
AS-0629	B3/B3X32	500	DIESEL FUEL	3000
AS-0705	B3/B5X36	10,000	HO/#2FO	UNKNOWN
AS-0804	C3/C3X34	1,000	DIESEL FUEL	6400
AS-0820	C3/C4X34	560	HO/#2FO	6000
AS-0822	C3/C4X34	270	DIESEL FUEL	6000
AS-0843-1	C3/C4X34	270	HO/#2FO	6100

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Building/Tank ID Number	Map Coordinates key#/coord.	Tank Capacity (gallons)	Tank Contents	distance to nearest well (ft)
AS-0843-2	C3/C4X34	500	DIESEL FUEL	6100
AS-0849	C3/C5X36	?	HO/#2FO	7700
AS-2800	B3/B4X35	550	HO/#2FO	7400
AS-2804	D3/D4X35	1,000	GAS	7400
AS-3000	D3/D1X32	500	DIESEL FUEL	4200
AS-3502	D3/D2X32	550	HO/#2FO	5100
AS-3504	D3/D2X32	2,000	HO/#2FO	5100
AS-3505-1	D3/D2X32	2,500	GAS	5100
AS-3505-2	D3/D2X32	2,500	DIESEL FUEL	5100
AS-3511	D3/D2X32	2,500	UNK/GAS/JP-5	UNKNOWN
AS-3512	D3/D2X32	2,500	UNK/DF/JP-5	UNKNOWN
AS-3525	D3/D2X32	550	HO/#2FO	4700
AS-3620	D2/D1X25	1,000	DIESEL FUEL	1500
AS-4135-1	C2/C4X24	1,000	DIESEL FUEL	500
AS-4135-2	C2/C4X24	1,000	GAS	500
AS-4135-3	C2/C4X24	550	UO	500
AS-4146-1	C2/C2X25	5,000	DIESEL FUEL	1500
AS-4146-2	C2/C2X25	5,000	GAS	1500
AS-4146-3	C2/C2X25	550	UO	1500
AS-4151-1	C2/C2X25	1,000	UO	750
AS-4151-2	C2/C2X25	1,000	DIESEL FUEL	750
AS-4158-1	C2/C4X23	1,000	UO	1600
AS-4158-2	C2/C4X23	550	UO	400
AS-4158-3	C2/C4X23	550	UO	400
AS-4159-1	C2/C5X23	1,000	UO	1000
AS-4159-2	C2/C5X23	550	UO	1000
AS-4165-1	C2/C4X23	3,000	DIESEL FUEL	1350
AS-4165-2	C2/C4X23	3,000	DIESEL FUEL	1350
AS-4165-3	C2/C4X23	3,000	GAS	1350
AS-0515	C2/C2X26	240	UO/SOLVENT	UNKNOWN

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