Section 10 – Appendices

A. Appendix A: Bridges in the Triassic Basins with minimum clearance

Table 10-1. Bridges in the Triassic Basins with Minimum Clearance

DIV	COUNTY	ROUTE	ACROSS	LOCATION	Minimum Vertical Clearance
10	ANSON	NC109	W.S.S.B. RR.	0.5 MI. N. JCT. SR1716	24.8
8	CHATHAM	SR1012	US1	0.4 MI. N. JCT. SR1011	16.6
8	CHATHAM	SR1927	SCL RR	0.1 MI.S. JCT. SR1101	22.4
8	CHATHAM	NC42	NORFOLK SOUTHERN RR	0.11 MI. N. JCT. SR1921	22.8
8	CHATHAM	SR1931	US1	0.3 MI. N. JCT. SR1011	16.9
8	CHATHAM	SR1972	US1	1.3 MI. N. JCT. SR1011	16.5
8	CHATHAM	SR1910	US1	0.4 MI.N.JCT.SR1011	16.4
8	CHATHAM	US1 SBL	SR1011 & SEABOARD RR	0.5 MI. N. JCT. SR1910	21.0
8	CHATHAM	US1 NBL	SR1011 & SEABOARD RR	0.5 MI. N. JCT. SR1910	21.9
5	DURHAM	US501NBL	I85&US 501	@ JCT.US501&U-85	17.2
5	DURHAM	NC55	NC147	0.76 MI.N.JCT.SR1945	16.3
5	DURHAM	US70WBL	I85/US15(NBL'S)	0.35 MI W SR1670	17.6
5	DURHAM	US70BUS.	US15BYP/US501BYP	0.27 MI.E.JCT.SR1401&US70	16.5
5	DURHAM	SR1127	US15BUS/US501BUS	0.02 MI S JCT SR1308	15.8
5	DURHAM	PETTIGREW ST	NC55	0.1 MI.N.JCT.NC55&NC147	13.8
5	DURHAM	US15/US501	US15/US501BUS	0.43 MI.N.JCT.SR1209	16.5
5	DURHAM	US70 EBL	SR1670(GEER STREET)	0.36 MI.E.JCT.SR1800	16.2
5	DURHAM	US70	SR1670(GEER STREET)	0.36 MI.E.JCT.SR1800	15.5
5	DURHAM	SR1303	US15BYP/US501BYP	50'W.JCT.SR1358	16.3
5	DURHAM	US15/501 S	NC147	US15/501(BUS)	16.2
5	DURHAM	US15/US501 NBL	SR1308	0.2MI.N.JCT.SR1303	14.8
5	DURHAM	US15/US501	SR1308	0.2MI.N.JCT.SR1303	15.1
5	DURHAM	NC751	US15BUS/US501BUS	0.24 MI S JCT S1303	14.3
5	DURHAM	SR2028	I40	0.25 MI.N.JCT.NC54	17.3
5	DURHAM	SR1800	US70 BYP	0.6 MI E JCT SR1670	16.7
5	DURHAM	US70 EBL	NC98	1.0 MI.E.JCT.SR1800	16.3
5	DURHAM	I85 NB	SR1401	1.0MI.S.JCT.SR1321	15.8
5	DURHAM	US15BYP/US501NBL	NC751	1.0 MI S JCT SR 1317	16.1
5	DURHAM	I85 S.B.	SR1401	1.0 MI S JCT SR 1321.	16.1
5	DURHAM	US15BYP/US	NC751	1.0 MI S JCT SR 1317	15.5
5	DURHAM	US15/501SB	NORFOLK SOUTHERN RAILWAY	0.5MI S.JCT I85	22.0
5	DURHAM	US70 WBL	NC98	1.0 MI E JCT SR 1800	14.3
5	DURHAM	US70BUS WB	US70 EBL	0.2MI.W.JCTSR1922	14.5
5	DURHAM	SR1317	US15BYP/US501BYP	1.6 MI S JCT US 701BUS	16.4
5	DURHAM	SR1321	I85	@JCT.I-85&SR1321	18.0
5	DURHAM	I85	NC157	0.6MI.N.JCT.I-85&SR1321	15.8
5	DURHAM	US15/501SB	I85NB&US70EB	0.2 MI N JCT SR1401	17.7
5	DURHAM	BROAD ST.	I85	0.7 MI.S.JCT.I85&US501	16.9
5	DURHAM	SR1322	NC147	0.15 MI.S.JCT.US70 BUS.	17.1
5	DURHAM	NC147 SBL	CAMPUS DRIVE	0.4 MI.S.JCT.SR1320	21.2
5	DURHAM	NC147 NBL	CAMPUS DRIVE	0.4 MI.S.JCT.SR1320	20.0
5	DURHAM	NC147 SBL	BUCHANAN BLVD	0.7 MI.E.JCT.SR1320	16.5
5	DURHAM	SR1127	NC147	0.1 MI.W.SR1361	16.3
5	DURHAM	WASHINGTON	I85&US70	0.3MI.N.JCT.I85&US501BYP	17.7
5	DURHAM	I85SB&US70	CLUB BOULEVARD	0.45MI.N.JCT.US501BYP	15.3
5	DURHAM	SR1361	NC147	0.2 MI.S.JCT.US70 BUS.	19.0
5	DURHAM	SR1445	NC147	0.3 MI.S.JCT.SR1127	15.9
5	DURHAM	NC147SBL	SR1359(BLACKWELL ST)	0.2 MI.N.JCT.US501	18.5
5	DURHAM	I85N/US15N	US15/501 BUS	0.19 M S JCT. NC55	18.8
5	DURHAM	I85S/US15/	US 501 BUS	0.19MI S JCT NC55	17.2
5	DURHAM	NC147 NBL	SR1359 (BLACKWELL ST)	0.2 MI.N.JCT.NC147	15.7
5	DURHAM	NC147 SBL	US15/501 NBL(BUS)	0.1 MI.S.JCT.US15/501 SBL	18.8
5	DURHAM	NC147 NBL	US15/501 NBL(BUS)	0.1 MI.S.JCT.US15/501 SBL	15.3
5	DURHAM	I85 NBL	NC55	JCT. I-85&NC55	18.7

Table 10-1, continued

DIV	COUNTY	ROUTE	ACROSS	LOCATION	Minimum Vertical Clearance
5	DURHAM	I85 SB&US1	NC55	JCT.OF I-85&NC55	19.6
5	DURHAM	SR1118	NC147	100' S.SR1364	15.7
5	DURHAM	NC147 SBL	GRANT ST.	0.3 MI.N.NC147 & NC55	20.8
5	DURHAM	NC147 NBL	GRANT ST.	0.3 MI.N.JCT.NC147 & NC55	15.3
5	DURHAM	NC147 SBL	BACON STREET	0.4 MI.S.JCT.NC55	15.8
5	DURHAM	I85 SB/US15SBL	SR1671	0.5 MI N.JCT NC55	16.3
5	DURHAM	NC147 NBL	BACON STREET	0.4 MI.S.JCT.NC55	16.4
5	DURHAM	I85	NORFOLK &WESTERNRR	0.7 MI N JCT NC55	22.9
5	DURHAM	BRIGGS AVE	NC147	@ JCT.BRIGGS AVE&NC147	16.9
5	DURHAM	SR1827	I85	0.18 MI.N. SR1670	16.9
5	DURHAM	NC147 SBL	SR1171	1.5 MI.S.JCT.NC55	16.1
5	DURHAM	NC147 NBL	SR1171	0.2 MI.E.JCT.SR2161	17.9
5	DURHAM	SR1671	I85/US15	.25 MI E JCT SR 1636	16.8
5	DURHAM	SR1940	NC147	0.2 MI.N.JCT.SR2020	16.8
5	DURHAM	SR1675	I85	0.70 MI. N. OF SR1671	16.2
5	DURHAM	NC147 NBL	SR1954	1.05 MI.N.JCT.SR2028	16.6
5	DURHAM	NC147 NBL	SR1954	1.05 MI.N.JCT.SR2028	19.6
5	DURHAM	I85 NBL&US	SR1632	0.33 MI.S.JCT.SR1637	13.8
5	DURHAM	I85 SBL&US15	SR1632	.33 MI.S.JCT.SR1537	14.6
5	DURHAM	SR2028	NC147	0.75 MI.S.JCT.SR1959	16.3
5	DURHAM	SR1121	NC147	0.3 MI.N.SR2017	16.8
5	DURHAM	NC147 RAMP	NC147 NBL	0.5 MI.S.JCT.SR1121	16.5
5	DURHAM	I85&US15 N	SR1637 & SOUTHERN RR	.33 MI.N.JCT.SR1632	19.2
5	DURHAM	I85 & US15	SR1637 & SOUTHERN RR	0.5 N.JCT.SR1632	19.2
5	DURHAM	I85&US15 N	SR1637	1.43 MI.N.JCT SR1632	14.2
5	DURHAM	I85& US15	SR1637	1.4 MI.N JCT SR1632	14.8
5	DURHAM	SR1999	I40	0.3 MI N JCT NC54	16.2
5	DURHAM	SR1959	I40	.3MI.S.JCT.SR2058	16.0
5	DURHAM	I40 WBL	NC55	1.1 MI.W.JCT.I40 & NC147	21.2
5	DURHAM	I40 EBL	NC55	1.1 MI.W.JCT.I40 & NC147	18.4
5	DURHAM	I40 WBL	SR1945	0.3 MI.E.JCT.NC55	18.0
5	DURHAM	I40 EBL	SR1945	0.3 MI.E.JCT.NC55	15.3
5	DURHAM	I40 WBL	NC147	0.3 MI.E.JCT.SR2028&I-40	16.4
5	DURHAM	I40 EBL	NC147	0.3 MI.E.JCT.SR2028&I-40	16.4
5	DURHAM	I40	NC147 RAMP	0.5 MI.E.JCT.SR2028	0.0
5	DURHAM	NC54	9906 (Triangle Pkwy)	0.14 MI.E.JCT.SR2028	21.9
5	DURHAM	US15/501	I40	@ JCT.US15/501 & I40	16.5
5	DURHAM	SR2220	I40	0.01 MI.W.JCT.SR1113	16.5
5	DURHAM	NC751	I40	1.1 MI.S.JCT.NC54	16.0
5	DURHAM	SR1118	I40	1.0 MI.E.JCT.NC751	17.6
5	DURHAM	I40 WBL	NC54	0.2 MI.E.JCT.SR1118	16.8
5	DURHAM	I40 EBL	NC54	0.2 MI.E.JCT.SR1118	16.6
5	DURHAM	SR1106	I40	0.3 MI.N.JCT.NC54	16.3
5	DURHAM	LASALLE ST	NC147	0.2 MI.S.JCT.US70 BUS.	16.8
5	DURHAM	ANDERSON S	NC147	0.2 MI.S.JCT.US70 BUS.	16.7
5	DURHAM	SR1110	I40	0.3 MI.N.JCT.SR1113	16.4
5	DURHAM	NC54	I40	0.1 MI.W.JCT.SR1110	16.5
5	DURHAM	US70 BUS	CAMPUS DRIVE	0.2 MI.E.JCT.SR1322	11.2
5	DURHAM	NC147SBL	HILLANDALE ROAD(SR1321)	JCT.OF NC147 & SR1321	15.2
5	DURHAM	NC147NBL	HILLANDALE ROAD(SR1321)	@ JCT.NC147 & SR1321	19.4
5	DURHAM	NC147 RAMP	NC147	0.5 MI.W.LASALLE STREET	17.5
5	DURHAM	US70 BUS.	SR1321	0.79 MI.E.JCT.US15-501BYP	15.3
5	DURHAM	NC147NB	SR1320	0.3MI.W.JCT.SR1322	18.4
5	DURHAM	NC147 SBL	US15/501	0.4MI.S.JCT.US70 BUS.	21.3

Table 10-1, continued

DIV	COUNTY	ROUTE	ACROSS	LOCATION	Minimum Vertical Clearance
5	DURHAM	NC147	SR1320	0.3MI.W.JCT.SR1322	14.8
5	DURHAM	NC147 NBL	US15/501 BYP.	JCT.NC147&US15/501 BYPASS	17.0
5	DURHAM	I40	SR1973	0.8 MI.W.JCT.SR1959	15.9
5	DURHAM	I540	I40	.96 MI.E.SR1973	16.7
5	DURHAM	I540	I40 & NW EXPRESSWAY	.96 MI.E.SR1973	17.6
5	DURHAM	US70 EB RAMP	I85,US70	JCT.I-85,US70	17.8
5	DURHAM	US501(GREGSON ST)	I85	@JCT I85	17.7
5	DURHAM	15/501 RAM	US15/501	@ JCT. S.PRKWY&US15/501	16.5
5	DURHAM	US15/501 R	15/501	@ JCT.S. PRK.WAY&US15/501	17.7
5	DURHAM	SR2104	I-540	JCT.SR-2104 & I-540	17.7
5	DURHAM	I-540 SB;	I-40	JCT. I-540 & I-40	17.2
5	DURHAM	I-540 NBL	I-40	JCT.I-540 & I-40	18.1
5	DURHAM	NC 147 SBL	SR1317	.65MI.N. JCT. US15/501	20.3
5	DURHAM	NC 147 NBL	SR1317	.65 MI.N.JCT US15/501	15.7
5	DURHAM	SR1978	NC147 EXT(TRIANGLE PKWY)	@JCT NC147 EXTENTION	20.3
5	GRANVILLE	US15	I85	0.4 MI.W SR1102	16.3
5	GRANVILLE	SR1103	I85	0.3 MI.W SR1102	16.5
5	GRANVILLE	NC56	I85	0.1 MI.E.SR1215	16.3
5	GRANVILLE	SR1127	I85	0.2 MI.W SR1129	16.7
8	LEE	US1 NBL	US1 BUS,NC42	1.4 MI. S. JCT. SR1100	16.3
8	LEE	SR1483	SEABOARD COASTLINE	100 FT. W. JCT. SR1424	22.9
8	LEE	US1 SBL	US1 BUS,NC42	1.4 MI. S. JCT. SR1100	14.3
8	LEE	US1	SR1009	0.85 MI. N. JCT. NC42	16.1
8	LEE	SR1100	US1, US15/501	0.4 MI. E. JCT. SR1328	15.8
8	LEE	US1	US421	1.94 MI. N. JCT. NC42	15.3
8	LEE	SR1406	US1,US15,US501	0.2 MI. E. JCT. SR1438	18.0
8	LEE	US1	US1BUS, US15/501, NC87	2.2 MI. N. JCT. US421	15.5
8	LEE	US1 SBL	SR1415	2.7 MI. N. JCT. NC87	15.4
8	LEE	SR1426	US1	0.7 MI.W.JCT.SR1423	16.0
8	LEE	SR1423	US1	1.0 MI. N. JCT. SR1426	16.5
8	LEE	SR1466	US1	0.7 MI. E. JCT. SR1434	16.4
8	LEE	SR1400	NORFOLK SOUTHERN RR	0.7 MI. N. JCT. SR1403	22.8
8	LEE	SR1400	SOUTHERN RR	0.6 MI.N.JCT.SR1403	19.5
8	LEE	US1 NBL	SR1415	2.7 MI. N. JCT. NC87	16.3
8	LEE	US421 NBL (FUT)	US1	0.45MI.W.JCT.US1 BUS.	22.5
8	LEE	US421 (FUTURE) SBL	US1	0.45 MI. W. JCT. US1BUS	19.9
8	LEE	US421(FUT) NBL COL	US1	0.45 MI. W. JCT. US1BUS	23.1
8	LEE	US421(FUT) SBL COL	US1	0.45 MI. W. JCT. US1 BUS	17.5
8	LEE	US1 BUS.	US421,NC87 (FUTURE)	0.45 MI. N. JCT. SR1406	18.9
8	LEE	US421,NC87SBL FUT.	CSXRR,LITTLE BUFFALO CK.	0.4 MI. E. JCT. US1 BUS	23.2
8	LEE	US421,NC87NBL(FUT)	CSXRR,LITTLE BUFFALO CRK	0.4 MI. E. JCT. US1 BUS.	23.7
8	LEE	SR1415	US421,NC87 (FUTURE)	0.6 MI.E.JCT. US13US.	16.6
8	LEE	SR1002	US421,NC87 (FUTURE)	1.2 MI. N. JCT. SR1521	17.1
8	LEE	SR1509	US421,NC87 (FUTURE)	0.65 MI. N. JCT. SR1521	16.3

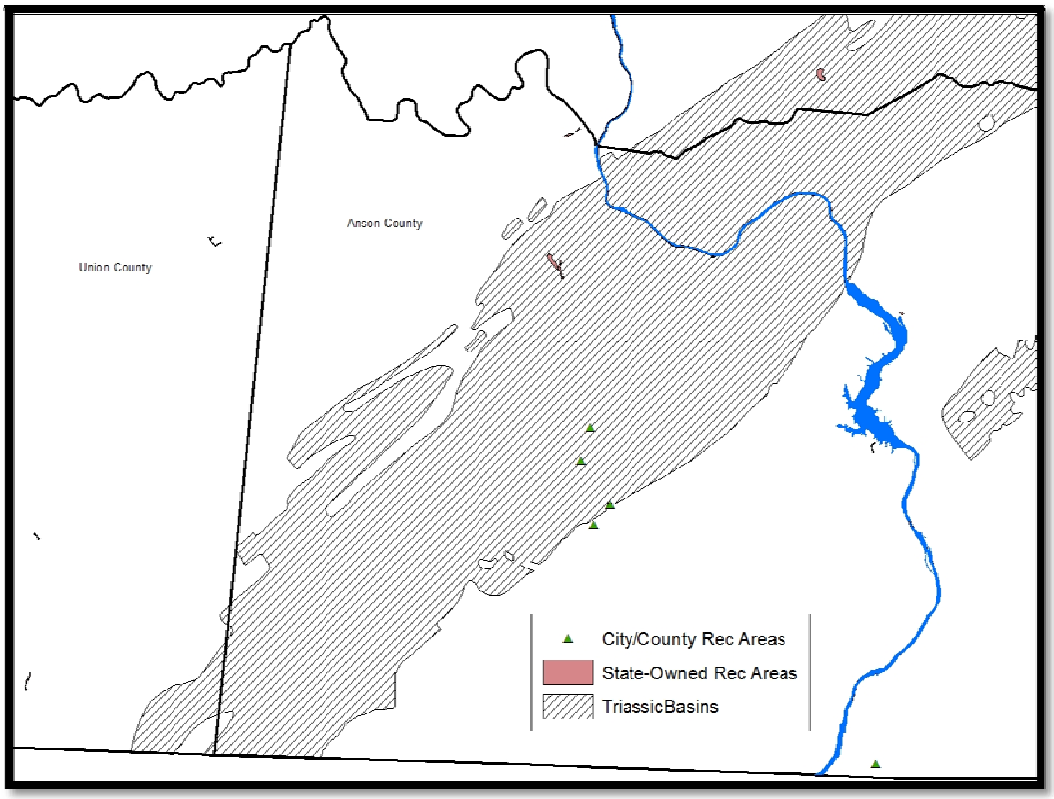
Table 10-1, continued

DIV	COUNTY	ROUTE	ACROSS	LOCATION	Minimum Vertical Clearance
8	LEE	SR1521	US421,NC87 (FUTURE)	0.65 MI. S. JCT. SR1506	16.9
7	ORANGE	SR1010 NBL	US15/US501 SBL	0.95 MI. N. JCT. SR1750	13.5
7	ORANGE	US15,US501	NC54	0.6 MI. N. JCT. SR1900	14.8
7	ORANGE	SR1734	I40	0.7 MI. N. JCT. SR1733	17.0
7	ORANGE	US15, US501 NBL	NC54	1.2 MI. S. JCT. SR1750	16.5
7	ROCKINGHAM	US220 BUS.	DAN R.,N&WRR &S.WATER ST	0.2 MI. E. JCT. US311	24.1
7	ROCKINGHAM	NC135	US220	0.20 MI. E. JCT. SR2177	14.3
7	ROCKINGHAM	NC700	NC14, NC87 & NC770	0.41 MI. W. JCT. SR1962	14.3
7	ROCKINGHAM	SR2150	US220	0.50 MI. W. JCT. NC 135	0.0
7	ROCKINGHAM	US220 NBL	NORFOLK WESTERN RR	0.57 MI. N. JCT. SR2209	22.6
7	ROCKINGHAM	US220 NBL	US220 BUS	0.6 MI. N. JCT.SR2209	14.4
7	ROCKINGHAM	NC14,NC87	C & NW RR	0.3 MI. N. JCT. NC770	22.9
7	ROCKINGHAM	US220 SBL	NORFOLK WESTERN RR	0.57 MI. N. JCT. SR2209	22.9
7	ROCKINGHAM	US220 SBL	US220 BUS	0.6 MI. N. JCT. SR2209	15.5
5	WAKE	NC55	US64	@ JCT.NC55&US64	16.8
5	WAKE	US64 EBL	SR1613	1.4MI.E.JCT NC55	15.8
5	WAKE	SR3015	I40	0.15 MI.SW SR1789	17.2
5	WAKE	NC55	US1	0.13MI.E.JCT.NC55&SR1158	16.1
5	WAKE	SR1002	I40	1.1 MI.SE SR1002	16.3
5	WAKE	SR1134	US1	0.3 MI.N.JCT.SR1189	17.3
5	WAKE	SR1127	US1	0.1 MI. N. JCT SR 1149	16.8
5	WAKE	SR1149	US1	JCT.US1&SR1149	16.9
5	WAKE	SR1153	US1	1.6 MI.S.JCT.SR1011	17.4
5	WAKE	US70	SR1002(WESTGATE RD)	1.8MI.N.W.JCT.SR1837	16.6
5	WAKE	SR1645	I540(N.WAKE EXPRESSWAY	0.68 MI.E.JCT.SR1646	17.1
5	WAKE	US64 WBL	SR1613	0.05MI.N.JCT.SR1613	17.0
5	WAKE	I540 WBL	US70	0.1 MI.S.JCT.SR1002	17.7
5	WAKE	I540 SBL R	I540&US70	0.1 MI.S.JCT.SR1002	16.8
5	WAKE	I540 EBL	US70	0.1MI.S.JCT.SR1002	17.9
5	WAKE	I540 NBL R	I540 & US70	0.1MI.S.JCT.SR1002	16.8
5	WAKE	SR1643	I540	1.3 MI.N.JCT.SR1792	17.3
5	WAKE	SR3097 RAMP E	I540 & RAMP B	0.3 OF I540 SBL	17.9
5	WAKE	SR3097 NB AV.PKWY	I540	0.7 MI.S.SR1644	17.2
5	WAKE	SR3097 SB AV.PKWY	I540	0.7 MI.S.SR1644	17.1
5	WAKE	SR3097 RAMP E	SR3097 RAMP B	0.2 MI.OF I540 SBL	17.4
5	WAKE	SR1644	I540	0.8 MI.S.JCT.AVIA.9908	17.3
5	WAKE	NC55 BYP	ACCESS RD.	1.0 MI. S. OF JCT. SR1172	15.7
5	WAKE	NC55 BYP.	ACCESS RD.	1.0 MI. S. JCT. SR1172	15.7
5	WAKE	SR1642	SR3097	0.3 E.JCT. SR 1789	16.5
5	WAKE	NC540 WBL	NC55	@ JCT.NC55	19.4
5	WAKE	NC540 EBL	NC55	@ JCT.NC55	17.2
5	WAKE	NC540 WBL	NC54,SOUTHERN R/R	@JCT.NC54	18.0
5	WAKE	NC540 EBL	NC54,SOUTHERN R/R	@JCT.NC54	20.2
5	WAKE	9906 FLYOVER	NC540 NB RMP.	@JCT.NC540	17.2
5	WAKE	NC540 FLYOVER EB	9906 TRIANGLE PKWY	@JCT.9906	17.2
5	WAKE	9906 FLYOVER	9906 TRIANGLE PKWY	@JCT.9906	33.3
5	WAKE	NC540 NB FLYOVER	NC540	@JCT.NC540	20.2
5	WAKE	I540 WBL	SR1613(DAVIS DRIVE)	@JCT.SR1613	16.7
5	WAKE	I540 EBL	SR1613(DAVIS DRIVE)	@JCT.SR1613	15.3
5	WAKE	I540 RAMP	SR1613(DAVIS DR.)	@JCT.SR1613	15.9
5	WAKE	NC540 WBL	LOUISE STEVENS RD(SR991)	0.4 MI.E.JCT.NC55	19.5
5	WAKE	NC540 EBL	LOUISE STEVENS RD(SR9910	0.4 MI.E.JCT. NC55	17.1
5	WAKE	NC540 WBL	ACCESS RD.	0.7 MI.E.JCT.NC55	16.7
5	WAKE	NC540 EBL	ACCESS RD.	0.8 MI.E.JCT NC55	17.3
5	WAKE	SR3112(CARY PKWY)N	SOUTHERN RAILROAD	0.3 MI.S.JCT.NC54	23.7
5	WAKE	SR3112(CARY PKWY)S	SOUTHERN RAILROAD	0.3 MI.S.JCT.NC54	23.3
5	WAKE	SR1615	NC540	@ JCT.NC540	18.0
5	WAKE	SR1621	NC540	0.5 MI.E.JCT.SR1600	17.3
5	WAKE	SR1624	NC540	0.6 MI.E.JCT.SR1625	17.6
5	WAKE	MCCRIMMON PKWY	NC540	0.9 MI.W.JCT.NC55	17.8
5	WAKE	MCCRIMMON PKW	NC540	0.9 MI.W.JCT.NC55	17.8
5	WAKE	SR1002 RAMP	SR3015	@ JCT.SR3015	17.4
5	WAKE	SR1002 SBL	SR3015	@ JCT.SR3015	17.2
5	WAKE	SR1002 NBL	SR 3015	@ JCT.SR3015	16.7
5	WAKE	SR1002 RAMP	SR1002 NBL	@ JCT.SR1002	17.4
5	WAKE	SR1002 SBL	SR3015 WBL	@ JCT.SR3015	16.7
5	WAKE	SR1002 SBL RAMP	SR3015	@ JCT.SR3015	27.2
5	WAKE	SR1002 NBL	SR3015 WBL		16.8

B. Appendix B: Maps of recreation areas

Maps of state, county, and local parks

Figure 10-1. Anson County State, County and Local Parks



Not all city and county parks are included in this map. Anson County does not keep mappable data for these sites.

Figure 10-2. Chatham County State, County and Local Parks

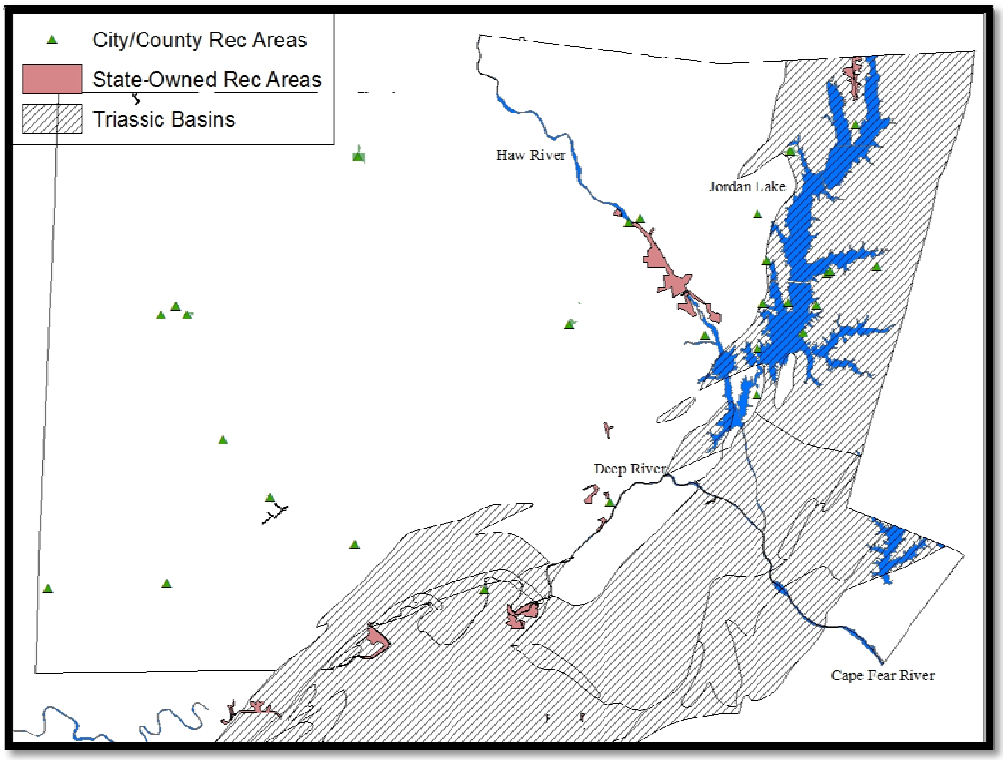
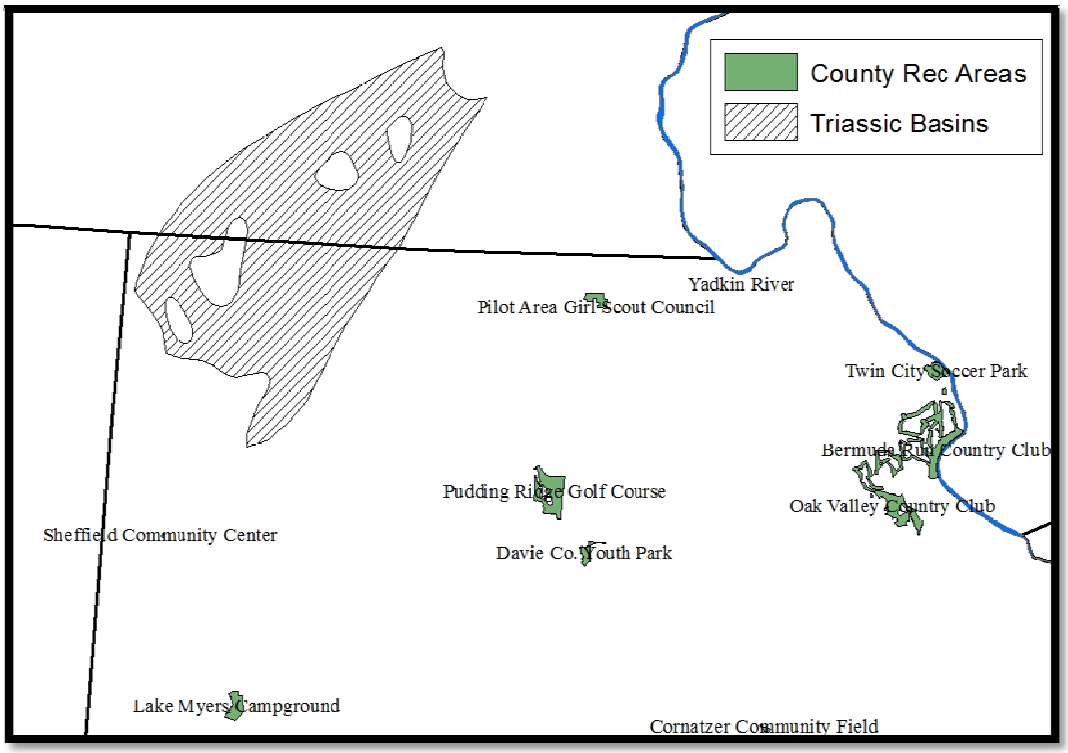


Figure 10-3. Davie County State, County and Local Parks



Not all city parks are included in this map. Davie County does not keep mappable data for these sites.

Figure 10-4. Durham County State, County and City Parks

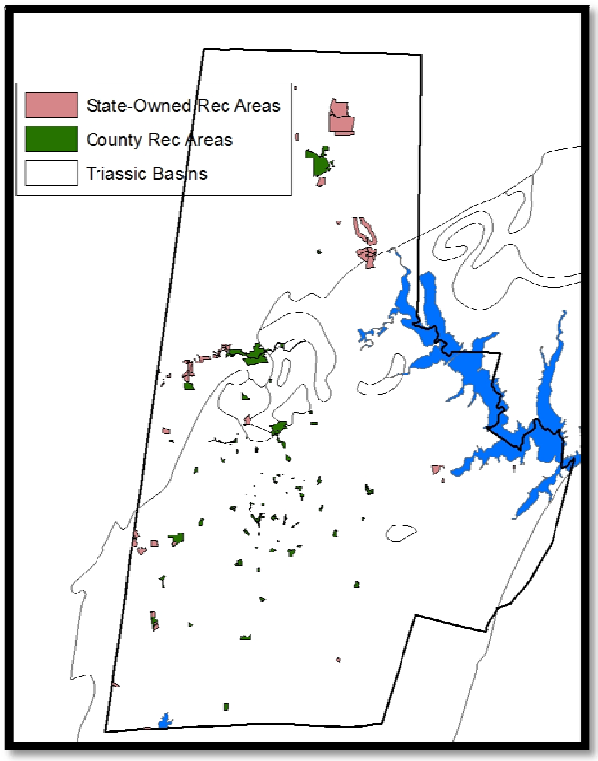
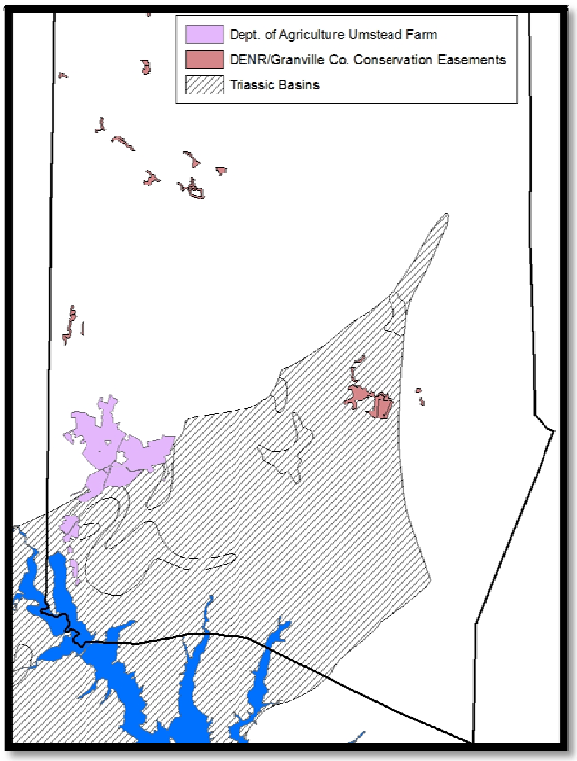
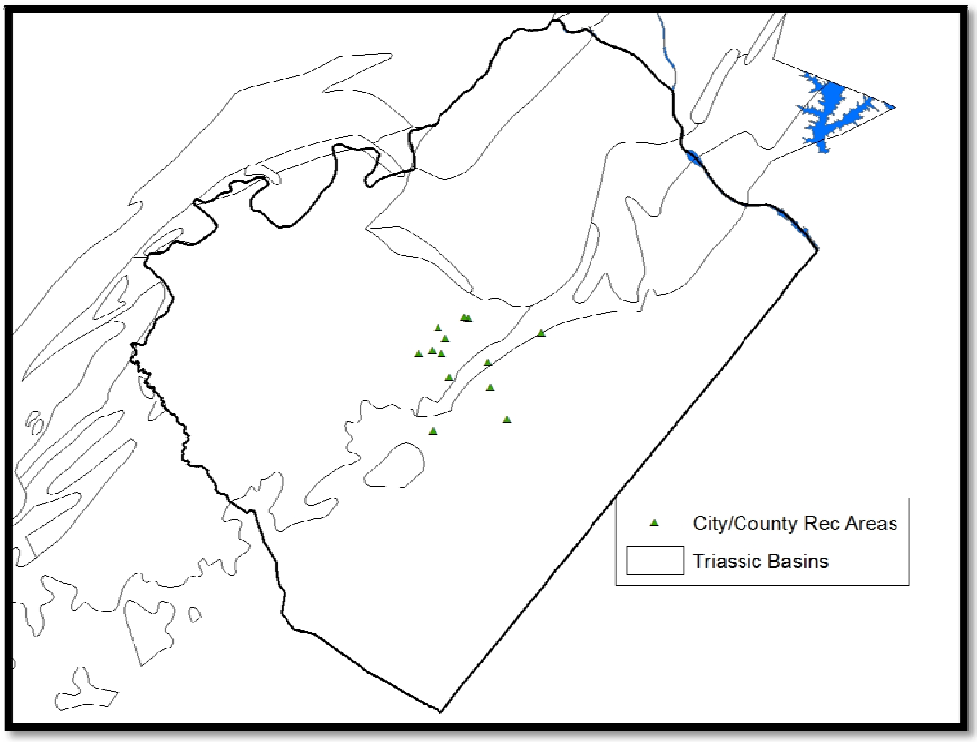


Figure 10-5. Granville County State, County and Local Parks



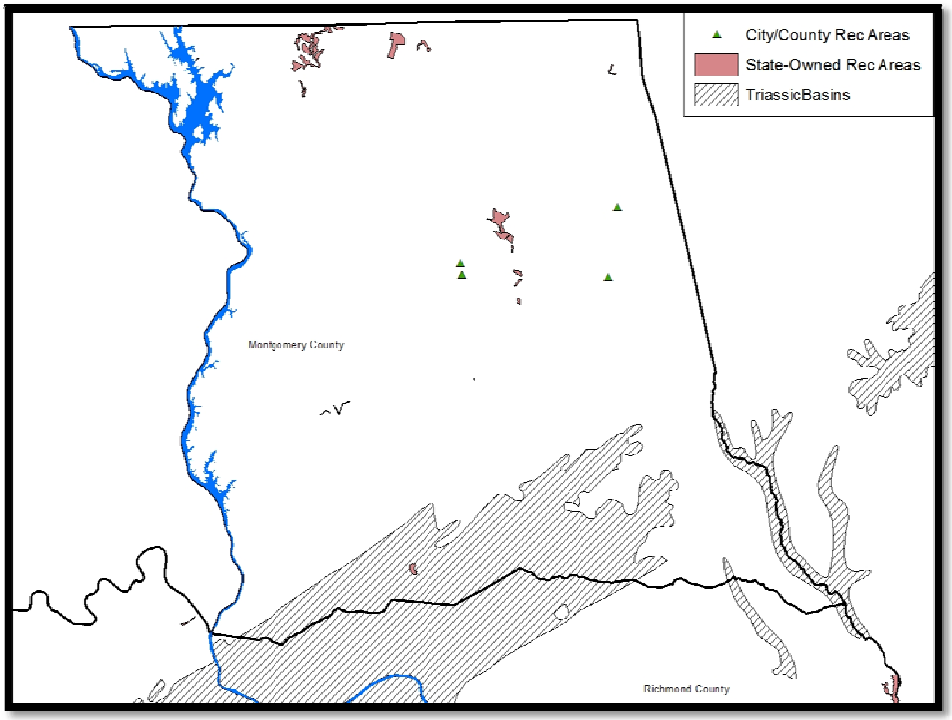
Not all city/county parks are included in this map. Granville County does not keep mappable data for these sites.

Figure 10-6. Lee County State, County and Local Parks



Not all city/county parks are included in this map. Lee County does not keep mappable data for these sites.

Figure 10-7. Montgomery County State, County and City Parks



Not all city/county parks are included in this map. Montgomery County does not keep mappable data for these sites.

Figure 10-8. Moore County State, County and City Parks

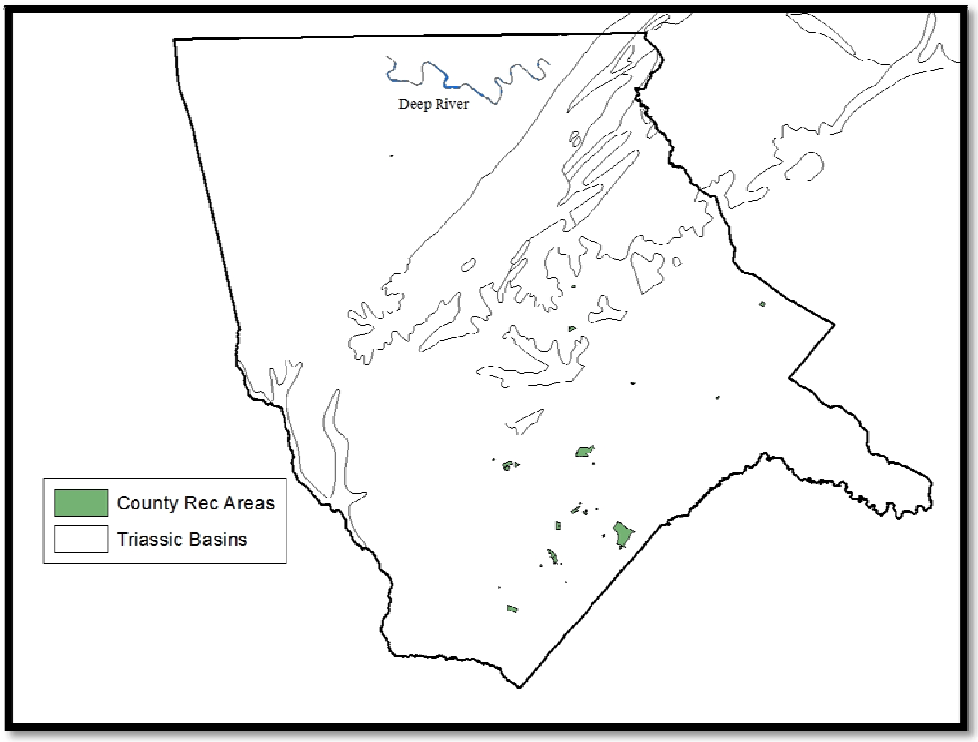


Figure 10-9. Orange County State, County and City Parks

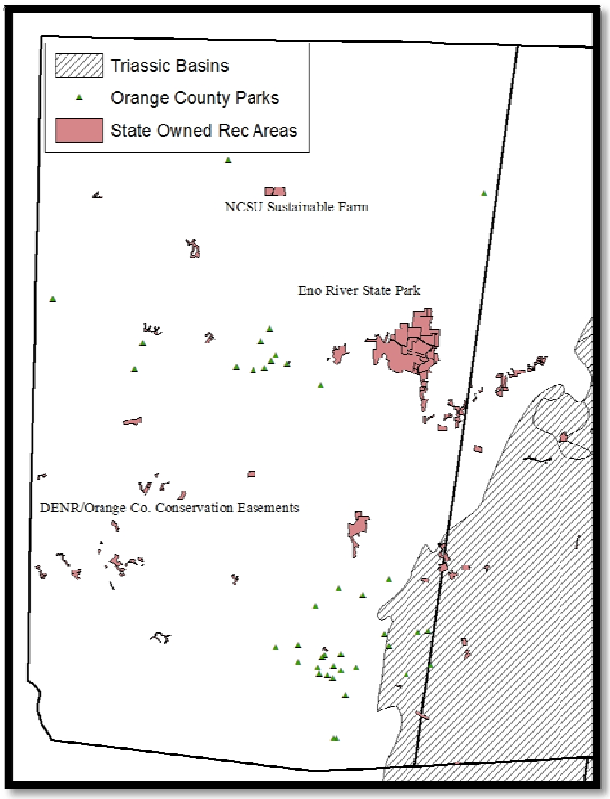


Figure 10-10. Richmond County State, County and City Parks

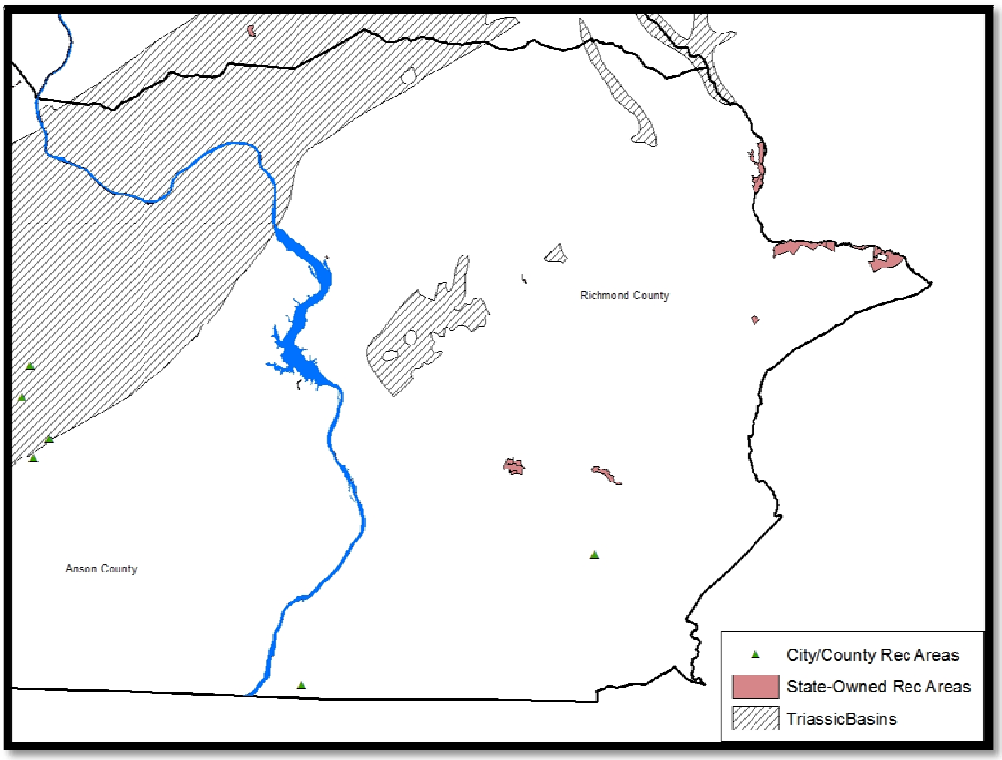


Figure 10-11. Rockingham County State, County and City Parks

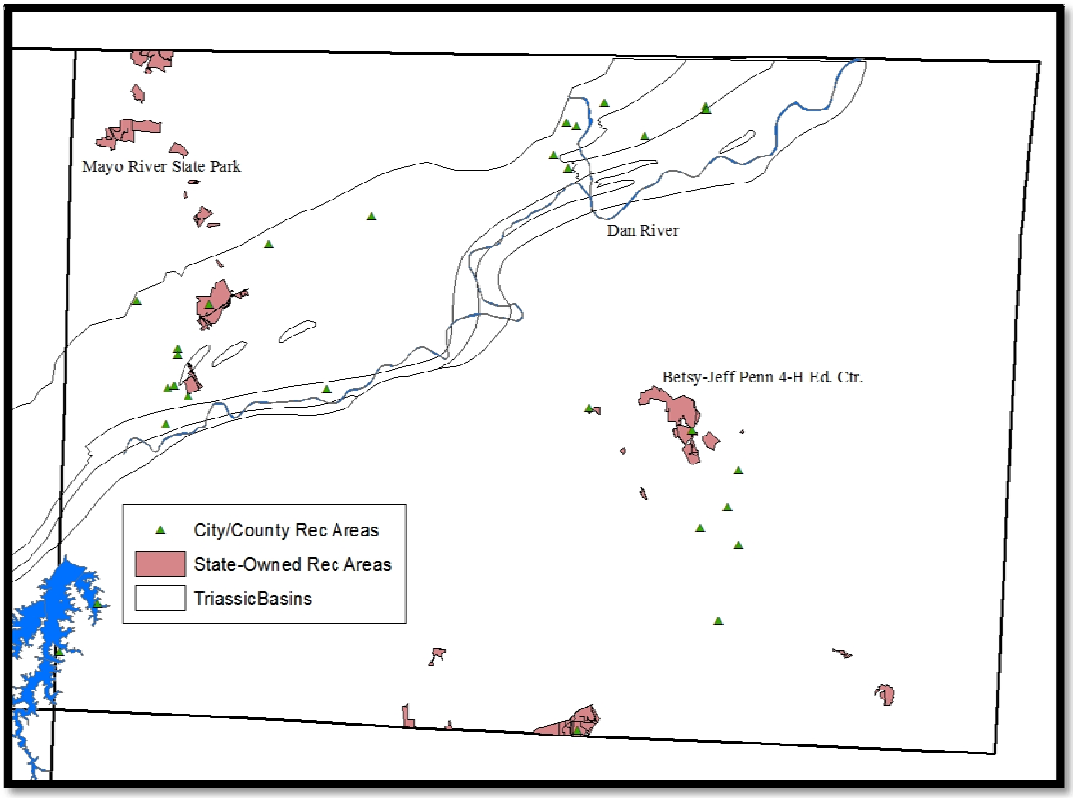


Figure 10-12. Stokes County State, County and City Parks

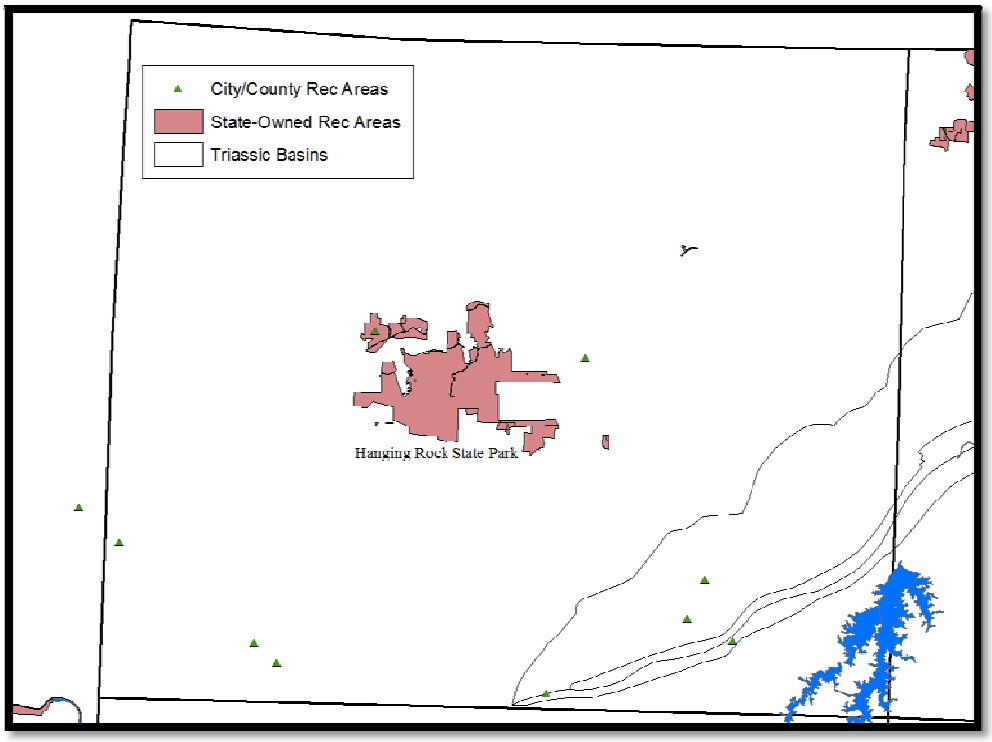
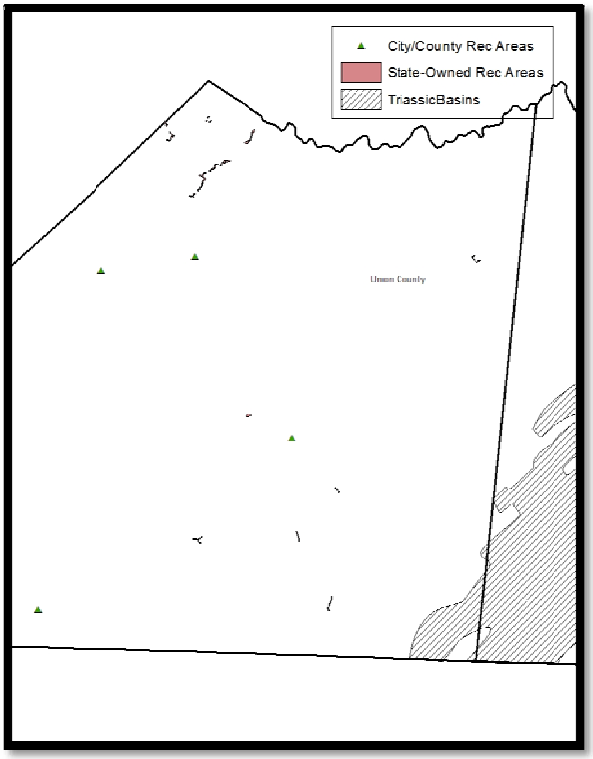


Figure 10-13. Union County State, County and City Parks



Not all city/county parks are included in this map. Union County does not keep mappable data for these sites.

Figure 10-14. Wake County State, County and City Parks

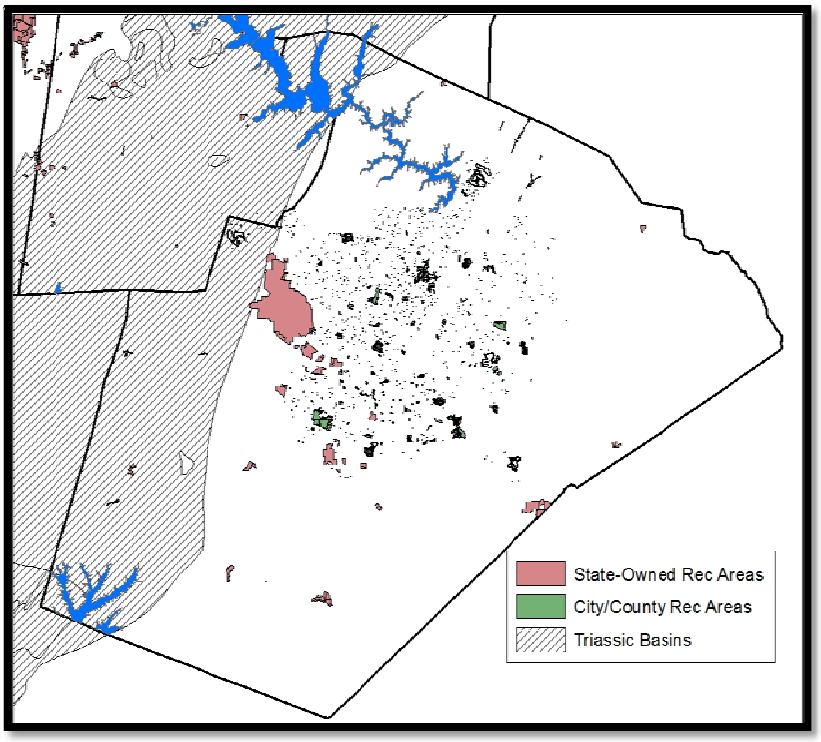
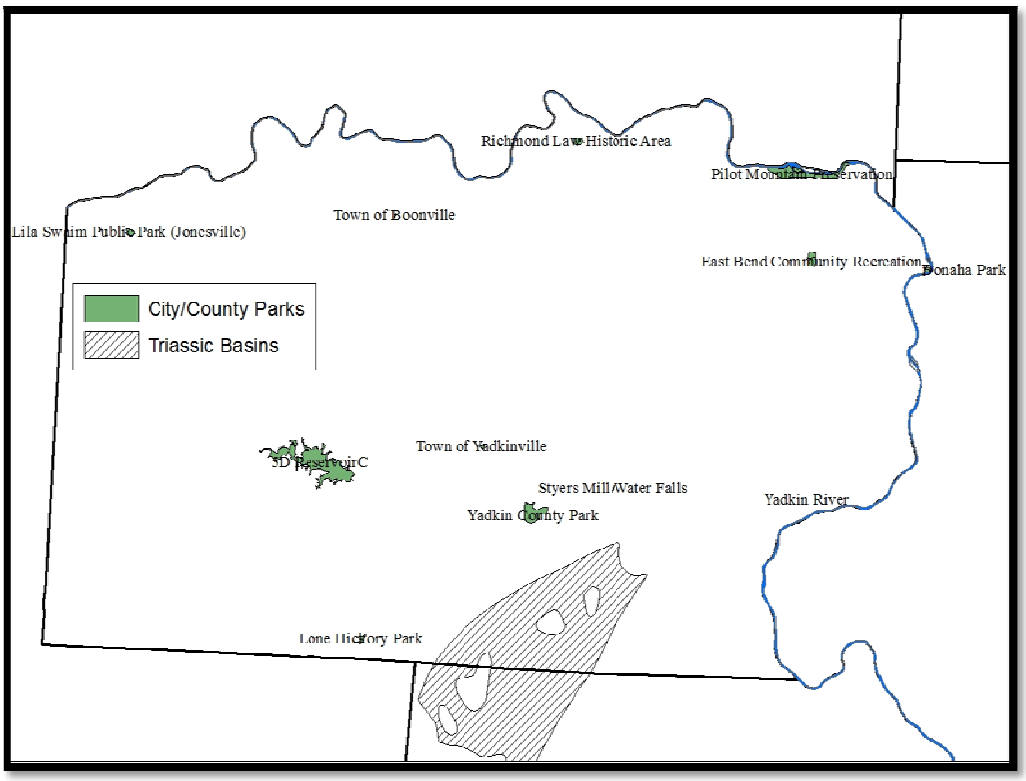


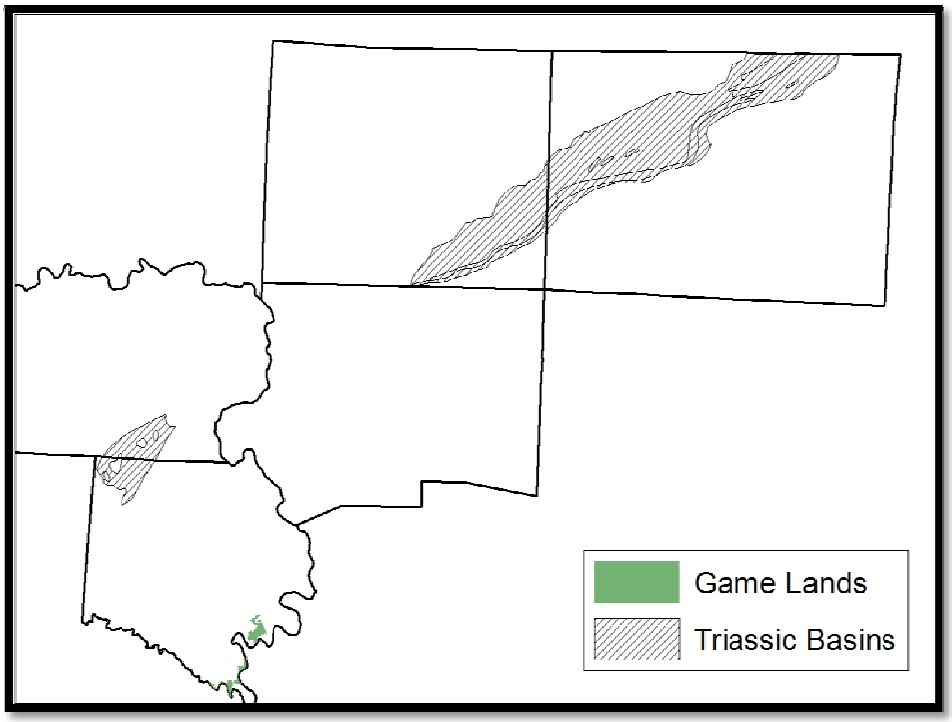
Figure 10-15. Yadkin County State, County and City Parks



Not all city/county parks are included in this map. Yadkin County does not keep mappable data for these sites.

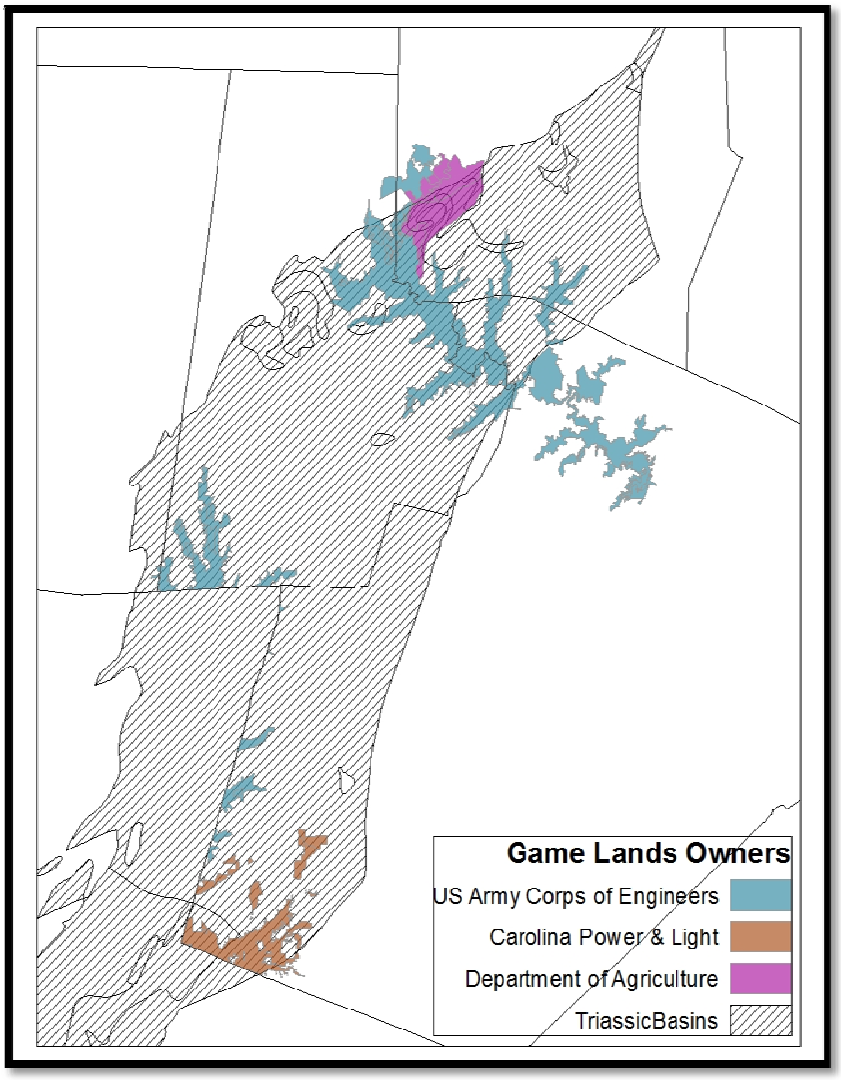
Maps of game lands in the Triassic Basins

Figure 10-16. Dan River Basin and Game Lands



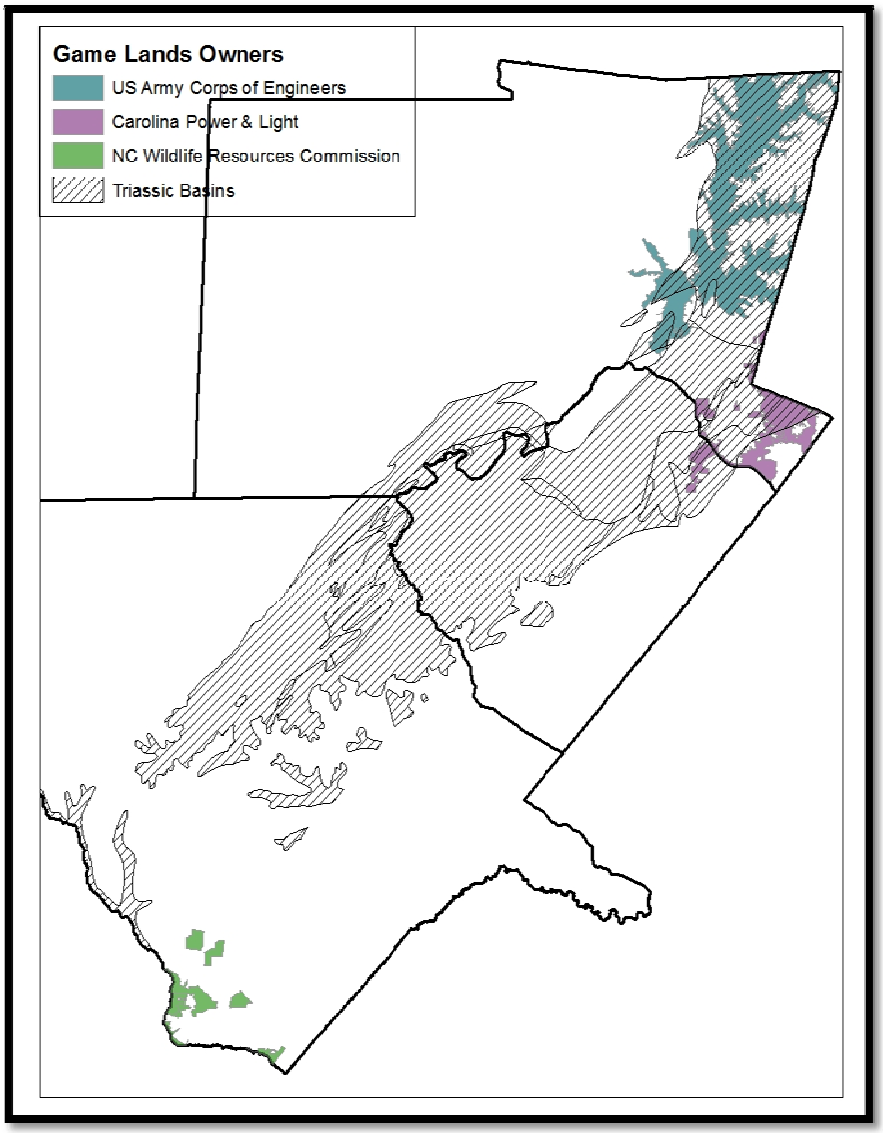
The Triassic Basin shale formation in the Dan River basin does not underlie any game lands.

Figure 10-17. Durham Sub-Basin and Game Lands



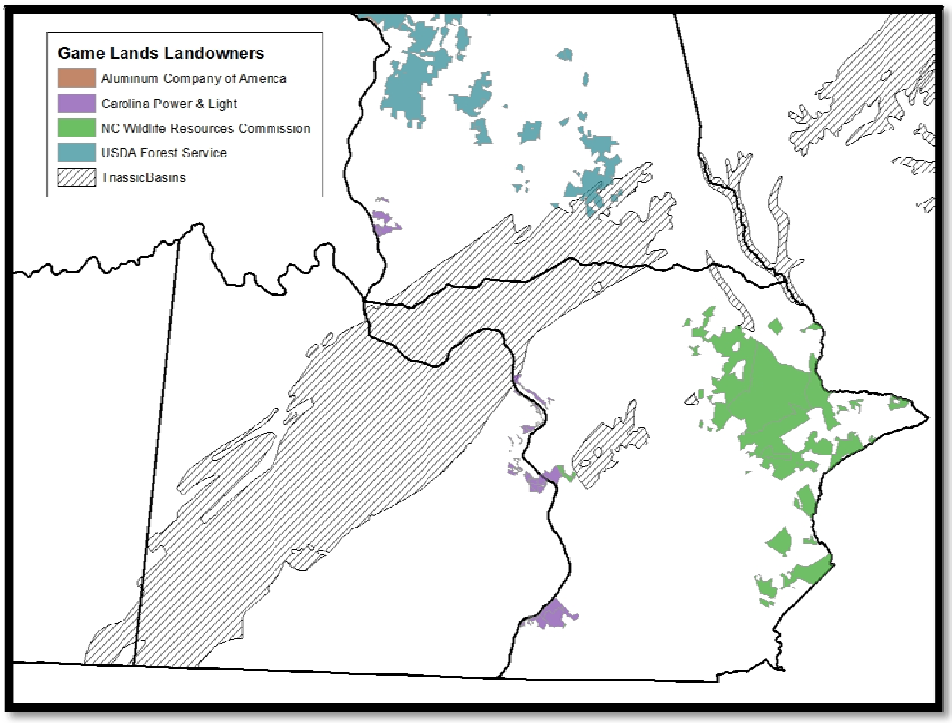
The Triassic Basins shale formation underlies significant portions of game lands in Durham, Wake and Granville counties. Game lands on and around Jordan, Harris and Kerr lakes each have the potential to be impacted if drilling occurs on or nearby the lakes.

Figure 10-18. Sanford Sub-Basin and Game Lands



The Triassic Basins shale formation underlies significant portions of game lands, primarily in the Jordan and Harris Lake regions of Chatham County.

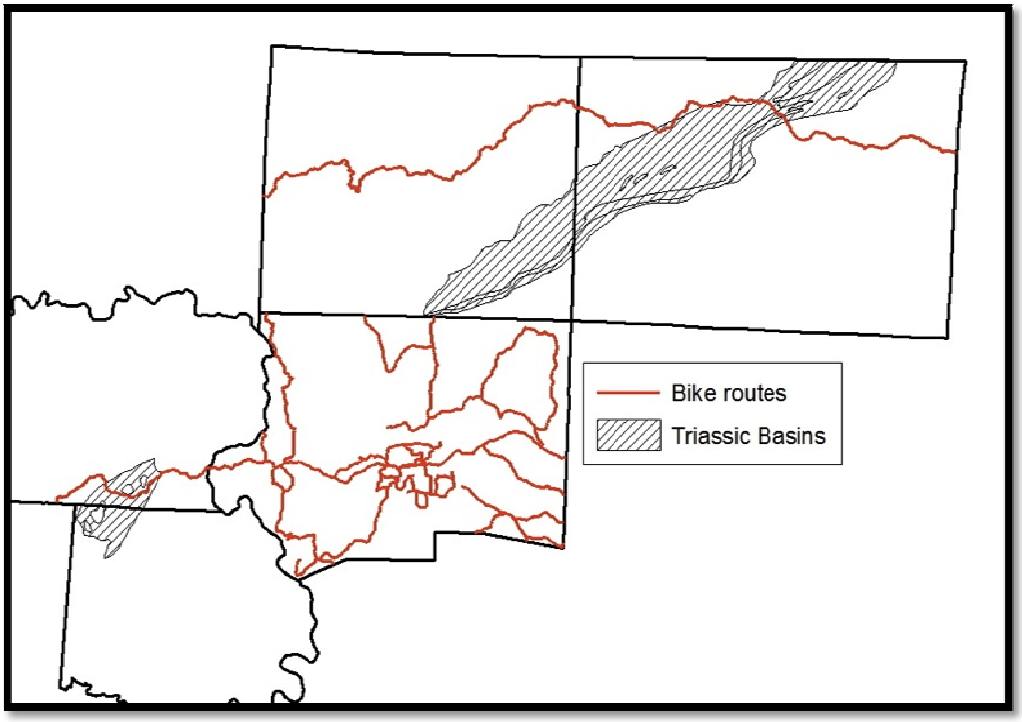
Figure 10-19. Wadesboro Sub-Basin and Game lands



The Triassic Basins shale formation underlies a small portion of game lands in Montgomery and Richmond counties.

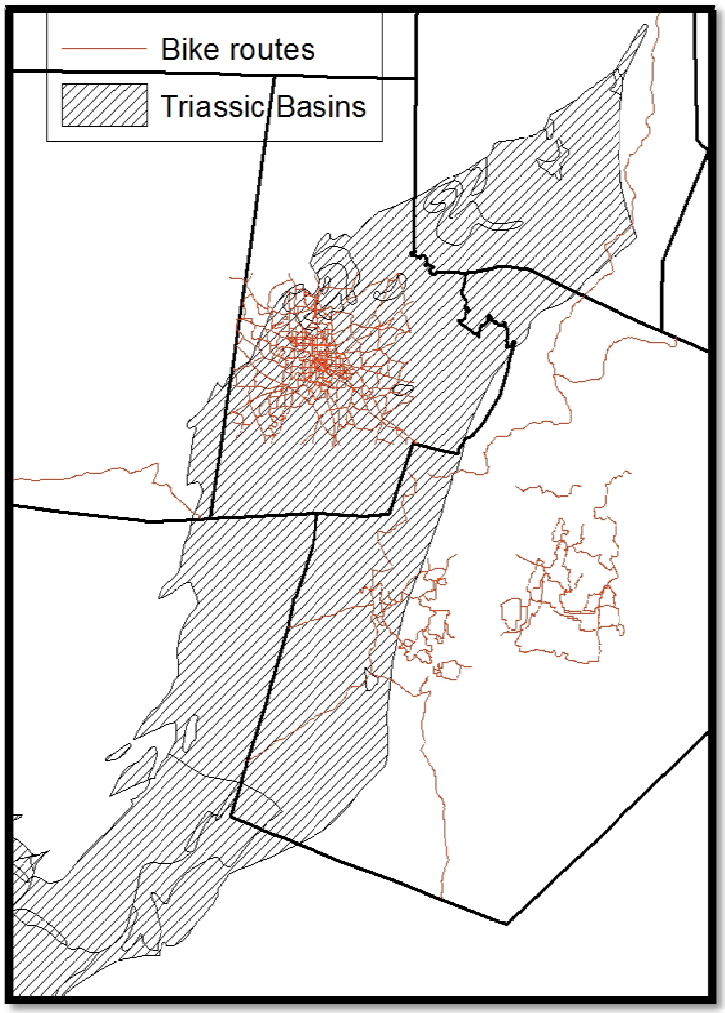
Maps of bike routes in the Triassic Basins

Figure 10-20. Dan River Basin and Bike Routes



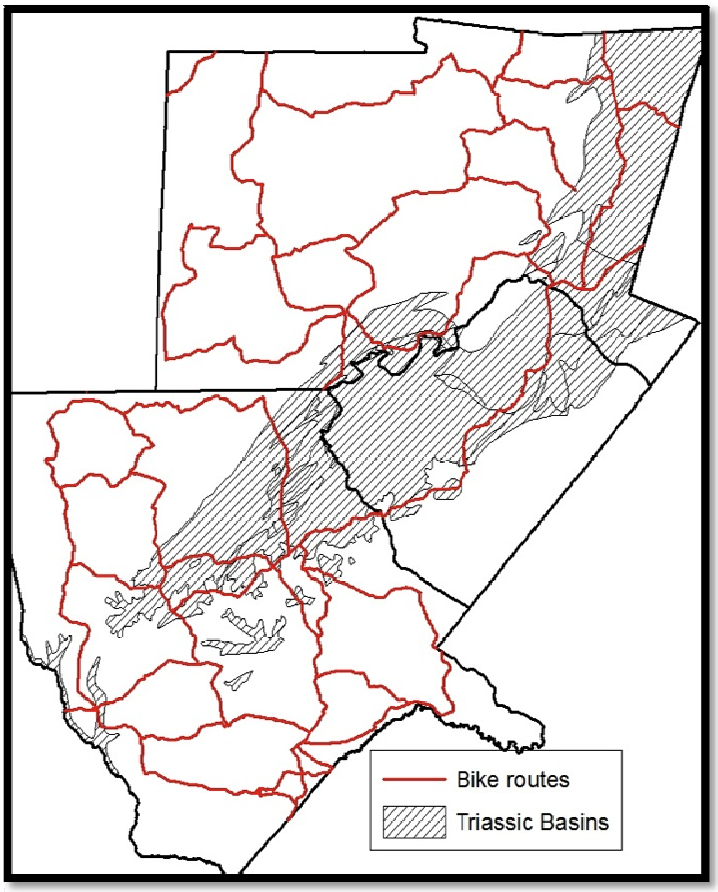
The Triassic Basins shale formations underlie two stretches of bike trail in Rockingham and Yadkin counties.

Figure 10-21. Durham Sub-Basin and Bike Routes



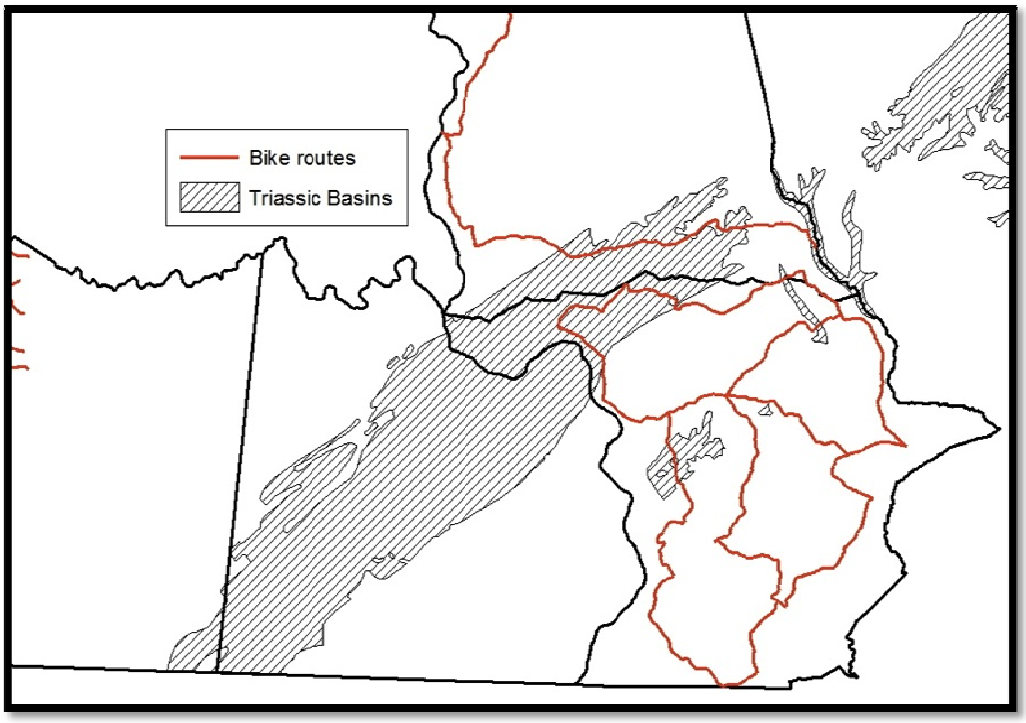
The Triassic Basins shale formation underlies significant portions of bike paths, particularly in Wake and Durham counties.

Figure 10-22. Sanford Sub-Basin and Bike Routes



The Triassic Basins shale formation underlies long stretches of several bike routes in Lee, Chatham and Moore counties.

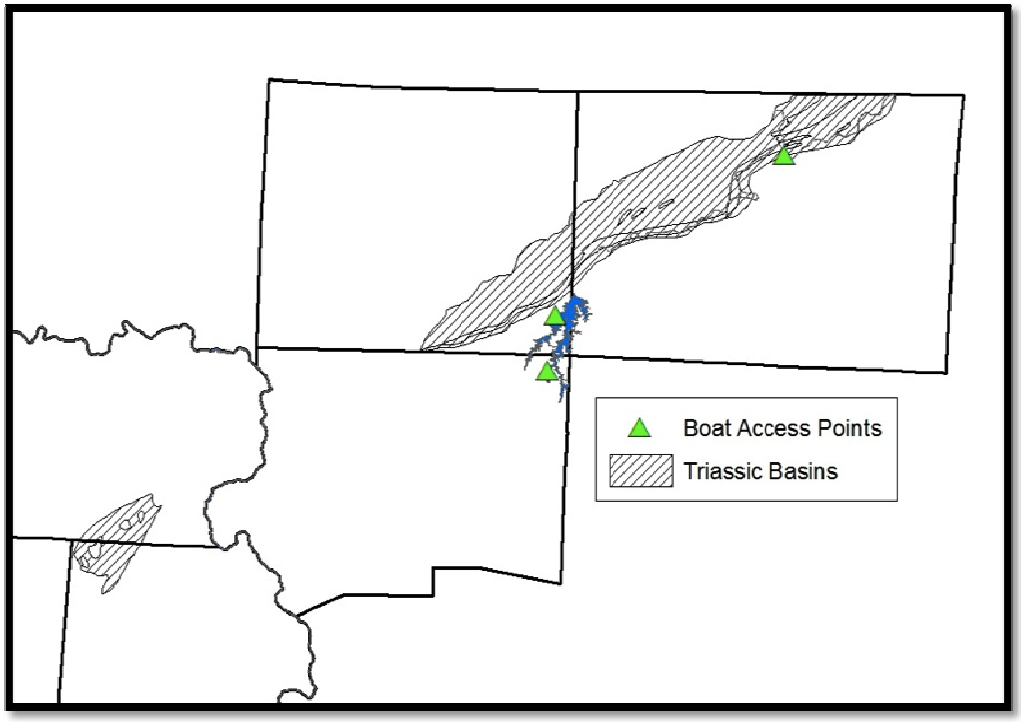
Figure 10-23. Wadesboro Sub-Basin and Bike Routes



The Triassic Basins shale formation underlies several stretches of bike routes in Montgomery and Richmond counties.

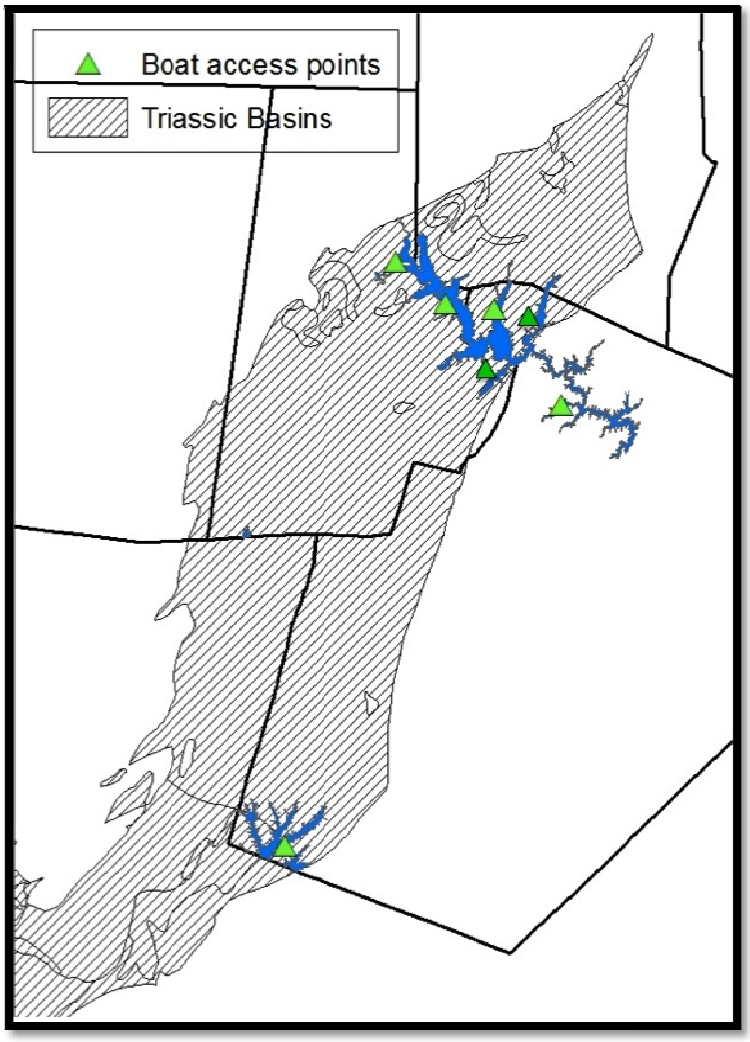
Maps of boat access points and major water bodies in the Triassic Basins

Figure 10-24. Dan River Basin, Boat Access Points and Major Water Bodies



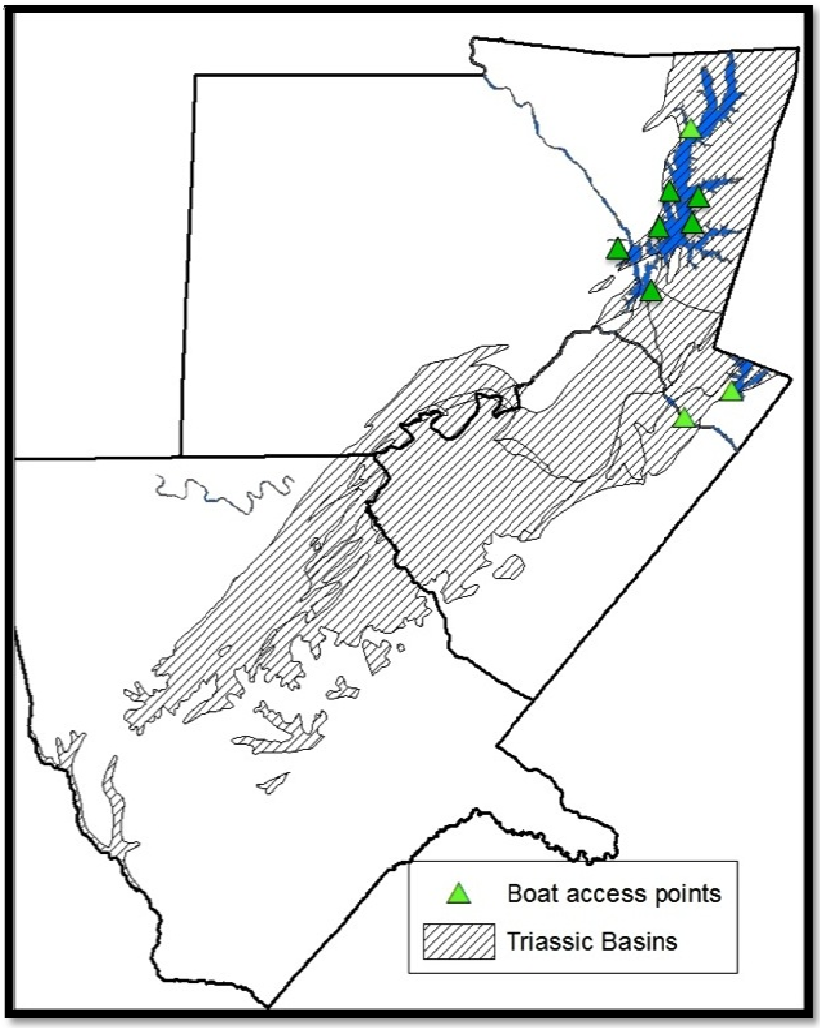
The Triassic Basins shale formation underlies one boat access point on the Dan River in Rockingham County, and lies close to two access points to Belews Lake in Stokes and Forsyth counties.

Figure 10-25. Durham Sub-Basin, Boat Access Points and Major Water Bodies



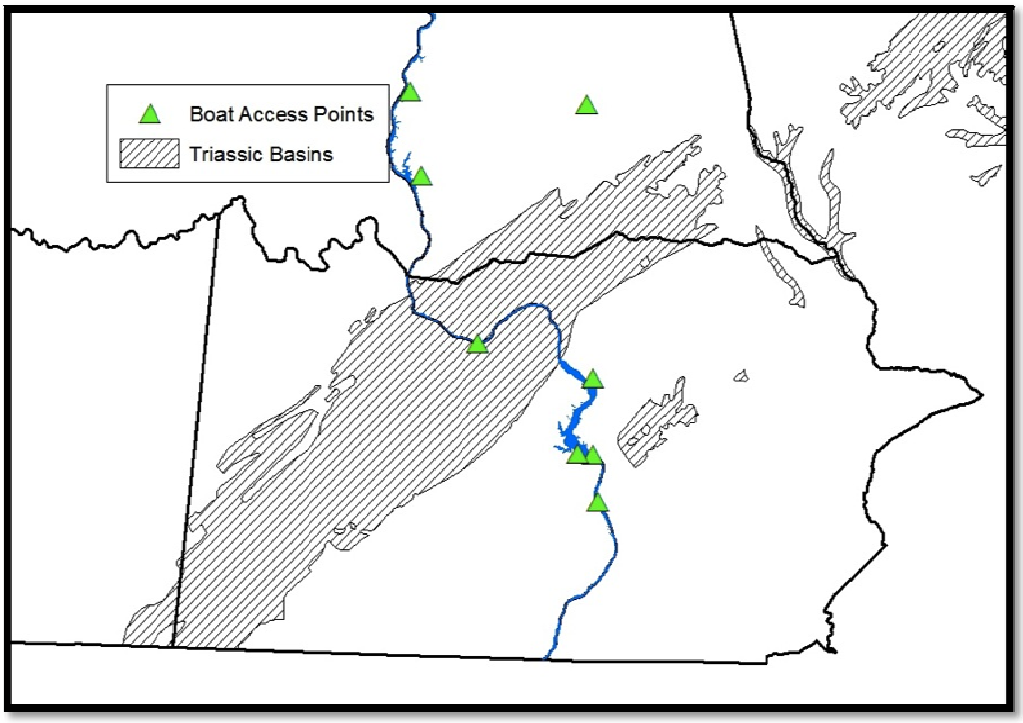
The Triassic Basins shale formation underlies several boat access points in and around Durham, Granville and Wakes counties. The formation underlies three access points, and lies close to one more, on Falls Lake, in Durham, Granville and Wake counties. The formation also underlies one access point to Harris Lake in Wake County.

Figure 10-26. Sanford Sub-Basin, Boat Access Points and Major Water Bodies



The Triassic Basins shale formation underlies one boat access point on Jordan Lake in Chatham County, one access point on Harris Lake in Chatham County, and one access point to the Deep River on the border of Chatham and Lee counties.

Figure 10-27. Wadesboro Sub-Basin, Boat Access Points and Major Water Bodies



The Triassic Basin shale formation underlies one boat access point on the Pee Dee River, along the border of Anson and Richmond counties. Several other boat access points, located along Blewett Falls Lake and south of Badin Lake, are located nearby the Triassic formation.

Map sources

NC One Map, DENR, N.C. Geological Survey, NCDOT and various North Carolina counties' GIS services.

C. Appendix C: Common noise sources and levels at 50 feet

Noise Source	Decibel Level
Quiet residential area	40
Electric toothbrush	50-60
Normal conversation	60
Coffee grinder	70-80
Whistling kettle	80
Blender	80-90
Shouted conversation	90
Motorcycle	95-110
Shouting in ear	110
Rock concert	110-120
Stock car race	130
Airplane taking off	140

Source: Center for Hearing and Communication

D. Appendix D: Statistical analysis methodology

Counties included in analysis

North Carolina Deep River Region: Anson, Chatham, Durham, Granville, Lee, Montgomery, Moore, Orange, Richmond, Union, Wake counties

North Carolina Dan River Region: Davie, Rockingham, Stokes, Yadkin counties

Colorado Western Slope Region: Adams, Arapahoe, Archuleta, Baca, Bent, Boulder, Broomfield, Cheyenne, Delta, Dolores, Elbert, Fremont, Garfield, Gunnison, Huerfano, Jackson, Jefferson, Kiowa, Kit Carson, La Plata, Larimer, Las Animas, Lincoln, Logan, Mesa, Moffat, Montezuma, Montrose, Morgan, Phillips, Prowers, Rio Blanco, Routt, San Miguel, Sedgwick, Washington, Weld, Yuma counties.

North Dakota Bakken Region: Adams, Billings, Bottineau, Bowman, Burke, Burleigh, Divide, Dunn, Emmons, Golden Valley, Grant, Hettinger, McHenry, McKenzie, McLean, Mercer, Morton, Mountrail, Oliver, Renville, Sheridan, Sioux, Slope, Stark, Ward, Williams counties.

Oklahoma: all counties.

Pennsylvania Marcellus Region: Allegheny, Armstrong, Beaver, Bedford, Blair, Bradford, Butler, Cambria, Cameron, Centre, Clarion, Clearfield, Clinton, Columbia, Crawford, Elk, Erie, Fayette, Forest, Greene, Huntingdon, Indiana, Jefferson, Lackawanna, Lawrence, Luzerne, Lycoming, McKean, Mercer, Potter, Somerset, Sullivan, Susquehanna, Tioga, Venango, Warren, Washington, Wayne, Westmoreland, Wyoming counties.

Texas Barnett Region: Archer, Bosque, Clay, Comanche, Cooke, Coryell, Dallas, Denton, Eastland, Ellis, Erath, Hamilton, Hill, Hood, Jack, Johnson, Montague, Palo Pinto, Parker, Shackleford, Somervell, Stephens, Tarrant, Wise counties.

Texas Eagle Ford Region: Atascosa, Bee, Brazos, Burleson, Dewitt, Dimmit, Edwards, Fayette, Frio, Gonzales, Grimes, Houston, Karnes, La Salle, Lavaca, Lee, Leon, Live Oak, Maverick, McMullen, Milam, Webb, Wilson, Wood, Zavala counties.

Wyoming Niobrara Region: Albany, Big Horn, Campbell, Carbon, Converse, Crook, Fremont, Goshen, Hot Springs, Johnson, Laramie, Lincoln, Natrona, Niobrara, Park, Platte, Sheridan, Sublette, Sweetwater, Teton, Uinta, Washakie, Weston counties.

Regression Results

Data were analyzed using county-level data from 2000-2009 or 2000-2010, depending on the availability of the data. Each state was analyzed separately. County level fixed-effects and year level fixed-effects were controlled for, as were population and population density. Other potential controls, including demographic and economic characteristics, were not included due to time and data limitations.

Regressions compared the change in annual oil and gas production per 100,000 people in a given county with assorted crime rates per 100,000 people in that same county each year.

Table 10-2. Natural Gas Production Changes and Crime Rates per 100,000 People: "T" and "P" Values

Crime	Colorado	North Dakota	Oklahoma	Pennsylvania	Barnett	Eagle Ford	Wyoming
Murder	t=-.37 p=.71	-.5 .62	-.20 .85	-.86 .39	-0.66 0.51	-3.66 .0001**	.93 .36
Rape	-.25 .81	-.55 .58	.45 .66	.38 .71	0.35 0.73	.19 .85	.62 .54
Robbery	.53 .60	-.05 .96	-.02 .99	1.67 .10	.38 .70	-.49 .62	.17 .87
Aggravated assault	2.48 .01**	-.46 .64	-.07 .94	.29 .77	-0.64 0.52	-1.60 .11	3.0 .003**
Burglary	1.70 .09	.24 .81	-.24 .81	.96 .34	-2.29 .02*	1.42 .16	-0.84 .40
Larceny/ theft	1.20 .23	-.02 .98	.23 .82	-1.0 .32	-2.73 .007**	-1.50 .14	1.6 .11
Car theft	-.42 .68	.02 .98	-.32 .75	-1.94 .06	-.28 .78	-.63 .53	.07 .94
Violent crime	2.38 .02*	-.45 .66	-.03 .98	.51 .62	-.51 .61	-1.87 .06	3.07 .002**
Non-violent crime	1.55 .12	.26 .79	.15 .88	-.56 .58	-3.57 .0001**	-.76 .45	1.12 .26
Total crime	1.74 .08	-.29 .77	.15 .88	-.23 .82	-.73 .47	-1.12 .27	1.8 .07

*=.95 confidence **=.99 confidence

Table 10-3. Natural Gas Production Changes and Crime Rates per 100,000 People: Coefficients and Confidence Intervals

Crime	Colorado	North Dakota	Oklahoma	Pennsylvania	Barnett	Eagle Ford	Wyoming
Murder	-6.05e-09 1.63e-08	-1.27e-06 2.55e-06	-1.26e-11 6.43e-11	-4.99e-08 5.77e-08	-1.56e-08 2.38e-08	-1.02e-08 2.79e-09**	1.60e-09 1.73e-09
Rape	-9.81e-09 4.00e-08	-1.48e-06 2.70e-06	1.06e-10 2.38e-10	8.49e-07 2.24e-06	2.18e-08 6.29e-08	7.20e-10 3.79e-09	4.35e-09 7.08e-09
Robbery	1.34e-08 2.54e-08	-5.31e-08 9.97e-07	-1.18e-11 6.75e-10	2.64e-07 1.58e-07	2.17e-08 5.67e-08	-2.35e-09 4.77e-09	5.02e-10 2.96e-09
Aggravated assault	4.95e-07 1.99e-07**	-2.72e-06 5.87e-06	-1.44e-10 1.93e-09	2.10e-07 7.13e-07	-2.22e-07 3.46e-07	-3.82e-08 2.39e-08	1.16e-07 3.87e-08**
Burglary	2.20e-07 1.30e-07	5.49e-06 2.34e-05	-8.24e-10 3.46e-09	1.58e-06 1.64e-06	-1.77e-06 7.73e-07*	7.14e-08 5.04e-08	-4.35e-08 5.15e-08
Larceny/ theft	3.49e-07 2.91e-07	-1.43e-06 6.08e-05	4.97e-09 2.19e-08	-3.23e-06 3.24e-06	-3.94e-06 1.45e-06**	-1.56e-07 1.04e-07	2.26e-07 1.42e-07
Car theft	-2.51e-08 6.01e-08	2.25e-07 9.21e-06	-1.14e-09 3.56e-09	-9.52e-07 4.90e-07	-1.84e-07 6.62e-07	-8.75e-09 1.38e-08	1.34e-09 1.92e-08
Violent crime	5.39e-07 2.26e-07*	-.000287 .000641	-6.19e-11 2.18e-09	1.27e-06 2.52e-06	-1.88e-07 3.67e-07	-5.01e-08 2.68e-08	1.23e-07 3.99e-08**
Non-violent crime	5.44e-07 3.51e-07	.000764 .002907	3.01e-09 2.05e-08	-2.38e-06 4.23e-06	-5.89e-06 1.65e-06**	-9.37e-08 1.23e-07	1.84e-07 1.65e-07
Total crime	1.44e-06 8.26e-07	-.0000291 .0001008	2.95e-09 2.01e-08	-1.11e-06 4.85e-06	-4.02e-06 5.51e-06	-1.42e-07 1.27e-07	3.07e-07 1.71e-01

*=.95 confidence **=.99 confidence

Table 10-4. Oil Production Changes and Crime Rates per 100,000 People: "T" and "P" Values

Crime	Colorado	North Dakota	Oklahoma	Barnett	Eagle Ford	Wyoming
Murder	t=.98 p=.33	-.41 .68	.55 .58	.46 .65	.60 .55	2.44 .02*
Rape	-3.62 .0001**	-.80 .42	-.07 .95	-1.29 .20	-1.74 .08	1.30 .20
Robbery	-.68 .50	-.03 .98	.09 .93	.97 .34	.75 .46	.45 .65
Aggravated assault	-.83 .41	.04 .96	.15 .88	0.45 0.65	-.46 .64	.75 .45
Burglary	.81 .42	.14 .89	.48 .63	.22 .82	-1.50 .14	2.38 .02*
Larceny/ theft	.03 .98	1.06 .29	-.03 .97	.40 .69	-.72 .47	1.92 .06
Car theft	-.89 .37	-.26 .80	.37 .72	1.31 .19	.21 .84	1.28 .20
Violent crime	-1.16 .25	.04 .97	.17 .87	.39 .70	-.46 .65	1.09 0.28
Non-violent crime	.17 .86	.31 .75	.11 .92	.96 .34	-1.20 .23	2.57 .01**
Total crime	.32 .75	.44 .66	.13 .90	.37 .72	-1.26 .21	2.73 .007**

*=.95 confidence **=.99 confidence

Table 10-5. Oil Production Changes and Crime Rates per 100,000 People: Coefficients and Confidence Intervals

Crime	Colorado	North Dakota	Oklahoma	Barnett	Eagle Ford	Wyoming
Murder	3.04e-07 3.09e-07	-7.83e-07 1.92e-06	1.35e-07 2.43e-07	3.18e-07 6.98e-07	3.16e-08 5.29e-08	4.35e-07 1.79e-07*
Rape	-2.66e-06 7.34e-07**	-2.96e-06 3.68e-06	-6.21e-08 9.00e-07	-2.37e-6 1.84e-06	-1.20e-07 6.92e-08	9.54e-07 7.36e-07
Robbery	-3.29e-07 4.81e-07	-3.67e-08 1.36e-06	2.37e-07 2.55e-06	1.60e-06 1.66e-06	6.57e-08 8.77e-08	1.38e-07 3.09e-07
Aggravated assault	-3.18e-06 3.84e-06	3.58e-07 8.03e-06	1.07e-06 7.29e-06	4.56e-06 1.01e-05	-2.05e-07 4.42e-07	3.09e-06 4.11e-06
Burglary	2.01e-06 2.47e-06	4.54e-06 3.19e-05	6.22e-06 1.31e-05	5.14e-06 2.90e-05	-1.38e-06 9.25e-07	.0000127 .0000053*
Larceny/ theft	1.77e-07 5.55e-06	.0000878 .0000829	-2.87e-06 8.28e-05	.0000173 .0000431	-1.38e-06 1.92e-06	.0000283 .0000147
Car theft	-1.02e-06 1.14e-06	-3.24e-06 1.26e-05	4.91e-06 1.34e-05	.0000253 .0000193	5.25e-08 2.54e-07	2.55e-06 1.99e-06
Violent crime	-5.05e-06 4.34e-06	.0000177 .0004834	1.38e-06 8.22e-06	4.19e-06 1.07e-05	-2.28e-07 4.96e-07	4.61e-06 4.24e-06
Non-violent crime	1.17e-06 6.71e-06	.00125 .00397	8.26e-06 7.72e-05	.0000477 .0000497	-2.71e-06 2.26e-06	.0000435 .000017**
Total crime	5.06e-06 1.59e-05	.0000612 .0001378	9.63e-06 7.59e-06	.000059 .000162	-2.95e-06 2.34e-06	.0000481 .0000176**

*=.95 confidence **=.99 confidence

Data plots

The X axes of the figures below, “indgaschp100k” or “indoilchp100k” show the change in natural gas production (per thousand cubic feet) or oil production (per barrel) per 100,000 residents in each county and each year of the survey. This figure was chosen because Uniform Crime Reporting data typically shows results in crimes per 100,000 residents. The results are indexed so that the average change in gas or oil production in all the surveyed counties equals the number one. If a given county experienced an increase in gas production in a given year that was 10 times greater than the average change in gas production for all those counties, it receives a value of 10.

The Y axes on the figures below indicate the relevant crime rate per 100,000 residents in a given county, and are also indexed so that the average value is one. If a given county experienced crime rates in one year that were twice the regional average, it receives a score of two.

Figure 10-28. Texas Barnett Region, Index of Change in Gas Production and Index of Nonviolent Crime Rates with Least Fit Squares Line

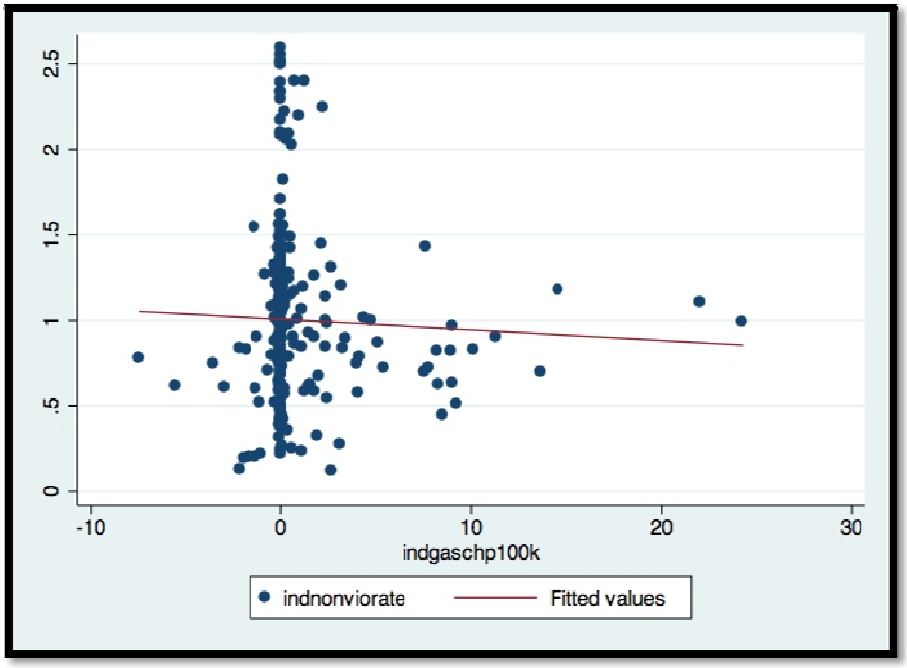


Figure 10-29. Colorado Western Slope Region, Index of Change in Gas Production and Index of Violent Crime Rates with Least Fit Squares Line

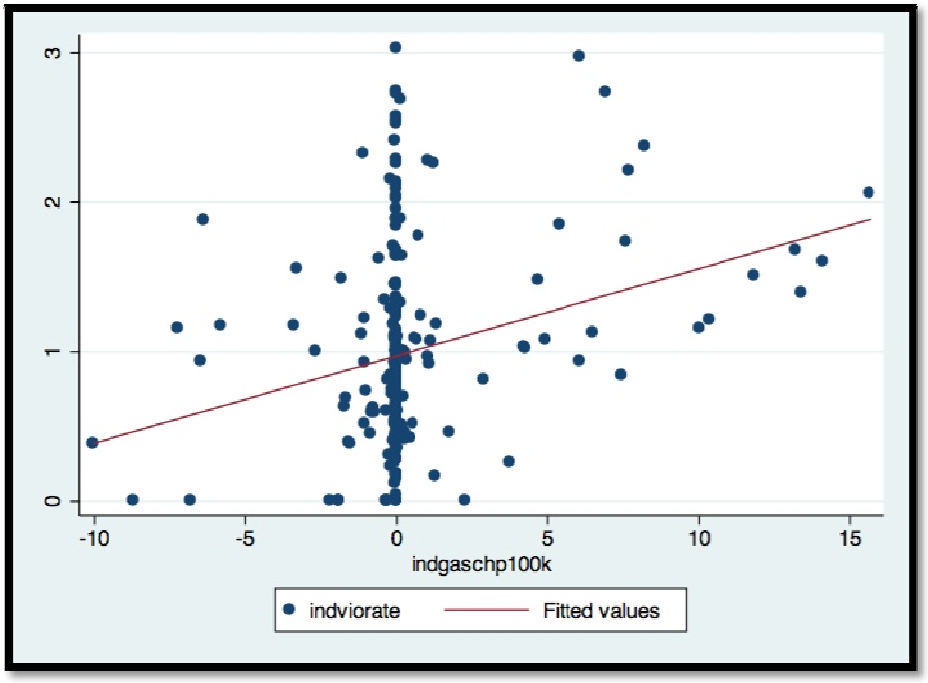


Figure 10-30. Wyoming Green River Basin Region, Index of Change in Gas Production and Index of Violent Crime Rates with Least Fit Squares Line

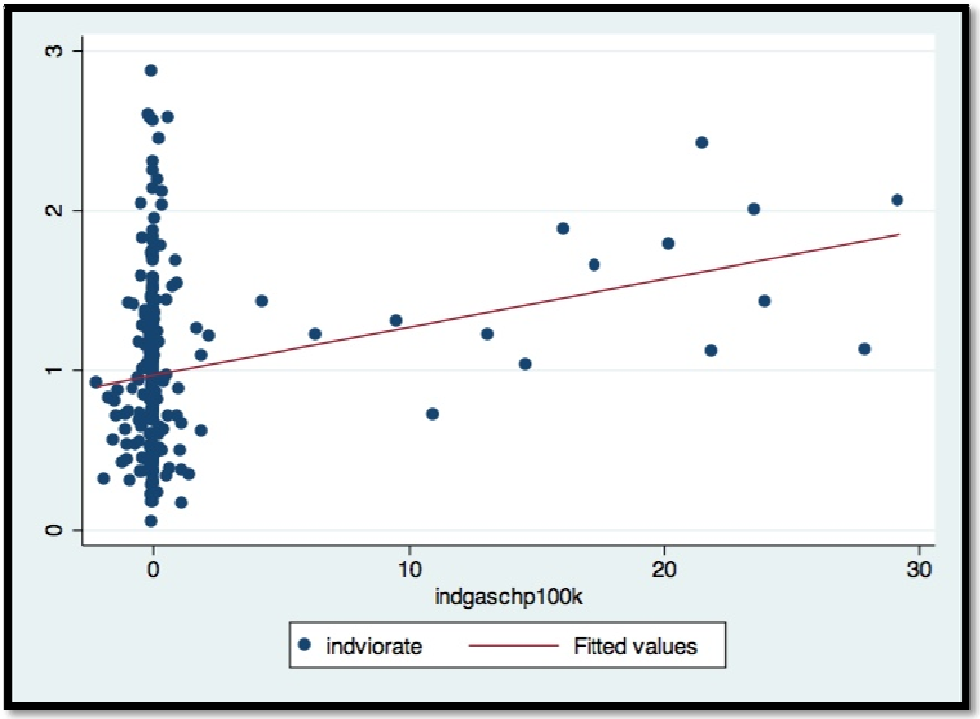
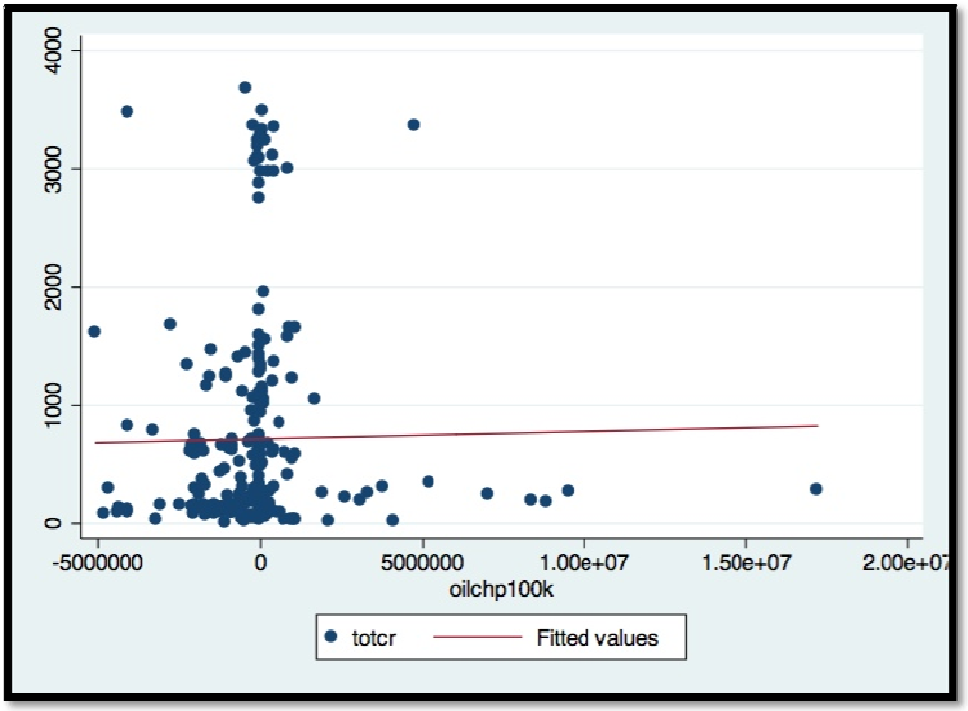


Figure 10-31. Wyoming Green River Basin Region, Index of Change in Oil Production and Index of Total Crime Rates with Least Fit Squares Line



E. Appendix E: STRONGER Report

North Carolina State Review

February, 2012

STRONGER
State Review of Oil & Natural Gas Environmental Regulations

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INTRODUCTION

In 1990, the Interstate Oil Compact Commission (IOCC) and the U.S. Environmental Protection Agency (USEPA) jointly published a Study of State Regulation of Oil and Gas Exploration and Production Waste, which contained guidelines for the regulation of oil and gas exploration and production wastes by the IOGCC member states (the "1990 Guidelines"). The published guidelines, developed by state, environmental and industry stakeholders, provided the basis for the State Review Process, a multi-stakeholder review of state exploration and production (E&P) waste management programs against the guidelines. The purposes of the State Review Process are to document the successes of states in regulating E&P wastes and to offer recommendations for program improvement. In 1994, the guidelines were updated and revised (the "1994 Guidelines") by the IOGCC, now named the Interstate Oil and Gas Compact Commission (IOGCC).

In 1999, administration of the State Review Process devolved to a non-profit, multi-stakeholder organization named State Review of Oil and Natural Gas Environmental Regulations, Inc. (STRONGER). STRONGER again revised, expanded and updated the Guidelines, which were accepted by the IOGCC and published in June 2000 as Guidelines for the Review of State Oil and Natural Gas Environmental Regulatory Programs (the "2000 Guidelines"). In 2005 and 2010, STRONGER again revised, expanded and updated the Guidelines (the "2005 Guidelines" and the "2010 Guidelines"). The 2010 Guidelines were used as the basis of this review.

USEPA and the U.S. Department of Energy have provided grant funding to STRONGER to support its activities. The American Petroleum Institute has also provided no-strings attached funding to support the state review process.

In January 2011, the North Carolina Department of Environment and Natural Resources (DENR) volunteered to have its environmental regulatory programs reviewed by STRONGER. In preparation for the review, DENR completed a questionnaire that had been prepared by the STRONGER Board. STRONGER intended the questionnaire to capture the status of the North Carolina program relative to the 2010 Guidelines. The NCDENR prepared a response to the questionnaire, which was sent to the review team.

In October 2011 through January 2012 an eight-person review team appointed by STRONGER conducted a review to evaluate the DENR programs compared to the 2010 Guidelines. The review team consisted of five members and three official observers. The five team members were: Leslie Savage, Railroad Commission of Texas; Don Garvin, Trout Unlimited; Mariel Escobar, independent North Carolina environmental advocate; Bob Sandilos, Chevron; and Chuck Price, BP. The official observer were: Bruce Moore, USEPA; Jim Collins, Independent Petroleum Association of America; and Hope Taylor, Clean Water for North Carolina. Will Morgan, representing the North Carolina Chapter of the Sierra Club, substituted for Ms. Taylor on one of the three days.

The review team conducted a meeting, the in-state portion of the review, in the conference facilities of the DENR in Raleigh, North Carolina on October 24 through 26,

2011. Ms. Robin Smith, Assistant Secretary for the Environment; Dr. Kenneth Taylor, Chief of the North Carolina Geological Survey; Mr. James Simons, State Geologist and Director of the Division of Land Resources; Mr. Evan Kane of the Division of Water Quality; Mr. William Willets of the Air Quality Division; Mr. Kenneth Pickle of the Division of Water Quality; Ms. Helen Cotton of the Hazardous Waste Program in the Division of Waste Management; Mr. Edward Mussler of the Division of Waste Management; and Mr. Thomas Reeder of the Division of Water Resources, all from NCDENR, and Mr. James Albright and Ms. Diana Sulas of the Radiation Protection Section of the North Carolina Department of Health and Human Services (DHHS) presented overviews of their respective program areas and responded to questions from the review team members and official observers. In addition to the North Carolina state employees who participated in the review and the review team, there were forty-eight attendees who observed at least a portion of the review. Following the meeting and after reviewing the written materials provided by the DENR and the DHHS, the review team members compiled this review report.

This is the report of the review of the North Carolina programs against the 2010 Guidelines of STRONGER. Appendix A is a glossary of acronyms used in the report. Appendix B contains North Carolina's written response to the STRONGER questionnaire.

EXECUTIVE SUMMARY

At the invitation of the North Carolina Department of Environment and Natural Resources (DENR), a multi-stakeholder review team has completed an in-depth review of the North Carolina environmental regulatory programs. The review compared the programs against the 2010 Guidelines for the Review of State Oil and Natural Gas Environmental Programs published by STRONGER. During the review of North Carolina's programs, the review team and official observers were granted full access to DENR staff, and all questions were answered in a responsive and open manner.

The review team has concluded that the DENR environmental programs are mature and the staff has significant experience in their various disciplines. However, while the review team recognized strengths in these programs, the review team also has concluded that DENR programs have not been developed in anticipation of the regulation of oil and gas exploration and production activities. Consequently, the findings in this report reflect the comparison of existing programs against the guidelines. The review team recommendations are given to guide the state in the event that it decides to develop an oil and gas regulatory program.

During the discussions with state officials and the review of documents supporting existing programs, the review team determined that several program areas deserve recognition. Those are summarized below.

Program Strengths

I. Mature Environmental Regulatory Programs

North Carolina has mature environmental regulatory programs staffed with experienced professionals. Consequently, North Carolina has experienced, knowledgeable staff and a sound regulatory foundation upon which to build, should the state decide to develop an oil and gas regulatory program.

II. Good Program Coordination

Most of the state's environmental regulatory programs, including the Division of Land Resources, are located in the Department of Environment and Natural Resources. With the exception of the Radiation Protection Section in the Department of Health and Human Services, programs likely to have a significant role in environmental regulation of oil and gas activities fall under the Assistant Secretary for the Environment in DENR. This organizational structure promotes the opportunity to coordinate programs and activities as evidenced during the in-state portion of the review.

III. No Abandoned or Orphan Wells

There have been 128 wells drilled in North Carolina. The first 126 were drilled between 1925 and 1997. Those wells were plugged according to the standards of the day. The two remaining wells, drilled in 1998, remain under permit and bond even though they are not in commercial production. The Division of Land Resources has files and location information on all of the wells.

Program Recommendations

The review team recognizes that North Carolina is evaluating the potential development of its oil and gas resources and is also evaluating changes that may be appropriate if that development were to occur. While this report makes no recommendations on whether or not such development should occur, the review team has made a number of recommendations for consideration **if** that development occurs. A summary of the more important recommendations follows.

I. Need to Develop Formal Standards

The review team found that there are few standards in place that would be applicable to an oil and gas regulatory program. When asked what standards would apply if an operator wanted to drill a well today, the review team was told that existing statutes and rules would be applied on a case-by-case basis.

The review team recognizes that, while this course of action might be workable when only a few permit applications are anticipated, it would not work well if the permit load increased significantly. Additionally, the potential operator and the public, as well as state agency staff, should know with some certainty what the regulatory expectations are before entering the permitting process. Consequently, the review team recommends that, if North Carolina develops an oil and gas regulatory program, formal standards and technical criteria meeting the Guidelines be developed.

II. Potential Need to Develop Oil and Gas Technical Criteria

While North Carolina has mature environmental regulatory programs, the programs have not needed to focus on regulating the impacts of oil and gas development. That may change depending on decisions made by the state. If North Carolina decides to develop an oil and gas regulatory program, that program should contain criteria to address oil and gas related activities, including administrative criteria, technical criteria related to exploration and production waste management, stormwater management, abandoned sites, naturally occurring radioactive materials, and hydraulic fracturing. The

review team recommends that, should such a program be developed, the Guidelines be used, along with a review of programs of other states.

III. Potential Use of Stakeholder Groups in Program Development

The Department of Environment and Natural Resources generally involves stakeholder groups early in discussions of proposed rules that involve major policy changes or are the subject of significant public interest.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the Department of Environment and Natural Resources continue to use independent scientific advisory groups, local advisory committees, groups of government, public and industry representatives, or other similar mechanisms, to obtain input and feedback in the development of the program.

PROGRAM OVERVIEW

Oil and gas production does not occur in North Carolina at this time. However, between 1925 and 1997, 126 oil and gas wells were drilled in the state. None of the wells produced commercial quantities of oil and gas, and all were plugged according to the standards of the day.

More recently, exploration in Lee and Chatham counties in central North Carolina has given rise to the anticipation of potential shale gas production from the Dan River and Deep River basins. Two exploration wells drilled in 1998 remain under permit and bond, but are not in production. Four companies have leased more than 9,000 acres in the Lee County area. A report by the U.S. Geological Survey assessing the shale formations in the Deep River and Dan River Basins is expected to be released in 2012.

I. GENERAL CRITERIA

The Department of Environment and Natural Resources (DENR) is the agency with primary responsibility for the regulation of oil and gas exploration and production in North Carolina. Within the Department, the Division of Land Resources (DLR) has lead responsibility for the evaluation and exploration of natural gas resources. Other programs, including the Divisions of Water Quality (DWQ), Waste Management (DWM), Air Quality (DAQ), and Water Resources (DWR), share portions of this responsibility for activities that fall within their jurisdictions. These divisions are all under the supervision of the Assistant Secretary for Environment.

Statutory Authority

Oil and gas activities regulated by DENR are conducted under the authority of the Well Construction Act (DWQ), the Oil and Gas Conservation Act (DLR), the Water and Air Resources Act (DAQ, DWR, DWQ), the Air Pollution Control Act (DAQ), the Oil Pollution and Hazardous Substances Control Act (DWM), and the Solid Waste Act (DWM). All of these statutes provide authority to promulgate rules and regulations.

The DLR has the authority to approve, deny, or revoke oil and gas permits. DAQ, DWQ and DWM have similar authority for permits issued under their jurisdictions. All of these programs have authority to assess civil penalties and to seek injunctions against violators. The Division of Waste Management also has the authority to issue administrative orders for compliance. In the case of particularly egregious violations, the divisions may also pursue a criminal enforcement action through the district attorney of the county where the violation occurred.

The Radiation Protection Section in the Division of Health Service Regulation within the Department of Health and Human Services has limited responsibilities relating to oil and gas. Its activities are conducted under the authority of the Radiation Protection Act.

The Oil and Gas Conservation Act (G.S. 113, Article 27) authorizes DENR to process applications to drill, regulate related activities, assess fees, protect landowners, prevent waste, limit production and regulate well construction, abandonment and plugging. The Act also provides authority to penalize operators who do not comply with the regulations. A rule adopted pursuant to the Oil and Gas Conservation Act, 15A NCAC 05D.0107, DRILLING AND COMPLETION, specifies that no well should be constructed that has a vertical variance greater than three degrees from top to bottom.

The Well Construction Act (G.S. 87, Article 7) provides for the regulation of well construction. Oil and gas operators seeking a permit to drill a well must obtain DWQ approval based on a case-by-case assessment of the well construction plan before a drilling permit will be issued by DLR.

The Division of Water Resources regulations require registration of water withdrawals of more than 100,000 gallons of water per day under the Water and Air Resources Act (N.C.G.S. 1`43, Article 21). The Water and Air Resources Act also provides statutory authority to regulate storm water. In addition, the Water and Air Resources Act prohibits the disposal of water in wells. Rules adopted pursuant to the statute prohibit the initiation and propagation of fractures by injection. DENR currently interprets these statutes and rules to prohibit underground waste disposal and hydraulic fracturing.

North Carolina has received primary enforcement responsibility under the federal Resources Conservation and Recovery Act, Clean Air Act, Clean Water Act and Safe Drinking Water Act (including the Underground Injection Control program). Many environmental standards in North Carolina are equivalent to those set by the USEPA.

Rules and Regulations

In North Carolina, most environmental rules are adopted by citizen boards and commissions. The Environmental Management Commission (EMC), which acts independently, but is organized under DENR, has authority and responsibility to promulgate rules safeguarding water and air resources of the state. EMC members represent all regions of North Carolina; appointments to the 19-member Commission are divided among the Governor, the Senate President Pro-Tempore, and the Speaker of the House. The Commission for Public Health (organized under the Department of Health and Human Resources) has responsibility for rules related to solid and hazardous waste.

A standing Scientific Advisory Board (SAB), whose members are appointed by the Secretary of DENR, advises the EMC in determining concentrations of acceptable ambient levels (AAL) of toxic air emissions within the state. AAL evaluations are made on a chemical-by-chemical basis, and are used by the DAQ and EMC in developing related rules.

The North Carolina Administrative Procedures Act (APA) recognizes three classes of rules. Emergency rules can be adopted without public notification or comment, but may only be adopted in response to "…public health and safety…" emergencies. Temporary rules and permanent rules require public notice, public hearings, and a 30-day period for comment. Once adopted, the Rules Review Commission (RRC) reviews the rule for clarity, necessity, statutory authority and compliance with APA rulemaking procedures. As part of the RRC process, the APA allows members of the public to submit letters of objection to a rule. If ten (10) or more people file objection letters with the RRC, the rule cannot go into effect until the legislature has had a chance to review the rule. The legislature can disapprove the rule, enact legislation that has the effect of changing some or all of the policy decisions set out in the rule, or allow the rule to go into effect. The APA sets specific timelines for legislative action; if the legislature fails to take action within the time allowed, the rule goes into effect as originally adopted. The APA has recently been amended to place additional restrictions on adoption of environmental rules that are more stringent than federal standards.

The Governor has authority to create Executive Orders; an Executive Order cannot override a statute. Under the APA, the Governor may use an Executive Order to put a rule into effect immediately – even though 10 people have objected to the rule – if the Governor finds it to be in the public interest. This kind of Executive Order allows an new rule to go into effect and remain in effect until the legislature disapproves the rule or until the rule would normally go into effect based on the legislature's failure to act.

Funding and Staffing

As there is no active oil and gas production activity in the state, the DENR currently has no full-time staff members working on oil and natural gas permitting and regulation. In recent years, budget cuts have reduced the number of field inspectors in the Division of Land Resources. The water, air, and waste programs have also lost staff positions due to the economic downturn and resulting loss of tax revenue.

DENR has divided the state into seven regions, with division field staff assigned to the various regional offices. Regional inspectors have authority to assess fines and penalties and initiate penalties for erosion and sedimentation permit violations. DENR programs assign regional office staff based on the nature and volume of each county's potential shale gas resources. These offices have not been staffed to handle an additional workload associated with natural gas exploration and development.

House Bill (HB) 242, Session Law 2011-276 mandates among other things that DENR, in conjunction with the North Carolina Department of Consumer Protection Section of the State Attorney General's Office, study potential oil and gas exploration and development in North Carolina. The bill specifically directs the Department to study the use of horizontal drilling and hydraulic fracturing for natural gas development and the potential impacts of these activities. The DENR is gathering information and public input. A report containing the DENR's findings and recommendations is due to the legislature by May 1, 2012.

Finding I.1.

North Carolina has mature environmental protection and regulatory programs staffed with experienced professionals.

Finding I.2.

All DENR Divisions with current jurisdiction over oil and gas E&P activities are under the supervision of the Assistant Secretary for Environmental Protection. This promotes cooperation and coordination between the programs.

Finding I.3.

Air toxics regulated by North Carolina include benzene as well as hydrogen sulfide and other potential constituents of air emissions from oil and gas operations. Air quality standards go beyond those promulgated by the USEPA.

II. ADMINISTRATIVE CRITERIA

Basic Requirements

DENR has been delegated primary enforcement authority for various federal programs, including the federal Clean Air Act, the Resource Conservation and Recovery Act (Solid Waste), the Clean Water Act (for National Pollutant Discharge Elimination System Permits), and the Safe Drinking Water Act (Underground Injection Control Program for injection wells in Classes I-V). The state has basically adopted and enforces the federal regulations, although there are some state-specific programs and requirements. Although a number of these requirements may affect oil and gas activity, very few are specific to these activities. These programs include provisions for permitting, compliance evaluation, and enforcement.

Permitting

For oil and gas permits, the applicant must register, provide a bond, and apply for a drilling permit. An application for permit to drill an oil or gas well triggers a series of other permits, which must be obtained prior to the issuance of a drilling permit. The applicant is required to submit a site plan describing where the drilling is proposed, the proposed depth of the well, the casing and cementing specifications, and the plan for on-site storage of water, wastewater and mud in pits and/or tanks. When the Division of Land Resources receives the drilling permit application, the information is shared with other DENR divisions to identify other issues that must be addressed. The drilling permit is the master permit; an applicant must obtain other state approvals, including a well construction permit, before a drilling permit can be issued. In addition, a sedimentation and erosion control plan is required if more than one acre of land is disturbed (including any access road to the site). The plan must include measures for controlling sediment during land-clearing, grading and construction, and a plan for restoring the site after land-disturbing activity has been completed. Air quality permitting may be required for some oil and gas operations.

The DENR includes conditions in the drilling permit to address site location, endangered or threatened wildlife species, off-site runoff, waste management, inspections and notification. The DENR has the ability to include any conditions it deems necessary within its authority.

The DENR has regulatory mechanisms to assure that wastes are managed in an environmentally responsible manner, however, the programs are not specific to E&P operations. State law defines “solid waste” to include both hazardous and non-hazardous waste, but the definition excludes oils and other liquid hydrocarbons. The definition of solid waste includes the non-oil components of E&P such as the drilling muds and cuttings. Solid wastes that are not RCRA hazardous wastes may go into an industrial landfill that is designed and constructed for that particular waste or may go to a municipal solid waste (MSW) landfill. North Carolina has strong standards for design and

construction of industrial and MSW landfills, but those standards were not developed to address disposal of RCRA hazardous waste. E&P wastes include some wastes that have the characteristics of RCRA hazardous waste, but are not regulated under RCRA because of the RCRA exclusion for E&P wastes. North Carolina does not specifically address disposal of those types of waste.

Without statute or rule changes, all E&P wastes (other than oils and liquid hydrocarbons) that are not classified as RCRA hazardous waste could legally go to a MSW landfill. The landfill operator can exclude wastes otherwise allowed for disposal, however. Wastes that are difficult to handle or that would pose an unusual risk may be turned away.

DENR programs include issuance of individual permits, generally on a case-by-case basis, and registration of operators and facilities. The DENR has the authority to refuse to issue or reissue permits or authorizations. Authority to consider the applicant's outstanding violations, unpaid penalties and past compliance history as factors in permitting varies somewhat among the different DENR regulatory programs. The DENR requires that the applicant comply with federal, local, or other state permits or regulatory requirements.

If DENR refuses to issue or reissue a permit or authorization, state law allows the applicant to appeal the decision by filing a petition for an administrative hearing under General Statute 150B-23, which is part of the state's Administrative Procedures Act. The time allowed for filing the petition may vary, however, from program to program. N.C.G.S. 150B-23 establishes a basic 60-day period (after receipt of the agency decision), but recognizes that other statutes may set different time periods for individual regulatory programs. The Oil and Gas Act allows only 10 days to appeal a decision or order issued under that Act. For water and air quality permits, a petition must be filed within 30 days after the applicant receives the decision.

The DENR issues individual permits for specific facilities or operations for fixed terms, generally five or less years, but in some instances eight years. The DENR programs and processing procedures ensure that, where similar requirements are mandated by two or more regulatory programs, those requirements are combined where feasible.

The DENR has an Environmental Permit Assistance program, whose stated purpose is to provide technical assistance and guidance through regulatory, permitting and compliance processes and to reduce overall environmental impacts. The center has staff representatives across the state and serves as a single point of contact for its customers and a liaison between the customer and the regulatory agencies.

Finding II.1.

The Review Team commends the DENR for its Environmental Permit Assistance Program.

Finding II.2.

The DLR has handled the very small number of oil and gas permits previously issued in the state on a case-by-case basis and coordinated review of those permit applications with other DENR divisions, as necessary. Handling of permit applications in such a manner allows the agencies to consider all aspects of an application and tailor the permit conditions. Such processing is admirable for the management of a small number of facilities.

Recommendation II.2.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR adopt more detailed standards and criteria for the potentially large number of permit applications that might be expected during periods of high oil and gas activity to ensure consistency and efficient permit application processing and to provide the regulated industry and the public with an understanding of the standards and criteria that will be used by the agency in reviewing and processing applications. (2010 STRONGER Guidelines, Section 4.1.1. and Section 5.)

Compliance Evaluation

The DENR programs have the authority to carry out inspections and investigations, enter property, examine records, and collect evidence. The DENR has the capability to conduct comprehensive investigations of facilities and activities subject to regulation in order to identify a failure to comply with program requirements by responsible persons.

The DENR has the authority to conduct regular inspections of regulated facilities and activities at a frequency that is commensurate with the risk to the environment that is presented by each facility or activity.

The DENR has the authority and procedures to investigate information obtained from inspections or complaints regarding violations of applicable program and permit requirements. Inspections are prioritized based on risk and may be unannounced. DENR staff has the authority to enter locations where records are kept during reasonable hours for purposes of copying and inspecting the records.

Generally, each DENR regulatory program coordinates the preparation and filing of formal enforcement actions through its headquarters office. Appeals of civil penalty assessments are handled by the Office of Administrative Hearings.

Finding II.3.

Recent state budget issues have impacted the DENR's ability to perform inspections in certain program areas.

Recommendation II.3.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the state provide the DENR with funding adequate to effectively and efficiently perform compliance evaluation of oil and gas activities for the protection of human health and the environment. (2010 STRONGER Guidelines, Section 4.1.2.)

Enforcement

The DENR has enforcement tools, including the authority to issue a notice of violation with a compliance schedule; issue cease and desist orders; revoke, modify, and suspend permits; assess administrative penalties; cause forfeiture of financial assurance instruments; and obtain injunctions. In addition, the DENR has the authority to identify emergency conditions that pose an imminent and substantial human health or environmental hazard that would warrant entry and immediate corrective action by the DENR after reasonable efforts to notify the operator have failed, and to seek reimbursement of the state's costs. State statutes provide the DENR with enforcement authority in the form of civil and criminal penalties, and injunctive relief.

Maximum penalty amounts are set in state statute. N.C. General Statute 113-410 sets penalties for violations of the Oil and Gas Conservation Act. Other DENR regulatory programs (such as water quality, air quality, and solid waste) have similar statutory provisions setting the maximum penalty for an individual violation of those requirements. The statutes also authorize the assessment of daily penalties for continuing violations. Most DENR divisions use a penalty tree to calculate civil penalties for violations of the statutes and rules; however, DENR staff could not remember ever having assessed the maximum penalty for a violation. In assessing penalties, the DENR considers statutory factors including economic benefit resulting from the violation, willfulness, harm to the environment and the public, harm to the ecosystem, and expenses incurred by the state in response and cleanup. N.C.G.S. 143B-282.1 specifically allows consideration of the responsible party's compliance history in determining the amount of a penalty for an air quality or water quality violation. The Oil and Gas Conservation Act does not identify factors to be considered in setting the amount of a penalty for violations of its requirements and simply sets the maximum daily penalty for a single violation at $1,000.

North Carolina's statutes afford the opportunity to appeal or seek administrative and/or judicial review of agency action.

Finding II.4.

The DENR has the necessary enforcement authority consistent with 4.1.3. of the Guidelines.

Recommendation II.4.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR evaluate their enforcement options and policies to assure that the full range of actions available are effectively used to provide compliance incentives for oil and gas activities and adequate to act as a disincentive to non-compliance. (2010 STRONGER Guidelines, Section 4.1.3.)

Contingency Planning and Spill Risk Management

North Carolina has an integrated Emergency Management Program (EMP). State regulations incorporate by reference 40 CFR 264, which is intended for treatment, storage, and disposal of hazardous waste by injection under the federal Resource Conservation and Control Act (RCRA) but serves as the comprehensive template for statewide contingency plan requirements. The State Emergency Operations Plan (SEOP), which lists the hazardous materials plan, includes the response to hazardous materials, suspected hazardous materials and unknowns. North Carolina has a well-defined SEOP and coordinates effectively with USEPA Region IV through the Raleigh office, and through joint action as described below.

The North Carolina EMP is funded by general revenue, which also is available to meet competing s tate government needs. North Carolina calls upon the USEPA Emergency Response Program to mobilize federal contractors to assist in the response to and remediation of spills as part of the National Contingency Plan, but Federal Emergency Management Agency (FEMA), hazardous materials (HAZMAT), and other federal emergency response funding also is being reduced.

Finding II.5.

The North Carolina State Contingency Plan does not contain criteria for spill response or responsibilities specific to E&P.

Recommendation II.5.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, North Carolina develop E&P-specific contingency plan response criteria and responsibilities. (2010 STRONGER Guidelines, Section 4.2.1.1.)

Finding II.6.

North Carolina does not receive any funding for state contingency or spill response program activities from the oil and gas industry.

Recommendation II.6.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, North Carolina consider development of a plan and incentive for E&P operators to directly fund any critical shortfalls in local direct emergency response and spill prevention capability. (2010 STRONGER Guidelines, Section 4.2.1.1.)

Finding II.7.

The DENR has reduced staff recently due to budget reductions.

Recommendation II.7.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, maintaining staff at a level to provide effective and E&P-specific SEOP capability should be a top priority. (2010 STRONGER Guidelines, Section 4.2.1.1.)

Personnel at the State Emergency Operations Center receive reports related to emergencies. The center is staffed 24 hours a day, 7 days a week. Their telephone number is 1-800-858-0368. In addition, operators or members of the public can contact local emergency services by dialing 911 or by calling the National Response Center. The state maintains seven regional HAZMAT teams.

Finding II.8.

The state maintains effective reporting capability.

Finding II.9.

The state maintains effective interagency coordination within the DENR Divisions. Interagency coordination is described in the state EOP and represents effective integration of USEPA and local LEPC roles and capabilities. The DENR Divisions communicate effectively with each other and with NC DPS on emergency response issues, but roles and responsibilities are diversified.

Recommendation II.9.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR, DPS and affected local LEPC/ first responders should develop a Memorandum of Understanding (MOU) concerning E&P activities. The review team further recommends that the state post the EOC Call Center responsibilities for E&P activities online for operators new to the state. (2010 STRONGER Guidelines, Section 4.2.1.3.)

Finding II.10.

Although a site-specific contingency plan may be required as a binding condition of the permit to drill, E&P-specific requirements do not exist.

Recommendation II.10.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the state should adopt and communicate spill prevention and response guidance for E&P operators consistent with API and other industry best practices and standards. The review team further recommends that the state provide for any necessary specialized training and equipment resources consistent with activity and risks associated with oil and gas E&P operations. (2010 STRONGER Guidelines, Section 4.2.1.4.)

Finding II.11.

The state maintains a one-call response center as discussed above. Response measures may be specified as permit conditions, but the state has no adopted minimum E&P-specific prevention measures. The EPA Region IV office in Raleigh maintains responsibility for enforcing the SPCC program, and is a resource on measures specific to upstream oil spill prevention.

Recommendation II.11.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the state develop and adopt guidance relating to planning for and meeting state spill prevention permit conditions. (2010 STRONGER Guidelines, Section 4.2.1.4.2.)

Finding II.12.

State Groundwater Classifications and Standards include general response requirements for corrective action, but these requirements apply only to spills "where groundwater quality has been degraded" and addresses spills to soil only in the context of hazardous waste requirements.

Recommendation II.12.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the state develop and communicate operator corrective action guidance specific to spills of RCRA Subtitle C-exempt E&P wastes, consistent with regulations and risk-based best practices. (2010 STRONGER Guidelines, Section 4.2.1.4.3.)

Finding II.13.

The state EOP outlines reporting, monitoring, and approvals, which are also addressed in regulations. The regulations apply only to spills "where groundwater quality has been degraded" and addresses spills to soil only in the context of hazardous waste requirements.

Recommendation II.13.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the state develop and communicate reporting, monitoring and approval guidance specific to spills of RCRA-exempt E&P wastes. The review team further recommends that the DLR and DWM determine primary responsibilities for E&P spill prevention and response and provide on-line access to spill prevention and response information. The review team further recommends that the state develop and make available to industry an incident review process for determining causation and future prevention measures suitable for E&P operations. (2010 STRONGER Guidelines, Section 4.2.1.4.3.)

Finding II.14.

The state EOP, which outlines general enforcement, damage assessment, responsible party, and reimbursement requirements applicable to E&P operations, meets the guidelines for follow-up action.

Finding II.15.

The state EOP outlines reporting and database requirements; however, the review team could not determine whether the plan includes a provision for periodic analysis of spills and releases, or if this will occur on an as-needed basis.

Public Participation

The DENR requires public notice for some activities for which it requires a permit. Public notice is not the same for all activities, but is determined by the magnitude of the proposed activity and the public interest in the proposed activity. However, notice requirements are not specific to oil and gas permitting.

The state's rulemaking process can take two or more years. Although the state's administrative procedures allow for emergency rulemaking when required by a "serious and unforeseen threat to the public health or safety," the statutes do not provide for emergency rulemaking to address a threat to public welfare.

In addition, DENR staff generally involves stakeholder groups early in discussions of rulemaking activities that involve major changes and/or are the subject of great public interest.

Finding II.16.

The DENR uses stakeholder groups early in the rulemaking process to help it formulate draft rules.

Recommendation II.16.

The Review Team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR establish public notice requirements for oil and gas activities and permits because notification to the public and landowners is critical to assuring accountability. (2010 STRONGER Guidelines, Section 4.2.2.1.)

General Statute Chapter 132 defines public records and establishes the requirements for their availability to the public. All public records are available for review at the DENR offices.

Finding II.17.

The DENR meets Section 4.2.2.1. of the Guidelines with respect to public records.

The DENR has outreach programs to educate the regulated industry and the public about its air, hazardous waste, and stormwater programs.

The DENR held a public meeting (which was also webcast) on the shale gas study mandated by Session Law 2011-242 in early October of this year in the area of potential interest (Sanford, N.C.). The purpose of the public meeting was to receive public comments on the draft outline for the study. The Department also accepted written comments. The DENR plans at least one more public meeting in the spring to gather input on the initial draft of the study report.

Finding II.18.

None of the DENR's public education and outreach programs relate to oil and gas activities.

Recommendation II.18.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR develop education and outreach programs for operators and the public for oil and gas activities. (2010 STRONGER Guidelines, Section 4.2.2.2.)

The DENR uses an independent Science Advisory Committee to aid it in determining program requirements. In addition, the DENR uses stakeholder groups early in the rulemaking process.

Furthermore, a small group of legal, scientific and technical experts will be asked to serve as advisors on the shale gas study mandated by Session Law 2011-276 (House Bill 242). This group will include people with expertise in local government law, environmental law and policy, energy development, hydrology, geology, and economic development. Advisors also will include representatives from the Department of Commerce, the Consumer Protection Division of the North Carolina Attorney General's Office, and the Rural Advancement Foundation International.

Finding II.19.

The review team commends the DENR for using advisory groups, particularly the independent Science Advisory Committee and the advisors with specific expertise related to the shale gas study.

Recommendation II.19.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR continue to use advisory groups of industry, government, and public representatives, or other similar mechanisms, to obtain input and feedback in the development of and the state programs for the management of E&P wastes. (2010 STRONGER Guidelines, Section 4.2.2.3.)

Program Planning and Evaluation

The DENR performs strategic planning periodically to identify issues and define goals and objectives, set priorities, and evaluate the clarity, efficiency, and effectiveness of its programs.

The 2009-2013 strategic plan states the DENR's mission and values and its goals for DENR programs over the coming years. The DENR's primary mission is to "conserve and protect North Carolina's natural resources and to maintain an environment of high quality by providing valuable services that consistently support and benefit the health and economic well-being of all citizens of our state". The plan includes actions such as "Improve the state's response to groundwater contamination incidents through improved coordination among state agencies and local governments, stronger enforcement policies, and increased public education." The latest strategic plan states that the DENR should "continue and support the evaluation and exploration of natural gas resources in the state."

Finding II.20.

The review team commends the DENR for including discussion of natural gas development in its latest strategic plan.

Recommendation II.20.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR include oil and gas activities in its strategic planning. (2010 STRONGER Guidelines, Section 4.2.3.1.)

Finding II.21.

The DENR publishes a "State of the Environment" report every 2 years. The latest report (2011) includes discussion of the issues the DENR faces, including the emerging issue of potential shale gas exploration and development, and outlines the DENR's plans to address those issues.

Recommendation II.21.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR obtain an environmental baseline and develop a process for continually evaluating how well the oil and gas program protects human health and the environment. (2010 STRONGER Guidelines, Section 4.2.3.2.)

Financial Assurance

Prior to drilling an exploratory well for oil or gas, current statutes require an operator to secure up-front financial assurance in the form of a bond in the amount of $5,000 plus $1 per foot of depth to ensure that wells are properly plugged. However, there are no statutory or regulatory requirements for financial assurance for other activities, such as land application of waste, site reclamation and closure, or remediation of environmental damage (such as soil or groundwater contamination). Since the bond amount is set by statute, the DENR does not have authority to expand bonding requirements or update bond amounts without additional legislative action.

Finding II.22.

The DENR does not have specific statutory or regulatory requirements relating to financial assurance for oil and gas activities other than bonding to ensure the proper plugging of an oil or gas well. Existing statutory authority would not allow the DENR to require a bond sufficient to cover site reclamation and closure or remediation of contamination.

Recommendation II.22.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the state give the DENR the authority to require additional financial assurance for site remediation, closure and remediation, to determine the form of the financial assurance, to set the amount of the financial assurance based on potential risk, and to access financial assurance when an operator fails to meet its obligations covered by the financial assurance instrument. (2010 STRONGER Guidelines, Section 4.2.4.)

Recommendation II.23.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR periodically review the amount of required financial assurance to determine if the amount is adequate to provide incentive for proper plugging of a well and reclamation of a site, and to assure proper management of E&P wastes. (2010 STRONGER Guidelines, Section 4.2.4.)

Waste Hauler Certification

Finding II.24.

The DENR does not require certification or permitting of waste haulers or registration of vehicles. Solid waste regulations require manifesting of wastes consistent with federal requirements. Manifests must be available on site.

Recommendation II.24.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR consider a certification program that requires training of oil and gas waste haulers and registration of all vehicles involved in the commercial hauling of oil and gas wastes. (2010 STRONGER Guidelines, Section 4.2.5.)

Location of Closed Disposal Sites

State statute requires notice of inactive hazardous substance or waste disposal sites. DENR maintains records of all closed disposal sites for programs under its jurisdiction. Land disposal of solid wastes must be recorded on the deed.

Finding II.25.

The Review Team finds that the DENR meets Section 4.2.6. of the guidelines.

Data Management

The DLR- N.C. Geological Survey maintains copies of all permits/reports for all oil and gas wells. These records are available for public review. Staff located and provided the Review Team the records of the two wells drilled in 1998.

The DENR's Division of Water Quality also maintains a Well Construction Database for water wells. The DENR regulations require that water well drillers submit a well construction record for every well they drill. The records include information on the driller and well owner, well location, well construction characteristics, and the driller's log. Drillers submit this information on paper and DWQ staff enters the information into the database. Most of this information is subject to public disclosure upon request, but none is posted on the Internet or made available without a request.

In addition, the DWQ maintains and uses the Basin-wide Information Management System to track data on permits and compliance for the NPDES wastewater and storm water, non-discharge wastewater, UIC (Class V), and well permitting programs. Nearly all data is submitted to the DWQ on paper and entered manually into the database, with the exception of a pilot project to provide electronic submissions for some major NPDES permits. All information is public record. The DWQ makes limited permit information available on its website.

The Division of Waste Management (DWM) maintains publicly available databases related to underground storage tanks, land application sites and active and closed permitted landfills

The Division of Air Quality (DAQ) maintains publicly available databases related to air quality permits.

Finding II.26.

The DENR has no computer data management capabilities with respect to oil and gas activities.

Recommendation II.26.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR consider developing an on-line permitting and reporting data management system to efficiently track oil and gas activities. (2010 STRONGER Guidelines, Section 4.2.7.)

Personnel and Funding

The DENR has well-qualified employees dedicated to the goals and objectives of its programs. Staff includes administrative personnel, field inspectors, geologists, engineers,

toxicologists, and health science specialists. As currently organized, responsibilities with respect to regulation of oil and gas activities are carried out through a coordinated review process involving program staff in multiple divisions.

The DENR has several regional offices that support headquarters. Inspectors for the various programs are assigned to areas based on the locations of the permitted facilities.

Currently there are no staff dedicated to E&P environmental regulatory program implementation; duties are distributed among existing staff in multiple divisions. A UIC grant from the EPA provides funding for one position in the DWQ. However, this position is not dedicated to E&P program implementation and North Carolina currently does not allow Class II wells.

Legal needs are filled by the DENR General Counsel and the North Carolina Attorney General's office. The State Office of Administrative Hearings provides hearing officers for appeals of permitting and enforcement decisions.

Technical personnel are capable of mapping hydrologically sensitive areas and areas containing treatable water, and provide guidance in waste handling.

Field personnel are responsible for conducting routine inspections of regulated facilities and activities to assure compliance with program requirements. In addition, field personnel are among the state agency's on-site representatives to witness critical regulated activities and to observe or supervise clean-up or remedial actions. Field personnel also are involved in the assembly of evidence for enforcement actions and in the state agency's community relations.

Finding II.27.

The review team found DENR staff directly involved in the review to be aware of and knowledgeable about issues related to shale gas development. These staff members are educating themselves on the issues, but represent a very small number of total DENR staff. The department lacks practical experience related to management of shale gas exploration and development activities.

Recommendation II.27.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR staff of the appropriate Divisions visit shale gas drilling and production sites in neighboring states to gain familiarity with E&P practices.

While DLR's Erosion & Sedimentation Control has a concerted training program, other training of DENR staff is generally performed on-the-job.

Finding II.28.

DENR does not have training competency requirements.

Recommendation II.28.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR provide for staff training regarding the regulations, policies, and criteria applicable to E&P waste management. (2010 STRONGER Guidelines, Section 4.3.1.5.)

The DENR programs currently are funded through appropriations, permit fees, and federal grants. The state statutes provide for severance taxes, which is dedicated to the implementation of the oil and gas conservation laws. However, the amount was set in 1945 and is one tenth of one cent per thousand cubic feet of natural gas. Penalties that the DENR collects are deposited in the Civil Penalty and Forfeiture Fund. Monies in the fund are distributed to the local school systems and cannot be used for operation of environmental programs.

Finding II.29.

Recent state budget issues have resulted in decreased funding for the DENR. Budget reductions have affected all of the regulatory programs with potential responsibilities for E&P activities. For example, the DLR had a decrease of 17 field staff across the division as a whole and the DWQ lost 30 positions.

Recommendation II.29.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the state provide the DENR with funding mechanisms that will provide funding adequate to create and maintain an effective E&P waste management program at a level sufficient to allow it to accomplish its environmental protection goals and objectives. Potential funding mechanisms include user fees and levies on production. The state may also want to consider dedication of fees and other revenue streams to special accounts. (2010 STRONGER Guidelines, Section 4.3.2.)

Coordination Among Agencies

The DENR has jurisdiction over oil and gas wells, impoundments, waste disposal, discharge, spill prevention and response, storm water, erosion and sediment control, and air. Radiation is regulated by the Department of Health and Human Services (DHHS). The DENR divisions coordinate their respective activities and coordinate with the DHHS Division of Health Service Regulation's Radiation Protection Section with respect to radiation issues.

Most of the regulatory programs in North Carolina are implemented under the DENR, with the exception of the Radiation Protection Section. Each division has its own administrative requirements relating to permitting, operational requirements, and financial assurance, and develops its own budget priorities. Each division has its own inspection and enforcement authorities. However, the various divisions within DENR have developed a high level of interagency coordination to avoid duplication of effort and conflicting standards for the regulated community and the public. The coordination also allows the various divisions to draw on expertise of other divisions as necessary. Where necessary, the divisions adopt memoranda of understanding. For example, the DWM and DWQ adopted a MOA in 2007 that specifies responsibilities of each division for managing contaminated sites.

In addition, the Interagency Leadership Team (ILT) is a group of agencies that coordinate to identify concerns and issues facing transportation, the environment, and the economy in North Carolina.

And, the DENR has permit coordinators who help industry determine up front what permits are necessary for a given project.

Finding II.30.

Most of the regulatory program is implemented under a single department. The Radiation Protection Section, if involved, is the only exception. The Review Team was encouraged by the good communication between all of the divisions of the DENR.

Finding II.31.

The DENR Divisions coordinate inspection activities wherever possible to avoid duplication of effort and to increase efficiencies.

Recommendation II.31.

The review team recommends that the DENR review existing agreements to ensure that they are current and effective and consider developing interagency mechanisms, such as formal meetings among the divisions, to facilitate the sharing of information among and between involved divisions with respect to E&P activities. (2010 STRONGER Guidelines, Section 4.4.)

III. TECHNICAL CRITERIA

General

North Carolina has extensive hazardous waste and solid waste management requirements but does not have specific technical criteria for E&P waste management, and does not have either a certification process for non-hazardous waste haulers or a formal waste tracking process for E&P exempt and non-hazardous solid wastes.

Currently, North Carolina law prohibits disposal of E&P wastes in solid waste landfills. Removal of that prohibition would require both legislative action and rule change. The state does not currently have siting or other technical criteria specific to E&P waste management facilities. Local zoning consistency determinations also may affect availability of future E&P waste management facilities.

The DENR has the authority to "regulate and, if necessary in its judgment for the protection of unique environmental values, to prohibit the location of wells in the interest of protecting the quality of the water, air, or any other environmental resource against injury, or damage, or impairment."

Setbacks and water table separation requirements in 15A NCAC 2T for land application of wastewater or wastewater treatment residuals may apply to land-spreading of E&P wastes. State rules also include setbacks and rock/water table separation requirements for landfills.

Various existing riparian and water table siting requirements may apply to E&P wastewater management or disposal facilities. Oil and gas drilling and completion regulation 15A NCAC 05D.0107 uses the term "fresh water" with respect to surface casing requirements, but the term is not defined in law or regulation for any purpose. North Carolina considers all groundwater to be "fresh water," but has two different groundwater classifications based on the salinity of the groundwater.

Finding III.1.

North Carolina does not have technical criteria specific to E&P waste management.

Recommendation III.1.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR develop and adopt E&P waste management standards and design specifications based on site-specific geology, hydrology, climate, and waste characteristics consistent with the Guidelines. (2010 STRONGER Guidelines, Section 5.1.)

Finding III.2.

North Carolina does not have a certification or formal waste tracking process for non-hazardous waste haulers, or siting or other technical criteria specific to E&P waste management facilities.

Recommendation III.2.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR develop and adopt E&P waste hauler certification and E&P waste tracking programs consistent with the Guidelines. (2010 STRONGER Guidelines, Section 5.1.) Existing land-farming facilities are most likely to initially receive E&P exempt wastes. The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR develop management and siting criteria specific to E&P activities prior to drilling permit issuance and initial waste generation. (2010 STRONGER Guidelines, Section 5.1.)

Finding III.3.

There are limited siting criteria concerning Deep River Basin sensitive areas, surface waters, and depth and quality of groundwater.

Recommendation III.3.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the state evaluate current requirements based on characterization of anticipated E&P wastes and operations, communicate guidance to operators for drilling and production program planning, and provide public notice of such siting requirements. The state should define "fresh water" for purposes of the Oil and Gas Act and ensure that the definition is consistent with the state's water quality classifications and standards. Groundwater with a naturally occurring concentration of chloride greater than 250 mg/l is GSA, or groundwater "for potable mineral water and conversion in fresh waters." Groundwater with less than 250 mg/l of naturally occurring chloride is class GA, fresh water intended for use as drinking water. State water quality standards include standards for chloride and for total dissolved solids (TDS) that are applicable to each classification. (2010 STRONGER Guidelines, Section 5.1.)

Waste Characterization

The DENR implements general solid waste management standards and definitions consistent with federal regulations, but focused on RCRA hazardous waste treatment, storage, and disposal. The DWQ regulations specify requirements for chemical, physical, or biological analyses to determine conformity with surface water quality standards (15 NCAC 2B.0103) and wastewater quality for land-applied wastewater. There are currently no authorized commercial E&P waste management facilities, although current

land-farming disposal sites may accept non-hazardous E&P wastes. Federal hazardous waste determination, treatment, disposal, and analytical requirements under 40 CFR 262 are adopted by reference.

Finding III.4.

North Carolina has not developed regulations specific to treatment, storage, and disposal facilities for E&P waste.

Recommendation III.4.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the appropriate rulemaking bodies should establish regulations specific to treatment, storage, and disposal facilities for RCRA-exempt and non-hazardous E&P wastes, including drilling fluids, cuttings and produced water. (2010 STRONGER Guidelines, Section 5.2.1.)

Finding III.5.

The DENR implements solid waste management characterization requirements consistent with federal regulations, surface water analytical requirements, and land-application criteria.

Recommendation III.5

Because existing waste characterization requirements focus on RCRA hazardous wastes and municipal solid waste, if North Carolina decides to develop an oil and gas regulatory program, the review team recommends that the state develop E&P exempt and non-hazardous solid waste characterization protocols, including for NORM. (2010 STRONGER Guidelines, Section 5.2.2.)

Finding III.6.

The state has adopted general solid waste management quality control provisions consistent with federal regulations.

Recommendation III.6.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR evaluate quality control requirements to ensure that they meet needs unique to E&P waste testing. (2010 STRONGER Guidelines, Section 5.2.3.)

Waste Management Hierarchy

The North Carolina General Statutes spell out a standard waste management hierarchy as the preferred method of waste management in the state, with source reduction first, followed by recycling and reuse, composting, incineration with energy recovery, incineration without energy recovery, and landfilling. However, there are no state statutes or policies that specifically promote source reduction and recycling for the oil and gas industry. The Division of Environmental Assistance and Outreach develops and maintains programs that provide technical assistance on the reduction and recycling of wastes and emissions, but has had little experience with oil and natural gas operations and resulting waste streams. Some generic waste streams possibly generated by oil and gas operations (e.g., waste oil, oil filters, and wooden pallets) are banned from solid waste disposal in North Carolina.

Finding III.7.

North Carolina statutes integrate the waste management hierarchy into other elements of the DENR programs for management of wastes.

Recommendation III.7.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR integrate the waste management hierarchy into any oil and gas programs consistent with 5.3. of the Guidelines.

Technical Criteria for Pits

Under North Carolina law, drilling of an oil or gas well cannot start until any associated pits have been installed to the satisfaction of the regulatory agency. The state has not developed any specific pit program requirements; the regulatory agencies determine requirements on a case-by-case basis.

Finding III.8.

The review team found that the state has no specific technical requirements in place for pits.

Recommendation III.8.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR develop a specific regulatory program that includes technical requirements for pits associated with E&P activities that meet the criteria of sections 5.51-5.55 of the Guidelines when oil and gas development begins. (2010 STRONGER Guidelines, Section 5.5.)

LANDSPREADING (Non-Commercial)

The DENR regulates land-spreading as soil remediation under 15A NCAC 2T.1500 or as a residual under 15A NCAC 2T.110. Approvals are required for each land-spreading event.

Finding III.9.

The review team found that there are no naturally occurring radioactive materials (NORM) action levels for land-spreading of E&P waste.

Recommendation III.9.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program and determines that oil and gas NORM waste is an issue, the state develop NORM action levels for land-spreading. (2010 STRONGER Guidelines, Section 5.6.1.c.)

Finding III.10.

The review team found that there are no specific land-spreading practices defined for E&P sites that address the operational requirements of section 5.6.3 of the guidelines.

Recommendation III.10.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR develop a more comprehensive land-spreading policy that meets the guidelines. (2010 STRONGER Guidelines, Section 5.6.)

Technical Criteria for Burial and Landfilling

The DENR permits solid waste landfills. However, current state law and DENR regulations prohibit the disposal of petroleum wastes in landfills. Road-spreading of E&P wastewaters would be subject to design criteria, use requirements, and requirements for operational plans for reclaimed water systems.

Finding III.11.

The state has no technical criteria for burial, landfill, or road-spreading specific to E&P wastes. State requirements and laws prohibit landfills from accepting any petroleum or E&P waste.

Recommendation III.11.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the state should develop and adopt technical requirements for burial, landfilling, and road-spreading specific to E&P wastes consistent with the 2010 STRONGER Guidelines. (2010 STRONGER Guidelines, Section 5.7.)

Technical Criteria for Tanks

The DENR would regulate the location and size of tanks at E&P sites through conditions in the master drilling permit. General tank requirements are determined as part of the master drilling permit application, on a case-by-case basis by the DLR in coordination with the DWM and DWQ. Related impoundment and other containment facility hazardous waste permit requirements are contained in 40 CFR 270.14, which has been adopted by reference, but there are currently no long-term hazardous waste disposal facilities in the state.

Finding III.12.

The state does not currently have E&P-specific tank requirements.

Recommendation III.12.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the state should adopt siting, safety, environmental, reporting and administrative requirements for operational oil and produced water tanks and for RCRA Subtitle C exempt E&P waste management consistent with the Guidelines. (2010 STRONGER Guidelines, Section 5.9.)

Finding III.13.

North Carolina does not have standards for spill prevention, preventive maintenance or inspections for tanks used for E&P.

Recommendation III.13.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR adopt E&P-specific oil and produced water tank spill prevention, preventive maintenance, and inspection best practice guidance or standards consistent with the Guidelines. (2010 STRONGER Guidelines, Section 5.9.)

Finding III.14.

The state does not have E&P-related tank construction and operating standards. Such standards are determined on a case-by-case basis by the DLR in coordination with the DWM and the DWQ.

Recommendation III.14.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR adopt E&P tank construction and operating standards, including measures for secondary containment and control of hydrogen sulfide (if appropriate) consistent with the Guidelines. (2010 STRONGER Guidelines, Section 5.9.)

Finding III.15.

The state program does not have E&P-related tank removal and closure requirements. E&P tank standards will be determined on a case-by-case basis by the DLR in coordination with the DWM and the DWQ.

Recommendation III.15.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR adopt E&P tank removal and site closure standards consistent with the Guidelines. (2010 STRONGER Guidelines, Section 5.9.)

IV. ABANDONED SITES

Between 1925 and 1997, 126 oil and gas wells were drilled in North Carolina, but none of the wells produced commercial quantities of oil and gas and they were plugged according to the standards of the day. In 1998, two exploratory wells were drilled in central North Carolina, but are not in production and remain under permit and bond.

The Oil and Gas Conservation Act requires that all wells be sealed completely from the bottom to the top. The DENR maintains records, locations and other miscellaneous well data for all wells completed.

The state also currently has funding mechanisms for plugging abandoned wells as bonding requirements are currently in place. The state requires a bond in the amount of $5,000 plus $1 per linear foot for any proposed wells to be drilled. The bonds cover only the proper plugging of the well. The last two wells drilled in 1998 still have open bonds to cover any damage.

The Oil & Gas Conservation Act (G.S. 113 Article 27) defines certain E&P terms, such as "oil and gas developer or operator," "developer or operator," "oil and gas operations," or "activities". However, neither the statutes nor the regulations include any definitions pertaining to abandoned sites.

North Carolina public records law requires agencies to maintain state records and make nearly all of those records available to the public. There are limited exceptions for trade secrets. Oil and gas files are maintained by the North Carolina Geological Survey and are filed by location in file cabinets at the North Carolina Geologic Survey Field Office and Core Repository.

When abandoning a well, a log of the drilling and development of each well is required by G.S. 113-379. G.S. 113-391 requires a reasonable bond condition for the performance of the duty to plug each dry or abandoned well. G.S. 113-395, as amended by S.L. 2011-276, requires notice that the well is to be abandoned and requires a $450 fee.

Finding IV.1.

The review team commends the DENR for its recordkeeping and file maintenance.

Finding IV.2.

The review team commends the DENR staff for its openness and transparency with regards to sharing records and for its strong collaborative effort.

Finding IV.3.

The review team found that the State of North Carolina currently has no abandoned oil and gas sites in the state.

Recommendation IV.3.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR consider defining terms associated with abandoned E&P sites. The review team further recommends that the state consider developing a process for prioritizing and ranking both the 126 existing plugged wells and wells permitted in the future based on potential risk. In addition, the state may want to consider cutting well casings to 3 ft. below plow depth in areas of agricultural use. (2010 STRONGER Guidelines, Section 6.3. and Section 6.5.)

V. NATURALLY OCCURING RADIOACTIVE MATERIAL

With little or no drilling activity in North Carolina in recent years, oilfield NORM has not been an issue at the DENR.

However, in 2011 the North Carolina General Assembly passed Session Law 2011-276 (House Bill 242), which directs the DENR to study the issue of oil and gas exploration in the state, specifically the use of horizontal drilling and hydraulic fracturing, and report back to the legislature by May 1, 2012. Part of that study will include testing for NORM.

Earlier this year, the Geologic Survey Division of the DLR conducted initial surveys of shale outcrops in the Sanford and Dan River basins and reports finding radioactivity levels 2.5 times the background levels, but well below levels of concern for public health. The DLR also has collected additional samples (164 from Sanford and 165 from Dan River) for further testing.

The Radiation Protection Section of the Division of Health Services Regulation in the Department of Health and Human Services regulates radiation in North Carolina (Radiation Protection Act: G.S. 104E), but does not regulate NORM unless the radioactivity exceeds an action level. The action level differs for each radioactive element.

North Carolina radiation protection rules at 15A NCAC 11 state that, if NORM is concentrated by natural means above the action level, shielding to protect persons from accidentally exposing themselves would be required. In addition, if NORM is concentrated by mechanical or chemical means above the action level (technologically enhanced), that process of concentration would require a permit from RPS. These technologically enhanced materials would be considered by-product materials.

While the state does have storage facilities for radioactive waste materials, they do not have disposal facilities for this material. All such waste is shipped out of state.

Finding V.1.

The DLR is conducting a study to determine the extent and potential impacts of oil field NORM.

Recommendation V.1.

If North Carolina decides to develop an oil and gas regulatory program, and if the state determines that NORM is an issue in E&P activities, the review team recommends that the state develop an E&P regulatory program consistent with Section 7 of the Guidelines.

VI. STORMWATER MANAGEMENT

General

The state's Sedimentation Pollution Control Act of 1973 governs all land-disturbing activities except those associated with agriculture and mining. Mining activities are regulated under the Mining Act of 1971. Erosion and sedimentation control are required regardless of the size of the area disturbed. The law requires the landowner to plan and implement effective temporary and permanent control measures to prevent accelerated erosion and off-site sedimentation. The DLR erosion and sediment control program maintains extensive web-based material available for industry and public stakeholder education and outreach.

The state maintains primacy for all federal storm water programs, but does not have E&P-specific stormwater permitting requirements. In addition to construction stormwater requirements (largely implemented through the state sedimentation program), E&P activities may also be subject to post-construction stormwater control requirements in some areas of the state. Post-construction stormwater requirements do not apply statewide and are implemented through a number of different programs – both federally delegated (such as the Phase II stormwater program) and "state only" programs. The "state only" post-construction stormwater permitting programs typically apply to new development activity within certain sensitive areas or in areas draining to impaired waters. Examples would be nutrient sensitive river basins and water supply watersheds. These programs are implemented by the DWQ or by local governments with oversight by the DWQ. Since post-construction stormwater requirements do not apply statewide, E&P activities in many areas of the state would not require stormwater controls after completion of initial construction. Pollutants in stormwater leaving the site after construction would not be regulated until a water quality impact actually occurred.

The state also has the authority to issue Water Quality Certifications under Section 401 of the federal Clean Water Act; under Section 401, an applicant seeking a Federal Section 404 Permit to discharge to navigable waters)which includes certain wetlands connected to those waters) must provide a certification that the discharge will meet state water quality standards. A State Isolated Wetlands and Waters Permit is required to impact isolated wetlands or waters that fall outside federal jurisdiction under Section 404.

Finding VI.1.

The combination of the DWQ state stormwater and DLR erosion/ sediment control programs are adequate to meet the General criteria of the Guidelines.

Recommendation VI.1.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR develop an operator and public on-line resource

identifying the E&P stormwater permit requirements and the best management practices for the E&S program. (2010 STRONGER Guidelines, Section 8.1.)

State Regulatory Program Elements

The state does not have E&P specific regulatory or best practice stormwater minimization requirements, but the extensive DLR Erosion and Sediment Control program, pursuant to 15A NCAC Ch. 4, appears to be an industry standard for sediment and erosion control. The E&S program includes regular training, guidance on inspection, auditing, and reporting, and community outreach.

State stormwater programs that address post-construction stormwater do not have E&P-specific regulatory standards or best management practice stormwater minimization requirements. In areas where the existing state stormwater programs apply, the programs establish best management practices (BMPs) and methods for minimizing environmental impacts from stormwater pollution. The programs also provide training, guidance on inspections, auditing, reporting and community outreach.

Finding VI.2.

The state partially meets Section 8.2 of the Guidelines related to state stormwater management regulatory program elements.

Recommendation VI.2.
The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR review and consider incorporating the appropriate elements of the comprehensive E&S program to meet the Guidelines (see note below). (2010 STRONGER Guidelines, Section 8.2.)

Agency Regulatory Program Criteria

All surface waters in North Carolina are classified as to best use. In areas where the use is threatened because of impaired water quality or maintenance of an existing use (such as water supply) measures to address nonpoint source pollution are required. There are restrictions on development in the contributing watersheds and/or restrictions as to permissible storm water or wastewater pollutant discharges. Discharges may be restricted based on classifications: Outstanding Resource Waters, High Quality Waters, Trout Waters, Water Supply I – V, Critical Area, Shell-fishing Waters, Nutrient Sensitive Waters, and zero-flow streams.

The state does not have E&P-specific standards or best stormwater management minimization requirements, but the state's existing programs cover many of the activities associated with E&P. The state's Stormwater BMP Manual and rules address many of the stormwater control measures identified in the Guidelines. In areas of the state where

no state stormwwater standards apply, only sediment pollutants and stormwater impacts associated with later phases of E&P activity would be addressed in existing rules.

Finding VI.3

There are gaps in the state's regulation of stormwater pollution outside the initial land-clearing and construction phase. In many areas of the state, stormwater generated during well drilling and production would not be addressed by the state's existing programs and only sedimentation impacts would be regulated during the construction phase.

Recommendation VI.3.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DLR and DWQ should work together to develop standards to address gaps in the state's existing stormwater program to ensure that stormwater from all phases of E&P and all potential pollutants from E&P are addressed in accordance with the Guidelines. (2010 STRONGER Guidelines, Section 8.3.2.)

Finding VI.4.

The DENR E&S control design manual and other resources are extensive, and address planning, construction standards, operation, maintenance, restoration, and reclamation criteria related to erosion and sedimentation control. The manual does not contain E&P-specific standards and does not address pollutants other than sediment.

Recommendation VI.4.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DLR combine E&P-related best management practices from the design manual into an oil and gas guidance document to facilitate use by the industry. (2010 STONGER Guidance, Section 8.3.)

VII. HYDRAULIC FRACTURING

Currently, shale gas development in most areas of the country relies heavily on the use of horizontal well drilling and hydraulic fracturing technologies.

Rule 15A NCAC 05D.0107(e) states "All wells shall be drilled in such a manner so that vertical deviation of the hole does not exceed three degrees between the bottom of the hole and the top of hole, and shall not deviate in such a manner as to cross property or unit lines, unless an exception is granted by the director. An inclination survey shall be filed with the director for each well subsequently produced for oil or gas." The DENR has interpreted this regulation to prohibit the drilling of horizontal oil and gas wells.

Rule 15 NCAC 02C.0213(e)(1), relating to the operation of Class V injection wells, requires that "Pressure at the well head shall be limited to a maximum which will ensure that the pressure in the injection zone does not initiate new fractures or propagate existing fractures in the injection zone, initiate fractures in the confining zone, or cause the migration of injected or formation fluids outside the injection zone or area." The DENR has interpreted this to prohibit hydraulic fracturing of oil and gas wells.

Finding VII.1.

The DENR currently believes that horizontal drilling and hydraulic fracturing are prohibited under North Carolina regulations.

Recommendation VII.1.

The review team recommends that, if North Carolina decides to develop an oil and gas regulatory program, the DENR obtain legal opinions from the Attorney General regarding the interpretation of Rule 15A NCAC 05D.0107(e) and Rule 15 NCAC 02C.0213(e)(1). If the Attorney General's opinions concur with the current DENR interpretations, the DENR should develop regulations for horizontal drilling and hydraulic fracturing that meet the criteria contained in Section 9 of the Guidelines. (2010 STRONGER Guidelines, Section 9.)

APPENDIX A

Acronyms

AAL	Accepted Ambient Levels
APA	Administrative Procedures Act
CFR	Code of Federal Regulations
DAQ	Division of Air Quality
DENR	Department of Environment and Natural Resources
DHHS	Department of Health and Human Services
DLR	Division of Land Resources
DPS	Department of Public Safety
DWM	Division of Waste Management
DWR	Division of Water Resources
DWQ	Division of Water Quality
E&P	Exploration and Production
EMP	Emergency Management Plan
EOC	Emergency Operations Center
FEMA	Federal Emergency Management Agency
HAZMAT	Hazardous Materials
ILT	Interagency Leadership Team
IOCC	Interstate Oil Compact Commission
IOGCC	Interstate Oil and Gas Compact Commission
LEPC	Local Emergency Planning Committee
NORM	Naturally Occurring Radioactive Materials

MOU	Memorandum of Understanding
RCRA	Resource Conservation and Recovery Act
RPS	Radiation Protection Section
RRC	Rules Review Commission
SAB	Science Advisory Board
SEOP	State Emergency Operations Plan
SPCC	Spill Prevention, Control and Countermeasures
STRONGER	State Review of Oil and Natural Gas Environmental Regulations, Inc.

APPENDIX B

INFORMATION FOR THE REVIEW OF STATE OIL AND GAS ENVIRONMENTAL REGULATORY PROGRAMS IN STATES WITH A SMALL NUMBER OF WELLS

State: North Carolina

Completed by NC Department of Environment and Natural Resources

Address 1601 Mail Service Center
Raleigh, NC 27699-1601

Telephone (919) 715-2613 Fax (919) 715-3060

Questionnaire Coordinator/Contact: Trina Ozer

INSTRUCTIONS: The primary basis for this review is the document, Guidelines for State Review of Oil and Natural Gas Environmental Regulatory Programs (2010). Please provide the information requested herein and be prepared to describe and discuss the additional information as requested. However, avoid providing background information, data, regulations or statutes that do not address issues in the Guidelines or are not related to the state's oil and gas environmental programs. (For example, regulation of underground fuel storage tanks is not addressed in this review.) Terms used in this questionnaire have meanings consistent with those contained in the Guidelines. Citations appearing in brackets (e.g., [5.3.]) refer to the applicable section or sections of the Guidelines.

REQUESTED BACKGROUND INFORMATION

1. Please provide a brief history or other description of the oil and gas industry in your state, its regulation by state agencies, and recent E&P trends.

Though natural gas and oil are known to occur in North Carolina, they are not currently produced in the state. Natural gas and oil can potentially be produced in commercial quantities from two general geologic regions: 1) the Mesozoic basins that are exposed in the Piedmont or lie buried beneath the Atlantic Coastal Plan, and 2) the Atlantic Outer Continental Shelf.

The history of oil and gas exploration in North Carolina spans over 80 years, with the earliest oil well drilled in 1925 in Craven County. Oil and gas exploration wells have been drilled in 23 counties across the state. The most active exploration years, those with ten or more wells completed, were: 1971 with 19, 1969 with 13, 1958 with 11, and 1966 with 10. To date, 127 oil and gas exploration wells have been completed in North Carolina. Since 1974, seven wells have been drilled, all in Lee County. The most recent oil and gas wells were drilled in 1998 in Lee County.

People interested in drilling an exploratory well for oil or gas are required to register with DENR, post a bond, and submit an application for a drilling permit to the Division of Land Resources (DLR). The bond is $5,000 plus $1 per linear foot proposed to be drilled. A permit is also required for all geophysical exploration work, including seismic explorations. Explorations are defined as geological, geophysical and other surveys and investigations, including seismic methods for the discovery and location of oil, gas or other mineral prospects, and which may or may not involve the use of explosives.

Recently, companies have approached landowners in Chatham, Lee and Moore Counties about leasing their mineral rights, and many of these landowners have signed lease agreements.

2. Please also include a copy of the following:

   A. Organization chart(s) showing the structure of all agencies responsible for the management and disposal of exploration and production (E&P) wastes, abandoned oil and gas sites, oil-field NORM (naturally occurring radioactive materials), storm water management and hydraulic fracturing.

There is an org chart for DENR attached. The units involved in the management of E&P wastes are the Division of Waste Management, the Division of Water Quality, the Division of Water Resources, the Division of Land Resources, and the Division of Air Quality. In addition to DENR divisions, the Radiation Protection Section (RPS) of the Division of Public Health in the Department of Health and Human Services would be involved. Org charts for each of these divisions are also attached.

B. Statutes, rules, regulations and orders applicable to the management and disposal of oil and gas E&P waste, abandoned oil and gas sites, NORM from oil and gas production, storm water management and hydraulic fracturing.

C. Any memoranda of understanding or similar agreements between state agencies or between the state and any other governmental entities (BLM, EPA, Indian Tribes, local jurisdictions) pertaining to the management and disposal of E&P wastes, abandoned sites, NORM from oil and gas production, storm water management and hydraulic fracturing.

UIC: The 1984 Memorandum of Agreement between EPA and North Carolina for the UIC Program is attached. The state applied for renewal of its UIC primacy in 2002, but EPA is still reviewing the application. The 2002 Memorandum of Agreement is also attached, but has not been signed by EPA.

NPDES: The 2007 Memorandum of Agreement between EPA and North Carolina for the NPDES Program is attached. This MOA covers the NPDES wastewater, NPDES stormwater, and pretreatment programs.

D. Any written mission statement(s), goals, objectives and policies applicable to oil and gas E&P waste management and disposal activities, abandoned sites, NORM from oil and gas production, storm water management and hydraulic fracturing.

The DENR 2009-2013 Strategic Plan states DENR's mission and values (see introduction) and also states that DENR should "continue and support the evaluation and exploration of natural gas resources in the state" (p. 5). Other sections have broader relevance. For instance, the Plan includes actions such as: "Improve the state's response to groundwater contamination incidents through improved coordination among state agencies and local governments, stronger enforcement policies and increased public education" (p. 2) and "Partner with business, the Department of Transportation and the Department of Commerce to effectively reduce diesel emissions from the movement of freight and limit diesel emissions from construction activities" (p. 4).

3. Also, please include on a separate page any other relevant practices, program measures, guidelines or controls applicable to your state.

Session Law 2011-276 directs DENR to study the issue of oil and gas exploration in the state, specifically the use of directional and horizontal drilling (see http://www.ncleg.net/Sessions/2011/Bills/House/PDF/H242v7.pdf).

4. The next pages contain a matrix to be used to summarize E&P waste management practices. It is recognized that further explanation will likely be necessary. Don't try to capture everything or give precise numbers if not readily available - give only the big picture in the matrix.

E&P Waste Management Matrix

Waste Management Practices	Number of Facilities	Volume Managed Annually	Basis for Volume Determination
Pits:			
Drilling	**0**		
Production	**0**		
Special Use	**0**		
Landspreading	**0**		
Roadspreading	**0**		
Tanks	**0**		
Commercial Facilities:			
Multipractice	**0**		
Landfarms	**0**		
Tank Bottom Reclaimers	**0**		
UIC Surface Facilities	**0 (Class II)**		
Oil-Field NORM	**0**		
Centralized Facilities (non-NORM)	**0**		
Oil-Field NORM	**0**		
Municipal Landfills Accepting E&P Waste	**0**		
Underground Injection Surface Facilities	**0 (Class II)**		
Abandoned Sites	**0**		
Other	**0**		

E&P Waste Management Matrix (cont.)

Waste Management Practice	Principal Agency	Primary Statute	Primary Rules, Regulations, or Orders	Applicable Guidelines
Pits:				
Drilling	DLR	Chapter 113, Article 27 (see attached document)	15A NCAC .05D	
Production	DLR	Same as above		
Special Use	DLR	Same as above		
Landspreading	DWQ	G.S. 143-215.1	15A NCAC 2T	
Roadspreading	DWQ	G.S. 143-215.1	15A NCAC 2U	N/A
Tanks (produced water, production tanks)	Depends on contents – DLR, DWM		DWQ – none, DWM: 15A NCAC 13A .0113	
Commercial Facilities: (facilities used by multiple operators)				
Multipractice	DWM			
Landfarms	DWQ or DWM depending on specifics	G.S. 143-215.1	15A NCAC 13B 15A NCAC 2T	
Tank Bottom Reclaimers	DWM			
UIC Surface Facilities	DWQ	G.S. 143-214.2(b)	15A NCAC 2C .0209(b)	N/A
Oil-Field NORM	DHHS-RPS	G.S. 104E	15A NCAC 11	
Centralized Facilities (non-NORM)	DLR or DWM			
Oil-Field NORM	DLR, DHHS-RPS	G.S. 104E	15A NCAC 11	
Municipal Landfills Accepting E&P Waste	DWM - would have to be legislative and/or rule making			

	enacted. Landfills do not currently accept petroleum wastes.			
Underground Injection Surface Facilities	DWQ	G.S. 143-214.2(b)	15A NCAC 2C .0209(b)	N/A
Abandoned Sites	DLR	G.S. 113, Article 27		
Other	TBD			
Wastewater Pump & Haul Permits	DWQ	G.S. 143-215.1	15A NCAC 2T .0200	N/A
Other non-discharge wastewater systems	DWQ	G.S. 143-215.1	15A NCAC 2T	N/A

During the in-state review, please be prepared to describe and discuss the following if they are applicable in your state:

I. GENERAL CRITERIA

1. The **statutory authority** upon which your E&P environmental regulatory program is based. [3.1.a]
   - Well Construction Act: G.S. 87, Article 7 (well construction standards, injection wells)
   - Oil & Gas Conservation Act: G.S. 113, Article 27 (issues related to exploration and production)
   - Water and Air Resources Act: G.S. 143, Article 21 (issues related to protection of air and water resources; wastewater and stormwater management)
   - Air Pollution Control: G.S. 143, Article 21B
   - Oil Pollution and Hazardous Substances Control: G.S. 143, Article 21A
   - Oil Spill Contingency Plan: G.S. 166A
   - Solid Waste: G.S. 130A, Article 9
   - Radiation Protection Act: G.S. 104E

2. Authority for the **promulgation of rules and regulations.** [3.1.b]
   - G.S. 87-87 (EMC authority to adopt well construction rules)
   - G.S. 113-391(c) (Department authority to adopt rules under Oil & Gas Conservation Act)
   - G.S. 143-215.3(a)(1) (EMC authority to promulgate rules under G.S. 143 Articles 21 – water and air resources, 21A – oil pollution and hazardous substances control, 21B – air pollution control and 38 – water resources)
   - G.S. 143B-282 (Creation of EMC)
   - Solid Waste G.S. 130A-29
   - Oil Spill Contingency Plan: G.S. 166A
   - Radiation Protection G.S. 104E-7

3. The **definitions** of terms necessary for program implementation. [3.1.c]

See above. Terms are defined within each statute and administrative code

4. The adequacy of **levels of funding and staff** provided for E&P environmental regulatory program implementation (differentiate between UIC and non-UIC program funding and staffing levels if applicable to your program). [3.1.d, 4.3.2]

Currently there are no staff dedicated to E&P environmental regulatory program implementation; duties are distributed among existing staff in multiple divisions. A UIC grant from EPA provides funding for one position in DWQ. However, this position is not dedicated to E&P program implementation and North Carolina currently does not allow Class II wells.

5. Mechanisms for the **coordination** of E&P environmental regulatory program activities among the public, government agencies and the regulated industry. [3.1.e, 4.4]

Most of regulatory program is implemented under a single department (Radiation Protection, if involved, the only exception). A 2007 MOA between DWM & DWQ (attached) specifies the responsibilities of each division for managing contaminated sites. North Carolina has primacy for the UIC program for all classes of injection wells.

6. The **goals or objectives** of the E&P environmental regulatory program (including how the goals and objectives relate to protection of human health and the environment). [3.2]

The Water & Air Resources Act, in G.S. 143-211, establishes the broadest goals and objectives for the state's environmental protection programs:

143-211. Declaration of public policy.

(a) It is hereby declared to be the public policy of this State to provide for the conservation of its water and air resources. Furthermore, it is the intent of the General Assembly, within the context of this Article and Articles 21A and 21B of this Chapter, to achieve and to maintain for the citizens of the State a total environment of superior quality. Recognizing that the water and air resources of the State belong to the people, the General Assembly affirms the State's ultimate responsibility for the preservation and development of these resources in the best interest of all its citizens and declares the prudent utilization of these resources to be essential to the general welfare.

(b) It is the public policy of the State to maintain, protect, and enhance water quality within North Carolina....

(c) …It is the intent of the General Assembly, through the duties and powers defined herein, to confer such authority upon the Department of Environment and Natural Resources as shall be necessary to administer a complete program of water and air conservation, pollution abatement and control and to achieve a coordinated effort of pollution abatement and control with other jurisdictions. Standards of water and air purity shall be designed to protect human health, to prevent injury to plant and animal life, to prevent damage to public and private property, to insure the continued enjoyment of the natural attractions of the State, to encourage the expansion of employment opportunities, to provide a permanent foundation for healthy industrial development and to secure for the people of North Carolina, now and in the future, the beneficial uses of these great natural resources. It is the intent of the General Assembly that the powers and duties of the Environmental Management Commission and the Department of Environment and Natural Resources be construed so as to enable the Department and the Commission to qualify to administer federally mandated programs of environmental management and to qualify to accept and administer funds from the federal government for such programs.

The Well Construction Act of 1967 (G.S. 87, Article 7) establishes "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 requirements as may be necessary to protect the public welfare, safety, health and groundwater

resources."

- Oil & Gas Conservation Act: G.S. 113-382 and as amended by S.L. 2011-276
- See list of statutory authorities in the table above.

7. Any **flexibility** in determining the criteria applicable to E&P environmental activities (e.g., variation in criteria dependent on region of the state or other factors). [3.3]
   - Customized permit conditions (DLR)
   - Most regulatory programs administered by NC DENR include provisions for the issuance of variances when compliance with standards is not technically feasible or when a greater level of protection can be provided through alternatives that do not otherwise comply with standards. Statutory variance authorities include:
     - G.S. 143-215.3(e), for variances from standards established by the EMC under G.S. 143-215.1 (Control of sources of water pollution).
   - In addition to these statutory authorities, variance authority is found in the following administrative code rules:
     - 15A NCAC 2B .0226 (Variance from surface water standards)
     - 15A NCAC 2C .0118 (Variances from well construction standards)
     - 15A NCAC 2C .0215 (Variances from injection well rules)
     - 15A NCAC 2L .0113 (Variances from groundwater standards)
     - 15A NCAC 2T .0105(b) (Variances from design criteria for non-discharge wastewater)

II. ADMINISTRATIVE CRITERIA

1. Mechanisms for **approval of permits, registration, notification**) to assure that E&P environmental impacts are managed responsibly. [4.1.1]

For oil and gas permits the applicant must register, provide a bond, and then apply for the permit. For other waste management and wastewater issues, existing processes for industrial facilities would be used.

An application for a drilling permit for an oil or gas well triggers a series of other permits which must be obtained prior to the issuance of a drilling permit. The applicant submits a site plan, which entails describing where the drilling is proposed, how deep the drilling is planned, the casing specification for the well, and the plan for on-site storage of water, wastewater and mud in pits and/or tanks.

As soon as the Division of Land Resources receives the drilling permit application, that information is shared with other NC DENR divisions to determine what other issues must be addressed. The drilling permit is the master permit and as such, the applicant must obtain a well construction permit before receiving a drilling permit. In addition, a sedimentation and erosion control permit is also required if more than one acre of land is

disturbed (this includes the access road to the site). The S&EC permit requires a site plan and a site restoration plan after the disturbance is completed.

Conditions are placed on the drilling permit that address site location, endangered or threatened wildlife species, off-site runoff, waste management, inspections and notification.

2. The **authority to refuse** to issue or reissue permits or authorizations. [4.1.1]

DLR issues a drilling permit when all conditions and requirements of the permit have been addressed to the satisfaction of the permitting authority. Under G.S. 113-402, "a party who is dissatisfied with a decision or order of the Department under this Article may obtain administrative review of the decision by filing a petition for a contested case hearing under G.S. 150B-23 within 10 days of the decision or order is made. Other facilities (well construction, solid waste, wastewater, etc) do have authority in statutes above.

3. Any notice of the permittee's obligation to comply with other federal, state or local requirements. [4.1.1]

The permit conditions of the master drilling permit require the applicant to comply with existing law. G.S. 113-408 allows the Department to bring suit in Superior Court to restrain people from continuing violations or from carrying out the threat of violations. The requirements of DLR's permit are listed in the Well Construction rules at 15A NCAC 2C .0100.

4. Fixed terms and renewal procedures for individual permits. [4.1.1]

Drilling permits are for a single use. Once bonded, a site should be drilled because the erosion and sedimentation control permit and other permits expire. Other waste facilities have a five-year permit cycle, except for a few programs which allow up eight years.

5. Your **compliance evaluation program** for:
   a. Receipt, evaluation, retention, and investigation of required notices and reports. [4.1.2.1]
   b. Inspection, sampling and surveillance procedures for facility monitoring, periodic inspections, comprehensive surveys, and violation investigation. [4.1.2.1.b]
   c. Public complaint and follow-up, including response times. [4.1.2.1.c]
   d. Authority to conduct unannounced inspections and investigations. [4.1.2.1.d]
   e. Right of entry for inspection and copying of records. [4.1.2.1.e]
   f. Chain of custody/evidence gathering. [4.1.2.1.f]

Oil & Gas Conservation:

- G.S. 113-391 describes DENR's authority to make appropriate inquiries to

determine whether or not waste (as defined at G.S. 113-389) exists or is imminent.

Solid Waste:

- Statutory authorities: G.S. 130A-294
- Right of entry: G.S. 130A-17

Water Quality and Air Quality:

- G.S. 143-215.3(a)(2) - authority for DWQ to carry out investigations and inspections, enter property, examine records and collect evidence related to determining the condition of the air and water resources of the state and the condition of any pollution control equipment.

Well Construction

- G.S. 87-90 – authority for DWQ to carry out investigations and inspections, enter property, examine records and collect evidence related to determining compliance with the Well Construction Act

6. The **enforcement actions** can be taken for violations of E&P environmental regulatory requirements, including the number of times these enforcement actions have been taken by the state over the past two years (number or frequency), or an indication which of these actions the state uses more often. [4.1.3.1]

Oil & Gas Conservation:

- Level of activity is N/A.
- G.S. 113-408 gives DENR authority to obtain injunctions when it appears the statute is being violated.
- G.S. 113-409 makes evading any rule under Article 27 or falsifying information a Class 2 misdemeanor.
- G.S. 113-410 describes penalties for violations.
- G.S. 113-411 discusses illegal oil and gas.

Solid Waste:

- Determining penalties for violations of the Solid Waste Management Act: 15A NCAC 13B.0702 - .0706.
- Guidelines for transporting, collecting or recycling used oil (violation is a misdemeanor): G.S. 130A-309.17.

Well Construction:

- G.S. 87-94 and 87-95 provide authority for civil penalties and injunctive relief, respectively, for violations of the Well Construction Act.

Water & Air Quality:

- G.S. 143-215.6A, G.S. 143-215.6B, and G.S. 143-215.6C provide enforcement authority in the form of civil penalties, criminal penalties, and injunctive relief for violations under the Water & Air Resources Act.

7. Any **formula for calculation of penalties**, its regulatory basis, and the penalties assessed and collected over the past two years. [4.1.3.2]

Maximum fines are set in statute for wastewater, wells, waste management, and oil and gas wells. G.S. 130A-22(a) describes administrative penalties related to the Solid Waste Management Act. G.S. 87-94 establishes maximum fines for violations of the Well Construction Act. G.S. 143-215.6A establishes maximum fines for violations under the Water & Air Resources Act. G.S. 113-410 sets penalties for violations of the oil & gas conservation act.

8. Any **right of appeal** for review of actions. [4.1.3.3]

- Solid waste: G.S. 150B-23 (referred to in G.S. 130A-22(e)
- G.S. 87-92 provides for appeals of any agency decision under the Well Construction Act.
- G.S. 143-215.5 provides for judicial review of any agency decision under the Water & Air Resources Act.

9. The **state contingency plan** for response to spills and releases, including volumes that trigger a response, time in which notification and clean-up is to occur, and criteria (i.e., cleanup standards) used to assure that remediation was accomplished. [4.2.1.1.a]

Under the State Emergency Management program, the State Emergency Operations Plan lists the hazardous materials plan which includes the response to hazardous materials, suspected hazardous materials and unknowns. That Tab of the State EOP is attached.

10. Any **funding** provisions to enable the state to respond to spills and releases in the event a responsible operator cannot be located or is unwilling or unable to respond, and any provisions for reimbursement of the state for monies so expended. [4.2.1.1.b]

The State of North Carolina calls upon the US EPA Emergency Response Program to mobilize federal contractors to assist in the response and remediation of spills as part of the National Contingency Plan.

11. Any mechanisms for the operators or public to report spills and releases. [4.2.1.2]

Reports are taken by the State Emergency Management personnel at the 24-7 State Emergency Operations Center. Their telephone number is 1-800-858-0368. In addition, operators or members of the public can contact local emergency services by dialing 911 or calling the National Response Center.

12. Any interagency **coordination of actions** between agencies having jurisdiction for response to spills and releases. [4.2.1.3]

Interagency coordination is described in the State EOP.

13. Any **requirements for operators** to prevent and respond to spills and releases. [4.2.1.4]

The conditions of the drilling permit are binding.

14. Any **general state contingency program elements** that address:
    a. Facilities, materials and equipment that may pose a significant threat. [4.2.1.4.1.a]
    b. The various environments at risk. [4.2.1.4.1.a]
    c. Measures to address public and responder safety concerns. [4.2.1.4.1.a]
    d. The operator's incident command structure. [4.2.1.4.1.b]
    e. Equipment, manpower and services to respond to spills and releases. [4.2.1.4.1.b]
    f. Opportunities for coordination of response actions. [4.2.1.4.1.b]
    g. Procedures for communication with threatened parties. [4.2.1.4.1.b]
    h. Methods of containment. [4.2.1.4.1.b]
    i. Methods of disposal of materials. [4.2.1.4.1.b]
    j. Responder training. [4.2.1.4.1.c]

A site-specific contingency plan may be required as a binding condition of the permit.

15. Any **spill prevention measures** that may include:
    a. Secondary containment measures. [4.2.1.4.2.a]
    b. Tertiary containment or monitoring systems in high risk areas. [4.2.1.4.2.b]
    c. Inspection, testing and maintenance procedures. [4.2.1.4.2.c]
    d. Site security measures as necessary. [4.2.1.4.2.d]
    e. Periodic review of opportunities to reduce future spills and releases. [4.2.1.4.2.e]

These may be specified by conditions in the permit.

16. Any **spill response measures** that may include:
    a. Agencies and parties to be notified. [4.2.1.4.3.a]
    b. Type of reporting (verbal, written) required. [4.2.1.4.3.a]
    c. Reporting time requirements. [4.2.1.4.3.a]
    d. Reporting thresholds. [4.2.1.4.3.a]
    e. Type of information to be reported. [4.2.1.4.3.a]

These may be specified by the conditions in the permit.

17. Any **state guidance for containment, abatement and remediation** of spills and releases including:

a. Clean-up standards. [4.2.1.4.3.b]
b. Required sampling and analyses. [4.2.1.4.3.b]
c. Any approved non-mechanical response actions. [4.2.1.4.3.b]

The Groundwater Classifications and Standards include general requirements for corrective action in 15A NCAC 2L .0106.

18. Any **final reporting, site monitoring requirements and necessary agency approvals** following the response to spills and releases. [4.2.1.4.3.c]

The Hazardous Materials Tab of the State EOP outlines these requirements.

19. Any **follow-up actions by the state**, including enforcement, assessment of damages, and reimbursement of costs for responding to spills and releases. [4.2.1.5]

The Hazardous Materials Tab of the State EOP outlines these requirements.

20. Any **database** that includes information on spills and releases. [4.2.1.6]

The Hazardous Materials Tab of the State EOP outlines these requirements.

21. Any **public participation** activities related to E&P environmental activities, such as public notice and comment requirements prior to permit issuance, availability of agency records for public review, public outreach to affected parties, and the use of any advisory groups. [4.2.2]

There are public notice allowances for wastewater and solid waste permits. G.S. Chapter 132 defines public records and sets requirements for their availability to the public. The specific rules for solid waste management can be found in15A NCAC 13A.0109, see (r), additional location standards for facilities, and 15A NCAC 13A.0109(r)(7)A-E. G.S. 143-215.1(c) specifies requirements for public hearings prior to the issuance of permits for discharges to surface waters.

22. The **program planning and evaluation process** including:
    a. Any short-term and long-term strategic planning for regulatory development. [4.2.3.1]
    b. Program evaluation of program effectiveness in protecting human health and the environment. [4.2.3.2.a]
    c. Data management capabilities to enable assessment of program effectiveness and timeliness. [4.2.3.2.b]
    d. Establishment of a baseline against which to compare future performance. [4.2.3.2.d]

As we do not yet have an established E&P program, we do not have program planning

and evaluation yet. However, S.L. 2011-276 does direct DENR to study the potential oversight and administrative issues associated with an oil and gas regulatory program.

23. Any **financial assurance** requirements for E&P environmental regulatory activities or facilities, the activities for which financial assurance is required, the scope of coverage, the types of financial assurance instruments accepted, and procedures to access the assurance funds when necessary. [4.2.4]

The binding conditions of the drilling permit could include bonding of the company to address the financial assurance of the drilling company.

24. Any **waste hauler training and certification** requirements for commercial transportation of E&P wastes. [4.2.5]

None. Manifests must be available on site.

25. Any program relating to identification of the **location of closed disposal sites**, including any provisions making this information available for public review. [4.2.6]

Solid waste notice of inactive hazardous substance or waste disposal sites: G.S. 130A-310.8

26. The **data management** systems in place in your state for information related to E&P environmental regulatory program activities, including a description of the data elements, the extent to which the program utilizes electronic data management systems, and what information is or is not made available to the public. [4.2.7]

DLR:

Copies of all permits/reports for all oil and gas wells are maintained by DLR – N.C. Geological Survey and are available for public review under the public records laws of North Carolina.

DWM:

DWM has databases related to USTs available at: http://portal.ncdenr.org/web/wm/ust/database.

DWQ:

Basinwide Information Management System is used to track data on permits and compliance for the NPDES wastewater and stormwater, non-discharge wastewater, and UIC and well permitting programs. Nearly all data in this database is submitted on paper records and is entered manually, with the exception of a pilot project to provide electronic submission for some major NPDES permits. Under North Carolina public records law, all data within BIMS is publicly available upon request. DWQ makes available limited permit information from BIMS on its website.

Well Construction Database: Well drillers are required by 15A NCAC 2C .0114 to submit a well construction record to the Division of Water Quality for every well they

drill. These records are entered into DENR's Well Construction Database and include information on the driller and well owner, well location, well construction characteristics, and driller's log. Data in this database is submitted on paper records and is entered manually,. Most of this information is subject to public disclosure upon request, but none is currently posted on the internet or otherwise made available without a request.

27. The **administrative support** assigned to the E&P environmental regulatory program, including the number, classifications, functions and duties, and minimum experience and training requirements for these positions, and any additional training that is made available to them. [4.3.1.1]

None currently assigned. Responsibilities carried out by program staff in multiple divisions.

28. How **legal support** is provided to the E&P environmental regulatory program. [4.3.1.2]

DENR Office of the General Council and the State Attorney General's office provide support to each division.

29. The **technical staff** assigned to provide geological or engineering support to the E&P environmental regulatory program, including the number, classifications, functions and duties and minimum experience and training requirements for these positions, and any additional training that is made available to them. [4.3.1.3]

None currently assigned. Responsibilities carried out by program staff in multiple divisions.

30. The **field personnel** assigned to conduct inspections and assure compliance with the E&P environmental regulatory program, including the number, classifications, functions and duties and minimum experience and training requirements for these positions, and any additional training that is made available to them. [4.3.1.4]

None currently assigned. Responsibilities carried out by program staff in multiple divisions.

31. Your program for **training** agency personnel on the regulations, policies and criteria applicable to E&P environmental regulatory activities. [4.3.1.5]

DLR's Erosion & Sedimentation Control has a concerted training program; otherwise, no formal training.

32. The methods used for **funding** the E&P environmental regulatory program in your state. [4.3.2]

Appropriations, permit fees, federal grants, portion of severance tax.

33. Any mechanisms to ensure **coordination among state agencies** on E&P environmental regulatory issues and, if your state has large tracts of federally administered public lands and/or tribal lands, any formal or informal mechanisms in which E&P environmental regulatory programs are coordinated with federal and/or Indian agencies. [4.4]

- The Interagency Leadership Team (ILT) is a group of agencies that have work sessions to identify concerns and issues facing transportation, the environment and the economy in North Carolina.
- Most of the regulatory programs are implemented under a single department (Radiation Protection, if involved, is the only exception).
- A 2007 MOA between DWM & DWQ specifies responsibilities of each division for managing contaminated sites.
- See previous section on EPA

III. TECHNICAL CRITERIA

A - GENERAL

1. Any **general performance or design standards** applicable to E&P waste management practices used in your state. [5.1.a]

Generic criteria would apply until specific E&P waste management criteria are developed.

2. Conditions, if any, under which disposal of E&P waste in **municipal solid waste landfills** allowed. [5.1.c]

Legislative changes or rulemaking would need to occur.

3. Provisions in the siting, construction or operation criteria for **variances**, **waivers**, **or other flexibility** to address site specific or regional conditions. [5.1.d]

N/A

4. Any **siting** criteria for E&P waste management facilities. [5.1.e]

Solid waste rules for issuing a permit to a hazardous waste facility.

Siting requirements that might apply to wastewater management or disposal facilities include:

- Riparian Buffer rules in 15A NCAC 2B apply to most development and require vegetated buffers to be maintained adjacent to surface waters in some river basins.
- Setbacks and water table separation requirements in 15A NCAC 2T for land application of wastewaters and wastewater treatment residuals.

5. Any **waste characterization** requirements, including sampling, analysis and quality control procedures. [5.2]

Solid Waste:

- Hazardous waste determination - 40 CFR 262.11 is adopted by reference at 15A NCAC 13A .0107.
- Standards for owners and operators of hazardous waste storage, treatment and disposal, including waste analysis plan for permitted facilities - 40 CFR 264.13 is adopted by reference at 15A NCAC 13A .0109

DWQ:

- 15A NCAC 2B .0103 specifies requirements for any chemical, physical, or biological analyses used to determine conformity with surface water standards.
- 15A NCAC 2T includes design criteria which specify wastewater quality requirements for each type of land-applied wastewater (e.g. 15A NCAC 2T .0505, Design Criteria for Wastewater Irrigation Systems).
- 15A NCAC 2U .0301 specifies effluent standards for reclaimed wastewater systems.

6. Any **air emission control** requirements applicable to E&P waste management facilities. [5.1.a and 5.10.2.2.c]

Air pollution control rules cover compressors over certain size, dehydration units for drying gas, drilling rigs, other heavy equipment, off-road general permits, etc. These rules are in 15A NCAC 2D.

7. Any programs promoting a **waste management hierarchy** that includes:
   a. source reduction opportunities. [5.3.1]
   b. recycling opportunities. [5.3.2]

The NC General Statutes spell out a standard waste management hierarchy that is the preferred method of waste management in the state, with source reduction first, followed by recycling and reuse, composting, incineration with energy recovery, incineration without energy recovery, and landfilling (see G.S. 130A-309.04). To our knowledge, there are no state statutes or policies that specifically promote source reduction and recycling for the oil and gas industry, such as specific requirements to adopt and implement such strategies, requirements for source reduction or recycling plans, reporting mechanisms on the use of source reduction or recycling techniques, or specific goals related to the reduction of oil and gas waste, especially as a condition of permitting. The Division of Environmental Assistance and Outreach has programs that provide technical assistance on the reduction and recycling of wastes and emissions, although to date the Division has had little experience with oil and natural gas operations and some of the resulting waste streams. Some generic waste streams possibly generated by oil and gas operations (e.g., waste oil, oil filters, and wooden pallets) are banned from solid waste disposal in North Carolina.

8. Any **program elements** that encourage E&P waste source reduction and recycling through policy, training, technical assistance or incentives. [5.3.3]

To our knowledge, there are no program elements that specifically pertain to oil and gas exploration and production. There would be opportunities to place in statute or as permitting and compliance conditions many of the source reduction and recycling best management practices articulated in the STRONGER 2010 Proposed Guidelines, but it seems the authority or ability to do so would possibly have to be created. The Hazardous Waste Section would address some of the liquid wastes that would result from oil and gas operations that would be deemed hazardous. We are not aware of any immediately available incentives to encourage adoption of source reduction and recycling techniques at oil and gas operations – those, too, may have to be created in statute and/or rules or policy. Reporting requirements would also seem critical to develop and implement.

B – PITS

As listed earlier, the master drilling permit application requires a site plan, drilling plan, drilling specification, and the location and size of proposed mud pits. The DLR in coordination with Waste Management, Water Quality, Air Quality and other federal agencies would put binding conditions on the drilling permit to address pits. That permit regulates mud pits. Conditions on the size, volume, lining, security, potential offsite disposal, chemical content, testing requirement of the pit contents and abandonment of pits are part of the drilling permit. In law, drilling cannot start until the pits have been installed to the satisfaction of the regulatory agency.

9. Technical criteria for **pits**. [5.5.1]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

10. How pits are **permitted**. [5.5.2.a]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

11. If pits are **permitted by rule,** any requirements or limitations that are applicable. [5.5.2.b]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

12. Whether pits are **permitted individually** and/or as part of **facility**, **operational or general permits**. [5.5.2.c]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

13. Any **notification** required prior to construction and operation of rule-authorized pits. [5.5.2.d]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

14. Any provisions concerning the issuance and use of **emergency permits** for pits. [5.5.2.e]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

15. Any requirements included in statewide regulations regarding the size, depth, berm height and other **construction** parameters for pits. [5.5.3.a]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

16. Any requirements to assure that there is no adverse **impact to ground water or surface waters** from use of the pit. [5.5.3.b]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

17. Any requirements to assure **structural integrity** of pits. [5.5.3.c]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

18. How construction requirements assure that pits are designed to accommodate **fluids** which are intended to be contained in them. [5.5.3.d]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

19. If construction standards for pits differ depending on the **waste characteristics** of materials they are to receive, the circumstances under which variances or special conditions are used. [5.5.3.e]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

20. Conditions under which **pit liners** or **tanks** are required in lieu of pits. [5.5.3.e]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

21. Any requirements for **fencing**, **netting and caging** of pits. [5.5.3.f]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

22. Any requirements for the **placement of reserve pits** relative to drilling equipment. [5.5.3.g]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

23. Any restrictions placed on the **type and characteristics of wastes** that can be placed in pits. [5.5.4.a]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

24. Any **security** guidelines or requirements are in place regarding pits. [5.5.4.b]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

25. Any requirements for maintaining a **freeboard** level in pits and how is this level calculated. [5.5.4.c]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

26. How **liner integrity** is maintained and assured in lined pits. [5.5.4.d]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

27. Any routine **inspections or monitoring and reporting** required by the operator to assure that pit operational and structural integrity requirements are being met. [5.5.4.e]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

28. Any requirements for the **removal/disposal/recycling of hydrocarbons** that accumulate in pits. [5.5.4.f]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

29. Any requirements for the **removal of separated oil or wastes** from unlined skimming/settling pits. [5.5.4.g]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

30. If **produced water pits** are allowed in your state, the requirements for disposal of the water? [5.5.4.h]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

31. Any restrictions concerning the use of **percolation pits**. [5.5.4.i]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

32. Any maintenance requirements for **evaporation pits**. [5.5.4.j]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

33. Any restrictions placed on the use of **emergency pits**, and any notification of the regulatory agency and removal of fluids required when they are used. [5.5.4.k]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

34. Any prohibition against the use of **unlined basic sediment pits** for oily wastes. [5.5.4.l]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

35. Any limitations placed on the operation of **workover pits.** [5.5.4.m]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

36. Any time limit placed on the **closure of reserve pits**. [5.5.5.b]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

37. Any **testing of pit liquids is required before pit closure**, and if on-site disposal of pit liquids is authorized, what criteria apply to such disposal. [5.5.5.c]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

38. Conditions under which pit **liquids must be removed** before closure. [5.5.5.d]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

39. The requirements for **closure and reclamation** of pit sites. [5.5.5.e]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

40. The **records** to be kept of pit sites and their availability to the public. [5.5.5.f]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

C - LANDSPREADING (Non-Commercial)

41. Any **criteria for landspreading** of E&P wastes. [5.6.1.b]

If there were landspreading of drilling wastes, this activity could be subject to permitting under either Soil Remediation in 15A NCAC 2T .1500 or possibly as a Residual under 15A NCAC 2T .1100. This scenario does not fit perfectly into either of these two categories, but we have precedents of flexibility for other waste streams. Soil remediation permits are issued by either the UST Section of DWM or the Aquifer Protection Section of DWQ, depending on the source of the waste. At this time, approvals would be

required for each landspreading event. Residuals permits are issued by the Aquifer Protection Section of DWQ. Statutory authority of G.S. 143-215.1 applies in either case.

42. Any prohibitions on **landspreading of waste containing NORM** above action levels. [5.6.1.c]

Unknown.

43. Any **operational requirements** applicable to landspreading. [5.6.3]

The UST Section of DWM regulates land farming in the state, and at this time, approvals would be required for each event.

D - BURIAL AND LANDFILLING (Non-Commercial)

44. Any **regulatory requirements** for burial or landfilling of E&P wastes. [5.7.2]

These requirements would have to be created by legislation or rulemaking. Landfills do not currently accept petroleum wastes.

Neither oil nor oil filters can be disposed of in landfills in North Carolina.

45. Any **operational requirements** applicable to burial or landfilling. [5.7.3]

See question 44.

E – ROADSPREADING

46. Any **regulatory criteria** for roadspreading of E&P wastes. [5.8.2]

Roadspreading of produced waters or other E&P wastewaters would be subject to permitting as a reclaimed water system under 15A NCAC 2U.

47. Any **operational requirements** applicable to roadspreading. [5.8.3]

Roadspreading of produced waters or other E&P wastewaters would be subject to design criteria, utilization requirements, and requirements for operational plans for reclaimed water systems in 15A NCAC 2U.

F – TANKS

48. Any requirements pertaining to the **location**, **use**, **capacity**, **age and construction of E&P waste tanks**, including registration, inventories, etc. [5.9.2.a]

This will be determined on a case by case basis in coordination with the Division of Waste Management and the Division of Water Quality. Solid waste: hazardous waste permits (40 CFR 270.14(b)(1) and 270.16 are adopted by reference at 15A NCAC 13A.0113)

49. Any state program pertaining to **pollution prevention requirements relating to tanks**. [5.9.2.c]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

50. Any **construction and operation requirements** applicable to E&P waste tanks. [5.9.3]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

51. Any tank **removal and closure** requirements. [5.9.4]

This will be determined on a case by case basis by DLR in coordination with the Division of Waste Management and the Division of Water Quality.

As listed earlier, the master drilling permit application requires a site plan, drilling plan, drilling specification, and the location and size of proposed tanks. The DLR in coordination with Waste Management, Water Quality, Air Quality and other federal agencies would put binding conditions on the drilling permit to address tanks. Conditions on the size, volume, lining, security, potential offsite disposal, chemical content, testing requirement of the pit contents and abandonment of tanks are part of the drilling permit. In law, drilling cannot start until the tanks necessary to support the drilling have been installed to the satisfaction of the regulatory agency.

G - COMMERCIAL AND CENTRALIZED DISPOSAL FACILITIES

There are no specific facilities now, but DWM would be responsible if any were developed/proposed.

52. Which agency (agencies) has (have) regulatory **jurisdiction** over these facilities. [5.10.1]

The Division of Waste Management.

53. If you have any centralized or commercial E&P waste disposal facilities, **how many**, **and of what type**, and how many are associated with UIC sites. [5.10.1]

There are none associated with UIC Class II sites.

54. The **regulatory requirements** related to permits, acceptable types and volumes of wastes, and waste characteristics as related to disposal facility compatibility. [5.10.2]

The attached document, Landfill Requirements Disposal Facility, outlines these requirements.

55. A description of **what wastes are acceptable** for disposal (i.e., do any of these facilities accept RCRA nonexempt wastes or wastes from other than oil and gas exploration and production activities). [5.10.2]

Yes, North Carolina facilities accept RCRA nonexempt wastes.

56. The **disposal and treatment methods** employed at these facilities. [5.10.2]

North Carolina does not have any commercial disposal facilities. Treatment methods employed by commercial facilities in North Carolina include:

- Aqueous inorganic treatment
- Aqueous organic treatment
- Energy recovery
- Fuel blending
- Incineration
- Land treatment/application/farming
- Landfill/surface impoundment
- Metals recovery
- Other treatment
- Sludge treatment
- Solvents recovery
- Stabilization
- Storage and/or transfer

57. The elements required as part of the **permit** application (e.g., siting plan, construction plan, operating plan, closure plan, etc.). [5.10.2.2.a]

See the attached document "Permitting Requirements."

58. Any permit application requirements for **siting**. [5.10.2.2.b]

Yes. There are requirements for issuing a permit to a hazardous waste facility, described in the following locations:

- Location standards are listed in: http://portal.ncdenr.org/web/wm/hw/rules/addrequirments#additionallocationstandards.
- Areas where a hazardous waste landfill, long-term storage, or a surface impoundment facility cannot be located are listed in: 15A NCAC 13A .0109(r)(4)(A)
- Minimum separation distances for hazardous waste facilities are found in: 15A NCAC 13A.0109(r)(2)(C)
- A requirement to make monthly reports is found in GS 130 A-294(c)(18)

59. Any **construction** requirements that will minimize or prevent releases to surface water, ground water, soil and air. [5.10.2.2.c]

40 CFR 270.21(b) requirements are incorporated by reference at 15A NCAC 13A .0113

and 40 CFR 264.301(d) and 40 CFR 264.301(e) requirements are incorporated by reference at 15A NCAC 13A .0109.

60. Any permit application requirements for **operating**. [5.10.2.2.d]

See the attached Contingency Plan, Inspection Requirements, and Waste Analysis documents.

61. Any **closure and post-closure monitoring** and maintenance requirements, including duration of post-closure care and financial assurance release schedules. [5.10.2.2.e]

See the attached Closure and Post Closure document.

62. For wastes not moved by pipeline, any requirements for **waste tracking**. [5.10.2.3]

Waste tracking is done by using the manifest system that inspectors review during an inspection.

63. Any **waste haulers** permitting or licensing program. [5.10.2.3]

Transporters of hazardous waste are required to get an EPA Identification Number: http://www.epa.gov/osw/inforesources/data/form8700/forms.htm.

IV. ABANDONED SITES

1. Any state program to **inventory**, **prioritize and remediate** (as necessary) abandoned oil and gas sites. [6.1]

There are no abandoned oil and gas sites in the State. If we had one we would seal it as the Oil and GAS Conservation Act requires for all wells – it is sealed completely from the bottom to the top.

2. Reference to any **definitions** pertaining to abandoned sites or your abandoned well site program, including the types of facilities included in the definitions. [6.2]

There are definitions in the Oil & Gas Conservation Act (G.S. 113 Article 27). Some of these are available at G.S. 113-27, but the S.L. 2011-276 additions are:

> Unless the context otherwise requires, the words defined in this section shall have the following meaning when found in this law:
>
> (7a) "Oil and gas developer or operator" or "developer or operator" shall mean a person who acquires a lease for the purpose of conducting exploration for or extracting oil or gas.

(7b) "Oil and gas operations" or "activities" shall mean the exploration for or drilling of an oil and gas well that requires entry upon surface estate and the production operations directly related to the exploration or drilling.
(15) "Surface owner" means the person who holds record title to or has a purchaser's interest in the surface of real property.

3. Your program for **identification**, **inventory and ranking** of abandoned sites. [6.3]
None

4. Any **funding** mechanisms available to the state for abandoned site remediation. [6.4]
None

5. The criteria used in your **abandoned site prioritizing** system. [6.5]
None

6. The state's abandoned site remediation **goals** and how progress is measured. [6.5.1]
None

7. The state's program relating to establishing **liability** for the remediation of abandoned sites. [6.5.2]
None

8. Any **standards for abandoned site remediation**. [6.6]

9. The state's **abandoned well remediation** program, including any flexibility allowed in plugging procedures. [6.6.1]

10. The state's program for **surface remediation** of abandoned sites, including any requirements regarding present or future land use and consultation with surface owners. [6.6.2]

11. The program for **maintenance of records** of remediated sites, including public access. [6.6.3]

Regulatory records are required to be maintained and available for the public under the North Carolina public records law. Oil and Gas files are maintained by the N.C. Geological Survey and are filled by location in file cabinets at the NCGS Field Office and Core Repository. When abandoning a well, a log of the drilling and development of each well is required by G.S. 113-379. G.S. 113-391requires a reasonable bond condition for the performance of the duty to plug each dry or abandoned well. G.S. 113-395, as amended by S.L. 2011-276, requires notice that the well is to be abandoned and requires a $450 fee.

12. Any **public participation** activities associated with the abandoned sites program, including public access to information, public participation in rulemaking

associated with the program, and participation regarding the priority of sites on the inventory and level of remediation. [6.7]

V. NATURALLY OCCURRING RADIOACTIVE MATERIAL

1. Any activities the state has undertaken to determine the **occurrence and need for regulation** of NORM. [7.2]

Study under H242 will include testing for NORM.

2. Any **program elements** applicable to the NORM regulatory program, including:
   a. Definitions. [7.3.1]
   b. Action levels. [7.3.2]
   c. Surveys. [7.3.3]
   d. Worker protection. [7.3.4]
   e. Licensing/permitting. [7.3.5]
   f. Removal/remediation standards. [7.3.6]
   g. Storage. [7.3.7]
   h. Transfer for continued use. [7.3.8]
   i. Release of sites, materials and equipment. [7.3.9]
   j. Disposal. [7.3.10]
   k. Interagency coordination. [7.3.11]
   l. Public participation. [7.3.12]

The Radiation Protection Section of the Division of Public Health in the Department of Health and Human Services does not regulate NORMs. Existing state laws do not allow RPS to regulate NORMs unless the radioactivity exceeds an action level. The action level differs for each radioactive element. Should the NORMs be concentrated by natural means above the action level, shielding to protect persons from accidentally exposing themselves would be required. Should NORMs be concentrated by mechanical or chemical means above the action level, that process of concentration would require a permit from RPS.

VI. STORMWATER MANAGEMENT

1. Any state program for the **management of storm water** and the basis for its development. [8.1]

North Carolina implements the following state programs for stormwater management:

- The federal NPDES Phase I permitting program for stormwater discharges from industrial activities.
- The federal NPDES Phase I permitting program for stormwater discharges from construction activities.
- The federal NPDES Phase I and Phase II stormwater permitting programs for local governments operating MS4s.
- A state post-construction stormwater permitting program for new development

not captured by the NPDES Phase II program but within certain areas.

- A state stormwater management permitting program for new development in the 20 coastal counties and especially protected waters including Outstanding Resource Waters and High Quality Waters (under S.L. 2008-211).
- State rules for the protection of Nutrient Sensitive Waters are applicable to several river basins and large reservoirs in the state and establish protective restrictions on stormwater discharges to be implemented by local jurisdictions.
- A state program supporting the protection of Water Supply Watersheds that includes some elements for stormwater management. Implemented by local governments; audited by DWQ
- Stormwater requirements are frequently included in the state 401 certification for the protection of wetlands.

The state stormwater program is implemented under G.S. 143-214.7 to regulate site development and post-construction stormwater runoff control. Stormwater Management rules in 15A NCAC 2H .1000 have been adopted in order to implement the state program. Areas subject to these permit programs include all 20 coastal counties, and various other counties and watersheds (such as water supply watersheds, high quality waters, and outstanding resource waters) throughout the state. While the state program does not specifically refer to hydrocarbon exploration and production, certain provisions may apply when these operations are located in the areas subject to the state program. The state has authority to require corrective action for conditions causing violations of a water quality standard even if the activity is not covered by an existing program; however, this authority can only be used after standard violation has occurred.

Under Session Law 2006-246, the Phase II program builds upon the existing Phase I program by requiring certain smaller communities (<100,000) and public entities that own and operate a municipal separate storm sewer system (MS4) to apply and obtain an NPDES permit for stormwater discharges. Certain urbanized areas of counties are also regulated by this law. The session law defines the communities that are required to obtain a Phase II permit, the process for including new communities, and the general requirements for compliance with a Phase II permit. Each community that is subject to Phase I and Phase II is required to meet the following six minimum measures:

- Public education and outreach on stormwater impacts.
- Public involvement/participation.
- Illicit discharge detection and elimination.
- Construction site stormwater runoff control.
- Post-construction stormwater management in new development and redevelopment.
- Pollution prevention/good housekeeping for municipal operations.

In addition to the state program, Section 401 of the Clean Water Act delegates authority to the states to issue a 401 Water Quality Certification for all projects that require a Federal Section 404 Permit due to impacts to wetlands or waters of the State. A 401 Water Quality Certification is also required to impact isolated wetlands, which are not covered under Section 404. The 401 Certification is verification by the Division of Water

Quality that a given project will not degrade waters of the State or otherwise violate water quality standards. The rules for issuance of a 401 certification are found in 15A NCAC 02H .0500. These rules and the stormwater requirements associated with receiving a 401 Certification can be found on the Division of Water Quality's web site at: http://portal.ncdenr.org/web/wq/swp/ws/401.

2. Any state regulatory **program mechanisms** for storm water management or erosion control such as permits/authorizations, compliance evaluation, outreach and training, and program evaluation. [8.2]

Erosion and sedimentation control permits, as described on pages 10 and 11. North Carolina has adopted requirements for stormwater permits for new development in 15A NCAC 2H.1000. In addition, as mentioned above, each MS4 that is subject to Phase I and Phase II is required to meet the following six minimum measures:

a. Public education and outreach on stormwater impacts.
b. Public involvement/participation.
c. Illicit discharge detection and elimination.
d. Construction site stormwater runoff control.
e. Post-construction stormwater management in new development and redevelopment.
f. Pollution prevention/good housekeeping for municipal operations.

3. Any regulatory **program criteria**, including:

a. Planning requirements with respect to site development. [8.3.1]
b. Construction standards or management practices appropriate for the area. [8.3.2]
c. Operation and maintenance measures to control sediment until the site is restored. [8.3.3]
d. Restoration and reclamation standards. [8.3.4]

The erosion & sedimentation control design manual addresses all of these.

Under Session Law 2006-246, Phase II local governments are required to implement stormwater planning requirements for site development, construction standards and best management practices, and post-construction stormwater management measures. Requirements within the 20 coastal counties are described in S.L. 2008-211.

All surface waters in North Carolina are classified as to best use. Some classifications are especially protected, and there are restrictions on development in the contributing watersheds and/or restrictions as to permissible stormwater or wastewater pollutant discharges. Discharges may be restricted based on classifications: Outstanding Resource Waters, High Quality Waters, Trout Waters, Water Supply I – V, Critical Area, Shellfishing Waters, Nutrient Sensitive Waters, and zero-flow streams.

In addition to broad restrictions based on classification, some few waters in North Carolina have special management strategies in place that may limit allowable stormwater or wastewater discharges. Special management strategies are tabulated in North Carolina regulations at 15A NCAC 2B .0200.

In addition, stream segments with threatened or endangered species, both on the federal list and the North Carolina list, may be subject to additional constraints on discharges.

VII. HYDRAULIC FRACTURING

1. Has the state evaluated potential **risks associated with hydraulic fracturing**, taking into account factors such as depth of the reservoir to be fractured, proximity of the reservoir to fresh water resources, well completion practices, well design, and volume and nature of fluids? [9.2]

No. A study is currently underway.

2. Has the state developed **standards to prevent the contamination** of groundwater and surface water from hydraulic fracturing? [9.2]

Injection well rules currently prohibit injection pressures from initiating or propagating fractures.

3. Describe how state standards for **casing and cementing** meet anticipated pressures associated with hydraulic fracturing to protect other resources and the environment. [9.2.1]

Current casing & cementing standards were not developed with hydraulic fracturing in mind.

4. Discuss how the program identifies and, where deemed appropriate, manages risks associated with **potential conduits for fluid migration** in the area of hydraulic fracturing. [9.2.1]

N/A – all hydraulic fracturing is currently prohibited.

5. Describe program requirements that address actions to be taken in **response to unanticipated operational or mechanical changes** encountered during hydraulic fracturing that may cause concern. [9.2.1]

N/A – all hydraulic fracturing is currently prohibited.

6. Briefly describe how **surface controls** associated with hydraulic fracturing, such as dikes, pits or tanks, meet Sections 5.5 and 5.9 of the guidelines. [9.2.1]

The master drilling permit application requires a site plan, drilling plan, drilling specification, and the location and size of proposed mud pits. The DLR in coordination with Waste Management, Water Quality, Air Quality and other federal agencies would put binding conditions on the drilling permit to address pits and tanks. That permit regulates mud pits. Conditions on the size, volume, lining, security, potential offsite disposal, chemical content, testing requirement of the pit contents and abandonment of pits and tanks are part of the drilling permit. In law, drilling cannot start until the pits and tanks have been installed to the satisfaction of the regulatory agency.

7. Briefly describe how **contingency planning and spill risk management** procedures related to hydraulic fracturing meet Section 4.2.1 of the guidelines. [9.2.1]

N/A

8. Briefly discuss how hydraulic fracturing **waste characterization requirements**, including, as appropriate, testing of fracturing fluids, are consistent with Section 5.2 of the guidelines. [9.2.1]

N/A

9. Briefly describe how the **waste management hierarchy** contained in Section 5.3 of the guidelines (source reduction, recycling, treatment and disposal), including the provisions relating to toxicity reduction, are promoted for hydraulic fracturing. [9.2.1]

N/A

10. Briefly describe how the **tracking of hydraulic fracturing waste** disposed at commercial or centralized facilities meets the requirements of Section 5.10.2.3 of the guidelines. [9.2.1]

N/A

11. Briefly describe how procedures in place for receipt of **complaints** related to hydraulic fracturing are consistent with Section 4.1.2.1 of the guidelines. [9.2.1]

N/A

12. Describe any required **notification** prior to, and reporting after completion of hydraulic fracturing operations. [9.2.2]

N/A

13. Is notification sufficient to allow the **presence of field staff** to monitor hydraulic fracturing activities? [9.2.2]

N/A

14. Describe **reporting requirements** for hydraulic fracturing activities and whether they include the identification of materials used, aggregate volumes of fracturing fluids and proppant used, and fracture pressures recorded. [9.2.2]

N/A

15. Describe any mechanisms for **disclosure of information on chemical constituents** used in hydraulic fracturing fluids to the state in the event of an investigation or to medical personnel in the event of a medical emergency. [9.2.2]

N/A

16. Briefly describe how hydraulic fracturing information submitted that is of **a confidential business nature**, is treated consistent with Section 4.2.2 of the guidelines. [9.2.2]

Not currently applicable, but G.S. 132-1.2 specifies the characteristics of information that is not subject to public disclosure.

17. Briefly discuss if, in addition to the personnel and funding recommendations found in Section 4.3 of the guidelines, **state staffing levels** sufficient to receive, record and respond to complaints of human health impacts and environmental damage resulting from hydraulic fracturing. [9.2.3]

N/A

18. Describe staff **training** to stay current with new and developing hydraulic fracturing technology. [9.2.3]

None

19. Briefly describe how the state agency provides for **dissemination of educational information** regarding well construction and hydraulic fracturing to bridge the knowledge gap between experts and the public as provided in Section 4.2.2.2 of the guidelines. This is especially important in areas where development has not occurred historically and in areas where high volume water use for hydraulic fracturing is occurring. [9.2.4]

None

20. Fundamental differences exist from state to state, and between regions within a state, in terms of geology and hydrology. Describe how the state evaluated and addressed, where necessary, the **availability of water for hydraulic fracturing** in the context of all competing uses and potential environmental impacts resulting from the volume of water used for hydraulic fracturing. [9.3]

Under review; to be determined by DWR as part of required study under H242.

21. Describe how the availability and use of alternative water sources for hydraulic fracturing, including recycled water, is encouraged. [9.3]

N/A

22. Briefly describe how **waste** associated with hydraulic fracturing is managed consistent with Section 4.1.1 and Section 7 of the guidelines. [9.3]

N/A

23. Discuss how the state encourages the efficient development of adequate **capacity and infrastructure** for the management of hydraulic fracturing fluids, including the transportation, recycling, treatment and disposal of source water and hydraulic fracturing wastes. [9.3]

13308 N. MacArthur Blvd, Oklahoma City, OK 73142 phone: 405.516.4972 fax: 405.516.4973
www.strongerinc.org

F. Appendix F: Session Law 2011-276

GENERAL ASSEMBLY OF NORTH CAROLINA
SESSION 2011

SESSION LAW 2011-276
HOUSE BILL 242

AN ACT TO (1) INCREASE THE AMOUNT OF THE BOND REQUIRED UPON REGISTRATION IN ORDER TO DRILL FOR OIL OR NATURAL GAS IN THE STATE; (2) INCREASE THE AMOUNT OF FEES APPLICABLE TO DRILLING AND ABANDONING OIL OR GAS WELLS; (3) ESTABLISH PROVISIONS FOR THE PROTECTION OF LANDOWNERS RELATIVE TO LEASES FOR OIL AND GAS EXPLORATION; (4) DIRECT THE DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES TO STUDY THE ISSUE OF OIL AND GAS EXPLORATION IN THE STATE, AND SPECIFICALLY THE USE OF DIRECTIONAL AND HORIZONTAL DRILLING AND HYDRAULIC FRACTURING FOR THAT PURPOSE; AND (5) DIRECT THE DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES TO CONDUCT AT LEAST TWO PUBLIC HEARINGS ON THE ISSUE IN THE AREA IN WHICH EXPLORATION FOR NATURAL GAS BY MEANS OF DIRECTIONAL AND HORIZONTAL DRILLING AND HYDRAULIC FRACTURING MAY OCCUR.

The General Assembly of North Carolina enacts:

SECTION 1. G.S. 113-378 reads as rewritten:

"**§ 113-378. Persons drilling for oil or gas to register and furnish bond.**

Any person, firm or corporation before making any drilling exploration in this State for oil or natural gas shall register with the Department of Environment and Natural ~~Resources or such other State agency as may hereafter be established to control the conservation of oil or gas in this State.~~Resources. To provide for such registration, the drilling operator must furnish the name and address of such person, firm or corporation, and the location of the proposed drilling operations, and file with the ~~aforesaid~~ Department a bond in ~~the~~ an amount totaling the sum of~~of~~ (i) five thousand dollars ($5,000) plus (ii) one dollar ($1.00) per linear foot proposed to be drilled for the well. ~~($5,000) running to the State of North Carolina, conditioned that any~~ Any well opened by the drilling operator ~~upon abandonment~~ shall be plugged upon abandonment in accordance with the rules of ~~said~~ the Department."

SECTION 2. G.S. 113-395 reads as rewritten:

"**§ 113-395. Notice and payment of fee to Department before drilling or abandoning well; plugging abandoned well.**

Before any well, in search of oil or gas, shall be drilled, the person desiring to drill the same shall notify the Department upon such form as it may prescribe and shall pay a fee of ~~fifty~~ three thousand dollars ~~($50.00)~~($3,000) for each well. The drilling of any well is hereby prohibited until such notice is given and such fee has been paid and permit granted.

Each abandoned well and each dry hole ~~promptly~~ shall be plugged promptly in the manner and within the time required by rules ~~to be~~ prescribed by the Department, and the owner of such well shall give notice, upon such form as the Department may prescribe, of the abandonment of each dry hole and of the owner's intention to abandon, and shall pay a fee of ~~fifteen~~ four hundred fifty dollars ~~($15.00)~~($450.00). No well shall be abandoned until such notice has been given and such fee has been paid."

SECTION 3.(a) G.S. 113-389 reads as rewritten:

"**§ 113-389. Definitions.**

Unless the context otherwise requires, the words defined in this section shall have the following meaning when found in this law:

…

(7a) "Oil and gas developer or operator" or "developer or operator" shall mean a person who acquires a lease for the purpose of conducting exploration for or extracting oil or gas.

(7b) "Oil and gas operations" or "activities" shall mean the exploration for or drilling of an oil and gas well that requires entry upon surface estate and the production operations directly related to the exploration or drilling.

…

(15) "Surface owner" means the person who holds record title to or has a purchaser's interest in the surface of real property.

…."

SECTION 3.(b) Article 27 of Chapter 113 of the General Statutes is amended by adding a new Part to read:

"Part 3. Landowner Protection.

"**§ 113-420. Notice and entry to property.**

(a) If an oil and gas developer or operator is not the surface owner of the property on which oil and gas operations are to occur, before entering the property for oil and gas operations that do not disturb the surface, including inspections, staking, surveys, measurements, and general evaluation of proposed routes and sites for oil and gas drilling operations, the developer or operator shall give written notice to the surface owner at least seven days before the desired date of entry to the property. Notice shall be given by certified mail, return receipt requested. The requirements of this subsection may not be waived by agreement of the parties. The notice, at a minimum, shall include all of the following:

(1) The identity of person(s) requesting entry upon the property.

(2) The purpose for entry on the property.

(3) The dates, times, and location on which entry to the property will occur, including the estimated number of entries.

(b) If an oil and gas developer or operator is not the surface owner of the property on which oil and gas operations are to occur, before entering the property for oil and gas operations that disturb the surface, the developer or operator shall give written notice to the surface owner at least 14 days before the desired date of entry to the property. Notice shall be given by certified mail, return receipt requested. The notice, at a minimum, shall include all of the following:

(1) A description of the exploration or development plan, including, but not limited to (i) the proposed locations of any roads, drill pads, pipeline routes, and other alterations to the surface estate and (ii) the proposed date on or after which the proposed alterations will begin.

(2) An offer of the oil and gas developer or operator to consult with the surface owner to review and discuss the location of the proposed alterations.

(3) The name, address, telephone number, and title of a contact person employed by or representing the oil or gas developer or operator who the surface owner may contact following the receipt of notice concerning the location of the proposed alterations.

(c) If the oil and gas developer or operator fails to give notice as provided in this section, the surface owner may seek appropriate relief in the superior court for the county in which the oil or gas well is located and may receive actual damages.

"**§ 113-421. Compensation for damages.**

(a) The oil and gas developer or operator shall be obligated to pay the surface owner compensation for all of the following:

(1) Any damage to a water supply in use prior to the commencement of the activities of the developer or operator which is due to those activities.

(2) The cost of repair of personal property of the surface owner, which personal property is damaged due to activities of the developer or operator, up to the value of replacement by personal property of like age, wear, and quality.

(b) When compensation is required, the surface owner shall have the option of accepting a one-time payment or annual payments for a period of time not less than 10 years.

(c) The surface owner has the right to seek damages pursuant to this section in the superior court for the county in which the oil or gas well is located. The superior court for the county in which the oil or gas well is located has jurisdiction over all proceedings brought pursuant to this section. If the surface owner or the surface owner's assignee is the prevailing

party in an action to recover unpaid royalties, the court shall award any court costs and reasonable attorneys' fees to the surface owner or the surface owner's assignee.

(d) Conditions precedent, notice provisions, or arbitration clauses included in lease documents that have the effect of limiting access to the superior court in the county in which the oil or gas well is located are void and unenforceable.

"**§ 113-422. Indemnification.**

An oil or gas developer or operator shall indemnify a surface owner for damage to property that is adjacent to property on which drilling occurs, as well as adjacent infrastructure, and wells.

"**§ 113-423. Maximum lease terms.**

Any lease of oil or gas rights or any other conveyance of any kind separating rights to oil or gas from the freehold estate of surface property shall expire at the end of 10 years from the date the lease is executed, unless, at the end of the 10-year period, oil or gas is being produced for commercial purposes from the land to which the lease applies. If, at any time after the 10-year period, commercial production of oil or gas is terminated for a period of six months or more, all rights to the oil or gas shall revert to the surface owner of the property to which the lease pertains. No assignment or agreement to waive the provisions of this subsection shall be valid or enforceable. As used in this subsection, the term "production" includes the actual production of oil or gas by a lessee, or when activities are being conducted by the lessee for injection, withdrawal, storage, or disposal of water, gas, or other fluids, or when rentals or royalties are being paid by the lessee.

"**§ 113-424. Applicability; effect.**

This Part applies to leases or contracts, and amendments to leases or contracts, entered into on or after June 15, 2011."

SECTION 4. The Department of Environment and Natural Resources, the Department of Commerce as specifically directed by subdivision (5) of this section, and the Consumer Protection Division of the Department of Justice as specifically directed by subdivision (8) of this section shall study the issue of oil and gas exploration in the State and the use of directional and horizontal drilling and hydraulic fracturing for that purpose. The Department of Environment and Natural Resources, in conjunction with the Department of Commerce and the Consumer Protection Division of the Department of Justice, shall report their findings and recommendations, including specific legislative proposals, to the Environmental Review Commission no later than May 1, 2012. At a minimum, the study shall include information on the following:

(1) Oil and gas resources present in the Triassic Basins and in any other areas of the State.

(2) Methods of exploration and extraction of oil and gas, including directional and horizontal drilling and hydraulic fracturing.

(3) Potential impacts on infrastructure, including roads, pipelines, and water and wastewater services. In analyzing potential impacts, the Department shall specifically examine the expected water usage from hydraulic fracturing, water resources in the area in which drilling may occur, as well as existing water users in the area that may be impacted by increased consumption of water for use in hydraulic fracturing.

(4) Potential environmental impacts, including constituents or contaminants that may be present in the fluid used in the hydraulic fracturing process; the potential for the contamination of nearby wells and groundwater, as well as the options for disposal and reuse of the wastewater produced; stormwater management; the potential for emission of toxic air pollutants; impacts on wildlife; management and reclamation of drilling sites, including orphaned sites; management of naturally occurring radioactive materials (NORM) generated by the drilling and production of natural gas; and the potential for seismic activity in the area in which drilling may occur. In examining this issue, the Department shall formulate regulatory requirements advisable to address potential environmental impacts and in doing so shall gather information on regulatory programs in other states where oil and gas exploration or extraction is occurring, particularly with regard to the use of hydraulic fracturing for that purpose.

(5) Potential economic impacts, including possible sources of revenue that could accrue to the benefit of the State in the event that drilling for oil or natural gas were to take place in the State. In examining this issue, the Department of Commerce, in consultation with the Department of Environment and Natural Resources, shall gather information on (i) the number of jobs that may be expected as a result from drilling activities in the State and (ii) what severance taxes, fees, royalties, bonds, or assessments may be appropriate in connection with the activity. For any sources of revenue that may be anticipated, the Department of Commerce, in consultation with the Department of Environment and Natural Resources, shall evaluate use of the revenue for the following purposes: funds necessary to implement an oil and gas regulatory program; funds dedicated to the conservation and preservation of land and water resources; funds dedicated to remediation of environmental contamination such as the Inactive Hazardous Sites Cleanup Fund; and funds dedicated to improving water and wastewater infrastructure across the State.

(6) Potential social impacts, including impacts of drilling operations on nearby communities and quality of life within those communities, recreational activities, and commercial and residential development.

(7) Potential oversight and administrative issues associated with an oil and gas regulatory program, including statutory authority necessary for implementation of such a program; funding requirements necessary to implement a stable and effective program; criteria for permit issuance or denial; frequency and scope of inspections; compliance and enforcement procedures; coordination of agency involvement to ensure efficient permitting and clear delineation of compliance responsibilities; opportunities for public participation; and data management.

(8) Consumer protection and legal issues relevant to oil and gas exploration in the State, including matters of contract and property law, mineral leases, and landowner rights. In examining these issues, the Consumer Protection Division of the Department of Justice, in consultation with the Department of Environment and Natural Resources, shall specifically examine appropriate provisions on recommended disclosures to landowners, compensation for damages, payment of royalties, and remedies for breach, and any other matters the Division deems relevant. The Division shall also study such issues in consultation with the Rural Advancement Foundation International (RAFI).

(9) Any other pertinent issues that the Department deems relevant to oil and gas exploration in the State and the use of hydraulic fracturing for that purpose.

SECTION 5. By February 1, 2012, the Department of Environment and Natural Resources shall hold at least two public hearings at separate locations within the Triassic Basin on the issue of drilling for natural gas by means of directional and horizontal drilling and hydraulic fracturing. The public hearings shall be conducted in order to promote awareness of the issue generally and inform and consult with the public and user groups on potential environmental impacts, potential regulatory controls, potential economic impacts, and consumer protection issues, including landowner rights and mineral leases. In developing the consumer protection portion of the public hearings, the Department shall consult with the Consumer Protection Division of the North Carolina Department of Justice and the Rural Advancement Foundation International (RAFI).

SECTION 6. In order to avoid redundancy and to make the most efficient use of State resources, the Department of Environment and Natural Resources and the Energy Jobs Council shall, to the maximum extent practicable, conduct the study required by Section 4 of this act in conjunction with the study required by Section 3(a) of Senate Bill 709, 2011 Regular Session, if Senate Bill 709 becomes law. The result of these consolidated studies, if applicable, shall result in one final report from the Department.

SECTION 7. This act is effective when it becomes law.

In the General Assembly read three times and ratified this the 17th day of June, 2011.

s/ Walter H. Dalton
President of the Senate

s/ Thom Tillis
Speaker of the House of Representatives

s/ Beverly E. Perdue
Governor

Approved 5:16 p.m. this 23rd day of June, 2011

G. Appendix G: Summary of Public Comments

This section summarizes public comments received on the draft version of this report at one of the three public meetings held on March 20, March 27 and April 2, 2012, or submitted via email or U.S. mail to DENR. Comments are organized by subject matter below. Where appropriate, a response to the comment or a description of how the comment was incorporated into the final version of the report is included.

General comments

1. The majority of people (more than 450 individuals and organizations) who spoke at the public meetings or submitted comments on the draft report are opposed to the development of natural gas extraction using horizontal drilling and hydraulic fracturing in North Carolina. Many who commented on the draft report feel that the benefits of shale gas extraction using horizontal drilling and hydraulic fracturing do not outweigh the risks. Commentators were concerned that these activities are unsafe, that our drinking water supplies will be contaminated, that our water resources will be depleted, that the accidents evidenced by this industry in other states will be repeated in North Carolina, that public health will be threatened, and that North Carolina cannot adopt regulations and provide enforcement activities sufficient to prevent damage to the environment and human health.

   One individual wrote, “Most important is our precious water, which we cannot live without. I rely on well water and I am terrified of the risk to my property, [and the] opportunity to sell my property in the future, should nearby contamination from fracking scare potential Chatham County residents away, leaving me with damaged goods for which I have worked and saved to afford, all my working life.”

   Another individual wrote, “Since the 1980s, North Carolina has protected our groundwater as a future drinking water resource, prohibiting the injection of pollutants into groundwater…Few other states have made our policy choice, and clean groundwater is becoming increasingly rare across the nation. Allowing fracking would require weakening the state laws that currently protect groundwater – both to allow injection of fracking fluids in gas wells, and to allow the disposal of used fluid in deep injection wells. Both of those changes are a betrayal of North Carolina’s proud tradition of protecting groundwater, and economically short-sighted, as the groundwater resource, once polluted, is effectively lost permanently.”

   One individual wrote, “I oppose Fracking in North Carolina…I do not trust the legislature which seems to want to create more jobs and income for NC than care for the health of our ecology and people.” Another wrote, “The risks listed in the draft report on shale gas extraction in NC clearly outweigh the small potential benefits that the people and state of North Carolina would see. North Carolinians need jobs but shale gas extraction would provide very few opportunities for them.

2. Many people (more than 175 individuals and organizations) spoke at the public meetings or wrote in during the public comment period to express support for the development of oil and natural gas resources in North Carolina because of the economic benefits. The North Carolina National Federation of Independent Business wrote, "By opening our state up to hydraulic fracturing we will see more jobs and higher incomes for North Carolinians, and that is good for small business." The Southeast Energy Alliance wrote that their organization "strongly believes that shale gas production utilizing horizontal drilling and hydraulic fracturing can proceed safely." The North Carolina Chamber wrote, "We can lead the nation in an 'all of the above' energy strategy that creates jobs, greater energy independence and increased revenue for our state. AND we can go about it in the right way, with protective measures and tough standards that safeguard our quality of life values." Piedmont Natural Gas wrote, "Piedmont believes that the benefits of developing the abundant and clean natural gas energy resources in North Carolina can and should be realized." Piedmont Natural Gas also notes, "Consumers benefit enormously from the tremendous growth of this new natural gas supply source, which has made natural gas prices reliably low and stable [and] benefits the environment through lower emissions of carbon dioxide, nitrogen oxide and sulfur dioxide."

   Others wrote, "The economic benefits such drilling would bring to the state will be immense, and with the right safeguards there will be no negative environmental impact on North Carolina…As we see in other states with shale gas drilling, there is significant job creation from the natural gas industry and many businesses in the drilling area, such as restaurants and hotels, see their business grow substantially."

3. More than 75 people expressed interest in the pursuit of renewable sources of energy in place of shale gas. One individual wrote, "we can create the same amount of jobs and a MUCH cleaner form of energy if we pursue truly renewable energy sources such as wind or solar, and these jobs will last forever, as opposed to the fracking jobs which will disappear as soon as the gas is gone."

4. More than 50 individuals and organizations wrote in support of a "go slow" approach, encouraging the General Assembly to hold off on legislation that would enable horizontal drilling and hydraulic fracturing until further research is completed. The Orange County Department of Environment, Agriculture, Parks & Recreation cautioned that North Carolina should not rush to begin oil and gas exploration and development because of "the current price of natural gas and the abundant resources that are known to exist in the United States." The City and County of Durham Environmental Affairs Board expressed support for recommendations 4, 7, 11 and 12 in the draft report while recommending a "thoughtful and deliberate approach be taken regarding hydraulic fracturing processes in North Carolina."

   Similarly, the Orange Water and Sewer Authority (OWASA), Sierra Club Capital Group and many others noted that the EPA's study of the potential effects of hydraulic fracturing on drinking water resources will not be released until 2014. NCCN writes that it makes sense to postpone legalization of hydraulic fracturing or creation of a

regulatory program at least until the USGS' study of the Triassic Basin shale gas resources is released.

One individual wrote, "Really, the safest, most conservative approach is to move slowly on this issue. It would be a mistake to move quickly to approve a process that is so poorly understood." The T. Gilbert Pearson Chapter of the National Audubon Society states, "we believe that the time allotted for preparation and completion of this Shale Gas Study has been grossly inadequate. We therefore respectfully ask that the May 2012 deadline be extended significantly in order to allow for a thorough study to occur."

RESPONSE: DENR agrees that more time would have allowed us to collect more information and incorporate information from as-yet-unpublished sources, including the EPA reports. DENR felt an obligation to provide as much information as possible to both the public and the General Assembly by the May 1, 2012, deadline so that decisions could be informed by the information that is available.

Conclusion of the report

5. Nearly 300 individuals and organizations have commented on the conclusion of the report and feel that, in the words of North Carolina Conservation Network, "the body of the study contradicts the claim that shale gas extraction can be conducted safely if adequate regulation is in place." The draft study "clearly states that significant research and investigation must be undertaken before a full understanding can be achieved of the unique set of risks that fracking would pose to North Carolina." Food & Water Watch states, "Precisely because of these fundamental open questions about the potential impact fracking would have on North Carolina, Food & Water Watch maintains that the leading conclusion of the draft study – that 'DENR believes that hydraulic fracturing can be done safely as long as the right protections are in place' – is problematic."

   Food & Water Watch goes on to say, "Despite the draft study's clearly stated limitations and despite the open questions it raises, proponents of fracking have taken the leading conclusion of the draft study out of context, using it to misrepresent the overall findings of the draft study as endorsing of the oil and gas industry's effort to reverse North Carolina's current ban on fracking." Food & Water Watch recommends that DENR "offer a lead conclusion that does justice to the thrust of its findings."

   A joint letter from Southern Environmental Law Center, Sierra Club and Environment North Carolina notes that the list of recommendations DENR proposed in the draft study "represents a significant number of detail-filled tasks which are interdependent and whose outcome is uncertain." The authors write that because of the study's limitations and because "entire programs must be created or overhauled to deal with fracking, it is not possible to say that the state can safely regulate fracking." Orange County offered similar comments, writing, "it is probably not reasonable to pronounce fracking as 'safe' if we do not yet know the regulatory environment that will ultimately govern this activity." The North Carolina Conservation Network advises DENR to "avoid projecting false confidence in the power of regulation to make shale gas extraction safe."

Many who wrote comments about the draft report felt the right protections for shale gas extraction do not exist because no other state has safely regulated the industry. Some said that no state can adequately regulate shale gas industry until the federal exemptions from are revoked and suggest that North Carolina should not moved forward until Congress overturns these.

RESPONSE: The first sentence of the draft report's conclusion has received a great deal of attention and has not been interpreted exactly as we intended. DENR did not mean to imply that shale gas extraction can be done safely in North Carolina at the current time, since a regulatory program has not been developed. Instead, the intent of the statement was to say that the information gathered in our research did not suggest that the process of hydraulic fracturing is impossible to conduct in a manner that is protective of the environment and public health. The report very clearly stated, however, that the ability to achieve that result is dependent on adequate environmental protection standards and a well-developed regulatory program. The report also clearly noted that those elements do not currently exist in North Carolina. We have revised this sentence in the final version of the report to more accurately reflect this concept.

Shale gas resource

6. Some people commented that the 160-acre well spacing used in the report as a basis for the analysis of potential impacts was flawed. One person wrote, "The 160-acre spacing is a good beginning estimate for initial development, but individual well production rates and economics will probably play a key role in determining well-spacing requirements." Another individual wrote, "what I have heard is that DENR is suggesting a well located every 160 acres!!!! Holy Cow! Where did that come from?"

   RESPONSE: The 160-acre well spacing was only an estimate used for the purposes of assessing potential impacts. This number was chosen based on research that showed 160-acre well spacing is common in some other states. This figure was not intended to be used as a recommended well spacing unit for North Carolina, nor as a prediction of what is likely to occur in North Carolina based on economic or other considerations. Determining recommended well spacing units would require additional work, and would be done as part of the development of a regulatory program.

7. One individual asked why only the two wells drilled in the late 1990s were used to develop an estimate of technically recoverable gas when 126 wells have been drilled in North Carolina before 1998. She comments that the 126 unproductive wells are underrepresented in the report, "as they show that the vast majority of exploratory wells did not produce commercial quantities of methane."

   RESPONSE: The 120 wells drilled before 1974 were drilled in exploration of conventional oil and gas resources in the Coastal Plain. After 1974, exploration turned to the Sanford sub-basin, where eight wells were drilled looking for unconventional or continuous natural gas. Since these early wells were not drilled in exploration of commercial quantities of methane, the fact that the wells never produced should not be taken as an

indication that commercial quantities of methane did not exist in those locations. Of the eight wells drilled after 1974 in search of unconventional natural gas, petrophysical reports are only available for two. This data is necessary to estimate productivity.

8. As the North Carolina Conservation Network (NCCN) notes, the DENR study uses a back-of-the-envelope calculation to estimate how gas might ultimately be recovered in North Carolina, and the draft study "is not explicit about the basis for the estimated ultimate recovery (EUR) it assigns to the two wells." NCCN calls upon DENR to articulate the rationale for the 4.2 Bcf estimate.

   RESPONSE: Additional detail on the rationale for this estimate has been added to the report in Section 1.C.

9. The City of Durham Joint City-County Planning Committee wrote, "The JCCPC is concerned that there is limited or no data, and the study contains no analysis, of the oil and gas resource in the Durham sub-basin."

   RESPONSE: At this time there is no data available for the Durham sub-basin. DENR has recommended that additional study be conducted to gather seismic reflection data for the Triassic Basins.

10. NCCN says that DENR's "estimate of 368 wells is wildly optimistic. In other shale gas plays, drillers have consistently found that most wells are losers. Only a few hotspots within a basin pay off, and it is impossible to tell where until wells are drilled. This makes a small play particularly risky, and will deter companies with any better options elsewhere."

    RESPONSE: We agree with this comment. The estimate of 368 wells represents the absolute maximum number of wells that could be supported in the Sanford sub-basin. It does not take into consideration local conditions (natural and man-made) that would make drilling infeasible in some areas of the sub-basin. We used this estimate to analyze the potential impacts of shale gas extraction in the area because we did not have sufficiently detailed information to refine the number further. We also did not want to downplay either the potential economic benefits or the environmental impacts by underestimating the number of wells.

Geology

11. Several people expressed concerns about the relationship between hydraulic fracturing and earthquakes. For example, BREDL recommends that "Before the Study is finalized, potential effects from fracking induced seismic activity must be analyzed including causing possible emergencies at Shearin-Harris" [*sic*].

    RESPONSE: The section of the report discussing the potential for increased seismic activity has been revised to include more recent information (see Section 2.F). Initial research on this issue indicates that earthquakes may have been induced in the Midwest United States by the underground injection of wastewater produced from

hydraulic fracturing processes. Research does not indicate that hydraulic fracturing itself has triggered large earthquakes. DENR has recommended that the General Assembly prohibit underground injection of wastewater.

12. Several commentators were concerned about the vertical movement of water between horizontal rock layers and requested scientific evidence that hydraulic fracturing fluids could not migrate upwards through diabase dikes. SELC, North Carolina Sierra Club and Environment North Carolina want DENR to "Conduct thorough analyses regarding the geology of the Triassic Basin, including a detailed fracture and fault study as well as an analysis of the effect of diabase dikes on migration of fracking fluids."

    RESPONSE: The report has been revised to include more explicit reference to the risks of vertical geological structures such as dikes and faults. DENR is also recommending additional study of groundwater in the Triassic Basins and thorough hydrogeological characterization prior to permitting any hydraulic fracturing.

13. A few peopled asked about the potential for natural gas extraction activities to cause an increase in explosive levels of gas that could lead to explosions in barns, homes or other structures.

    RESPONSE: There has been no history of explosions and fires at buildings due to the concentration of stray natural gas in the Triassic Basins of North Carolina. Explosive levels of natural gases are naturally occurring in some areas and are not likely to increase with the development of a natural gas industry, unless natural gas wells are not properly abandoned.

14. Some people commented that natural gas exploration and production would be dangerous in this part of the state because mining accidents occurred in this area in the early 1900s.

    RESPONSE: There are several historic incidents of underground gas explosions in coal mines in North Carolina. Natural gas is a routine hazard in underground coal mines and explosions are still causing mining disasters today. The presence of shale gas may have made it more difficult for miners during the early 20th century to keep the mine well ventilated. The mines have long since closed and the mine entrances have been filled-in and sealed. It is likely that oil and gas exploration would seek to avoid drilling into underground mines. Information on the location and extent of the abandoned mines is available from the N.C. Division of Land Resources.

Water supply impacts

15. Some people commented that if the groundwater is allowed for use in hydraulic fracturing then groundwater levels should be monitored closely in those areas.

    RESPONSE: DENR agrees, and references to this have been added to the revised report. In addition, the recommendation for baseline data collection has been modified to add monitoring of groundwater levels as another parameter.

16. One person commented, "The population projections for Chatham County do not appear to include the development of the 8,000 acres owned by Preston Development. Preliminary estimates project up to 50,000 people in this development. This needs to be factored in."

    RESPONSE: The forecasts of populations to be served by local water utilities are provided by the local water utilities. Some residential developments placed on the outskirts of existing water systems may be supplied by privately-operated groundwater-based community water systems. To the extent the potential residents of a Preston Development were factored into the local water supply plan provided by Chatham County to DENR, their water demands are included in the analysis.

17. Several people commented on the water withdrawals for fracking during times of drought. As Orange County notes, "If a drought were to occur in this area, the removal of 3 to 5 million gallons of water per event – (not just per well) – could be profound. This could also be the case if several wells were fracked in mid-summer, which is likely the reason why the draft report also includes some discussion of the importance of the timing of fracking water withdrawals in the Triassic Basin." Another commentator asked, "If fracking is allowed in North Carolina and when we next face a serious drought, will we too [like Texas] have to let citizens, farmers, small businesses and shops and our communities bear full consequences while fracking companies are free to withdraw and intentionally contaminate our dwindling water supplies without restrictions?"

    In a joint letter, American Rivers, Environmental Defense Fund and North Carolina Conservation Network note, "There is nothing in DENR's present ability to register or manage water use that tracks cumulative uses and impacts. Thus, even if all water withdrawals were reported, all were permitted, and all were regulated to prevent withdrawals in excess of 20% of the 7Q10 (three very, very big if's), only six pipes withdrawing only 16% of the 7Q10 would be required to dry the river up during a ten-year low flow. Second, DENR's analysis does not take into account the fact that the greatest demand for agricultural water is during droughts, when water is least available."

    RESPONSE: DENR has recommended that drilling operations be required to operate under an approved water management plan as part of a comprehensive update of North Carolina gas well development regulations. Along with the recommendation to limit withdrawals to 20% of the 7Q10 flow, DENR has modified the recommendation to expressly state that new withdrawals for gas well development should be prohibited during droughts and low flows.

18. The joint letter from American Rivers, Environmental Defense Fund and North Carolina Conservation Network takes issue with DENR's scenario for water use by hydraulic fracturing wells in Section 3 of the draft report, calling it "seriously flawed" and "fanciful" and saying that it "bears no resemblance to the much more probable scenario of little or no development unless and until the price of gas rises significantly in response to developing scarcity in more well-endowed shale plays." Southern

Environmental Law Center, North Carolina Sierra Club and Environment North Carolina want DENR to "Prepare a realistic estimate of the number of wells North Carolina would support, identify water sources for those wells, and evaluate the potential effect on human and environmental uses of existing water supplies."

RESPONSE: There is little evidence to define one development scheme as "more probable" than another at this time. Given the current prohibitions on horizontal drilling and underground injection of wastes, no gas well development will occur in the absence of legislative changes. To provide the required analysis, however, DENR had to use theoretical development scenarios in order to estimate potential water withdrawals and quantify the range of possible impacts if gas wells are developed in North Carolina. As more technical information on the geology and potential productivity of these areas becomes available, water use scenarios can be improved. If gas well development does occur in North Carolina it will be within the context of new policies that have yet to be constructed and which should include specific rules managing water withdrawals and use in the industry.

19. American Rivers, Environmental Defense Fund and North Carolina Conservation Network disagree with the use of 20 percent of the 7Q10 as protective of environmental quality and ecological integrity. They note that the Ecological Flows Scientific Advisory Board has observed that maintaining the 7Q10 as a minimum flow fails to protect most guilds and species from very significant losses of habitat. They note, "If water resources are to be protected in a basin where natural gas exploration and exploitation require hydraulic fracturing, DENR must have a complete inventory of water uses in the basin and must have the authority to balance and periodically rebalance the volume and timing of all of those existing and all proposed new uses." They also recommend replacing the 20 percent of the 7Q10 approach with the safe presumptive standard proposed by Richter et al,[585] which they define as allowing modification of daily flow by no more than 10 percent.

    The U.S. Fish & Wildlife Service (USFWS) comments that the section on water supply "lacks information on the 2010 legislative directive for DENR to develop hydrologic models for each river basin in NC, including the determination of the flows needed to maintain ecological integrity in surface waters." USFWS therefore concludes that limiting withdrawals to 20 percent of the 7Q10 stream flow is "unsubstantiated as DENR has not yet determined if this threshold provides adequate flows to maintain ecological integrity."

    RESPONSE: DENR thanks the commenters for identifying specific criteria for possible inclusion in a water withdrawal management strategy for hydraulic fracturing in North Carolina. Developing comprehensive water resource management policies will be beneficial from a broad range of perspectives. Under current water management

[585] Richter, B.D. and M.M. Davis, C. Apse, and C. Konrad. "A Presumptive Standard for Environmental Flow Protection." *River Research and Applications*, 2011. Published online in Wiley Online Library.

protocols, limiting withdrawals to 20 percent of the 7Q10 is assumed to be protective of aquatic habitats except during extreme low-flow events. DENR has modified the withdrawal recommendations to prohibit new withdrawals for gas well development during drought and low-flow conditions. The details of the specific thresholds that would trigger such a prohibition will need to be specified during the development of a targeted water withdrawal management scheme for the industry. The recommendations of the Ecological Flows Science Advisory Board will provide valuable information to be considered during the development of any changes to current water withdrawal management schemes that are adopted to provide for hydraulic fracturing and shale gas production.

20. Some people commented that the recommendation requiring water management plans was too weak to protect water resources. Clean Water for North Carolina writes, "Calling for mere 'water management plans' for gas operators that will be unenforceable would provide a carte blanche for operators to carry out withdrawals at their convenience."

    RESPONSE: Although it is too early to define all the specific criteria and standards for the recommended water management plans, the intent of the DENR recommendation is to have enforceable water management plans. If DENR finds in its review of a water management plan that surface water supplies are threatened by the proposed withdrawals, DENR would not permit the activity.

21. One individual wrote, "Agricultural water use was severely under-reported. Table 3-6 cannot possibly be a reliable indicator of the water needs of our agricultural community. Chatham County data for agricultural water use is most certainly under-reported. Agriculture is the largest industry in Chatham County, and it is clearly not limited to 12 farms…This data must be researched further with consultation of more accurate sources."

    RESPONSE: The data in this table on agricultural water use comes directly from the North Carolina Department of Agriculture and Consumer Services' annual *Agricultural Water Use Survey.* The water use figures are not related to or dependent on the estimate of the number of agricultural operations in these counties reported in the first draft of the shale gas study. (Those figures have since been corrected.) Table 3-6 shows the number of unique agricultural operations that used 10,000 gallons or more of water on any day in 2010. The intent of this table is to show the magnitude of withdrawals that may be made at the farmer's discretion and for which we do not have a specific location or source information. There are likely additional agricultural operations not counted in these two sets of data. Although the data in the *Agricultural Water Use Survey* does have limitations, to our knowledge, it is the best data available on agricultural water use in North Carolina.

Roads

22. BREDL states, "NC DOT should calculate the costs to North Carolina taxpayers for road damage." The North Carolina Conservation Network urges the study authors to "locate

the increased infrastructure burden within the context of the NC Department of Transportation's prioritization system and gradual abandonment of many rural roads."

RESPONSE: Although there was not enough time to calculate this cost in time to meet the General Assembly's May 1, 2012, deadline for this report, DENR has made a recommendation within the study that the NCDOT look into this issue further. Some information on NCDOT's prioritization system has been added to the report.

Pipelines

23. North Carolina Conservation Network (NCCN) noted that pipeline safety is a serious unsolved problem for shale gas development. NCCN also suggested that there should be a recommendation related to closing the gaps in regulatory authority over the siting, construction and operation of gathering lines.

    RESPONSE: DENR agrees, and has added more information on this subject to the report in Section 3.C. and has added a recommendation to this effect.

Hydraulic fracturing fluids

24. Some people requested analysis of the potential environmental impacts from mining sand for proppant.

    RESPONSE: Sand mining is an existing industry with an existing regulatory program in North Carolina. It is too soon to say how much additional sand mining we could expect to support from hydraulic fracturing in the state.

25. Halliburton Energy Services Inc. (HESI) supports the approach to hydraulic fracturing fluid disclosure recently adopted by the Colorado Oil and Gas Conservation Commission (COGCC) because it "represents a reasonable balance between public disclosure of the makeup of frac fluids and the need to protect trade secrets to provide continued incentives for innovation. These rules also ensure access to trade secret information for regulators and health professionals when the information is needed to respond to a spill or for medical diagnosis or treatment purposes while minimizing the significant burdens on regulators associated with managing trade secret information."

    While some people who reviewed the draft report applauded DENR's recommendation relating to chemical disclosure, some called for full disclosure to the public. The Environmental Defense Fund (EDF) calls for full public disclosure of hydraulic fracturing chemicals, "presented in formats that are useful and user-friendly for the public." They also note the need for disclosure of all chemicals, not just those reported on MSDSs, "should be stated more clearly in DENR's recommendations." EDF notes that "A high bar should be set for trade secret protections…The public deserves assurance that trade secrecy claims cannot be used inappropriately." EDF suggests trade secret claims should be documented and substantiated, and citizens should be allowed to challenge these claims.

The Durham Environmental Affairs Board is opposed to any exemption for trade secret information and writes, "The public should be able to know the concentrations and mass of the hydraulic fracturing chemicals and constituents. To prevent this knowledge from being public would inhibit further research on the role that hydraulic fracturing chemicals and constituents have in impacting the environment.

One individual wrote, "I work in the Food Industry; we are required to disclose everything that is in our products. And we are not allowed by law to put anything out there that is known to cause harm to consumers. Other industries should have no less stringent standards, particularly when our ground water, streams and rivers can become contaminated."

RESPONSE: The recommendation with respect to disclosure of chemicals used in hydraulic fracturing has been modified to more clearly require disclosure to state regulatory and emergency response agencies of all chemicals and not just those reported on a MSDS. The recommendation has also been revised to encourage full public disclosure on a voluntary basis and to otherwise provide for disclosure consistent with North Carolina's public records law, which already includes a provision protecting trade secrets. The text of Section 4 has been revised to include a brief discussion of North Carolina law concerning disclosure of trade secrets under the state's Public Records Act.

26. The Durham Environmental Affairs Board applauds Recommendation 8 but "would like to suggest that the recommendation … include diesel fuel, its toxic constituents, and other known carcinogens like naphthalene in hydraulic fracturing fluids." Clean Water for North Carolina writes, "Instead of the extensive effort required to regulate these substances, or providing for limited public disclosure, companies should be restricted to a list of approved, non-toxic additives for use in wells, such as that provided for in current UIC rules for remedial injections." A joint letter from Southern Environmental Law Center, North Carolina Sierra Club and Environment North Carolina says, "Any regulation of fracking fluids should also require the use of increasingly common non-toxic substitutes – an issue that was not addressed in the Draft Study and must be analyzed before judging whether fracking can be done safely."

    RESPONSE: DENR has revised the recommendation related to hydraulic fracturing fluids to recommend that the General Assembly encourage environmentally friendly and non-toxic alternatives where feasible.

27. EDF also suggests "chemical characterizations, tracking and reporting of all wastes must be made part of any regulatory regime to help ensure the safe handling, transportation, storage and disposal of the materials."

    RESPONSE: DENR agrees. These issues would be incorporated as part of the development of waste management standards for the industry.

28. The U.S. Fish & Wildlife Service encourages DENR to add the "costs, staff and timelines needed to develop" water quality criteria and standards for the chemicals involved in hydraulic fracturing.

    RESPONSE: DENR feels that it is premature to know what standards would need to be developed, and thus the cost to develop those standards is unknown at this time.

29. One individual suggested that public disclosure be required before drilling takes place.

    RESPONSE: DENR agrees, and has modified this recommendation to include this suggestion.

Groundwater impacts

30. Some commentators wrote that because there is a lack of understanding in the scientific community of how thermogenic methane contaminated groundwater in other areas, it is not possible to design regulations to prevent methane migration. For example, one individual wrote, "The mechanism that brought that thermogenic methane from shale deposits to the aquifer has not been identified. The scientific community has neither the scope of scientific knowledge in fracture dynamics nor the ability to analyze the subsurface with enough resolution to see cracks and fractures. Both of these would be required to determine the mechanics by which this thermogenic methane was introduced to the aquifers. North Carolina is moving forward with the assumption that increased regulation can prevent these problems. We cannot prevent problems that we do not understand."

    RESPONSE: The report has been edited to more clearly reflect the uncertainty in recent studies of stray gas migration and the fact that certain potential sources of stray gas may not be possible to regulate directly.

31. BREDL recommended that DENR examine the work of the Wake/Chatham low-level radioactive waste (LLRW) dump to determine if "the movement of contaminants in groundwater and where that groundwater will go can possibly be predicted."

    RESPONSE: We agree that a high level of hydrogeologic characterization will be necessary before any hydraulic fracturing should be permitted in North Carolina.

32. Halliburton Energy Services Inc. (HESI) states that "regulators from around the country have continually reaffirmed that there are no confirmed instances anywhere in the country of hydraulic fracturing causing contamination of drinking water aquifers; this conclusion has been repeatedly confirmed by a number of other key organizations such as the Ground Water Protection Council and the Interstate Oil and Gas Compact Commission." HESI goes on to say they do not believe "that the draft report issued by the U.S. Environmental Protection Agency ("EPA") regarding its investigation of groundwater contamination in the Pavillion, Wyo., area should be considered as providing any evidence to the contrary. The EPA report is only a draft and has not been subject to peer review. Moreover, the Draft Report has been subject to substantial

criticism, and HESI's own review of the Draft Report indicates that there are serious questions about the design of EPA's study, the validity of the data it collected and the basis for EPA's conclusions. In fact, EPA and the State of Wyoming announced last month that EPA would be undertaking another round of sampling to 'clarify questions about the initial sampling results.' Therefore, EPA's Draft Report should not serve as the basis for any conclusions regarding hydraulic fracturing."

However, others were disappointed that the study did not fully review the EPA's report on Pavillion. Clean Water for North Carolina states that a full review of this report should have been included "as both the geological conditions of fracturing of shallow and discontinuous shale formations in close proximity to current or potential water supplies, and regulatory conditions with an under-resourced, poorly monitored program may [be] highly relevant to NC conditions if a quickly developed and inadequately staffed program were to emerge from this effort."

RESPONSE: The Pavillion investigation has some relevance to North Carolina, but it still is a draft report and there is some uncertainty about the similarity of hydrogeological, operational and regulatory conditions in Pavillion as compared to North Carolina. As a result, the degree of its relevance is still uncertain. Our report has been revised to clarify this point.

33. One person commented that an article in *The New York Times* ("A Tainted Water Well, and Concern There May be More," by Ian Urbina, dated Aug. 3, 2011) states that documented cases of groundwater contamination due to hydraulic fracturing exist but that the EPA was "unable to investigate many suspected cases because their details were sealed from the public when energy companies settled lawsuits with landowners. Based on this article, one commenter requested that DENR "Subpoena the sealed settlements with landowners from industry."

    RESPONSE: DENR does not have subpoena power. DENR staff will continue to follow emerging research on this issue.

Wastewater

34. Several who commented on the report said that DENR should strongly encourage the recycling and reuse of "flowback" water from hydraulic fracturing operations.

    RESPONSE: DENR has edited its recommendation related to wastewater. It is now recommended that recycling and reuse of flowback water be required to the maximum extent feasible.

35. Many were concerned that there is no way to dispose of wastewater from hydraulic fracturing without ultimately discharging treated hydraulic fracturing wastewater to surface waters. North Carolina Conservation Network writes, "there are no affordable treatment technologies that will make fracking wastewater safe for surface discharge, at a central facility or anywhere else." EDF writes, "we are not persuaded that the combination of a wastewater pretreatment program with centralized wastewater

processing will be sufficient to protect the health of North Carolina's waterways or public water supplies. North Carolina should not allow treatment and discharge to surface waters of wastewater from oil and gas operations through public or privately operated treatment plants or centralized wastewater treatment facilities until such time as technology is developed, demonstrated and installed that can provide for the safe processing of this kind of wastewater." Waterkeepers Carolina echoes that concern, specifically pointing to chemicals in wastewater that may be trade secrets. Southern Environmental Law Center, North Carolina Sierra Club and Environment North Carolina write, "Ohio has recently become more cautious about underground injection in the aftermath of several fracking-related earthquakes. The Draft Study does not provide a solution to this persistent wastewater program, yet the conclusion that fracking can be done safely assumes that one exists – even though other states have been unable to discover it."

RESPONSE: It is true that treated wastewater from hydraulic fracturing may ultimately be discharged to surface waters. However, a number of mechanisms are in place to ensure that sufficient treatment is in place prior to discharge and prior to a POTW receiving the wastewater. The report has been edited to clarify these mechanisms. Additionally, the report now recommends requiring a wastewater management plan that will demonstrate protection of receiving wastewater treatment plants, receiving waters, and downstream water users.

36. Several organizations and individuals, including OWASA, the North Carolina Rural Water Association, the City of Durham Department of Water Management, and the Orange County Department of Environment, Agriculture, Parks & Recreation, remarked on the need to account for appropriate wastewater disposal prior to the start of fracking and suggested expanding the recommendation for requiring a DENR-approved Water Management Plan so that a DENR-approved Water and Wastewater Management Plan is required. Such a plan should "require, to the maximum extent possible, use of recycled and/or reclaimed water for the hydraulic fracturing process." The City of Durham Department of Water Management writes, "Durham supports the development of a regulatory program to address the unique characteristics of the wastewater generated from the hydraulic fracturing process which would encourage the recycling and reuse of fracking fluids and require on-site pretreatment of such fluids."

    RESPONSE: DENR agrees. The recommendation calling for a water management plan has been revised to recommend requiring a water and wastewater management plan.

37. The North Carolina Conservation Network (NCCN) says that recommendation 6(c), which calls for North Carolina to retain the current prohibition on deep well injection of wastes, is "good public policy." NCCN notes, "For decades, North Carolina has treated our groundwater as a valuable economic resource. In the 1970s, an experiment with deep well injection of sewage into a saline aquifer near Wilmington ended disastrously, with pollutants migrating into supposedly unconnected drinking water aquifers. Since then, North Carolina has prohibited deep well injection of wastes. In the meantime, as

other states have allowed their groundwater to become contaminated, our protected resource has become an increasingly important competitive advantage in economic recruitment."

38. The City and County of Durham Environmental Affairs Board commented, "On-site wastewater must be stored in closed tanks in order to minimize potential health risks to humans and ecosystems due to accidental releases. This will also help to protect wildlife (birds, frogs, snakes, turtles, etc.)." Several individuals also commented that DENR should require closed-loop systems and prohibit open pits.

    RESPONSE: More research and analysis is needed to examine this issue, and a recommendation has been added to this effect.

39. A few people commented that land application of waste should not be allowed. One commentator said that there is a loophole for the land application of wastes via public wastewater treatment plants.

    RESPONSE: The report has been edited to better distinguish between the land application of mud and cuttings and the land application of wastewaters. Land application of wastewaters could be allowed, provided there is adequate treatment and a demonstration that the wastewater and its application could meet performance standards (i.e., sustaining vegetative cover and meeting groundwater standards). However, site evaluation, predictive modeling for protection of groundwater, determination of appropriate agronomic rates, and availability of suitable and adequate land for disposal all pose potential challenges for land application of wastewater generated by hydraulic fracturing. These challenges will likely make land application of the wastewater more expensive than other wastewater management options.

40. The Durham Environmental Affairs Board writes, "Any wastewater resulting from hydraulic fracturing operations must be subject to stringent, verified, third-party treatment. As such, the level of water treatment would be subject to well-established protocols and contaminant limits that have been established through permitting for other industrial activities."

    RESPONSE: Onsite treatment and nearby disposal by land application will become more likely the further the wastewater needs to be hauled to a third-party treatment system (CWT). As noted above, there are many challenges in permitting an onsite wastewater treatment and disposal system via land application, but the feasibility of such a system is highly dependent on the availability of other wastewater management systems and the suitability of onsite conditions to handle the wastewater.

41. One individual commented, "as wells age they continue to produce wastewater even for decades after being fracked. The wastewater flow from a well becomes more toxic over time. It is therefore important that abandoned wells be monitored by the State of NC for decades after fracking to assure that plugs and casings are intact."

RESPONSE: Specific requirements for monitoring of abandoned wells would be determined as part of the development of a modern oil and gas regulatory program.

Surface water impacts and stormwater management

42. Some suggested that North Carolina should use a network of real-time monitors to collect and transmit water quality information along surface waters that could be impacted by a discharge or spill, using parameters such as temperature, conductance, dissolved oxygen, pH and turbidity.

    RESPONSE: It is too early to specify the detailed technical requirements necessary for monitoring this industry. Additionally, there are ways of implementing the necessary monitoring that will be influenced by the density of wells and the time period over which drilling occurs.

43. The North Carolina League of Conservation Voters comments that land-disturbing activities should at a minimum fall under the stormwater conditions of the General Construction Stormwater permit and the state Sedimentation Pollution Control Act, and "Local municipalities with more stringent requirements for both stormwater and sedimentation and erosion control should be allowed to continue the implementation of those programs for activities associated with oil and gas exploration."

    RESPONSE: Local government control is addressed in DENR's recommendations.

44. Some commentators noted the potential for sedimentation of streams from the development of thousands of acres of land for hydraulic fracturing wells. As one person writes, "Without sedimentation regulations, large volumes of mud, silt, and other sediments are almost completely inevitable." Another person said that current enforcement of sedimentation regulations is inadequate, which does not bode well for enforcement of sedimentation violations from oil and gas activities.

    RESPONSE: The existing North Carolina Sedimentation and Pollution Control Act would apply to oil and gas activities in the same way as it applies to other types of land disturbing activities. DENR agrees that more inspectors are needed to adequately enforce sedimentation and erosion control regulations, both for the current programs and for any future oil and gas activities.

45. A few people, including the organization Liberty NC, asked DENR to review the Google map that lists accidents related to fracking, or to include each of the accidents listed on the "fraccidents" map (http://maps.google.com/maps/ms?ie=UTF8&source=embed&oe=UTF8&msa=0&msid=209825270514233970353.0004899ff5c6ef5ddf104).

    RESPONSE: DENR acknowledges within the report that accidents will occur with any shale gas development. DENR was not able to independently verify each of the accidents on the "fraccidents" map. However, specific instances of spills or other accidents are cited in the report, including cases where animals may have come into contact with hydraulic fracturing chemicals (see Spills of fluids related to gas drilling

operations for examples). Accidents are a possibility with any industrial activity, however, DENR believes that because of the nature of the chemicals used by the shale gas industry, safeguards should be in place to protect public health and the environment from possible spills of hydraulic fracturing fluids and wastes, gas well blowouts and other potential accidents.

Setbacks and areas prohibited from drilling

46. Many individuals desired more specificity in the recommendation for setbacks, including identifying who should establish the setbacks – DENR or the General Assembly. A number of comments recommended setbacks from a number of specific activities or features, such as setbacks from water supply wells, residences, farms, crops, pastures, farm ponds, homes, barns and schools, among others. Several people commented that regulations need to be in place to specify setbacks of oil and gas wells from public water supply wells and surface water intakes.

    RESPONSE: DENR recognizes that development of these setbacks will be a detailed process, and that a large number of setbacks are needed. DENR believes that it is premature at this stage to identify the specific setbacks and prohibited areas that would be needed to protect the public, the environment, and fish, wildlife and important natural areas. DENR supports the development of specific setbacks and areas prohibited from drilling with the assistance of local governments, other state and federal agencies, nonprofit organizations, industry representatives, and members of the public.

Air quality impacts

47. Several individuals and groups commented on the need for DENR to incorporate recent air quality research into the draft report, such as a recent study in Colorado and a recent NOAA study.

    RESPONSE: DENR agrees with this comment and has added in Section 4.G. a summary of the air quality research that was identified during the public comment period.

48. On the issue of air quality, EDF encourages DENR to "consider key areas where federal rules fail to adequately protect public health and the environment and where state programs may need additional authority to limit emissions of dangerous air pollutants produced by oil and gas development activities." EDF also suggests "strategies to monitor and minimize methane emissions from oil and gas operations," which will not only protect air quality but also reduce waste of the natural gas resource.

    RESPONSE: DENR will continue to evaluate whether the appropriate authority exists in North Carolina to ensure the protection of public health by limiting emissions of dangerous air pollutants from oil and gas operations. Currently, DENR believes that the combination of federal rules and the state air toxics rules should be sufficient authority. With regard to monitoring and minimizing methane emissions from oil and gas operations, DENR agrees with the recommendation. The report now addresses methane emissions in more detail.

49. Proposed changes to the state's Air Toxics Programs made some readers question the state's ability to regulate air emissions from oil and gas activities. North Carolina Conservation Network wrote, "Draft changes to the state air toxics program would exempt any source required to comply with 40 CFR parts 61 or 63, thereby granting a blanket exemption to sources that are also not limited by federal rule…proposed changes to the state air toxics program will exempt sources from control under the state program if they are already controlled for any other hazardous air pollutant under a federal standard. Since virtually all sources of hydrogen sulfide will also be sources of other hazardous air pollutants, they will almost all fall out of the state program. The state program will thus provide no defense against hydrogen sulfide released from shale gas facilities." Moreover, NCCN notes that shale gas development has the potential to release many toxics…that are not on either the state air toxic or federal hazardous air pollutant lists." BREDL recommended that "DENR, along with DHHS should assess public health impacts of proposed changes to North Carolina's air toxics standards, and how they may affect communities in the shale basin. The Legislature must hold back the air toxics 'reform' bill, and not reintroduce SB781, which could effectively tie DENR's hands in efforts to protect public health and the environment."

    Southern Environmental Law Center, North Carolina Sierra Club and Environment North Carolina note that the STRONGER report said North Carolina's air toxics program "would be helpful if fracking were to come to North Carolina," but the proposed amendment to the program would eliminate that benefit. These groups call for DENR to evaluate measures to ensure the minimization of the release of toxic chemicals and greenhouse gases, assess North Carolina's air toxics rules in conjunction with EPA's proposed regulations for the oil and gas industry, reassess the use of property boundaries as the measuring point for ambient air levels for air toxics, assess the potential ozone impacts of hydraulic fracturing, and evaluate emission increases from mobile sources associated with oil and gas activities.

    RESPONSE: Draft legislation is currently being developed to make changes to the state air toxics program. The primary effect of the proposed legislation would be to exempt sources subject to federal hazardous air pollution requirements from the state air toxics program. Under the proposal as currently drafted DENR would, however, retain the authority to evaluate ambient impacts of state regulated air toxics through the permitting program. If the Division of Air Quality found that a particular source would pose a threat to public health, the division director could require the proposed operation to comply with the state air toxics program, even if it met federal requirements. The proposed legislation will likely be considered by the General Assembly in the upcoming May legislative session.

    DENR agrees that the existing procedure for assessing ambient concentrations at the property boundary will need to be evaluated for situations where a well could be located on a piece of property that also contains a home, a farm, etc. This issue is now included as a recommendation in the report.

DENR agrees that an assessment of the emissions from hydraulic fracturing operations, as well as the increase in emissions from the resulting truck traffic, needs to be done to understand the impact on ozone in North Carolina, and has included a recommendation to that effect.

50. The section on potential air quality impacts does not discuss flaring, despite the fact that it's in the heading "Air emissions, including fugitive emissions and flaring."

    RESPONSE: DENR agrees with the comment and has added a discussion of flaring in Section 4.G.

Impacts on fish, wildlife and important natural areas

51. The T. Gilbert Pearson Chapter of the National Audubon Society, based in Guilford County, states that the report's recommendations do not mention "how to protect the wildlife of the state." They mention specifically the need for the recommendations to "include setback limits for light pollution measured in lumens, not feet." A joint letter from American Rivers, Environmental Defense Fund and North Carolina Conservation Network says "There are no recommendations at all in Section 9 intended to protect fish, wildlife and important natural areas."

    RESPONSE: One of DENR's recommendations is to "Develop setback requirements and identify areas (such as floodplains) where oil and gas exploration and production activities should be prohibited." The protection of fish, wildlife and important natural areas would be taken into consideration in the development of setback requirements if the state were to move forward with shale gas development. This recommendation has been revised to clarify this intent. However, as discussed under the heading "Setbacks and areas prohibited from drilling," DENR believes that it is premature to identify the specific setbacks. The development of these standards should be done in consultation with experts and with input from stakeholders.

    An additional recommendation has been added to the report to address secondary and cumulative impacts through the review of drilling unit management plans.

52. The T. Gilbert Pearson Chapter of the National Audubon Society states that the draft report does not discuss the impacts of support infrastructure for natural gas, such as pipelines, access roads, metering stations and compressor stations. The impacts noted by the Audubon Society are habitat destruction and fragmentation as well as noise, light, air and water pollution.

    RESPONSE: The draft report discusses impacts from the development of pipelines, access roads and compressor stations on pages 164 and 165. These sections have been revised to clarify that these impacts result from all phases of natural gas development, not just from the construction of the well pad.

53. The T. Gilbert Pearson Chapter of the National Audubon Society comments that the impact to wildlife from light pollution should be considered in the report. Others suggested discussion of the impact to wildlife from noise pollution.

RESPONSE: A discussion of these potential impacts has been added to the final report.

54. The U.S. Fish and Wildlife Service (FWS) expressed interest in "the evaluation of the extent of secondary and cumulative impacts of permitted actions."

    RESPONSE: Research in this area is currently limited. DENR staff will continue to monitor emerging research on the extent of secondary and cumulative impacts from the shale gas industry, such as the effects of forest fragmentation.

55. Based on recommendations of the Secretary of Energy Advisory Board (SEAB) Natural Gas Subcommittee, EDF recommends that state and local governments create development plans for areas affected by natural gas drilling and production to avoid or minimize the adverse cumulative environmental and community impacts from shale gas development. Such plans can optimize the use of multi-well drilling pads to minimize transport traffic and needs for new road construction, characterize important landscapes, habitats and corridors to inform planning, prevention, mitigation and reclamation of surface impacts, and mitigate noise, air and visual pollution. These plans should incorporate community participation.

    RESPONSE: DENR appreciates this suggestion, and has recommended that the General Assembly require the submittal of drilling unit management plans under the broader recommendation for the development of a modern oil and gas regulatory program.

56. The T. Gilbert Pearson Chapter of the National Audubon Society states that the recommendations in the draft report for baseline data collection are inadequate to measure the effects of natural gas development on wildlife and do not mention "biological survey data collection prior to commencement of drilling and/or infrastructure installation operations."

    RESPONSE: Based on public comment, DENR considered adding such a recommendation. Ultimately, DENR decided against recommending a biological survey. DENR staff believes the greatest threats to fish, wildlife and important natural areas from natural gas exploration and production are secondary and cumulative impacts, such as habitat fragmentation. Collecting site-specific biological survey data would not offer much information to minimize these impacts. DENR staff felt that requiring a review of drilling unit management plans would better address these potential impacts.

Waste management

57. Because wastewater recycling from hydraulic fracturing operations creates residual waste streams that can be highly concentrated with salts, metals and organics, EDF urges DENR to "develop specific technical criteria for the safe management and disposal of all exploration and production wastes, including wastes associated with recycling."

    RESPONSE: Additional work would be required to develop specific technical criteria and would occur as part of the development of a regulatory program for oil and gas.

Management and reclamation of drilling sites

58. EDF notes, "it is critical that operators be required to restore well sites to their original condition."

    RESPONSE: We agree that reclamation is very important, but it is premature to develop specific standards for reclamation at this time.

Naturally Occurring Radioactive Materials

59. BREDL comments "There is no safe level of radiation exposure." BREDL recommends that the shale gas study be withheld from the Legislature "until all geochemical test results have been evaluated and included. Discussion of how the highly radioactive metal piping and other well pad materials should be handled and transported safely should be included in the Study. Additionally, potential impacts to workers and the surrounding community should be assessed."

    RESPONSE: The Radiation Protection Section of the Department of Health and Human Services has always strived to keep the radiation dosage from human activities as low as possible, and will continue to analyze test results as they become available. Specific standards for storage and transportation of radioactive materials would be established as part of the development of a modern oil and gas regulatory program.

Public health impacts

60. BREDL requests a "multi-disciplinary health risk assessment" be performed in the areas potentially impacted by shale gas extraction, including both physiological and psychological effects. NCCN and others pointed out the public health impacts of exposure to endocrine-disrupting toxins, and suggested that the final study "call for much more detailed analysis of these diffuse but potentially very expensive impacts."

    RESPONSE: DENR staff will continue to monitor research relating to the public health impacts of natural gas extraction and production as it becomes available. A discussion of endocrine-disrupting toxins was added to the study (see Endocrine disruptors).

Economic impacts

61. Many people felt that the economic benefits reported in the draft study were not worth the potential environmental and public health impacts of the shale gas industry, or the costs to develop a regulatory program for the industry. A group of business leaders writes to say the study "does not evaluate shale gas against a longer term view of sustainable economic development." This group also noted the recoverable resource is "tiny: perhaps 309 billion cubic feet, just *one year and two days* of gas at North Carolina's modest 2010 rates of consumption. That is not energy independence by any definition." Another person wrote, "State resources squandered on the pipe dream of shale gas could be better invested in creating a favorable climate for sustainable businesses that hire locally and do not leave and do not damage the environment." Food & Water Watch commented that "fracking for shale gas will do little to ensure American energy security." North Carolina Conservation Network (NCCN) states, "There

is no economic upside to legalizing fracking or horizontal drilling now, as shale gas development is not economically viable in North Carolina and is not likely to become viable for at least a generation, if ever."

NCCN also points out, "Legalizing fracking now would impose lasting costs on the local economy and taxpayers…the final study should recommend that North Carolina defer further discussion of legalizing fracking for at least five to ten years, while monitoring the economics of the natural gas industry. During that time, technology and regulatory tools in states with active production may improve, and it may someday be appropriate for North Carolina to revisit the issue." NCCN states shale gas is seen "as a source of jobs and energy independence, even as its supporters privately admit it will deliver neither for the foreseeable future. The text of the study lays this bare; the final executive summary should also." Clean Water for North Carolina notes "the very modest, likely overly optimistic estimate of the resource provides no justification for the agency moving ahead with a very time-intensive and costly process of developing a regulatory program for oil and gas." NCCN states, "The current price of natural gas is far below the break-even price needed to justify a new well in an existing play, and is expected to remain low for years…North Carolina lacks the infrastructure for shale gas extraction: processing plants, pipelines, compressor stations, waste disposal facilities. Construction of that infrastructure would raise the break-even cost of drilling in North Carolina relative to existing plays in other states." One individual commentator summarized these concerns by saying, "How many more teachers must be laid off in order to hire a paltry number of inspectors for these well sites? From which well do you propose to mine those dollars?"

RESPONSE: The Department of Commerce used the limited information available on the natural gas resource and jobs associated with natural gas drilling to prepare an economic analysis of shale gas development in the Sanford geologic sub-basin. The information available did not allow the Department of Commerce to prepare a detailed statewide cost/benefit analysis for development of North Carolina's shale gas resource. Several sections of the report identify potential costs associated with shale gas development (including development of a modern oil and gas regulatory program; modification of existing environmental standards to address drilling activities; demands on local infrastructure and services; and impacts to state roads), but quantifying those costs would be extremely speculative. Quantifying the likely statewide economic benefits would also be speculative at this time.

All agencies involved in the study agree that the current price of natural gas and uncertainty about the natural gas resource in North Carolina compared to other regions of the United States make it unlikely that North Carolina will see a flurry of activity in the oil and gas industry soon. However, price forecasting is only the result of modeling, and forecasts such as the EIA reference case noted in the study only represent one possible outcome out of a range of possibilities.

62. A number of commentators, including North Carolina Conservation Network, have called on the Department of Commerce to modify the impacts section to account for potential costs related to the environment or community development activity. For example, one individual noted in Chatham County, farming is growing and has great potential, but in the draft report, "There was no mention of the effects of displacing food-growing with shale-gas exploration." The growing local foods industry in this area was also noted as an area of deficiency by several commentators. One commentator wrote, "I am very concerned about the chemicals used in fracking and the effects on farms and water supplies. Please do not allow fracking to come to North Carolina which is one of the few states in our country with a robust organic agriculture movement that absolutely depends on clean water." Others called for estimates of remediation costs or the external costs from accidents, spills, and explosions.

    RESPONSE: The Department of Commerce does not have the data or in-house expertise to model these economic effects. In addition, creating a model for many of these issues would require assumptions about specific industry standards such as closed or open waste pits, standards for disposition of wastewater, weight limits on trucks versus rated capacity of roads, and the intensity of activity affecting air quality, and quantifying assumptions of accidents or violations and their consequences. The report recommends that such issues be examined and standards developed to prevent or mitigate risks.

63. Several people noted that the agriculture industry in Lee and Chatham Counties was not accurately described in the draft report. A number of people also talked about the recent surge of sustainable agriculture in the Triangle area and the Triangle's local food culture. As one person notes, "many more new businesses are springing up around the production, distribution, and culture of organic food production. In this Cape Fear River basin where shale formations have been located, we now are nurturing a nascent small, vital, sustainable, organic farm explosion."

    RESPONSE: We have made revisions to more accurately capture the agricultural industry in this part of the state.

Regulatory agency funding and staffing

64. Many commentators noted that the safety of hydraulic fracturing is in part dependent on the resources North Carolina invests in inspections and enforcement. Southern Environmental Law Center, North Carolina Sierra Club and Environment North Carolina point out, "Even if DENR were able to design a program that included regulatory standards that were universally determined to be protective of public health and the environment, those standards would only be as good as the inspection and enforcement program." Commentators are concerned that because of recent budget cuts to DENR, it would be difficult for the department to adequately monitor oil and gas activities or enforce violations without significantly greater resources. One individual wrote, "The biggest problem with the study is the statement that gas exploration and extraction can be done safely IF there is an inspector at each site to ensure proper safety and compliance with regulations. This logic is severely flawed. DENR has already been

reduced by 40% in the last year. Other state agencies and county services have suffered unprecedented cuts in staff and budgets, as well. Implying that there will be a qualified government inspector at each gas extraction site to ensure compliance is a grave flaw. As it is, there aren't enough inspectors for anything in this state to ensure compliance with current regulations on water quality, zoning compliance, food and health inspections, animal welfare, soil conservation, or even traffic violations."

SELC, North Carolina Sierra Club and Environment North Carolina call for DENR to develop and evaluate each of the additional regulatory programs and to develop an inspection and enforcement scheme that ensures the state has sufficient inspections and that companies that consistently violate environmental regulation pay fines and restrictions that deter future violations. The North Carolina League of Conservation Votes calls for additional detail "on the frequency of inspections and the number of inspectors per well needed to ensure permit compliance."

RESPONSE: We agree that a rigorous inspection program with significant enforcement efforts would be needed if shale gas development were permitted in North Carolina. DENR believes, however, that defining the extent and needs of such a program is premature at this time and should be done as part of the development of a modern oil and gas regulatory program.

65. If North Carolina chooses to allow shale gas development using hydraulic fracturing and horizontal drilling, "DENR is the right agency" to provide environmental oversight. Rob Jackson and Bill Holman of Duke University's Nicholas School for the Environment note that "Not to put DENR in charge of environmental oversight of oil and gas development would be a step backwards." Putting DENR in charge of environmental oversight "will avoid conflicts of interest, reduce duplication and bureaucracy, and promote independent oversight of the industry. In contrast, history shows that creating a new, politically appointed oil and gas commission to promote and regulate oil and gas activities will lead to conflicts of interest and trouble." The North Carolina League of Conservation writes that the organization, "strongly agrees that the environmental permitting program for oil and gas activities remain in DENR where it will benefit from the expertise of the state geological staff and the ability to coordinate air, land and water quality permitting." Clean Water for North Carolina writes, "Keeping any oil and gas permitting within DENR, with adequate funding and staffing, will provide the most comprehensive and credible approach to natural resource protection and be in the public interest." These statements were echoed by Orange Water and Sewer Authority and the Orange County Department of Environment, Agriculture, Parks & Recreation.

RESPONSE: DENR concurs with these comments.

66. Piedmont Natural Gas notes, "State and local government entities have an obligation to implement regulatory constructs that protect the environment and consumer interest. To accomplish these ends, we respectfully suggest that the final report recommends adequate funding to provide proper oversight." The Orange County Department of Environment, Agriculture, Parks & Recreation points out that "Since DENR, and

especially DWQ, has lost funding and staff positions in recent years, these trends must be reversed if adequate regulatory programs have any chance of being implemented and maintained."

North Carolina Conservation Network (NCCN) points out, "The cost of establishing a regulatory program will fall on North Carolina taxpayers" because without an active oil and gas industry in the state, there are no permit fees or severance taxes to provide revenue at this time, and there may not be for the foreseeable future. NCCN also notes that until the industry comes to North Carolina, "taxpayers will have to foot the bill for an unnecessary program to regulate an industry that is not there."

An individual wrote, "If the legislature eventually decides to go ahead with this industry, then we would need DENR to be fully funded to regulate any natural gas activities in our state. It is not okay for the legislature to say that it will regulate the natural gas industry, then to inadequately fund the regulating entity." Another person wrote, "Regulations currently in place cannot be enforced because of lack of staff. How can we trust our General Assembly to fund getting this new, extremely complicated technology properly regulated, when it doesn't support the enforcement of regulations where the science is much better understood and the regulations have been in place for years?"

RESPONSE: We are adding a recommendation to this effect.

Social impacts

67. Some people expressed concerns about property values. One individual wrote, "I'm also very concerned about what I'm hearing is happening in other states with contaminated drinking water and loss of value of property near contaminated sites, as well as Fannie Mae and the Agriculture Dept. not backing mortgages for property with leased mineral rights."

    RESPONSE: The Secretary of the U.S. Department of Agriculture has stated that the USDA "will not require an extensive environmental review before issuing mortgages to people who have leased their land for oil and gas drilling" because rural housing loans are excluded under the National Environmental Policy Act.[586] Like any other loan program administered by the federal government, taxpayers stand to either lose or gain, depending on the direction of the values of the property. A data analysis described in Section 6B, Potential Impacts on Property Values, shows that property values in Oklahoma and Pennsylvania increased in the most heavily-drilled areas, while property values decreased in Colorado's most heavily-drilled areas.

68. The City and County of Durham Environmental Affairs Board is "concerned that counties with large populations of low- or fixed-income renters could be impacted the most by the increased housing costs of extensive shale gas development. In Durham, with a rental rate of 44%, [DENR's report] predicts that a significant number of residents would

[586] Urbina, Ian. "U.S. Rejects Environmental Reviews on Mortgages Linked to Drilling." *The New York Times*. March 23, 2012. Retrieved April 16, 2012 from http://www.nytimes.com/2012/03/23/us/usda-wont-review-mortgages-linked-to-drilling.html.

bear the economic impacts, while not sharing in the economic benefits. We note that they may also bear more of the environmental impacts, such as increased road traffic and air pollution. There is nothing in the recommendations to remedy this inequity, nor further discussion in the summary, yet it is an important issue for the wellbeing of all Durham citizens. There must be steps taken to ensure that vulnerable citizens are not disproportionately adversely affected by these activities."

RESPONSE: DENR agrees, and has modified this recommendation to reflect this.

Environmental justice

69. Several people commented that there is no discussion of the potential environmental justice impacts. The Blue Ridge Environmental Defense League (BREDL) points out that "Many of the mostly rural shale communities have a significant number of minority residents." BREDL recommends that before the shale gas study is finalized, DENR "identify the potential for disproportionate impacts from this industry on People of Color and the Poor." Waterkeepers Carolina also notes that environmental justice is not examined fully. BREDL requests that DENR "evaluate the demographics of renters in the basin to see if people of color and the poor will stand to be disproportionately affected. Additionally, the Attorney General's office should be consulted on possible protections from unscrupulous landlords."

    The West End Revitalization Association (WERA) requests that the final report "fully incorporate the National Environmental Protection Action (NEPA), Title VI of the Civil Right Act of 1964, and Federal Environmental Justice Strategies of 18 branches of Federal government" [sic]. The authors of this letter request that the U.S. EPA not renew North Carolina's Memorandum of Agreement on primacy for the Underground Injection Control program until environmental justice concerns are incorporated into the draft report. WERA also requests that the North Carolina Research Triangle Environmental Collaborative's Environmental Inequities / Environmental Justice Workgroup (EI/EJWG) "organize and facilitate information and training sessions on environmental inequities and environmental justice disparities in North Carolina and related EPA, NEPA, and Title VI of the Civil Rights Act of 1964 laws for preparers of [the draft report] and committee members of [the North Carolina Legislature] prior to submission, action, and voting. This would include delay of any legislative votes until after the EPA final 2014 study is completed on the impacts on environmental health, public health, and economic and social stressors."

    RESPONSE: Section 6A of the report provides a variety of demographic characteristics of the counties that could be impacted if shale gas development occurs in North Carolina. While racial characteristics are not described in detail, Tables 6-1, 6-2, 6-3, and 6-4 describe demographic "risk factors" that could make certain areas more vulnerable to increased housing costs. Additionally, a new paragraph has been added to Section 6, Distributional Impacts, which discusses how renters in a community may be impacted negatively by shale gas development.

DENR agrees that this is not a complete discussion of the potential environmental justice impacts from natural gas extraction and production, but feels that it is premature to address environmental justice on a site-specific basis at this time. DENR's permitting programs incorporate an environmental justice process consistent with state and federal laws.

70. WERA also requests that a bipartisan panel be established "to determine current elected officials and those running for local, county, state and federal positions representing citizens, taxpayers, and voters of North Carolina who have received campaign contributions from oil and gas industry agencies. This is necessary in order to comply with existing Federal and state open/public records, 'sunshine', and election laws and statutes."

    RESPONSE: The State Ethics Act has specific criteria that would apply to this situation.

71. The City and County of Durham Environmental Affairs Board and others commented on the risk of increased housing costs. The Environmental Affairs Board wrote, "We are concerned that counties with large populations of low- or fixed-income renters could be impacted the most by the increasing housing costs of extensive shale gas development." Clean Water for North Carolina noted that increased property values may have negative impacts, for example, "for smaller landowners in drilling areas, or those who have not leased their mineral rights, the higher assessed property values will result in a higher tax burden with no compensating income. This impact will fall particularly disproportionately on low-income residents, seniors, disabled persons or others on limited incomes."

    RESPONSE: It is important to note that increased housing costs are not inevitable if shale gas development occurs in North Carolina. In some rural communities in the United States, new drilling projects have led to rapidly increasing housing costs; however, those communities are significantly more rural than North Carolina (see Table 6-9), and have seen a far greater amount of drilling than is expected in North Carolina. An additional paragraph has been added to Section 6.A. discussing the potential impacts to renters in North Carolina.

72. The City and County of Durham Environmental Affairs Board commented, "the report predicts that a significant number of residents would bear the economic impacts, while not sharing in the economic benefits. We note that they may also bear more of the environmental impacts, such as increased road traffic and air pollution. There is nothing in the recommendations to remedy this inequity, nor further discussion in the summary."

    RESPONSE: The Environmental Affairs Board is correct that renters are less likely to see the economic benefits of shale gas development than landowners who lease to natural gas operators. While renters may benefit from the employment opportunities generated by the development of shale gas in North Carolina, they would not receive leasing bonuses or royalty payments. Renters may also experience the negative impacts

of development, including impacts from noise, traffic or environmental pollution; however, they are not necessarily more likely to experience these impacts than property owners. Low-income residents may be less able to cope with potential negative impacts than wealthier residents. DENR agrees that policymakers should attempt to minimize any impacts that would disproportionately impact vulnerable residents, but DENR feels that it is premature to address environmental justice on a site-specific basis at this time. DENR's permitting programs incorporate an environmental justice process consistent with state and federal laws.

Regulatory framework

73. The North Carolina League of Conservation Voters, the U.S. Fish & Wildlife Service and others commented on the Rules Reform Act and its effect on the ability of state agencies to regulate hydraulic fracturing. Specifically, the League of Conservation Voters notes, "The passage of the Rules Reform Act significantly limits the discretion of agencies in promulgating and enforcing administrative rules, environmental regulations in particular are dependent on adopting and enforcing many complex rules." The U.S. Fish & Wildlife Service "encourages DENR to seek resolution on its ability to regulate and enforce an oil and gas industry in NC given the constraints set forth in NC Session Law 2011-398."

    RESPONSE: It is true that North Carolina's already lengthy rulemaking process will likely become somewhat more time-consuming as a result of new requirements (such as expanded cost-benefit analysis) enacted in 2011. Prior to the 2011 changes, the process for adopting a new rule of any significance took between 12 and 18 months. It is not clear how much additional time the new requirements will add. The 2011 amendments also put new constraints on agency rulemaking powers and expressly limit the power of a state agency to go beyond federal standards in the absence of express rulemaking authority from the General Assembly. Those provisions may affect development of oil and gas production rules since in a number of cases state rules will be needed specifically because Congress has exempted exploration and production activities from federal regulation. DENR assumes that the General Assembly will be cognizant of the impact that new APA requirements may have on adoption of oil and gas production rules and will provide sufficient authority for rule development.

74. One commentator requested "a complete analysis of all industry influences in the 2005 Energy Policy Act which exempted fracking from the Clean Air Act and the Safe Drinking Water Act. Not following these important safety regulations helps explain why fracking cannot be done completely safely."

    RESPONSE: Although we consider analyzing the industry influences in the development of these federal laws outside the scope of this particular report, we have noted the exemptions afforded the oil and gas industry by these laws in this report. We considered these exemptions while drawing up our recommendations for how North Carolina could govern shale gas extraction, and we agree that additional protections would need to be in place in North Carolina to fill in those gaps.

Water use laws

75. One commenter requested more discussion of water use laws, specifically riparian law and the reasonable use of groundwater.

    RESPONSE: The text of the report references the basic rule of reasonable use for both riparian property owners and groundwater users. The report focused on the lack of any water withdrawal permitting authority because the reasonable use rule in itself provides no environmental protection and leaves resolution of any conflict between competing water users to the courts.

Consumer protection

76. Several people commented on the lack of a consumer protection section. BREDL states that "The Study should have been held until all mandated parts were complete."

    RESPONSE: S.L. 2011-276 directed the Department of Justice to work on the consumer protection section of the report in consultation with RAFI-USA and DENR. The Department of Justice did not provide the Department of Environment and Natural Resources with a draft version of this section in time for the release of the study to the public, because the Department of Justice did not believe that section was ready to be released for public comment. DENR made the decision to release the rest of shale gas study, because we felt it was important for the public to have an opportunity to comment on as much of the report as possible before the study was submitted to the General Assembly by the legislatively mandated deadline of May 1, 2012.

77. Clean Water for North Carolina (CWFNC) also commented on the lack of a consumer protection section in the draft report. CWFNC states "The failure to release the critical Consumer Protection section of the report with the remainder of the draft report is completely unacceptable [and CWFCNC calls for] at least a 15 day comment period" after that section is released. Several individuals who commented on the draft report expressed similar concerns. One individual wrote that a major issue with the study "is that it has come to public input without Section 8, the statement of landowner and consumer rights. This is a grave disservice to the residents of North Carolina. **I urge you to request an extension of the deadline for DENR to submit this study to the State Assembly because the citizens of North Carolina have the right to comment on landowner and consumer recommendations that will be impacted by this study.** It is clear that the state and gas corporations are waiting to act on this study as quickly as possible. This is the only opportunity we citizens will have to comment on what the politicians do with our rights concerning this controversial issue. Please give us the chance to comment on our landowner and consumer rights. This is our future."

    RESPONSE: DENR has shared with our colleagues in the Department of Justice the concerns about the lack of a public comment period on the consumer protection section of the study.

Local government authority

78. Several local governments have passed or are working to pass resolutions related to hydraulic fracturing. This includes the town of Butner, which has proposed a resolution to urge the General Assembly "to maintain current laws in North Carolina that prevent hydraulic fracturing and horizontal drilling in the State and to take no action that would weaken these laws before it is fully demonstrated that North Carolina public health, waters, land, air, economy, and quality of life can be fully protected from impacts of allowing shale gas development in the State." The town of Cary and town of Pittsboro passed a resolution "urging prudence and demanding that before we green light a new industry in our region and state that we ensure that we are very confident that the air we breathe and the water we drink is safe and protected from the encroachments of 'fracking.'"

    The Lee County Board of Commissioners passed a resolution supporting efforts to develop sound legislation and polices for the extraction of natural gas in North Carolina, including support for legislation that is a model for other states, protects the environment and "preserves Local Governments' authority to protect the property rights, mineral rights and surface rights of its citizens and the jurisdiction's infrastructure, including land use regulation."

    RESPONSE: DENR feels that this issue should be addressed by the General Assembly and has recommended that the General Assembly clarify the extent of local government regulatory authority over oil and gas exploration and production activities.

79. The City of Durham Joint City-County Planning Committee commented, "Local government should retain its ability, through zoning and its general police power, to assure that hydraulic fracturing, if legally authorized and feasible, is performed in a manner that minimizes negative impacts to local communities." The Durham Environmental Affairs Board recommended that Durham "***maintain the authority***, through local zoning or other means, to determine exactly ***where*** and ***when*** hydraulic fracturing might be done safely, and to apply more stringent requirements if necessary for Durham." Some individuals who commented on the report agreed, including one person who wrote, "Local communities should have authority to block and regulate fracking, which would damage citizens' water resources and roads and drive up the cost of living as new workers come to the area."

    RESPONSE: DENR feels that this issue, while important, reaches beyond environmental and public health impacts and should be addressed by the General Assembly.

80. The City of Durham Joint City-County Planning Committee commented, "Revenues received from oil and gas proceeds must be shared with local governments to fully compensate the costs that will be incurred by local governments in addressing the local impacts of hydraulic fracturing.

RESPONSE: DENR has recommended that local governments be included in the distribution of revenues from oil and gas proceeds. Determining the exact distribution of revenues will require further work with assistance from stakeholders.

Comments about draft recommendations

81. Some people commented that the recommendation to require oil and gas operators to collect baseline data on water is a conflict of interest, and that DENR should collect this data.

    RESPONSE: The use of monitoring data collected by regulated parties is a routine and cost-effective component of regulatory programs throughout DENR.

82. The Durham Environmental Affairs Board says that the recommendation on baseline data collection "lacks important details on the collection of baseline data such as the number of samples and length of time required to accurately capture existing conditions, distance from the well, and sample patter density. Additionally, the recommendation does not require ongoing monitoring of the drilling site through the drilling, pumping, or closure of the site."

    RESPONSE: DENR believes that it is premature at this stage to identify such specific criteria and requirements. The development of specific criteria and requirements for baseline data collection would be a detailed and lengthy process. DENR supports the development of these standards with the assistance of stakeholders, including other government agencies, nonprofit organizations, industry representatives, and members of the public.

83. The Durham Environmental Affairs Board "whole-heartedly concur[s] with the need of a robust data management system. The EAB encourages that this data management system be easily accessible by the general public."

    RESPONSE: DENR has hired a database contractor to develop a new database to house all groundwater data in DENR, including groundwater monitoring data from contaminated sites, permitted waste application sites, and ambient groundwater monitoring stations. The new system, known as the Groundwater Decision Support System, or GWDSS, will ultimately allow electronic submission of data from well contractors and laboratories and could be used to manage groundwater data from oil and gas operations.

    The original request for proposals for the GWDSS included a GIS-enabled website for sharing groundwater data with the public, as well as a number of other features that DENR did not have sufficient funds to include in the final contract. Bids for everything in the RFP were in the range of $1 million to $2 million; DENR was ultimately able to assemble about $600,000 to fund the core of the system without the public interface.

Additional data management systems, and funding to build them, will be necessary in order to manage and publicize data related to exploration and production permits, production and tax data, and waste tracking.

84. The Durham EAB commented that Recommendation 10 omits the cost for additional or special equipment that may be required to combat emergency situations related to fracking, costs which "should be borne by the industry through permitting fees, severance taxes, or other cost recovery methods."

    RESPONSE: DENR agrees, and this recommendation has been revised to reflect the need for additional or special equipment.

85. The Durham EAB commented, "Recommendation 19 should be changed to language that clearly assigns liability and cleanup responsibility to the industries that lease and operate gas and oil wells. The citizens of North Carolina should not ever have to pay for industry negligence."

    RESPONSE: DENR agrees that consistent with existing law, the oil and gas industry should be held responsible for damages that it causes. This recommendation has been revised to include that note.