APPENDIX 7E. BLUE CYPRESS SOIL RELEASE CALCULATIONS AND MODEL SIMULATIONS

Gross soil oxidation rates used for this analysis were obtained from "Influence of Water Levels on Subsidence of Organic Soils in the Upper St. Johns River Basin" (Reddy et al. 2007) Two studies from this report were used to estimate gross oxidation rates for the release of nutrients from BCMCA (spell out) peat soils. The first study involved incubating intact cores at varying water depths to determine the effect of water level on gross soil oxidation rates. The intact cores were incubated in a core bath at room temperature (approximately 23ºC) for 91 days (+) at 8 different water levels, 20 cm of inundation, water level at soil surface, -2 cm, -5 cm, -7.6 cm, -15 cm, -20 cm, and -30 cm.
The second study also involved the collection of intact cores that were incubated under different flooding frequencies to determine the effect of inundation frequency on gross soil oxidation rates. The intact cores were subjected to variable inundation frequencies for a period of 150 days. The inundation treatments consisted of flooding the cores to a depth of 15 cm above the soil surface for variable lengths of time and then slowly draining cores to a depth of -15 cm below the soil surface for equal amounts of time. The durations of inundation were 10 days (50% inundation), 25 days (50% inundation), and 50 days (30% inundation) with corresponding durations of drawdown. Two additional sets of cores acted as controls for permanent inundation (+15 cm) and permanent draw down (-15 cm).

The combined results of these two studies indicate that when the soil is exposed to a depth of 15 cm below the soil surface we can expect to see a 0.5 cm yr^{-1} gross loss of soil. When the water level is at the soil surface, these studies indicated that we would observe a gross soil loss of 0.25 cm yr^{-1}. If we assume that when the water level is at the soil surface the system is in a state of balance and soil loss equals accretion, then we can assume that gross accretion will at least be 0.25 cm yr^{-1}. With this assumption, we can estimate a net soil loss of 0.25 cm yr^{-1} when the water level is below the soil surface to a depth of 15 cm.

We used the bulk storage of nutrients stored in the top 10 cm of soil within BCMCA to estimate the nutrient release rate based on a net loss rate of 0.25 cm yr^{-1}. This loss rate yielded release rate estimates of 38.1, 2.42, and 0.06 g m^{-2} d^{-1} for organic carbon, total nitrogen and t otal phosphorus, respectively. Based on ratios of DOC released to Organic carbon lost (Reddy et al. 2007), DOC had a release rate of 6.29.

For this exercise, we ran the Wetland Constituent Release Model followed by the Wetland Constituent Reduction Model and fit the results for DOC and TP to the multi-regression [DO] prediction model from Chapter 7 (Eq. 4–1). The results follow in Table 7E–1.

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Table 7E–1 Annual Dissolved Organic Carbon (DOC) and Total Phosphorus (TP) loads in metric tons if soils had been from Blue Cypress Marsh and median reduction rates using the Full1995NN scenario. Resultant changes in [DOC], [TP], concentrations are shown for DOC, TP, and the calculated change in monthly Dissolved Oxygen concentration [DO].

Year	Load DOC	Load TP	Load TN	mg L^{-1} [DOC]	mg L^{-1} [TP]	mg L^{-1} [TN]	mg L^{-1} Change in [DO]
1976	1,150	3.40	273	17.55	0.052	4.163	-1.532
1976	1,145	3.38	271	17.84	0.053	4.214	-1.557
1976	1,044	3.08	247	17.85	0.053	4.216	-1.558
1976	2,995	8.85	712	17.36	0.051	4.128	-1.518
1976	1,504	4.45	367	15.70	0.046	3.826	-1.368
1977	31	0.08	6	249.38	0.685	45.763	-21.591
1977	166	0.45	34	80.97	0.222	16.773	-7.007
1977	219	0.60	46	79.45	0.218	16.511	-6.876
1977	1,284	3.53	255	106.02	0.291	21.085	-9.172
1977	4,221	11.59	860	89.67	0.246	18.271	-7.759
1978	1,020	2.57	95	47.48	0.119	4.402	-4.053
1978	1,903	4.79	178	48.12	0.121	4.505	-4.108
1978	6,823	17.16	616	45.82	0.115	4.136	-3.918
1978	4,656	11.71	393	42.32	0.106	3.571	-3.615
1978	2,165	5.45	182	42.17	0.106	3.548	-3.599
1979	1,705	4.77	336	25.37	0.071	4.997	-2.198
1979	1,459	4.08	290	23.75	0.067	4.714	-2.057
1979	866	2.42	171	24.91	0.070	4.917	-2.154
1979	4,129	11.56	815	24.79	0.069	4.896	-2.152
1979	5,415	15.16	1,075	23.73	0.066	4.711	-2.060
1980	1,815	5.46	592	142.25	0.427	46.365	-12.476
1980	1,695	5.09	602	117.73	0.354	41.852	-10.328
1980	1,048	3.15	384	110.42	0.332	40.506	-9.687
1980	1,001	3.01	357	116.86	0.351	41.691	-10.251
1980	876	2.63	337	100.34	0.301	38.649	-8.804
1981	0	0	0	0.00	0.000	0.000	0.000
1981	0	0	0	0.00	0.000	0.000	0.000
1981	107	0.23	14	195.20	0.413	26.294	-16.334
1981	2,285	4.84	298	116.58	0.247	15.210	-9.746
1981	2,426	5.13	316	114.92	0.243	14.976	-9.608
1982	2,187	5.44	281	25.43	0.063	3.273	-2.168
1982	2,808	6.99	354	23.42	0.058	2.952	-1.997
1982	1,680	4.18	212	23.33	0.058	2.938	-1.988
1982	1,210	3.01	154	24.40	0.061	3.109	-2.079
1982	1,177	2.93	148	23.01	0.057	2.886	-1.958
1983	1,731	5.56	261	51.99	0.167	7.852	-4.603
1983	1,633	5.24	244	50.10	0.161	7.487	-4.436

	DOC	TP	TN	[DOC]	[TP]	[TN]	Change in [DO]
1983	3,834	12.30	591	56.03	0.180	8.635	-4.967
1983	5,123	16.44	770	51.17	0.164	7.695	-4.535
1983	4,604	14.78	689	50.19	0.161	7.506	-4.450
1984	3,253	10.08	528	132.65	0.411	21.528	-11.693
1984	2,025	6.27	327	128.76	0.399	20.795	-11.352
1984	5,430	16.83	892	143.08	0.443	23.493	-12.616
1984	5,216	16.16	833	120.54	0.373	19.247	-10.625
1984	3,082	9.55	495	125.03	0.387	20.093	-11.022
1985	170	0.40	47	22.98	0.054	6.398	-1.942
1985	314	0.74	80	28.47	0.067	7.236	-2.405
1985	683	1.60	175	28.04	0.066	7.170	-2.367
1985	2,217	5.20	571	27.49	0.064	7.085	-2.325
1985	4,865	11.41	1,291	25.61	0.060	6.799	-2.169
1986	123	0.43	25	430.33	1.491	86.344	-38.688
1986	1,809	6.27	327	65.76	0.228	11.869	-5.906
1986	4,041	14.01	719	59.26	0.205	10.542	-5.324
1986	4,061	14.08	716	55.91	0.194	9.858	-5.023
1986	2,641	9.16	464	54.58	0.189	9.585	-4.899
1987	3,787	7.93	310	139.80	0.293	11.445	-11.677
1987	2,236	4.68	183	139.68	0.292	11.428	-11.667
1987	2,706	5.67	230	147.33	0.308	12.497	-12.304
1987	4,384	9.18	373	148.08	0.310	12.602	-12.368
1987	5,524	11.57	460	143.13	0.300	11.910	-11.954
1988	1,271	2.66	223	103.53	0.217	18.160	-8.646
1988	1,099	2.30	194	99.48	0.208	17.594	-8.308
1988	3,074	6.44	527	116.97	0.245	20.038	-9.769
1988	5,386	11.28	941	105.37	0.221	18.417	-8.800
1988	2,097	4.39	372	98.22	0.206	17.418	-8.201
1989	1	0.00	0	40.12	0.111	13.143	-3.476
1989	64	0.18	20	45.12	0.125	14.010	-3.907
1989	707	1.96	222	43.76	0.121	13.774	-3.786
1989	1,564	4.33	507	41.06	0.114	13.307	-3.552
1989	4,796	13.28	1,577	39.84	0.110	13.095	-3.451
1990	94	0.25	18	31.48	0.084	6.024	-2.706
1990	1,160	3.08	233	22.75	0.060	4.559	-1.954
1990	1,497	3.97	304	21.04	0.056	4.272	-1.808
1990	1,329	3.53	270	21.06	0.056	4.276	-1.810
1990	3,019	8.01	612	21.20	0.056	4.299	-1.824
1991	992	2.80	178	10.76	0.030	1.926	-0.930
1991	1,486	4.20	266	11.96	0.034	2.137	-1.037
1991	2,097	5.93	375	10.97	0.031	1.964	-0.952
1991	1,624	4.59	291	10.75	0.030	1.925	-0.933
1991	1,679	4.75	301	10.35	0.029	1.854	-0.897

	DOC	TP	TN	[DOC]	[TP]	[TN]	Change in [DO]
1992	623	2.11	99	46.36	0.157	7.368	-4.145
1992	2,605	8.82	397	40.10	0.136	6.112	-3.586
1992	1,725	5.84	264	40.59	0.137	6.209	-3.627
1992	2,600	8.80	397	40.53	0.137	6.197	-3.625
1992	3,896	13.19	585	38.26	0.130	5.742	-3.422
1993	4,912	14.48	772	198.71	0.586	31.212	-17.383
1993	1,995	5.88	307	174.90	0.516	26.890	-15.302
1993	838	2.47	126	156.97	0.463	23.636	-13.736
1993	874	2.58	135	180.74	0.533	27.951	-15.814
1993	4,519	13.32	724	227.32	0.670	36.405	-19.887
1994	222	0.48	82	6.07	0.013	2.249	-0.503
1994	541	1.17	224	5.11	0.011	2.112	-0.426
1994	651	1.41	275	4.93	0.011	2.086	-0.412
1994	792	1.71	331	5.02	0.011	2.099	-0.419
1994	955	2.07	407	4.87	0.011	2.078	-0.407
1995	578	2.18	43	14.25	0.054	1.061	-1.294
1995	963	3.63	68	13.91	0.052	0.988	-1.266
1995	2,562	9.67	182	13.90	0.052	0.984	-1.267
1995	3,822	14.42	285	14.26	0.054	1.064	-1.302
1995	5,930	22.37	436	14.16	0.053	1.042	-1.293
1996	3,839	12.95	572	96.69	0.326	14.410	-8.645
1996	6,853	23.13	1,014	94.72	0.320	14.015	-8.471
1996	3,719	12.55	551	95.01	0.321	14.073	-8.493
1996	3,551	11.98	519	91.56	0.309	13.381	-8.185
1996	3,295	11.12	488	94.78	0.320	14.026	-8.472
1997	1,162	2.98	292	31.72	0.081	7.974	-2.714
1997	1,275	3.27	331	29.05	0.075	7.536	-2.482
1997	3,244	8.32	835	29.67	0.076	7.638	-2.541
1997	3,435	8.81	893	28.87	0.074	7.508	-2.473
1997	2,457	6.30	637	29.12	0.075	7.548	-2.492
1998	453	1.34	84	23.27	0.069	4.310	-2.030
1998	633	1.87	117	27.88	0.082	5.148	-2.435
1998	1,512	4.47	279	27.12	0.080	5.011	-2.369
1998	3,913	11.57	724	25.31	0.075	4.681	-2.214
1998	3,157	9.34	585	22.74	0.067	4.214	-1.987
1999	209	0.52	29	26.13	0.065	3.579	-2.224
1999	789	1.96	109	28.13	0.070	3.898	-2.394
1999	959	2.38	131	25.81	0.064	3.528	-2.195
1999	2,736	6.78	376	26.73	0.066	3.675	-2.278
1999	8,333	20.64	1,122	23.71	0.059	3.194	-2.023
2000	97	0.32	19	0.00	0.000	0.000	0.005
2000	1,126	3.75	230	76.33	0.254	15.621	-6.806
2000	1,890	6.30	389	65.57	0.218	13.484	-5.847
2000	2,943	9.81	605	67.00	0.223	13.768	-5.976

	DOC	TP	TN	[DOC]	[TP]	[TN]	Change in [DO]
2000	7,046	23.48	1,454	60.10	0.200	12.398	-5.362
2001	99	0.21	28	5.90	0.012	1.659	-0.484
2001	479	1.00	149	4.85	0.010	1.513	-0.402
2001	1,004	2.09	328	4.47	0.009	1.461	-0.373
2001	1,051	2.19	347	4.40	0.009	1.450	-0.366
2001	1,046	2.18	344	4.41	0.009	1.452	-0.368
2002	59	0.23	13	12.95	0.049	2.839	-1.182
2002	1,105	4.21	243	5.23	0.020	1.152	-0.478
2002	1,363	5.19	300	4.81	0.018	1.061	-0.440
2002	644	2.45	142	4.64	0.018	1.023	-0.421
2002	395	1.50	87	4.98	0.019	1.097	-0.452
2003	494	1.55	71	21.65	0.068	3.120	-1.907
2003	1,146	3.60	147	16.07	0.051	2.057	-1.415
2003	1,764	5.55	239	18.29	0.058	2.479	-1.615
2003	2,739	8.61	359	16.94	0.053	2.222	-1.496
2003	2,045	6.43	264	16.36	0.051	2.113	-1.444
2004	225	0.56	27	14.20	0.035	1.706	-1.204
2004	430	1.07	50	13.18	0.033	1.544	-1.117
2004	1,108	2.75	130	13.22	0.033	1.549	-1.125
2004	4,585	11.40	530	12.70	0.032	1.467	-1.084
2004	6,155	15.31	696	12.03	0.030	1.360	-1.027
2005	1,748	6.24	469	12.22	0.044	3.279	-1.102
2005	2,189	7.81	594	11.68	0.042	3.166	-1.054
2005	1,804	6.44	491	11.52	0.041	3.134	-1.040
2005	1,654	5.90	449	11.60	0.041	3.149	-1.047
2005	2,064	7.37	559	11.79	0.042	3.189	-1.063
2006	198	0.69	32	96.18	0.334	15.516	-8.643
2006	1,999	6.94	301	77.42	0.269	11.678	-6.954
2006	2,408	8.36	349	69.96	0.243	10.151	-6.283
2006	4,587	15.92	675	72.40	0.251	10.652	-6.507
2006	4,684	16.26	666	66.68	0.231	9.481	-5.990
2007	1,285	3.26	229	43.27	0.110	7.693	-3.697
2007	2,949	7.47	526	42.20	0.107	7.521	-3.608
2007	2,909	7.37	525	37.32	0.095	6.730	-3.188
2007	1,431	3.63	255	41.54	0.105	7.414	-3.548
2007	3,307	8.38	592	40.29	0.102	7.211	-3.445
2008	12	0.04	6	5.02	0.015	2.300	-0.439
2008	289	0.89	117	6.23	0.019	2.527	-0.543
2008	1,509	4.66	673	5.26	0.016	2.346	-0.463
2008	1,334	4.12	613	5.00	0.015	2.297	-0.440
2008	1,428	4.41	647	5.12	0.016	2.319	-0.450
Median	1,680	4.773	310	29	0.075	5.742	-2.473
Average	2,138	6.190	376	53	0.152	9.561	-4.627