APPENDIX 5: 2002 ROUGE RIVER MYSTERY OIL SPILL - Restoration scaling, calculation of Discounted Service Acre Years (DSAYs) assuming a 30 year project life cycle, including both implementation and maintenance.

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Rouge River Compensatory Wetland Restoration Requirements Calculations - FINAL

May 2015 - M. Annis

Assumes: 1) spill occurs in 2002; 2) Restoration begins in 2016 (14 years after spill); 3) Emergent marsh requires 15 years to reach full function (based on LA DEQ et al., 2003), ultimately reaching 100% of natural habitat productivity; 4) Project lifetime is 30 years (LA DEQ et al., 2003); 5) Wetlands are dominated by *Carex lacustris* and *Typha latifolia*; and 6) habitat/resource recovery function is linear based on Penn and Tomasi (2002).

Conversion factor for change in project initation date as per Tim's email 4/11/14:

1.03exp (2016-2014)=1.03 exp (2)=1.0609

Discounted Service Acre-Years restored per Acre of Sedge Wetland Restored as per scaling dec 2012
16.3

Discounted Service Acre-Years restored per Acre of Cattail Wetland Restored as per scaling dec 2012
16.3

	Compensatory Lake Sedge Marsh (Acres) if beginning 2014	Lake Sedge Acres 2016	Sedge DSAY 2016	Compensatory Common Cattail Marsh (Acres) 2014	C. Cattail Acres 2016	Cattail DSAY 2016
All Birds	224	237.64	3873.56	172	182.47	2974.34
Muskrats	161	170.80	2784.12	123	130.49	2127.00
Reptiles and Amphibians	0.08	0.08	1.38	0.062	0.07	1.07
Fish	0.53	0.56	9.17	0.407	0.43	7.04
Marsh Habitat	0.226	0.240	3.908	0.226	0.24	3.91
Totals	385	409.33	6672.13	296	313.70	5113.36

DSAYs Expected from Proposed Projects*	30 yrs project life
Project	DSAYs produced
Humbug & Monguagon	912.65
Gibraltar-70acres	620.61
Great Lakes Marsh	671.40
Pt. Mouillee Pump-Lautenschalger Unit	470.92
Pt. Mouillee Pump-Vermet Unit	1177.30
Pt. Mouillee Pump-Humphries Unit	1246.89
Pt. Mouillee substitute Bad Creek (30acres)	334.93
Total	5434.70
Proposed supplemental LEMP Projects:	
Marsh Edge	147.17
Shoreline	47.47
LakePlain	255.61
Subtotal Supplemental LEMP	450.24
Total with extra LEMP acres	5884.95

50%:50% Mix of Cattail and Sedge DSAY required if project begins 2016 = 5892.75

DSAYs achieved - Preferred Restoration Alternative = 5884.95

DSAYs Required / DSAYs Achieved (%) = 99.90%

Rouge River Compensatory Wetland Restoration Requirements Calculations - FINAL

April 25, 2014 - M. Annis

Assumes: 1) spill occurs in 2002; 2) Wetland Restoration occurrs in 2016 (14 years after spill); 3) Emergent marsh requires 15 years to reach full function (based on LA DEQ et al., 2003), ultimately reaching 100% of natural habitat productivity; 4) Project lifetime is 20 years once wetland matures, achieving 100% function (LA DEQ et al., 2003); 5) Wetland is dominated by *Carex Lacustris* ; and 6) habitat/resource recovery function is linear based on Penn and Tomasi (2002).

Model Carex Wetland

Year Restoration Initiated	Restoration Year	*Carex lacustris* restoration required (acres) (Grant et al. 2011)	Percent Service Gain	Adjusted Service Gains (Acres)	Discount Rate (1+r)	Span of Years (Years)	Discount Factor	Discounted Service Acre Years (DSAYs) gained
2016	2016	409.23	6.67	27.30	1.03	0	1.0000	27.30
2016	2017	409.23	13.34	54.59	1.03	-1	0.9709	53.00
2016	2018	409.23	20.01	81.89	1.03	-2	0.9426	77.19
2016	2019	409.23	26.68	109.18	1.03	-3	0.9151	99.92
2016	2020	409.23	33.35	136.48	1.03	-4	0.8885	121.26
2016	2021	409.23	40.02	163.77	1.03	-5	0.8626	141.27
2016	2022	409.23	46.69	191.07	1.03	-6	0.8375	160.02
2016	2023	409.23	53.36	218.37	1.03	-7	0.8131	177.55
2016	2024	409.23	60.03	245.66	1.03	-8	0.7894	193.93
2016	2025	409.23	66.70	272.96	1.03	-9	0.7664	209.20
2016	2026	409.23	73.37	300.25	1.03	-10	0.7441	223.42
2016	2027	409.23	80.04	327.55	1.03	-11	0.7224	236.63
2016	2028	409.23	86.71	354.84	1.03	-12	0.7014	248.88
2016	2029	409.23	93.38	382.14	1.03	-13	0.6810	260.22
2016	2030	409.23	100.00	409.23	1.03	-14	0.6611	270.55
2016	2031	409.23	100.00	409.23	1.03	-15	0.6419	262.67
2016	2032	409.23	100.00	409.23	1.03	-16	0.6232	255.02
2016	2033	409.23	100.00	409.23	1.03	-17	0.6050	247.59
2016	2034	409.23	100.00	409.23	1.03	-18	0.5874	240.38
2016	2035	409.23	100.00	409.23	1.03	-19	0.5703	233.38
2016	2036	409.23	100.00	409.23	1.03	-20	0.5537	226.58
2016	2037	409.23	100.00	409.23	1.03	-21	0.5375	219.98
2016	2038	409.23	100.00	409.23	1.03	-22	0.5219	213.57
2016	2039	409.23	100.00	409.23	1.03	-23	0.5067	207.35
2016	2040	409.23	100.00	409.23	1.03	-24	0.4919	201.31
2016	2041	409.23	100.00	409.23	1.03	-25	0.4776	195.45
2016	2042	409.23	100.00	409.23	1.03	-26	0.4637	189.76
2016	2043	409.23	100.00	409.23	1.03	-27	0.4502	184.23
2016	2044	409.23	100.00	409.23	1.03	-28	0.4371	178.86
2016	2045	409.23	100.00	409.23	1.03	-29	0.4243	173.66
2016	2046	409.23	100.00	409.23	1.03	-30	0.4120	168.60
2016	2047	409.23	100.00	409.23	1.03	-31	0.4000	163.69
2016	2048	409.23	100.00	409.23	1.03	-32	0.3883	158.92
2016	2049	409.23	100.00	409.23	1.03	-33	0.3770	154.29
2016	2050	409.23	100.00	409.23	1.03	-34	0.3660	149.80
2016	2051	409.23	100.00	409.23	1.03	-35	0.3554	145.43

Discounted Service Acre Years (DSAY) of wetland habitat, invertebrates and wildlife gained from *Carex* restoration: 6670.84

Magnitude of *Carex lacustris* wetland restoration required for Rouge River Compensatory Restoration (acres): 409

Discounted Service Acre-Years restored per Acre of *Carex* Wetland Restored: 16.30

Rouge River Compensatory Wetland Restoration Requirements Calculations - FINAL

April 25, 2014 - M. Annis

Assumes: 1) spill occurrs in 2002; 2) Wetland Restoration occurrs in 2016(14 years after spill); 3) Emergent marsh requires 15 years to reach full function (based on LA DEQ et al., 2003), ultimately reaching 100% of natural habitat productivity; 4) Project lifetime is 20 years once wetland matures (LA DEQ et al., 2003); 5) Wetland is dominated by *Typha latifolia*; and 6) habitat/resource recovery function is linear based on Penn and Tomasi (2002).

Model Typha Wetland

Year Restoration Initiated	Restoration Year	*Typha latifolia* restoration required (acres) (Grant et al. 2011)	Percent Service Gain	Adjusted Service Gains (Acres)	Discount Rate (1+r)	Span of Years (Years)	Discount Factor	Discounted Service Acre Years (DSAYs) gained
2016	2016	313.70	6.67	20.92	1.03	0	1.0000	20.92
2016	2017	313.70	13.34	41.85	1.03	-1	0.9709	40.63
2016	2018	313.70	20.01	62.77	1.03	-2	0.9426	59.17
2016	2019	313.70	26.68	83.70	1.03	-3	0.9151	76.59
2016	2020	313.70	33.35	104.62	1.03	-4	0.8885	92.95
2016	2021	313.70	40.02	125.54	1.03	-5	0.8626	108.29
2016	2022	313.70	46.69	146.47	1.03	-6	0.8375	122.66
2016	2023	313.70	53.36	167.39	1.03	-7	0.8131	136.10
2016	2024	313.70	60.03	188.31	1.03	-8	0.7894	148.66
2016	2025	313.70	66.70	209.24	1.03	-9	0.7664	160.36
2016	2026	313.70	73.37	230.16	1.03	-10	0.7441	171.26
2016	2027	313.70	80.04	251.09	1.03	-11	0.7224	181.39
2016	2028	313.70	86.71	272.01	1.03	-12	0.7014	190.78
2016	2029	313.70	93.38	292.93	1.03	-13	0.6810	199.47
2016	2030	313.70	100.00	313.70	1.03	-14	0.6611	207.39
2016	2031	313.70	100.00	313.70	1.03	-15	0.6419	201.35
2016	2032	313.70	100.00	313.70	1.03	-16	0.6232	195.49
2016	2033	313.70	100.00	313.70	1.03	-17	0.6050	189.79
2016	2034	313.70	100.00	313.70	1.03	-18	0.5874	184.27
2016	2035	313.70	100.00	313.70	1.03	-19	0.5703	178.90
2016	2036	313.70	100.00	313.70	1.03	-20	0.5537	173.69
2016	2037	313.70	100.00	313.70	1.03	-21	0.5375	168.63
2016	2038	313.70	100.00	313.70	1.03	-22	0.5219	163.72
2016	2039	313.70	100.00	313.70	1.03	-23	0.5067	158.95
2016	2040	313.70	100.00	313.70	1.03	-24	0.4919	154.32
2016	2041	313.70	100.00	313.70	1.03	-25	0.4776	149.82
2016	2042	313.70	100.00	313.70	1.03	-26	0.4637	145.46
2016	2043	313.70	100.00	313.70	1.03	-27	0.4502	141.22
2016	2044	313.70	100.00	313.70	1.03	-28	0.4371	137.11
2016	2045	313.70	100.00	313.70	1.03	-29	0.4243	133.12
2016	2046	313.70	100.00	313.70	1.03	-30	0.4120	129.24
2016	2047	313.70	100.00	313.70	1.03	-31	0.4000	125.48
2016	2048	313.70	100.00	313.70	1.03	-32	0.3883	121.82
2016	2049	313.70	100.00	313.70	1.03	-33	0.3770	118.27
2016	2050	313.70	100.00	313.70	1.03	-34	0.3660	114.83
2016	2051	313.70	100.00	313.70	1.03	-35	0.3554	111.48

Discounted Service Acre Years (DSAYs) of Wetland habitat, invertebrates and wildlife gained from *Typha* wetland restoration **5113.61**

Magnitude of *Typha latifolia* wetland restoration required for Rouge River Compensatory Restoration (acres) = **314**

Discounted Service Acre Years restored per acre of *Typha* wetland restored = **16.30**

Rouge River Compensatory Wetland Restoration Service Gains: Humbug Marsh/Monguagon Creek Bank Habitat Improvements

Compensatory Restoration Project Scaling Assumptions: 1) This project involves both invasives control in Humbug Marsh (i.e., *Phragmites* removal on 25% of 410 acres = 102.5 acres) and stabilization of the Monguagon Creek riparian zone - 0.44 acres - by vegetation planting and by other means; 2) wetland/riparian bank restoration occurs in 2016; 3) Emergent marsh requires 10 years to reach full function since habitat is already partially functional (based on LA DEQ et al., 2003); 4) habitats ultimately reach 90% of natural habitat service functionality (fully developed habitat services reduced in productivity due to required continued invasives management such as *Phragmites* control); 5) Project lifetime is 30 years inclusive of maturation period.; 6) restored wetland is dominated by an assumed mix of *Carex lacustris* and *Typha latifolia*; and 7) habitat/resource recovery function is linear based on Penn and Tomasi (2002).

January 22, 2015 Meeting: Acres and Functionality per agreement with Greg Norwood. Full functionality reached after 10 yrs, initial functionality estimated as 33%.

Year Restoration Initiated	Restoration Year	Restoration Acreage	Percent Services Provided	Precent Baseline Services	Percent Net Services Gained	Adjusted Service Gains (Acres)	Discount Rate (1+r)	Span of Years (Years)	Discount Factor	Discounted Service Acre Years (DSAYs) Gained
2016	2016	102.94	33.00	33.00	0.00	0.00	1.03	0	1.0000	0.00
2016	2017	102.94	38.70	33.00	5.70	5.87	1.03	-1	0.9709	5.70
2016	2018	102.94	44.40	33.00	11.40	11.74	1.03	-2	0.9426	11.06
2016	2019	102.94	50.10	33.00	17.10	17.60	1.03	-3	0.9151	16.11
2016	2020	102.94	55.80	33.00	22.80	23.47	1.03	-4	0.8885	20.85
2016	2021	102.94	61.50	33.00	28.50	29.34	1.03	-5	0.8626	25.31
2016	2022	102.94	67.20	33.00	34.20	35.21	1.03	-6	0.8375	29.48
2016	2023	102.94	72.90	33.00	39.90	41.07	1.03	-7	0.8131	33.40
2016	2024	102.94	78.60	33.00	45.60	46.94	1.03	-8	0.7894	37.06
2016	2025	102.94	84.30	33.00	51.30	52.81	1.03	-9	0.7664	40.47
2016	2026	102.94	90.00	33.00	57.00	58.68	1.03	-10	0.7441	43.66
2016	2027	102.94	90.00	33.00	57.00	58.68	1.03	-11	0.7224	42.39
2016	2028	102.94	90.00	33.00	57.00	58.68	1.03	-12	0.7014	41.15
2016	2029	102.94	90.00	33.00	57.00	58.68	1.03	-13	0.6810	39.96
2016	2030	102.94	90.00	33.00	57.00	58.68	1.03	-14	0.6611	38.79
2016	2031	102.94	90.00	33.00	57.00	58.68	1.03	-15	0.6419	37.66
2016	2032	102.94	90.00	33.00	57.00	58.68	1.03	-16	0.6232	36.56
2016	2033	102.94	90.00	33.00	57.00	58.68	1.03	-17	0.6050	35.50
2016	2034	102.94	90.00	33.00	57.00	58.68	1.03	-18	0.5874	34.47
2016	2035	102.94	90.00	33.00	57.00	58.68	1.03	-19	0.5703	33.46
2016	2036	102.94	90.00	33.00	57.00	58.68	1.03	-20	0.5537	32.49
2016	2037	102.94	90.00	33.00	57.00	58.68	1.03	-21	0.5375	31.54
2016	2038	102.94	90.00	33.00	57.00	58.68	1.03	-22	0.5219	30.62
2016	2039	102.94	90.00	33.00	57.00	58.68	1.03	-23	0.5067	29.73
2016	2040	102.94	90.00	33.00	57.00	58.68	1.03	-24	0.4919	28.86
2016	2041	102.94	90.00	33.00	57.00	58.68	1.03	-25	0.4776	28.02
2016	2042	102.94	90.00	33.00	57.00	58.68	1.03	-26	0.4637	27.21
2016	2043	102.94	90.00	33.00	57.00	58.68	1.03	-27	0.4502	26.42
2016	2044	102.94	90.00	33.00	57.00	58.68	1.03	-28	0.4371	25.65
2016	2045	102.94	90.00	33.00	57.00	58.68	1.03	-29	0.4243	24.90
2016	2046	102.94	90.00	33.00	57.00	58.68	1.03	-30	0.4120	24.17

Discounted Service Acre Years (DSAYs) of wetland habitat, invertebrates and wildlife gained from Humbug Marsh/ Monguagon Creek restoration: **912.65**

Rouge River Compensatory Wetland Restoration Service Gains: Gibraltar Wetland Restoration

Compensatory Restoration Project Scaling Assumptions: 1) This project involves redesign of Gibraltar wetland (i.e., to enhance hydrology of 70 acre wetland parcel); 2) wetland restoration occurs in 2016; 3) Emergent marsh requires 10 years to reach full function since habitat is already partially functional (based on LA DEQ et al., 2003); 4) habitats ultimately reach 90% of natural habitat service functionality (fully developed habitat services reduced in productivity due to required continued invasives management such as *Phragmites* control); 5) Project lifetime is 30 years inclusive of the maturation period; 6) restored wetland is dominated by an assumed mix of *Carex lacustris* and *Typha latifolia*; and, 7) habitat/resource recovery function is linear based on Penn and Tomasi (2002).

January 22, 2015 Meeting: Adjusted by Greg Norwood to reflect only emergent marsh which would be impacted by management due to hydro survey with 70 acres at 33% functionality, full maturity reached after 10yrs.

Year Restoration Initiated	Restoration Year	Restoration Acreage	Percent Services Provided	Precent Baseline Services	Percent Net Services Gained	Adjusted Service Gains (Acres)	Discount Rate (1+r)	Span of Years (Years)	Discount Factor	Discounted Service Acre Years (DSAYs) Gained
2016	2016	70.00	33.00	33.00	0.00	0.00	1.03	0	1.0000	0.00
2016	2017	70.00	38.70	33.00	5.70	3.99	1.03	-1	0.9709	3.87
2016	2018	70.00	44.40	33.00	11.40	7.98	1.03	-2	0.9426	7.52
2016	2019	70.00	50.10	33.00	17.10	11.97	1.03	-3	0.9151	10.95
2016	2020	70.00	55.80	33.00	22.80	15.96	1.03	-4	0.8885	14.18
2016	2021	70.00	61.50	33.00	28.50	19.95	1.03	-5	0.8626	17.21
2016	2022	70.00	67.20	33.00	34.20	23.94	1.03	-6	0.8375	20.05
2016	2023	70.00	72.90	33.00	39.90	27.93	1.03	-7	0.8131	22.71
2016	2024	70.00	78.60	33.00	45.60	31.92	1.03	-8	0.7894	25.20
2016	2025	70.00	84.30	33.00	51.30	35.91	1.03	-9	0.7664	27.52
2016	2026	70.00	90.00	33.00	57.00	39.90	1.03	-10	0.7441	29.69
2016	2027	70.00	90.00	33.00	57.00	39.90	1.03	-11	0.7224	28.82
2016	2028	70.00	90.00	33.00	57.00	39.90	1.03	-12	0.7014	27.99
2016	2029	70.00	90.00	33.00	57.00	39.90	1.03	-13	0.6810	27.17
2016	2030	70.00	90.00	33.00	57.00	39.90	1.03	-14	0.6611	26.38
2016	2031	70.00	90.00	33.00	57.00	39.90	1.03	-15	0.6419	25.61
2016	2032	70.00	90.00	33.00	57.00	39.90	1.03	-16	0.6232	24.86
2016	2033	70.00	90.00	33.00	57.00	39.90	1.03	-17	0.6050	24.14
2016	2034	70.00	90.00	33.00	57.00	39.90	1.03	-18	0.5874	23.44
2016	2035	70.00	90.00	33.00	57.00	39.90	1.03	-19	0.5703	22.75
2016	2036	70.00	90.00	33.00	57.00	39.90	1.03	-20	0.5537	22.09
2016	2037	70.00	90.00	33.00	57.00	39.90	1.03	-21	0.5375	21.45
2016	2038	70.00	90.00	33.00	57.00	39.90	1.03	-22	0.5219	20.82
2016	2039	70.00	90.00	33.00	57.00	39.90	1.03	-23	0.5067	20.22
2016	2040	70.00	90.00	33.00	57.00	39.90	1.03	-24	0.4919	19.63
2016	2041	70.00	90.00	33.00	57.00	39.90	1.03	-25	0.4776	19.06
2016	2042	70.00	90.00	33.00	57.00	39.90	1.03	-26	0.4637	18.50
2016	2043	70.00	90.00	33.00	57.00	39.90	1.03	-27	0.4502	17.96
2016	2044	70.00	90.00	33.00	57.00	39.90	1.03	-28	0.4371	17.44
2016	2045	70.00	90.00	33.00	57.00	39.90	1.03	-29	0.4243	16.93
2016	2046	70.00	90.00	33.00	57.00	39.90	1.03	-30	0.4120	16.44
Discounted Service Acre Years (DSAYs) of wetland habitat, invertebrates and wildlife gained from Gibraltar Wetland restoration										**620.61**

Rouge River Compensatory Wetland Restoration Service Gains: LEMP Coastal Marsh Edge Restoration

Compensatory Restoration Project Scaling Assumptions: 1) This project involves treatment of non-native invasive species on 16 acres of coastal marsh edge; 2) restoration occurs in 2016; 3) Emergent marsh requires 11 years to reach full function since habitat is already partially functional (based on LA DEQ et al., 2003); 4) habitats ultimately reach 90% of natural habitat service functionality (fully developed habitat services reduced in productivity due to required continued invasives management such as *Phragmites* control); 5) Project lifetime is 30 years inclusive of maturation period; 6) restored wetland is dominated by an assumed mix of *Carex lacustris* and *Typha latifolia*; and 7) habitat/resource recovery function is linear based on Penn and Tomasi (2002).

Possible addition to restoration to meet DSAY needs of injuried resources: 16 acres of edge marsh. Assuming functionality is 30% and with maturity reached after 11yrs.

Year Restoration Initiated	Restoration Year	Restoration Acreage	Percent Services Provided	Precent Baseline Services	Percent Net Services Gained	Adjusted Service Gains (Acres)	Discount Rate (1+r)	Span of Years (Years)	Discount Factor	Discounted Service Acre Years (DSAYs) Gained
2016	2016	16.00	30.00	30.00	0.00	0.00	1.03	0	1.0000	0.00
2016	2017	16.00	35.70	30.00	5.70	0.91	1.03	-1	0.9709	0.89
2016	2018	16.00	41.40	30.00	11.40	1.82	1.03	-2	0.9426	1.72
2016	2019	16.00	47.10	30.00	17.10	2.74	1.03	-3	0.9151	2.50
2016	2020	16.00	52.80	30.00	22.80	3.65	1.03	-4	0.8885	3.24
2016	2021	16.00	58.50	30.00	28.50	4.56	1.03	-5	0.8626	3.93
2016	2022	16.00	64.20	30.00	34.20	5.47	1.03	-6	0.8375	4.58
2016	2023	16.00	69.90	30.00	39.90	6.38	1.03	-7	0.8131	5.19
2016	2024	16.00	75.60	30.00	45.60	7.30	1.03	-8	0.7894	5.76
2016	2025	16.00	81.30	30.00	51.30	8.21	1.03	-9	0.7664	6.29
2016	2026	16.00	87.00	30.00	57.00	9.12	1.03	-10	0.7441	6.79
2016	2027	16.00	90.00	30.00	60.00	9.60	1.03	-11	0.7224	6.94
2016	2028	16.00	90.00	30.00	60.00	9.60	1.03	-12	0.7014	6.73
2016	2029	16.00	90.00	30.00	60.00	9.60	1.03	-13	0.6810	6.54
2016	2030	16.00	90.00	30.00	60.00	9.60	1.03	-14	0.6611	6.35
2016	2031	16.00	90.00	30.00	60.00	9.60	1.03	-15	0.6419	6.16
2016	2032	16.00	90.00	30.00	60.00	9.60	1.03	-16	0.6232	5.98
2016	2033	16.00	90.00	30.00	60.00	9.60	1.03	-17	0.6050	5.81
2016	2034	16.00	90.00	30.00	60.00	9.60	1.03	-18	0.5874	5.64
2016	2035	16.00	90.00	30.00	60.00	9.60	1.03	-19	0.5703	5.47
2016	2036	16.00	90.00	30.00	60.00	9.60	1.03	-20	0.5537	5.32
2016	2037	16.00	90.00	30.00	60.00	9.60	1.03	-21	0.5375	5.16
2016	2038	16.00	90.00	30.00	60.00	9.60	1.03	-22	0.5219	5.01
2016	2039	16.00	90.00	30.00	60.00	9.60	1.03	-23	0.5067	4.86
2016	2040	16.00	90.00	30.00	60.00	9.60	1.03	-24	0.4919	4.72
2016	2041	16.00	90.00	30.00	60.00	9.60	1.03	-25	0.4776	4.59
2016	2042	16.00	90.00	30.00	60.00	9.60	1.03	-26	0.4637	4.45
2016	2043	16.00	90.00	30.00	60.00	9.60	1.03	-27	0.4502	4.32
2016	2044	16.00	90.00	30.00	60.00	9.60	1.03	-28	0.4371	4.20
2016	2045	16.00	90.00	30.00	60.00	9.60	1.03	-29	0.4243	4.07
2016	2046	16.00	90.00	30.00	60.00	9.60	1.03	-30	0.4120	3.96
									Discounted Service Acre Years (DSAYs) of wetland habitat, invertebrates and wildlife gained:	**147.17**

Rouge River Compensatory Wetland Restoration Service Gains: LEMP Lake Erie Shoreline Restoration

Compensatory Restoration Project Scaling Assumptions: 1) This project involves treatment of non-native and invasive species on 9 acres along the Lake Erie shoreline within the Lake Erie Metro Park; 2) Wetland restoration occurs in 2016; 3) Emergent marsh requires 6 years to reach full function since habitat is already partially functional (based on LA DEQ et al., 2003); 4) Habitats ultimately reach 90% of natural habitat service functionality (fully developed habitat services reduced in productivity due to required continued invasives management such as *Phragmites* control); 5) Project lifetime is 30 years inclusive of maturation period; 6) Restored wetland habitat is dominated by an assumed mix of *Carex lacustris* and *Typha latifolia*; and, 7) Habitat/resource recovery function is linear based on Penn and Tomasi (2002).

Possible addition to restoration to meet DSAY needs of injuried resources: 9 acres of shoreline marsh. Assuming functionality is 60% and with maturity reached after 6 yrs.

Year Restoration Initiated	Restoration Year	Restoration Acreage	Percent Services Provided	Precent Baseline Services	Percent Net Services Gained	Adjusted Service Gains (Acres)	Discount Rate (1+r)	Span of Years (Years)	Discount Factor	Discounted Service Acre Years (DSAYs) Gained
2016	2016	9.00	60.00	60.00	0.00	0.00	1.03	0	1.0000	0.00
2016	2017	9.00	65.70	60.00	5.70	0.51	1.03	-1	0.9709	0.50
2016	2018	9.00	71.40	60.00	11.40	1.03	1.03	-2	0.9426	0.97
2016	2019	9.00	77.10	60.00	17.10	1.54	1.03	-3	0.9151	1.41
2016	2020	9.00	82.80	60.00	22.80	2.05	1.03	-4	0.8885	1.82
2016	2021	9.00	88.50	60.00	28.50	2.57	1.03	-5	0.8626	2.21
2016	2022	9.00	90.00	60.00	30.00	2.70	1.03	-6	0.8375	2.26
2016	2023	9.00	90.00	60.00	30.00	2.70	1.03	-7	0.8131	2.20
2016	2024	9.00	90.00	60.00	30.00	2.70	1.03	-8	0.7894	2.13
2016	2025	9.00	90.00	60.00	30.00	2.70	1.03	-9	0.7664	2.07
2016	2026	9.00	90.00	60.00	30.00	2.70	1.03	-10	0.7441	2.01
2016	2027	9.00	90.00	60.00	30.00	2.70	1.03	-11	0.7224	1.95
2016	2028	9.00	90.00	60.00	30.00	2.70	1.03	-12	0.7014	1.89
2016	2029	9.00	90.00	60.00	30.00	2.70	1.03	-13	0.6810	1.84
2016	2030	9.00	90.00	60.00	30.00	2.70	1.03	-14	0.6611	1.79
2016	2031	9.00	90.00	60.00	30.00	2.70	1.03	-15	0.6419	1.73
2016	2032	9.00	90.00	60.00	30.00	2.70	1.03	-16	0.6232	1.68
2016	2033	9.00	90.00	60.00	30.00	2.70	1.03	-17	0.6050	1.63
2016	2034	9.00	90.00	60.00	30.00	2.70	1.03	-18	0.5874	1.59
2016	2035	9.00	90.00	60.00	30.00	2.70	1.03	-19	0.5703	1.54
2016	2036	9.00	90.00	60.00	30.00	2.70	1.03	-20	0.5537	1.49
2016	2037	9.00	90.00	60.00	30.00	2.70	1.03	-21	0.5375	1.45
2016	2038	9.00	90.00	60.00	30.00	2.70	1.03	-22	0.5219	1.41
2016	2039	9.00	90.00	60.00	30.00	2.70	1.03	-23	0.5067	1.37
2016	2040	9.00	90.00	60.00	30.00	2.70	1.03	-24	0.4919	1.33
2016	2041	9.00	90.00	60.00	30.00	2.70	1.03	-25	0.4776	1.29
2016	2042	9.00	90.00	60.00	30.00	2.70	1.03	-26	0.4637	1.25
2016	2043	9.00	90.00	60.00	30.00	2.70	1.03	-27	0.4502	1.22
2016	2044	9.00	90.00	60.00	30.00	2.70	1.03	-28	0.4371	1.18
2016	2045	9.00	90.00	60.00	30.00	2.70	1.03	-29	0.4243	1.15
2016	2046	9.00	90.00	60.00	30.00	2.70	1.03	-30	0.4120	1.11

Discounted Service Acre Years (DSAYs) of wetland habitat, invertebrates and wildlife gained: 47.47

Rouge River Compensatory Wetland Restoration Service Gains: LEMP Lakeplain Prairie Restoration

Compensatory Restoration Project Scaling Assumptions: 1) This project involves treatment of non-native and invasive species in lakeplain prairie habitat within the Lake Erie MetroPark; 2) wetland restoration occurs in 2016; 3) Habitat requires 8 years to reach full function since habitat is already partially functional (based on LA DEQ et al., 2003); 4) habitats ultimately reach 90% of natural habitat service functionality (fully developed habitat services reduced in productivity due to required continued invasives management such as *Phragmites* control); 5) Project lifetime is 30 years inclusive of maturation period; 6) restored prairie is dominated by native species; and, 7) habitat/resource recovery function is linear based on Penn and Tomasi (2002).

Possible addition to restoration to meet DSAY needs of injuried resources: 38 acres of lake plain marsh. Assuming functionality is 50% and with maturity reached after 8 yrs.

Year Restoration Initiated	Restoration Year	Restoration Acreage	Percent Services Provided	Precent Baseline Services	Percent Net Services Gained	Adjusted Service Gains (Acres)	Discount Rate (1+r)	Span of Years (Years)	Discount Factor	Discounted Service Acre Years (DSAYs) Gained
2016	2016	38.00	50.00	50.00	0.00	0.00	1.03	0	1.0000	0.00
2016	2017	38.00	55.70	50.00	5.70	2.17	1.03	-1	0.9709	2.10
2016	2018	38.00	61.40	50.00	11.40	4.33	1.03	-2	0.9426	4.08
2016	2019	38.00	67.10	50.00	17.10	6.50	1.03	-3	0.9151	5.95
2016	2020	38.00	72.80	50.00	22.80	8.66	1.03	-4	0.8885	7.70
2016	2021	38.00	78.50	50.00	28.50	10.83	1.03	-5	0.8626	9.34
2016	2022	38.00	84.20	50.00	34.20	13.00	1.03	-6	0.8375	10.88
2016	2023	38.00	89.90	50.00	39.90	15.16	1.03	-7	0.8131	12.33
2016	2024	38.00	90.00	50.00	40.00	15.20	1.03	-8	0.7894	12.00
2016	2025	38.00	90.00	50.00	40.00	15.20	1.03	-9	0.7664	11.65
2016	2026	38.00	90.00	50.00	40.00	15.20	1.03	-10	0.7441	11.31
2016	2027	38.00	90.00	50.00	40.00	15.20	1.03	-11	0.7224	10.98
2016	2028	38.00	90.00	50.00	40.00	15.20	1.03	-12	0.7014	10.66
2016	2029	38.00	90.00	50.00	40.00	15.20	1.03	-13	0.6810	10.35
2016	2030	38.00	90.00	50.00	40.00	15.20	1.03	-14	0.6611	10.05
2016	2031	38.00	90.00	50.00	40.00	15.20	1.03	-15	0.6419	9.76
2016	2032	38.00	90.00	50.00	40.00	15.20	1.03	-16	0.6232	9.47
2016	2033	38.00	90.00	50.00	40.00	15.20	1.03	-17	0.6050	9.20
2016	2034	38.00	90.00	50.00	40.00	15.20	1.03	-18	0.5874	8.93
2016	2035	38.00	90.00	50.00	40.00	15.20	1.03	-19	0.5703	8.67
2016	2036	38.00	90.00	50.00	40.00	15.20	1.03	-20	0.5537	8.42
2016	2037	38.00	90.00	50.00	40.00	15.20	1.03	-21	0.5375	8.17
2016	2038	38.00	90.00	50.00	40.00	15.20	1.03	-22	0.5219	7.93
2016	2039	38.00	90.00	50.00	40.00	15.20	1.03	-23	0.5067	7.70
2016	2040	38.00	90.00	50.00	40.00	15.20	1.03	-24	0.4919	7.48
2016	2041	38.00	90.00	50.00	40.00	15.20	1.03	-25	0.4776	7.26
2016	2042	38.00	90.00	50.00	40.00	15.20	1.03	-26	0.4637	7.05
2016	2043	38.00	90.00	50.00	40.00	15.20	1.03	-27	0.4502	6.84
2016	2044	38.00	90.00	50.00	40.00	15.20	1.03	-28	0.4371	6.64
2016	2045	38.00	90.00	50.00	40.00	15.20	1.03	-29	0.4243	6.45
2016	2046	38.00	90.00	50.00	40.00	15.20	1.03	-30	0.4120	6.26

Discounted Service Acre Years (DSAYs) of wetland habitat, invertebrates and wildlife gained: 255.61

Rouge River Compensatory Wetland Restoration Service Gains: Great Lakes Marsh Restoration

Compensatory Restoration Project Scaling Assumptions: 1) This project involves management of invasives in Great Lakes Marsh (esp. *Phragmites*, and, possibly, flowering rush and European frogbit) 350 acre marsh parcel; 2) wetland restoration occurs in 2016; 3) Emergent marsh requires 10 years to reach full function since habitat is already partially functional (based on LA DEQ et al., 2003); 4) habitats ultimately reach 90% of natural habitat service functionality (fully developed habitat services reduced in productivity due to required continued invasives management such as Phragmites control); 5) Project lifetime is 30 years inclusive of the maturation period; 6) restored wetland is dominated by an assumed mix of *Carex lacustris* and *Typha latifolia*; and, 7) habitat/resource recovery function is linear based on Penn and Tomasi (2002).

February 23, 2015 Phone Meeting : Paul Muelle requested maintenance for 350 acres of marsh which had completed initial phrag control measures through a GLRI grant in Spring 2015. After initial treatment the 350 acre marsh is estimated to be 80% functional with 3 yrs to reach functionality.

Year Restoration Initiated	Restoration Year	Restoration Acreage	Percent Services Provided	Precent Baseline Services	Percent Net Services Gained	Adjusted Service Gains (Acres)	Discount Rate (1+r)	Span of Years (Years)	Discount Factor	Discounted Service Acre Years (DSAYs) Gained
2016	2016	350.00	80.00	80.00	0.00	0.00	1.03	0	1.0000	0.00
2016	2017	350.00	85.70	80.00	5.70	19.95	1.03	-1	0.9709	19.37
2016	2018	350.00	90.00	80.00	10.00	35.00	1.03	-2	0.9426	32.99
2016	2019	350.00	90.00	80.00	10.00	35.00	1.03	-3	0.9151	32.03
2016	2020	350.00	90.00	80.00	10.00	35.00	1.03	-4	0.8885	31.10
2016	2021	350.00	90.00	80.00	10.00	35.00	1.03	-5	0.8626	30.19
2016	2022	350.00	90.00	80.00	10.00	35.00	1.03	-6	0.8375	29.31
2016	2023	350.00	90.00	80.00	10.00	35.00	1.03	-7	0.8131	28.46
2016	2024	350.00	90.00	80.00	10.00	35.00	1.03	-8	0.7894	27.63
2016	2025	350.00	90.00	80.00	10.00	35.00	1.03	-9	0.7664	26.82
2016	2026	350.00	90.00	80.00	10.00	35.00	1.03	-10	0.7441	26.04
2016	2027	350.00	90.00	80.00	10.00	35.00	1.03	-11	0.7224	25.28
2016	2028	350.00	90.00	80.00	10.00	35.00	1.03	-12	0.7014	24.55
2016	2029	350.00	90.00	80.00	10.00	35.00	1.03	-13	0.6810	23.83
2016	2030	350.00	90.00	80.00	10.00	35.00	1.03	-14	0.6611	23.14
2016	2031	350.00	90.00	80.00	10.00	35.00	1.03	-15	0.6419	22.47
2016	2032	350.00	90.00	80.00	10.00	35.00	1.03	-16	0.6232	21.81
2016	2033	350.00	90.00	80.00	10.00	35.00	1.03	-17	0.6050	21.18
2016	2034	350.00	90.00	80.00	10.00	35.00	1.03	-18	0.5874	20.56
2016	2035	350.00	90.00	80.00	10.00	35.00	1.03	-19	0.5703	19.96
2016	2036	350.00	90.00	80.00	10.00	35.00	1.03	-20	0.5537	19.38
2016	2037	350.00	90.00	80.00	10.00	35.00	1.03	-21	0.5375	18.81
2016	2038	350.00	90.00	80.00	10.00	35.00	1.03	-22	0.5219	18.27
2016	2039	350.00	90.00	80.00	10.00	35.00	1.03	-23	0.5067	17.73
2016	2040	350.00	90.00	80.00	10.00	35.00	1.03	-24	0.4919	17.22
2016	2041	350.00	90.00	80.00	10.00	35.00	1.03	-25	0.4776	16.72
2016	2042	350.00	90.00	80.00	10.00	35.00	1.03	-26	0.4637	16.23
2016	2043	350.00	90.00	80.00	10.00	35.00	1.03	-27	0.4502	15.76
2016	2044	350.00	90.00	80.00	10.00	35.00	1.03	-28	0.4371	15.30
2016	2045	350.00	90.00	80.00	10.00	35.00	1.03	-29	0.4243	14.85
2016	2046	350.00	90.00	80.00	10.00	35.00	1.03	-30	0.4120	14.42

Discounted Service Acre Years (DSAYs) of wetland habitat, invertebrates and wildlife gained from Great Lakes Marsh restoration: 671.40

Rouge River Compensatory Wetland Restoration Service Gains: Pointe Mouillee Wetland Restoration - Lautenschlager Unit

Compensatory Restoration Project Scaling Assumptions: 1) This project involves replacing a main pump station at the Pointe Mouillee State Game Area, improving water level control in the wetlands os several units including this Lautenschalger Unit of 70 marsh acres. Improving the State's ability to control water levels at the State Game Area facilitates wetland management and invasives control, thereby directly improving wetland function, services and quality; 2) wetland restoration occurs in 2016; 3) Emergent marsh requires 7 years to reach full function since habitat is already partially functional (based on LA DEQ et al., 2003); 4) habitats ultimately reach 90% of natural habitat service functionality (fully developed habitat services reduced in productivity due to required continued invasives management such as Phragmites control); 5) Project lifetime is 30 years inclusive of maturation period; 6) restored wetland is dominated by an assumed mix of *Carex lacustris* and *Typha latifoli* a; and, 7) habitat/resource recovery function is linear based on Penn and Tomasi (2002).

January 22, 2015 Meeting: Zach Cooley provided Lautenschalger Unit as an emergent marsh which would be affected by proposed electric pump station. Emergent Marsh on the unit is 70 acres at 50% current functionality, needing 40% increase in functionality to reach 90%. Zach estimates a pump life of 30-50 yrs with regular maintenance. Full functionality reached after 7yrs.

Year Restoration Initiated	Restoration Year	Restoration Acreage	Percent Services Provided	Precent Baseline Services	Percent Net Services Gained	Adjusted Service Gains (Acres)	Discount Rate (1+r)	Span of Years (Years)	Discount Factor	Discounted Service Acre Years (DSAYs) Gained
2016	2016	70	50.00	50.00	0.00	0.00	1.03	0	1.0000	0.00
2016	2017	70	55.70	50.00	5.70	3.99	1.03	-1	0.9709	3.87
2016	2018	70	67.10	50.00	11.40	7.98	1.03	-2	0.9426	7.52
2016	2019	70	72.80	50.00	17.10	11.97	1.03	-3	0.9151	10.95
2016	2020	70	78.50	50.00	22.80	15.96	1.03	-4	0.8885	14.18
2016	2021	70	84.20	50.00	28.50	19.95	1.03	-5	0.8626	17.21
2016	2022	70	89.90	50.00	34.20	23.94	1.03	-6	0.8375	20.05
2016	2023	70	90.00	50.00	40.00	28.00	1.03	-7	0.8131	22.77
2016	2024	70	90.00	50.00	40.00	28.00	1.03	-8	0.7894	22.10
2016	2025	70	90.00	50.00	40.00	28.00	1.03	-9	0.7664	21.46
2016	2026	70	90.00	50.00	40.00	28.00	1.03	-10	0.7441	20.83
2016	2027	70	90.00	50.00	40.00	28.00	1.03	-11	0.7224	20.23
2016	2028	70	90.00	50.00	40.00	28.00	1.03	-12	0.7014	19.64
2016	2029	70	90.00	50.00	40.00	28.00	1.03	-13	0.6810	19.07
2016	2030	70	90.00	50.00	40.00	28.00	1.03	-14	0.6611	18.51
2016	2031	70	90.00	50.00	40.00	28.00	1.03	-15	0.6419	17.97
2016	2032	70	90.00	50.00	40.00	28.00	1.03	-16	0.6232	17.45
2016	2033	70	90.00	50.00	40.00	28.00	1.03	-17	0.6050	16.94
2016	2034	70	90.00	50.00	40.00	28.00	1.03	-18	0.5874	16.45
2016	2035	70	90.00	50.00	40.00	28.00	1.03	-19	0.5703	15.97
2016	2036	70	90.00	50.00	40.00	28.00	1.03	-20	0.5537	15.50
2016	2037	70	90.00	50.00	40.00	28.00	1.03	-21	0.5375	15.05
2016	2038	70	90.00	50.00	40.00	28.00	1.03	-22	0.5219	14.61
2016	2039	70	90.00	50.00	40.00	28.00	1.03	-23	0.5067	14.19
2016	2040	70	90.00	50.00	40.00	28.00	1.03	-24	0.4919	13.77
2016	2041	70	90.00	50.00	40.00	28.00	1.03	-25	0.4776	13.37
2016	2042	70	90.00	50.00	40.00	28.00	1.03	-26	0.4637	12.98
2016	2043	70	90.00	50.00	40.00	28.00	1.03	-27	0.4502	12.61
2016	2044	70	90.00	50.00	40.00	28.00	1.03	-28	0.4371	12.24
2016	2045	70	90.00	50.00	40.00	28.00	1.03	-29	0.4243	11.88
2016	2046	70	90.00	50.00	40.00	28.00	1.03	-30	0.4120	11.54
									Discounted Service Acre Years (DSAYs) gained:	**470.92**

Rouge River Compensatory Wetland Restoration Service Gains: Pointe Mouillee Wetland Restoration - Vermet Unit

Compensatory Restoration Project Scaling Assumptions: 1) This project involves replacing a main pump station at the Pointe Mouillee State Game Area, improving water level control in the wetlands of several units including this Vermet Unit of 175 marsh acres. Improving the State's ability to control water levels at the State Game Area facilitates wetland management and invasives control, thereby directly improving wetland function, services and quality; 2) wetland restoration occurs in 2016; 3) Emergent marsh requires 7 years to reach full function since habitat is already partially functional (based on LA DEQ et al., 2003); 4) habitats ultimately reach 90% of natural habitat service functionality (fully developed habitat services reduced in productivity due to required continued invasives management such as Phragmites control); 5) Project lifetime is 30 years inclusive of maturation period; 6) restored wetland is dominated by an assumed mix of *Carex lacustris* and *Typha latifolia*; and 7) habitat/resource recovery function is linear based on Penn and Tomasi (2002).

January 22, 2015 Meeting: Zach Cooley provided Vermet Unit as an emergent marsh which would be affected by proposed electric pump station. Emergent Marsh on the unit is 175 acres at 50% current functionality, needing 40% increase in functionality to reach 90%. Zach estimates a pump life of 30-50 yrs with regular maintenance. Full maturity reached after 7 yrs

Year Restoration Initiated	Restoration Year	Restoration Acreage	Percent Services Provided	Precent Baseline Services	Percent Net Services Gained	Adjusted Service Gains (Acres)	Discount Rate (1+r)	Span of Years (Years)	Discount Factor	Discounted Service Acre Years (DSAYs) Gained
2016	2016	175	50.00	50.00	0.00	0.00	1.03	0	1.0000	0.00
2016	2017	175	55.70	50.00	5.70	9.98	1.03	-1	0.9709	9.68
2016	2018	175	67.10	50.00	11.40	19.95	1.03	-2	0.9426	18.80
2016	2019	175	72.80	50.00	17.10	29.93	1.03	-3	0.9151	27.39
2016	2020	175	78.50	50.00	22.80	39.90	1.03	-4	0.8885	35.45
2016	2021	175	84.20	50.00	28.50	49.88	1.03	-5	0.8626	43.02
2016	2022	175	90.00	50.00	34.20	59.85	1.03	-6	0.8375	50.12
2016	2023	175	90.00	50.00	40.00	70.00	1.03	-7	0.8131	56.92
2016	2024	175	90.00	50.00	40.00	70.00	1.03	-8	0.7894	55.26
2016	2025	175	90.00	50.00	40.00	70.00	1.03	-9	0.7664	53.65
2016	2026	175	90.00	50.00	40.00	70.00	1.03	-10	0.7441	52.09
2016	2027	175	90.00	50.00	40.00	70.00	1.03	-11	0.7224	50.57
2016	2028	175	90.00	50.00	40.00	70.00	1.03	-12	0.7014	49.10
2016	2029	175	90.00	50.00	40.00	70.00	1.03	-13	0.6810	47.67
2016	2030	175	90.00	50.00	40.00	70.00	1.03	-14	0.6611	46.28
2016	2031	175	90.00	50.00	40.00	70.00	1.03	-15	0.6419	44.93
2016	2032	175	90.00	50.00	40.00	70.00	1.03	-16	0.6232	43.62
2016	2033	175	90.00	50.00	40.00	70.00	1.03	-17	0.6050	42.35
2016	2034	175	90.00	50.00	40.00	70.00	1.03	-18	0.5874	41.12
2016	2035	175	90.00	50.00	40.00	70.00	1.03	-19	0.5703	39.92
2016	2036	175	90.00	50.00	40.00	70.00	1.03	-20	0.5537	38.76
2016	2037	175	90.00	50.00	40.00	70.00	1.03	-21	0.5375	37.63
2016	2038	175	90.00	50.00	40.00	70.00	1.03	-22	0.5219	36.53
2016	2039	175	90.00	50.00	40.00	70.00	1.03	-23	0.5067	35.47
2016	2040	175	90.00	50.00	40.00	70.00	1.03	-24	0.4919	34.44
2016	2041	175	90.00	50.00	40.00	70.00	1.03	-25	0.4776	33.43
2016	2042	175	90.00	50.00	40.00	70.00	1.03	-26	0.4637	32.46
2016	2043	175	90.00	50.00	40.00	70.00	1.03	-27	0.4502	31.51
2016	2044	175	90.00	50.00	40.00	70.00	1.03	-28	0.4371	30.60
2016	2045	175	90.00	50.00	40.00	70.00	1.03	-29	0.4243	29.70
2016	2046	175	90.00	50.00	40.00	70.00	1.03	-30	0.4120	28.84

Discounted Service Acre Years (DSAYs) gained: 1177.30

Rouge River Compensatory Wetland Restoration Service Gains: Pointe Mouillee Wetland Restoration - Humphries Unit

Compensatory Restoration Project Scaling Assumptions: 1) This project involves replacing a main pump station at the Pointe Mouillee State Game Area, improving water level control in the wetlands of several units including this Humphries Unit of 650 marsh acres. Improving the State's ability to control water levels at the State Game Area facilitates wetland management and invasives control, thereby directly improving wetland function, services and quality; 2) wetland restoration occurs in 2016; 3) Emergent marsh requires 3 years to reach full function since habitat is already partially functional (based on LA DEQ et al., 2003); 4) habitats ultimately reach 90% of natural habitat service functionality (fully developed habitat services reduced in productivity due to required continued invasives management such as *Phragmites* control); 5) Project lifetime is 30 years inclusive of maturation period; 6) restored wetland is dominated by an assumed mix of *Carex lacustris* and *Typha latifolia* ; and 7) habitat/resource recovery function is linear based on Penn and Tomasi (2002).

January 22, 2015 Meeting: Zach Cooley provided Humphries Unit as an emergent marsh which would be affected by proposed electric pump station. Emergent Marsh on the unit is 175 acres at 80% current functionality, needing 10% increase in functionality to reach 90%. Zach estimates a pump life of 30-50yrs with regular maintenance. Based on LA DEQ et al 2003, requires 3 yrs to reach full function given current functionality.

Year Restoration Initiated	Restoration Year	Restoration Acreage	Percent Services Provided	Precent Baseline Services	Percent Net Services Gained	Adjusted Service Gains (Acres)	Discount Rate (1+r)	Span of Years (Years)	Discount Factor	Discounted Service Acre Years (DSAYs) Gained
2016	2016	650	80.00	80.00	0.00	0.00	1.03	0	1.0000	0.00
2016	2017	650	85.70	80.00	5.70	37.05	1.03	-1	0.9709	35.97
2016	2018	650	90.00	80.00	10.00	65.00	1.03	-2	0.9426	61.27
2016	2019	650	90.00	80.00	10.00	65.00	1.03	-3	0.9151	59.48
2016	2020	650	90.00	80.00	10.00	65.00	1.03	-4	0.8885	57.75
2016	2021	650	90.00	80.00	10.00	65.00	1.03	-5	0.8626	56.07
2016	2022	650	90.00	80.00	10.00	65.00	1.03	-6	0.8375	54.44
2016	2023	650	90.00	80.00	10.00	65.00	1.03	-7	0.8131	52.85
2016	2024	650	90.00	80.00	10.00	65.00	1.03	-8	0.7894	51.31
2016	2025	650	90.00	80.00	10.00	65.00	1.03	-9	0.7664	49.82
2016	2026	650	90.00	80.00	10.00	65.00	1.03	-10	0.7441	48.37
2016	2027	650	90.00	80.00	10.00	65.00	1.03	-11	0.7224	46.96
2016	2028	650	90.00	80.00	10.00	65.00	1.03	-12	0.7014	45.59
2016	2029	650	90.00	80.00	10.00	65.00	1.03	-13	0.6810	44.26
2016	2030	650	90.00	80.00	10.00	65.00	1.03	-14	0.6611	42.97
2016	2031	650	90.00	80.00	10.00	65.00	1.03	-15	0.6419	41.72
2016	2032	650	90.00	80.00	10.00	65.00	1.03	-16	0.6232	40.51
2016	2033	650	90.00	80.00	10.00	65.00	1.03	-17	0.6050	39.33
2016	2034	650	90.00	80.00	10.00	65.00	1.03	-18	0.5874	38.18
2016	2035	650	90.00	80.00	10.00	65.00	1.03	-19	0.5703	37.07
2016	2036	650	90.00	80.00	10.00	65.00	1.03	-20	0.5537	35.99
2016	2037	650	90.00	80.00	10.00	65.00	1.03	-21	0.5375	34.94
2016	2038	650	90.00	80.00	10.00	65.00	1.03	-22	0.5219	33.92
2016	2039	650	90.00	80.00	10.00	65.00	1.03	-23	0.5067	32.93
2016	2040	650	90.00	80.00	10.00	65.00	1.03	-24	0.4919	31.98
2016	2041	650	90.00	80.00	10.00	65.00	1.03	-25	0.4776	31.04
2016	2042	650	90.00	80.00	10.00	65.00	1.03	-26	0.4637	30.14
2016	2043	650	90.00	80.00	10.00	65.00	1.03	-27	0.4502	29.26
2016	2044	650	90.00	80.00	10.00	65.00	1.03	-28	0.4371	28.41
2016	2045	650	90.00	80.00	10.00	65.00	1.03	-29	0.4243	27.58
2016	2046	650	90.00	80.00	10.00	65.00	1.03	-30	0.4120	26.78
									Discounted Service Acre Years (DSAYs) gained:	**1246.89**

Rouge River Compensatory Wetland Restoration Service Gains: Pointe Mouillee Wetland Restoration - Bad Creek Unit

Compensatory Restoration Project Scaling Assumptions: 1) This project involves infrastructure replacement for moist soil management of the Bad Creek Unit (30acres). Improving the State's ability to control water levels at the State Game Area facilitates wetland management and invasives control, thereby directly improving wetland function, services and quality; 2) wetland restoration occurs in 2016; 3) Emergent marsh requires 14 years to reach full function since habitat is already partially functional (based on LA DEQ et al., 2003); 4) habitats ultimately reach 90% of natural habitat service functionality (fully developed habitat services reduced in productivity due to required continued invasives management such as *Phragmites* control); 5) Project lifetime is 30 years inclusive of maturation period; 6) restored wetland is dominated by an assumed mix of *Carex lacustris* and *Typha latifolia*; and, 7) habitat/resource recovery function is linear based on Penn and Tomasi (2002).

January 22, 2015 Meeting: Zach Cooley provided Bad Creek Unit as a substitute for the original Cripple Creek Unit. Moist Soil management will occur on 30 acres at 10% current functionality, needing 80% increase in functionality to reach 90%. Based on LA DEQ et al 2003, requires 14 yrs to reach full function given current functionality.

Year Restoration Initiated	Restoration Year	Restoration Acreage	Percent Services Provided	Precent Baseline Services	Percent Net Services Gained	Adjusted Service Gains (Acres)	Discount Rate (1+r)	Span of Years (Years)	Discount Factor	Discounted Service Acre Years (DSAYs) Gained
2016	2016	30	10.00	10.00	0.00	0.00	1.03	0	1.0000	0.00
2016	2017	30	15.70	10.00	5.70	1.71	1.03	-1	0.9709	1.66
2016	2018	30	21.40	10.00	11.40	3.42	1.03	-2	0.9426	3.22
2016	2019	30	27.10	10.00	17.10	5.13	1.03	-3	0.9151	4.69
2016	2020	30	32.80	10.00	22.80	6.84	1.03	-4	0.8885	6.08
2016	2021	30	38.50	10.00	28.50	8.55	1.03	-5	0.8626	7.38
2016	2022	30	44.20	10.00	34.20	10.26	1.03	-6	0.8375	8.59
2016	2023	30	49.90	10.00	39.90	11.97	1.03	-7	0.8131	9.73
2016	2024	30	55.60	10.00	45.60	13.68	1.03	-8	0.7894	10.80
2016	2025	30	61.30	10.00	51.30	15.39	1.03	-9	0.7664	11.80
2016	2026	30	67.00	10.00	57.00	17.10	1.03	-10	0.7441	12.72
2016	2027	30	72.70	10.00	62.70	18.81	1.03	-11	0.7224	13.59
2016	2028	30	78.40	10.00	68.40	20.52	1.03	-12	0.7014	14.39
2016	2029	30	84.10	10.00	74.10	22.23	1.03	-13	0.6810	15.14
2016	2030	30	89.80	10.00	79.80	23.94	1.03	-14	0.6611	15.83
2016	2031	30	90.00	10.00	80.00	24.00	1.03	-15	0.6419	15.40
2016	2032	30	90.00	10.00	80.00	24.00	1.03	-16	0.6232	14.96
2016	2033	30	90.00	10.00	80.00	24.00	1.03	-17	0.6050	14.52
2016	2034	30	90.00	10.00	80.00	24.00	1.03	-18	0.5874	14.10
2016	2035	30	90.00	10.00	80.00	24.00	1.03	-19	0.5703	13.69
2016	2036	30	90.00	10.00	80.00	24.00	1.03	-20	0.5537	13.29
2016	2037	30	90.00	10.00	80.00	24.00	1.03	-21	0.5375	12.90
2016	2038	30	90.00	10.00	80.00	24.00	1.03	-22	0.5219	12.53
2016	2039	30	90.00	10.00	80.00	24.00	1.03	-23	0.5067	12.16
2016	2040	30	90.00	10.00	80.00	24.00	1.03	-24	0.4919	11.81
2016	2041	30	90.00	10.00	80.00	24.00	1.03	-25	0.4776	11.46
2016	2042	30	90.00	10.00	80.00	24.00	1.03	-26	0.4637	11.13
2016	2043	30	90.00	10.00	80.00	24.00	1.03	-27	0.4502	10.80
2016	2044	30	90.00	10.00	80.00	24.00	1.03	-28	0.4371	10.49
2016	2045	30	90.00	10.00	80.00	24.00	1.03	-29	0.4243	10.18
2016	2046	30	90.00	10.00	80.00	24.00	1.03	-30	0.4120	9.89

Discounted Service Acre Years (DSAYs) of wetland habitat, invertebrates and wildlife gained from Pointe Mouillee wetland restoration: 334.93

References for Rouge River Mystery Spill Scaling

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