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New England District

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INTERIM-FINAL BASELINE ECOLOGICAL RISK ASSESSMENT

VOLUME II OF II

Centredale Manor Restoration Project Superfund Site North Providence, Rhode Island

SDMS DocID 000206667

APPENDIX A

ANALYTICAL SAMPLES USED IN THE BERA

Table A-1

Samples Used in the Ecological Risk Assessment

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Surface Water	Assapumpset Pond	RAB-SW-3004-01	11/10/1999			X	X		X			X			
		RAB-SW-3004-01F	11/10/1999							X					
		RAB-SW-5004-01	7/17/2001		X	X	X		X	X					X
	Greystone Mill Pond	RCC-SW-3001-01	11/10/1999			X	X		X			X			
		RCC-SW-3001-01F	11/10/1999							X					
		RCC-SW-3002-01F	11/10/1999							X					
		RWR-SW-5001-01	7/17/2001		X	X	X		X	X					X
		RWR-SW-5002-01	7/17/2001		X	X	X		X	X					X
	Allendale Pond	APB-SW-2029-01	10/29/1999			X	X		X			X			
		APB-SW-2029-01F	10/29/1999							X					
		APB-SW-2034-01	11/3/1999			X	X		X			X			
		APB-SW-2034-01F	11/3/1999							X					
		CMW-SW-2016-01	10/26/1999			X	X		X			X			
		CMW-SW-2016-01F	10/26/1999							X					
		CMW-SW-2019-01	10/26/1999			X	X		X			X			
		CMW-SW-2019-01F	10/26/1999							X					
		CMW-SW-2020-01	10/26/1999			X	X		X			X			
		CMW-SW-2020-01F	10/26/1999							X					
		CMW-SW-2021-01	10/26/1999			X	X		X			X			
		CMW-SW-2021-01F	10/26/1999							X					
		CMW-SW-2022-01	10/27/1999			X	X		X						
		CMW-SW-2022-01F	10/27/1999							X					
		CMW-SW-2024-01	10/27/1999			X	X		X			X			
		CMW-SW-2024-01F	10/27/1999							X					
		CMW-SW-2025-01	10/28/1999			X	X		X			X			
		CMW-SW-2025-01F	10/28/1999							X					
		WRC-SW-2009-01	11/1/1999			X	X		X			X			

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		WRC-SW-2009-01F	11/1/1999							X					
		WRC-SW-2010-01	11/2/1999			X	X		X			X			
		WRC-SW-2010-01F	11/2/1999							X					
		WRC-SW-2011-01F	11/2/1999							X					
		WRC-SW-2012-01	11/2/1999			X	X		X			X			
		WRC-SW-2012-01F	11/2/1999							X					
		WRC-SW-2013-01	11/1/1999			X	X		X			X			
		WRC-SW-2013-01F	11/1/1999							X					
		WRC-SW-2014-01	11/1/1999			X	X		X			X			
		WRC-SW-2014-01F	11/1/1999							X					
		WRC-SW-2015-01	11/1/1999			X	X		X			X			
		WRC-SW-2015-01F	11/1/1999							X					
		WRC-SW-4001-01	7/16/2001		X	X	X		X	X					X
		WRC-SW-4002-01	7/16/2001		X	X	X		X	X					X
		WRC-SW-4003-01	7/16/2001		X	X	X		X	X					X
		WRC-SW-4004-01	7/16/2001		X	X	X		X	X					X
		WRL-SW-2039-01	10/25/1999			X	X		X			X			
		WRL-SW-2039-01F	10/25/1999							X					
		WRL-SW-2044-01	11/9/1999			X	X		X			X			
		WRL-SW-2044-01F	11/9/1999							X					
	Lyman Mill Pond	LPX-SW-2045-01F	11/8/1999							X					
		LPX-SW-2046-01	11/8/1999			X	X		X			X			
		LPX-SW-2046-01F	11/8/1999							X					
		LPX-SW-2047-01	11/8/1999			X	X		X			X			
		LPX-SW-2047-01F	11/8/1999							X					
		LPX-SW-2048-01	11/9/1999			X	X		X			X			
		LPX-SW-2048-01F	11/9/1999							X					

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Surface Water (continued)	Lyman Mill Pond (continued)	LPX-SW-2049-01	11/5/1999			X	X		X			X			
		LPX-SW-2049-01F	11/5/1999							X					
		LPX-SW-2050-01	11/4/1999			X	X		X			X			
		LPX-SW-2050-01F	11/4/1999							X					
		LPX-SW-2051-01A	11/9/1999			X	X								
		LPX-SW-2051-01F	11/4/1999							X					
		LPX-SW-2052-01	11/4/1999			X	X		X			X			
		LPX-SW-2052-01F	11/4/1999							X					
		LPX-SW-2053-01	11/4/1999			X	X		X			X			
		LPX-SW-2053-01F	11/4/1999							X					
		WRL-SW-2041-01	10/25/1999			X	X		X			X			
		WRL-SW-2041-01F	10/25/1999							X					
		WRL-SW-2042-01	11/2/1999			X	X		X			X			
		WRL-SW-2042-01F	11/2/1999							X					
		WRL-SW-2043-01	11/8/1999			X	X		X			X			
		WRL-SW-2043-01F	11/8/1999							X					
		WRL-SW-4004-01	7/17/2001		X	X	X		X	X					X
		WRL-SW-4005-01	7/17/2001		X	X	X		X	X					X
Groundwater	Allendale Pond	GEC-6	3/22/1999		X	X	X								
		CMS-GW-GEC6-02	8/21/2001		X	X	X		X			X			X
		CMS-GW-GEC6F-02	8/21/2001							X					
		CMS-GW-MW05S-02	8/15/2001		X	X	X		X			X			X
		CMS-GW-MW05SF-02	8/15/2001							X					

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Sediment	Assapumpset Pond	RAB-FP-3004-01	11/10/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		RAB-SD-2069-01	9/18/2000	0-0.5ftbgs		X	X		X		X	X			X
		RAB-SD-2070-01	9/18/2000	0 - 0.5 ft bgs		X	X		X		X	X			X
		RAB-SD-3004-01	11/10/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		RAB-SD-5004-0000-01	7/12/2001	0 - 0.5 ft bgs			X		X		X	X			X
		RAB-SD-5008-0000-01	7/9/2001	0-0.5 ft bgs		X	X		X		X				X
	Greystone Mill Pond	GMP-SD-5002-0000-01	7/11/2001	0-0.5 ft bgs			X		X		X	X			X
		GMP-SD-5007-0000-01	7/9/2001	0 - 0.5 ft bgs		X	X		X		X				X
		RCC-BK-3001Y-01	10/22/1999	0-0.5 ft bgs		X	X		X			X			
		RCC-BK-3001Z-01	10/22/1999	0 - 0.5 ft bgs		X	X		X			X			
		RCC-BK-3002X-01	10/22/1999	0 - 0.5 ft bgs		X	X		X			X			
		RCC-BK-3002Y-01	10/22/1999	0 - 0.5 ft bgs		X	X		X			X			
		RCC-BK-3002Z-01	10/22/1999	0 - 0.5 ft bgs		X	X		X			X			
		RCC-FP-3001-01	11/10/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		RCC-FP-3002-01	11/10/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		RCC-SD-3001-01	11/10/1999	0-0.5 ft bgs		X	X		X		X	X			X
		RWR-SD-5003-0000-01	7/12/2001	0 - 0.5 ft bgs			X		X		X	X		X	X
		RWR-SD-5004-0000-01	7/12/2001	0 - 0.5 ft bgs			X		X		X	X			X
	Allendale Pond	3428-CMS-020	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-022	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-023	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-024	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-025	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-073	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-143	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-151	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-159	2/17/1999	0 - 0.25 ft bgs								X			

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Sediment (continued)	Allendale Pond (continued)	3428-CMS-167	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-174	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-175	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-176	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-177	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-179	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-181	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-183	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-186	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-187	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-188	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-190	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-192	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-194	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-195	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-196	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-197	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-199	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-200	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-201	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-203	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-208	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-209	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-210	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-211	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-212	2/17/1999	0 - 0.25 ft bgs								X			

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Sediment (continued)	Allendale Pond (continued)	3428-CMS-213	2/17/1999	0 - 0.25 ft bgs								X,X			
		3428-CMS-214	2/17/1999	0 - 0.25 ft bgs											
		3428-CMS-215	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-216	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-224	2/16/1999	0 - 0.25 ft bgs								X			
		APB-BK-2003Y-01	10/21/1999	0 - 0.5 ft bgs		X	X		X			X			
		APB-BK-2003Z-01	10/21/1999	0 - 0.5 ft bgs		X	X		X			X			
		APB-FP-2028-000.5-01	10/28/1999	0 - 0.5 ft bgs		X	X		X		X				X
		APB-FP-2031-01	10/28/1999	0 - 0.5 ft bgs		X	X		Xj		X				X
		APB-FP-2032-01	10/28/1999	0 - 0.5 ft bgs		X	X		X		X				X
		APB-FP-2033-000.5-01	10/28/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		APB-SD-2030-01	10/22/1999	0-0.5 ft bgs		X	X		X		X				X
		APB-SD-2034-01	11/3/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		APB-SD-2037-01	10/22/1999	0 - 0.5 ft bgs		X	X		X		X				X
		APB-SD-4008-0000-01	7/9/2001	0 - 0.5 ft bgs		X	X								X
		APB-SD-4009-0000-01	7/9/2001	0 - 0.5 ft bgs		X	X		X		X				X
		APB-SD-4010-0000-01	7/10/2001	0 - 0.5 ft bgs		X	X		X		X				X
		APC-SD-2035-000.5-01	11/3/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		CMS-021-A	7/14/1999	0 -1 ft bgs								X			
		CMS-022-A	7/14/1999	0 -1 ft bgs								X			
		CMS-023-A	7/14/1999	0 -1 ft bgs								X			
		CMS-024-A	7/14/1999	0 -1 ft bgs								X			
		CMS-025-A	7/14/1999	0 -1 ft bgs								X			
		CMS-159-A	7/1/1999	0 -1 ft bgs	X	X	X	X	X			X			
		CMS-167-A	6/29/1999	0 -1 ft bgs								X			
		CMS-175-A	6/25/1999	0 -1 ft bgs			X					X			

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Sediment (continued)	Allendale Pond (continued)	CMS-182-A	7/7/1999	0 -1 ft bgs								X			
		CMS-186-A	7/6/1999	0 -1 ft bgs								X			
		CMS-187-A	7/6/1999	0 -1 ft bgs								X			
		CMS-188-A	7/6/1999	0 -1 ft bgs								X			
		CMS-192-A	6/30/1999	0 -1 ft bgs	X	X	X	X	X			X			
		CMS-195-A	7/7/1999	0 -1 ft bgs								X			
		CMS-196-A	7/7/1999	0 -1 ft bgs								X			
		CMS-200-A	7/7/1999	0 -1 ft bgs								X			
		CMS-203-A	7/7/1999	0 -1 ft bgs								X			
		CMS-204-A	7/7/1999	0 -1 ft bgs								X			
		CMS-208-A	7/8/1999	0 -1 ft bgs								X			
		CMS-209-A	7/8/1999	0 -1 ft bgs								X			
		CMS-210-A	7/12/1999	0 -1 ft bgs								X			
		CMS-212-A	7/12/1999	0 -1 ft bgs								X			
		CMS-213-A	7/8/1999	0 -1 ft bgs								X			
		CMS-214-A	7/12/1999	0 -1 ft bgs								X			
		CMS-465-A	7/27/1999	0 -1 ft bgs								X			
		CMS-467-A	7/27/1999	0 -1 ft bgs								X			
		CMS-470-A	7/27/1999	0 -1 ft bgs								X			
		CMS-471-A	7/27/1999	0 -1 ft bgs								X			
		CMS-472-A	7/29/1999	0 -1 ft bgs								X			
		CMS-477-A	7/29/1999	0 -1 ft bgs								X			
		CMS-484-A	7/30/1999	0 -1 ft bgs								X			
		CMS-487-A	7/30/1999	0 -1 ft bgs								X			
		CMS-489-A	7/30/1999	0 -1 ft bgs								X			
		CMS-490-A	7/30/1999	0 -1 ft bgs								X			

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Sediment (continued)	Allendale Pond (continued)	CMS-493-A	7/30/1999	0 -1 ft bgs								X			
		CMS-494-A	8/12/1999	0 -1 ft bgs								X			
		CMS-495-A	8/12/1999	0 -1 ft bgs								X			
		CMS-496-A	8/12/1999	0 -1 ft bgs								X			
		CMS-600-A	9/29/1999	0 - 0.5 ft bgs			X					X			
		CMS-601-A	9/29/1999	0-0.5 ft bgs			X					X			
		CMS-603-A	9/30/1999	0-0.5 ft bgs			X					X			
		CMS-604-A	10/1/1999	0 - 0.5 ft bgs			X					X			
		CMS-605-A	9/29/1999	0 - 1 ft bgs			X					X			
		CMS-606-A	9/29/1999	0 - 0.5 ft bgs			X					X			
		CMS-608-A	9/29/1999	0 - 0.5 ft bgs			X					X			
		CMS-609-A	9/29/1999	0 - 0.5 ft bgs			X					X			
		CMS-610-A	10/1/1999	0 - 0.5 ft bgs			X					X			
		CMS-612-A	9/30/1999	0 - 0.5 ft bgs			X					X			
		CMS-613-A	9/30/1999	0-0.5 ft bgs			X					X			
		CMS-614-A	9/29/1999	0 - 0.5 ft bgs			X					X			
		CMS-615-A	9/29/1999	0 -1 ft bgs			X					X			
		CMS-616-A	9/29/1999	0 - 0.5 ft bgs			X					X			
		CMS-618-A	10/1/1999	0 - 0.5 ft bgs			X					X			
		CMS-619-A	10/1/1999	0 - 0.5 ft bgs			X					X			
		CMS-620-A	10/1/1999	0 - 0.5 ft bgs			X					X			
		CMS-622-A	10/5/1999	0 - 0.5 ft bgs			X					X			
		CMS-623-A	10/5/1999	0-0.5 ft bgs			X					X			
		CMS-625-A	10/1/1999	0 - 0.5 ft bgs			X					X			
		CMS-626-A	10/1/1999	0-0.5 ft bgs			X					X			
		CMS-627-A	1075/1999	0-0.5 ft bgs			X					X"			

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Sediment (continued)	Allendale Pond (continued)	CMS-628-A	9/29/1999	0 -1 ft bgs			X					X			
		CMS-630-A	10/1/1999	0-0.5 ft bgs			X					X			
		CMS-631-A	10/5/1999	0 - 0.5 ft bgs			X					X			
		CMS-633-A	10/5/1999	0 - 0.5 ft bgs			X					X			
		CMS-634-A	10/5/1999	0 - 0.5 ft bgs			X					X			
		CMS-FP-4001-0000-01	7/18/2001	0 - 0.5 ft bgs		X	X		X			X			X
		CMS-FP-4002-0000-01	7/18/2001	0 - 0.5 ft bgs		X	X		X			X			X
		CMS-FP-4003-0000-01	7/19/2001	0 - 0.5 ft bgs		X	X		X			X			X
		CMS-FP-4005-0000-01	7/20/2001	0 - 0.5 ft bgs		X	X		X			X			X
		CMS-SD-4003-0000-01	7/12/2001	0 - 0.5 ft bgs			X		X		X	X			X
		CMS-SD-4006-0000-01	7/12/2001	0 - 0.5 ft bgs			X		X		X	X			X
		CMS-SD-4007-0000-01	7/12/2001	0 - 0.5 ft bgs			X		X		X	X			X
		CMW-FP-2027-01	10/28/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		CMW-SD-2016-01	10/26/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		CMW-SD-2018-01	10/26/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		CMW-SD-2019-01	10/26/1999	0-0.5 ft bgs		X	X		X		X	X			X
		CMW-SD-2020-01	10/26/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		CMW-SD-2021-01	10/26/1999	0-0.5 ft bgs		X	X		X		X	X			X
		CMW-SD-2023-01	10/27/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		CMW-SD-2024-01	10/27/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		CMW-SD-2025-000.5-01	10/28/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		DAM002-SD	10/23/1998	0 - 0.33 ft bgs		X	X		X			X		X	X
		RES-SS-12-239-01	11/16/1999	0 -1 ft bgs		X	X		X						
		RES-SS-12-240-02	11/16/1999	0 -1 ft bgs								X			
		RES-SS-12-550-01	11/16/1999	0 -1 ft bgs		X	X		X						
		RES-SS-12-551-01	11/16/1999	0 -1 ft bgs		X	X		X						

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Sediment (continued)	Allendale Pond (continued)	RES-SS-12-552-01	11/16/1999	0 -1 ft bgs		X	X		X						
		RES-SS-12-554-01	11/16/1999	0 -1 ft bgs		X	X		X						
		RES-SS-14-303-01	11/15/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-14-303-02	11/15/1999	0 -1 ft bgs								X			
		RES-SS-14-333-01	11/15/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-14-334-01	11/15/1999	0 -1 ft bgs		X	X		X						
		RES-SS-14-365-01	11/15/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-14-365-02	11/15/1999	0 -1 ft bgs								X			
		RES-SS-14-365-03	11/15/1999	0 -1 ft bgs								X			
		RES-SS-14-366-01	11/15/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-14-366-02	11/15/1999	0 -1 ft bgs								X			
		RES-SS-14-398-01	11/15/1999	0 -1 ft bgs		X	X		X						
		RES-SS-14-399-01	11/15/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-14-419-01	11/19/1999	0 -1 ft bgs		X	X		X						
		RES-SS-14-420-01	11/19/1999	0 -1 ft bgs		X	X		X						
		RES-SS-14-422-01	12/2/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-14-424-01	12/2/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-14-424-02	1.2/2/1999	0 -1 ft bgs								X			
		RES-SS-14-425-01	12/2/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-14-448-01	11/15/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-14-449-01	12/2/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-14-449-02	12/2/1999	0 -1 ft bgs											
		SD-20	9/9/1998	0 - 0.25 ft bgs			X					X			X
		SD-22	9/9/1998	0 - 0.25 ft bgs			X					X			X
		SD-23	9/9/1998	0 - 0.25 ft bgs			X					X			X
		SD-24	9/9/1998	0 - 0.25 ft bgs			X					X			X

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	[illegible]	Coplanar PCBs	Lipids	TOC
Sediment (continued)	Allendale Pond (continued)	SD-25	9/9/1998	0 - 0.25 ft bgs			X					X			X
		SD-26	9/9/1998	0 - 0.5 ft bgs			X					X			X
		SD-27	9/9/1998	0 - 0.5 ft bgs			X					X			X
		SD-28	9/9/1998	0 - 0.5 ft bgs			X					X			X
		SD-29	9/9/1998	0 - 0.5 ft bgs			X					X			X
		SD-30	9/9/1998	0 - 0.5 ft bgs			X					X			X
		SD-31	9/9/1998	0 - 0.5 ft bgs			X					X			X
		WRC-SD-2009-01	11/1/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		WRC-SD-2010-01	11/2/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		WRC-SD-2011-000.5-01	11/2/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		WRC-SD-2012-01	11/2/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		WRC-SD-2013-000.5-01	11/1/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		WRC-SD-2014-01	11/1/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		WRC-SD-2015-01	11/1/1999	0 - 0.5 ft bgs		X	X		X		X	X		[illegible]	X
		WRL-SD-2039-01	10/25/1999	0 - 0.5 ft bgs		X	X		X		X	X		[illegible]	X
		WRL-SD-2044-000.5-01	11/9/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
	Lyman Mill Pond	DAM003-SD	10/23/1998	0 - 0.33 ft bgs		X	X		X			X		X	X
		LPX-BK-2006X-01	10/21/1999	0 - 0.5 ft bgs		X			X			X			
		LPX-BK-2006Y-01	10/21/1999	0 - 0.5 ft bgs		X	X		X			X			
		LPX-BK-2006Z-01	10/21/1999	0 - 0.5 ft bgs		X	X		X			X			
		LPX-BK-2008X-01	10/21/1999	0 - 0.5 ft bgs		X	X		X			X			
		LPX-BK-2008Y-01	10/21/1999	0 - 0.5 ft bgs		X	X		X			X			
		LPX-BK-2008Z-01	10/21/1999	0 - 0.5 ft bgs		X	X		X			X			
		LPX-SD-2045-01	11/8/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		LPX-SD-2045B-02	7/25/2001	0 - 0.3 ft bgs		X	X		X			X			
		LPX-SD-2046-000.5-01	11/8/1999	0-0.5 ft bgs		X	X		X		X	X			X

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Sediment (continued)	Lyman Mill Pond (continued)	LPX-SD-2047-01	11/8/1999	0 - 0.5 ft bgs		X			X		X	X			X
		LPX-SD-2049-01	11/5/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		LPX-SD-2050-01	11/5/1999	0-0.5 ft bgs		X	X		X		X	X			X
		LPX-SD-2051-01	11/4/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		LPX-SD-2052-000.5-01	11/4/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		LPX-SD-2072-01	7/25/2001	0-0.5 ft bgs		X	X		X			X			
		LPX-SD-4001-0000-01	7/12/2001	0-0.5 ft bgs			X		X		~X~	X		X	X
		LPX-SD-4002-0000-01	7/12/2001	0 - 0.5 ft bgs			X		X		X	X			X
		LPX-SD-4004-0000-01	7/12/2001	0 - 0.5 ft bgs			X		X		X	X		~X~	X
		LPX-SD-4011-0000-01	7/10/2001	0-0.5 ft bgs		X	"X		X		X				X
		LPX-SD-4012-0000-01	7/10/2001	0 - 0.5 ft bgs		X	X		X		X				X
		LPX-SD-4013-0000-01	7/10/2001	0 - 0.5 ft bgs		X	X		X		X				X
		SD-10	9/9/1998	0-0.5 ft bgs		X	X					X			X
		SD-11	9/9/1998	0 -1 ft bgs		X	X					X			X
		SD-12	9/9/1998	0 -1 ft bgs		X	X					X			X
		SD-13	9/9/1998	0 -1 ft bgs		X	X					X			X
		SD-14	9/9/1998	0-0.5 ft bgs		X	X					X			X
		SD-15	9/9/1998	0-0.5 ft bgs			X					X			~X
		SD-16	9/9/1998	0 - 0.5 ft bgs			X					X			X
		SD-17	9/9/1998	0 - 0.5 ft bgs			X					X			~X~
		SD-18	9/9/1998	Lp - 0.25 ft bgs			X					X			X
		SD-19	9/9/1998	HD - 0.25 ft bgs			X					X			X
		WRL-BK-2004X-01	10/21/1999	0 - 0.5 ffbgs		X	X		X			X		r.	
		WRL-BK-2004Y-01	10/21/1999	0-0.5 ft bgs		X			X			X			
		WRL-BK-2004Z-01	10/21/1999	0-0.5 ft bgs		X	X		X			X			
		WRL-BK-2005X-01	10/21/1999	0-0.5 ft bgs		X	X		X			X			

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Sediment (continued)	Lyman Mill Pond (continued)	WRL-BK-2005Y-01	10/21/1999	0 - 0.5 ft bgs		X	X		X			X			
		WRL-BK-2005Z-01	10/21/1999	0 - 0.5 ft bgs		X	X		X			X			
		WRL-SD-2041-01	10/25/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		WRL-SD-2042-01	11/2/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		WRL-SD-2042-02	7/24/2001	0 - 0.3 ft bgs		X	X		X			X			
		WRL-SD-2043-01	11/8/1999	0 - 0.5 ft bgs		X	X		X		X	X			X
		WRL-SD-2043-02	7/25/2001	0 - 0.2 ft bgs		X	X		X			X			
		WRL-SD-2071-01	7/24/2001	0 - 0.2 ft bgs		X	X		X			X			
		WRL-SD-4005-0000-01	7/12/2001	0 - 0.5 ft bgs			X		X		X	X			X
		WRM-SD-2054-01	12/2/1999	0 - 0.5 ft bgs		X	X		X			X			
		WRM-SD-2055-01	9/20/2000	0 - 0.5 ft bgs		X	X		X		X	X			X
		WRM-SD-2057-01	9/20/2000	0 - 0.5 ft bgs		X	X		X		X	X			X
		WRM-SD-2062-01	9/19/2000	0 - 0.5 ft bgs		X	X		X		X	X			X
	Manton Pond	MAP-SD-2058-01	9/20/2000	0 - 0.5 ft bgs		X	X		X		X	X			X
		MAP-SD-2059-01	9/20/2000	0 - 0.5 ft bgs		X	X		X		X	X			X
		MAP-SD-2060-01	9/20/2000	0 - 0.5 ft bgs		X	X		X		X	X			X
	Dyerville Reach	DAM005-SD	10/23/1998	0 - 0.33 ft bgs		X	X		X			X		X	X
		DYP-SD-2065-01	9/19/2000	0 - 0.5 ft bgs		X	X		X		X	X			X
		DYP-SD-2066-01	9/19/2000	0 - 0.5 ft bgs		X	X		X		X	X			X
Crayfish	Assapumpset Pond	RAB-CF-5004-0000-01	7/20/2001				X		X			X		X	
	Greystone Mill Pond	GMP-CF-5001-0000-01	7/20/2001				X		X			X	X		
		GMP-CF-5002-0000-01	7/20/2001				X		X			X		X	
		RWR-CF-5003-0000-01	7/20/2001				X		X			X		X	
		RWR-CF-5004-0000-01	7/20/2001				X		X			X		X	

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Crayfish (continued)	Allendale Pond	CMS-CF-4003-0000-01	7/20/2001				X		X			X		X	
		CMS-CF-4006-0000-01	7/20/2001				X		X			X		X	
		CMS-CF-4007-0000-01	7/20/2001				X		X			X		X	
	Lyman Mill Pond	LPX-CF-4001 -0000-01	7/20/2001				X		X			X	X	X	
		LPX-CF-4002-0000-01	7720/2001				X		X			X	X	X	
		LPX-CF-4004-0000-01	7/20/2001				X		X			X		X	
		WRL-CF-4005-0000-01	7/20/2001				X		X			X		X	
Emerging Insects	Greystone Mill Pond	GMP-EI-5001 -5005-0000-01	7/20/2001									X	X	X	
	Lyman Mill Pond	LPX-EI-4006-4010-0000-01	7/20/2001									X	X	X	
Tree Swallow Stomach Contents	Allendale Pond	Allendale Pond Diet	6/19/2000									X			
		DIET-AP	6/12/2001									X			
	Greystone Mill Pond	Greystone Pond Diet	6/19/2000									X			
		DIET-GP	6/9/2001									X			
	Lyman Mill Pond	DIET-LP	6/12/2001									X			
	Manton Pond	Manton Food	6/14/2003									X			
Floodplain Soil	Greystone Mill Pond	RWR-FP-5001-0000-01	7/17/2001	0-0.5ftbgs		X	X		X			X			X
		RWR-FP-5002-0000-01	7/16/2001	0 - 0.5 ft bgs		X	X		X			X		X	X
		RWR-FP-5003-0000-01	7/17/2001	0-0.5ftbgs		X	X		X			X			X
		RWR-FP-5004-0000-01	7/19/2001	0-0.5 ft bgs		X	X		X			X			X
	Allendale Pond	3428-CMS-002	2/17/1999	0-0.25 ft bgs								X			
		3428-CMS-003	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-006	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-007	2717/1999	0-0.25 ft bgs								X			

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Floodplain Soil (continued)	Allendale Pond (continued)	3428-CMS-008	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-009	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-010	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-011	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-012	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-013	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-014	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-015	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-016	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-017	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-018	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-019	2/17/1999	0 - 0.25 ft bgs								Hx			
		3428-CMS-026	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-028	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-029	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-030	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-031	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-033	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-034	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-035	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-037	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-038	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-041	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-044	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-047	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-048	2/16/1999	0 - 0.25 ft bgs								X			

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Floodplain Soil (continued)	Allendale Pond (continued)	3428-CMS-050	2/16/1999	0-0.25 ft bgs								X			
		3428-CMS-053	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-054	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-056	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-058	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-059	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-062	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-064	2/16/1999	0-0.25 ft bgs								X			
		3428-CMS-065	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-066	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-067	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-070	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-072	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-075	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-076	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-079	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-081	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-082	2/16/1999	H) - 6.25 ft bgs								X			
		3428-CMS-085	2/17/1999	0-0.25 ft bgs								X			
		3428-CMS-087	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-088	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-089	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-090	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-091	2/17/1999	0-0.25 ft bgs								X			
		3428-CMS-094 "	2/16/1999 ~	0~~6.25 ft bgs								X			
		3428-CMS-095	2/16/1999	0 - 0.25 ft bgs								X			

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Voiatiies	Semivoiatiies	Pesticides/PCBs	[Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Copianar PCBs	Lipids	TOC
Floodplain Soil (continued)	Allendale Pond (continued)	3428-CMS-098	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-099	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-100	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-102	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-104	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-107	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-108	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-110	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-111	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-112	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-115	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-116	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-118	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-119	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-121	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-125	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-127	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-128	2/16/1999.	0 - 0.25 ft bgs								X			
		3428-CMS-130	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-132	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-133	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-134	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-135	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-136	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-137	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-139	2/16/1999	0 - 0.25 ft bgs								X			

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	CoplanarPCBs	Lipids	TOC
Floodplain Soil (continued)	Allendale Pond (continued)	3428-CMS-140	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-141	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-142	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-144	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-147	2/16/1999	0-0.25 ft bgs								X			
		3428-CMS-148	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-149	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-150	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-152	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-153	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-154	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-155	2/16/1999	0-0.25 ft bgs								X			
		3428-CMS-156*	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-157	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-161	2/17/1999	0-0.25 ft bgs								X			
		3428-CMS-162	2/17/1999	0-0.25 ft bgs								"X"			
		3428-CMS-163	2/17/1999	0-0.25 ft bgs								X			
		3428-CMS-165	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-166	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-168	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-169	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-170	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-171	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-172	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-173	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-180	2/17/1999	0-0.25 ft bgs								X			

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	W15	Coplanar PCBs	Lipids	TOC
Floodplain Soil (continued)	Allendale Pond (continued)	3428-CMS-184	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-185	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-189	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-218	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-219	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-220	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-222	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-223	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-225	2/16/1999	0 - 0.25 ft bgs								X			
		3428-CMS-226	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-227	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-228	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-229	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-230	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-231	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-232	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-233	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-234	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-235	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-236	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-237	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-238	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-239	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-240	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-241	2/17/1999	0 - 0.25 ft bgs								X			
		3428-CMS-242	2/17/1999	0 - 0.25 ft bgs								X			

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Floodplain Soil (continued)	Allendale Pond (continued)	CMS-019-A	7/14/1999	0 -1 ft bgs								X			
		CMS-075-A	6/30/1999	0 -1 ft bgs								X			
		CMS-076-A	6/29/1999	0 -1 ft bgs								X			
		CMS-081-A	6/29/1999	0 -1 ft bgs								X			
		CMS-082-A	6/29/1999	0 -1 ft bgs								X			
		CMS-089-A	6/28/1999	0 - 1 ft bgs	X	X	X	X	X			X			
		CMS-093-A	6/30/1999	0 -1 ft bgs								X			
		CMS-094-A	6/29/1999	0 - 1 ft bgs								X			
		CMS-098-A	6/28/1999	0 - 1 ft bgs	X	X	X	X	X			X			
		CMS-102-A	6/29/1999	0 -1 ft bgs								X			
		CMS-118-A	6/30/1999	0 -1 ft bgs	X	X	X	X	X			X			
		CMS-134-A	6/24/1999	0 -1 ft bgs			X					X			
		CMS-135-A	6/25/1999	0 -1 ft bgs								X			
		CMS-140-A	6/24/1999	0 -1 ft bgs			X					X			
		CMS-141-A	6/24/1999	0 -1 ft bgs			X					X			
		CMS-147-A	6/24/1999	0 -1 ft bgs			X					X			
		CMS-148-A	6/24/1999	0 -1 ft bgs			X					X			
		CMS-149-A	6/25/1999	0 -1 ft bgs								X			
		CMS-152-A	6/21/1999	0 -1 ft bgs			X					X			
		CMS-153-A	6/22/1999	0 -1 ft bgs			X					X			
		CMS-154-A	6/22/1999	0 -1 ft bgs			X					X			
		CMS-155-A	6/22/1999	0 -1 ft bgs			X					X			
		CMS-156-A	6/24/1999	0 -1 ft bgs			X					X			
		CMS-157-A	6/29/1999	0 -1 ft bgs								X			
		CMS-158-A	6/29/1999	0 -1 ft bgs								X			
		CMS-160-A	6/23/1999	0 -1 ft bgs			X					X			

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	(Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Floodplain Soil (continued)	Allendale Pond (continued)	CMS-161-A	6/23/1999	0 -1 ft bgs			X					X			
		CMS-164-A	6/22/1999	0 -1 ft bgs	X	X	X	X	X			X			
		CMS-165-A	6/29/1999	0 -1 ft bgs								X			
		CMS-166-A	6/29/1999	0 -1 ft bgs								X			
		CMS-168-A	6/25/1999	0 -1 ft bgs			X					X			
		CMS-169-A	6/25/1999	0 -1 ft bgs			X					X			
		CMS-170-A	6/24/1999	0 -1 ft bgs			X					X			
		CMS-171-A	6/24/1999	0 -1 ft bgs			X					X			
		CMS-172-A	6/29/1999	0 -1 ft bgs								X			
		CMS-173-A	6/28/1999	0 -1 ft bgs	X	X	X	X	X			X			
		CMS-232-A	6/29/1999	0 -1 ft bgs								X			
		CMS-237-A	6/23/1999	0 -1 ft bgs	X	X	X	X	X			X			
		CMS-238-A	6/23/1999	0 -1 ft bgs			X					X			
		CMS-239-A	6/23/1999	0 -1 ft bgs			X					X			
		CMS-240-A	6/25/1999	0 -1 ft bgs			X					X			
		CMS-241-A	6/25/1999	0 -1 ft bgs			X					X			
		CMS-242-A	6/24/1999	0 -1 ft bgs			X					X			
		CMS-400-A	6/21/1999	0 -1 ft bgs			X					X			
		CMS-401-A	6/22/1999	0 -1 ft bgs			X					X			
		CMS-402-A	6/22/1999	0 -1 ft bgs			X					X			
		CMS-403-A	6/22/1999	0 -1 ft bgs			X					X			
		CMS-405-A	6/23/1999	0 -1 ft bgs	X	X	X	X	X			X			
		CMS-406-A	6/29/1999	0 -1 ft bgs			X					X			
		CMS-407-A	6/28/1999	0 -1 ft bgs	X	X	X	X	X			X			
		CMS-408-A	6/28/1999	0 -1 ft bgs	X	X	X	X	X			X			
		CMS-409-A	6/23/1999	0 -1 ft bgs			X					X			

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Floodplain Soil (continued)	Allendale Pond (continued)	CMS-410-A	6/24/1999	0 -1 ft bgs			X					X			
		CMS-411-A	6/24/1999	0 -1 ft bgs			X					X			
		CMS-412-A	6/25/1999	0 -1 ft bgs			X					X			
		CMS-413-A	6/25/1999	0 -1 ft bgs			X					X			
		CMS-414-A	6/25/1999	0 -1 ft bgs			X					X			
		CMS-415-A	6/25/1999	0 -1 ft bgs			X					X"			
		CMS-416-A	6/25/1999	0 -1 ft bgs			X					X			
		CMS-417-A	6/24/1999	0 -1 ft bgs	X	X	X	X, X	X			X			
		CMS-418-A	6/30/1999	0 -1 ft bgs	X	X	X	X,	X			X			
		CMS-419-A	7/7/1999	0 -1 ft bgs			X					X			
		CMS-420-A	7/2/1999	0 -1 ft bgs			X					X			
		CMS-421-A	7/8/1999	0 -1 ft bgs			X					X			
		CMS-422-A	7/2/1999	0 -1 ft bgs			~X~					X			
		CMS-423-A	7/7/1999	0 -1 ft bgs			X					~X~			
		CMS-424-A	7/2/1999	0 -1 ft bgs			X					X			
		CMS-425-A	7/8/1999	0 -1 ft bgs			X	—				X			
		CMS-426-A	7/7/1999	0 -1 ft bgs			X					X			
		CMS-427-A	7/6/1999	0 -1 ft bgs			X					X			
		CMS-428-A	7/20/1999	0 -1 ft bgs			X					X			
		CMS-429-A	7/8/1999	0 -1 ft bgs			X					X			
		CMS-430-A	7/9/1999	0 -1 ft bgs			X	—	—			X			
		CMS-431-A	7/9/1999	0 -1 ft bgs			"X"					X			
		CMS-432-A	7/9/1999	0 -1 ft bgs			X					X			
		CMS-433-A	7/9/1999	0 -1 ft bgs			X					X			
		CMS-434-A	7/13/1999	0 -1 ft bgs								X			
		CMS-436-A	7/13/1999	0 -1 ft bgs								X	—		

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Fioodplain Soil (continued)	Allendale Pond (continued)	CMS-437-A	7/13/1999	0 -1 ft bgs								X			
		CMS-438-A	7/13/1999	0 -1 ft bgs								X			
		CMS-439-A	7/13/1999	0 -1 ft bgs								X			
		CMS-440-A	7/13/1999	0 -1 ft bgs								X			
		CMS-441-A	7/13/1999	0 -1 ft bgs								X			
		CMS-442-A	7/13/1999	0 -1 ft bgs								X			
		CMS-443-A	7/14/1999	0 -1 ft bgs								X			
		CMS-444-A	7/14/1999	0 -1 ft bgs								X			
		CMS-445-A	7/14/1999	0 -1 ft bgs								X			
		CMS-446-A	7/14/1999	0 -1 ft bgs								X			
		CMS-447-A	7/14/1999	0 -1 ft bgs								X			
		CMS-456-A	7/20/1999	0 -1 ft bgs	X	X	X	X	X			X			
		CMS-457-A	7/22/1999	0 -1 ft bgs								X			
		CMS-458-A	7/22/1999	0 -1 ft bgs								X			
		CMS-459-A	7/22/1999	0 -1 ft bgs								X			
		CMS-460-A	7/27/1999	0 -1 ft bgs								X			
		CMS-461-A	7/27/1999	0 -1 ft bgs								X			
		CMS-462-A	7/27/1999	0 -1 ft bgs								X			
		CMS-466-A	7/27/1999	0 -1 ft bgs								X			
		CMS-468-A	7/27/1999	0 -1 ft bgs								X			
		CMS-469-A	7/27/1999	0 -1 ft bgs								X			
		CMS-473-A	7/29/1999	0 -1 ft bgs								X			
		CMS-474-A	7/29/1999	0 -1 ft bgs								X			
		CMS-475-A	7/29/1999	0 -1 ft bgs								X			
		CMS-478-A	7/29/1999	0 -1 ft bgs								X			
		CMS-479-A	7/29/1999	0 -1 ft bgs								X			

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	CoplanarPCBs	Lipids	TOC
Floodplain Soil (continued)	Allendale Pond (continued)	CMS-480-A	7/29/1999	0 -1 ft bgs								X			
		CMS-481-A	7/30/1999	0 -1 ft bgs								X			
		CMS-482-A	7/30/1999	0 -1 ft bgs								X			
		CMS-485-A	7/30/1999	0 -1 ft bgs								X			
		CMS-486-A	7/30/1999	0 -1 ft bgs								X			
		CMS-488-A	7/30/1999	0 -1 ft bgs								X			
		CMS-491-A	7/30/1999	0 -1 ft bgs								X			
		CMS-492-A	7/30/1999	0 -1 ft bgs								X			
		CMS-497-A	8/12/1999	0 -1 ft bgs								X			
		CMS-498-A	8/12/1999	0 -1 ft bgs								X			
		CMS-499-A	8/12/1999	0 -1 ft bgs								X			
		CMS-501-A	8/12/1999	0 -1 ft bgs								X			
		CMS-502-A	8/12/1999	0 -1 ft bgs								X			
		CMS-503-A	8/12/1999	0 -1 ft bgs								X			
		CMS-505-A	8/12/1999	0 -1 ft bgs								X			
		CMS-506-A	8/12/1999	0 -1 ft bgs								X			
		CMS-507-A	8/12/1999	0 -1 ft bgs								X			
		CMS-508-A	8/12/1999	0 -1 ft bgs								X			
		CMS-624-A	10/1/1999	0-0.5 ft bgs			X					X			
		CMS-629-A	10/1/1999	0-0.5 ft bgs			X					X			
		CMS-632-A	10/5/1999	0-0.5 ft bgs			X					X			
		RES-SS-12-556-01	11/16/1999	0 - 1 ft bgs		X	X		X			X			
		RES-SS-12-556-02	11/16/1999	0 - 1 ft bgs								X			
		RES-SS-14-210-01	11/16/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-14-210-02	11/16/1999	0 -1 ft bgs								X			
		RES-SS-14-210-03	11/16/1999	0 -1 ft bgs								X			

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Floodplain Soil (continued)	Allendale Pond (continued)	RES-SS-14-271-01A	12/2/1999	0 -1 ft bgs								X			
		RES-SS-14-302-01	11/18/1999	0 -1 ft bgs		X	X		X						
		RES-SS-14-333-02	11/15/1999	0 -1 ft bgs								X			
		RES-SS-14-333-03	11/15/1999	0 -1 ft bgs								X			
		RES-SS-14-366-03	11/15/1999	0 -1 ft bgs								X			
		RES-SS-14-399-02	11/17/1999	0 -1 ft bgs								X			
		RES-SS-14-421-01	11/19/1999	0 -1 ft bgs		X	X		X						
		RES-SS-14-422-02	12/2/1999	0 -1 ft bgs								X			
		RES-SS-14-425-02	12/2/1999	0 -1 ft bgs								X			
		RES-SS-14-425-03	12/2/1999	0 -1 ft bgs								X			
		SS-01	9/9/1998	0 - 0 ft bgs		X	X								X
		WRL-SD-2038-01	10/25/1999	0-0.5 ft bgs		X	X		X		X	X			X
	Lyman Mill Pond	RES-SS-10-004-01	11/18/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-10-004-02	11/18/1999	0 -1 ft bgs								X			
		RES-SS-10-004-03	11/18/1999	0 -1 ft bgs								X			
		RES-SS-10-005-01	11/18/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-10-005-02	11/18/1999	0 -1 ft bgs								X			
		RES-SS-10-005-03	11/18/1999	0 -1 ft bgs								X			
		RES-SS-10-042-01	11/18/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-10-042-02	11/18/1999	0 -1 ft bgs								X			
		RES-SS-10-042-03	11/18/1999	0 -1 ft bgs								X			
		RES-SS-10-044-02	11/19/1999	0 -1 ft bgs								X			
		RES-SS-10-044-03	11/19/1999	0 -1 ft bgs								X			
		RES-SS-10-053-02	12/2/1999	0 -1 ft bgs								X			
		RES-SS-10-068-01	11/19/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-10-068-02	11/19/1999	0 -1 ft bgs								X			

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Floodplain Soil (continued)	Lyman Mill Pond (continued)	RES-SS-10-068-03	11/19/1999	0 -1 ft bgs								X			
		RES-SS-10-074-02	11/19/1999	0 -1 ft bgs								X			
		RES-SS-10-074-03	11/19/1999	0 -1 ft bgs								X			
		RES-SS-10-075-02	11/19/1999	0 -1 ft bgs								X			
		RES-SS-10-075-03	11/19/1999	0 -1 ft bgs								X			
		RES-SS-10-076-01	11/19/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-10-076-02	11/19/1999	0 -1 ft bgs								X			
		RES-SS-10-076-03	11/19/1999	0 -1 ft bgs								X			
		RES-SS-10-604-02	11/18/1999	0 -1 ft bgs								X			
		RES-SS-10-604-03	11/18/1999	0 -1 ft bgs								X			
		RES-SS-11-011-01	12/2/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-11-011-02	12/2/1999	0 -1 ft bgs								X			
		RES-SS-11-012-01	12/2/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-11-012-02	12/2/1999	0 -1 ft bgs								X			
		RES-SS-11-012-03	12/2/1999	0 -1 ft bgs								X			
		RES-SS-11-328-02	11/18/1999	0 -1 ft bgs								X			
		RES-SS-11-328-03	11/18/1999	0 -1 ft bgs								X			
		RES-SS-11-396-02	11/17/1999	0 -1 ft bgs								X			
		RES-SS-11-396-03	11/17/1999	0 -1 ft bgs								X			
		RES-SS-11-419-01	11/19/1999	0 - 1 ft bgs		X	X		X			X			
		RES-SS-11-419-02	11/19/1999	0 - 1 ft bgs								X			
		RES-SS-11-419-03	11/19/1999	0 -1 ft bgs								X			
		RES-SS-11-420-01	11/17/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-11-420-02	11/17/1999	0 -1 ft bgs								X			
		RES-SS-11-420-04	11/17/1999	0 -1 ft bgs								X			
		RES-SS-11-422-01	11/17/1999	0 -1 ft bgs		X	X		X			X			

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Floodplain Soil (continued)	Lyman Mill Pond (continued)	RES-SS-11-422-02	11/17/1999	0 -1 ft bgs								X			
		RES-SS-11-422-03	11/17/1999	0 -1 ft bgs								X			
		RES-SS-11-423-01	11/16/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-11-423-02	11/16/1999	0 -1 ft bgs								X			
		RES-SS-11-423-03	11/16/1999	0 -1 ft bgs								X			
		RES-SS-11-424-01	11/16/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-11-424-02	11/16/1999	0 -1 ft bgs								X			
		RES-SS-11-424-03	11/16/1999	0 -1 ft bgs								X			
		RES-SS-11-425-02	11/17/1999	0 -1 ft bgs								X			
		RES-SS-11-426-01	11/17/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-11-426-02	11/17/1999	0 -1 ft bgs								X			
		RES-SS-11-426-03	11/17/1999	0 -1 ft bgs								X			
		RES-SS-11-427-01	11/16/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-11-427-02	11/16/1999	0 -1 ft bgs								X			
		RES-SS-11-427-03	11/16/1999	0 -1 ft bgs								X			
		RES-SS-11-428-01	11/17/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-11-428-02	11/17/1999	0 -1 ft bgs								X			
		RES-SS-11-428-G	11/17/1999	0 -1 ft bgs								X			
		RES-SS-11-429-01	11/17/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-11-429-02	11/17/1999	0 -1 ft bgs								X			
		RES-SS-11-430-01	11/17/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-11-430-02	11/17/1999	0 -1 ft bgs								X			
		RES-SS-11-430-03	11/17/1999	0 -1 ft bgs								X			
		RES-SS-11-431-01	11/17/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-11-431-02	11/17/1999	0 -1 ft bgs								X			
		RES-SS-11-431-03	11/17/1999	0 -1 ft bgs								X			

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Floodplain Soil *(continued)*	Lyman Mill Pond *(continued)*	*RES-SS-11-432-02*	*11/18/1999*	*0 -1 ft bgs*								X			
		RES-SS-11-432-03	11/18/1999	0 -1 ft bgs								X			
		RES-SS-11-433-01	11/18/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-11-433-02	11/18/1999	0 -1 ft bgs								X			
		RES-SS-11-433-03	11/18/1999	0 -1 ft bgs								X			
		RES-SS-11-486-02	11/18/1999	0 -1 ft bgs								X			
		RES-SS-11-486-03	11/18/1999	0 -1 ft bgs								X"			
		RES-SS-11-497-01	12/2/1999	0 -1 ft bgs		X	X		X			X			
		RES-SS-11-497-02	12/2/1999	0 -1 ft bgs								X			
		RES-SS-11-497-03	12/2/1999	0 -1 ft bgs								X			
		RES-SS-11-577-02	11/18/1999	0 -1 ft bgs								X			
		RES-SS-11-577-03	11/18/1999	0 -1 ft bgs								~X			
		RES-SS-12-560-01	11/16/1999	0 -1 ft bgs		X	X		X						
		RES-SS-12-560-02	11/16/1999	0 -1 ft bgs		X	X		X						
		SS-99-07	1/15/1999	0 - 0.25 ft bgs								X			
		SS-99-08	1/15/1999	0-0.25 ft bgs								X			
		SS-99-09	1/15/1999	0-0.25 ft bgs								X			
		SS-99-10	1/15/1999	0 - 0.25 ft bgs								X			
		SS-99-11	1/15/1999	0 - 0.25 ft bgs								X			
		SS-99-12	1/15/1999	0 - 0.25 ft bgs								X			
		SS-99-13	1/15/1999	0 - 0.25 ft bgs								X			
		SS-99-14	1/15/1999	0-0.25 ft bgs								X			
		SS-99-15	1/15/1999	0 - 0.25 ft bgs								X			
		SS-99-16	1/15/1999	0 - 0.25 ft bgs								X			

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Samples Used in the Ecological Risk Assessment

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North Providence, Rhode Island

Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Grain Size	Coplanar PCBs	Lipids	TOC
Earthworm	Greystone Mill Pond	RWR-EW-5001-0000-01	7/17/2001				X		X			X		X	
		RWR-EW-5002-0000-01	7/16/2001				X		X			X	X	X	
		RWR-EW-5003-0000-01	7/17/2001				X		X			X		X	
		RWR-EW-5004-0000-01	7/18/2001				X		X			X		X	
	Allendale Pond	CMS-EW-4001-0000-01	7/18/2001				X		X			X		X	
		CMS-EW-4002-0000-01	7/18/2001				X		X			X		X	
		CMS-EW-4003-0000-01	7/19/2001				X		X			X		X	
		CMS-EW-4005-0000-01	7/20/2001				X							X	
		LPX-EW-4005-0000-01	7/20/2001						X			X			
	Lyman Mill Pond	LPX-EW-4004-0000-01	7/19/2001				X		X			X	X	X	
		LPX-EW-4006-0000-01	7/19/2001				X		X			X		X	
		LPX-EW-4007-0000-01	7/19/2001				X		X			X		X	
American Eel	Assapumpset Pond	RAB-AE-5001-0000-01-W	6/26/2001			X	X		X			X		X	
		RAB-AE-5002-0000-01-W	6/26/2001			X	X		X			X		X	
		RAB-AE-5003-0000-01-W	6/26/2001			X	X		X			X		X	
		RAB-AE-5004-0000-01-W	6/27/2001			X	X		X			X		X	
		RAB-AE-5005-0000-01-W	6/27/2001			X	X		X			X		X	
		RAB-AE-5006-0000-01-W	7/2/2001			X	X		X			X		X	
	Greystone Mill Pond	GMP-AE-5001-0000-01-W	6/22/2001			X	X		X			X	X	X	
		GMP-AE-5002-0000-01-W	6/22/2001			X	X		X			X		X	
		GMP-AE-5003-0000-01-W	6/22/2001			X	X		X			X		X	
		GMP-AE-5004-0000-01-W	6/22/2001			X	X		X			X		X	
		GMP-AE-5005-0000-01-W	6/22/2001			X	X		X			X		X	
		GMP-AE-5006-0000-01-W	6/22/2001			X	X		X			X		X	
		GMP-AE-5007-0000-01-W	6/22/2001			X	X		X			X		X	
		GMP-AE-5008-0000-01-W	6/22/2001			X	X		X			X		x	
		GMP-AE-5009-0000-01-W	6/22/2001			X	X		X			X		x	

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
American Eel (continued)	Greystone Mill Pond (continued)	GMP-AE-5010-0000-01-W	6/25/2001			X	X		X			X		X	
	Allendale Pond	APC-AE-4001-0000-01-W	6/20/2001			X	X		X			X	X	X	
		APC-AE-4002-0000-01-W	6/20/2001			X	X		X			X	X	X	
		APC-AE-4003-0000-01-W	6/20/2001			X	X		X			X	X	X	
		APC-AE-4004-0000-01-W	6/20/2001			X	X		X			X		X	
		APC-AE-4005-0000-01-W	6/20/2001			X	X		X			X		X	
		APC-AE-4006-0000-01-W	6/20/2001			X	X		X			X		X	
		APC-AE-4007-0000-01-W	6/20/2001			X	X		X			X		X	
		APC-AE-4008-0000-01-W	6/20/2001			X	X		X			X		X	
		APC-AE-4009-0000-01-W	6/20/2001			X	X		X			X		X	
		APC-AE-4010-0000-01-W	6/20/2001			X	X		X			X		X	
	Lyman Mill Pond	LPX-AE-4001-0000-01-W	6/21/2001			X	X		X			X	X	X	
		LPX-AE-4002-0000-01-W	6/21/2001			X	X		X			X	X	X	
		LPX-AE-4003-0000-01-W	6/21/2001			X	X		X			X	X	X	
		LPX-AE-4004-0000-01-W	6/21/2001			X	X		X			X		X	
		LPX-AE-4005-0000-01-W	6/21/2001			X	X		X			X		X	
		LPX-AE-4006-0000-01-W	6/21/2001			X	X		X			X		X	
		LPX-AE-4007-0000-01-W	6/21/2001			X	X		X			X		X	
		LPX-AE-4008-0000-01-W	6/21/2001			X	X		X			X		X	
		LPX-AE-4009-0000-01-W	6/21/2001			X	X		X			X		X	
		LPX-AE-4010-0000-01-W	6/21/2001			X	X		X			X		X	
	Dyerville Reach	DYP-AE-5001-0000-01-W	7/2/2001			X	X		X			X		X	
		DYP-AE-5002-0000-01-W	7/2/2001			X	X		X			X		X	
		DYP-AE-5003-0000-01-W	7/2/2001			X	X		X			X	X	X	

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Brown Bullhead	Assapumpset Pond	RAB-BB-5001-0000-01-W	6/26/2001			X	X		X			X		X	
		RAB-BB-5002-0000-01-W	6/26/2001			X	X		X			X		X	
		RAB-BB-5003-0000-01-W	7/2/2001			X	X		X			X		X	
White Sucker	Greystone Mill Pond	GMP-WS-5001-0000-01-W	6/22/2001			X	X		X			X	X	X	
		GMP-WS-5002-0000-01-W	6/22/2001			X	X		X			X		X	
		GMP-WS-5003-0000-01-W	6/22/2001			X	X		X			X		X	
		GMP-WS-5004-0000-01-W	6/22/2001			X	X		X			X		X	
		GMP-WS-5005-0000-01-W	6/22/2001			X	X		X			X		X	
		GMP-WS-5006-0000-01-W	6/22/2001			X	X		X			X		X	
		GMP-WS-5007-0000-01-W	6/22/2001			X	X		X			X		X	
		GMP-WS-5008-0000-01-W	6/22/2001			X	X		X			X		X	
		GMP-WS-5009-0000-01-W	6/22/2001			X	X		X			X		X	
		GMP-WS-5010-0000-01-W	6/22/2001			X	X		X			X		X	
	Allendale Pond	AP-CC-06	4/10/2001									X	X	X	
		APC-WS-4001-0000-01-W	6/20/2001			X	X		X			X		X	
		APC-WS-4002-0000-01-W	6/20/2001			X	X		X			X		X	
		APC-WS-4003-0000-01-W	6/20/2001			X	X		X			X		X	
		APC-WS-4004-0000-01-W	6/20/2001			X	X		X			X		X	
		APC-WS-4005-0000-01-W	6/20/2001			X	X		X			X		X	
		APC-WS-4006-0000-01-W	6/20/2001			X	X		X			X		X	
		APC-WS-4007-0000-01-W	6/20/2001			X	X		X			X	X	X	
		APC-WS-4008-0000-01-W	6/20/2001			X	X		X			X	X	X	
		APC-WS-4009-0000-01-W	6/20/2001			X	X		X			X	X	X	
		APC-WS-4010-0000-01-W	6/20/2001			X	X		X			X		X	
	Fall Fish	AP-SC-01, AP-SC-02, AP-SC-03	4/10/2001									X	X	X	
	Fall Fish	AP-SC-04, AP-SC-05	4/10/2001									X	X	X	

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivoiatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	[AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
White Sucker (continued)	Lyman Mill Pond	LP-CC-07	4/10/2001									X	X	X	
		LP-CC-07EGG	4/10/2001									X	X	X	
		LP-CC-08	4/10/2001									X	X	X	
		LPX-WS-4001 -0000-01 -W	6/21/2001			X	X		X			X		X	
		LPX-WS-4002-0000-01 -W	6/21/2001			X	X		X			X		X	
		LPX-WS-4003-0000-01 -W	6/21/2001			X	X		X			X		X	
		LPX-WS-4004-0000-01 -W	6/21/2001			X	X		X			X		X	
		LPX-WS-4005-0000-01 -W	6/21/2001			X	X		X			X		X	
		LPX-WS-4006-0000-01 -W	6/21/2001			X	X		X			X		X	
		LPX-WS-4007-0000-01 -W	6/21/2001			X	X		X			X	X	X	
		LPX-WS-4008-0000-01 -W	6/21/2001			X	X		X			X	X	X	
		LPX-WS-4009-0000-01 -W	6/21/2001			X	X		X			X	X	X	
		LPX-WS-4010-0000-01 -W	6/21/2001			X	X		X			X		X	
Largemouth Bass	Assapumpset Pond	RAB-LB-5001 -0000-01 -W	6/26/2001			X	X		X			X		X	
		RAB-LB-5002-0000-01-W	6/26/2001			X	X		X			X		X	
		RAB-LB-5003-0000-01 -W	6/27/2001			X	X		X			X		X	
		RAB-LB-5004-0000-01 -W	6/27/2001			X	X		X			X		X	
	Greystone Mill Pond	GMP-LB-5001-0000-01-W	6/22/2001			X	X		X			X		X	
		GMP-LB-5002-0000-01 -W	6/22/2001			X	X		X			X		X	
		GMP-LB-5003-0000-01 -W	6/25/2001			X	X		X			X		X	
		GMP-LB-5004-0000-01 -W	6/25/2001			X	X		X			X		X	
		GMP-LB-5005-0000-01 -W	6/25/2001			X	X		X			X		X	
		GMP-LB-5006-0000-01 -W	6/25/2001			X						XXX		XXX	
		GMP-LB-5007-0000-01'-W	6/25/2001"			~x"	X		X						
		GMP-LB-5008 0000-01 -W	'" 6/25/2001'			Y	X		X						

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Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Largemouth Bass (continued)	Greystone Mill Pond (continued)	GMP-LB-5009-0000-01-W	6/25/2001			X	X		X			X		X	
		GMP-LB-5010-0000-01-W	6/25/2001			X	X		X			X		X	
	Lyman Mill Pond	LPX-LB-4001-0000-01-W	6/21/2001			X	X		X			X	X	X	
		LPX-LB-4002-0000-01-W	6/21/2001			X	X		X			X	X	X	
		LPX-LB-4003-0000-01-W	6/21/2001			X	X		X			X	X	X	
		LPX-LB-4004-0000-01-W	6/21/2001			X	X		X			X	X	X	
		LPX-LB-4005-0000-01-W	6/21/2001			X	X		X			X	X	X	
		LPX-LB-4006-0000-01-W	6/21/2001			X	X		X			X		X	
		LPX-LB-4007-0000-01-W	6/21/2001			X	X		X			X		X	
		LPX-LB-4008-0000-01-W	6/21/2001			X	X		X			X		X	
		LPX-LB-4009-0000-01-W	6/26/2001			X	X		X			X		X	
		LPX-LB-4010-0000-01-W	6/26/2001			X	X		X			X		X	
	Manton Pond	MAP-LB-4001-0000-01-W	6/27/2001			X	X		X			X		X	
		MAP-LB-4002-0000-01-W	6/27/2001			X	X		X			X		X	
		MAP-LB-4003-0000-01-W	6/27/2001			X	X		X			X		X	
Tree Swallow Egg	Fire Station	RF02-P	6/5/2002									X			
		RF08-P	6/4/2002									X			
		RF13-P	6/3/2002									X			
	Greystone Mill Pond	GP-TS-02-P	5/26/2000									X			
		GP-TS-06-P	5/26/2000									X			
		GP-TS-17-P	5/26/2000									X			
		GP-TS-18-P	5/26/2000									X			
		GP-TS-19-P	5/26/2000									X			
		GP-TS-23-P	5/26/2000									X			

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Matrix	Area	Sample ID	Date Sampled	Sample Depth	Voiatiies	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Tree Swallow Egg (continued)	Greystone Mill Pond (continued)	GP-TS-29-P	5/26/2000									X			
		G-TS-01-P	5/21/2001				X							X	
		G-TS-02-P	5/21/2001									X			
		G-TS-04-P	5/28/2001									X			
		G-TS-06-P	5/31/2001				X							X	
		G-TS-07-P	5/21/2001									X			
		G-TS-19-P	6/11/2001				X							X	
		G-TS-21-P	5/25/2001									X			
		G-TS-22-P	5/26/2001									X			
		G-TS-29-P	5/26/2001									X			
	Allendale Pond	AP-TS-08-P	5/26/2000									X			
		AP-TS-09-E	6/12/2000									X			
		AP-TS-10-E&P	5/26/2000									X			
		AP-TS-11-E	6/12/2000									X			
		AP-TS-15-P	^5/26/2000									X			
		AP-TS-16-E	^6/12/2000									X			
		AP-TS-17-P	5/26/2000									X			
		AP-TS-18-E	6/12/2000									X			
		AP-TS-19E&P	5/26/2000									X			
		AP-TS-22-P	5/26/2000									X			
		AP-TS-23-P	5/26/2000									X			
		AP-TS-24-P	5/26/2000									X			
		AP-TS-29-P	5/26/2000									X			
		A-TS-33-P	679/2001"				X							X	
		A-TS^35-P	5/31/2001 ~									X			

TaL_ A-1
Samples Used in the Ecological Risk Assessment

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	SEM-5	Coplanar PCBs	Lipids	TOC
Tree Swallow Egg (continued)	Allendale Pond (continued)	A-TS-38-P	5/25/2001									X			
		A-TS-39-P	6/12/2001				X							X	
		A-TS-42A-P	6/9/2001									X			
		A-TS-42B-P	6/7/2001				X							X	
		A-TS-45-P	6/8/2001									X	X		
		A-TS-46-P	5/28/2001									X			
		A-TS-47-P	6/22/2001									x	X		
		A-TS-48-P	5/26/2001									x			
		A-TS-49-P	5/30/2001									X			
		A-TS-51-P	6/22/2001									x			
		A-TS-52-P	6/9/2001									x	X		
		A-TS-53-P	5/30/2001									X			
		A-TS-54-P	6/11/2001									X			
	Lyman Mill Pond	L-TS-62-P	5/27/2001									X			
		L-TS-63-P	5/27/2001									X	X		
		L-TS-65-P	6/14/2001				X					-		X	
		L-TS-67-P	6/18/2001									X			
		L-TS-69-P	5/25/2001									X			
		L-TS-70-P	5/26/2001									X			
		L-TS-73-P	5/30/2001				X							X	
		L-TS-83-P	5/25/2001									X			
		L-TS-84-P	5/28/2001									X			
		L-TS-89-P	5/31/2001									X			
		L-TS-90-P	5/26/2001									X	X		

Table A-1
Samples Used in the Ecological Risk Assessment

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	Semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Tree Swallow Egg (continued)	Manton Pond	RMP120E	5/27/2003									X			
		RMP 123-E	5/27/2003									X			
		RMP 124-E	5/27/2003									X			
		RMP129-E	5/27/2003									X			
Tree Swallow Nestling	Greystone Mill Pond	GP-TS-02-N	6/19/2000									X	X	X	
		GP-TS-06-N	6/19/2000									X	X	X	
		GP-TS-17-N	6/12/2000									X	X	X	
		GP-TS-18-N	6/12/2000									X	X	X	
		GP-TS-19-N	6/12/2000									X	X	X	
		G-TS-02-N	5/30/2001				X					X		X	
		G-TS-04-N	6/9/2001				X					X	X	X	
		G-TS-07-N	5/30/2001				X					X		X	
		G-TS-22-N	6/7/2001				X					X		X	
		GTS29-Nb	6/7/2001									X			
	Allendale Pond	AP-TS-08-N	6/12/2000									X	X	X	
		AP-TS-15-N	6/12/2000									X	X	X	
		AP-TS-20-N	6/12/2000									X			
		AP-TS-23-N	6/19/2000									X	X	X	
		AP-TS-24-N	6/12/2000									X	X	X	
		AP-TS-29-N	6/19/2000									X	X		
		A-TS-35-N	6/12/2001				X					X	X	X	
		A-TS-46-N	6/9/2001				X					X		X	
		A-TS-48-N	6/7/2001				X					X		X	
		A-TS-49-N	6/12/2001				X					X		X	
		A-TS-57-N	6/8/2001				X					X		X	

TaV.- A-1
Samples Used in the Ecological Risk Assessment

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Matrix	Area	Sample ID	Date Sampled	Sample Depth	Volatiles	[semivolatiles	Pesticides/PCBs	Herbicides	Metals	Metals, Dissolved	AVS/SEM	Dioxins	Coplanar PCBs	Lipids	TOC
Tree Swallow Nestling (continued)	Lyman Mill Pond	L-TS-62-N	6/8/2001				X					X	X	X	
		L-TS-63-N	6/8/2001				X					X		X	
		L-TS-70-N	6/7/2001				X					X		X	
		L-TS-84-N	6/9/2001				X					X		X	
		L-TS-89-N	6/12/2001				X					X		X	
	Manton Pond	RMP 120-N	6/14/2003									X			
		RMP 123-N	6/14/2003									X			
		RMP 124-N	6/14/2003									X			
		RMP 129-N	6/14/2003									X			
Tree Swallow Liver	Greystone Mill Pond	G-TS-02-L	5/30/2001						X						
		G-TS-04-L	6/9/2001						X						
		G-TS-07-L	5/30/2001						X						
		G-TS-22-L	6/7/2001						X						
		G-TS-29-L	6/7/2001						X						
	Allendale Pond	A-TS-35-L	6/12/2001						X						
		A-TS-46-L	6/9/2001						X						
		A-TS-48-L	6/7/2001						X						
		A-TS-49-L	6/12/2001						X						
		A-TS-57-L	6/8/2001						X						
	Lyman Mill Pond	L-TS-62-L	6/8/2001						X						
		L-TS-63-L	6/8/2001						X						
		L-TS-70-L	6/7/2001						X						
		L-TS-84-L	6/9/2001						X						
		L-TS-89-L	6/12/2001						X						

Analytical results are presented in the Data Evaluation Report (MACTEC, 2003).

Table A-2
Sample Locations Excluded from the Ecological Risk Assessment

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Original Matrix	BERA Matrix	Sample ID	Exposure Area	Reason for Exclusion
Tree Swallow Nestling		G-TS-29-N	GREYSTONE MILL	Reanalyzed
Tree Swallow Egg		RA32-P	FIRESTATION	Switched Egg
Tree Swallow Egg		RA36-P	FIRESTATION	Switched Egg
Tree Swallow Egg		RAP 33-P	FIRESTATION	Switched Egg
Tree Swallow Egg		RF21-P	FIRESTATION	Switched Egg
Tree Swallow Egg		RA34-P	GREYSTONE MILL	Switched Egg
Tree Swallow Egg		RA35-P	GREYSTONE MILL	Switched Egg
Tree Swallow Egg		RAP 43-9	GREYSTONE MILL	Switched Egg
Tree Swallow Egg		RGP 106-P	GREYSTONE MILL	Switched Egg
Tree Swallow Egg		RG110-P	GREYSTONE MILL	Switched Egg
Tree Swallow Egg		RL74-P	GREYSTONE MILL	Switched Egg
Tree Swallow Egg		RA41-P	ALLENDALE	Switched Egg
Tree Swallow Egg		RF06-P	ALLENDALE	Switched Egg
Tree Swallow Egg		RF11-P	ALLENDALE	Switched Egg
Tree Swallow Egg		RF14-P	ALLENDALE	Switched Egg
Tree Swallow Egg		RFS 07-P	ALLENDALE	Switched Egg
Tree Swallow Egg		RG94-P	ALLENDALE	Switched Egg
Tree Swallow Egg		RG96-P	LYMAN MILL	Switched Egg
Tree Swallow Egg		RG98-P	LYMAN MILL	Switched Egg
Tree Swallow Egg		RL65-P	LYMAN MILL	Switched Egg
Tree Swallow Egg		RL66-P	LYMAN MILL	Switched Egg
Soil	Sediment	CMS-073	ALLENDALE	2 ft Cap - Sluiceway
Soil	Sediment	CMS-143	ALLENDALE	2 ft Cap - Sluiceway
Soil	Sediment	CMS-159	ALLENDALE	2 ft Cap - Sluiceway
Soil	Sediment	CMS-167	ALLENDALE	2 ft Cap - Sluiceway
Sediment	Sediment	CMW-SD-2017	ALLENDALE	2 ft Cap - Sluiceway
Sediment	Sediment	CMW-SD-2018	ALLENDALE	2 ft Cap - Sluiceway
Sediment	Sediment	CMW-SD-2019	ALLENDALE	2 ft Cap - Sluiceway
Sediment	Sediment	CMW-SD-2020	ALLENDALE	2 ft Cap - Sluiceway
Sediment	Sediment	CMW-SD-2021	ALLENDALE	2 ft Cap - Sluiceway
Sediment	Sediment	CMW-SD-2022	ALLENDALE	2 ft Cap - Sluiceway
Soil	Sediment	MW02	ALLENDALE	2 ft Cap - Sluiceway
Soil	Sediment	RES-14-303-01	ALLENDALE	2 ft Cap - Sluiceway
Soil	Sediment	RES-14-303-02	ALLENDALE	2 ft Cap - Sluiceway
Sediment	Sediment	SD-30	ALLENDALE	2 ft Cap - Sluiceway
Sediment	Sediment	SD-31	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-054	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-059	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-062	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-067	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-068	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-078	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-079	ALLENDALE	2 ff Cap - Sluiceway
Soil	Soil	CMS-084	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-085	ALLENDALE	2 ft Cap - Sluiceway

Table A-2
Sample Locations Excluded from the Ecological Risk Assessment

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Original Matrix	BERA Matrix	Sample ID	Exposure Area	Reason for Exclusion
Soil	Soil	CMS-090	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-091	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-099	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-100	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-107	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-108	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-114	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-115	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-428	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-434	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-435	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-436	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-437	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-438	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-439	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-440	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-441	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-442	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-443	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-444	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-445	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-456	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	MW01	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	MW03	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	RES-14-271-01A	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	RES-14-302-01	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	SS-99-00	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	SS-99-01	ALLENDALE	2 ft Cap - Sluiceway
Soil	Soil	CMS-132	ALLENDALE	Cap#1
Soil	Soil	CMS-133	ALLENDALE	Cap#1
Soil	Soil	CMS-134	ALLENDALE	Cap#1
Soil	Soil	CMS-135	ALLENDALE	Cap#1
Soil	Soil	CMS-140	ALLENDALE	Cap#1
Soil	Soil	CMS-141	ALLENDALE	Cap#1
Soil	Soil	CMS-142	ALLENDALE	Cap#1
Soil	Soil	CMS-147	ALLENDALE	Cap#1
Soil	Soil	CMS-148	ALLENDALE	Cap#1
Soil	Soil	CMS-149	ALLENDALE	Cap#1
Soil	Soil	CMS-150	ALLENDALE	Cap#1
Soil	Soil	CMS-153	ALLENDALE	Cap#1
Soil	Soil	CMS-154	ALLENDALE	Cap#1
Soil	Soil	CMS-155	ALLENDALE	Cap#1
Soil	Soil	CMS-156	ALLENDALE	Cap#1
Soil	Soil	CMS-157	ALLENDALE	Cap#1
Soil	Soil	CMS-158	ALLENDALE	Cap#1
Soil	Soil	CMS-160	ALLENDALE	Cap#1

Table A-2
Sample Locations Excluded from the Ecological Risk Assessment

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
fiorth Providence, Rhode Island

Original Matrix	BERA Matrix	Sample ID	Exposure Area	Reason for Exclusion
Soil	Soil	CMS-161	ALLENDALE	Cap#1
Soil	Soil	CMS-162	ALLENDALE	Cap#1
Soil	Soil	CMS-163	ALLENDALE	Cap#1
Soil	Soil	CMS-164	ALLENDALE	Cap#1
Soil	Soil	CMS-165	ALLENDALE	Cap#1
Soil	Soil	CMS-166	ALLENDALE	Cap#1
Soil	Soil	CMS-168	ALLENDALE	Cap#1
Soil	Soil	CMS-169	ALLENDALE	Cap#1
Soil	Soil	CMS-170	ALLENDALE	Cap#1
Soil	Soil	CMS-171	ALLENDALE	Cap#1
Soil	Soil	CMS-172	ALLENDALE	Cap#1
Soil	Soil	CMS-173	ALLENDALE	Cap#1
Soil	Soil	CMS-236	ALLENDALE	Cap#1
Soil	Soil	CMS-237	ALLENDALE	Cap#1
Soil	Soil	CMS-238	ALLENDALE	Cap#1
Soil	Soil	CMS-239	ALLENDALE	Cap#1
Soil	Soil	CMS-240	ALLENDALE	Cap#1
Soil	Soil	CMS-241	ALLENDALE	Cap#1
Soil	Soil	CMS-242	ALLENDALE	Cap#1
Soil	Soil	CMS-410	ALLENDALE	Cap#1
Soil	Soil	SS-99-03	ALLENDALE	Cap#1
Soil	Soil	SS-99-04	ALLENDALE	Cap#1
Soil	Soil	SS-99-05	ALLENDALE	Cap#1
Sediment	Sediment	WRC-SD-2010	ALLENDALE	Cap #2
Sediment	Sediment	WRC-SD-2011	ALLENDALE	Cap #2
Sediment	Sediment	WRC-SD-2012	ALLENDALE	Cap #2
Soil	Soil	CMS-060	ALLENDALE	Cap #2
Soil	Soil	CMS-063	ALLENDALE	Cap #2
Soil	Soil	CMS-065	ALLENDALE	Cap #2
Soil	Soil	CMS-069	ALLENDALE	Cap #2
Soil	Soil	CMS-070	ALLENDALE	Cap #2
Soil	Soil	CMS-071	ALLENDALE	Cap #2
Soil	Soil	CMS-074	ALLENDALE	Cap #2
Soil	Soil	CMS-075	ALLENDALE	Cap #2
Soil	Soil	CMS-076	ALLENDALE	Cap #2
Soil	Soil	CMS-080	ALLENDALE	Cap #2
Soil	Soil	CMS-081	ALLENDALE	Cap #2
Soil	Soil	CMS-082	ALLENDALE	Cap #2
Soil	Soil	CMS-086	ALLENDALE	Cap #2
Soil	Soil	CMS-087	ALLENDALE	Cap #2
Soil	Soil	CMS-088	ALLENDALE	Cap #2
Soil	Soil	CMS-092	ALLENDALE	Cap #2
Soil	Soil	CMS-093	ALLENDALE	Cap #2
Soil	Soil	CMS-094	ALLENDALE	Cap #2
Soil	Soil	CMS-101	ALLENDALE	Cap #2
Soil	Soil	CMS-102	ALLENDALE	Cap #2

Table A-2
Sample Locations Excluded from the Ecological Risk Assessment

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

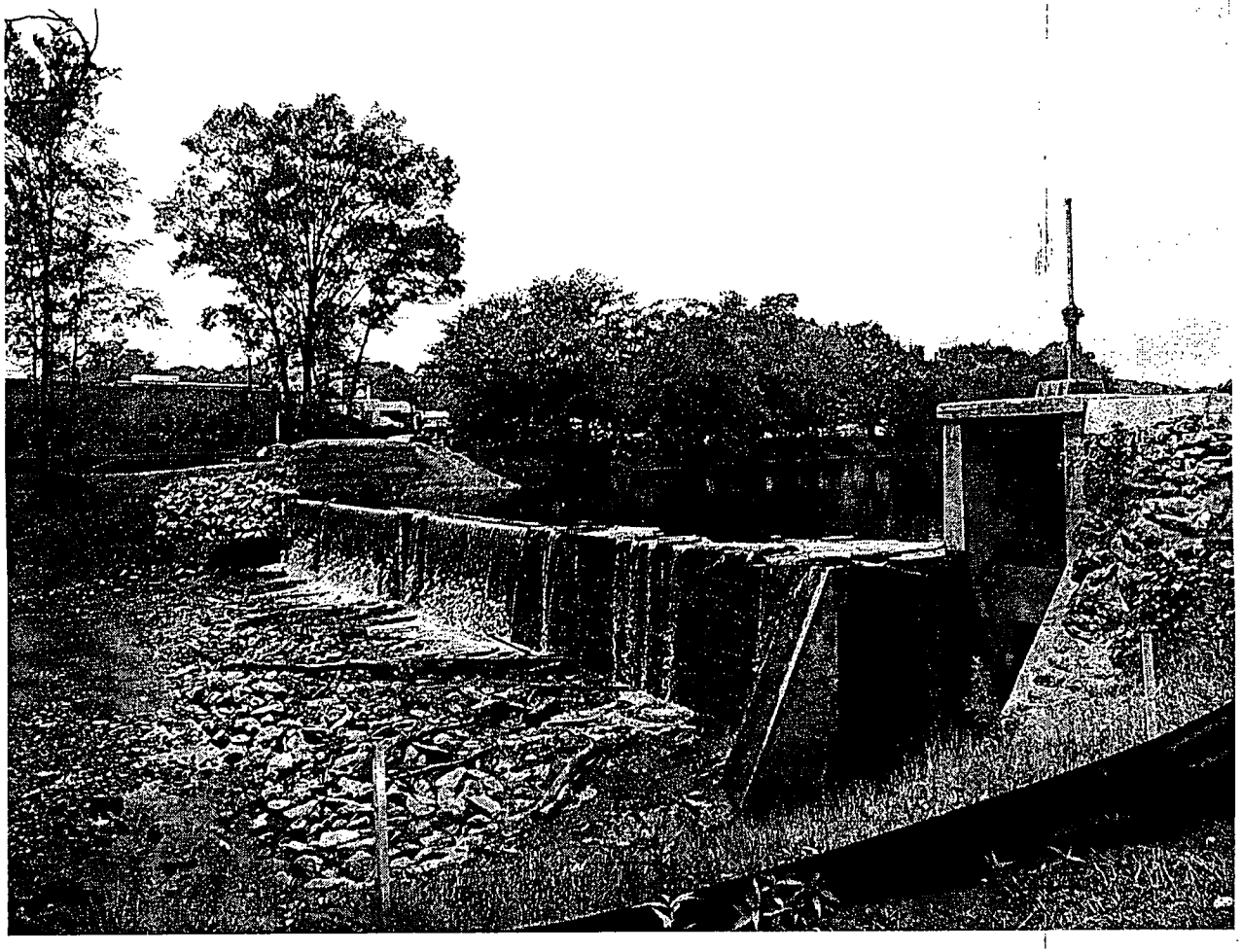
Original Matrix	BERA Matrix	Sample ID	Exposure Area	Reason for Exclusion
Soil	Soil	CMS-109	ALLENDALE	Cap #2
Soil	Soil	CMS-110	ALLENDALE	Cap #2
Soil	Soil	CMS-117	ALLENDALE	Cap #2
Soil	Soil	CMS-228	ALLENDALE	Cap #2
Soil	Soil	CMS-229	ALLENDALE	Cap #2
Soil	Soil	CMS-230	ALLENDALE	Cap #2
Soil	Soil	CMS-231	ALLENDALE	Cap #2
Soil	Soil	CMS-232	ALLENDALE	Cap #2
Soil	Soil	CMS-233	ALLENDALE	Cap #2
Soil	Soil	CMS-234	ALLENDALE	Cap #2
Soil	Soil	CMS-235	ALLENDALE	Cap #2
Soil	Soil	CMS-417	ALLENDALE	Cap #2
Soil	Soil	MW04B	ALLENDALE	Cap #2
Soil	Soil	MW06	ALLENDALE	Cap #2
Soil	Soil	MW07	ALLENDALE	Cap #2
Soil	Soil	MW09	ALLENDALE	Cap #2
Soil	Soil	SS-99-02	ALLENDALE	Cap #2
Soil	Soil	CMS-051	ALLENDALE	Rip-Rap
Soil	Soil	CMS-055	ALLENDALE	Rip-Rap
Soil	Soil	CMS-057	ALLENDALE	Rip-Rap
Soil	Soil	CMS-124	ALLENDALE	Rip-Rap
Soil	Soil	CMS-131	ALLENDALE	Rip-Rap
Soil	Soil	CMS-138	ALLENDALE	Rip-Rap
Soil	Soil	CMS-145	ALLENDALE	Rip-Rap
Soil	Soil	CMS-700	ALLENDALE	Rip-Rap
Soil	Soil	CMS-701	ALLENDALE	Rip-Rap
Soil	Soil	CMS-702	ALLENDALE	Rip-Rap
Soil	Soil	CMS-703	ALLENDALE	Rip-Rap
Soil	Soil	CMS-123	Excavated-ALLENDALE	NTCRA
Soil	Sediment	CMS-193	Excavated-ALLENDALE	NTCRA
Soil	Sediment	CMS-205	Excavated-ALLENDALE	NTCRA
Soil	Sediment	CMS-206	Excavated-ALLENDALE	NTCRA
Soil	Soil	CMS-221	Excavated-ALLENDALE	NTCRA
Soil	Soil	CMS-476	Excavated-ALLENDALE	NTCRA
Soil	Soil	CMS-483	Excavated-ALLENDALE	NTCRA
Sediment	Sediment	LPX-BK-2007	Excavated-LYMAN MILL	NTCRA
Soil	Soil	RES-11-396-01	Excavated-LYMAN MILL	NTCRA
Soil	Soil	RES-11-425-01	Excavated-LYMAN MILL	NTCRA
Soil	Soil	All other residential locations	Not evaluated	NTCRA

NTCRA - Non Time Critical Removal Action

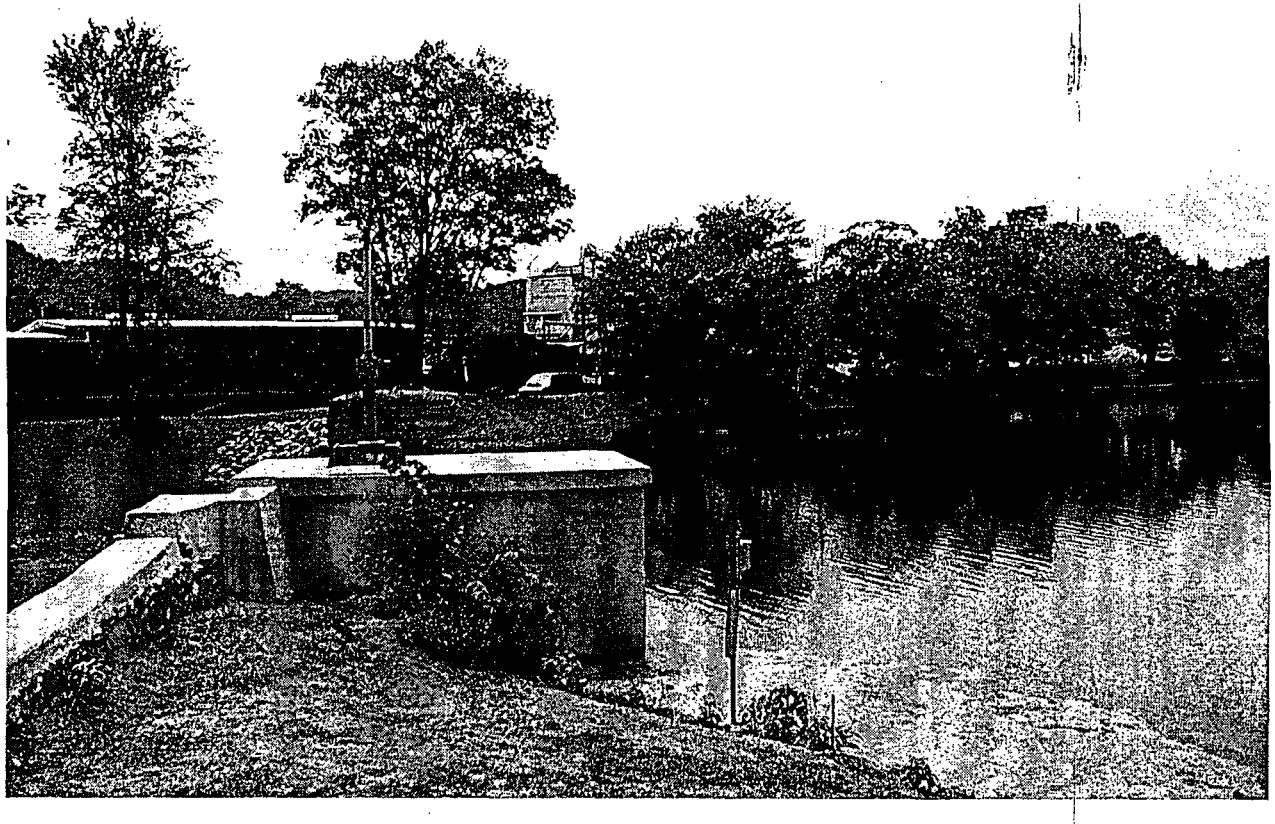
APPENDIX B

SITE PHOTOGRAPHS

Allendale Dam looking NW



Allendale Dam Looking West



River and West Bank across from southern end of CM parking lot



Area between Brookside Village Apts and River Looking North

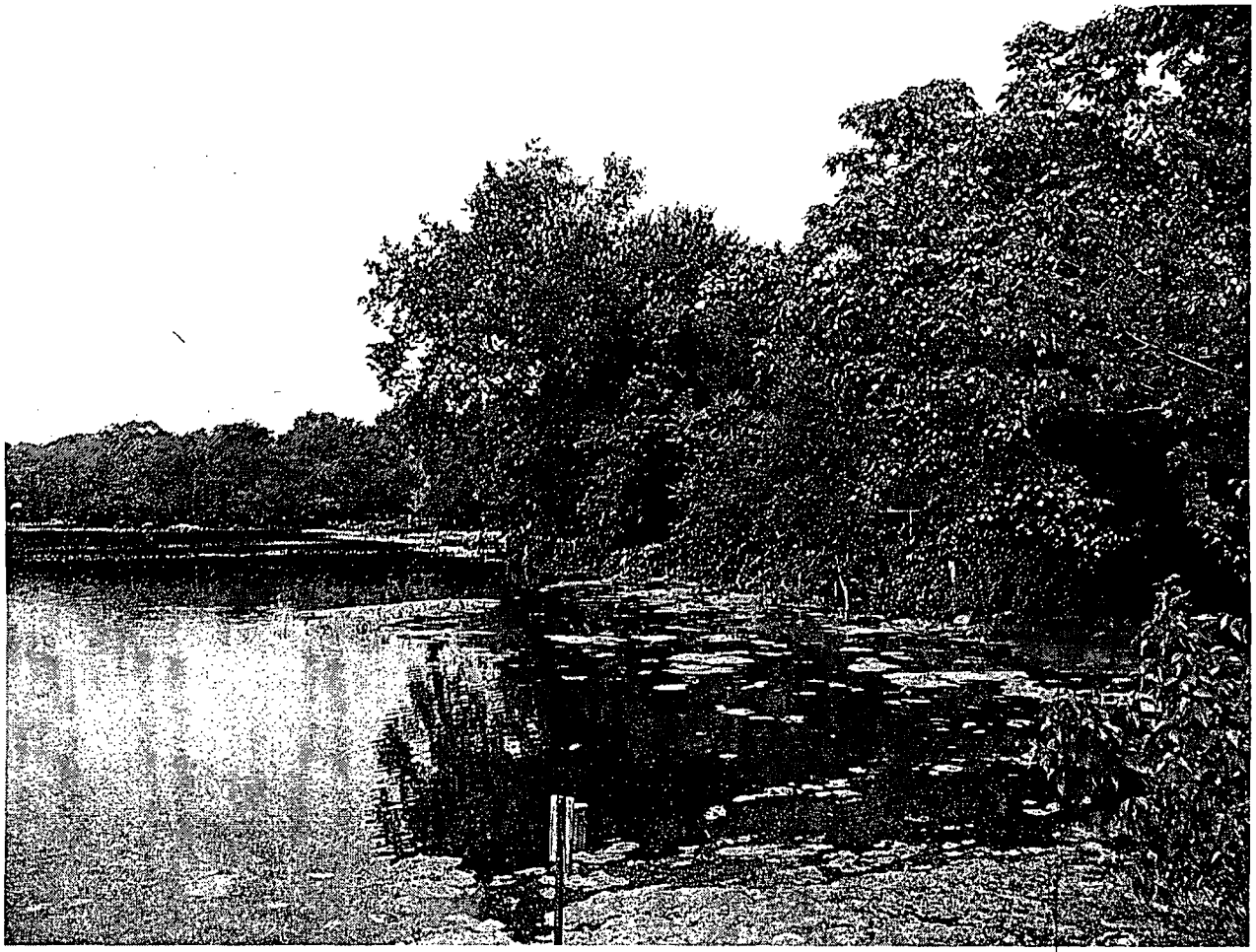


Allendale Pond Looking North from Allendale Dam (after repair)

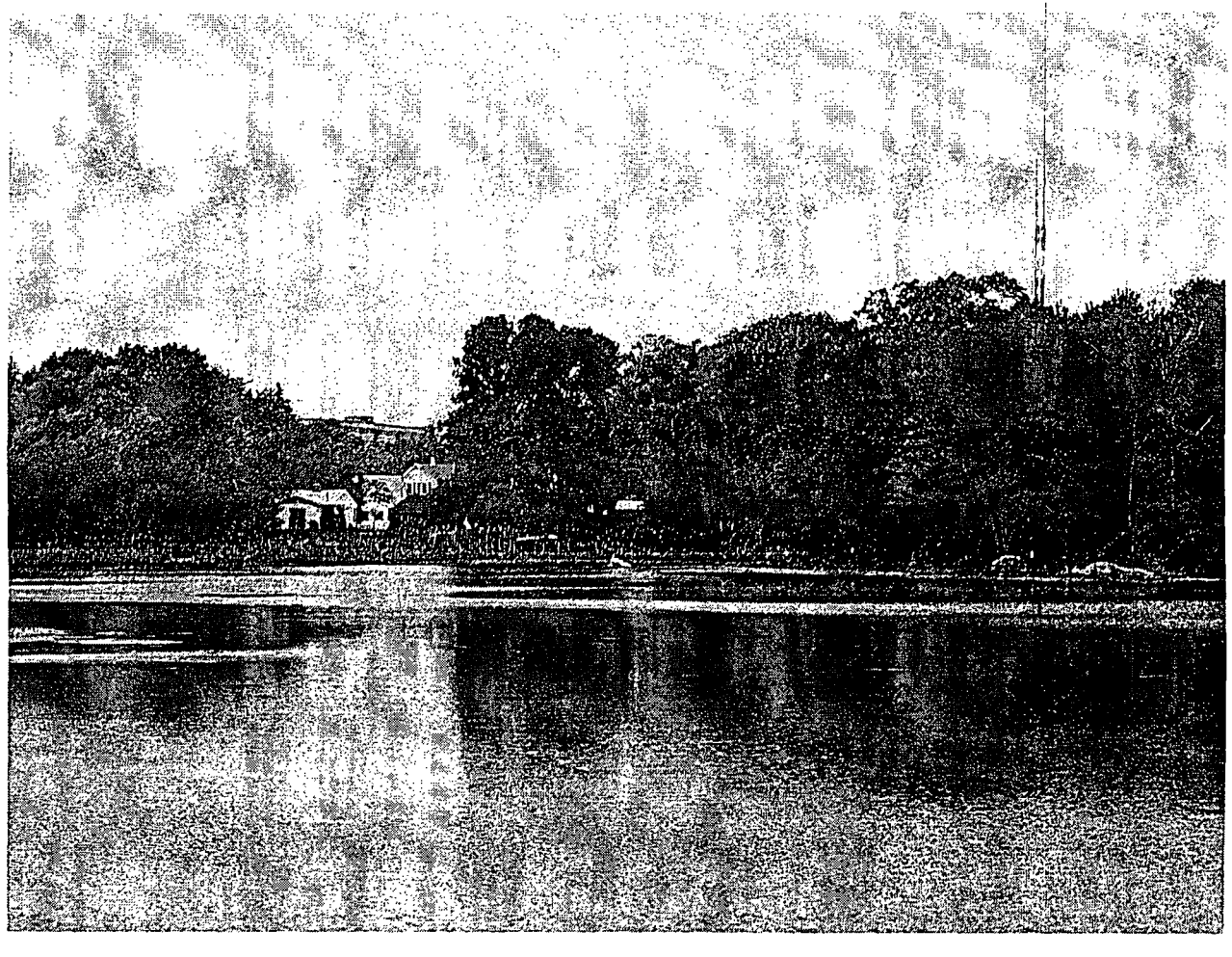


Allendale Pond Southeast corner

(looking northeast from Allendale Dam)



Allendale pond – central portion of eastern shore (looking from Allendale Dam)



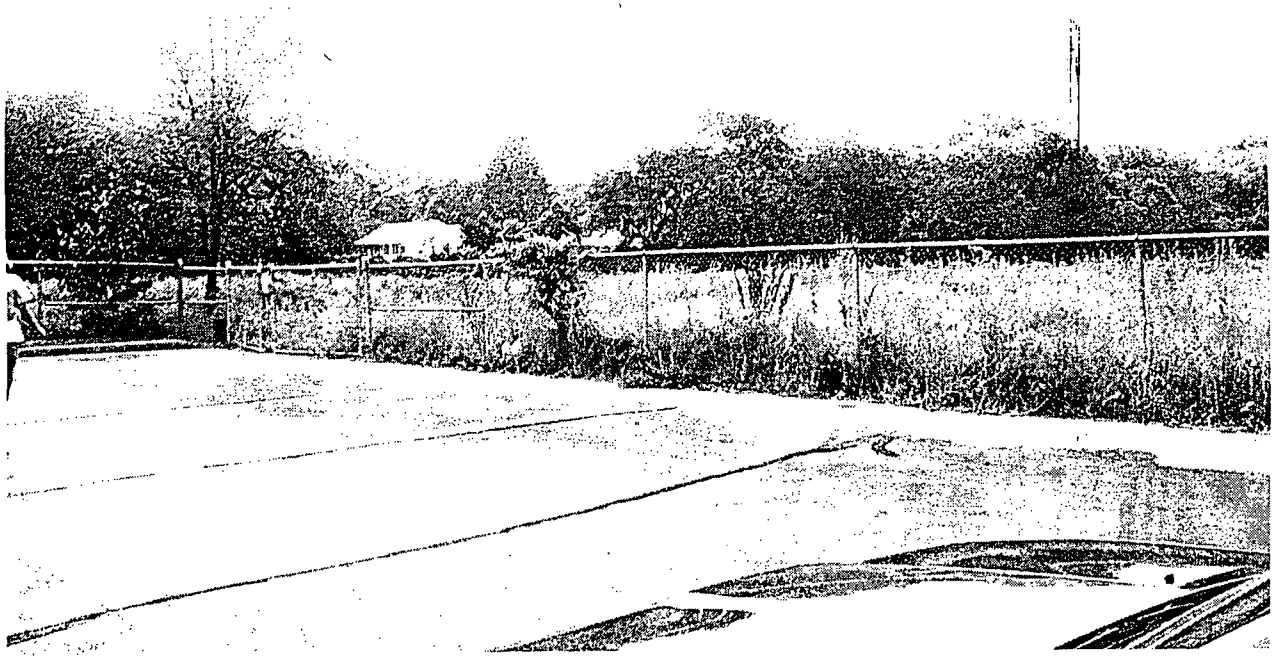
West Branch of Woonasquatucket River (looking south from Cap #1)



Rip-Rap

Inaccessible Heavily Vegetated Bank?

Cap #1(beyond fence) looking southeast from CM parking lot



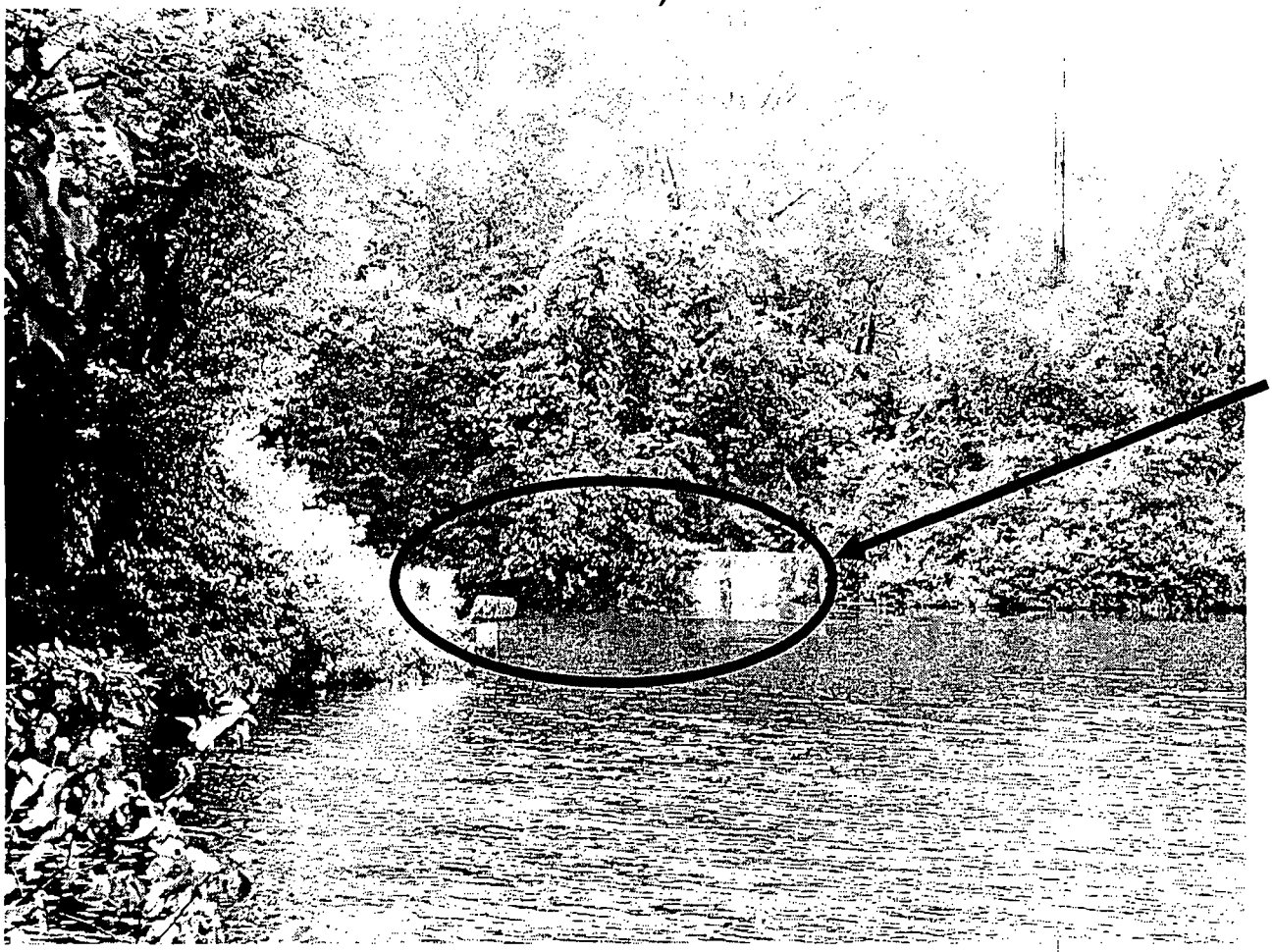
Path to Lyman Mill eastern shore, near LM Dam (looking west from parking lot just south of Fogarty Ctr)



Southwest corner of Lyman Mill Pond, north of LM Dam (looking west from eastern shore near Fogarty Ctr)



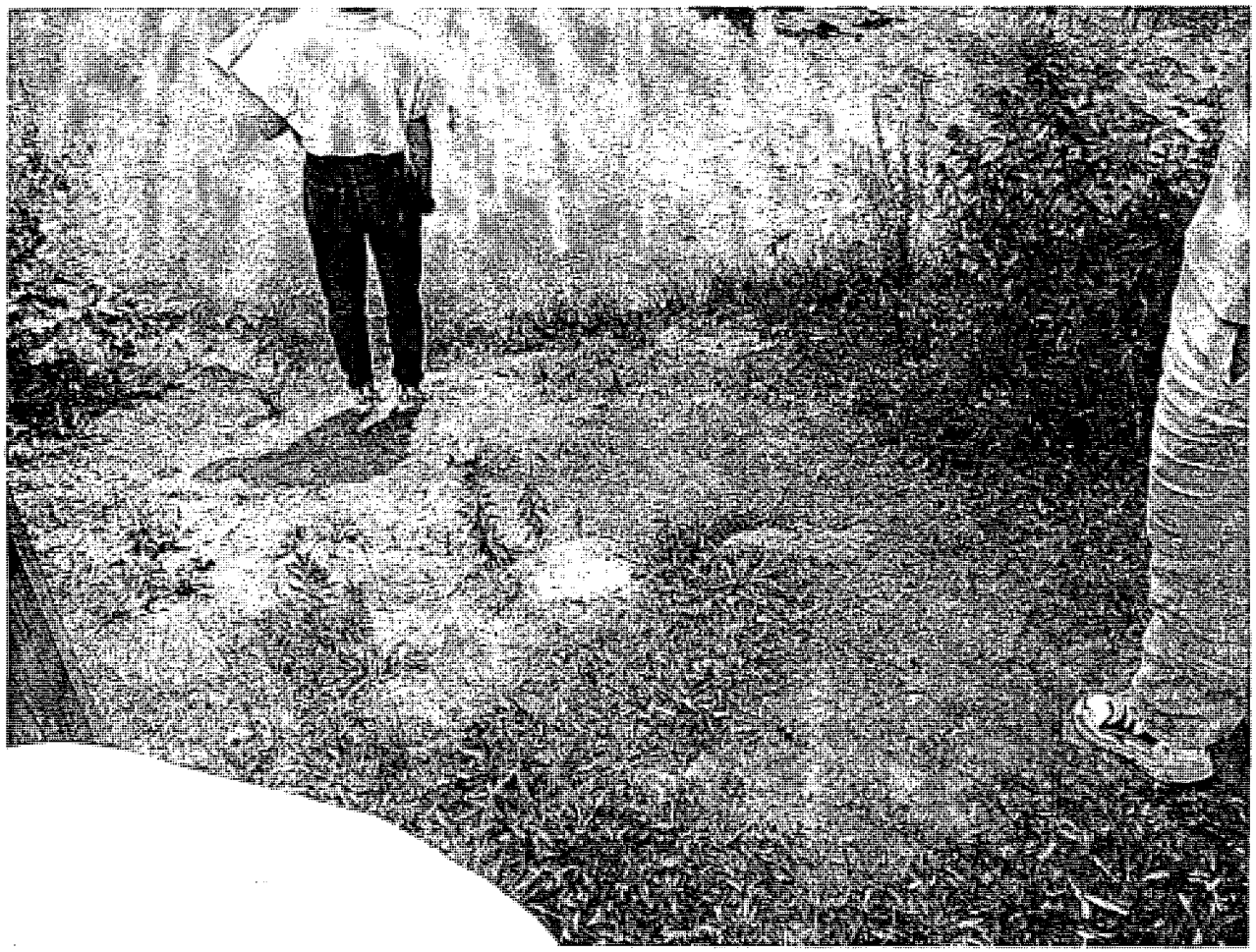
Water Flowing Over Lyman Mill Dam (Looking southwest from eastern shore of LMP near Fogarty Ctr)







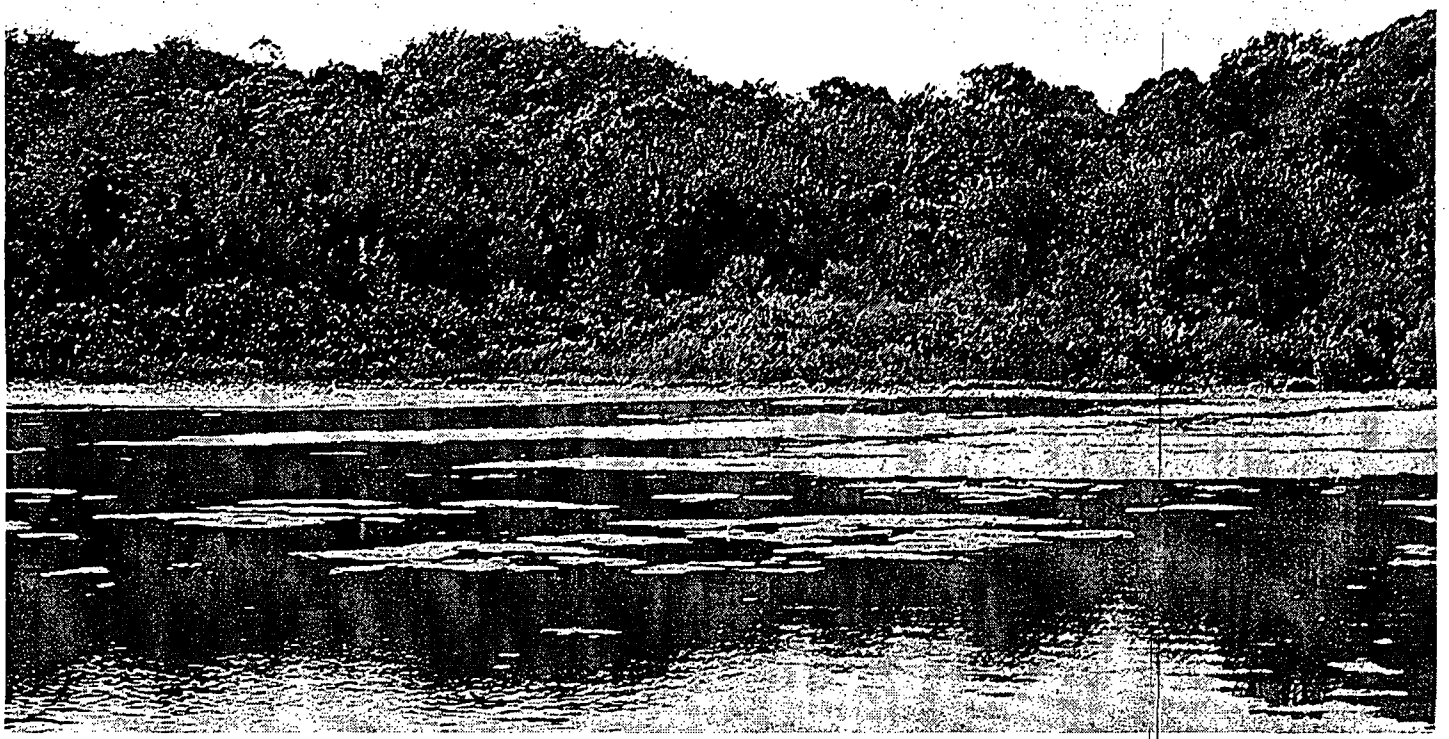
Access area – Lyman Mill Pond







Assapumpset Pond, looking north from southern shore



Assapumpset Dam, looking northwest



Assapumpset Brook, south of the Assapumpset Dam



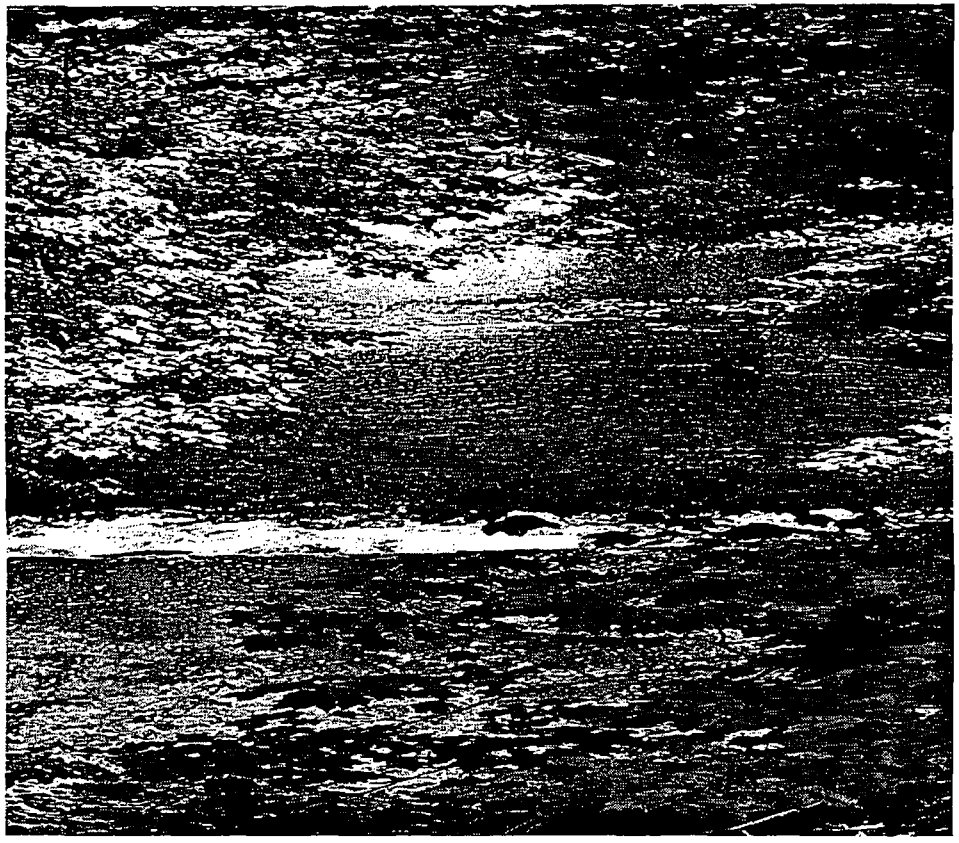
Greystone Pond, looking northeast from dam



Greystone Mill Pond Dam, looking north



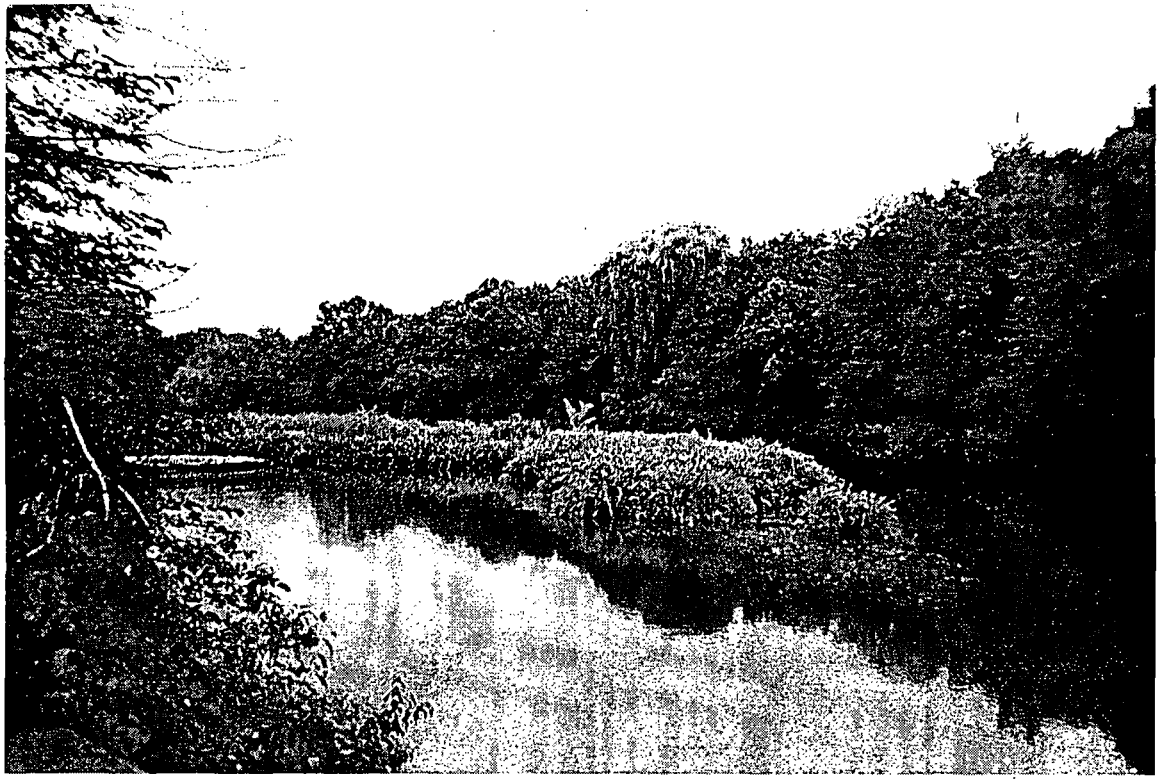
Woonasquatucket River looking north from Route 44 (Greystone Mill Pond reference area)



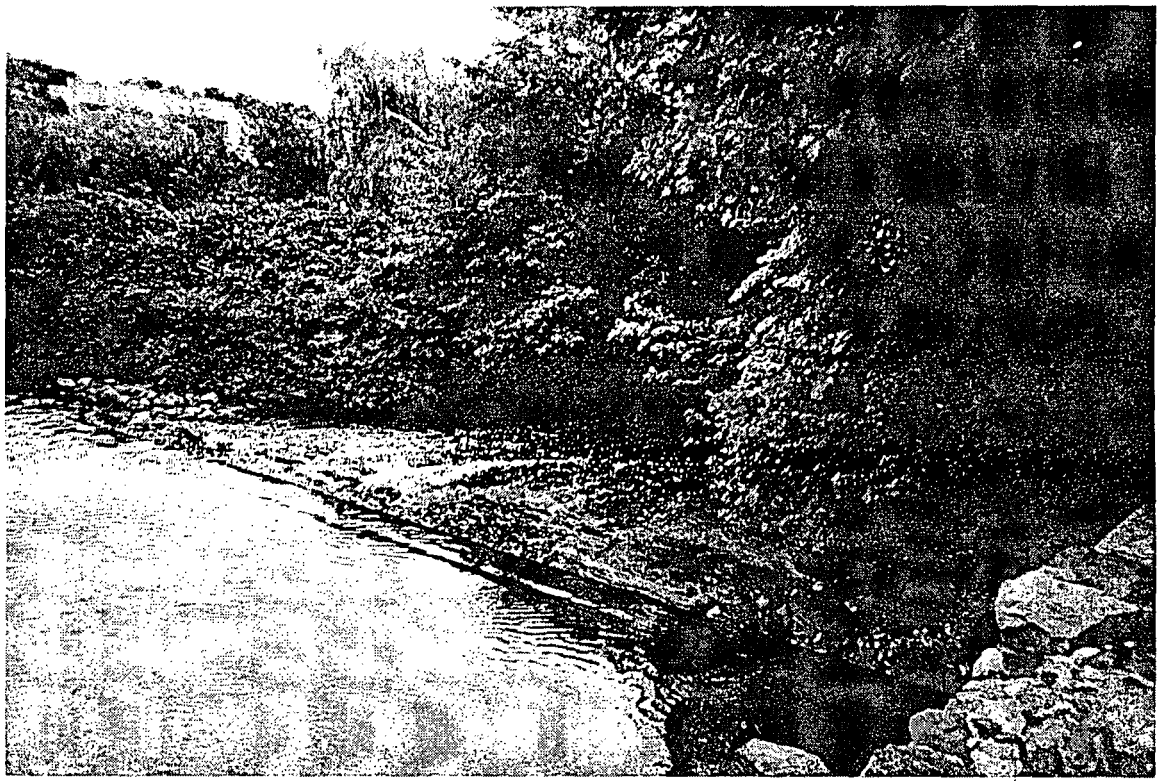
River floodplain just north of Route 44, soil sampling area



Manton Pond, looking north



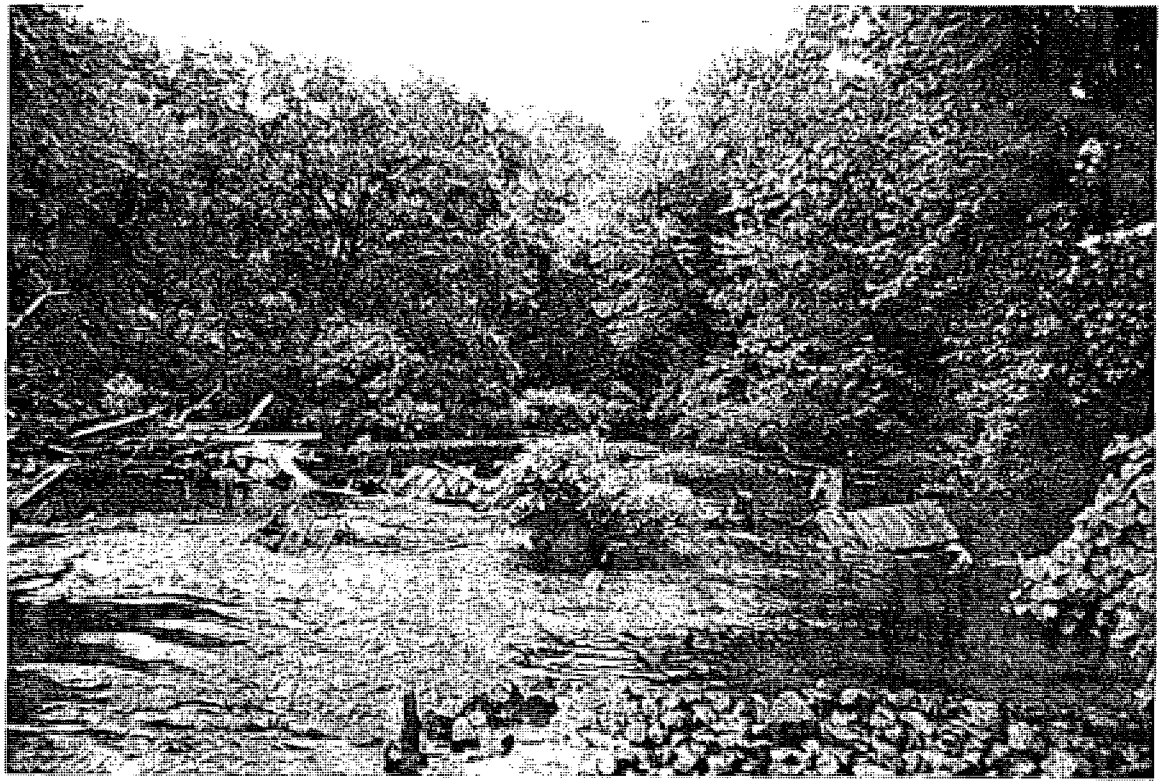
Manton Dam, looking southeast



Dyerville Pond looking north from southwest corner of Dyerville Reach



Former Dyerville Dam, looking south



APPENDIX C

SPECIES OF CONCERN RESPONSES FROM TRUSTEE AGENCIES

02478

United States Department of the Interior

FISH AND WTLDLIFE SKK V l(:i 1
New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087

June 19,2002

Shannon G. DIonne
Harding ESE, Inc.
107 Audubun Road, Suite 301
WaLeGeld, MA OJSSO

Dear Ms Dionne:

This re3pond3 to your May 14, 2002 letter requeuing infi>rm.?ition on the presence of federally-listed and proposed endangered or threatened species in relation TO the. Onterdale Manor Restoration Project inNortfi Providence, Rhodclsland. Oar comment* arc provided in *accordance.* with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 US C IVi I-1543).

Based on information cuiîeutly available to us, no federally-listed or proposed threatened or endangered spwies under the jurisdicticui orilicU.S. Fish and Wildlife Service are known to occur in the project area, with the exception of occasiuiial transient bilé cables *(Ilalicwetits Icucocephalits)* .

A list of federally-endangered and threatened species in .Rhode island is included for youi information. Thank you for your cooperarirm and please contact me at 60ð-223-2543 if we can be of further assistance.

Sincerely yours,

Su&anna L. von Oeubgen
Endangered Species Biologist
New England Held Office

Enclosure

RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

DIVISION OF FISH AND WILDLIFE
Field Headquarters
P.O. Box 218
West Kingston, RI 02892

401 789-0281
401 222-1267
FAX 401 783-7490
TDD 401 831-5508

Shannon Dionne
Harding ESE, Inc.
107 Audubon Road, Suite 301
Wakefield, MA 01880

23 June 2002

Dear Ms. Dionne,

In terms of compliance with Section 7 of the Endangered Species Act, there are no known endangered species or critical habitats in the vicinity of the proposed Centerdale Manor Restoration Project Site in North Providence, RI.

However, because I do not maintain the data for all state-listed rare species, I will forward this correspondence to Richard Enser at the R.I. Natural Heritage Program for his perusal.

Best,

Christopher J. Raithel

Principal VMdlife Biologist
RI Division of Fish and Wildlife

cc: Enser
Lapisky

APPENDIX D

CHEMICAL-SPECIFIC SCREENING, BENCHMARKS AND TOXICITY REFERENCE DOSE VALUES

TABLE 1-1

SUMMARY OF APPLICABLE STANDARDS, CRITERIA, AND OTHER BENCHMARKS FOR SURFACE WATER

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Chemical Name	Freshwater chronic AWQC or guideline[1]	Note	Region IV Screening Values[10]	Note	Chronic AQUIRE[0]	Note	ORNL Chronic Values[10]	Note	ORNL Tier II Values[10]	Note	ECOSAR[7]	Note	RI State Surface Water Standard[9]	Note	Selected Benchmark[11]	Note	Selected Benchmark Basis
4-Methyl-2-Pentanone	-	-	-	-	2.0E+02	2c	7.7E+01	1	1.7E-01	-	-	-	-	-	2.0E+02	C	AQUIRE
1-Methylcyclohexane	-	-	-	-	-	-	-	-	-	-	5.5E-02	-	-	-	5.5E-02	F	ECOSAR
Cyclohexane	-	-	-	-	-	-	-	-	-	-	6.3E-02	-	-	-	6.3E-02	F	ECOSAR
Methyl tert-Butyl Ether	-	-	-	-	1.3E+01	2d	-	-	-	-	-	-	-	-	1.3E+01	C	AQUIRE
2-Hexanone	-	-	-	-	8.6E+00	2d	3.3E+01	1	9.9E-02	-	-	-	-	-	8.6E+06	C	AQUIRE
Acetone	-	-	-	-	1.1E+03	2a	1.6E+00	2	1.5E+00	-	-	-	-	-	1.1E+03	C	AQUIRE
2-Butanone	-	-	-	-	2.0E+02	1b	2.8E+02	1	1.4E+01	-	-	-	-	-	2.0E+~02	C	AQUIRE
Methyl Acetate	-	-	-	-	-	-	-	-	-	-	1.6E+00	-	-	-	1.6E+00	F	ECOSAR
Acetophenone	-	-	-	-	-	-	-	-	-	-	2.0E+00	-	-	-	2.0E+00	F	ECOSAR
cis-1,3-Dichloropropene	2.4E-01	3	2.4E-02	-	-	-	-	-	-	-	-	-	-	-	2.4E-01	A	NAWQC
trans-1.3-Dichloropropene	2.4E-01	3	2.4E-02	-	-	-	-	-	-	-	-	-	-	-	2.4E-01	A	NAWQC
1,2-Dibromoethane	"-UE+OO"	4	-	-	3.0E-01	2d	-	-	-	-	-	-	-	-	TiE+ob	A	NAWQC
1,2-Dichloroethane	"2.0E+01	3	2.OE+OO"	-	3~4E-02"	1a	1.5E+01 ""	2	9.1E-01	-	-	-	1.3E-01""	1	1"3E-01	G	~~StateWQC
Bis-(2-chloroisopropyl)ether	2.4E+01	4	-	-	-	-	-	-	-	-	-	-	-	-	2.4E+01	A	NAWQC
Bis(2-chloroethyl)ether	2.4E+01""	4	2.4E+00~	-	"~9.1E+0(f"	1b	-	-	-	-	-	-	-	-	2.4E+01	A	NAWQC
Bis(2-chloroethoxy)methane	2.4E+01	4	-	-	-	-	-	-	-	-	-	-	-	-	2.4E+01	A	NAWQC
Dibromochloromethane	1.1E+00	4	-	-	6.8E-01	2d	-	-	-	-	-	-	-	-	1.1E+00	A	NAWQC
Tetrachloroethene	8.4E-01	3	8.4E-02	-	5.0E-01	1a	7.4E-01	1	9.8E-02	-	-	-	5.3E-03	1	5.3E-03	G	State WQC
1,3-Dichloropropane	5.7E+00	3	-	-	8.0E+00	2a	-	-	-	-	-	-	6.7E-03	1	6.7E-03	G	State WQC
1,2-Dichloroethene (cis)	1.2E+00	4	-	-	-	-	9.5E+00	1	5.9E-01	-	-	-	-	-	1.2E+00	A	NAWQC
trans-1,2-Dichloroethene	1.2E+00	4	1.4E+00	-	2.2E+01	"1b	-	-	-	-	-	-	-	-	1.2E+00	A	NAWQC
Carbon tetrachloride	3.5E+00	4	3.5E-01	-	2.0E-02	1b	2.0E+00	1	9.8E-03	-	-	-	3.0E-02	1	3.0E-02	G	State WQC
1,1-Dichloropropene	2.4E-01	3	2.4E-02	-	-	-	-	-	-	-	-	-	-	-	2.4E-01	A	NAWQC
1,1,1,2-Tetrachloroethane	9.3E-01	4	-	-	4.0E-01	2d	-	-	-	-	-	-	2.2E-02	1	2.2E-02	G	State WQC
Chloroform	1.2E+00	3	2.9E-01	-	5.0E-03	1b	1.2E+00	1	2.8E-02	-	-	-	3.2E-02	1	3.2E-02	G	State WQC
Hexachloroethane	5.4E-01	3	9.8E-03	-	6.7E-02	1a	-	-	1.2E-02	-	-	-	1.1E-03	1	1.1E-03	G	State WQC
4-Chlorophenyl-phenylether	2.4E+01	4	-	-	-	-	-	-	-	-	-	-	-	-	2.4E+01	A	NAWQC
1,1,1 -Trichloroethane	1.8E+00	4	5.3E-01	-	1.1E+00	1b	3.5E+00	1	1.1E-02	-	-	-	-	-	1.8E+00	A	NAWQC
Bromomethane	1.1E+00	4	1.1E-01	-	6.0E-05	1b	-	-	-	-	-	-	-	-	1.1E+00	A	NAWQC
Chloromethane	1.1E+00	4	5.5E+00	-	1.1E+01	2d	-	-	-	-	-	-	-	-	1.1E+00	A	NAWQC
Dibromomethane	1.1E+00	4	-	-	-	-	-	-	-	-	-	-	-	-	1.1E+00	A	NAWQC
Bromochloromethane	1.1E+00	4	-	-	1.3E+00	2d	-	-	-	-	-	-	-	-	1.1E+00	A	NAWQC
Chloroethane	2.3E+02	3	-	-	-	-	-	-	-	-	-	-	-	-	2.3E+02	A	NAWQC
Vinyl Chloride	-	-	-	-	4.1E+02	1a	-	-	-	-	-	-	-	-	4.1E+02	C	AQUIRE
Methylene Chloride	1.1E+00	4	1.9E+00	-	3.6E+00	2c	4.3E+01	2	2.2E+00	-	-	-	2.1E-01	1	2.1E-01	G	State WQC
Bromoform	-	-	2.9E-01	-	2.9E+00	1b	-	-	3.2E-01	-	-	-	3.3E-02	1	3.3E-02	G	State WQC
Bromodichloromethane	1.1E+00	4	-	-	1.0E+00	1a	-	-	-	-	-	-	-	-	1.1E+00	A	NAWQC
1,1-Dichloroethane	-	-	-	-	-	-	-"~i.'5E+0i""	"1	4.7E-02""	-	-	-	-	-	1.5E+01	"D	ORNL CVs
1,1-Dichloroethene	1.2E+00	4	3.0E-01	-	1.2E+00	1b	2.8E+00	1	2.5E-02	-	-	-	1.3E-02	1	1.3E-02	G	State WQC
Trichlorofluoromethane	1.1E+00	4	-	-	-	-	-	-	-	-	-	-	-	-	iii+6"o ""	A	NAWQC

TABLE D-1
SUMMARY OF APPLICABLE STANDARDS, CRITERIA, AND OTHER BENCHMARKS FOR SURFACE WATER

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Chemical Name	Freshwater chronic AWQC or guideline[8]	Note	Region IV Screening Values[10]	Note	Chronic AQUIRE[6]	Note	ORNL Chronic Values[7]	Note	ORNL Tier II Values[7]	Note	ECOSAR[7]	Note	RI State Surface Water Standard[9]	Note	Selected Benchmark[11]	Note	Selected Benchmark Basis
Dichlorodifluoromethane	1.1E+00	4	-		-		-		-		-		-		1.1E+00	A	NAWQC
1,1,2-Trichloro-1,2,2-trifluoroethar	-		-		-		-		-		2.2E-01		-		2.2E-01	F	ECOSAR
Hexachlorocyclopentadiene	5.2E-03	3	7.0E-05		-		-		-		-		8.0E-06	1	8.0E-06	G	State WQC
1,2-Dichloropropane	5.7E+00	3	5.3E-01		6.0E+00	1a	-		-		-		5.8E-02	1	5.8E-02	G	State WQC
1,1,2-Trichloroethane	9.4E+00	3	9.4E-01		6.0E+00	1a	9.4E+00	1	1.2E+00		-		2.0E-02	1	2.0E-02	G	State WQC
Trichloroethene	2.2E+01	3	-		1.7E+00	1a	7.3E+00	2	4.7E-02		-		4.3E-02	1	4.3E-02	G	State WQC
1,1,2,2-Tetrachloroethane	2.4E+00	3	2.4E-01		1.4E+00	1a	2.4E+00	1	6.1E-01		-		1.0E-02	1	1.0E-02	G	State WQC
Hexachlorobutadiene	9.3E-03	3	9.3E-04		6.5E-03	1a	-		-		-		-		9.3E-03	A	NAWQC
1,2-Dibromo-3-chloropropane	-		-		4.0E-01	2d	-		-		-		-		4.0E-01	C	AQUIRE
1,2,3-Trichloropropane	-		-		1.3E+00	2d	-		-		-		-		1.3E+00	C	AQUIRE
Benzyl Alcohol	-		-		-		5.9E-01	1	8.6E-03		-		-		5.9E-01	D	ORNL CVs
Benzaldehyde	-		-		-		-		-		1.6E+00		-		1.6E+00	F	ECOSAR
Caprolactam	-		-		-		-		-		8.5E+00		-		8.5E+00	F	ECOSAR
Isophorone	1.2E+01	4	1.2E+00		-		-		-		-		1.3E-01	1	1.3E-01	G	State WQC
1,1'-Biphenyl	-		-		2.3E-01	1a	-		1.4E-02		-		-		2.3E-01	C	AQUIRE
Ethyl benzene	3.2E+00	4	4.5E-01		9.0E-03	1b	4.4E-01	1	7.3E-03		-		3.6E-02	1	3.6E-02	G	State WQC
Styrene	-		-		5.0E-02	2d	-		-		-		-		5.0E-02	C	AQUIRE
n-Propyl benzene	-		-		3.6E-01	2c	-		-		-		-		3.6E-01	C	AQUIRE
n-Butyl benzene	-		-		4.9E-01	2a	-		-		-		-		4.9E-01	C	AQUIRE
2,4-Dimethylphenol	2.1E-01	4	2.1E-02		2.1E-01	1b	-		-		-		2.4E-03	1	2.4E-03	G	State WQC
4-Methylphenol	-		-		-		-		-		1.4E-01		-		1.4E-01	F	ECOSAR
m&p-Xylene	-		-		4.0E+01	2b	-		1.8E-03		-		-		4.0E+01	C	AQUIRE
1,3,5-Trimethylbenzene	-		-		1.2E+00	2c	-		-		-		-		1.2E+00	C	AQUIRE
Toluene	1.8E+00	4	1.8E-01		6.0E+00	2b	1.3E+00	1	9.8E-03		-		1.4E-02	1	1.4E-02	G	State WQC
Phenol	2.6E+00	3	2.6E-01		4.0E-02	1a	2.0E-01	1	-		-		5.6E-03	1	5.6E-03	G	State WQC
Total Xylenes	-		-		7.4E-01	1b	6.2E+01	1	1.3E-02		-		-		7.4E-01	C	AQUIRE
sec-Butylbenzene	-		-		-		-		-		1.5E-02		-		1.5E-02	F	ECOSAR
3+4-Methylphenols	-		-		-		-		-		1.4E-01		-		1.4E-01	F	ECOSAR
Benzene	5.3E-01	4	5.3E-02		4.6E-01	1b	9.8E+01	2	1.3E-01		-		5.9E-03	1	5.9E-03	G	State WQC
o-Xylene	-		-		1.2E-01	2c	-		-		-		-		1.2E-01	C	AQUIRE
2-Methylphenol	-		-		-		4.9E-01	1	1.3E-02		-		-		4.9E-01	D	ORNL CVs
1,2,4-Trimethylbenzene	-		-		7.2E-01	2c	-		-		-		-		7.2E-01	C	AQUIRE
tert-Butylbenzene	-		-		8.2E-01	2d	-		-		-		-		8.2E-01	C	AQUIRE
Isopropylbenzene	-		-		1.2E-01	2c	-		-		-		-		1.2E-01	C	AQUIRE
p-Isopropyltoluene	-		-		4.4E+00	2c	-		-		-		-		4.4E+00	C	AQUIRE
4-Nitrophenol	1.5E-01	3	8.3E-02		-		4.8E-01	1	3.0E-01		-		-		1.5E-01	A	NAWQC
4-Bromophenyl-phenylether	-		-		-		-		1.5E-03		-		4.0E-04	1	4.0E-04	G	State WQC
4-Chlorotoluene	-		-		8.8E-02	2d	-		-		-		-		8.8E-02	C	AQUIRE
1,4-Dichlorobenzene	7.6E-01	3	1.1E-02		2.7E-01	1a	-		1.5E-02		-		-		7.6E-01	A	NAWQC
Bromobenzene	-		-		-		-		-		2.5E-01		-		2.5E-01	F	ECOSAR

TABLE 0-1

SUMMARY OF APPLICABLE STANDARDS, CRITERIA, AND OTHER BENCHMARKS FOR SURFACE WATER

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Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Chemical Name	Freshwater chronic AWQC or guideline[a]	Note	Region IV Screening Values[a]	Note	Chronic AQUIRE[c]	Note	ORNL Chronic Values[a]	Note	ORNL Tier II Values[f]	Note	ECOSAR[f]	Note	RI State Surface Water Standard[g]	Note	Selected Benchmark[11]	Note	Selected Benchmark Basis
Chlorobenzene	5.0E-02	3	2.0E-01		5.9E-02	1b	1.2E+00	1	6.4E-02		-		1.8E-02	1	1.8E-02	G	State WQC
Hexachloro benzene	5.0E-02	3	-		1.6E-02	1a	-		-		-		-		5.0E-02	A	NAWQC
1,2,4-Trichlorobenzene	5.0E-02	3	4.5E-02		4.1E-01	1a	-		1.1E-01		-		1.7E-03	1	1.7E-03	G	State WQC
2,4-Dichlorophenol	3.7E-01	3	3.7E-02		7.0E-02	1a	-		-		-		2.2E-03	1	2.2E-03	G	State WQC
2,4-Dinitrotoluene	2.3E-01	3	3.1E-01		2.0E-02	1a	-		-		-		3.4E-02	1	3.4E-02	G	State WQC
2,4-Dinitrophenol	-		6.2E-03		2.3E-03	1b	-		-		-		6.9E-04	1	6.9E-04	G	State WQC
4,6-Dinitro-o-cresol	-		2.3E-03		6.4E-03	3b	-		-		-		-		2.3E-03	B	Region IV
1,3-Dichlorobenzene	7.6E-01	3	5.0E-02		5.6E-01	1a	-		7.1E-02		-		8.7E-03	1	8.7E-03	G	State WQC
4-Chloro-3-methylphenol	3.0E-03	4	3.0E-04		-		-		-		-		-		3.0E-03	A	NAWQC
2,6-Dinitrotoluene	-		-		-		-		-		2.6E-02		-		2.6E-02	F	ECOSAR
1,2,3-Trichlorobenzene	5.0E-02	3	-		4.0E-02	2c	-		-		-		-		5.0E-02	A	NAWQC
Pentachlorophenol	6.7E-03	1	1.3E-02		-		-		-		-		6.7E-03	1	6.7E-03	A	NAWQC
2,4,6-Trichlorophenol	3.2E-02	4	3.2E-03[e]		6.5E-01	1a	-		-		-		3.6E-04[e]	1	3.6E-04	G	State WQC
2-Nitrophenol	1.5E-01	3	3.5E+00		-		-		-		-		-		1.5E-01	A	NAWQC
2-Chlorotoluene	-		-		4.0E+00	2c	-		-		-		-		4.0E+00	C	AQUIRE
1,2-Dichlorobenzene	7.6E-01	3	1.6E-02		4.0E-01	1a	-		1.4E-02		-		1.8E-03	1	1.8E-03	G	State WQC
2-Chlorophenol	4.4E-01		4.4E-02		8.0E-02	1a	-		-		-		2.9E-03	1	2.9E-03	G	State WQC
2,4,5-Trichlorophenol	4.5E-02	4	-		3.4E-02	1a	-		-		-		5.1E-04	1	5.1E-04	G	State WQC
Nitrobenzene	2.7E+00	4	2.7E-01		-		-		-		-		3.0E-02	1	3.0E-02	G	State WQC
Anthracene	-		-		1.3E-04	1b	9.0E-05	1	7.3E-04		-		-		1.3E-04	C	AQUIRE
Pyrene	-		-		4.0E-04	1b	-		-		-		-		4.0E-04	C	AQUIRE
Benzo(g,h,i)perylene	-		-		2.0E-05	1b	-		-		-		-		2.0E-05	C	AQUIRE
Indeno(1,2,3-cd)pyrene	-		-		-		-		-		1.0E-03		-		1.0E-03	F	ECOSAR
Benzo(b)fluoranthene	-		-		4.2E-04	1b	-		-		-		-		4.2E-04	C	AQUIRE
Fluoranthene	4.0E-01	4	4.0E-02		-		1.5E-02	2	-		-		4.4E-03[e]	1	4.4E-03	G	State WQC
Benzo(k)fluoranthene	-		-		1.4E-04	1b	-		-		-		-		1.4E-04	C	AQUIRE
Acenaphthylene	-		-		-		-		-		5.0E-02		-		5.0E-02	F	ECOSAR
Chrysene	-		-		7.0E-05	1b	-		-		-		-		7.0E-05	C	AQUIRE
Benzo(a)pyrene	-		-		5.0E-03	1a	3.0E-04	2	1.4E-05		-		-		5.0E-03	C	AQUIRE
Dibenzo(a,h)anthracen8	-		-		4.0E-05	1b	-		-		-		-		4.0E-05	C	AQUIRE
Benzo(a)anthracene	-		-		1.0E-03	1b	6.5E-04	2	2.7E-05		-		-		1.0E-03	C	AQUIRE
Acenaphthene	5.2E-01	3	1.7E-02		-		7.4E-02	1	-		-		1.9E-03	1	1.9E-03	G	State WQC
Phenanthrene	6.3E-03	3	-		-		2.0E-01	2	-		-		-		6.3E-03	A	NAWQC
Fluorene	-		-		-		-		3.9E-03		-		-		3.9E-03	E	Tier II
Naphthalene	6.2E-01	3	6.2E-02		1.1E-01	1a	6.2E-01[f]	1	1.2E-02[f]		-		2.6E-03[e]	1	2.6E-03	G	State WQC
Dibenzofuran	-		-		-		1.0E+00[f]	2	3.7E-03[f]		-		-		1.0E+00	D	ORNLCVs
Perylene	-		-		-		-		-		1.8E-03		-		1.8E-03	F	ECOSAR
2,6-Dimethylnaphthalene	-		-		-		-		-		2.8E-02		-		2.8E-02	F	ECOSAR
1-Methylnaphthalene	-		-		-		5.3E-01	1	2.1E-03		-		-		5.3E-01	D	ORNL CVs
2-Methylnaphthalene	-		-		1.5E-01	1b	-		-		-		-		1.5E-01	C	AQUIRE

TABLE D-1
SUMMARY OF APPLICABLE STANDARDS, CRITERIA, AND OTHER BENCHMARKS FOR SURFACE WATER

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Chemical Name	Freshwater chronic AWQC or guideline[a]		Region IV Screening Values[b]		Chronic AQUIRE[c]		ORNL Chronic Values[d]		ORNL Tier II Values[e]		ECOSAR[f]		RI State Surface Water Standard[g]		Selected Benchmark[h]		Selected Benchmark Basis
2-Chloronaphthalene	1.6E-01	4	-		-		-		-		-		-		1.6E-01	A	NAWQC
BAPEQ	-		-		-		-		-		2.2E-03		-		2.2E-03	F	ECOSAR
High Molecular Weight PAHs	-		-		-		-		-		-		-		-	A	
Low Molecular Weight PAHs	-		-		-		-		-		-		-		-	A	
Total PAH	-		-		-		-		-		-		-		-	A	
Bis(2-ethylhexyl)phthalate	-		3.0E-04		1.1E-01	1a	9.1E-01	2	3.0E-03		-		1.2E-02	1	1.2E-02	G	State WQC
Di-n-octylphthalate	3.0E-03	3	-		-		7.1E-01	2	-		-		-		3.0E-03	A	NAWQC
Dimethylphthalate	3.0E-03	3	3.3E-01		1.5E+01	1a	-		-		-		3I7E-02	1	3.0E-03	A	NAWQC
Diethylphthalate	3.0E-03	3	5.2E-01		3.0E+00	1a	8.6E+01	4	2.1E-01		-		5.8E-02	1	3.0E-03	A	NAWQC
Di-n-Butylphthalate	3.0E-03	3	9.4E-03		-		7.0E-01	2	3.5E-02		-		-		3.0E-03	A	NAWQC
Butylbenzylphthalate	3.0E-03	3	2.2E-02		-		-		1.9E-02		-		1.9E-03	1	1.9E-03	G	State WQC
4-Nitroaniline	-		-		-		-		-		3.3E-02		-		3.3E-02	F	ECOSAR
4-Chloroaniline	-		-		2.7E-05	1b	-		-		-		-		2.7E-05	C	AQUIRE
2-Nitroaniline	-		-		-		-		-		2.3E-02		-		2.3E-02	F	ECOSAR
3-Nitroaniline	-		-		-		-		-		3.4E-02		-		3.4E-02	F	ECOSAR
3,3'-Dichlorobenzidine	-		-		1.1E-01	1b	-		-		-		-		1.1E-01	C	AQUIRE
N-Nitroso-di-n-propylamine	5.8E-01	4	-		-		-		-		-		-		5.8E-01	A	NAWQC
N-Nitroso-diphenylamine	5.8E-01	4	5.9E-02		-		3.3E-01	1	2.1E-01		-		6.5E-03	1	6.5E-03	G	State WQC
alpha-BHC	-		5.0E-01		1.0E-02	3b	9.5E-02	2	2.2E-03		-		-		5.0E-01	B	Region IV
beta-BHC	-		5.0E+00		-		9.5E-02	2	2.2E-03		-		-		5.0E+00	B	Region IV
delta-BHC	-		-		-		9.5E-02	2	2.2E-03		-		-		9.5E-02	D	ORNL CVs
4,4'-DDT	1.0E-06	1	1.0E-06		-		1.6E-05	2	1.3E-05		-		1.0E-06	1	1.0E-06	A	NAWQC
gamma-BHC	9.5E-05	2	8.0E-05		2.6E-04	3b	3.3E-03	3	-		-		8.0E-05	1	8.0E-05	B	Region IV
Methoxychlor	3.0E-05	1	3.0E-05		1.0E-05	1a	-		1.9E-05		-		-		3.0E-05	A	NAWQC
4,4'-DDD	6.0E-05	4	6.4E-06		1.8E-04	1a	1.7E-03	1	1.1E-05		-		-		6.0E-05	A	NAWQC
4,4'-DDE	1.1E-01	4	1.1E-02		1.7E-03	1a	-		-		-		-		1.1E-01	A	NAWQC
Toxaphene	2.0E-07	1	2.5E-07		-		-		-		-		2.0E-07	1	2.0E-07	A	NAWQC
Heptachlor epoxide	3.8E-06	1	3.8E-06		-		-		-		-		3.8E-06	1	3.8E-06	A	NAWQC
Endosulfan sulfate	-		-		-		-		5.1E-05		-		-		5.1E-05	E	Tier II
Aldrin	3.0E-04	2	3.0E-04		9.7E-06	1b	-		-		-		3.0E-03	2	3.0E-04	A	NAWQC
Endosulfan II	5.6E-05	1	5.6E-05		-		-		5.1E-05		-		5.6E-05	1	5.6E-05	A	NAWQC
alpha-Chlordane	-		-		-		-		-		-		4.3E-06	1	4.3E-06	G	State WQC
gamma-Chlordane	-		-		-		-		-		-		4.3E-06	1	4.3E-06	G	State WQC
Endrin ketone	-		-		-		-		-		2.2E-02		-		2.2E-02	F	ECOSAR
Technical Chlordane	4.3E-06	1	4.3E-06		-		1.1E-03	3	-		-		4.3E-06	1	4.3E-06	A	NAWQC
Dieldrin	5.6E-05	1	1.9E-06		2.0E-04	3c	-		-		-		1.9E-06	1	1.9E-06	B	Region IV
Endrin	3.6E-05	1	2.3E-06		-		-		-		-		2.3E-06	1	2.3E-06	B	Region IV
Endrin aldehyde	-		-		-		-		-		3.2E-02		-		3.2E-02	F	ECOSAR
Heptachlor	3.8E-06	1	3.8E-06		-		1.3E-03	1	6.9E-06		-		3.8E-06	1	3.8E-06	A	NAWQC
Endosulfan I	5.6E-05	1	5.6E-05		-		-		5.1E-05		-		5.6E-05	1	5.6E-05	A	NAWQC

TABLE J-1

SUMMARY OF APPLICABLE STANDARDS, CRITERIA, AND OTHER BENCHMARKS FOR SURFACE WATER

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Chemical Name	Freshwater chronic AWQC or guideline[a]	Note	Region IV Screening Values[a]	Note	Chronic AQUIRE[a]	Note	ORNL Chronic Values[a,1]	Note	ORNL Tier II Values[a]	Note	ECOSAR*	Note	RI State Surface Water Standard[a]	Note	Selected Benchmark[11]	Note	Selected Benchmark Basis
2,4,6,8-TCDT	-		-		-		Z..'.Z-ZZ'Z		-		-		-		-	A	
Dalapon	-		-		-				-		8.8E+01		-		^8.8E+01	F	"ECOSAR""
Dinoseb	-		-		7.9E-03	3c	-		-		-		-		1.9E-03	C	AQUIRE
Atrazine CO'	1.2E-02	1	-		""" 1.8E-01 "	3b'	-		-		-		-		1".2E-O2	A	~NAWQC
Dicamba	-		-		""""7.8E-O2""	3b	-		-		-		-		7;8Y-02	C	~ AQUIRE
2,4,5-T	-		-		3.1E-01	3c	-		-		-		-		3.1E-01	C	AQUIRE
MCPA	-		-		1.5E+00	3c	-		-		-		-		1.5E+00	C	AQUIRE
2,4-D	-		-		1.7E-01	3b	-		-		-		-		1.7E-01	C	AQUIRE
2,4-DB	-		-		1.5E-01	3c	-		-		-		-		1.5E-01	C	AQUIRE
Dichlorprop	-		-		2.9E-02	3c	-		-		-		-		2.9E-02	C	AQUIRE
MCPP	-		-		-		-		-		2.7E+00		-		2.7E+00	F	ECOSAR
2,4,5-TP (Silvex)	-		-		6I8E-03" ""	3b	-		-		-		-		"6."8E-03""~	C	AQUIRE
Aroclor-1260	-		1.4E-05		-		1.3E-03	1	9.4E-02		-		1.4E-05	1	1.4E-05	B"	Region IV
Aroclor-1254	-		1.4E-05		-		1.0E-04	4	3.3E-05		-		1.4E-05	1	1.4E-05	B	Region IV
Aroclor-1268	-		-		-		-		-		3.3E-04		-		3.3E-04	F	ECOSAR-
Aroclor-1221	-		1.4E-05		-		6.0E-02	1	2.8E-04		-		1.4E-05	1	1.4E-05	B	Region IV
Aroclor-1232	-		1.4E-05		-		1.2E-01	1	5.8E-04		-		1.4E-05	1	1.4E-05	B	Region IV"
Aroclor-1248 « « «	-		1.4E-05		-		-		8.1E-05		-		1.4E-05	1	1.4E-0S	B	Region IV
Aroclor-1016 ' C'f	-		1.4E-05		-		-		-		-		1.4E-05	1	1.4E-05	B	Region IV;
Aroclor, Total	-		-		-		1.4E-04	4	1.4E-04		-		-		1.4E-04"	D	ORNL CVS
Polychlorinated biphenyls (PCBs)	1~'4E-05	T~	-		-		"""Y.4E-04	4"	T.4E-04		-		-		1".4E-O5	"A	NAWQC
Aroclor-1262	-		-		-		-		-		3.3E-04		-		3.3E-04	F	ECOSAR
Aroclor-1242	-	—	1.4E-05		-		4.9E-03	3	5.3E-05		-		I.4E-05	1	1.4E-05	B	Region IV
Chromium III	2.8E-02	1	1.2E-01		-		4.4E-02	2	-		-		6.7E-02	1	2.8E-02	A	NAWQC
Chromium III (dissolved)	2.4E-02	1	-		-		-		-		-		5.7E-02	1	2.4E-02	A	NAWQC
Arsenic V	8.5E-02	4	-		-		4.8E-02	4	3.1E-03		-		-		8.5E-02	A	NAWQC
Chromium VI (dissolved)	1.1E-02	1	-		-		-		-		-		1.1E-02	1	1.1E-02	A	"NAWQC
Arsenic III	1.5E-01	1	1.9E-01		-		9.'iE-oT	2	-		-		1.5E-01	1	1.5E-01	A	NAWQC
Mercury (methyl)	-		-		-		4.0E-05	2	2.8E-06		-		-		4.0E-05	D	ORNLCVs
Aluminum	8.7E-02	1	8.7E-02		-		4.6E-01	4	-		-		8.7E-02*"	1	8.7E-02	A	NAWQC
Iron	1.0E+00	1	1.0E+00		-		1.6E-01	2	-		-		-		1.0E+00	A	NAWQC
Lead	5.4E-04	1	1.3E-03		-		1.2E-02	2'	-		-		"" 5I4E-04		5.4E-04	A'	" NAWQC
Lead (dissolved)	5.4E-04 """	1	-		-		-		-		-		5.4E-04."	~ 1	"5.4E-04	"A"	NAWQC
Magnesium	-		-		-		8.2E+01	2	-		-		-		8.2E+01	" D	ORNLCVs'
Manganese	-		-		-		" 'i1.1E+OO"	2	"< 1.2E-01		-		-		1.1E+00	D	" ORNL CVs "
Mercury	9.1E-04	1	1.2E-05		-		2.3E-04	1'	1.3E-01		-		1.2E-05	1	"1.2E-05"	G'	" State WQC""
Mercury (dissolved)	7.7E-04	1	-		-		-		-		-		2.1E-03"	2	7.'7E-04	A"	NAWQC
Molybdenum	-		-		-		8.8E-01	2	3.7E-01		-		-		8.8E-01	D	ORNL CVs
Nickel	1.6E-02	1	8.8E-02		-		5.0E-03^ "	2	-		-		4.9E-02	1	"1.6E.02"	"A"	NAWQC
Nickel (dissolved)	1.6E-02	1	-		-		-		-		-		" 4.9E-02"""	1	1.6E.02	A	NAWQC

TABLE D-1
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Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Chemical Name	Freshwater chronic AWQC or guideline[8]	Note	Region IV Screening Values[10]	Note	Chronic AQUIRE[9]	Note	ORNL Chronic Values[10]	Note	ORNL Tier II Values[10]	Note	ECOSAR[7]	Note	RI State Surface Water Standard[9]	Note	Selected Benchmark[11]	Note	Selected Benchmark Basis
Silver	3.5E-05	2	1.2E-05		-		1.2E-04	1	3.6E-04		-		3.7E-04	2	**3.5E-05**	A	NAWQC
Silver (dissolved)	3.0E-05	2	-		-		-		-		-		3.2E-04	2	**3.0E-05**	A	NAWQC
Thallium	4.0E-02	3	4.0E-03		1.1E-02	1b	5.7E-02	1	1.2E-02		-		1.0E-03	1	**1.0E-03**	G	State WQC
Antimony	1.6E+00	3	1.6E-01		5.3E-02	1a	6.1E-01	4	3.0E-02		-		1.0E-02	1	**1.0E-02**	G	State WQC
Arsenic	1.5E-01	1	-		-		-		-		-		1.5E-01	1	**1.5E-01**	A	NAWQC
Arsenic (dissolved)	1.5E-01	1	-		-		-		-		-		1.5E-01	1	**1.5E-01**	A	NAWQC
Barium	-		-		2.6E+00	1b	-		4.0E-03		-		-		**2.6E+00**	C	AQUIRE
Beryllium	5.3E-03	3	5.3E-03		5.3E-03	1a	5.3E-03	2	6.6E-04		-		1.7E-04	1	**1.7E-04**	G	State WQC
Cadmium	9.7E-05	1	6.6E-04		-		1.5E-04	2	-		-		3.8E-04	1	**9.7E-05**	A	NAWQC
Cadmium (dissolved)	9.4E-05	1	-		-		-		-		-		3.7E-04	1	**9.4E-05**	A	NAWQC
Chromium	-		-		-		-		-		-		-		-	A	
Cobalt	-		-		-		5.1E-03	2	2.3E-02		-		-		**5.1E-03**	D	ORNL CVs
Copper	2.9E-03	1	6.5E-03		-		2.3E-04	2	-		-		3.6E-03	1	**2.9E-03**	A	NAWQC
Copper (dissolved)	2.7E-03	1	-		-		-		-		-		3.5E-03	1	**2.7E-03**	A	NAWQC
Vanadium	-		-		1.6E-01	1a	8.0E-02	1	2.0E-02		-		-		**1.6E-01**	C	AQUIRE
Zinc	3.7E-02	1	5.9E-02		-		3.0E-02	4	-		-		3.3E-02	1	**3.3E-02**	G	State WQC
Zinc (dissolved)	3.7E-02	1	-		-		-		-		-		3.2E-02	1	**3.2E-02**	G	State WQC
Selenium	5.0E-03	1	3.0E-03		-		8.8E-02	1	-		-		5.0E-03	1	**5.0E-03**	A	NAWQC
Selenium (dissolved)	4.6E-03	1	-		-		-		-		-		5.0E-03	1	**4.6E-03**	A	NAWQC
Nitrate	-		-		-		-		-		9.8E+00		-		**9.8E+00**	F	ECOSAR
Nitrite	-		-		-		-		-		1.8E+00		-		**1.8E+00**	F	ECOSAR
Cyanide	2.2E-02	1	5.2E-03		-		7.8E-03	1	-		-		5.2E-03	1	**5.2E-03**	B	Region IV
Sodium	-		-		-		6.8E+02	2	-		-		-		**6.8E+02**	D	ORNL CVs
Calcium	-		-		-		1.2E+02	2	-		-		-		**1.2E+02**	D	ORNL CVs
Carbon disulfide	2.0E-03	3	-		4.2E+00	2c	2.4E-01	2	9.2E-04		-		-		**2.0E-03**	A	NAWQC
Potassium	-		-		-		5.3E+01	2	-		-		-		**5.3E+01**	D	ORNL CVs
Benzoic acid	-		-		-		1.3E+01	1	4.2E-02		-		-		**1.3E+01**	D	ORNL CVs
Carbazole	-		-		-		-		-		7.9E-02		-		**7.9E-02**	F	ECOSAR
Ammonia	3.0E+00	1	-		-		1.7E-03	1	-		-		3.0E+00	1	**3.0E+00**	A	NAWQC
2.3.7,8-TCDD	1.0E-08	3	1.0E-08		3.8E-08	1a	-		-		-		-		**1.0E-08**	A	NAWQC

TAf >-1

SUMMARY OF APPLICABLE STANDARDS, CRITERIA, MND OTHER BENCHMARKS FOR SURFACE WATER

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Chemical Name	Freshwater chronic AWQC or guideline[a] Note	Region IV Screening Values[b] Note	Chronic AQUIRE[c] Note	ORNL Chronic Values[d] Note	ORNL Tier II Values[e] Note	ECOSAR[f] Note	RI State Surface Water Standard[g] Note	Selected Benchmark[h] Note	Selected Benchmark Basis

NOTES:

Units in mg/L = milligram per liter

a. Federal Chronic Ambient Water Quality Criteria for Freshwater (AWQC) (USEPA, 2002; 1991). An estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect.
Value is equal to the 4-day average concentration that should not be exceeded more than once every 3 years.
[1] Chronic Freshwater Ambient Water Criterion
[2] Acute Freshwater Ambient Water Criterion divided by a ten-fold extrapolation factor.
[3] Chronic Lowest Observed Effect Level.
[4] Acute LOEL divided by a ten-fold extrapolation factor.
Hardness-dependent metal criteria calculated assuming water hardness of 25 mg/L as calcium carbonate

b. EPA Region IV Water Management Division, Water Quality Standards Unit's Screening List (as cited in Suter and Tsao, 1996); all values are chronic screening values.

c. Value from the Aquatic Information Retrieval (AQUIRE) database; notes refer to the following compilations:
[1] MADEP - queries derived during the development of groundwater standards; a - chronic study, b - acute study divided by a ten-fold extrapolation factor.
[2] Rowe et al., 1997. a - Maximum Allowable Toxicant Concentration (MATC), b - Lowest Observed Effect Concentration (LOEC), c - EC_5/5, d - LC_{50}/50.
[3] Munn and Gilliom, 2001. Most sensitive taxon indicated: a - cladoceran, b - benthic macroinvertebrate, c - fish.

d. Lowest chronic value as reported in Suter and Tsao, 1996:
[1] Fish
[2] Daphnids
[3] Non-daphnid invertebrates
[4] Plants

e. Tier II Secondary Chronic Value as reported in Suter and Tsao, 1996.

f. Value estimated using USEPA ECOSAR program; for multiple QSAR models, most sensitive endpoint used. A 50-fold EF used for LC50 estimates and a 5 fold EF used for EC50 endpoints, respectively.

g. RIDEM, 2002.

h. Surface water benchmark is selected according to following sequence:
[1] Minimum of national freshwater chronic AWQC (or surrogate) or RIDEM Water Quality Standard;
[2] If above unavailable, Region IV Screening Value;
[3] If all above unavailable, lowest AQUIRE value;
[4] If all above unavailable, lowest ORNL Chronic Value (Suter and Tsao, 1996);
[5] If all above unavailable, lowest Chronic Tier II value from ORNL (Suter and Tsao, 1996);
[6] If all above unavailable, ECOSAR estimate.

Prepared by: SGD
Checked by: NAR

TAI 1-2

SUMMARY OF ECOLOGICAL SCREENING BENCHMARrvo FOR SEDIMENT AND SELECTED SCREENING VALUE

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

PARAMETER	APCs[1]	CVs[n]	OMEE LELs[o]	NOAA ER-Ls[d]	WA SQVs[s]	EPAESGs/ SQCs[t]	%	ORNLEqP Tier II[9]	Note	ORNLEqP CVs[u]	Note	EqP-based Benchmarks[t]	Selected Aquatic Benchmark[1]	Basis	Semi-Aquatic Wildlife Benchmark[11]	Basis	Selected Sediment Benchmark[v]	Note
4-Methyl-2-Pentanone												3.8E+01	3.8E+01	I	4.3E+04	4	3.8E+01	1
1-Methylcyclohexane												2.0E+00	2.0E+00	I	1.2E+02	6	2.0E+00	1
Cyclohexane												1.5E+00	1.5E+00	I	4.5E+01	6	T5E+00	1
Methyl tert-Butyl Ether												1.1E+00	VL-1E+00	I	1.1E+04	4	1.1E+00	1
2-Hexanone												1.9E+00	Y1.9E+00	I	9.1E+02	1	1.9E+00 Y	1
Acetone												6.4E+00	6.4E+00	I	2.4E+03	4	6.4E+00	1
2-Butanone												3.8E+00	3.8E+00	I	8.6E+04	4	3.8E+00	1
Methyl Acetate												2.4E-02	2.4E-02	I	2.6E+05	4	2.4E-02#v	1
Acetophenone												7.0E-01	7.0E-01	I	2.1E+04	4	7.0E-0.1-M	1
cis-1,3-Dichloropropene												2.6E-01	2.6E-01 V	I	1.2E+02	4	2.6E-01	1
trans-1,3-Dichloropropene												2.4E-01	Y 2.4E-0fer	I	1.2E+02	4	2.4E10t	1
1,2-Dibromoethane												9.3E-01	9.3E-01Y5"	I	5.8E+01	4	3E-0fi	1
1,2-Dichloroethane								0.25		4.2	2	nc	2.5E-bts	G	7.7E+02	4	P2.5E-M	1
Bis-(2-chloroisopropyl)6ther												6.5E+01	V.2 6.5E+01wE	I	1.6E+03	5	6.5E+01	1
Bis(2-chloroethyl)ether												4.4E+00	K 4.4E+00 3 1	I	3.5E+02	4	SI4.4E*O0Se	1
Bis(2-chloroethoxy)methane												4.5E+00	4.5E+W3	I	2.0E+02	4	4.5E+00	1
Dibromochloromethane												1.5E+00	1.5E+0Q 7	I	1.7E+02	4	4> i.SE+00v'A	1
Tetrachloroethene												1.8E+01	t#fEt.8E+0iitii	I	6.2E+01	2	IS 1.8E+0fK	1
1,3-Dichloropropane												5.3E+00	llk' 5.3E+0tfiS	I	1.2E+02	4	5.3E+00	1
1,2-Dichloroethene (cis)								0.4		6.4	1	nc	4.0E-Ots vY	G	1.6E+03	4	4.0E-01	1
trans-1,2-Dichloroethena								0.4		6.4	1	no	4.0E-ot	G	2.5E+05	4	4.0E-01	1
Carbon tetrachloride								0.047		9.5	1	nc	4.7E-02	G	5.4E+02	4	.4.7E-024f	1
1,1-Dichloropropene												7.5E-01	V7.5E-01 >m	I	1.2E+02	4	a.Y7.5E41 K	1
1,1,1,2-Tetrachloroethane												7.1E+00	7.1E+00	I	4.4E+03	4	7.1E+00	1
Chloroform								0.022		0.96	1	nc	2.2E-02	G	1.5E+03	4	2.2E-02	1
Hexachloroethane								1				nc	4.6E+00	G	4.6E+02	6	i.oE+oo	1
4-Chlorophenyl-phenylether												9.9E+03	9.9E+03	I	2.7E+02	6	i'2,7E,0i	2
1,1,1-Trichloroethane								0.03		9.6	1	nc	3.0E-02	G	2.6E+03	4	3.0E-02	1
Bromomethane												1.6E-01	1.6E-01 V	I	4.3E+03	4	1.6E-01	1
Chloromethane												8.6E-02	8.6E-02	I	1.1E+03	4	8.6E-02	1
Dibromomethane												5.2E-01	5.2E-01	I	8.8E+01	4	5.2E-01	1
Bromochloromethane												2.7E-01	2.7E-01	I	2.0E+02	4	2.7E-01	1
Chloroethane												5.9E+01	5.9E+01	I	1.4E+05	4	5.9E+01	1
Vinyl Chloride												1.6E+02	1.6E+02	I	8.3E+01	4	8.3E+01	2
Methylene Chloride								0.37		7.2	2	nc	3.7E-01	G	4.0E+02	4	3.7E-01	1
Bromoform								0.65				nc	6.5E-01	G	3.5E+03	4	6.5E-01	1
Bromodichloromethane												1.0E+00	1.0E+00	I	2.4E+02	4	1.0E+00	7
1,1-Dichloroethane								0.027		8.4	1	nc	2.7E-02 7	G	1.9E+05	4	2.7E-02	1
1,1-Dichloroethene								0.031		3.5	1	nc	3.1E-02	G	2.4E+02	4	3~IE-02	T
Trichlorofluoromethane												3.4E+00	3.4E+00	I	1.7E+03	4	3.4E+00 W	1
Dichlorodifluoromethane												1.5E+00	1.5E+06 v	I	7.3E+02	4	1.5E+00	1
1,1,2-Trichloro-1,2,2-trifluoroethane												2.9E+00	2.9E+00	I	3.2E^04	6	f'Z9E*oM	1
Hexachlorocyclopentadiene												4.7E+00	V4.7E+00(>	I	3.7E+00	6	3.7E+00	2
1,2-Dichloropropane												5.0E+00	5.0E+00	I	2.2E+03	4	5.0E+00	1

TABLE D-2
SUMMARY OF ECOLOGICAL SCREENING BENCHMARKS FOR SEDIMENT AND SELECTED SCREENING VALUE

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

PARAMETER	ARCS[1]	Note	CVs[b]	Note	OMEE LELs[e]	Note	NOAA ER-L's[d]	Note	WA SQVs[e]	Note	EPAESGs/ SQCs[f]	Note	ORNLEqP Tier II[g]	Note	ORNL EqP CVs[h]	Note	EqP-based Benchmarks[i]	Note	Selected Aquatic Benchmark[k]	Basis	Semi-Aquatic Wildlife Benchmark[m]	Basis	Selected Sediment Benchmark[n]	Note
1,1,2-Trichloroethane													1.2		9.7	1	no		1.2E+00	G	3.2E+03	4	1.2E+00	1
Trichloroethene													0.22		33	2	nc		2.2E-01	G	3.7E+03	4	2.2E-01	1
1,1,2,2-Tetrachloroethane													1.4		5.4	1	nc		1.4E+00	G	2.2E+03	4	1.4E+00	1
Hexachlorobutadiene																	4.7E+00		4.7E+00	I	4.3E+00	7	4.3E+00	2
1,2-Dibromo-3-chloropropane																	3.3E+00		3.3E+00	I	4.4E+00	4	3.3E+00	1
1,2,3-Trichloropropane																	2.3E+00		2.3E+00	I	1.1E+03	4	2.3E+00	1
Benzyl Alcohol													0.0011		0.073	1	nc		1.1E-03	G	7.0E+03	4	1.1E-03	1
Benzaldehyde																	4.6E-01		4.6E-01	I	1.0E+04	4	4.6E-01	1
Caprolactam																	3.8E-01		3.8E-01	I	2.4E+03	4	3.8E-01	1
Isophorone																	5.5E+00		5.5E+00	I	1.5E+03	4	5.5E+00	1
1,1'-Biphenyl													1.1				nc		1.1E+00	G	1.4E+02	6	1.1E+00	1
Ethylbenzene													0.089		5.4	T	nc		8.9E-02	G	3.0E+03	6	8.9E-02	1
Styrene																	4.0E-01		4.0E-01	I	4.6E-03	4	4.0E-01	1
n-Propylbenzene																	1.5E+01		1.5E+01	I	2.9E+02	6	1.5E+01	1
n-Butylbenzene																	9.9E+01		9.9E+01	I	2.9E+02	6	9.9E+01	1
2,4-Dimethylphenol																	3.9E-01		3.9E-01	I	5.7E+03	A	3.9E-01	1
4-Methylphenol																	1.1E-01		1.1E-01	I	2.1E+02	7	1.1E-01	1
m&p-Xylene																	5.3E+02		5.3E+02	I	1.8E+02	7	1.8E+02	2
1,3,5-Trimethylbenzene																	2.8E+01		2.8E+01	I	2.1E+01	6	2.1E+01	2
Toluene													0.05		6.4	1	nc		5.0E-02	G	3.8E+03	4	5.0E-02	1
Phenol									0.048	2					0.057		nc		4.8E-02	E	2.0E+03	4	4.8E-02	1
Total Xylenes													0.16		740	1	nc		1.6E-01	G	1.8E+02	7	1.6E-01	1
sec-Butylbenzene																	4.8E+00		4.8E+00	I	2.8E+02	6	4.8E+00	1
3+4-Methylphenols																	1.1E-01		1.1E-01	I	1.7E+02	7	1.1E-01	1
Benzene													0.16		120	2	nc		1.6E-01	G	1.3E+03	4	1.6E-01	1
o-Xylene																	1.4E+00		1.4E+00	I	1.8E+02	7	1.4E+00	1
2-Methylphenol													0.012		0.44	1	nc		1.2E-02	G	5.7E+02	5	1.2E-02	1
1,2,4-Trimethylbenzene																	2.7E+01		2.7E+01	I	2.1E+01	6	2.1E+01	2
tert-Butylbenzene																	9.0E+01		9.0E+01	I	2.9E+02	6	9.0E+01	1
Isopropylbenzene																	4.8E+00		4.8E+00	I	2.9E+02	6	4.8E+00	1
p-Isopropyltoluene																	4.7E+02		4.7E+02	I	2.9E+02	6	2.9E+02	2
4-Nitrophenol																	1.1E-01		1.1E-01	I	6.1E+02	4	1.1E-01	1
4-Bromophenyl-phenylether													1.2				no		1.2E+00	G	2.7E+02	6	1.2E+00	1
4-Chlorotoluene																	1.7E+00		1.7E+00	I	1.1E+01	6	1.7E+00	1
1,4-Dichlorobenzene													0.34				nc		3.4E-01	G	5.9E+01	6	3.4E-01	1
Bromobenzene																	2.2E+00		2.2E+00	I	2.3E+03	4	2.2E+00	1
Chlorobenzene													0.41		7.8	1	nc		4.1E-01	G	3.8E+02	4	4.1E-01	1
Hexachlorobenzene					0.02	1											nc		2.0E-02	C	8.6E-01	6	2.0E-02	1
1,2,4-Trichlorobenzene													9.6				nc		9.6E+00	G	3.3E+02	6	9.6E+00	1
2,4-Dichlorophenol																	3.7E+00		3.7E+00	I	8.0E+00	6	3.7E+00	1
2T4-Dinitrotoluene																	2.0E-01		2.0E-01	I	4.6E+00	5	2.0E-01	1
2,4-Dinitrophenol																	2.7E-03		2.7E-03	I	1.5E+00	7	2.7E-03	1
4,6-Dinitro-o-cresol																	2.8E-03		2.8E-03	I	5.8E-01	7	2.8E-03	1
1,3-Dichlorobenzene													1.7				nc		1.7E+00	G	5.9E+01	6	1.7E+00	1
4-Chloro-3-methylphenol																	3.3E-02		3.3E-02	I	1.1E+01	6	3.3E-02	1
2,6-Dinitrotoluene																	3.0E-02		3.0E-02	I	9.2E+00	5	3.0E-02	1

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SUMMARY OF ECOLOGICAL SCREENING BENCHMARrw FOR SEDIMENT AND SELECTED SCREENING VALUE

Baseline Ecological Risk Assessment • Interim Final
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North Providence, Rhode Island

PARAMETER	ARCS"	Note	CVs"	Note	OMEE LELs°	Note	NOAA ER-Ls"	Note	WA SQVs'	Note	EPA ESGs/ SQCs'	Note	ORNL EqP Tier II"	Note	ORNLEqP CVs[h]	Note	EqP-based Benchmarks'	£ z	Selected Aquatic Benchmark[l]	Basis	Semi-Aquatic Wildlife Benchmark"	Basis	Selected Sediment Benchmark'	Note
1,2,3-Trichlorobenzene	-		-		-		-		-		-		-		-		4.8E+00		4.8E+00	I	3.3E+02	6	"V -4.8S+00	1
Pentachlorophenol	-		-		-		-		-		-		-		-		7.2E+00		~E+OJ>	I	3.8E-01'	"4"	3.8E-01	~2
2.4.6-Trichlorophenol	-		-		-		-		-		-		-		-		1.4E+00		1.4E+01	I	8.3E+00	"6	"ul+bo	1
2-Nitrophenol	-		-		-		-		-		-		-		-		8.6E-02		8.6E-02	I	6.0E+02	5	8.6E-02	1
2-Chlorotoluene	-		-		-		-		-		-		-		-		9.2E+01		9.2E+01	I	1.1E+01	6	1.1E+01 vi	2
1,2-Dichlorobenzene[K2]	-		-		-		-		-		-		0.33		-		nc		3.3E-O1-K1	G	2.3E+02	6	C.'I.V3.3E-01,'g	1
2-Chlorophenol - Q_{fc}	-		-		-		-		-		-		-		-		5.7E-01		5.7E-01	I	1.1E+02		5.7E-01, iiSi	1
2,4,5-Trichlorophenol	-		-		-		-		-		-		-		-		2.0E+00		2.0E+00	I	8.3E+00	6	2.0E+00	1
Nitrobenzene	-		-		-		-		-		-		-		-		1.8E+00		1.8E+00	I	3.8E+02	4	1.8E+00	1
Anthracene	0.03162	1	0.0572	1	0.22	1	0.0853		8.1	1	-		0.22		0.027	T	nc		2.7E-02	H	5.5E+02	6	2.7E-02	1
Pyrene	0.57	1	0.195	1	0.49	1	0.665		11	1	13.11	2	-		-		nc		2.0E-01	B	1.9E+02-	2	2.0E-01	1
Benzo(g,h,i)perylene	0.29	1	-		0.17	1	0.0634		1.6	1	-		-		-		nc		6.3E-02	D	2.6E+0Q-	6	6.3E-02;	1
Indeno(1,2,3-cd)pyrene	0.078	1	-		0.2	1	0.0634		1.4	1	-		-		-		nc		6.3E-02	D	5.2E-04I-	7	H 5.2E-04	2
Benzo(b)fluoranthene	0.0272	1	-		0.24	1	0.0634		5.4	1	-		-		-		nc		2.7E-02	A	3.7E-04	7	T<'>'3.7E-04,'	2
Fluoranthene	0.06423	1	0.423	1	0.75	1	0.6		16	1	6.2	2	-		16	2	nc		6.4E-02 v	A	3.1E+02	2	"6.4E-02	1
Benzo(k)fluoranthene	0.0272	1	-		0.24	1	0.0634		5.4	1	-		-		-		nc		N 2.7E-02"S'V	A	3.7E-04	7	V'3.7E-04" v	2
Acenaphthylene	-		-		0.19	1	0.044		0.39	1	-		-		-		nc		r"H4.4E-02	D	9.7E+01	6	4.4E-02 V	1
Chrysene	0.5	1	0.166	1	0.34	1	0.384		6	1	-		-		-		nc		i.7E-Ql faa	B	5.3E-04	7	5.3E-04	2
Benzo(a)pyrene	0.35	1	0.15	1	0.37	1	0.43		2.5	1	10.63	2	0.14		3	2	nc		S ft1.4E-01Sii0	G	5.3E-03	7	V-5.IE-03;I'S	2
Dibenzo(a,h)anthracene	0.00282	2	-		0.06	1	0.0634		0.47	1	-		-		-		nc		S-2.8E-03 V	A	1.0E-03	7	1.0E-03	2
Benzofajanthracene	0.26	1	0.108	1	0.32	1	0.261		4,1	1	13.17	2	0.11		2.6	2	nc		1.1E-01W	B	2.1E-03	7	2.1E-03	2
Acenaphthene	-		-		0.19		0.016		19	1	1.3	2	-		5.3	1	nc		1.6M2Pv	D	9.7E+01	6	1.6E-02	1
Phenanthrene	-		0.204	1	0.56		0.24		24	1	1.8	2	-		59	2	nc		2.0E-01 V	B	4.1E+01	6	V2.0E-01	1
Fluorene	0.03464	1	0.0774	1	0.19		0.019		20	1	-		0.54		-		nc		1.9E-02	D	6.5E+00	2	1.9E^2	1
Naphthalene	0.03275	1	0.176	1	0.19		0.16		8.5	1	-		0.24		12	1	nc		3.3E-0SPSW	A	8.4E+00	2	^ 3.3E*02	1
Dibenzofuran	-		-		-		-		0.79	1	-		0.42		110	2	nc		4.2E-01	G	6.9E+01	6	4.2E-0te	1
Perylene	-		-		-		-		-		-		-		-		2.5E+01		2.5E+01	I	2.6E+00	6	2.6E+0O V	2
2,6-Dimethylnaphthalene	-		-		-		-		-		-		-		-		4.8E+00		4.8E+00	I	8.3E+01	6	4.8E+0O	1
1-Methylnaphthalene	-		-		-		0.07		-		-		0.13		34	T	nc		7.0E-02	D	8.3E+01	6	7.0E-02	1
2-Methylnaphthalene	-		-		-		0.07		-		-		-		-		nc		7.0E-02	D	8.3E+0r	6	7.0E-02	1
2-Chloronaphthalene	-		-		-		-		-		-		-		-		1.1E+01		1.1E+01	I	1.4E+02	6	1.1E+01SS	1
BAPEQ	0.35	1	0.15	1	0.37	1	0.43		2.5	1	-		-		-		nc		Hf.5E-01sJv	B			ISi I.SE-03H-f	1
High Molecular Weight PAHs	2.9	1	0.108	1	0.06	1	1.7		47	1	-		-		-		-		PROE-02^	C			6.0E-02	1
Low Molecular Weight PAHs	0.786	1	0.0774	1	0.19	1	0.552		68	1	-		-		-		-		7.7E-02	B			7.7E-02	1
Total PAH	3.553	1	2.28	2	4	1	4.022		85	1	-		-		-		-		Hi2.3E+00K/	B			2.3E+0(SV	1
Bis(2-ethylhexyl)phthalate	-		-		-		-		-		-		890		-		nc		1Si 8.9E+02	G	6.8E+00	2	6.8E+005	2
Di-n-octylpbthalate	-		-		-		-		-		-		-		-		2.8E+03		2.8E+03 S	I	6.9E-01	2	S.9E-0V	2
Dimethylphthalate	-		-		-		-		-		-		-		-		1.1E-03		1.1E-03	I	1.0E+02	1	I/'"t.1E-03"	1
Diethylphthalate	-		-		-		-		-		-		0.6		-		nc		NOE+0	G	1.0E+02	1	6.0E-01	1
Oi-n-Butylphthalate	-		-		-		-		0.042	2	-		11		240	1	nc		A2ETO2	E	6.9E-01	2	4.2E-02	1
Butylbenzylphthalate	-		-		-		-		-		-		11		-		nc		1.1E+01	G	1.5E+00	7	1.5E+00	2
4-Nitroaniline	-		-		-		-		-		-		-		-		7.7E-03		?. S:iv7.7E-03p:i	I	1.0E+03	4	fiC?7.7E^)3-'Vv	1
4-Chloroaniline	-		-		-		-		-		-		-		-		1.7E-05		'M: 1.7E-05!E'S	I	6.1E+02	4	"<g 1.7E-05'%	1
2-Nitroaniline	-		-		-		-		-		-		-		-		1.5E-02		1.5E-02	I	4.9E+02	5	1.5E-02	1
3-Nitroaniline	-		-		-		-		-		-		-		-		7.6E-03		7.6E-03	I	4.9E+02	5	7.6Em3i	1
3,3'-D(chlorobenzidine	-		-		-		-		-		-		-		-		3.0E+00		3.0E+00	I	2.9E+01	6	3.0E+00	1

TABLE D-2
SUMMARY OF ECOLOGICAL SCREENING BENCHMARKS FOR SEDIMENT AND SELECTED SCREENING VALUE

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

PARAMETER	ARCs	Note	CVs	Note	OMEE LELs	Note	NOAA ER-L	Note	WA SQVs	Note	EPA *BSGs*/ SQCs	Note	ORNLEqP Tier II	Note	ORNLEqP CVs	Note	EqP-based Benchmarks	Selected Aquatic Benchmark	Basis	Semi-Aquatic Wildlife Benchmark	Basis	Selected Sediment Benchmark	Note
N-Nitroso-di-n-propylamine																	1.3E-01	1.3E-01	I	3.6E+00	4	1.3E-01	1
N-Nilroso-diphenylamine									0.1	1							nc	1.0E-01	E	5.4E+01	6	1.0E-01	1
alpha-BHC					0.006	1							0.12		5.2	2	nc	6.0E-03	C	3.3E-02	5	6.0E-03	1
beta-BHC					0.005	1							0.12		5.2	2	nc	5.0E-03	C	4.3E-02	5	5.0E-03	1
delta-BHC					0.003	1							0.12		5.2	2	nc	3.0E-03	C	5.3E-02	4	3.0E-03	1
4,4'-DDT			0.00416	1	0.008	1	0.001				0.00828	2	0.34		0.42	2	nc	1.0E-03	D	3.7E-03	7	1.0E-03	1
gamma-BHC			0.00237	1	0.003	1					0.00157	2			0.15	3	nc	1.6E-03	F	5.3E-02	4	1.6E-03	1
Methoxychlor													0.019				nc	1.9E-02	G	5.2E+00	2	1.9E-02	1
4,4'-DDD			0.00488	1	0.008	1	0.002						0.11		17	1	nc	2.0E-03	D	3.7E-03	7	2.0E-03	1
4,4'-DDE			0.00316	1	0.005	1	0.0022										nc	2.2E-03	D	2.1E-03	3	2.1E-03	2
Toxaphene																	1.3E-03	1.3E-03	I	2.5E-01	5	1.3E-03	1
Heptachlor epoxide			0.00247	1	0.005	1			0.24	1							nc	2.5E-03	B	6.8E-02	6	2.5E-03	1
Endosulfan sulfate													0.0055				nc	5.5E-03	G	4.6E-01	6	5.5E-03	f
Aldrin					0.002	1			0.1	1							nc	2.0E-03	C	4.7E-02	5	2.0E-03	1
Endosulfan II													0.0055				nc	5.5E-03	G	8.6E-01	7	5.5E-03	1
alpha-Chlordane			0.00324	1	0.007	1	0.0005								18	3	nc	5.0E-04	D	4.0E-02	2	5.0E-04	1
gamma-Chlordane			0.00324	1	0.007	1	0.0005								18	3	nc	5.0E-04	D	8.7E-02	2	5.0E-04	1
Endrin ketone					0.003	1	0.00002										nc	2.0E-05	D	6.8E-02	7	2.0E-05	f
Technical Chlordane			0.00324	1	0.007	1	0.0005								18	3	nc	5.0E-04	D	8.0E-01	3	5.0E-04	1
Dieldrin			0.0019	1	0.002	1	0.00002				0.12	1					nc	2.0E-05	O	1.4E-02	5	2.0E-05	1
Endrin			0.00222	1	0.003	1	0.00002				0.054	1					nc	2.0E-05	D	3.6E-02	2	2.0E-05	1
Endrin aldehyde			0.00222	1	0.003	1	0.00002										nc	2.0E-06	D	6.8E-02	7	2.0E-05	1
Heptachlor			0.00247	1	0.005	1					d.ooi-i	2	0.068		12	1	nc	1.1E-03	F	6.6E-02	6	1.1E-03	f
Endosulfan 1													0.0055				nc	5.5E-03	G	4.6E-01	6	5.5E-03	1
Dalapon																	5.1E+00	5.1E+00	I	2.7E+02	7	5.1E+00	1
Dinoseb																	6.1E-02	6.1E-02	I	2.8E-01	6	6.1E-02	1
Atrazine																	4.4E-02	4.4E-02	I	1.7E+02	4	4.4E-02	1
Dicamba																	1.2E-01	1.2E-01	I	2.9E+00	5	1.2E-01	1
2,4,5-T																	5.6E+00	5.6E+00	I	8.2E+00	6	5.6E+00	1
MCPA																	2.4E+01	2.4E+01	I	9.7E+00	7	9.7E+00	2
2,4-D																	1.0E+00	1.0E+00	I	5.2E+01	7	1.0E+00	1
2,4-DB																	4.4E+00	4.4E+00	I	3.1E+00	4	3.1E+00	2
Dichlorprop																	6.8E-01	6.8E-01	I	1.0E+00	6	6.8E-01	1
MCPP																	3.2E+01	3.2E+01	I	1.8E+01	7	1.8E+01	2
2,4,5-TP (Silvex)																	3.7E-01	3.7E-01	I	6.9E+01	6	3.7E-01	1
Aroclor-1260					0.005	1							4500		63	1	nc	5.0E-03	O	5.3E-02	4	5.0E-03	1
Aroclor-1254					0.06	1			0.16	1	0.195	2	0.81		71	2	nc	6.0E-02	O	5.5E-02	4	5.5E-02	2
Aroclor-1268					0.005	1											nc	5.0E-03	O	5.3EJ02	4	5'0E-03	1
Aracior-1221					0.005	T							0.12		25	1	nc	5.0E-03	O	5.7E-02	4	5.0E-03	1
Aroclor-1232					0.005	1							0.6		130	1	nc	5.0E-03	c	5.7E-02	4	5.0E-03	1
Aroclor-1248					0.03	1							1				nc	3.0E-02	c	5.3E-02	5	3.0E-02	1
Aroclor-1016					0.007	1											nc	7.0E-03	C	1.8E-01	6	7.0E-03	1
Aroclor, Total			0.0676	2	0.07	1	0.0227											2.3E-02	D			2.3E-02	1
Polychlorinated biphenyls (PCBs)	0.03162	1	0.0676	2	0.07	1			0.45	2								3.2E-02	A	4.6E-02	5	3.2E-02	1
Aroclor-1262					0.005	1											nc	5.0E-03	C	5.3E-02	4	5.0E-03	1
Aroclor-1242					0.005	i			0.1	2						3	nc	5.0E-03	C	1.8E-01	6	5.0E-03	f

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SUMMARY OF ECOLOGICAL SCREENING **BENCHMARrxo** FOR SEDIMENT **AND** SELECTED SCREENING VALUE

Baseline Ecological Risk Assessment • Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

PARAMETER	ARCs*	Note	CVs"	Note	OMEE LELs°	Note	NOAA ER-Ls"	Note	WA SQVs'	Note	EPAESGs/ SQCs'	ORNLEqP Tier 11º	ORNLEqP CVsʰ	EqP-based Benchmarks'	Selected Aquatic Benchmark[1]	Basis	Semi-Aquatic Wildlife Benchmark"	Basis	Selected Sediment Benchmark'	Note
Mercury (methyl)																	8.2E-03	7	w 8.2E-03S	2
Aluminum	5803	2													5.8E+03	A	4.4E+01	5	4.4E+01	2
Iron					20000	1									2.0E+04	C			J 2.0E+04»	1
Lead	34.2	1	35.8	1	31	1	46.7		490	2					3.1E+01	C	1.5E+00	7	1.5E+00	2
Magnesium																				
Manganese	726	1			460	1			1400	2					#4.6E+02^2	C	1.3E+03	7	F 4.6E+02S	1
Mercury			0.18	1	0.2	1	0.15		1.6	2					<Sfc-1.5E-01.rffi	D	1.9E-01	6	?-fi- 15E-oi &?	1
Molybdenum																	2.8E+00	6	2.8E+00	2
Nickel	39.6	1	22.7	1	16	1	20.9								1.6E+017	C	1.9E+01	6	1.6E+01	1
Silver					0.5	1	1		3.9	2					STO*E-OI	C	~"""1.5E+O2	6	5.0E-01	1
Thallium																	3.2E+00	5	3.2E+00	2
Antimony							2		35	2					SV 2.0E+00	D	6.0E-01	5	6.0E-01	2
Arsenic	12.1	1	9.79	1	6	1	8.2		19	2					6.0E+00	C	9.6E-01	4	S9.6E-01v	2
Barium																	5.4E+01	7	5.4E+01	2
Beryllium																	1.9E-01	7	1.9E-01	2
Cadmium	0.592	1	0.99	1	0.6	1	1.2		93	2					5.9E-01'	A	1.9E+00	7	5.9E-01	1
Chromium	56	1	43.4	1	26	1	81		110	2					T5V2.6E+01.V/	C	4.6E-01	3	4.5E-01"	2
Cobalt					50	1									5.0E+01	C	1.7E+00	5	51.7E+0O.B	2
Copper	28	1	31.6	1	16	1	34		340	2					?-"v1.6E+0IS S	C	1.6E-02	6	"1.6E-02s-SI	2
Vanadium															vv.		9.6E+00	5	9.6E+00	2
Zinc	159	1	121	1	120	1	150		1000	2					"1-2E+02>	C	3.7E-01	3	3.7E-01	2
Selenium																	5.2E-01	7	5.2E-01 J	2
Cyanide					0.1	1								nc	1.0E-01	C	6.8E-01	7	LOE-Oi	1
Sodium																				
Calcium																				
Carbon disulfide												0.00085	0.23	2 nc	8.5E-04	G	1.4E+02	4	8.5E-04	1
Potassium																				
Benzoic acid														8.9E+00	8.9E+00	I	2.4E+03	4	8.9E+00	1
Carbazole									0.36	1				nc	3.6E-01	E	1.1E+02	2	3.6E-01	1
2,3,7,8-TCDD									0.0000072	2				nc	7.2E-06	E	2.6E-06	6	2.6E-06	2

TABLE D-2
SUMMARY OF ECOLOGICAL SCREENING BENCHMARKS FOR SEDIMENT AND SELECTED SCREENING VALUE

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

PARAMETER	ARCs[a]	Note Z	CVs[b]	Note Z	OMEE LELs[c]	Note Z	NOAA ER-Ls[d]	Note Z	WA SQVs[e]	Note Z	EPA ESGs/ SQCs[f]	Note	ORNL EqP Tier II[g]	Note Z	ORNL EqP CVs[h]	Note Z	EqP-based Benchmarks[i]	Note	Selected Aquatic Benchmark[j]	Note	Semi-Aquatic Wildlife Benchmark[j,k]	Note	Selected Sediment Benchmark[l]	Note Z

Notes:
Units in mg/kg (milligram per kilogram [dry weight]).
Sediment quality benchmarks dependent upon organic carbon were calculated using by using an assumed 1 percent TOC.

a. ARCS = Assessment and Remediation of Contaminated Sediments Program; values as derived in Jones et al.. 1997.
[1] TEC - Threshold Effect Concentration
[2] PEC - Probable Effect Concentration (used when no TEC was available); value is the PEC divided by a factor of 10.
b. CV = Consensus Values; values as presented in MacDonald, et al., 2000a,b.
[1] TEC - Threshold Effect Concentrations, levels below which harmful effects are unlikely to be observed
[2] PEC - Probable Effect Concentrations, levels above which harmful effects are likely to be observed; value is the PEC divided by a factor of 10.
c. Ontario Ministry of the Environment Lowest Effect Level (LELs) Provincial Sediment Quality Guidelines as presented in Persaud et al., 1993.
LELs are levels of sediment contamination that can be tolerated by the majority of benthic organisms. For organic compounds, generally based on the 5th percentile of the Screening Level Concentration (SLC).
d. National Oceanic and Atmospheric Administration (NOAA) Effects Range-Low (ER-L) Sediment Guidelines corresponds to the lower 10th percentile of effects data for each chemical, a range intended to estimate conditions in which effects would be rarely observed (Long et al., 1994). Based on data for estuarine and saltwater species.
e. Washington State Freshwater Sediment Quality Values (SQVs) as presented in Cubbage et al.. 1997.
[1] Probable Apparent Effects Thresholds (PAETs) for *Hyalella azteca* are the 95th percentile of the no "hit" concentrations above the lowest "hit" level; see Cubbage etal.. 1997 for further explanation. Values not expressed on a carbon-normalized basis.
[2] Probable Apparent Effects Thresholds (PAETs) for Hyalella azteca based on organic carbon normalized SQVs. adjusted assuming 1 percent TOC.
f. U.S. Environmental Protection Agency (USEPA) Sediment Quality Criteria (SQCs) or Equilibrium Partitioning Sediment Guidelines (ESGs) adjusted by an assumed TOC content of 1 percent.
[1] ESGs - Equilibrium Partitioning Sediment Guidelines (ESGs) as derived in USEPA (2000a.b); available for dieldrin and endrin only.
[2] SQCs - Sediment Quality Criteria as derived in USEPA (1988, 1993a,b,c,d,e).
g. Sediment screening benchmarks derived using equilibrium partitioning assumptions and based on Chronic Tier II values; values as summarized in Jones et al., 1997.
h. Sediment quality benchmarks (Jones et al., 1997) derived using equlibrium partitioning assumptions and conventional aqueous benchmarks as presented in Suter and Tsao (1996). 1 percent TOC assumed.
[1] Based on chronic value for fish.
[2] Based on chronic value for daphnids.
[3] Based on chronic value for non-daphnid invertebrates.
i. Derived based on equilibrium partioning assumptions using selected surface water quality screening benchmarks, see Table D-1. Values are presented only for analytes lacking sediment benchmarks from other sources,
j. Value is the minimum of the available sediment screening benchmarks.
k. Sediment concentration protective of semi-aquatic wildlife exposure to sediment via incidental sediment ingestion and consumption of contaminated prey item exposure pathways; value is minimum of selected receptor species.
l. Selected Sediment Benchmark is the lower of the values selected for aquatic organisms and semi-aquatic wildlife receptors.
[1] Based on aquatic organism.
[2] Based on semi-aquatic wildlife receptor.

Prepared by: SGD
Checked by: NAR

TABLE J-3

SUMMARY OF ECOLOGICAL SCREENING BENCHMARKS FOR SURFACE SOIL AND SELECTED SCREENING VALUES

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

CAS#	Chemical Name	ORNL Soil Invertebrate Benchmarks[8]	Region IV Soil Bencharks[b]	QSAR Earthworm Bencharks[c]	Equilibrium Partitioning Based Benchmarks[11]	Soil Invertebrate Screening Benchmark[8]	Basis	Wildlife Benchmark[7]	Basis	Soil Screening Benchmark[9]	Basis
108-10-1	4-Methyl-2-Pentanone			2.0E+02	3.8E+02	2.0E+02	3	1.5E+03	w	2.0E+02	1
108-87-2	1-Methylcyclohexane			3.9E+01	2.0E+01	3.9E+01	3	7.7E+01	w	3.9E+01	1
110-82-7	Cyclohexane		1.0E-01	3.7E+01	1.5E+01	1.0E-01	2	2.8E+01	2	1.0E-01	1
1634-04-4	Methyl tert-Butyl Ether			2.3E+02	1.1E+01	2.3E+02	3	3.9E+02	2	2.3E+02	1
591-78-6	2-Hexanone			1.9E+02	1.9E+01	1.9E+02	3	7.4E+01	2	7.4E+01	2
67-64-1	Acetone			3.5E+02	6.4E+01	3.5E+02	3	8.6E+01	2	8.6E+01	2
78-93-3	2-Butanone			3.0E+02	3.8E+01	3.0E+02	3	3.1E+03	2	3.0E+02	1
79-20-9	Methyl Acetate				2.4E-01	2.4E-01	4	9.2E+03	2	2.4E-01	1
98-86-2	Acetophenone			2.0E+02	7.0E+00	2.0E+02	3	7.3E+02	2	2.0E+02	1
10061-01-5	cis-1,3-Dichloropropene		1.0E-01		2.6E+00	1.0E-01	2	2.2E+01	2	1.0E-01	1
10061-02-6	trans-1,3-Dichloropropene		1.0E-01		2.4E+00	1.0E-01	2	2.2E+01	2	1.0E-01	1
106-93-4	1,2-Dibromoethane			2.4E+02	9.3E+00	2.4E+02	3	2.1E+00	2	2.1E+00	2
107-06-2	1,2-Dichloroethane		4.0E-01	1.8E+02	5.7E+01	4.0E-01	2	2.7E+01	2	4.0E-01	1
108-60-1	Bis-(2-chloroisopropyl)ether		1.0E-01	1.5E+02	6.5E+02	1.0E-01	2	1.2E+02	2	1.0E-01	1
111-44-4	Bis(2-chloroethyl)ether		1.0E-01	2.9E+02	4.4E+01	1.0E-01	2	1.2E+01	2	1.0E-01	1
111-91-1	Bis(2-chloroethoxy)methane		1.0E-01	3.5E+02	4.5E+01	1.0E-01	2	6.9E+00	2	1.0E-01	1
124-48-1	Dibromochloromethane			2.3E+02	1.5E+01	2.3E+02	3	6.2E+00	2	6.2E+00	2
127-18-4	Tetrachloroethene		1.0E-02		1.8E+02	1.0E-02	2	6.1E+01	2	1.0E-02	1
142-28-9	1,3-Dichloropropane		1.0E-01	1.4E+02	5.3E+01	1.0E-01	2	2.2E+01	2	1.0E-01	1
156-59-2	1,2-Dichloroethene (cis)		1.0E-01		7.8E+00	1.0E-01	2	5.5E+01	2	1.0E-01	1
156-60-5	trans-1,2-Dichloroethene		1.0E-01		1.3E+01	1.0E-01	2	8.9E+03	2	1.0E-01	1
56-23-5	Carbon tetrachloride	1.0E+03	1.0E+03	1.1E+02	2.1E+02	1.0E+03	1	1.9E+01	2	1.9E+01	2
563-58-6	1,1-Dichloropropene		1.0E-01		7.5E+00	1.0E-01	2	2.2E+01	2	1.0E-01	1
630-20-6	1,1,1,2-Tetrachloroethane		1.0E-01	1.1E+02	7.1E+01	1.0E-01	2	1.5E+02	2	1.0E-01	1
67-66-3	Chloroform		1.0E-03	1.5E+02	1.1E+01	1.0E-03	2	8.6E+01	2	1.0E-03	1
67-72-1	Hexachloroethane		1.0E-01	6.4E+01	6.3E+02	1.0E-01	2	2.9E+02	w	1.0E-01	1
7005-72-3	4-Chlorophenyl-phenylether		1.0E-01	3.7E+01	9.9E+04	1.0E-01	to	1.7E+02	2	1.0E-01	1
71-55-6	1,1,1-Trichloroethane		1.0E-01	1.2E+02	5.0E+01	1.0E-01	to	5.2E+01	2	1.0E-01	1
74-83-9	Bromomethane			2.1E+02	1.6E+00	2.1E+02	3	3.1E+00	2	3.1E+00	2
74-87-3	Chloromethane		1.0E-01	1.3E+02	8.6E-01	1.0E-01	2	4.0E+01	2	1.0E-01	1
74-95-3	Dibromomethane			2.6E+02	5.2E+00	2.6E+02	3	3.1E+00	2	3.1E+00	2
74-97-5	Bromochloromethane			2.4E+02	2.7E+00	2.4E+02	3	7.1E+00	2	7.1E+00	2
75-00-3	Chloroethane		1.0E-01	1.2E+02	5.9E+02	1.0E-01	w	4.9E+03	2	1.0E-01	1
75-01-4	Vinyl Chloride		1.0E-02		1.6E+03	1.0E-02	w	2.9E+00	2	1.0E-02	1

TABLE D-3
SUMMARY OF ECOLOGICAL SCREENING BENCHMARKS FOR SURFACE SOIL AND SELECTED SCREENING VALUES

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

CAS#	Chemical Name	ORNL Soil Invertebrate Benchmarks[a]	Region IV Soil Bencharks[b]	QSAR Earthworm Bencharks[c]	Equilibrium Partitioning Based Benchmarks[d,1]	Soil Invertebrate Screening Benchmark[6]	Basis	Wildlife Benchmark[f]	Basis	Soil Screening Benchmark[g]	Basis
75-09-2	Methylene Chloride		2.0E+00	1.8E+02	1.9E+00	2.0E+00	2	1.4E+01	2	2.0E+00	1
75-25-2	Bromoform			2.3E+02	6.7E+00	2.3E+02	3	1.2E+02	2	1.2E+02	2
75-27-4	Bromodichloromethane			2.0E+02	1.0E+01	2.0E+02	3	8.6E+00	2	8.6E+00	2
75-34-3	1,1-Dichloroethane		1.0E-01	1.4E+02	8.4E+01	1.0E-01	2	6.7E+03	2	1.0E-01	1
75-35-4	1,1-Dichloroethene		1.0E-01		1.4E+01	1.0E-01	2	1.1E+02	3	1.0E-01	1
75-69-4	Trichlorofluoromethane		1.0E-01	1.2E+02	3.4E+01	1.0E-01	2	6.0E+01	2	1.0E-01	1
75-71-8	Dichlorodifluoromethane		1.0E-01	1.3E+02	1.5E+01	1.0E-01	2	2.6E+01	2	1.0E-01	1
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane		1.0E-01	1.0E+02	2.9E+01	1.0E-01	2	2.0E+04	2	1.0E-01	1
77-47-4	Hexachlorocyclopentadiene		1.0E+01		4.7E+01	1.0E+01	2	2.3E+00	2	2.3E+00	2
78-87-5	1,2-Dichloropropane	7.0E+02	7.0E+02	1.4E+02	5.0E+01	7.0E+02	1	7.6E+01	2	7.6E+01	2
79-00-5	1,1,2-Trichloroethane		1.0E-01	1.8E+02	6.8E+01	1.0E-01	2	1.1E+02	2	1.0E-01	1
79-01-6	Trichloroethene		1.0E-03		5.2E+02	1.0E-03	2	1.3E+02	2	1.0E-03	1
79-34-5	1,1,2,2-Tetrachloroethane		1.0E-01	1.6E+02	5.4E+01	1.0E-01	2	7.6E+01	2	1.0E-01	1
87-68-3	Hexachlorobutadiene		1.0E-01		4.7E+01	1.0E-01	2	3.3E+00	2	1.0E-01	1
96-12-8	1,2-Dibromo-3-chloropropane		1.0E-01	1.5E+02	3.3E+01	1.0E-01	2	1.6E-01	2	1.0E-01	1
96-18-4	1,2,3-Trichloropropane		1.0E-01	1.5E+02	2.3E+01	1.0E-01	2	3.9E+01	2	1.0E-01	1
100-51-6	Benzyl Alcohol				7.1E-01	7.1E-01	4	2.5E+02	2	7.1E-01	1
100-52-7	Benzaldehyde				4.6E+00	4.6E+00	4	3.7E+02	2	4.6E+00	1
105-60-2	Caprolactam			3.6E+02	3.8E+00	3.6E+02	3	8.6E+01	2	8.6E+01	2
78-59-1	Isophorone				5.5E+01	5.5E+01	4	2.1E+02	2	5.5E+01	1
92-52-4	1,1'-Biphenyl		6.0E+01	4.7E+01	1.9E+02	6.0E+01	2	8.6E+01	2	6.0E+01	1
100-41-4	Ethylbenzene		5.0E-02	5.8E+01	4.0E+02	5.0E-02	2	1.9E+03	2	5.0E-02	1
100-42-5	Styrene		1.0E-01	6.5E+01	4.0E+00	1.0E-01	2	1.6E+02	2	1.0E-01	1
103-65-1	n-Propylbenzene			4.5E+01	1.5E+02	4.5E+01	3	1.8E+02	2	4.5E+01	1
104-51-8	n-Butylbenzene			3.1E+01	9.9E+02	3.1E+01	3	1.8E+02	2	3.1E+01	1
105-67-9	2,4-Dimethylphenol				3.9E+00	3.9E+00	4	4.3E+02	2	3.9E+00	1
106-44-5	4-Methylphenol		5.0E-01		1.1E+00	5.0E-01	2	8.6E-01	2	5.0E-01	1
10838-3/-1	m&p-Xylene		5.0E-02	5.6E+01	5.3E+03	5.0E-02	2	3.0E+02	2	5.0E-02	1
108-67-8	1,3,5-Trimethylbenzene			5.4E+01	2.8E+02	5.4E+01	3	1.3E+01	2	1.3E+01	2
108-88-3	Toluene		5.0E-02	6.8E+01	8.5E+01	5.0E-02	2	1.3E+02	2	5.0E-02	1
108-95-2	Phenol	3.0E+01	5.0E-02		7.0E+00	3.0E+01	1	6.9E+01	2	3.0E+01	1
1330-20-7	Total Xylenes		5.0E-02	5.7E+01	9.5E+01	5.0E-02	2	3.0E+02	2	5.0E-02	1
135-98-8	sec-Butylbenzene			2.7E+01	4.8E+01	2.7E+01	3	1.8E+02	2	2.7E+01	1
65794-96-9	3+4-Methylphenols		5.0E-01		1.1E+00	5.0E-01	2	8.6E-01	2	5.0E-01	1

TAb. D-3

SUMMARY OF ECOLOGICAL SCREENING BENCHMARKS FOR SURFACE SOIL AND SELECTED SCREENING VALUES

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

CAS#	Chemical Name	ORNL Soil Invertebrate Benchmarks[8]	Region IV Soil Bencharks[b]	QSAR Earthworm Bencharks[c]	Equilibrium Partitioning Based Benchmarks[7*]	Soil Invertebrate Screening Benchmark[8]	Basis	Wildlife Benchmark*	Basis	Soil Screening Benchmark[9]	Basis
71-43-2	Benzene		5.0E-02	8.8E+01	6.6E+00	5.0E-02	9	4.5E+01	2	5.0E-02	1
95-47-6	o-Xylene		5.0E-02	5.9E+01	1.4E+01	5.0E-02	9	2.1E+02	1	5.0E-02	1
95-48-7	2-Methylphenol		5.0E-01		4.0E+00	5.0E-01	9	8.6E+01	2	5.0E-01	1
95-63-6	1,2,4-Trimethylbenzene			4.7E+01	2.7E+02	4.7E+01	8	1.3E+01	2	1.3E+01	2
98-06-6	tert-Butylbenzene			3.7E+01	9.0E+02	3>E+01	8	1.8E+02	2	3.7E+01	1
98-82-8	Isopropylbenzene			4.0E+01	4.8E+01	4.0E+01	3	1.8E+02	2	4.0E+01	1
99-87-6	p-Isopropyltoluene			37E+01	4.7E+03	3.7E+01	3	1.8E+02	2	3.7E+01	1
100-02-7	4-Nitrophenol	7.0E+00	7.0E+00		1.1E+00	7.0E+00	1	2.2E+01	2	7.0E+00	1
101-55-3	4-Bromophenyl-phenylether			3.8E+01	1.1E+01	3.8E+01	3	1.7E+02	2	3.8E+01	1
106-43-4	4-Chlorotoluene			6.1E+01	1.7E+01	6.1E+01	3	6.8E+00	2	6.8E+00	2
106-46-7	1,4-Dichlorobenzene	2.0E+01	1.0E-02	6.5E+01	1.8E+02	2.0E+01	1	3.6E+01	2	2.0E+01	1
108-86-1	Bromobenzene			9.6E+01	2.2E+01	9.6E+01	3	8.2E+01	2	8.2E+01	2
108-90-7	Chlorobenzene	4.0E+01	5.0E-02	7.6E+01	3.1E+00	4.0E+01	1	7.4E+01	2	4.0E+01	1
118-74-1	Hexachlorobenzene	1.0E+03	2.5E-03	2.5E+01	2.1E+03	1.0E+03	1	5.3E-01	2	5.3E-01	2
120-82-1	1,2,4-Trichlorobenzene	2.0E+01	1.0E-02	5.3E+01	4.5E+01	2.0E+01	1	2.1E+02	2	2.0E+01	1
120-83-2	2,4-Dichlorophenol		3.0E-03		3.7E+01	3.0E-03	2	5.1E+00	2	3.0E-03	1
121-14-2	2,4-Dinitrotoluene				2.0E+00	2.0E+00	4	1.0E-01	2	1.0E-01	2
51-28-5	2,4-Dinitrophenol		2.0E+01		2.7E-02	2.0E+01	2	6.3E+00	1	6.3E+00	2
534-52-1	4,6-Dinitro-o-cresol				2.8E-02	2.8E-02	4	1.0E-01	2	2.8E-02	1
541-73-1	1,3-Dichlorobenzene		1.0E-02	6.1E+01	2.3E+02	1.0E-02	9	3.7E+01	2	1.0E-02	1
59-50-7	4-Chloro-3-methylphenol				3.3E-01	3.3E-01	4	6.8E+00	2	3.3E-01	1
606-20-2	2,6-Dinitrotoluene				3.0E-01	3.0E-01	4	2.4E+00	2	3.0E-01	1
87-61-6	1,2,3-Trichlorobenzene	2.0E+01		5.2E+01	4.8E+01	2.0E+01	1	2.1E+02	2	2.0E+01	1
87-86-5	Pentachlorophenol	6.0E+00	2.0E-03		7.2E+01	6.0E+00	1	2.1E+00	3	2.1E+00	2
88-06-2	2,4,6-Trichlorophenol	1.0E+01	1.0E+01		1.4E+01	1.0E+01	1	5.1E+00	2	5.1E+00	2
88-75-5	2-Nitrophenol				8.6E-01	8.6E-01	4	4.5E+01	2	8.6E-01	1
95-49-8	2-Chlorotoluene			5.7E+01	9.2E+02	5.7E+01	3	6.8E+00	2	6.8E+00	2
95-50-1	1,2-Dichlorobenzene		1.0E-02	6.6E+01	1.8E+02	1.0E-02	2	1.5E+02	2	1.0E-02	1
95-57-8	2-Chlorophenol		1.0E-02		5.7E+00	1.0E-02	2	8.6E+00	2	1.0E-02	1
95-95-4	2,4,5-Trichlorophenol	9.0E+00	4.0E+00		2.0E+01	9.0E+00	1	5.1E+00	CHN CM	5.1E+00	2
98-95-3	Nitrobenzene	4.0E+01	4.0E+01	1.7E+02	1.8E+01	4.0E+01	1	3.3E+0~	CM	1.3E+01	2
120-12-7	Anthracene		1.0E-01	3.9E+01	3.0E-01	1.0E-01	2	3.4E+02~	WD	1.0E-01	1
129-00-0	Pyrene		1.0E-01	3.2E+01	2.5E+00	1.0E-01	2	1.3E+02	2	1.0E-01	1
191-24-2	Benzo(g,h,i)perylene			1.3E+01	6.6E+00	1.3E+01	3	1.3E+00	2	1.3E+00~	2

TABLE D-3
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North Providence, Rhode Island

CAS#	Chemical Name	ORNL Soil Invertebrate Benchmarks[3]	Region IV Soil Bencharks[b]	QSAR Earthworm Bencharks[0]	Equilibrium Partitioning Based Benchmarks"	Soil Invertebrate Screening Benchmark[6]	Basis for TO	Wildlife Benchmark[x]	Basis for TO	Soil Screening Benchmark[9]	Basis for
193-39-5	Indeno(1,2,3-cd)pyrene			1.2E+01	3.9E+02	1.2E+01	3	2.1E-03	1	2.1E-03	2
205-99-2	Benzo(b)fluoranthene			2.1E+01	2.0E+01	2.1E+01	3	1.5E-03	1	1.5E-03	2
206-44-0	Fluoranthene		1.0E-01	2.6E+01	4.7E+03	1.0E-01	2	2.1E+02	2	1.0E-01	1
207-08-9	Benzo(k)fluoranthene			1.7E+01	1.4E+01	1.7E+01	3	1.5E-03	1	1.5E-03	2
208-96-8	Acenaphthylene			4.7E+01	3.7E+01	4.7E+01	3	6.0E+01	2	4.7E+01	1
218-01-9	Chrysene			1.9E+01	3.6E+00	1.9E+01	3	2.1E-03	1	2.1E-03	2
50-32-8	Benzo(a)pyrene		1.0E-01	1.7E+01	5.3E+02	1.0E-01	2	2.1E-02	1	2.1E-02	2
53-70-3	Dibenzo(a,h)anthracene			1.2E+01	1.7E+01	1.2E+01	3	4.1E-03	1	4.1E-03	2
56-55-3	Benzo(a)anthracene			2.0E+01	4.6E+01	2.0E+01	3	8.2E-03	1	8.2E-03	2
83-32-9	Acenaphthene		2.0E+01	4.9E+01	3.7E+02	2.0E+01	2	6.0E+01	2	2.0E+01	1
85-01-8	Phenanthrene		1.0E-01	3.8E+01	1.5E+01	1.0E-01	2	2.6E+01	2	1.0E-01	1
86-73-7	Fluorene	3.0E+01		4.4E+01	5.0E+00	3.0E+01	1	4.3E+01	2	3.0E+01	1
91-20-3	Naphthalene		1.0E-01	6.3E+01	1.1E+02	1.0E-01	2	5.1E+01	2	1.0E-01	1
132-64-9	Dibenzofuran			4.6E+01	1.1E+03	4.6E+01	3	4.3E+01	2	4.3E+01	2
198-55-0	Perylene			1.5E+01	2.5E+02	1.5E+01	3	1.5E+00	2	1.5E+00	2
581-42-0	2,6-Dimethylnaphthalene			3.7E+01	4.8E+01	3.7E+01	3	5.1E+01	2	3.7E+01	1
90-12-0	1-Methylnaphthalene			4.6E+01	3.4E+02	4.6E+01	3	5.1E+01	2	4.6E+01	1
91-57-6	2-Methylnaphthalene			4.7E+01	9.1E+01	4.7E+01	3	5.1E+01	2	4.7E+01	1
91-58-7	2-Chloronaphthalene		1.0E+00	5.2E+01	1.1E+02	1.0E+00	2	8.6E+01	2	1.0E+00	1
BAPEQ	BAPEQ				2.3E+02	2.3E+02	4			2.3E+02	1
HMWPAH	High Molecular Weight PAHs		1.0E+00			1.0E+00	2			1.0E+00	1
LMWPAH	Low Molecular Weight PAHs		1.0E+00			1.0E+00	2			1.0E+00	1
TOTPAH	Total PAH		1.0E+00			1.0E+00	2			1.0E+00	1
117-81-7	Bis(2-ethylhexyl)phthalate				8.9E+02	8.9E+02	4	6.8E+00	2	6.8E+00	2
117-84-0	Di-n-octylphthalate				2.8E+04	2.8E+04	4	5.8E+00	1	5.8E+00	2
131-11-3	Dimethylphthalate	2.0E+02	2.0E+02		1.1E-02	2.0E+02	1	5.8E+00	1	5.8E+00	2
84-66-2	Diethylphthalate		1.0E+02		7.2E-02	1.0E+02	2	5.8E+00	1	5.8E+00	2
84-74-2	Di-n-Butylphthalate		2.0E+02		8.0E+00	2.0E+02	2	5.8E+00	1	5.8E+00	2
85-68-7	Butylbenzylphthalate				1.3E+01	1.3E+01	4	5.8E+00	1	5.8E+00	2
100-01-6	4-Nitroaniline				7.7E-02	7.7E-02	4	3.7E+01	2	7.7E-02	1
106-47-8	4-Chloroaniline				1.7E-04	1.7E-04	4	2.2E+01	2	1.7E-04	1
88-74-4	2-Nitroaniline				1.5E-01	1.5E-01	4	3.7E+01	2	1.5E-01	1
99-09-2	3-Nitroaniline				7.6E-02	7.6E-02	4	3.7E+01	2	7.6E-02	1
91-94-1	3,3'-Dichlorobenzidine				3.0E+01	3.0E+01	4	1.8E+01	2	1.8E+01	2

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CAS#	Chemical Name	ORNL Soil Invertebrate Benchmarks[a]	Region IV Soil Bencharks[b]	QSAR Earthworm Bencharks[c]	Equilibrium Partitioning Based Benchmarks[d]	Soil Invertebrate Screening Benchmark[a]	Basis	Wildlife Benchmark[e]	Basis	Soil Screening Benchmark[g]	Basis
621-64-7	N-Nitroso-di-n-propylamine				1.3E+00	1.3E+00	4	1.3E-01	2	1.3E-01	2
86-30-6	N-Nitroso-diphenylamine	2.0E+01	2.0E+01		7.0E+01	2.0E+01	1	3.4E+01	2	2.0E+01	1
319-84-6	alpha-BHC		2.5E-03	rOE+02	2.7E+02	2.5E-03	2	"2.7E+06"	2	2.5E-03	1
319-85-7	beta-BHC		1.0E-03	1.0E+02	2.6E+03	1.0E-03	2	2.7E+00	2	1.0E-03	1
319-86-8	delta-BHC		i.OE-01	7".8E+01	"i7i"E+O2	1.0E-01	2	~ T.7E+00"	2	I7"0"E-0I	1
50-29-3	4,4'-DDT		2.5E-03		6.2E-01	2.5E-03	CHM	1.5E-02	1	2.5E-03	1
58-89-9	gamma-BHC		5.0E-05	1.1E+02	4.3E-02"	570E-05		2.7E+00	2	5.0E-05	1
72-43-5	Methoxychlor		1.0E-01		3.0E-01	1.0E-01	2	8.5E+00	2	1.0E-01	1
72-54-8	4,4'-DDD		2.5E-03		5.0E+00	2.5E-03	2	1.5E-02	1	2.5E-03	1
72-55-9	4,4'-DDE		2.5E-03		2.6E+04	2.5E-03	CHM	1.5E-02	1	2.5E-03	1
8001-35-2	Toxaphene		1.0E-01	3.2E+01	1.3E-02	1.0E-01	CHM	i.7E+00	3	1.0E-01	1
1024-57-3	Heptachlor epoxide		i.OE-01		.3.0E-02	1.0E-01	CHM	.4.3E-02	2	4.3E-02	2
1031-07-8	Endosulfan sulfate		1.0E-01		2.0E-02	1"7OE-01	CHM	"~ 2.9E-01"	2	1.0E-01	1
309-00-2	Aldrin		2.5E-03		7.4E+01	2.5E-03	2	2.7E-01	2	2.5E-03	1
33213-65-9	Endosulfan II		1.0E-01		3.3E-02	1.0E-01	2	1.4E+00	2	1.0E-01	1
5103-71-97.7,	alpha-Chlordane		1.0E-01		6.0E+00	i.OE-01	2	1.5E+00	1	1.0E-01	1
5103-74-2	gamma-Chlordane		1.0E-01		5.2E+00"	~I~.OE-OI~		~1'.5E+OO~		i.OE-01	1
53494-70-5	Endrin ketone		1.0E-01	5.6E+01	1.8E+02	1.0E-01	2	1.1E-01	2	1.0E-01	1
57-74-9	Technical Chlordane		1.0E-01		4.9E-01	1.0E-01	CHM	1.5E+00	1	1.0E-01	1
60-57-1	Dieldrin		5.0E-04		1.1E+00	5.0E-04	CHM	4.7E-02"	2	5.0E-04	1
72-20-8	Endrin		1.0E-03		4.7E-01	1.0E-03	2	1.1E-01	2	1.0E-03	1
7421-93-4	Endrin aldehyde		1.0E-01		1.7E+02	1.0E-01	2	5.4E-02	1	5.4E-02	2
76-44-8	Heptachlor		1.0E-01		3.8E-01	1.0E-01	2	3.9E-02	2	3.9E-02	2
959-98-8	Endosulfan I		1.0E-01		3.3E-02	1.0E-01	2	2.9E-01	2	1.0E-01	1
75-99-0	Dalapon			4.2E+03	5.1E+01	4.2E+03	3	8.6E+01	2	8.6E+01	2
88-85-7	Dinoseb				6.1E-01	6.1E-01	4	1.7E-01	2	1.7E-01	2
1912-24-9	Atrazine		5.0E-05		4.4E-01	5.0E-05	2	6.0E+00	2	5.0E-05	1
1918-00-9	Dicamba			2.3E+03	1.2E+00	2.3E+03	3	2.6E+00	3	2.6E+00	2
93-76-5	2,4,5-T			1.2E+03	5.6E+01	1.2E+03	3	5.1E+00	2	5.1E+00	2
94-74-6	MCPA			1.0E+03	2.4E+02	1.0E+03	3	1.3E+01	2	1.3E+01	2
94-75-7	2,4-D			1.5E+03	1.0E+01	1.5E+03	3	8.6E+00	2	8.6E+00	2
94-82-6	2,4-DB			1.0E+03	4.4E+01	1.0E+03	3	4.3E+00	2	4.3E+00	2
120-36-5	Dichlorprop			1.0E+03	6.8E+00	1.0E+03	3	6.2E-01	2	6.2E-01	2
93-65-2	MCPP			1.2E+03	3.2E+02	1.2E+03	3	7.3E+01	1	7.3E+01	2

TABLE D-3
SUMMARY OF ECOLOGICAL SCREENING BENCHMARKS FOR SURFACE SOIL AND SELECTED SCREENING VALUES

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

CAS#	Chemical Name	ORNL Soil Invertebrate Benchmarks[8]	Region IV Soil Bencharks[b]	QSAR Earthworm Bencharks[0]	Equilibrium Partitioning Based Benchmarks[11]	Soil Invertebrate Screening Benchmark[8]	Basis	Wildlife Benchmark'	Basis	Soil Screening Benchmark[9]	Basis
93-72-1	2,4,5-TP (Silvex)			9.3E+02	3.7E+00	9.3E+02	3	4.3E+01	2	4.3E+01	g
11096-82-5	Aroclor-1260			9.5E+00	3.7E+01	9.5E+00	"3	""2.8E-02 "	2	2.8E-02	g
11097-69-1"	Aroclor-1254			1.7E+01	3.4E+00	1.7E+01	3"	"9.2E-02	2	9.2E-02	g
11100-14-4	Aroclor-1268				8.6E+02	8.6E+02	4	2.8E-02	2	2.8E-02	2
11104-28-2	Aroclor-1221			3.5E+01	5.2E-02	3.5E+01	3	1.2E-01	2	1.2E-01	2
11141-16-5	Aroclor-1232			4.2E+01	3.0E-02	4.2E+01	3	1.0E-01	3	1.0E-01	2
12672-29-6	Aroclor-1248			1.8E+01	1.7E+00	1.8E+01	3	1.0E-01	2	1.0E-01	g
~12674-11-2"	Aroclor-1016			2.3E+01	5.5E-01	2.3E+01	"3	1.1E-01	2	-fiE-01	g
12767-79-2	Aroclor, Total				1.4E+02	1.4E+02	4			1.4E+02	1
1336-36-3	Polychlorinated biphenyls (PCBs)		2.0E-02		1.3E+01	2.0E-02	2	1.0E-01	2	2.0E-02	1
37324-23-5	Aroclor-1262				8.6E+02	8.6E+02	4	2.8E-02	2	2.8E-02	g
"53469-21-9"	Aroclor-1242			1.7E+01	2.4E+00	1.7E+01	3	9.8E-02	2	9.8E-02	K
22967-92-6"	Mercury (methyl)		6.7E-01			6.7E-01	2	3.3E-02	1"	3.3E-02	g
7429-90-5	Aluminum	6.0E+02	5.0E+01			6.0E+02	1	3.3E+00	2	3.3E+00	2
7439-89-6	Iron	2.0E+02	2.0E+02			2.0E+02	1			2.0E+02	1
7439-92-1	Lead	5.0E+02	5.0E+01			5.0E+02	1	2.0E+01	1	2.0E+01	2
7439-95-4	Magnesium										
7439-96-5"	Manganese	1.0E+02	1.0E+02			1.0E+02~"	1	1.5E+02	2	1.0E+02~"~	1
7439-97-6	Mercury	1.0E-01	1.0E-01			1.0E-01	1	4.5E-01	2	1.0E-01	1
7439-98-7	Molybdenum	2.0E+02	2.0E+00			"~ 2.0E+02~	1	3.2E-01	2	3.2E-01	2
7440-02-0	Nickel	9.0E+01	3.0E+01			"~ 9.0E+01	1	5.3E+01	2	5.3E+0T	2
7440-22-4	Silver	5.0E+01	2.0E+00			5.0E+01	1	3.8E+01	2	3.8E+01	g
7440-28-0	Thallium		1.0E+00			"2 j-OE+00	2	2.4E-01"""	2	Z4E-01	g
7440-36-0	Antimony		3.5E+00			3.5E+00	2	4.5E-02 ""	2	4.5E-02	4
7440-38-2	Arsenic	6.0E+01	1.0E+01			6.0E+01	1	2.2E-01	2	2.2E-01	g
7440-39-3	Barium	3.0E+03	1.7E+02			3.0E+03	1	1.3E+02	2	1.3E+02	2
7440-41-7	Beryllium		1.1E+00			1.1E+00	2	7.7E-01	1	7.7E-01	g
7440-43-9	Cadmium	2.0E+01	1.6E+00			2.0E+01	1	1.7E+00~"	2	~1.7E+00	g
744O.47.3	Chromium	4.0E-01	4.0E-01			4.0E-01	1	5.2E+00	1	4.0E-01	1
7440-48-4	Cobalt	1.0E+03	2.0E+01			1.0E+03	1	1.3E-01	2	1.3E-01	2
7440-50-8	Copper	5.0E+01	4.0E+01			5.0E+01	1	7.1E-01	2	7.1E-01	g
7440-62-2	Vanadium	2.0E+01	2.0E+00			2.0E+01	1	7.2E-01	2	7.2E-01	g
7440-66-6	Zinc	1.0E+02	5.0E+01			1.0E+02	1	7.6E+01	1	7.6E+01	2
7782-49-2	Selenium	7.0E+01	8.1E-01			7.0E+01	1	3.4E-01	2	3.4E-01	2

SUMMARY OF ECOLOGICAL SCREENING BENCHMARKS FOR SURFACE SOIL AND SELECTED SCREENING VALUES

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

CAS#	Chemical Name	ORNL Soil Invertebrate Benchmarks[a]	Region IV Soil Bencharks[b]	QSAR Earthworm Bencharks[c]	Equilibrium Partitioning Based Benchmarks[d,f]	Soil Invertebrate Screening Benchmark[e]	Basis	Wildlife Benchmark[f]	Basis	Soil Screening Benchmark[g]	Basis
57-12-5	Cyanide		5.0E+00	2.2E+02		**5.0E+00**	2	1.1E+00	1	**1.1E+00**	2
75-15-0	Carbon disulfide			9.8E+01		**9.8E+01**	3	5.0E+00	2	**5.0E+00**	2
65-85-0	Benzoic acid			il6E+03	8,-9E+01"	**i76E+03**	3	" 8.6E+01"	2	**8.6E+01**	2
86-74-8	Carbazole			6.1E+01	3.6E+01	**6.1E+01**	3	"" i'.7E+02~~"	2	**6.1E+01**	1
1746-01-6	2,3,7,8-TCDD				4.8E-03"	**4.8E-03~"**	4	""8.9E-07	*i*	**"8.9E-07**	2
38178-99-3	1,2,4,5,7,8-hexachloro(9H)xanthene				1.7E+03	**1.7E+03**	4			**1.7E+03**	1

NOTES:

a. Ecological screening benchmarks as provided in Efroymson et al., 1997.

b. Region IV Recommended Ecological Screening Values for Soil. From: Friday, G.P., .November, 1998. Ecological Screening Values for Surface Water, Sediment and Soil. Westinghouse Savannah River Company, Savannah River Technology Center, SC (WSRC-TR-98-00110), Aiken, SC 29808.

c. Estimated LC50 for 14-day earthworm exposure; values estimated by USEPA ECOSAR program, adjusted with a five-fold extrapolation factor.

d. Estimated using equilibrium partitioning assumptions and surface water screening values presented in Table D-1 (assumed TOC = 10%).

e. Basis for the selected screening benchmark is indicated; the following hierarchy was used:

[1] If available, the ORNL value was selected.

[2] If no ORNL value was available, the Region IV Recommended Ecological Screening Value was selected;

[3] If the above were not available, the ECOSAR-derived value was selected;

[4] If the above were not availabe, a screening benchmark was estimated using EqP assumptions.

f. Soil concentration protective of semi-aquatic wildlife exposure to sediment via incidental sediment ingestion and consumption of contaminated prey item exposure pathways; value is minimum of sete

g. Selected Soil Benchmark is the lower of the values selected for soil invertebrates and wildlife receptors.

[1] Based on soil invertebrate

[2] Based on most sensitive wildlife receptor.

Prepared by; SGD
Checked by: NAR

TABLfc D-4
SUMMARY OF ORAL TOXICITY REFERENCE DOSES FOR WILDLIFE RECEPTORS

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Chemical Name	Toxicity Reference Dose NOAEL*	Toxicity Reference Dose LOAEL[b]	Study Type[c]	Exposure Route	Test Species	Effect	Relevance[0]	Reference	Study Endpoint	Study Result	Reported LOAEL	Exposure Duration[d]	Exposure Regime (# d/w)	EF	UF	Notes
4-Nitroaniline	2.1E+01	7.1E+01	c	oral (gavage)	mouse	significant reduction in hematocrit and erythrocyte counts	low	NIH. 1993	NOAEL	30	100	2y	5	1	1	
4-Nitrophenol	1.3E+01	1.3E+02	a	oral (gavage)	mouse	mortality	high	ATSDR, 1992; Plasterer etal., 1985	LD50	626		8d	7	1	50	4-nitrophenol more toxic than 2-nitrophenol (ATSDR, 1992)
Ethyl benzene	1.1E+03	2.0E+03	c	gavage	rat	reduction in body weight	intermediate	ATSDR, 1999; Wolf et al., 1956	NOAEL	1119.68674	1970.6487	6 - 7 m	7	1	1	
Styrene	9.5E+01	2.9E+02	c	oral	rat	reduced growth	intermediate	Ponomarkov and Tomatis, 1978	NOAEL	95	285	185 d	7	1	1	
Benzyl Alcohol	1.4E+02	1.4E+03	c	oral (gavage - oil)	rat	neurotoxicity; lethality; body weight gain	high	EUSCF, 2002; NTP, 1989	NOAEL	200		103 w	5	1	1	
Benzaldehyde	2.1E+02	4.3E+02	sc	gavage	mouse	kidney toxicity (renal tubular necrosis)	intermediate	IRIS, 2002; Klue et al., 1983	NOAEL	300	600	13w	5	1	1	RfD based on forstomaoh hyperplasia and byperkeratosis at a lower dose in rats; deemed less relevant
cis-1,3-Dichloropropene	2.5E+00	1.5E+01	sc	oral (diet)	dog (beagle)	significant decrease in body weight (males)	intermediate	CEPA, 1999; Stott et al. 1992	NOAEL	2.5	15	1y	7	1	1	No UF applied due to the nature of the observed effects
cis-1,3-Dichloropropena	1.3E+01	2.5E+01	c	oral	rat	decrease in body weight gain	intermediate	IRIS, 2002; Stott et al. 1995	NOAEL	12.5	25	24 m	7	1	1	
cis-1,3-Dich)oropropene	2.1E+02	2.1E+03	sa	oral	mallard	mortality	high	WHO, 1993; Worthing and Hance, 1991	LC »	10534		single dose	7	10	5	
trans-1,3-Dichloropropene	2.5E+00	1.5E+01	sc	oral(diet)	dog (beagle)	significant decrease in body weight (males)	intermediate	CEPA, 1999: Stott etal. 1992	NOAEL	2.5	15	1y	7	1	1	No UF applied due to the nature of the observed effects
trans-1,3-Dichloropropene	1.3E+01	2.5E+01	c	oral	rat	decrease in body weight gain	intermediate	IRIS, 2002; Stott et al. 1995	NOAEL	12.5	25	24 m	7	1	1	
trans-1.3-Dichloropropene	2.1E+02	2.1E+03	sa	oral	mallard	mortality	high	WHO, 1993: Worthing and Hance, 1991	LCso	10534		single dose	7	10	5	
4-Bromophenyt-phenylether	1.0E+02	1.0E+03	c	oral (gavage)	mouse	embryotoxicity; developmental effects	high	INCHEM 1994; Francis, 1989	NOAEL	1000		days 5-14 (gestation)	7	10	1	Pups counted and weighed and gross abnormalities and liver/kidney weights measured
Heptachlor epoxide	2.5E-02	2.5E-01	c	oral (diet)	rat	F1: 30% decrease in fertility, increased resorption, 16% embryo survival: F2: 100% infertility	high	ATSDR, 1993; Green, 1970	LOAEL	0.25	0.25	60 d through gestation	7	10	1	Value for heptachlor used as a surrogate value
Heptachlor epoxide	1.3E-01	1.8E-01	c	oral (diet)	dog	reduced pup survival	high	IRIS, 2002; Velsicol Chemical, 1973a	NOAEL	0.125	0.175	2g	7	1	1	
Heptachlor epoxide	4.2E+01	4.2E+02	a	oral (capsule)	mallard	mortality	high	Hudson etal., 1984	LDso	2080		14 d	7	50	1	Heptachlor used as a surrogate value.

TABLE D-4
SUMMARY OF ORAL TOXICITY REFERENCE DOSES FOR WILDLIFE RECEPTORS

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[b]	Study Type[a]	Exposure Route	Test Species	Effect	Relevance[0]	Reference	Study End point	Study Result	Reported LOAEL	Exposure Duration[d]	Exposure Regime (# d/w)	EF	UF	Notes
Endosulfan sulfate	1.7E-01	2.5E+00	c	oral (diet)	mouse	sigificantly decreased survival and body weight gain in high dose females and males, respectively.	high	IRIS. 2002; Hoechst Celanese Corp., 1988	NOAEL	0.84	2.51	2y	7	5	1	Although mortality appears to be one of the most sensitive effects; a five-fold extrapolation factor applied because of a reported LD50 of 7.36 mg/kg in male mice (Gupta etal., 1981).
Endosulfan sulfate	5.7E-01	1.9E+00	c	oral(diet)	dog (beagle)	significantly decreased weight gain and severe nervous symptoms (e.g., loss of righting response)	high	IRIS, 2002: Hoechst Celanese Corp., 1989b	NOAEL	0.57	1.9	iy	7	1	1	
Endosulfan sulfats	6.2E-01	6.2E+00	a	oral(diet)	mallard	mortality	high	Hudson etal.. 1984	LD50	31.2		14 d	7	50	1	Endosulfan used as a surrogate value.
Endosulfan sulfate	1.6E+00	1.6E+01	a	oral(diet)	ring-necked pheasant	mortality	high	Hudson etal.. 1970	LD50	80		14 d	7	50	1	Endosulfan used as a surrogate value.
n-Propylbenzene	1.0E+02	2.6E+02	sc	inhalation	rat	significant reduction in body weight gain, decreased food consumption; increased liver weight; no effect on gestational parameters	intermediate	IRIS. 2002; Bushy Run Research Center, 1989a	NOAEL	520	1290	Gd6-18	7	1	5	Limited toxicological data available; values for the closely-related branch-chain alkyl benzene, isopropylbenzene (cumene), used as a surrogate.
n-Butylbenzene	1.0E+02	2.6E+02	sc	inhalation	rat	significant reduction in body weight gain, decreased food consumption: increased liver weight; no effect on gestational parameters	intermediate	IRIS, 2002; Bushy Run Research Center, 1989a	NOAEL	520	1290	Gd6-18	7	1	5	Limited toxicological data available; values for the closely-related branch-chain alkyl benzene, isopropylbenzene (cumene), used as a surrogate.
Caprolactam	5.0E+01	2.5E+02	c	oral	rat	mean body weight and food consumption in parental generations; reduced offspring body weights	intermediate	IRIS 2002; Serota etal.. 1984	NOAEL	50	250	3g	7	1	1	
2,4-Dimethylphenol	2.5E+02	2.5E+03	sc	oral (gavage)	mouse	reduced survival, body weights, and food consumption	high	IRIS, 2002, USEPA, 1989	NOAEL	250		90 d	7	1	1	
4-Chlorotoluene	4.0E+00	1.6E+01	sc	gavage	rat	decrease in body weight gain (males only)	intermediate	IRIS. 2002; Gibson et al.. 1974a	NOAEL	20	80	103 d	7	1	5	No data available: value for 2-chlorotoluene used as a surrogate
4-CNorotoluene	1.6E+01	1.6E+02	sc	oral (capsule)	dog (beagle)	changes in body weight	intermediate	IRIS, 2002; Gibson et al.. 1974b)	NOAEL	80		97 d	7	1	5	No data available; value for 2-chlorotoluene used as a surrogate
4-Methylphenol	5.0E-01	5.0E+00	a	gavage	rabbit	difficulty breathing	high	ATSDR, 1992; BRRC. 1988b	NOAEL	5	50	days 6 -18 (gestation)	7	1	10	A ten-fold UF was used due to relative sensitivity of the effect
4-Methylphenol	2.3E+00	2.3E+01	3	oral (gavage)	redwinged blackbird	mortality	high	WHO, 1995; Schafer et al.. 1983	LD_M	113		single dose	7	10	5	!Reported value >113 mg/kg.

TABLc D-4

SUMMARY OF ORAL TOXICITY REFERENCE DOSES FOR WILDLIFE RECEPTORS

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Chemical Name	Toxicity Reference Dose NOAEL*	Toxicity Reference Dose LOAEL[b]	Study Type[c]	Exposure Route	Test Species	Effect	Relevance[e]	Reference	Study End point	Study Result	Reported LOAEL	Exposure Duration[d]	Exposure Regime (# d/w)	EF	UF	Notes
4-Methylphenol	2.5E+01	1.1E+02	sc	oral(diet)	mink	decreased body weight gain	intermediate	ATSDR, 1992; Hornshawetal.. 1986	NOAEL	25	105	6 m	7	1	1	Value for 2-methylphenol (o-cresol) used as a surrogate
1,4-Dichlorobenzene	2.1E+01	4.3E+01	c	gavage (oil)	rat	significantly increased mortality (males); increased severity of nephrophathy	high	ATSDR, 1998; NTP, 1987	NOAEL	150	300	2y	5	1	1	5-fold modifying factor added due to the severity of the observed mortality (26/50 males)
4-Chloroaniline	1.3E+01	2.5E+01	c	oral	rat	significantly increased mortality; decreased average body weight gain	high	IRIS. 2002; NCI, 1979	NOAEL	12.5	25	78 w	7	1	1	Nonneoplastic lesions of splenic capsule were observed at 12.5 mg/kg-d dose but this effect is not considered ecologically significant
1,2-Dibromoethane	1.2E+00	1.2E+01	c	inhalation	rat	testicular degeneration	intermediate	ATSDR; 1992; NTP, 1982	LOAEL	11.8873655	11.887366	104 w	7	10	1	
1,2-Dibromoethane	1.6E+00	1.6E+01	a	oral (gavage - oil)	chicken	mortality	high	WHO, 1996; Roweet al., 1952	LDK.	79		single dose	7	50	1	
1,2-Dichloroethane	1.6E+01	2.0E+01	sc	oral	rat	increased resorptions and nonsurviving implants; decreased maternal body weight gain	high	ATSDR, 2001; Payanet al.. 1995	NOAEL	158	198	days 6-20 (gestation)	7	1	10	
1,2-DicHoroethane	1.7E+01	3.4E+01	c	oral(diet)	chicken	significant reduction in egg production	high	Sample etal., 1996; Alumot et al., 1976b	NOAEL	17.2	34.4	2y	7	1	1	
4-Methyl-2-Pentanone	8.9E+02	2.7E+03	o	oral	rat	decreased body weight gains and food consumption; signficantly reduced fetal body weight and retardation of skeletal ossification	high	RAIS, 2002; Bushy Run Research Center, 1984	NOAEL	887.212022	2661.6361	days 6-15 (gestation)	7	1	1	
4-Methyl-2-Pentanon9	1.0E+03	2.0E+03	sc	inhalation	chicken	leg weakness	low	WHO, 1990; Abou-Doniaetal.. 1985b	NOAEL	1024	2048	90 d	7	1	1	
m&p-Xylene	1.4E+02	1.4E+03	sa	oral (diet)	Japanese quail	mortality	high	Hill and Camardese, 1986	NOAEL	3390		5d	7	25	1	Total xylene value used as a surrogate
m&p-Xylene	1.8E+02	3.6E+02	c	gavage	rat	decreased body weight and increased mortality (males); hyperactivity	high	IRIS, 2002; NTP. 1986	NOAEL	250	500	103 w	5	1	1	Value for total xylenes use as a surrogate.
Bis-(2-chloroisopropyl)ether	7.1E+01	1.4E+02	c	oral (gavage)	rat	significant decrease in survival	high	CEPA. 1999; NCI. 1979	NOAEL	100	200	103 w	5	1	1	Percent suvival (M/F) at the high and low doses were 56/50 and 92/88, respectively after 78 weeks
1,3,5-Trimethylbenzene	7.6E+00	7.6E+01	c	inhalation	rat	reduced maternal body weights; increased frequency of whole litter resorptions, reduced pup viability	high	USEPA. 1994; Seed. 1989; Campbell. 1989	LOAEL	76	76	39	7	10	1	Value for 1,2,4-trimethylbenzene used as a surrogate.

TABLE D-4
SUMMARY OF ORAL TOXICITY REFERENCE DOSES FOR WILDLIFE RECEPTORS

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North Providence, Rhode Island

Chemical Name	Toxicity Reference Dose NOAEL"	Toxicity Referenc e Dose LOAEL[b]	Study Type"	Exposure Route	Test Species	Effect	Relevance^	Reference	Study Endpoint	Study Result	Reported LOAEL	Exposure Duration"	Exposure Regime (# d/w)	EF	UF	Notes
Bromobenzene	4.8E+01	4.8E+02	a	oral (gavage)	rat	mortality	high	Haskell Laboratories. 1981	LD50	2383		single dose	7	1	50	primary target organ is liver; toxicity associated with formation of epoxide adducts
1-Methylcyclohexane	4.5E*01	4.5E+02	a	oral	mouse	mortality	high	CDC. 2002; Izmerov et al.. 1982	LD50	2250		single	7	1	50	
Toluene	7.8E+01	7.8E+02	c	gavage	mouse	significantly reduced fetal weights and increased mortality in embryos	high	Sample etal.. 1996; Nawrot and Staples, 1979	LOAEL	779.4	779.4	days 6-12 (gestation)	7	10	1	Animals were gavaged thrice daily (not considered in Sample etal., 1996)
Chlorobenzene	7.8E+00	3.9E+01	sc	oral (capsule)	dog (beagle)	mortality; body weight loss; pathological changes to liver anci kidney	high	IRIS. 2002; Knapp et al., 1971	NOAEL	54.5	272.5	13w	5	1	5	
Chlorobenzene	4.3E+01	8.6E+01	c	oral (gavage)	rat	liver necrosis; significant increase in mortality (males)	high	ATSDR, 1990; NTP. 1985	NOAEL	60	120	103 w	5	1	1	
Phenol	4.0E+01	5.4E+01	c	oral (gavage)	rat	significant decrease in number of live-born pups; respiratory effects in dams	high	ATSDR, 1998; Narotsky and Kavlock, 1995	NOAEL	40	53.5	days 6-19 (gestation)	7	1	1	several other studies concluded NOAELs for developmental effects around 120mg/kd-d
Cyclohexane	1.6E+0T	1.6E+02"	a	oral	mouse	mortality	high	1974	LD50	813		single	7	T	50	
Aroclor-1260	5.0E-03	2.0E-02	c	oral (capsule)	monkey (rhesus)	42% reduced conception rate	high	ATSDR, 2000; Arnold et al., 1995	NOAEL	0.005	0.02	37 m	7	1	1	Aroclor 1254 used as a surrogate value.
Aroclor-1260	1.5E-02	1.5E-01	c	oral (diet)	mink	reproductive toxicity (75.8% higher neonatal deaths during first week; average body weights significantly lower)	high	ATSDR, 2000; Wren et al.. 1987b	LOAEL	0.15	0.15	6m	7	10	1	Aroclor 1254 used as a surrogate value.
Aroclor-1260	6.8E-02	6.8E-01	c	oral	mouse (oldfield. Peromyscu s poliontus)	reduced number of litters, offspring weights and offspring survival	high	Sample etal.. 1996; McCoy etal., 1995	LOAEL	0.68	0.68	12 m	7	10	1	Aroclor 1254 used as a surrogate value.
Aroclor-1260	1.8E-01	1.8E+00	c	oral (capsule)	pheasant	significantly reduced egg hatchability	high	Sample etal., 1996; Dahlgreanetal.. 1972	LOAEL	1.8	1.8	17w	7	10	1	Aroclor 1254 used as a surrogate value; however. comparative toxicity data suggests that Aroclor 1260 is 10 times less sensitive for this endpoint (WHO, 1993).
Aroclor-1254	5.0E-03	2.0E-02	c	oral (capsule)	monkey (rhesus)	42% reduced conception rate	high	ATSDR, 2000; Arnold et al., 1995	NOAEL	0.005	0.02	37 m	7	1	1	Selected values supported by several studies that demonstrated reproductive effects (FELs) at exposure doses of 0.1 mg/kg-d
Aroclor-1254	1.5E-02	1.5E-01	c	oral (diet)	mink	reproductive toxicity (75.8% higher neonatal deaths during first week; average body weights significantly lower)	high	ATSDR, 2000; Wren et al., 1987b	LOAEL	0.15	0.15	6 m	7	10	1	

TABLE D-4

SUMMARY OF ORAL TOXICITY REFERENCE DOSES FOR WILDLIFE RECEPTORS

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Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[a]	Study Type[b]	Exposure Route	Test Species	Effect	Relevance[a]	Reference	Study Endpoint	Study Result	Reported LOAEL	Exposure Duration[a1]	Exposure Regime (# d/w)	EF	UF	Notes
Aroclor-1254	6.8E-02	6.8E-01	c	oral	mouse (oldfield, Peromyscus poliontus)	reduced number of litters, offspring weights and offspring survival	high	Sample etal.. 1996; McCoy etal., 1995	LOAEL	0.68	0.68	12 m	7	10	1	
Aroclor-1254	1.8E-01	1.8E+00	c	oral (capsule)	pheasant	significantly reduced egg hatchability	high	Sample etal., 1996; Dahlgreanet al.. 1972	LOAEL	1.8	1.8	17w	7	10	1	
Arodor-1268	5.0E-03	2.0E-02	c	oral (capsule)	monkey (rhesus)	42% reduced conception rate	high	ATSDR, 2000; Arnold et al., 1995	NOAEL	0.005	0.02	37 m	7	1	1	Aroclor 1254 used as a surrogate value.
Aroclor-1268	1.5E-O2	1.5E-01	c	oral (diet)	mink	reproductive toxicity (75.8% higher neonatal deaths during first week; average body weights significantly lower)	high	ATSDR. 2000; Wren et al., 1987b	LOAEL	0.15	0.15	6m	7	10	1	Aroclor 1254 used as a surrogate value.
Aroclor-1268	6.8E-02	6.8E-01	c	oral	mouse (oldfield. Peromyscus poliontus)	reduced number of litters, offspring weights and offspring survival	high	Sample etal.. 1996; McCoy etal., 1995	LOAEL	0.68	0.68	12m	7	10	1	Aroclor 1254 used as a surrogate value.
Aroclor-1268	1.1E+00	1.1E+01	c	oral(diet)	chicken	reduction in egg production and hatchability	high	Stendell, 1975; Platanow and Reinhart, 1973; Cecil etal., 1974	NOAEL	1.1		39 w	7	1	1	
Aroclor-1221	7.0E-03	2.8E-02	c	oral (diet)	monkey (rhesus)	significantly reduced birth weights; impairment of learning ability	high	IRIS, 2002; Barsotti and van Miller, 1984; Levin etal., 1988;Schantzet al., 1989, 1991	NOAEL	0.007	0.028	22 m	7	1	1	Aroclor 1016 used as a surrogate value.
Aroclor-1221	1.5E-O2	1.5E-01	c	oral(diet)	mink	reproductive toxicity (75.8% higher neonatal deaths during first week; average body weights significantly lower)	high	ATSDR, 2000: Wren et al., 1987b	LOAEL	0.15	0.15	6m	7	10	1	Aroclor 1254 used as a surrogate value.
Aroclor-1221	6.8E-02	6.8E-01	c	oral	mouse (oldfield, Peromyscus poliontus)	reduced number of litters, offspring weights and offspring survival	high	Sample etal., 1996; McCoy etal., 1995	LOAEL	0.68	0.68	12m	7	10	1	Aroclor 1254 used as a surrogate value.
Aroclor-1221	1.1E+00	1.1E+01	c	oral (diet)	chicken	reduction in egg production and hatchability	high	Stendell, 1975; Platanow and Reinhart, 1973; Cecil etal., 1974	NOAEL	1.10566613		39 w	7	1	1	
Aroclor-1232	5.0E-03	2.0E-02	c	oral (capsule)	monkey (rhesus)	42% reduced conception rate	high	ATSDR, 2000: Arnold et al., 1995	NOAEL	0.005	0.02	37 m	7	1	1	Aroclor 1254 used as a surrogate value.
Aroclor-1232	1.5E-02	1.5E-01	c	oral (diet)	mink	reproductive toxicity (75.8% higher neonatal deaths during first week; average body weights significantly lower)	high	ATSDR, 2000; Wren et al., 1987b	LOAEL	0.15	0.15	6m	7	10	1	Aroclor 1254 used as a surrogate value.
Aroclor-1232	6.8E-02	6.8E-01	c	oral	mouse (oldfield, Peromyscus poliontus)	reduced number of litters, offspring weights and offspring survival	high	Sample etal., 1996; McCoy etal., 1995	LOAEL	0.68	0.68	12m	7	10	1	Aroclor 1254 used as a surrogate value.

TABLE D-4
SUMMARY OF ORAL TOXICITY REFERENCE DOSES FOR WILDLIFE RECEPTORS

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North Providence, Rhode Island

Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicily Referenc e Dose LOAEL[6]	Study Type"	Exposure Route	Test Species	Effect	Relevance[0]	Reference	Study Endpoint	Study Result	Reported LOAEL	Exposure Duration[1+]	Exposure Regime (# d/w)	EF	UF	Notes
Aroclor-1232	1.1E-01	2.8E-01	c	oral(diet)	chicken	reduction in egg production and hatchability	high	Stendell, 1975; Platanow and Reinhart, 1973; Cecil etal., 1974	NOAEL	0.11	0.28	39 w	7	1	1	
Bis(2-chloroethyl)ether	7.1E+00	1.4E+01	c	gavage	rat	significant reduction in survival of females	high	ATSDR, 1989; Weisburger et al.. 1981	NOAEL	25	50	78 w	2	1	1	
Bis(2-chloroetboxy)methane	4.0E+00	8.0E+00	sc	gavage	rat	reduced survival and body weights	high	NTP. 2002; Bio/dynamics. 1989	NOAEL	40	80	90 d	7	1	10	
Bis(2-ethylhexyl)phthalate	1.1E+01	1.1E+02	sc	oral (diet)	chicken	significant reduction in egg production and body weights	high	WHO. 1992; Wood and Bitman, 1984	LOAEL	110.566613	110.56661	4 w	7	10	1	
Bis(2-ethylhexyl)phthalate	1.8E+01	1.8E+02	c	oral(diet)	mouse	significant reproductive effects including reduced litters/pair and number live pups/litter	high	Sample etal.. 1996; Lamb et al.. 1987	NOAEL	18.3	183.3	105 d	7	1	1	
Di-n-octyiphthalate	1.1E+00	1.1E+01	c	oral (diet)	ringed dove	10% reduction in egg shell thickness	intermediate	Sample etal., 1996; Peakall, 1974	NOAEL	1.11		4 w	7	1	1	Di-n-butylphthalate used as a surrogate value
Di-n-octytphthalate	1.0E+02	4.0E+02	c	oral(diet)	mouse	significant reproductive effects including fewer number of live offspring/titter and increased incidence of external anomalies	high	WHO. 1997; Hamano et al., 1977	NOAEL	100	400		7	1	1	Value for di-n-butylphthalate used as a surrogate.
Hexachlorobenzene	3.2E-01	1.6E+00	c	oral(diet)	rat	decrease neonatal viability of F1 pups	high	ATSDR. 2000; Arnold et al., 1985	NOAEL	0.32	1.6	2g	7	1	1	
Hexachlorobenzene	1.0E+00	1.0E+01	c	oral (capsule)	dog (beagle)	significant decrease in body weight	Intermediate	ATSDR, 2000; Gralla et al.. 1977a	NOAEL	1	10	i y	7	1	1	
Hexachlorobenzene	1.3E+00	1.3E+01	sa	oral(diet)	mallard	mortality	high	Hill etal.. 1975	LC50	66.0979883		5d	7	50	1	Concentration converted to a daily dose using estimated body weight and ingestion rate date summarized in
Hexachlorobenzene	1.2E+01	1.2E+02	a	oral (capsule)	bobwhite quail	mortality	high	Hudson etal., 1970	LD50	575		14 d	7	50	1	
Hexachlorobenzene	2.9E+01	2.9E+02	a	oral (capsule)	mallard	mortality	high	Hudson etal., 1970	LDs,	1450		14 d	7	50	1	
Anthracene	1.8E+02	1.8E+03	sc	oral	mallard	mortality	high	Eisler, 1987; Pattonand Dieter, 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Anthracene	2.0E+02	2.0E+03	sc	oral (gavage)	mouse	mortality, reduced food consumption, body weight loss and other clinical effects	high	IRIS, 2002; USEPA, 1989a	NOAEL	1000		90 d	7	5	1	
1,2,4-Trichlorobenzene	1.2E+02	3.6E+02	c	oral	rat	significant retardation in four embryonic growth criteria (i.e. itead length, crown-rump weight. somite number, and protein content)	intermediate	IRIS, 2002; Kitchin and Ebron, 1980	NOAEL	120	360	days(9-13) gestation	7	1	1	Significant increased adrenal gland weights have been consistently observed at lower chronic exposure doses (i.e., 53.6 mg/kg-d; Robinson et al., 1981)
2,4-Dichlorophenol	3.0E+00	3.0E+01	c	oral (water)	rat	decreased mean litter size	high	ATSDR, 1999; Exon and Koller, 1985; Exon etal., 1984	NOAEL	3	30	13w (including Gd 1-21)	7	1	1	

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SUMMARY OF ORAL TOXICITY REFERENCE DOSES FOR WILDLIFE RECEPTORS

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Chemical Name	Toxicity Reference Dose NOAEL*	Toxicity Reference Dose LOAEL"	Study Type"	Exposure Route	Test Species	Effect	Relevance[b]	Reference	Study Endpoint	Study Result	Reported LOAEL	Exposure Duration[d]	Exposure Regime (# d/w)	EF	UF	Notes
2,4-Dinitrotoluene	6.0E-02	6.0E-01	c	oral	rat	atrophy of seminiferous tubules; aspermatogenesis	high	ATSDR, 1998; Lee et al., 1978. 1985; Ellis et al.. 1979	LOAEL	0.6	0.6	1-2y	7	10	1	
2,4-Dinitrotoluene	2.0E-01	1.5E+00	c	oral (capsule)	dog (beagle)	loss of hindquarter control; convulsions	high	ATSDR, 1998; Ellis et al., 1979; 1985	NOAEL	0.2	1.5	24 m	7	1	1	
Dibromochloromethane	3.6E+00	3.6E+00	c	oral (gavage)	mouse	severe nephrosis and liver necrosis	intermediate	ATSDR. 1990; NTP. 1985	LOAEL	50	50	105 w	5	1	10	
Aroclor-1248	1.0E-02	1.0E-01	c	oral (diet)	monkey (rhesus)	reduced pregnancy and live birth rates: decreased spermatogenesis and libido	high	Sample etal., 1996; Barsotti et al., 1976: ATSDR, 2000; Allen and Norback. 1976	LOAEL	0.1	0.1	14 m	7	10	1	
Aroclor-1248	1.5E-02	1.5E-01	c	oral(diet)	mink	reproductive toxicity (75.8% higher neonatal deaths during first week; average body weights significantly lower)	high	ATSDR, 2000; Wren et al.. 1987b	LOAEL	0.15	0.15	6m	7	10	1	Aroclor 1254 used as a surrogate value.
Aroclor-1248	6.8E-02	6.8E-01	c	oral	mouse (oldfield, Peromyscus poliontus)	reduced number of litters, offspring weights and offspring survival	high	Sample etal., 1996: McCoy etal., 1995	LOAEL	0.68	0.68	12 m	7	10	1	Aroclor 1254 used as a surrogate value.
Aroclor-1248	1.1E-01	2.8E-01	c	oral (diet)	chicken	reduction in egg production and hatchability	high	Platanow and Reinhart, 1973; Cecil etal., 1974	NOAEL	0.11056661	0.2764165	39 w	7	1	1	
Aroclor-1016	7.0E-03	2.8E-02	c	oral(diet)	monkey (rhesus)	significantly reduced birth weights; impairment of learning ability	high	IRIS, 2002; Barsotti and van Miller, 1984; Levin etal., 1988; Schantz et al., 1989. 1991	NOAEL	0.007	0.028	22 m	7	1	1	
Aroclor-1016	6.8E-02	6.8E-01	c	oral	mouse (oldfield, Peromyscus poliontus)	reduced number of litters, offspring weights and offspring survival	high	Sample etal.. 1996; McCoy etal., 1995	LOAEL	0.68	0.68	12 m	7	10	1	Aroclor 1254 used as a surrogate value.
Aroclor-1016	4.0E-01	3.8E+00	c	oral (diet)	mink	impaired reproduction and increased maternal and postnatal mortality (reduced birth rate; reduced pup body weight and fewer infants per lactating female)	high	IRIS, 2002; Aulerich and Ringer. 1977; Bleavins etal., 1980	NOAEL	0.4	3.8	39 w	7	1	1	NOAEL and LOAELs derived from separate studies
Aroclor-1016	1.1E+00	1.1E+01	c	oral (diet)	chicken	reduction in egg production and hatchability	high	Stendell. 1975; Platanow and Reinhart, 1973; Cecil etal., 1974	NOAEL	1.10566613		39 w	7'	1	1	Aroclor 1221 used as a surrogate value.

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SUMMARY OF ORAL TOXICITY REFERENCE DOSES FOR WILDLIFE RECEPTORS

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Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[b]	Study Type[a]	Exposure Route	Test Species	Effect	Relevance[c]	Reference	Study Endpoint	Study Result	Reported LOAEL	Exposure Duration[d]	Exposure Regime (# d/w)	EF	UF	Notes
TetracNoroethene	3.6E+01	7.1E+01	sc	oral (gavage-oil)	mouse	severe hepatic necrosis	intermediate	IRIS, 2002; Buben and O'Flaherty. 1985	NOAEL	100	200	6w	5	1	2	Increased liver weights observed at 100 mg/kg-d. Similar nephrophathy observed in a 78-w study using rats and mice (NCI, 1977) at doses in 350-500 mg/kg-d range.
Aroclor, Total	5.0E-03	2.0E-02	c	oral (capsule)	monkey (rhesus)	42% reduced conception rate	high	ATSDR, 2000; Arnold et al., 1995	NOAEL	0.005	0.02	37 m	7	1	1	Aroclor 1254 used as a surrogate value.
Aroclor, Total	1.5E-02	1.5E-01	c	oral (diet)	mink	reproductive toxicity (75.8% higher neonatal deaths during first week; average body weights significantly lower)	high	ATSDR, 2000; Wren et al., 1987b	LOAEL	0.15	0.15	6 m	7	10	1	Aroclor 1254 used as a surrogate value.
Aroclor. Total	6.8E-02	6.8E-01	c	oral	mouse (oldfield. Peromyscus poliontus)	reduced number of litters, offspring weights and offspring survival	high	Sample etal.. 1996; McCoy etal., 1995	LOAEL	0.68	0.68	12m	7	10	1	Aroclor 1254 used as a surrogate value.
Aroclor. Total	1.1E-01	2.8E-01	c	oral (diet)	chicken	reduction in egg production and hatchability	high	Stendell. 1975; Platanow and Reinhart, 1973; Cecil etal.. 1974	NOAEL	0.11	0.28	39 w	7	1	1	Aroclor 1248 used as a surrogate value.
Pyrene	7.5E+01	1.3E+02	sc	oral (gavage - oil)	mouse	mortality, reduced food consumption, body weight loss and other clinical effects (including nephropathy)	low	IRIS. 2002; USEPA, 1989b	NOAEL	75	125	13w	7	1	1	A dose dependent increase in kidney lesions (described as mild/moderate) was observed in female mice. No EF applied due to the low relevance of the effect.
Pyrene	1.8E+02	1.8E+03	sc	oral	mallard	mortality	high	Eisler, 1987; Patton and Dieter. 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Dimethylphthalate	1.1E+00	1.1E+01	c	oral (diet)	ringed dove	10% reduction in egg shell thickness	intermediate	Sample etal.. 1996; Peakall, 1974	NOAEL	1.1		4 w	7	1	1	Di-n-butylphthalate used as a surrogate value
Dimethylphthalate	7.5E+01	3.2E+02	sc	oral	rat	reduced growth and food consumption rates	intermediate	IRIS, 2002; Brown et al., 1978	NOAEL	750	3160	16w	7	1	10	Value for diethylphthalate used as a surrogate.
Dibenzofuran	2.5E+01	2.5E+02	sc	oral (gavage - oil)	mouse	significant reduction in pup weights	intermediate	IRIS, 2002; USEPA. 1989d	NOAEL	125	250	13w	7	5	1	Fluorene used as a surrogate value.
Total Xylenes	1.4E+02	1.4E+03	sa	oral(diet)	Japanese quail	mortality	high	Hill and Camardese. 1986	NOAEL	3389.66752		5d	7	25	1	
Total Xylenes	1.4E+02	1.4E+03	sa	oral (diet)	Japanese quail	mortality	high	Hill and Camardese. 1986	NOAEL	3389.66752		5d	7	25	1	Reagent grade. Concentration converted to a daily dose using estimated body weight and ingestion rate date summarized in

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SUMMARY OF ORAL TOXICITY REFERENCE DOSES FOR WILDLIFE RECEPTORS

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Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[b]	Study Type[c]	Exposure Route	Test Species	Effect	Relevance[d]	Reference	Study End point	Study Result	Reported LOAEL	Exposure Duration[e]	Exposure Regime (# d/w)	EF	UF	Notes
Total Xylenes	1.8E+02	3.6E+02	c	gavage	rat	decreased body weight and increased mortality (males); hyperactivity	high	IRIS. 2002; NTP. 1986	NOAEL	250	500	103 w	5	1	1	Marks et al., 1982 reported significantly reduced fetal weights and increased incidence of fetal malformations during gestation exposures of 2,600 mg/kg-d to dam.
Polychlorinated biphenyls (PCBs)	5.0E-03	2.0E-02	c	oral (capsule)	monkey (rhesus)	42% reduced conception rate	high	ATSDR, 2000; Arnold et al., 1995	NOAEL	0.005	0.02	37 m	7	1	1	Aroclor 1254 used as a surrogate value.
Polychlorinated biphenyls (PCBs)	1.5E-02	1.5E-01	c	oral (diet)	mink	reproductive toxicity (75.8% higher neonatal deaths during first week; average body weights significantly lower)	high	ATSDR. 2000; Wren et al., 1987b	LOAEL	0.15	0.15	6m	7	10	1	Aroclor 1254 used as a surrogate value.
Polychlorinated biphenyls (PCBs)	6.8E-02	6.8E-01	c	oral	mouse (oldfield. Peromyscus polionlus)	reduced number of litters, offspring weights and offspring survival	high	Sample etal., 1996; McCoy etal., 1995	LOAEL	0.68	0.68	12m	7	10	1	Aroclor 1254 used as a surrogate value.
Polychlorinated biphenyls (PCBs)	1.1E-01	2.8E-01	c	oral (diet)	chicken	reduction in egg production and hatchability	high	Stendell. 1975; Platanow and Reinhart, 1973: Cecil et al., 1974	NOAEL	0.11056661	0.2764165	39 w	7	1	1	Aroclor 1248 used as a surrogate value.
sec-Butylbenzene	1.0E+02	2.6E+02	sc	inhalation	rat	significant reduction in body weight gain, decreased food consumption; increased liver weight; no effect on gestational parameters	intermediate	IRIS, 2002; Bushy Run Research Center, 1989a	NOAEL	520	1290	days 6-15 (gestation)	7	1	5	Limited toxicological data available; values for the closely-related branch-chain alkyl benzene, isopropylbenzene (cumene). used as a surrogate.
1,3-Dichloropropane	2.5E+00	1.5E+01	sc	oral (diet)	dog (beagle)	significant decrease in body weight (males)	intermediate	CEPA, 1999; Stott etal.. 1992	NOAEL	2.5	15	1 y	7	1	1	No datum available; values for 1,3-dichloropropena used
1,3-Dichloropropane	1.3E+01	2.5E+01	c	oral	rat	statistical decrease in body weights (both sexes)	intermediate	IRIS, 2002; Stott et al.. 1995	NOAEL	12.5	25	24 m	7	1	1	No data available; values for 1,3 Dichloroprene used as a surrogate.
1,2-Dichloroethene (cis)	3.2E+01	2.9E+02	sc	inhalation	rat	decreased body weight (males)	intermediate	ATSDR, 1996; McCauley et al., 1990	NOAEL	32	290	90 d	7	1	1	
trans-1,2-Dichloroethene	5.2E+03	1.0E+04	c	inhalation	rat	reduction in mean fetal weights in exposed dams	high	ATSDR, 1996; Hurtt et al., 1993	NOAEL	5152.66806	10305.336	days 7-16 (gestation)	7	1	1	
Methyl tert-Butyl Ether	2.2E+02	1.7E+03	c	inhalation	rat	reduced body weights and body weight gains in F1 pups	high	IRIS, 2002; Neeper-Bradley. 1991	NOAEL	224.330318	1684.7095	2g	7	1	1	
2.3,7,8-TCDD	1.0E-06	1.0E-05	c	oral(diet)	rat	significant reduction in fertility and neonatal survival	high	Sample et al., 1996; Murray etal.. 1979	NOAEL	0.000001	0.00001	3g	7	1	1	
2.3,7,8-TCDD	1.4E-05	1.4E-04	c	interperitoneal injection	ring-necked pheasant	significant reduction in egg production and egg hatchability	high	Sample etal.. 1996; Noseketal., 1992	NOAEL	0.000098	0.00098	10w	1 "	1	1	
2.3.7.8-TCDD	1.4E-05	1.4E-04	c	interperitoneal injection (weekly)	ring-necked pheasant	significant reduction in egg xoduction and egg hatchability	high	Sample etal., 1996: Noseketal.. 1992	NOAEL	0.000014	0.00014	10w	7	1	1	

TABLE D-4
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Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[b]	Study Type[a]	Exposure Route	Test Species	Effect	Relevance[c]	Reference	Study End point	Study Result	Reported LOAEL	Exposure Duration[d]	Exposure Regime (# d/w)	EF	UF	Notes
Atrazine	3.5E+00	2.5E+01	c	oral	rat	decreased adult body weight; decreased body weight in F2 male pups	intermediate	IRIS 2002; Ciba Geigy Corp., 1986	NOAEL	3.5	25	2y	7	1	1	
Atrazine	4.0E+01	4.0E+02	a	oral (capsule)	mallard	mortality	high	Hudson etal., 1984	LD_{50}	2000		14 d	7	50	1	Reported as <2,000 mg/kg(bw). Survivors showed weakness, tremors, ataxia and weight loss. Signs of poisoning appeared within one hour post-treatment and persisted for up to 11 days.
Benzo(g,h,i)perylene	1.0E+00	1.0E+01	c	oral (intubation)	mouse	significant reduction in pup weights	intermediate	Sample etal.. 1996; Mackenzie and Angevine, 1981	LOAEL	10	10	days 7-16 (gestation)	7	10	1	Benzo(a)pyrene used as a surrogate value.
Benzo(g,h,i)perylene	1.8E+02	1.8E+03	sc	oral	mallard	mortality	high	Eisler. 1987; Patton and Dieter, 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Dicamba	1.3E-01	6.3E-01	c	oral (diet)	dog	decrease in body weight	intermediate	IRIS, 2002; Velsicol Chemical. 1962a	NOAEL	0.125	0.625	2 y	7	1	1	
Dicamba	3.0E+00	1.0E+01	c	oral	rabbit	reduction in fetal body weights and increased post implantation losses	high	IRIS. 2002; Velsicol Chemical Corporation, 1978	NOAEL	3	10	na	7	1	1	
Dicamba	3.4E+01	3.4E+02	sc	oral(diet)	Japanese quail	mortality	high	Hill etal., 1975	NOAEL	847.416881		5d	7	25	1	Concentration converted to a daily dose using estimated body weight and ingestion rate date summarized in
Dicamba	8.0E+01	8l0E+02	sc	oral	mallard	mortality	high	Pesticide. 2002	LDa, 7	2009		5 d	7	25	1	
Indeno(1.2,3-cd)pyrene	1.0E+00	1.0E+01	c	oral (intubation)	mouse	significant reduction in pup weights	intermediate	Sample etal., 1996; Mackenzie and Angevine. 1981	LOAEL	10	10	days 7-16 (gestation)	7	10	1	Benzo(a)pyrene used as a surrogate value.
Indeno(1,2,3-cd)pyrene	1.8E+02	1.8E*03	sc	oral	mallard	mortality	high	Eisler. 1987; Patton and Dieter, 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Perylene	1.0E+00	1.0E+01	c	oral (intubation)	mouse	significant reduction in pup weights	intermediate	Sample etal., 1996; Mackenzie and Angevine, 1981	LOAEL	10	10	days 7-16 (gestation)	7	10	1	Benzo(a)pyrene used as a surrogate value.
Benzo(b)fluoranthene	1.0E+00	1.0E+01	c	oral (intubation)	mouse	significant reduction in pup weights	intermediate	Sample et al., 1996; Mackenzie and Angevine. 1981	LOAEL	10	10	days 7 -16 (gestation)	7	10	1	Benzo(a)pyrene used as a surrogate value.
Benzo(b)fluoranthene	1.8E+02	1.8E+03	sc	oral	mallard	mortality	high	Eisler. 1987; Patton and Dieter, 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene

TABLC; D-4

SUMMARY OF ORAL TOXICITY REFERENCE DOSES FOR WILDLIFE RECEPTORS

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Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[a]	Study Type[b]	Exposure Route	Test Species	Effect	Relevance[5]	Reference	Study End point	Study Result	Reported LOAEL	Exposure Duration[d]	Exposure Regime (# d/w)	EF	UF	Notes
Fluoranthene	1.3E+02	2.5E+02	sc	oral (gavage)	mouse	nephropathy, increased liver weights; hematological alterations	low	IRIS, 2002; USEPA, 1988	NOAEL	125	250	13w	7	1	1	No EF applied due to the low relevance of the effect
Fluoranthene	1.8E+02	1.8E+03	sc	oral	mallard	mortality	high	Eisler, 1987; Patton and Dieter, 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Benzo(k)fluoranthene	1.0E+00	1.0E+01	c	oral (intubation)	mouse	significant reduction in pup weights	intermediate	Sample etal., 1996: Mackenzie and Angevine, 1981	LOAEL	10	10	days 7-16 (gestation)	7	10	1	Benzo(a)pyrene used as a surrogate value.
Benzo(k)fluoranthene	1.8E+02	1.8E+03	sc	oral	mallard	mortality	high	Eisler. 1987; Patton and Dieter, 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Acenaphthylene	3.5E+01	3.5E+02	sc	oral (gavage)	mouse	decreased ovary weights; decreased ovarian and uterine activity including smaller and fewer corpora lutea; increased liver weights and cholesterol levels	intermediate	IRIS. 2002; USEPA. 1989c	NOAEL	175	350	90 d	7	5	1	Acenaphthene used as a surrogate value.
Acenaphthylene	1.8E+02	1.8E+03	sc	oral	mallard	mortality	high	Eisler, 1987; Patton and Dieter, 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Chrysene	1.0E+00	1.0E+01	c	oral (intubation)	mouse	significant reduction in pup weights	intermediate	Sample etal., 1996; Mackenzie and Angevine, 1981	LOAEL	10	10	days 7-16 (gestation)	7	10	1	Benzo(a)pyrene used as a surrogate value.
Chrysene	1.8E+02	1.8E+03	sc	oral	mallard	mortality	high	Eisler. 1987; Patton and Dieter, 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene S
Mercury (methyl)	6.4E-03	6.4E-02	c	oral(diet)	mallard	significant reduction in egg production and number of offspring	high	Sample etal., 1996; Heinz, 1979	LOAEL	0.064	0.064	3g	7	10	1	Methyl mercury dicyandiamide
Mercury (methyl)	1.5E-02	2.5E-02	c	oral(diet)	mink	significantly increased mortality, weight loss, and behavioral abnormalities (including ataxia)	high	Sample etal.. 1996; Wobeser et al., 1976	NOAEL	0.15	0.247	93 d	7	1	10	Methyl mercuric chloride
Mercury (methyl)	3.2E-02	1.6E-01	c	oral(diet)	rat	decreased pup viability	high	Sample etal.. 1996; Vershuurenetal., 1976	NOAEL	0.032	0.16	3g	7	1	1	Methyl mercury chloride
Aldrin	1.5E-02	1.5E-01	c	oral (diet)	dog	increased mortality in offspring	high	ATSDR, 2000; IDeichmann et al., 1971	LOAEL	0.15	0.15	14 m	7	10	1	Small number of animals tested accounts for low study reliability; however, 0.2 mg/kg-d exposures for 1 year also resulted in poor litter suvival (Kitselman, 1953)
Aldrin	1.3E-01	1.3E+00	a	oral (capsule)	bobwhite	mortality	high	Hudson etal.. 1970	LD50	6.59		14 d	7	50	1	

TABLE D-4
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Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[b]	Study Type[a]	Exposure Route	Test Species	Effect	Relevance[c]	Reference	Study End point	Study Result	Reported LOAEL	Exposure Duration[d]	Exposure Regime (# d/w)	EF	UF	Notes
Aldrin	2.0E-01	1.0E+00	c	oral(diet)	rat	significant reduction in number of litters and offspring survival	high	Sample etal., 1996; Treon and Cleveland, 1955	NOAEL	0.2	1	3g	7	1	1	
Aldrin	5.8E-01	5.8E+00	a	oral (capsule)	fulvous whistling-duck	mortality	high	Hudson etal., 1984	LD_M	29.2		14 d	7	50	1	
alpha-BHC	1.4E-02	1.4E-01	c	oral (diet)	mink	kit mortality and reduced kit body weight	high	Sample etal., 1996; Bleavinsetal., 1984	LOAEL	0.137	0.137	331 d	7	10	1	BHC mixed isomers
alpha-BHC	5.6E-01	2.3E+00	c	oral(diet)	Japanese quail	reduced egg hatchability, egg volume	high	Sample etal., 1996; Vos et al., 1971	NOAEL	0.56	2.3	90 d	7	1	1	Based on BHC mixed isomers
alpha-BHC	1.6E+00	3.2E+00	c	oral (diet)	rat	reduced pup birthweights	intermediate	Sample etal., 1996; Grant etal., 1977	NOAEL	1.6	3.2	4g	7	1	1	BHC mixed isomers
beta-BHC	1.4E-02	1.4E-01	c	oral(diet)	mink	kit mortality and reduced kit body weight	high	Sample etal., 1996; Bleavinsetal., 1984	LOAEL	0.137	0.137	331 d	7	10	1	BHC mixed isomers
beta-BHC	5.6E-01	2.3E+00	c	oral (diet)	Japanese quail	reduced egg hatchability, egg volume	high	Sample etal., 1996; Vos etal., 1971	NOAEL	0.56	2.3	90 d	7	1	1	Based on BHC mixed isomers
beta-BHC	1.6Et00	3.2E+00	c	oral(diet)	rat	reduced pup birthweights	intermediate	Sample etal., 1996; Grant etal., 1977	NOAEL	1.6	3.2	4g	7	1	1	BHC mixed isomers
delta-BHC	1.4E-02	1.4E-01	c	oral(diet)	mink	kit mortality and reduced kit body weight	high	Sample etal., 1996; Bleavins et al., 1984	LOAEL	0.137	0.137	331 d	7	10	1	BHC mixed isomers
delta-BHC	5.6E-01	2.3E+00	c	oral (diet)	Japanese quail	reduced egg hatchability, egg volume	high	Sample etal., 1996; Vos etal., 1971	NOAEL	0.56	2.3	90 d	7	1	1	Based on BHC mixed isomers
delta-BHC	1.6E+00	3.2E+00	c	oral(diet)	rat	reduced pup birthweights	intermediate	Sample etal., 1996; Grant etal., 1977	NOAEL	1.6	3.2	4g	7	1	1	BHC mixed isomers
Endosulfan II	5.7E-01	1.9E+00	c	oral(diet)	dog (beagle)	significantly decreased weight gain and severe nervous symptoms (e.g., loss of righting response)	high	IRIS, 2002; Hoechst Celanese Corp., 1989b	NOAEL	0.57	1.9	1 y	7	1	1	
Endosulfan II	6.2E-01	6.2E+00	a	oral (diet)	mallard	mortality	high	Hudson etal., 1984	LD_{50}	31.2		14d	7	50	1	
Endosulfan II	8.4E-01	2.5E+00	c	oral(diet)	mouse	sigificantly decreased survival and body weight gain in high dose females and males. respectively.	high	IRIS, 2002; Hoechst Celanese Corp., 1988	NOAEL	0.84	2.51	2y	7	1	1	Endosulfan II is known to be approximately 3 times less toxic than Endosulfan I or Endosulfan sulfate (ATSDR, 2000)
Endosulfan II	1.6E+00	1.6E+01	a	oral (diet)	ring-necked pheasant	mortality	high	Hudson etal., 1970	LD50	80		14 d	7	50	1	
Aroclor-1262	5.0E-03	2.0E-02	c	oral (capsule)	monkey (rhesus)	42% reduced conception rate	high	ATSDR, 2000; Arnold et al., 1995	NOAEL	0.005	0.02	37 m	7	1	1	Aroclor 1254 used as a surrogate value.
Aroclor-1262	1.5E-02	1.5E-01	c	oral (diet)	mink	reproductive toxicity (75.8% higher neonatal deaths during 1st week; average body weights significantly lower)	high	ATSDR, 2000; Wren et al., 1987b	LOAEL	0.15	0.15	6 m	7	10	1	Aroclor 1254 used as a surrogate value.

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SUMMARY OF ORAL TOXICITY REFERENCE DOSES FOR WILDLIFE RECEPTORS

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Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[b]	Study Type[a]	Exposure Route	Test Species	Effect	Relevance[c]	Reference	Study End point	Study Result	Reported LOAEL	Exposure Duration[d]	Exposure Regime (# d/w)	EF	UF	Notes
Aroclor-1262	6.8E-02	6.8E-01	c	oral	mouse (oldfield. Peromyscus poliontus)	reduced number of litters, offspring weights and offspring survival	high	Sample etal., 1996; McCoy etal., 1995	LOAEL	0.68	0.68	12 m	7	10	1	Aroclor 1254 used as a surrogate value.
Aroclor-1262	1.1E+00	1.1E+01	c	oral(diet)	chicken	reduction in egg production and hatchability	high	Stendell, 1975; Platanow and Reinhart, 1973; Cecil etal., 1974	NOAEL	1.1		39 w	7	1	1	Aroclor 1268 used as a surrogate value.
Aroclor-1262	1.1E+00	1.1E+01	c	oral (diet)	chicken	reduction in egg production and hatchability	high	Stendell, 1975; Platanow and Reinhart, 1973; Cecil etal.. 1974	NOAEL	1.10566613		39 w	7	1	1	Aroclor 1268 used as a surrogate value.
4,4'-DDT	2.8E-03	2.8E-02	c	oral (diet)	brown pelican	fledgling rate inadequate to maintain stable population (by 30%)	high	Sample etal.. 1996; Anderson et al., 1975	LOAEL	0.028	0.028	5y	7	10	1	Species known to be particularly sensitive to DDT exposure
4,4'-DDT	1.4E-02	1.4E-01	c	oral(diet)	barn owl	reduced eggshell thickness	high	Longcore and Stendell, 1977	LOAEL	0.14	0.14	2y	7	10	1	
4,4'-DDT	8.0E-01	4.0E+00	o	oral	rat	decrease in number of offspring produced	high	Sample etal., 1996; Fitzhugh. 1948	NOAEL	0.8	4	2y	7	1	1	
Benzo(a)pyrene	1.0E+00	1.0E+01	c	oral (intubation)	mouse	significant reduction in pup weights	intermediate	Sample etal., 1996; Mackenzie and Angevine, 1981	LOAEL	10	10	days 7-16 (gestation)	7	10	1	Benzo(a)pyrene exposure of 160 mg/kg-d significantly reduced pregnancy rates and percentage of viable offspring; total sterility was observed in 97% of offspring at 40 mg/kg-d.
Benzo(a)pyr9ne	1.8E+02	1.8E+03	sc	oral	mallard	mortality	high	Eisler, 1987; Patton and Dieter, 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
alpha-Chlordane	2.8E-01	2.8E+00	a	oral (capsule)	California quail	mortality	high	Hudson etal., 1970	LD50	14.1		14 d	7	50	1	
alpha-Chlordane	4.6E+00	9.2E+00	c	oral(diet)	mouse	decreased viability and reduced abundance of offspring (4rth and 5th generations)	high	Sample etal., 1996; Keplinger, et al., 1968	NOAEL	4.58	9.16	6g	7	1	1	
alpha-Chlordane	2.4E+01	2.4E+02	a	oral (capsule)	mallard	mortality	high	Hudson etal., 1984	LD_M	1200		14 d	7	50	1	
gamma-Chlordane	2.8E-01	2.8E+00	a	oral (capsule)	California quail	mortality	high	Hudson etal., 1970	LD50	14.1		14 d	7	50	1	
gamma-Chlordane	4.6E+00	9.2E+00	c	oral (diet)	mouse	decreased viability and reduced abundance of offspring (4rth and 5th generations)	high	Sample etal., 1996; Keplinger, etal., 1968	NOAEL	4.58	9.16	6g	7	1	1	
gamma-Chlordane	2.4E+01	2.4E+02	a	oral (capsule)	mallard	mortality	high	Hudson etal., 1984	LD_M	1200		14 d	7	50	1	
2,4-Dinitrophenol	1.2E+00	2.2E+00	a	oral (gavage - oil)	chicken	cataract formation	Intermediate	ATSDR, 1995a; Buschke, 1947	NOAEL	6	11	single dose	7	1	5	A five-fold UF was applied due to the sensitive nature of the toxicological response
2.4-Dinitrophenol	2.0E+01	3.0E+01	c	oral(diet)	rat	25% decrease in body weight gain	intermediate	ATSDR, 1995; Tainter, 1938	NOAEL	20	30	lifetime	7	1	1	

TABLE D-4
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Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[b]	Study Type[b]	Exposure Route	Test Species	Effect	Relevance[b]	Reference	Study Endpoint	Study Result	Reported LOAEL	Exposure Duration[b]	Exposure Regime (# d/w)	EF	UF	Notes
4,6-Dinitro-o-cresol	6.0E-02	6.0E-01	sc	oral (gavage - water)	mouse	100% mortality	high	ATSDR, 1995; Arustamyan, 1972	LOAEL	3	3	32 d	7	10	5	A five-fold UF to convert to a chronic threshold was considered appropriate because the reported value is uncharactistically low
4,6-Dinitro-o-cresol	1.4E-01	1.4E+00	sa	oral (gavage)	pheasant	mortality	high	WHO, 2000; Janda, 1970	LD50	7.1		3d	7	10	5	
4,6-Dinitro-o-cresol	3.0E-01	3.0E+00	a	oral (capsule)	Japanese quail	mortality	high	WHO. 2000; Dickhaus and Heisler, 1980	LD50	14.8		1 d	7	10	5	
4,6-Dinitro-o-cresol	4.5E-01	4.5E+00	a	oral (capsule)	mallard	mortality	high	Hudson et al., 1984	LD_M	22.7		14 d	7	50	1	
Aroclor-1242	5.0E-03	2.0E-02	c	oral (capsule)	monkey (rhesus)	42% reduced conception rate	high	ATSDR, 2000; Arnold et al., 1995	NOAEL	0.005	0.02	37 m	7	1	1	Aroclor 1254 used as a surrogate value.
Aroclor-1242	6.8E-02	6.8E-01	c	oral	mouse (oldfield. Peromyscus poliontus)	reduced number of litters. offspring weights and offspring survival	high	Sample et al., 1996; McCoy et al.. 1995	LOAEL	0.68	0.68	12m	7	10	1	Aroclor 1254 used as a surrogate value.
Aroclor-1242	6.9E-02	6.9E-01	c	oral (diet)	mink	total reproductive failure	high	Sample et al.. 1996; Bleavinsetal., 1980	LOAEL	0.685	0.685	7m	7	10	1	
Aroclor-1242	4.1E-01	4.1E+00	c	oral (diet)	screech owl	no effect on fertility, hatchling success	high	Sample et al., 1996; McLane and Hughes, 1980	NOAEL	0.41		29	7	1	1	
Endrin ketone	2.5E-02	5.0E-02	c	oral (diet)	dog (beagle)	convulsions	intermediate	ATSDR, 1996; Kettering, 1969	NOAEL	0.025	0.05	2y	7	1	1	Endrin used as a surrogate value.
Endrin ketone	5.0E-02	3.0E-01	c	oral (diet)	mallard	embryo survival decreased by 9.6%	high	ATSDR. 1996; Roylance et al., 1985.	NOAEL	0.05	0.30	ns	7	1	1	Value for endrin used as a surrogate.
Endrin ketone	6.5E-02	6.5E-01	c	oral (diet)	mouse	significant reproductive effects including reduced parental survival, litter size)	high	ATSDR, 1996; Good and Ware, 1969	LOAEL	0.65	0.65	120 d	7	10	1	Endrin used as a surrogate value.
Endrin ketone	1.0E-01	1.0E-01	c	oral (diet)	screech owl	significant reduction in egg production and hatchling success	high	Sample et al., 1996; Fleming et al.. 1982	LOAEL	0.1035	0.1035	83 d	7	1	1	Endrin used as a surrogate value.
Dibenzo(a.h)anthracene	1.0E*00	1.0E-01	c	oral (intubation)	mouse	significant reduction in pup weights	intermediate	Sample et al., 1996; Mackenzie and Angevine. 1981	LOAEL	10	10	days 7-16 (gestation)	7	10	1	Benzo(a)pyrene used as a surrogate value.
Dibenzo(a.h)anthracene	1.8E+02	1.8E+03	sc	oral	mallard	mortality	high	Eisler, 1987; Pattonand Dieter, 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
1,3-Dichlorobenzene	2.1E+01	4.3E+01	c	oral (gavage - oil)	rat	significantly increased mortality (males); increased severity of nephrophathy	high	ATSDR, 1998; NTP, 1987	NOAEL	150	300	2y	5	1	1	No data available; values for 1,4-dichlorobenzene used as a surrogate

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Chemical Name	Toxicity Reference Dose NOAEL"	Toxicity Reference Dose LOAEL"	Study Type"	Exposure Route	Test Species	Effect	Relevance'	Reference	Study End point	Study Result	Reported LOAEL	Exposure Duration[11]	Exposure Regime (# d/w)	EF	UF	Notes
Carbon tetraohloride	1.1E+01	1.1E+02	c	oral	rat	reproductive parameters (% conception, w/ litters, mean litter size, mean body weight of F1s); serum enzyme levels; hepatic fat content	high	ATSDR, 1994; Alumot etal., 1976	NOAEL	11		2y	7	1	1	Selected over gavage studies with lower NOAELs; see ATSDR. 1994
1,1 -Dichloropropene	2.5E+00	1.5E+01	sc	oral (diet)	dog (beagle)	significant decrease in body weight (males)	intermediate	CEPA, 1999; Stottetal., 1992	NOAEL	2.5	15	iy	7	1	1	No datum available; values for 1,3-dichloropropene used
1,1 -Dichloropropene	1.3E+01	2.5E+01	c	oral	rat	statistical decrease in body weights (both sexes)	intermediate	IRIS, 2002; Stott et al.. 1995	NOAEL	12.5	25	24 m	7	1	1	No data available; values for 1,3 Dichloroprene used as a surrogate,
Benzo(a)anthracene	1.0E+00	1.0E+01	c	oral (intubation)	mouse	significant reduction in pup weights	intermediate	Sample etal.. 1996; Mackenzie and Angevine, 1981	LOAEL	10	10	days 7-16 (gestation)	7	10	1	Benzo(a)pyrene used as a surrogate value.
Benzo(a)anthracene	1.8E+02	1.8E+03	sc	oral	mallard	mortality	high	Eisler, 1987; Pattonand Dieter, 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Cyanide	2.1E-01	2.1E+00	a	oral	American kestrel	mortality	high	Eisler, 1991; Wiemeyer et al., 1986	LD50	2.12		single dose	7	10	1	no EF applied because cyanide does not pose a chronic hazard
Cyanide	4.5E-01	4.5E+00	a	oral(diet)	Japanese quail	mortality	high	Eisler. 1991; Wiemeyer etal., 1986	LD50	4.5		single dose	7	10	1	No EF applied because cyanide is not considered to pose a chronic hazard to wildlife
Cyanide	4.8E-01	4.8E+00	c	oral(diet)	dog	mortality	high	Eisler, 1991: EPA, 1980	LD50	24		single dose	7	10	5	No EF applied because cyanide is not considered to pose a chronic hazard to wildlife
Cyanide	5.3E-01	1.1E+00	a	oral(diet)	mallard	mortality (about 6% dead)	high	Eisler. 1991: Hill, personal communication	NOAEL	0.53	1.1	single dose	7	1	1	LDM reported of 1.43 mg CN/kg (bw); no EF applied 'aecause cyanide does not 3ose a chronic hazard
Cyanide	1.2E+00	5.1E+01	c	oral	rat	significant reduction in offspring growth and food consumption	intermediate	ATSDR, 1997; Tewe and Maner, 1981a	NOAEL	1.2	s1 -	days 1-16 (gestation) + 21 days	7	1	1	Potassium cyanide; LD50 values for rats range from 4-20 mg/kg-d (ATSDR, 1991).
Technical Chlordane	2.8E-01	2.8E+00	a	oral (capsule)	California quail	mortality	high	Hudson etal.. 1970	LD50	14.1		14 d	7	50	1	
Technical Chlordane	4.6E+00	9.2E+00	c	oral(diet)	mouse	decreased viability and reduced abundance of offspring (4rth and 5th generations)	high	Sample etal., 1996; Keplinger, etal., 1968	NOAEL	4.58	9.16	eg	7	1	1	
Technical Chlordane'	"2.4E+01"	2.4E+02"	a	oral (capsule)	mallard	mortality	high	Hudson etal., 1984	LDJO	"""12OO"...		.....14 d"	7	~50"		
2,6-Dimethylnaphthalene	3.0E+01	3.0E+02	c	oral (gavage - oil)	mouse	increased mortality and reduced body weight gain in dams and a reduced number of live young at birth	high	ATSDR, 1995: Pflastereretal.. 1985	LOAEL	300	300	days(7-14) gestation	7	10	1	Naphthalene used as a surrogate value.

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Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[b]	Study Type[a]	Exposure Route	Test Species	Effect	Relevance[c]	Reference	Study Endpoint	Study Result	Reported LOAEL	Exposure Duration[a]	Exposure Regime (# d/w)	EF	UF	Notes
gamma-BHC	1.4E-02	1.4E-01	c	oral (diet)	mink	kit mortality and reduced kit body weight	high	Sample etal., 1996; Bleavins et al.. 1984	LOAEL	0.137	0.137	331 d	7	10	1	BHC mixed isomers
gamma-BHC	1.6E+00	3.2E+00	c	oral(diet)	rat	reduced pup birthweights	intermediate	Sample etal., 1996; Grant etal., 1977	NOAEL	1.6	3.2	4g	7	1	1	BHC mixed isomers
gamma-BHC	2.0E+00	2.0E+01	c	oral (intubation)	mallard duck	reduced eggshell thickness and egg production; longer interval between egg laying	high	Sample etal., 1996; Chakravarty and Lahiri, 1986; Chakravarty et al., 1986	NOAEL	2	20	8 w	7	1	1	
2-Hexanone	1.0E+01	1.0E+02	sc	gavage	chicken	ataxia	intermediate	*ATSDR, 1992; Abou-*Doniaetal., 1982.	LOAEL	100	100	90 d	7	10	1	
2-Hexanona	2.0E+01	1.0E+02	sc	gavage	chicken	ataxia	intermediate	ATSDR, 1992: Abou-Doniaetal., 1982.	LOAEL	100	100	90 d	7	5	1	Similar LOAEL established for inhalation exposures for lethal effects
2-Hexanone	4.3E+01	4.3E+02	sc	oral (gavage)	rat	significant weight loss	intermediate	ATSDR. 1992; Krasavageetal., 1980	LOAEL	600	600	90 d	5	10	1	Effect considered less serious
4-Chloro-3-methylphenol	4.0E+00	4.0E+01	sc	oral	rat	weight loss or decreased weight gain	intermediate	RTECS, 2002; BECTA6. 1986	LOAEL	400	400	28 d	7	10	10	lowest published toxic dose (11.200 mg/kg/28 days) adjusted to a daily dose
Dieldrin	1.5E-02	1.5E-01	c	oral (diet)	dog	increased mortality in offspring	high	ATSDR, 2000; Deichmannetal., 1971	LOAEL	0.15	0.15	14 m	7	10	1	Aldrin used as a surrogate value
Dieldrin	2.8E-02	2.8E-01	c	oral(diet)	rat	decreased numbers of litters; increased mortality of offspring	high	ATSDR, 2000; Treon and Cleveland, 1954a	LOAEL	0.275	0.275	3 g	7	10	1	
Dieldrin	7.7E-02	7.7E-01	c	oral(diet)	barn owl	slight but significant reduction in eggshell thickness; however, no significant effect on # eggs laid or hatched/pair, % eggs broken, embryo or nestling mortality	high	Sample et al., 1996; Mendenhall et al., 1983	NOAEL	0.077		2y	7	1	1	
Dieldrin	1.8E-01	1.8E+00	a	oral (capsule)	California quail	mortality	high	Hudson etal., 1970	LD50	8.78		14 d	7	50	1	
Dieldrin	7.6E+00*	7.6E+01	a	oral (capsule)	mallard	mortality	high	Hudson etal., 1984	LD50	381		14 d	7	50	1	
2,6-Dinitrotoluene	4.0E-01	2.0E+00	sc	oral (capsule)	dog (beagle)	testicular degeneration	intermediate	ATSDR, 1998; Lee et al., 1976	NOAEL	4	20	13w	7	1	10	See 2,4-dinitrotoluene for comparison
2,6-Dinitrotoluene	1.4E+00	7.0E+00	sc	oral	rat	decreased spermatogenesis: degeneration of testes	intermediate	ATSDR, 1998; Lee et al., 1976	NOAEL	7	35	13w	7	1	5	See 2,4-dinitrotoluene for comparison
N-Nitroso-di-n-propylamine	7.3E-02	7.3E-01	sc	oral (water)	rat	decreased longevity due to tumor development	high	ATSDR, 1989; Lijinsky and Taylor. 1979	LOAEL	5.1	5.1	30 w	5	10	5	
1,1,1,2-Tetrachloroethane	8.9E+01	1.8E+02	c	oral (gavage)	rat	reduction in survival (males only)	high	IRIS. 2002; NTP. 1983	NOAEL	125	250	103 w	5	1	1	
3+4-Methylphenols	5.0E-01	5.0E+00	a	gavage	rabbit	difficulty breathing	high	ATSDR. 1992; BRRC, 1988b	NOAEL	5	50	days 6- 18 (gestation)	7	1	10	Value for 4-methylphenol cresol used.
3+4-Methylphenols	2.5E+01	1.1E+02	sc	oral(diet)	mink	decreased body weight gain	intermediate	ATSDR. 1992; Hornshawet al., 1986	NOAEL	25	105	6 m	7	1	1	Value for 2-methylphenol (0-cresot) used as a surrogate
3+4-Methylphenols	1.4E+02	1.4E+03	sa	oral (diet)	Japanese quail	mortality	high	Hill and Camardese, 1986	NOAEL	3389.66752		5d	7	25	1	Total xylene value used as a surrogate

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Chemical Name	Toxicity Reference Dose NOAEL*	Toxicity Referenc eDose LOAEL"	Study Type"	Exposure Route	Test Species	Effect	Relevance[0]	Reference	Study End point	Study Result	Reported LOAEL	Exposure Duration"[l]	Exposure Regime (# d/w)	EF	UF	Notes
Benzoic acid	5.0E+01	7.5E+02	c	oral	rat	decreased food consumption and body weights	intermediate	IRIS, 2002: Marguardt. 1960	NOAEL	50	750	na	7	1	1	
Acetone	5.0E+01	2.5E+02	sc	oral (gavage-water	rat	increased severity of age-relatec nephropathy (males)	intermediate	ATSDR. 1994; American Biogenics Corp., 1986	NOAEL	100	500	90 d	7	1	2	No hepatic/renal effects observed in a 13-w drinking water study w/ mice exposed to 11,298 mg/kg-d (NTP, 1991)
Acetone	1.7E+03	1.7E+04	sa	oral (diet)	ring-necked pheasant	mortality	high	Hill etal., 1975	NOAEL	42137.0212		5d	7	25	1	Concentration converted to a daily dose using estimated body weight and ingestion rate date summarized in
Acetone	4.2E+03	4.2E+04	sa	oral(diet)	ring-necked pheasant	mortality	high	Hill etal., 1975	NOAEL	42137.0212		5d	7	10	1	
Chloroform	3.0E+01	3.0E+02	c	oral (capsule)	dog (beagle)	survival	high	IRIS. 2002; Heywood et al., 1979	NOAEL	30		7.5 y	7	1	1	Increase in size and number of fatty cysts in livers were noted in both 15 and 30 mg/kg d treatments; however, this effect is not considered ecologically relevant
Chloroform	5.0E+01	1.3E+02	c	oral (gavage-oil)	rat	significant reduction in fetal weight	intermediate	IRIS, 2002; Thompson etal., 1974	NOAEL	50	126	days (6-18) gestation	7	1	1	Maternal toxicity (decreased weight gain) observed at 50 mg/kg-d
Hexachloroethane	1.7E+02	5.0E+02	o	oral (gavage - oil)	rat	increased late-stage fetal resorptions; 20-25% decrease in fetal body weights	high	ATSDR, 1997; Shimuzu etal., 1992	NOAEL	167	500	days 7-17 (gestation)	7	1	1	Males more sensitive to renal/hepatic effects (LOAEL - 20 mg/kg-d)
4-Chlorophenyl-phenylether	1.0E+02	1.0E+03	c	oral (gavage)	mouse	embryotoxicity; developmental effects	high	INCHEM 1994; Francis, 1989	NOAEL	1000		days 5-14 (gestation)	7	10	1	No data available; values for 4 bromophenylphenyletner used as a surrogate
Benzene	2.6E+01	2.6E+02	c	gavage	mouse	significantly increased embryonic resorption and reduced fetal weights	high	Sample et al., 1996; Nawrot and Staples, 1979	LOAEL	263.6	263.6	days 6-12 (gestation)	7	10	1	
1,1,1-Trichloroethane	5.4E+01	5.4E+02	c	gavage	rat	significant reduction in survival (50%) and body weight gain	high	ATSDR, 1995; NCI, 1977	LOAEL	750	750	78 w	5	10	1	
Endrin	2.5E-02	5.0E-02	c	oral (diet)	dog (beagle)	convulsions	intermediate	ATSDR. 1996; Kettering, 1969	NOAEL	0.025	0.05	2y	7	1	1	Exposure to slightly higher dose (0.20-0.27 mg/kg-d) resulted in convulsions, tremors and death after 47 days (ATSDR, 1996)
Endrin	5.0E-02	3.0E-01	c	oral (diet)	mallard	embryo survival decreased by 9.6%	high	ATSDR, 1996; Roylance etal., 1985.	NOAEL-	0.05	0.30	ns	7	1	1	8-d LD50 value for 12 month mallard ducks is 5.64 mg/kg-d (Hudson et al., 1984)
Endrin	6.5E-02	6.5E-01	c	oral (diet)	mouse	significant reproductive effects including reduced parental survival, litter size)	high	ATSDR, 1996; Good and Ware, 1969	LOAEL	0.65	0.65	120 d	7	10	1	

TABLE D-4
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Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Referenc eDose LOAEL[b]	Study Type[a]	Exposure Route	Test Species	Effect	Relevance[c]	Reference	Study End point	Study Result	Reported LOAEL	Exposure Duration[11]	Exposure Regime (# d/w)	EF	UF	Notes
Endrin	1.0E-01	1.0E-01	c	oral(diet)	screech owl	significant reduction in egg production and hatchling success	high	Sample etal.. 1996; Fleming etal., 1982	LOAEL	0.1035	0.1035	83 d	7	1	1	
Methoxychlor	5.0E-+00	3.6E+01	c	oral (gavage)	rabbit	increased frequency of abortions and late resorptions; 10-12% decreased fetal body weight and percentage of male fetuses	high	ATSDR, 2000; IRIS, 2002; Kincaid Enterprises, 1986	NOAEL	5.01	35.5	days (7-19) gestation	7	1	1	
Methoxychlor	8.0E+01	8.0E+02	a	oral (capsule)	mallard	mortality	high	Hudson etal.. 1984	LDaj	2000		14 d	7	25	1	Reported as <2,000 mg/kg(bw)
4,4'-DDD	2.8E-03	2.8E-02	c	oral(diet)	brown pelican	fledgling rate inadequate to maintain stable population (by 30%)	high	Sample etal.. 1996; Anderson et al., 1975	LOAEL	0.028	0.028	5y	7	10	1	DDT used as a surrogate value.
4.4'-DDD	1.4E-02	1.4E-01	c	oral (diet)	barn owl	reduced eggshell thickness	high	Longcore and Stendell. 1977	LOAEL	0.14	0.14	2y	7	10	1	DDT used as a surrogate value.
4,4'-DDD	8.0E-01	4.0E+00	c	oral	rat	decrease in number of offspring produced	high	Sample et al., 1996; Fitzhugh, 1948	NOAEL	0.8	4	2y	7	1	1	DDT used as a surrogate value.
4,4'-DDE	2.8E-03	2.8E-02	c	oral(diet)	brown pelican	fledgling rate inadequate to maintain stable population (by 30%)	high	Sample etal., 1996; Anderson etal., 1975	LOAEL	0.028	0.028	5y	7	10	1	DDT used as a surrogate value.
4.4'-DDE	1.4E-02	1.4E-01	c	oral(diet)	barn owl	reduced eggshell thickness	high	Longcore and Stendell, 1977	LOAEL	0.14	0.14	2y	7	10	1	DDT used as a surrogate value.
4,4'-DDE	8.0E-01	4.0E+00	c	oral	rat	decrease in number of offspring produced	high	Sample etal.. 1996: Fitzhugh, 1948	NOAEL	0.8	4	2 y	7	1	1	DDT used as a surrogate value.
Endrin aldehyde	1.0E-02	1.0E-01	c	oral(diet)	screech owl	significant reduction in egg production and hatchling success	high	Sample etal., 1996; Fleming etal., 1982	LOAEL	0.1035	0.1035	83 d	7	10	1	Endrin used as a surrogate value
Endrin aldehyde	2.5E-02	5.0E-02	c	oral(diet)	dog (beagle)	convulsions	intermediate	ATSDR, 1996; Kettering, 1969	NOAEL	0.025	0.05	2y	7	1	1	Endrin used as a surrogate value.
Endrin aldehyde	5.0E-02	3.0E-01	c	oral (diet)	mallard	embryo survival decreased by 9.6%	high	ATSDR, 1996; Roylance etal.. 1985.	NOAEL	0.05	0.30	ns	7	1	1	Endrin used as a surrogate value.
Endrin aldehyde	6.5E-02	6.5E-01	c	oral (diet)	mouse	significant reproductive effects including reduced parental survival, litter size)	high	ATSDR, 1996; Good and Ware, 1969	LOAEL	0.65	0.65	120 d	7	10	1	Endrin used as a surrogate value.
Aluminum	1.9E+00	1.9E+01	c	oral (water)	mouse	no effect on number of litters or number of offspring/litter, however, growth in second and third generations was reduced	intermediate	Sample etal., 1996; Ondreicka etal., 1977	LOAEL	19.3	19.3	3g	7	10	1	Aluminum chloride; food consumption not reported so significance of reduced body weight unclear.
Aluminum	1.1E+02	1.1E+03	c	oral(diet)	ringed dove	reproduction	high	Sample etal.. 1996; Carriereetal., 1986	NOAEL	109.7		4 m	7	1	1	
Lead	1.1E+00	1.1E+01	c	oral (diet)	Japanese quail	significant reduction in egg hatching success	high	Sample etal., 1996; Edens etal.. 1976	NOAEL	1.1	11.3	12w	7	1	1	Lead acetate

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Lead	3.9E+00	3.9E+01	c	oral(diet)	kestrel	no significant reproductive effects observed	high	Sample etal., 1996; Pattee, 1984	NOAEL	3.9		7m	7	1	1	Metallic lead
Lead	1.3E+02	3.8E+02	c	oral (water)	rat	28% rate of stillbirth compared to 4% controls	high	ATSDR, 1999;Roniset al., 1998b, 1998c	NOAEL	126	377	days (5-21) gestation; days(21 - 85) post natal	7	1	1	Lead acetate; reduced birth weights reported at lower dose were not considered as ecologically relevant
Manganese	8.8E+01	2.8E+02	c	oral(diet)	rat	significant reduction in pregnancy percentage and fertility	high	Sample etal.. 1996; Laskeyetal., 1982	NOAEL	88	284	224 d	7	1	1	Manganese oxide
Manganese	9.8E+02	9.8E+03	c	oral (diet)	Japanese quail	no reduction In growth although aggressive behavior reduced by 25% to 50% relative to controls	low	Sample etal.. 1996; Laskey and Edens, 1985	NOAEL	977		75 d	7	1	1	
Mercury	2.6E-01	2.6E+00	c	oral (gavage)	rat	significantly increased mortality	high	IRIS, 2002: NTP, 1993	LOAEL	3.7	3.7	2y	5	10	1	Mercuric chloride; survival in dosed male rats were 10/50 and 5/50 for low and high dose levels, respectively (compared to 26/50 for control).
Mercury	4.5E-01	9.0E-01	c	oral (diet)	Japanese quail	significant reduction in egg fertility and hatchability although egg production was positively correlated with dose	high	Sample etal., 1996; Hill and Schaffner, 1976	NOAEL	0.45	0.9		7	1	1	Mercuric chloride
Mercury	1.0E+00	1.0E+01	c	oral(diet)	mink	fertility, kit survival	high	Sample etal., 1996; Aulerich et al., 1974	NOAEL	1.01		6m	7	1	1	Mercuric chloride; single dose
Molybdenum	1.9E-01	1.9E+00	c	oral (water)	mouse	decrease survival in F2 and F3 generations	high	RAIS, 1993; Schoeder and Mitchener, 1971	LOAEL	1.9	1.9	3g	7	10	1	F3 generation totaled 123 mice compared to 230 for controls; no effect on total number of litters or average litter size.
Molybdenum	3.5E+00	3.5E+01	c	oral (diet)	chicken	embryonic viability reduced to zero	high	Sample etal.. 1996: Lepore and Miller, 1965	LOAEL	35.3	35.3	21 d	7	10	1	Sodium molybdate
Nickel	2.5E+01	6.3E+01	c	oral(diet)	dog	decrease in body weight (40%)	intermediate	Eisler, 1998; USPHS, 1993	NOAEL	25	63	2y	7	1	1	Nickel sulfate
Nickel	3.1E+01	5.2E+01	c	oral (water)	rat	decrease in maternal body weight; decrease in number of live pups/litter, increase in pup mortality, decrease in average pup weights in F1a and F1b generations	high	RAIS, 1995; RTI, 1987	NOAEL	30.8	51.6	2g	7	1	1	Nickel chloride
Nickel	7.7E+01	1.1E+02	c	oral(diet)	mallard	signficant reduction in growth and 79% mortality	high	Sample etal., 1996; Cain and Pafford, 1981	NOAEL	77.4	107	90 d	7	1	1	Nickel sulfate
Silver	2.2E+01	2.2E*02	sc	oral (water)	rat	decreased weight gain; decreased lifespan	intermediate	ATSDR, 1990; Matuk et al.. 1981	LOAEL	222	222	37 w	7	10	1	

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Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[b]	Study Type[b]	Exposure Route	Test Species	Effect	Relevance[c]	Reference	Study End point	Study Result	Reported LOAEL	Exposure Duration[d]	Exposure Regime (# d/w)	EF	UF	Notes
Silver	9.0E+01	9.0E+02	sc	oral	bobwhite quail	mortality	high	Pesticide, 2002	LD50	2250		14 d	7	25	1	Value reported as >2.250 mg/kg-d
Silver	2.4E+02	2.4E+03	sc	oral	mallard	mortality	high	Pesticide72002	LD_{50}	5920.25147		14 d	7	25	f'	
Thallium	1.4E-01	1.4E+00	sc	oral (water)	rat	mortality (21% in treatment group)	high	ATSDR, 1992;Manzoet al.. 1983	LOAEL	1.4	1.4	36 w	7	10	1	
Thallium	3.5E+00	5.0E+00	sc	oral (diet)	duck	mortality	high	WHO, 1996; Shaw. 1932	NOAEL	35	50	single dose	7	1	10	Thallium (I) sulfate
Antimony	2.6E-02	2.6E-01	c	oral (water)	rat	decreased lifespan	intermediate	ATSDR, 1992; Schroederetal., 1970	LOAEL	0.262	0.262	746-1,342 d	7	10	1	Potassium antimony tartrate (organic) form; inorganic antimonials are absorbed much less readily and effect thresholds are correspondingly higher.
Arsenic	4.8E-02	4.8E-01	c	oral (diet)	dog (beagle)	mortality; weight loss (44-61% - As(3+))	high	ATSDR, 2000; Byron et al.. 1997	LOAEL	2.4	2.4	2y	7	10	5	6/6 animals died exposed to As(3+); 1/6 animals died exposed to As(5+)
Arsenic	1.3E-01	1.3E+00	c	oral (water)	mouse	declining litter sizes	high	Sample etal., 1996; Shroeder and Mitchner, 1971	LOAEL	1.261	1.261	3g	7	10	1	Sodium arsenite (3+)
Arsenic	5.1E+00	1.3E+01	c	oral (diet)	mallard	mortality	high	Sample etal., 1996; USFWS, 1964	NOAEL	5.1	12.8	128 d	7	1	1	Mallards in 1000. 500, 250, and 100 ppm treatments experienced 92%, 60%, 12%, and 0% mortality, respectively.
Barium	4.2E+01	8.3E+01	sc	oral(diet)	chicken (1-dold)	mortality	high	Sample et al., 1996; Johnson et al., 1960	NOAEL	208	417	4 w	7	1	5	Chicks in the 4000 to 32000 ppm treatments experienced 5% to 100% mortality. Five-fold EF applied due to the magnitude of the affect at the 4,000 ppm level (LOAEL).
Barium	7.5E+01	1.6E+02	c	oral (water)	mouse	significant increase in mortality; renal toxicity	high	IRIS, 2002; NTP, 1994	NOAEL	75	160	2y	7	1	1	
Beryllium	1.5E-01	1.5E+00	a	subcutaneous	chicken	mortality	high	WHO, 1990; Krampitz etal.. 1978	LDJO	3.7		single dose	7	25	1	Beryllium sulfate.
Beryllium	6.6E-01	6.6E+00	c	oral (water)	rat	longevity	low	Sample et al., 1996; Shroeder and Mitchner. 1975	NOAEL	0.66		3.2 y	7	1	1	Weight loss in males was observed in months 2-6.
Beryllium	1.2E+00	1.2E+01	c	oral (diet)	dog (beagle)	significantly increased mortality	high	ATSDR. 2000; Morgareidge et al., 1976	LOAEL	12	12	172 w	7	10	1	Ulcerative and inflammatory lesions in the gastrointestinal tract and weight loss were also observed in treated animals.

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Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[b]	Study Type[c]	Exposure Route	Test Species	Effect	Relevance[5]	Reference	Study Endpoint	Study Result	Reported LOAEL	Exposure Duration[11]	Exposure Regime (# d/w)	EF	UF	Notes
Cadmium	1.0E+00	1.0E+01	c	oral (gavage)	rat	fetal implantations reduced by 28%; fetal survivorship reduced by 50%; fetal resorptions increased by 400%	high	Sample etal., 1996; Sutouetal., 1980b	NOAEL	1	10	6 w during mating/ gestation	7	1	1	Cadmium chloride
Cadmium	1.5E+00	2.0E+01	c	oral (diet)	mallard	significant reduction in egg production	high	Sample et al.. 1996: White and Finley, 1978	NOAEL	1.5	20	90 d	7	1	1	
Chromium	1.0E+00	5.0E+00	c	oral(diet)	black duck	significant reduction in duckling survival	high	Sample et al., 1996; Haseltineetal.. unpublished data	NOAEL	1	5	10 m	7	1	1	Exposure to trivalent chromium.
Chromium	1.5E+03	1.5E+04	c	oral(diet)	rat	mortality; body weight loss and food consumption	high	IRIS. 2002; Ivankovic and Preussman, 1975	NOAEL	2055.2		840 d	5	1	1	Value for trivalent chromium (i.e., chromic oxide).
Cobalt	7.6E-02	7.6E-01	sc	oral(diet)	rat	45-65% reduction in body weight gain	intermediate	ATSDR, 2001;Cheltyet al., 1979	LOAEL	3.79	3.79	4w	7	10	5	Value for cobalt chloride; however, no decrease in body weight reported in rats following longer term exposures (Domingo et al.. 1984; Bourg etal., 1985)
Copper	4.2E-01	4.2E+00	c	oral (water)	mouse	decreased survival; 13% decrease in maximum lifespan	high	ATSDR, 1990; Massie and Aiello, 1984	LOAEL	4.2	4.2	850 d	7	10	1	Copper gluconate; check this study (should result be 42 as in RAIS?)
Copper	1.2E+01	1.5E+01	c	oral (diet)	mink	increased percentage mortality in mink kits	high	Sample etal., 1996; Aulerich et al., 1982	NOAEL	11.71	15.14	357 d	7	1	1	Copper sulfate; threshold includes copper concentration in base feed (60.5 ppm)
Copper	4.7E+01	6.2E+01	c	oral(diet)	chicken (1-dold)	growth reduction (30%) and mortality increased by 15%	high	Sample etal., 1996; Mehring et al., 1960	NOAEL	47	62	10w	7	1	1	
Vanadium	4.2E-01	2.1E+00	c	oral (intubation)	rat	reduction in pup weight and length	high	Sample etal., 1996; Domingo et al., 1986	LOAEL	2.1	2.1	60 d through gestation	7	5	1	Effect was described as "slight"
Vanadium	1.1E+01	1.1E+02	c	oral(diet)	mallard	no effects on survivorship, body weight, or blood chemistry	high	Sample etal., 1996; White and Dieter, 1978	NOAEL	11.4		12w	7	1	1	vanadyl sulfate
Zinc	1.5E+01	1.3E+02	c	oral(diet)	white longhorn hen	reduced egg hatchability (<20% of controls)	high	Sample etal., 1996; Stahletal., 1990	NOAEL	14.5	131	44 w	7	1	1	zinc sulfate
Zinc	1.6E+02	3.2E+02	c	oral(diet)	rat	increased rates of fetal resorption and reduced fetal growth rates	high	Sample etal., 1996; Schlicker and Cox, 1968	NOAEL	160	320	days 1-16 (gestation)	7	1	1	Zinc oxide
Zinc	2.0E+02	3.9E+02	sc	oral(diet)	European ferret	mortality: diffuse nephrosis	high	ATSDR, 1994;Straube et al., 1980	NOAEL	195	390	up to 6 m	7.	1	1	Zinc oxide; all animals in extremis or dead by day 21.
Bromomethane	1.8E+00	1.8E+01	c	inhalation	rat	significant concentration-related reduction in body weights in F2 (both sexes)	intermediate	IRIS, 2002; American Biogenics Corporation, 1986	NOAEL	1.8	18	2g	7	1	1	
Bromomethane	8.9E+01	1.8E+02	sc	oral(diet)	dog (beagle)	increased weight gain; lethargy	intermediate	IRIS, 2002; Rosenblum etal., 1960	NOAEL	89.1	178.2	1y	7	1	1	No UF applied due to the nature of the observed effects.

TABLE D-4
SUMMARY OF ORAL TOXICITY REFERENCE DOSES FOR WILDLIFE RECEPTORS

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Chemical Name	Toxicity Reference Dose NOAEL*	Toxicity Referenc e Dose LOAEL"	Study Type"	Exposure Route	Test Species	Effect	Relevance[b]	Reference	Study Endpoint	Study Result	Reported LOAEL	Exposure Duration[d]	Exposure Regime (# d/w)	EF	UF	Notes
Chloromethane	2.3E+01	3.5E+01	a	oral	mouse	mortality; significant reduction in body weight	high	ATSDR, 1998;Landryet al., 1985	NOAEL	230.612286	345.91843	11 d	7	1	10	
Dibromomethane	1.8E+00	1.8E+01	c	inhalation	rat	significant concentration-related reduction in body weights in F2 (both sexes)	intermediate	IRIS. 2002; American Biogenics Corporation, 1986	NOAEL	1.8	18	[2] 9	7	1	1	No data available; values for bromomethane used as a surrogate
Bromochloromethane	4.1E+00	4.1E+01	sc	inhalation	rat	weight loss or decreased weight gain	intermediate	RTECS. 2002; JOC, 1966	LOAEL	409.332081	409.33208	26 w	7	10	10	
Chloroethane	2.8E+03	2.8E+04	c	inhalation	rat	changes in resorption rate, litter size, sex ratio, or fetal body weights	Intermediate	ATSDR, 1996; Scortichinietal., 1986	NOAEL	2828.23901		Gd6-15	7	1	1	
Vinyl Chloride	1.7E+00	5.0E+00	c	oral(diet)	rat	increased mortality	intermediate	ATSDR. 1997: Til etal., 1983, 1991	NOAEL	1.7	5	144 w	7	1	1	Females appear somewhat more sensitive to oral exposure
Methylene Chloride	8.2E+00	4.1E+01	c	oral (gavage-oil)	mouse	significant increase in mortality	high	ATSDR, 2000; Maltoni etal., 1988	LOAEL	64	64	64 w	4.5	5	1	Hepatoxicological effects also reported at similar effect concentrations (IRIS, 2002; NCA, 1982)
Carbon disulfide	2.9E+00	2.9E+01	c	inhalation	rat	maternal toxicity (reduced weight gain through gestation;- 59% in parental and F1); average fetal weights significantly reduced (5%); slight increase in preimplantation lethality	high	IRIS, 2002; Tabacova, 1969; Tabacova and Balabaeva, 1980; Tabacova etal., 1978. 1983	NOAEL	2.87762826	28.776283	21 d (through gestation); parental and F1	7	1	1	Study limited by failure to report critical information on chemical exposure and test conditions (ATSDR, 1996).
Bromoform	7.1E+01	1.4E+02	c	oral (gavage)	rat	significant reduction (10-28%) in mean body weights; significant reduction in survival of maies	high	IRIS, 2002; NTP. 1989a	NOAEL	100	200	103 w	5	1	1	Study threshold supported by survival and reproductive effects levels provided in ATSDR, 1990
Bromodichloromethane	5.0E+00	5.0E+01	c	gavage	rat	fetotoxicity, maternal reduction in aody weight gain	high	ATSDR, 1989; Ruddick etal., 1983	LOAEL	50	50	Gd6- 15	7	10	1	
1,1-Dichloroethane	3.9E+03	6.1E+03	c	inhalation	rat	retarded fetal development; maternal food consumption and body weight	high	ATSDR. 1990; Schwetz et al.. 1974	NOAEL	3886.57505	6136.6974	Gd6- 15	7	1	1	
1,1-Dichloroethene	5.0E+00	5.0E+01	sc	oral (capsules)	dog	mortality, body weight, liver histology	high	ATSDR. 1994: Quast et al., 1983	NOAEL	25		97 d	7	1	5	Study threshold supported by subchronic inhalation study by Prendergast et al., 1967. Effect concentrations are similar to those eliciting tubular necrosis in mice under chronic exposures. Study supported by 2 year reproductive study (Nitschke etal., 1983.
1,1-Dichloroethene	6.9E+01	1.4E+02	c	inhalation	mouse	maternal food consumption and weight gain; complete early resorptions	high	IRIS, 2002; Short et al.. 1977	NOAEL	69	139	Gd6- 16	7	1	1	
Trichlorofluoromethane	3.5E+01	3.5E+02	c	oral	rat	survival; histopathology	high	IRIS, 2002; NCI, 1978	LOAEL	488	488	78 w	5	10	1	

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Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Referenc eDose LOAEL[b]	Study Type[c]	Exposure Route	Test Species	Effect	Relevance[d]	Reference	Study Endpoint	Study Result	Reported LOAEL	Exposure Duration[e]	Exposure Regime (# d/w)	EF	UF	Notes
Dichlorodifluoromethane	1.5E+01	1.5E+02	c	oral	rat	reduced body weights	intermediate	IRIS, 2002; Sherman, 1974	NOAEL	15	150	2y	7	1	1	
Dalapon	5.0E+01	5.0E+02	c	oral	rat	decreased and delayed ossification	high	IRIS, 2002; Dow Chemical, 1971	LOAEL	500	500	na	7	10	1	
Dalapon	2.1E+02	2.1E+03	sa	oral(diet)	mallard	mortality	high	Hilletal.. 1975	NOAEL	5267		5d	7	25	1	
1,1,2-Trichloro-1,2.2-trifluoroethane	1.ZE+04	2.4E+04	c	inhalation	rat	reduction in mean body weights	intermediate	USEPA, 1997; Du Pont, 1985	NOAEL	11856	23711.46	2y	7	1	1	
Heptachlor	2.5E-02	2.5E-01	c	oral(diet)	rat	F1: 30% decrease in fertility. increased resorption, 16% embryo survival; F2: 100% infertility	high	ATSDR. 1993; Green. 1970	LOAEL	0.25	0.25	60 d through gestation	7	10	1	Only 19 of 122 offspring of treated rats survived 21 days postpartum compared to 179 out of 288 offspring of controls (ATSDR, 1993)
Heptachlor	1.0E-01	1.0E+00	c	oral (diet)	mink	reduced kit weights at 3 and 6 weeks reducted 23% and 19% relative to controls	intermediate	Sample etal., 1996; Crum et al., 1993	LOAEL	1	1	181 d	7	10	1	
Heptachlor	6.7E-01	6.7E+00	sc	oral(diet)	Japanese quail	mortality	high	Hilletal., 1975	LC50	16.7788542		5d	7	25	1	
Heptachlor	4.2E+01	4.2E+02	a	oral (capsule)	mallard	mortality	high	Hudson etal., 1984	LDs,	2080		14 d	7	50	1	
Hexachlorocyclopentadiene	1.4E+00	2.7E+00	sc	gavage	rat	reduction in body weight (males)	intermediate	IRIS, 2002; Abdo et al., 1984	NOAEL	19	38	13w	5	1	10	
Selenium	6.0E-02	6.0E-01		oral (diet)	Japanese quail	reduced egg hatching	high	Eisler, 1985	LOAEL	0.6	0.6		7	10	1	
Selenium	2.0E-01	3.3E-01	c	oral (water)	rat	50 percent reduction in number of pups reared in second generation	high	Sample etal., 1996; Rosenfeld and Beath, 1954	NOAEL	0.2	0.33	1y	7	1	1	fertility, pup survival, maternal toxicity and failure of second generation to reproduce observed in 1.05 mg/kg-d treatment.
Selenium	4.0E-01	8.0E-01	c	oral(diet)	mallard	significant reduction in duckling survival	high	Sample etal., 1996; Heinz etal., 1989	NOAEL	0.4	0.8	100 d	7	1	1	selanomethionine; similar effect concentration obtained in a 78-d exposure study with sodium selenite
Selenium	4.4E-01	1.5E+00	c	oral(diet)	screech owl	egg production and hatchling success reduced by 38% and 88%, respectively, and nestling survival reduced by 100%	high	Sample etal., 1996; Wiemeyer and Hoffman, 1996	NOAEL	0.44	1.5	13.7 w	7	1	1	selenomethionine
Isophorone	3.0E+01	3.0E+02	sc	oral (capsule)	dog (beagle)	no adverse systemic effects	intermediate	IRIS, 2002; NorAm Agricultural Products, 1972a	NOAEL	150		90 d	7	1	5	
Isophorone	1.2E+02	1.4E+02	c	inhalation	rat	fetal growth retardation (crown-rump length)	high	ATSDR. 1989; Bio/dynamics. 1984a,b	NOAEL	122	141	days 6-15 (gestation)	7	1	1	

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Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[a]	Study Type[b]	Exposure Route	Test Species	Effect	Relevance[c]	Reference	Study Endpoint	Study Result	Reported LOAEL	Exposure Duration[d]	Exposure Regime (# d/w)	EF	UF	Notes
1,2-Dichloropropane	4.4E+01	8.9E+01	c	oral (gavage)	rat	decreased body weight gain	intermediate	ATSDR.1989; NTP, 1986	NOAEL	62	125	103w	5	1	1	ATSDR raised concern about weigth loss could be attributable to non-chemical stressor but this study result is conservative relative to other end points
2-Butanone	1.8E+03	3.1E+03	c	oral (water)	rat	decreased fetal birth weight	high	Sample etal.. 1996; IRIS, 2002	NOAEL	1771	3122	2g	7	1	1	metabolic intermediate of MEK
1.1,2-Trichloroethane	6.6E+01	6.6E+02	c	gavage	rat	mortality	high	1978	NOAEL	92		78 w	5	1	1	
Trtchloroethene	7.5E+01	1.5E+02	c	oral (diet)	rat	reduction in number of live pups/litter	high	RAIS, 2002; NTP. 1986b	NOAEL	75	150	2g	7	1	1	
Methyl Acetate	*5.3E+03*	*8.2E+03*	*c*	*inhalation*	*mouse*	*increased embryo/fetal death including incidence of full litter resorptions*	*high*	*WHO, 1997; Rogers et al., 1993*	*NOAEL*	*5344.00718*	*8220.6601*	*days 6-15 (gestation)*	*7*	*1*	*1*	
1.1,2,2-Tetrachloroethane	4.4E+01	7.7E+01	c	oral (gavage - oil)	rat	20% decrease in body weight gain (males)	intermediate	ATSDR. 1996; NCI, 1978	NOAEL	62	108	78 w	5	1	1	Significant increased mortality occurred in several studies at dose levels approximately twice the LOAEL reported in this study
Toxaphene	8.0E-02	8.0E-01	sc	oral (capsule)	dog	convulsions	high	ATSDR, 1996; Lackey, 1949	LOAEL	4	4	106 d	7	10	5	
Toxaphene	4.0E-01	4.0E+00	a	oral (capsule)	sharp-tailed grouse	mortality	high	Hudson etal.. 1970	LD50	19.9		14 d	7	50	1	
Toxaphene	6.2E-01	6.2E+00	a	oral (capsule)	mallard (duckling)	mortality	high	Hudson etal.. 1984	LDM	30.8		14d	7	50	1	
Toxaphene	3.2E+00	3.2E+01	c	oral (gavage-oil)	rat	positive correlation between maternal thymus weight and fetal death	high	ATSDR. 1996; Chernoff etal., 1990	LOAEL	32	32	days (6-15) gestation	7	10	1	
Acenaphthene	3.5E+01	3.5E+02	sc	oral (gavage)	mouse	decreased ovary weights; decreased ovarian and uterine activity including smaller and fewer corpora lutea; increased liver weights and cholesterol levels	intermediate	IRIS. 2002; USEPA. 1989c	NOAEL	175	350	90 d	7	5	1	
Acenaphthene	1.8E+02	1.8E+03	sc	oral	mallard	mortality	high	Eisler, 1987; Pattonand Dieter, 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Diethytphthalate	1.1E+00	1.1E+01	c	oral(diet)	ringed dove	10% reduction in egg shell thickness	intermediate	Sample etal., 1996; Peakall, 1974	NOAEL	1.1		4 w	7	1	1	Di-n-butylphthalate used as a surrogate value
Diethylphthalate	7.5E+O1	3.2E+02	sc	oral	rat	reduced growth and food consumption rates	intermediate	IRIS, 2002; Brown et al., 1978	NOAEL	750.0	3160.0	16w	7	1	10	

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Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[a]	Study Type[b]	Exposure Route	Test Species	Effect	Relevance[c]	Reference	Study End point	Study Result	Reported LOAEL	Exposure Duration[d]	Exposure Regime (# d/w)	EF	UF	Notes
Di-n-Butylphthalate	1.1E+00	1.1E+01	c	oral(diet)	ringed dove	10% reduction in egg shell thickness	intermediate	Sample et al., 1996; Peakall. 1974	NOAEL	1.1		4 w	7	1	1	Study result considered a NOAEL because percent reduction is less than 15% (WHO. 1997). Korhonen et al. (1993) established an ED_K for embryotoxicity in chickens of 33umol(9.19mg/egg).
Di-n-Butylphthalate	1.0E+02	4.0E+02	c	oral(diet)	mouse	significant reproductive effects including fewer number of live offspring/litter and increased incidence of external anomalies	high	WHO, 1997; Hamanoet al.. 1977	NOAEL	100	400		7	1	1	
Phenanthrene	1.5E+01	1.5E+02	a	oral	mouse	mortality	high	RAIS, 2002; Simmon et al., 1979	LD50	750			7	1	50	
Phenanthrene	1.8E+02	1.8E+03	sc	oral	mallard	mortality	high	Eisler, 1987; Patton and Dieter. 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Butyl benzylphthalate	1.1E+00	1.1E+01	c	oral(diet)	ringed dove	10% reduction in egg shell thickness	intermediate	Sample et al., 1996; Peakall, 1974	NOAEL	1.1		4 w	7	1	1	Di-n-butylphthalate used as a surrogate value
Butyl benzylphthalate	2.0E+02	4.8E+01	sc	gavage	rat	testicular atrophy	intermediate	IRIS. 2002, NTP, 1985	NOAEL	1960	480	14d	7	1	10	
N-Nitroso-diphenylamine	2.0E+01	2.0E+02	c	oral (diet)	rat	30% mortality in females	high	1979	LOAEL	200	200	100 w	7	10	1	
Fluorene	2.5E+01	2.5E+02	sc	oral (gavage - oil)	mouse	significant reduction in pup weights	intermediate	IRIS, 2002; USEPA, 1989d	NOAEL	125	250	13w	7	5	1	Labored respiration and unkempt appearance was reported in animals exposed to a dose of 500 mg/kg-d
Fluorene	1.8E+02	1.8E+03	sc	oral	mallard	mortality	high	Eisler, 1987; Patton and Dieter, 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Carbazole	1.0E+02	1.0E+03		oral(diet)	rat	mortality	high	HSDB, 2002; Budavari, 1989	LD50	5000			7	50	1	
1,2,3-Trichlorobenzene	1.2E+02	3.6E+02	c	oral	rat	significant retardation in four embryonic growth criteria (i.e. head length, crown-rump weight, somite number, and protein content)	intermediate	IRIS, 2002; Kitchin and Ebron, 1980	NOAEL	120	360	days (9-13) gestation	7	1	1	No data available; values for 1,2,4-trichlorobenzene used as a surrogate
Hexachlorobutadiene	2.0E+00	2.0E+01	c	oral (diet)	rat	significant increase in mortality (males)	high	IRIS, 2002; Kociba, 1977a	NOAEL	2	20	2y	7	1	1	Study result supported by other investigations reporting body weight decreases in fetuses
Hexachlorobutadiene	3.2E+00	3.2E+01	c	oral	Japanese quail	mortality	high	Schwertz et al.. 1974	NOAEL	3.185		3m	7	1	1	
Pentachlorophenol	1.0E-01	1.0E+00	c	oral (diet)	mink	decreased birth rate and acceptance of second mating; increased severity of cystic uteri	high	ATSDR, 2001; Beard et al.. 1997	LOAEL	1	1	3 w(pre-breeding thru weaning)	7	10	1	

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Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[a]	Study Type[a]	Exposure Route	Test Species	Effect	Relevance[b]	Reference	Study Endpoint	Study Result	Reported LOAEL	Exposure Duration[c]	Exposure Regime (# d/w)	EF	UF	Notes
Pentachlorophenol	4.0E+00	1.4E+01	c	oral	rat	10% reduction in fetal body weight	intermediate	ATSDR. 2001; Welsh et al., 1987	NOAEL	4	14	181 d	7	1	1	Various other developmental and reproductive effects have been reported in subchronic/chronic duration exposures to 15-30 mg/kg-d
Pentachlorophenol	7.6E+00	7.6E+01	a	oral (capsule)	mallard	mortality	high	Hudson etal., 1984	LDso	380		14 d	7	50	~T"	
Pentachlorophenol	1.0E+01	1.0E+02	a	oral (capsule)	pheasant	mortality	high	Hudson et'al..' 1970	LD50	504		14d	' ?"'	"50"	1	
2,4,6-Trichlorophenol	3.0E+00	3.0E+01	c	oral (water)	rat	decreased mean litter size	high	ATSDR, 1999: Exon and Koller, 1985	NOAEL	3	30	13w (including Gd 1-21)	7	1	1	
2-Nitroaniline	2.1E+01	7.1E+01	c	oral (gavage)	mouse	significant reduction in hematocrit and erythrocyte counts	low	NIH, 1993	NOAEL	30	100	2 y	5	1	1	Value for 4-Nitroaniline used as a surrogate
2-Nitrophenol	2.6E+01	2.6E+02	a	oral (gavage - oil)	mouse	mortality	high	ATSDR, 1992; Vernot et al., 1977	LD50	1300		ns	7	1	50	
Dinoseb	1.0E-01	1.0E+00	c	oral (diet)	rat	decreased fetal weight	high	IRIS, 2002; Dow Chemical, 1981a	LOAEL	1	1	39	7	10	1	
Dinoseb"	5.3E~oT	~5'13E+00	a	oral (capsule)	pheasant	mortality	high	Hudson etal., 1970	LD50	26.4		14 d	7	50	'-T	
Dinoseb	5.4E-01	5.4E+00	a	oral (capsule)	mallard	mortality	high	Hudson etal., 1984	LD_M	27		14 d	7	50	1	
1-Methylnaphthalene	3.0E+01	3.0E*02	c	oral (gavage - oil)	mouse	increased mortality and reduced body weight gain in dams and a reduced number of live young at birth	high	ATSDR. 1995; Pflasterer et al.. 1985	LOAEL	300	300	days (7-14) gestation	7	10	1	Naphthalene used as a surrogate value.
Naphthalene	3.0E+01	3.0E+02	c	oral (gavage - oil)	mouse	increased mortality and reduced body weight gain in dams and a reduced number of live young at birth	high	ATSDR. 1995; Pflasterer etal., 1985	LOAEL	300	300	days(7-14) gestation	7	10	1	Mice appear to be more sensitive than rats (ATSDR, 1995) with single dose LD50s of 533 and 710mg/kgfor males and females, respectively (Shopp et al.. 1984); dose response curve appears to be very steep.
Naphthalene	5.4E+01	5.4E+02	a	oral	bobwhite quail	mortality	high	Pesticide. 2002	LDK	2690		14 d	7	50	1	
2-Methylnaphthalene	3.0E+01	3.0E+02	c	oral (gavage - oil)	mouse	increased mortality and reduced body weight gain in dams and a reduced number of live young at birth	high	ATSDR, 1995; Pflasterer etal., 1985	LOAEL	300	300	days (7-14) gestation	7	10	1	Naphthalene used as a surrogate value.
2-Chloronaphthalene	5.0E+01	6.0E+02	sc	gavage	mouse	dyspnea, abnormal appearance. liver enlargement	low	IRIS, 2002; USEPA, 1989e	NOAEL	250	600	13w	7	5	1	
3,3'-Dichlorobenzidine	1.0E+01	1.0E+02	c	oral	dog	reduced body weight	intermediate	ATSDR. 1998;Stulaet al,, 1978	NOAEL	10.4		7y	7	1	1	

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Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Referenc eDose LOAEL[b]	Study Type[c]	Exposure Route	Test Species	Effect	Relevance[d]	Reference	Study Endpoint	Study Result	Reported LOAEL	Exposure Duration[e]	Exposure Regime (# d/w)	EF	UF	Notes
U'-Biphenyi	5.0E+01	2.5E+02	c	oral	rat	kidney damage (tubular atrophy, lymphatic infiltration), reduced hemoglobin levels, decreased food intake; retarded growth	intermediate	IRIS, 2002; Ambrose et al., 1960	NOAEL	50	250	700 d	7	1	1	
MCPP	1.4E+01	1.4E+02	a	oral	bobwhite quail	mortality	high	National Pesticide Information Center (Extoxnet). 2002	LD_{50}	700			7	50	1	
MCPP	5.0E+01	1.3E+02	c	oral	rat	increased intra-uterine deaths; decreased crown/rump lengths	high	IRIS, 2002; Boots Co.. Ltd., 1980	NOAEL	50	125	Gd6-15	7	1	1	
2,4,5-TP (Silvex)	2.5E+01	5.0E+01	c	oral	rat	reduced pup weight; incomplete skull ossification	high	IRIS, 2002; NAS, 1977	NOAEL	25	50	na	7	1	1	
2,4,5-TP (Silvex)	8.0E+01	8.0E+02	a	oral (capsule)	mallard	mortality	high	Hudson etal., 1984	LD_{50}	2000		14 d	7	25	1	Reported as <2,000 mg/kg(bw)
2,4,5-T	3.0E+00	1.0E+01	c	oral (diet)	rat	reduced neonatal survival	high	IRIS, 2002; Smith et al., 1981	NOAEL	3	10	3g	7	1	1	
2,4,5-T	1.0E+01	1.0E+02	a	oral (capsule)	pheasant	mortality	high	Hudson et al., 1970	LD50	500		14d	7	50	1	
2,4,5-T	4.0E+01	4.0E+02	a	oral (capsule)	mallard	mortality	high	Hudson etal.. 1984	LDso	2000		14 d	7	50	1	Reported as <2,000 mg/kg(bw)
MCPA	7.5E+00	2.3E+01	c	oral	rat	significant depression of male and/or female pup weights/pup weight gains by days 14 and 21 of weaning in all littering groups	intermediate	IRIS. 2002; Industrial Task Force on MCPA Research Data, 1986b	NOAEL	7.5	22.5	2g	7	1	1	
MCPA	7.5E+00	7.5E+01	a	oral	bobwhite quail	mortality	high	National Pesticide Information Center (Extoxnet). 2002	LD50	377			7	50	1	
2.4-D	5.0E+00	2.0E+01	c	oral (diet)	rat	reduced pup weights in F2a litters	intermediate	NIH, 2002; Bingham et al., 2001	NOAEL	5	20	2g	7	1		
2.4-D	9.4E+00	9.4E+01	a	oral (capsule)	pheasant	mortality	high	Hudson etal., 1970	LD50	472		14d	7	50	1	An oral LD50 of 420 was calculated for chicks (Morgulis et al., 1977)
2.4-D	1.5E+01	1.5E+02	c	oral(diet)	dog	no adverse reproductive effects	high	IRIS, 2002; Hansen et al., 1971	NOAEL	14.5		ns	7	1	1	Dogs believed to be more sensitive to exposure than rodents due to less efficient ability to excrete organic acids (EXTOXNET PIP)
2.4-D	4.0E+01	4.0E+02	a	oral (capsule)	mallard	mortality	high	Hudson etal.. 1984	LDs,	2000		14 d	7	50	1	
2,4-DB	8.0E-01	2.5E+00	sc	oral(diet)	dog	mortality; hemorrhage throughout body; aspermatogenesis	high	IRiS. 2002; Rhodia, Inc., 1969a	NOAEL	8	25	90 d	7	1	10	
2,4-DB	2.5E*00	8.0E+00	sc	oral(diet)	rat	severe liver and kidney damage	high	IRIS. 2002; Rhodia, Inc., 1969b	NOAEL	25	80	90 d	7	1	10	
2,4-DB	9.4E+00	9.4E+01	a	oral (capsule)	pheasant	mortality	high	Hudson etal., 1970	LD50	472		14 d	7	50	1	2,4-D used as a surrogate value

TABLE D-4
SUMMARY OF ORAL TOXICITY REFERENCE DOSES FOR WILDLIFE RECEPTORS

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[b]	Study Type[c]	Exposure Route	Test Species	Effect	Relevance[d]	Reference	Study Endpoint	Study Result	Reported LOAEL	Exposure Duration[e]	Exposure Regime (# d/w)	EF	UF	Notes
2,4-DB	4.0E+01	4.0E+02	a	oral (capsule)	mallard	mortality	high	Hudson etal., 19S4	LD_M	2000		14 d	7	50	1	2.4-D used as a surrogate value
O-Xylene	4.0E+01	4.0E+02	a	oral	Japanese quail	mortality	high	Hill and Camardese, 1986	LD50	2014.38849		5d	7	50	1	Value for total xylenes use as a surrogate.
o-Xylene	1.4E+02	1.4E+03	sa	oral(diet)	Japanese quail	mortality	high	Hill and Camardese, 1986	NOAEL	3390		5d	7	25	1	Total xylene value used as a surrogate
o-Xylene	1.4E+02	1.4E+03	sa	oral(diet)	Japanese quail	mortality	high	Hill and Camardese, 1986	NOAEL	3389.66752		5d	7	25	1	Total xytene value used as a surrogate
o-Xylene	1.8E+02	3.6E+02	c	gavage	rat	decreased body weight and increased mortality (males); hyperactivity	high	IRIS, 2002; NTP. 1986	NOAEL	250	500	103 w	5	1	1	Value for total xylenes used as a surrogate.
2-Methylphenol	2.5E+01	1.1E+02	sc	oral(diet)	mink	decreased body weight gain	intermediate	ATSDR, 1992; Hornshaw et al., 1986	NOAEL	25	105	6m	7	1	1	
2-Methylphenol	5.0E+01	1.0E+02	c	gavage	rabbit	slightly fetotoxicity	high	ATSDR, 1992; BRRC, 1988a	NOAEL	50	100	days 6 -18 (gestation)	7	1	1	
2-Chlorotoluene	4.0E+00	1.6E+01	sc	oral (gavage)	rat	decrease in body weight gain (males only)	intermediate	IRIS. 2002; Gibson et al., 1974a	NOAEL	20	80	103 d	7	1	5	
2-Chlorotoluene	1.6E+01	1.6E+02	sc	oral (capsule)	dog (beagle)	changes in body weight	intermediate	IRIS, 2002; Gibson et al.. 1974b)	NOAEL	80		97 d	7	1	5	
1,2-Dichlorobenzene	8.6E*01	2.6E+02	c	oral (gavage)	rat	mortality and renal tubular degeneration	high	ATSDR. 1998; NTP, 1985	NOAEL	120		2y	5	1	1	No LOAEL was identified in the critical study; a LOAEL was estimated by a applying a 3-fold extrapolation factor to the reported NOAEL based on reported renal effects (not considered ecologically-significant) and evaluation of other studies of related compounds
2-Chlorophenol	5.0E+00	5.0E*01	c	oral (water)	rat	increase in the percentage of stillborn pups; decrease in live litter size	high	ATSDR, 1999; Exon and Koller, 1982, 1985	NOAEL	5	50	13w (including Gd 1-21)	7	1	1	
1,2,4-Trimethyl benzene	7.6E+00	7.6E+01	c	inhalation	rat	reduced maternal body weights; increased frequency of whole litter resorptions, reduced pup viability	high	USEPA. 1994; Seed, 1989; Campbell. 1989	LOAEL	76	76	3g	7	10	1	Long-term exposure to C9 fraction; 1.2,4-TMB typically constitutes -40%.
2,4,5-Trichlorophenol	3.0E-MD0	3.0E+01	c	oral (water)	rat	decreased mean litter size	high	ATSDR. 1999; Exon and Koller. 1985	NOAEL	3	30	13w (including Gd 1-21)	7	1	1	No data for sensitive endpoint available; values for 2,4,6-trichlorophenol used as a surrogate

SUMMARY OF ORAL TOXICITY REFERENCE DOSES FOR WILDLIFE RECEPTORS

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[a]	Study Type[a]	Exposure Route	Test Species	Effect	Relevance[b]	Reference	Study End point	Study Result	Reported LOAEL	Exposure Duration[j]	Exposure Regime (# d/w)	EF	UF	Notes
Endosulfan 1	1.7E-01	2.5E+00	c	oral(diet)	mouse	sigificantly decreased survival and body weight gain in high dose females and males, respectively.	high	IRIS, 2002; Hoechst Celanese Corp., 1988	NOAEL	0.84	2.51	2y	7	5	1	Although mortality appears to be one of the most sensitive effects; a five-fold extrapolation factor applied because of a reported LD50 of 7.36 mg/kg in male mice (Gupta etal., 1981).
Endosulfan 1	5.7E-01	1.9E+00	c	oral (diet)	dog (beagle)	significantly decreased weight gain and severe nervous symptoms (e.g., loss of righting response)	high	IRIS, 2002; Hoechst Celanese Corp., 1989b	NOAEL	0.57	1.9	1y	7	1	1	
Endosulfan 1	6.2E-01	6.2E+00	a	oral (diet)	mallard	mortality	high	Hudson etal., 1984	LD_{50}	31.2		14 d	7	50	1	
Endosulfan 1	1.6E+00	1.6E+01	a	oral(diet)	ring-necked pheasant	mortality	high	Hudson etal., 1970	LD50	80		14 d	7	50	1	
1,2-Dibromo-3-ohloropropane	9.1E-02	9.1E-01	c	inhalation	rabbit	atrophy of testes. epidiymedes. and accessory glands; mean number of implantations per litter	high	IRIS, 2002; Rao etal., 1982	NOAEL	0.091	0.91	14 w	7	1	1	
1,2-Dibromo-3-chloropropane	1.3E+00	1.3E+01	a	oral (capsule)	mallard	mortality	high	Hudson etal., 1984	LD_{M}	66.8		14d	7	50	1	
1,2-Dibromo-3-chloropropane	3.1E+00	3.1E+01	a	oral (capsule)	pheasant	mortality	high	Hudson et al., 1970	LD50	156		14 d	7	50	1	
1,2,3-Trichloropropane	2.3E+01	4.5E+01	c	oral (gavage)	rat	decreased body weight gain	intermediate	ATSDR. 1992; NTP, 1983a	NOAEL	32	63	17w	5	1	1	
tert-Butylbenzene	1.0E+02	2.6E+02	sc	inhalation	rat	significant reduction in body weight gain, decreased food consumption; increased liver weight; no effect on gestational parameters	intermediate	IRIS, 2002; Bushy Run Research Center, 1989a	NOAEL	520	1290	Gd6-18	7	1	5	Limited toxicological data available; values for the closely-related branch-chain alkyl benzene. isopropylbenzene (cumene), used as a surrogate.
Isopropylbenzene	5.2E+01	1.3E+02	sc	inhalation	rat	significant reduction in body weight gain, decreased food consumption; increased liver weight; no effect on gestational parameters	intermediate	IRIS, 2002; Bushy Run Research Center, 1989a	NOAEL	520	1290	Gd 6 -18	7	1	10	Chronic oral exposure to female mice resulted In increased liver weights (IRIS, 2002) at a higher dose but the selected study is considered more ecologically relevant.
Isopropyl benzene	1.0E+02	2.6E+02	sc	inhalation	rat	significant reduction in body weight gain, decreased food consumption; increased liver weight; no effect on gestational jaarameters	intermediate	IRIS, 2002; Bushy Run Research Center, 1989a	NOAEL	520	1290	Gd6-18	7	1	5	Chronic oral exposure to female mice resulted in increased liver weights (IRIS, 2002) at a higher dose but the selected study is considered more ecologically relevant.

TABLE D-4
SUMMARY OF ORAL TOXICITY REFERENCE DOSES FOR WILDLIFE RECEPTORS

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Reference Dose LOAEL[b]	Study Type"	Exposure Route	Test Species	Effect	Relevance[c]	Reference	Study End point	Study Result	Reported LOAEL	Exposure Duration"	Exposure Regime (# d/w)	EF	UF	Notes
Acetophenone	4.2E+02	4.2E+03	sc	oral	rat	growth, tissue, hematological	intermediate	IRIS. 2002; Hagan et al., 1967	NOAEL	423		17w	7	1	1	
Nitrobenzene	7.8E+00	3.1E+01	c	inhalation	rat	decrease in fertility indices; seminiferous tubules atrophy	high	ATSDR, 1990; Dodd et al.. 1987	NOAEL	7.78929941	31.157198	10w	7	1	1	
3-Nitroaniline	2.1E+01	7.1E+01	c	oral (gavage)	mouse	significant reduction in hematocrit and erythrocyte counts	low	NIH, 1993	NOAEL	30	100	2y	5	1	1	Value for 4-Nitroaniline used as a surrogate
p-Isopropyltoluene	5.2E+01	1.3E+02	sc	inhalation	rat	significant reduction in body weight gain, decreased food consumption; increased liver weight; no effect on gestational parameters	intermediate	IRIS. 2002; Bushy Run Research Center, 1989a	NOAEL	520	1290	Gd6-18	7	1	10	Value for isopropylbenzene (cumene) used as a surrogate; structurally similar with a comparable acute oral LD50 ;4750 mg/kg (p-isopropyltoluene and 1,400 mg/kg (isopropylbenzene) in rats
BAPEQ	1.0E+00	1.0E+01	c	oral (intubation)	mouse	significant reduction in pup weights	intermediate	Sample et al., 1996: Mackenzie and Angevine. 1981	LOAEL	10	10	days 7-16 (gestation)	7	10	1	See toxicological data for benzo(a)pyrene
BAPEQ	1.8E+02	1.8E+03	sc	oral	mallard	mortality	high	Eisler, 1987; Pattonand Dieter, 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
High Molecular Weight PAHs	1.0E+00	1.0E+01	c	oral (intubation)	mouse	significant reduction in pup weights	intermediate	Sample et al., 1996; Mackenzie and Angevine, 1981	LOAEL	10	10	days 7-16 (gestation)	7	10	1	See toxicological data for benzo(a)pyrene
High Molecular Weight PAHs	1.8E+02	1.8EfO3	sc	oral	mallard	mortality	high	Eisler, 1987; Pattonand Dieter, 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Low Molecular Weight PAHs	3.0E+01	3.0E+02	c	oral (gavage - oil)	mouse	increased mortality and reduced body weight gain in dams and a reduced number of live young at birth	high	ATSDR, 1995; Pflasterer et al., 1985	LOAEL	300	300	days (7-14) gestation	7	10	1	See toxicological data for napthalene
Low Molecular Weight PAHs	1.8E+02	1.8E+03	sc	oral	mallard	mortality	high	Eisler, 1987; Pattonand Dieter, 1980	NOAEL	920		7 m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Total Dioxin Equivalent birds (PCBs) (f/*)	1.4E-05	1.4E-04	c	interperitoneal injection	ring-necked pheasant	significant reduction in egg production and egg hatchability	high	Sample et al., 1996; Noseketal.. 1992	NOAEL	0.000098	0.00098	10w	1	1	1	
Total Oioxin Equivalent mammals (PCBs) (f>)	1.0E-06	1.0E-05	c	oral(diet)	rat	significant reduction in fertility and neonatal survival	high	Sample etal., 1996; Murray etal., 1979	NOAEL	0.000001	0.00001	3 g	7	1	1	
Total Dioxin Equivalent birds (Dioxins/furans) (^{1}/j)	1.4E-05	1.4E-04	c	interperitoneal injection	ring-necked pheasant	significant reduction in egg production and egg hatchability	high	Sample et al., 1996; Noseketal., 1992	NOAEL	0.000098	0.00098	10w	1	1	1	
Total Dioxin Equivalent mammals (Dioxins/Furans)	1.0E-06	1.0E-05	c	oral(diet)	rat	significant reduction in fertility and neonatal survival	high	Sample etal., 1996; Murray etal.. 1979	NOAEL	0.000001	0.00001	3g	7	1	1	

TABu- 0-4

SUMMARY OF ORAL TOXICITY REFERENCE DOSES FOR WILDLIFE RECEPTORS

Baseline Ecological Risk Assessment - Interim Final
Centredale Manor Restoration Project Superfund Site
North Providence, Rhode Island

Chemical Name	Toxicity Reference Dose NOAEL[a]	Toxicity Referenc eDose LOAEL[b]	Study Type[a]	Exposure Route	Test Species	Effect	Relevance[c]	Reference	Study End point	Study Result	Reported LOAEL	Exposure Duration[d]	Exposure Regime (# d/w)	EF	UF	Notes
Total Dioxin Equivalent birds (PCBs) (V4) - Nestlings	1.0E-04	1.0E-03	a	oral (diet)	white leghorn chicken	mortality	high	USEPA, 1993; Schwetz etal., 1973	NOAEL	0.0001	0.001	21 d	7	1	1	Used for tree swallow nestling model
Total Dioxin Equivalent birds (Dioxins/furans) (14) - Nestlings	1.0E-04	1.0E-03	a	oral(diet)	white leghorn chicken	mortality	high	USEPA, 1993; Schwetz et al., 1973	NOAEL	0.0001	0.001	21 d	7	1	1	Used for tree swallow nestling model
Total PAH	1.0E+00	1.0E+01	c	intubation	mouse	significant reduction in pup weights	intermediate	Sample et al., 1996; Mackenzie and Angevlne, 1981	LOAEL	10	10	days 7-16 (gestation)	7	10	1	See toxicological data for benzo(a)pyrene
Total PAH	1.8E+02	1.8E+03	sc	oral	mallard	mortality	high	Eisler, 1987; Patton and Dieter, 1980	NOAEL	920		7m	7	5	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene

Notes:

a. Units in mg/kg-d.

b. Study types include acute, subchronic, and chronic duration studies.

c. Qualitative scoring of effect studied relative to the selected assessment endoints.

d. Exposure duration include (d) - days, (w) - weeks, (y) - year, (g) - generation.

Prepared by: SGD
Checked by: NAR

APPENDIX E

FIELD STUDY REPORTS

BIOASSESSMENT REPORT OF THE FLOODPLAIN SOIL INVERTEBRATE COMMUNITY IN THE WOONASQUATUCKET RIVER, NORTH PROVIDENCE, RHODE ISLAND

April 2002

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

BIO ASSESSMENT REPORT OF THE FLOODPLAIN SOIL INVERTEBRATE COMMUNITY IN THE WOONASQUATUCKET RIVER, NORTH PROVIDENCE, RHODE ISLAND

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1.0 INTRODUCTION

The Centredale Manor Superfund Site (the Site), consisting of approximately 9.04 acres, is located in North Providence, Rhode Island, just south of Route 44 on the eastern bank of the Woonasquatucket River. The main area of the Site is known as 2072 and 2074 Smith Street. The Site consists of reaches of the Woonasquatucket River associated with Allendale Pond and Lyman Mill Pond and includes all contaminated areas within this area as well as any other location to which contamination from that area has come to be located, or from which that contamination came.

Currently, two high rise buildings (Centredale Manor and Brook Village, both federally subsidized, senior housing complexes) are located in the main area of the Site, which is zoned for residential occupancy. In addition to the buildings, the main area is covered by roadway and parking lots. On the eastern portion of the main area is a drainage swale that begins near the northern portion of the main area and extends south, then curves to the west and discharges south of the main area into the Woonasquatucket River and Allendale Pond.

The Site was used for disposal of wastes containing hazardous substances. Between approximately 1940 and 1970, USEPA has reason to believe that the main area of the Site was the location of a chemical manufacturing facility (which produced hexachlorophene, among other chemicals) and an incineration-based drum recycling facility. The first housing complex was built in approximately 1976. The second high rise was built in 1982. Construction records show that hazardous substances were removed from the Site during the construction of the second complex. Samples indicate the presence of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and other contaminants in soil and sediment at the main portion of the Site as well as river sediment and floodplain soils downstream.

Beginning in May 2001, Normandeau Associates, Inc. (NAI) worked with Harding ESE to collect community composition data on fish, benthic macroinvertebrates, emergent aquatic insects, ichthyoplankton, and floodplain soil invertebrates near the Site. Bioassessment reports produced from these data will be incorporated into the Baseline Ecological Risk Assessment for the Centredale Manor Restoration Superfund Site to assess effects from the Site on these communities. The following report describes the findings of the floodplain soil invertebrate community bioassessment.

2.0 METHODS

Soil invertebrates were sampled at 11 locations where soil chemistry samples within the floodplain of the Woonasquatucket River were collected during 16 to 29 July 2001 (Figures 1 and 2) at four reference stations (Stations RWR 5001, RWR 5002, RWR 5003, RWR 5004) and seven experimental stations (CMS 4001, CMS 4002, CMS 4003, CMS 4005, LPX 4004, LPX 4006, LPX 4007). Samples were collected by delineating a 10 foot by 10 foot area around the soil sampling location with a line marked in one foot increments; therefore each sampling grid was comprised of 100-1 ft^2 sections. Five randomly selected numbers between 1 and 100 were chosen and one replicate soil invertebrate core sample was collected from each of the five sections.

Samples were collected by removing all surface litter and detritus, then using a decontaminated shovel one shovelful of soil, 6 inches deep, was removed. Samples were sorted for 5 minutes and all organisms within the sample were removed, rinsed with distilled water, placed in a labeled sample container, and preserved with 10% formalin.

After the soil invertebrate community samples were removed from the quadrat, the remaining soil wai searched to a depth of 4 to 6 inches to collect additional earthworms for tissue analysis. After soil invertebrates and earthworms were collected the general habitat conditions at each station were recorded.

In the laboratory, earthworms were identified to species at the Oligochaetology Laboratory, Kitchener, Ontario and all other organisms were identified to higher taxonomic levels at NAI's Biological Laboratory. A voucher collection of soil invertebrates was prepared and all Quality Assurance/Quality Control procedures provided in the FSP for floodplain soil invertebrate sample processing were followed and documented.

On 16 July 2001, representatives from Normandeau and Harding ESE conducted a pilot study to refine sampling techniques for collecting earthworm tissue and floodplain soil invertebrate samples from stations located along the Woonasquatucket River. Sampling procedures provided in the Field **Sampling Plan (FSP, Harding ESE 2001)** were followed when possible; however observations made during the pilot study showed that the following changes in sampling procedures were necessary:

- **The FSP stated that the sample plot** size **would be 3 ft^2 by 0.5 ft deep.** Since this sample plot size would have been too small to collect enough tissue for analysis the plot size was increased to 100 ft^2 (10 ft by 10 ft) by 0.5 ft deep.
- **The FSP stated that samples would be collected using a 3-inch diameter core sampler.** Instead, samples were collected using a decontaminated shovel to collect the samples. One shovelful of soil 0.5 ft deep was collected from each of the five replicate sample locations in each sample plot.
- **The FSP stated that if digging collected an insufficient number of earthworms for tissue analysis, then a mustard/water solution could** be used **to extract the worms.** Instead, in areas where the soil was moist, a backpack electroshocker was rigged to allow an electrical current to be applied to the soil, which effectively caused earthworms to emerge. In areas where not enough worms could be collected by electroshocking, the soil within the sample plot was hand-sifted until 120 grams of tissue were obtained.
- **The FSP stated that earthworm sample processing would consist of:**
  1. **Rinsing the worms with distilled water.**
  2. **Segregating the worms into adult and juvenile age classes.**
  3. **Identifying and segregating the species of the worms.**
  4. **Weighing the worms and recording their individual and combined composite sample weights.**
  5. **Freezing the worms pending shipment to the analytical laboratory.**

  However, in the field worms collected for tissue analysis were rinsed with distilled water, placed in clean, labeled glass sample containers, and frozen pending shipment to the analytical laboratory. Species composition and age class distribution of the earthworm samples could not be accomplished in the field due to the high level of taxonomic expertise that would be required. Also, since individual worms were not identified in the field, individual and combined composite sample weights were not measured, only total weight of the tissue sample from each station was measured.

3.0 RESULTS

A total of 19 invertebrate taxa were collected in soil samples from the Greystone Mill Pond, Lyman Mill Pond, and Woonasquatucket River floodplain (Table 1). Seven species of earthworms were collected, six from the family Lumbricidae and one from the family Megascolecidae. Other organisms collected in the samples included arthropods, gastropods, and nematodes.

Earthworms numerically dominated the floodplain soil invertebrate communities and comprised 73 percent of the fauna. The numerically dominant earthworm at the upstream reference stations (RWR-5001 to 5004) was *Aporrectodea rosea,* whereas at the experimental stations (CMS-4001 to 4005, LPX-4004 to 4007), the numerically dominant earthworm was *Lumbricus rubellus.* Coleoptera (beetles) was the numerically dominant non-annelid taxon at all stations.

Dominant vegetation and soil types found at each station are provided below.

Reference Station RWR-5001

Habitat/Soil Profile: The area sampled is located in the floodplain adjacent to the east side of the Woonasquatucket River north of Rte. 44. This station is located in a wet meadow approximately 50 feet north of the remnants of a historic dam. Grasses including blue-joint *(Calamagrostis canadensis)* and reed-canary grass *(Phalaris arundinacea)* dominated the area where the sample was collected. Jewel weed was also present as a subordinate herbaceous species. There were no trees or shrubs in the immediate vicinity of the sampling location.

The Soil Survey of Rhode Island (SCS, 1977) identifies the soils in the vicinity of the sampling location as Canton-Urban Land Complex (CB). The Canton-Urban Complex typically include 40 percent Canton soils, 30 percent Urban Soils, and 30 percent other soils (SCS, 1977). The observed soil profile would fall into the "other soils" category because it lacked the characteristics of the other two. Canton soils are typically well-drained soils located on crests of glacial upland hills and ridges, which describes the area surrounding this location. The soils where the sample was collected were once likely under water, based on their proximity to the dam, and the plant life that has colonized the area. This area appears to be an emergent marsh in an early successional stage.

The soil profile that was observed at this location is presented in the table below. The soils at this location were likely formed from deposition of alluvial material behind the historic dam. The soils in this location are more typical of the Rumney soil series. These soils are typically poorly drained soils formed in recent alluvium (SCS, 1977).

Depth (bgs)	Description	Munsel Color Code	**Comments**
1-0"	Oi, dense root mat		
0-12"	A, fine silt loam 10YR 3/2	10YR 3/2	Contained a few areas of dark brown/black organic accumulations (10YR2/1)
12"->	B/C, coarse sand with silt intermixed	(sand) 5YR 5/1 (silt inclusion) 5YR 2.5/1	Free/standing water at 24"

A mean total of 5.4 organisms per sample was collected. The numerically dominant organism was the earthworm *Dendrobaena octaedra* (Table 1). This station had eight invertebrate taxa, which included three earthworm species.

Earthworm collection for tissue analysis was the most difficult at this location. A total of 9.75 person-hours was required to collect 67 grams of tissue, and included digging and electroshocking at several locations inside and outside the sampling quadrat.

Reference Station RWR-5002

Habitat/Soil Profile: The area sampled is located in the floodplain adjacent to the west side of the Woonasquatucket River north of Rte. 44. This area is located approximately 100 feet south of sample location RWR-EW/FP-5004. The floodplain in this area was dominated by herbaceous plant species including jewel weed *{Impatiens capensis),* arrow-leaved tearthumb *(Polygonum sagittatum),* Arrow-arum *(Peltandra virginica),* and sedges *{Carex* sp.). This area would be best characterized as an emergent marsh, dominated by semi-persistent emergent vegetation.

The Soil Survey of Rhode Island (SCS, 1977) identified the soils in the vicinity of this sampling location as Adrian muck (Aa). The soils in this area are somewhat consistent with the descriptions presented in the Soil Survey. The soils were characterized as silt loam in the field, however there are pockets of highly decomposed organic matter present, and the soils exhibited the dark colors consistent with muck soils. In addition, the area sampled is located close to the river edge and in a depositional area that likely receives mineral inputs, similar to the other sample locations in this area during flood events.

Depth (bgs)	**Description**	**Munsel Color** Code	Comments
0-8"	A, silt loam	10YR 3/2	Redox. features, low croma mottles
8-24"	B, silt loam	10YR3/1	Saturated at 24" (free water)
>24"	Bhs, silt loam	5Y 2.5/1	

The mean total number of organisms per sample was 4.4, the lowest of any station. Also, two earthworm species, *Lumbricus rubellus* and *Einsenoides lonnbergi,* were collected from this station (Table 1); both species had the same abundance. A total of five'invertebrate taxa were collected at this station, including the two earthworm species.

Earthworm collection for tissue analysis required 6 person-hours to collect approximately 120 grams of tissue using digging and electroshocking methods.

Reference Station RWR-5003

Habitat /Soil Profile: The area sampled is located in the floodplain adjacent to the west side of the Woonasquatucket River north of Route 44. Red Maple *(Acer rubrum)* dominated the floodplain canopy in the area where the sample was collected. Northern catalpa *{Catalpa speciosa)* were the only subordinate trees in the area. The ground surface, which slopes slightly away from the river,

was sparsely vegetated with grasses, wood nettles *{Laportea canadensis),* and poison ivy *(Toxicodendron radicans).* A slirub layer was absent in the vicinity of the sampling location.

The Soil Survey of Rhode Island (SCS, 1977) identified the soils in the vicinity of this sampling location as Adrian muck (Aa). The Adrian soil series typically have a histic epipedon (i.e., thick organic layer) which are underlain by mineral, fine sand to gravelly sand, soil horizons. As shown in the table below, the soils at this sample location were lacking these characteristics. The soils at the location sampled consisted of a mineral soil, and were likely formed by deposition of material carried by the river during flood events, which were deposited when the banks were overflowed. The soils at this location had sandy soil horizons overlying silty and loamy horizons which is consistent with sporadic depositions of material during flood events.

Depth (bgs)	Description	Munsel Color Code	Comments
0-6"	A, medium to coarse sandy-silt	10YR4/3 (matrix) 10YR5/4, (mottle) 25YR 4/4	Redoxymorfic features present at 6", roots at $\leq$ 8", saturated at 18"
6-12"	Bhs, silt loam	2.5YR 2.5/1	Black Loamy
12-18"	Bhs, fine silt	7.5YR2/0	Black (organic accumulations)
>18"	Bhs silt	7.5YR 3/4	Dark Brown

The mean number of organisms per sample was 9.8, and the numerically dominant organism was the earthworm *Aporrectodea rosea.* A total of five invertebrate taxa were collected at this station, including three earthworm species.

A total of 3.75 person-hours was required to obtain 150 grams of earthworm tissue from this station using digging and electroshocking methods.

Reference **Station RWR-5004**

Habitat/Soil Profile: The area sampled is located in the floodplain adjacent to the west side of the Woonasquatucket River north of Route 44. This area is located approximately 200 feet south of sample location RWR-5003. The floodplain in this area was also located within the red maple dominated forest. Grey birch *(Betulapopufolid),* was the dominant sapling. **Alder** *(Alnus* sp.) was the only subordinate shrub in the area and jewel weed *{Impatiens capensis)* dominated the herbaceous layer.

The Soil Survey of Rhode Island (SCS, 1977) identified the soils in the vicinity of this sampling location as Adrian muck (Aa). As noted for location RWR-EW/FP-5003, and as shown in the table below, the soils in this area do not have a histic eppipedon, and are therefore not consistent with the Soil Survey. These soils are mineral in origin and are likely formed by deposition of material carried by the river during flood events.

Table 1. Mean number of organisms collected from five replicate soil samples per station at Woonasquatucket River, RI floodplain sampling stations during July 2001

Station	Coleoptera (beetles)	Aranae (spiders)	Lepidoptera (butterflies/ moths)	Diptera (true flies)	Phalangida (daddy longlegs)	Crustacea (sowbugs)	Gastropoda (slugs)	Chilopoda (centipedes)	Nematoda (round worms)	Hemiptera (true bugs)	Hymenoptera (ants)	Diplopoda (millipedes)	TOTAL
RWR-5001	0.4	0.2	0.2	0.2	0.2	0	0	0	0	0	0	0	1.2
RWR-5002	0.8	0	0	0	0	0.6	0.6	0	0	0	0	0	2.0
RWR-5003	1.2	0	0	0.2	0	0	0	0	0	0	0	0	1.4
RWR-5004	1.4	0	0	0.2	0	0.6	0	0	0	0	0.2	0	2.4
CMS-4001	1.0	0	0	0	0	1.4	0	0.8	0	0	0	0	3.2
CMS-4002	0.4	0	0	0.4	0.2	1.6	0.4	0	0	0	0	0	3.0
CMS-4003	3.2	0.2	0.4	0.2	0	0.4	0	0	0.4	0.2	0	0	5.0
CMS-4005	2.0	0	0	0	0	1.0	0	0	0	0	0	0	3.0
LPX-4004	0.2	0.2	0	0	0	0	0	0.2	0	0.2	0	0	0.8
LPX-4006	1.0	0	0	0	0	0.2	0	0	0	0	0.4	0.2	1.8
LPX-4007	0.2	0.2	0	0.4	0	0.4	0.4	0	0	0	0.2	0	1.8
TOTAL	11.8	0.8	0.6	1.6	0.4	6.2	1.4	1.0	0.4	0.4	0.8	0.2	25.6

	Annelida							
	Amynthas diffringens	*Lumbricus rubellus*	*Dendrobaena octaedra*	*Einsenoides lonnbergi*	*Dendrodrilus rubidus*	*Aporreclodea rosea*	*Aporrectodea longn*	TOTAL
RWR-5001	0	0.2	3.8	0	0.2	0	0	4.2
RWR-5002	0	1.2	0	1.2	0	0	0	2.4
RWR-5003	0.2	0	0	0.2	0	8.0	0	8.4
RWR-5004	5.0	0	0	0	0	0	0	5.0
CMS-4001	0.4	11.6	0.6	0	0	0	0	12.6
CMS-4002	0.8	4.8	0.8	0.4	0.2	0	0	7.0
CMS-4003	1.4	0.2	0.2	0	0	0.4	0	2.2
CMS-4005	0.6	3.2	0.2	0	0	0.2	0	4.2
LPX-4004	0	0.6	0	0	0	5.0	0	5.6
LPX-4006	0	4.0	0	0	0	3.0	0	7.0
LPX-4007	0	5.4	0.4	0	0	4.4	1.2	11.4
TOTAL	8.4	31.2	6.0	1.8	0.4	21.0	1.2	70.0

Depth (bgs)	Description	Munsel Color Code	Comments
0-6"	A, fine sandy loam	10YR3/3	roots to 12"
6-12"	Bhs, silt loam	10YR2/1 (mottles) 2.5YR 4/4	Redox features
12-24"	B, fine silty loam	7.5YR4/0	Saturated, dense root mat in the upper 6" of the profile

The mean number of organisms per sample at this station was 7.4, and the community was numerically dominated by the earthworm *Amynthas diffringens.* A total of five invertebrate taxa were collectedat this station, including one earthworm species *(A. diffringens).*

Collecting earthworms for tissue analysis was relatively easy at this station and only required 1 person-hour using digging and electroshocking methods to collect 130 grams of tissue.

Experimental Station CMS-4001

Habiat/Soil Profile: The site is located approximately 75 feet south of the lower capped area at the Centredale Manor Site. The area sampled is very similar to sample location CMS-4005. Herbaceous plants dominated this sample location the plants identified at location CMS-4005 as well as steeple bush *(Spirea tomentosa).* The soils observed at this location were identical to the soils observed at sample location CMS-4005.

Depth (bgs)	**Description**	Munsel Color Code	Comments
0-6"	Ai, fine silty loam, Oi, fibric materials	10YR3/2	
6-18"	B, fine silty loam, hemic to sapric material (highly decomposed organic material)	7.5 YR 3/0	(free/standing water at 18")

The mean number of organisms per sample at this station was 15.8, the largest number of organisms collected from any station. The community was numerically dominated by earthworm *Lumbricus rubellus.* A total of six invertebrate taxa were collected at this station, including three earthworm species.

Earthworm tissue collection required 3 person-hours to collect 120 grams of tissue using digging and electroshocking methods.

Experimental Station CMS-4002

Habitat/Soil Profile: The area sampled is located in the floodplain below the lower capped area at the Centredale Manor Site. The area is dominated by trees including yellow birch *{Betula alleghaniensis),* gray birch (£. *populifolia),* and red maples *{A. rubrum).* Dogwoods *(Cornus* sp.) and vines *(Vitus* sp.) dominated the shrub layer, and jewel weed (/. *capensis),* and false indigo *(Amorpha fruticosa)* dominate the herbaceous layer. None of the trees in this area was considered mature, as the majority of the trees were less than 30 feet tall. This area appears to be a depositional area, and often

flooded during heavy flow. There were several areas that showed signs of water flowing through this area including eroded ruts and rills as well as matted plant material and silt staining on vegetation. In addition, this area may have been flooded prior to the breaching of the Allendale Pond dam.

The Soil Survey of Rhode Island (SCS, 1977) identifies the soils in this area as Udorthents-Urban land complex. These soils are typically altered well drained to excessively drained soils that have been cut, filled, or eroded (SCS, 1977). The soils at this location are consistent with this soil type, based on the horizon description presented in the table below. The presence of a buried A horizon confirms that material has been deposited in this area. It is likely that this material is alluvial in origin, based on the eroded banks of the Woonasquatucket River up stream from this location.

Depth (bgs)	Description	Munsel Color Code	- Comments
0-3"	A, fine sandy loam	10YR 3/2	
3-6"	E, medium silty sand	2.5YR 5/1	
6-12"	Bhs, medium silty sand	7.5YR 3/0	Roots to 12" in oxidized ryzoshpheres, soil moist through out
12-15"	Burried A horizon / Oi	2.5YR 3/4	Highly organic, sticks etc.
15-24"	Bhs, silty sand	7.5YR 3/0	(free/standing water at 24")

The mean number of organisms per sample at this station was 10.0, and the community was numerically dominated by the earthworm *Lumbricus rubellus.* A total often invertebrate taxa were collected at this station, including five earthworm species.

A total of 6.person-hours was required, using digging and electroshocking methods, to collect approximately 120 grams of earthworm tissue.

Experimental Station CMS-4003

The crew conducting the habitat and soil survey was unable to locate this earthworm/floodplain soil sampling location. The soil classification/characterization was conducted several days after the earthworms and floodplain soils were collected. The mean number of organisms per sample at this station was 7.2, and the community was numerically dominated by Coleoptera (beetles), primarily Elateridae (click beetles). A total of eleven invertebrate taxa were collected at this station, the highest number of taxa collected from any station, and included four earthworm species.

A total of 3.5 person-hours, using digging and electroshocking methods, was required to collect 145 grams of earthworm tissue.

Experimental Station CMS-4005

Habitat/Soil Profile: The area sampled is located in the same floodplain as sample location CMS-EW/FP-4002 (i.e., below the lower capped area at the Centredale Manor Site). This area is dominated by herbaceous species including jewel weed (*I. capensis),* wood nettle *(Laportea*

canadensis), cattails *(Typha* sp.), woolly sedge *(Scirpus cyperinus),* and purple loosestrife *(Lythrum salicaria).* Black willow *{Salix nigra)* was the dominant tree in the area.

The Soil Survey of Rhode Island (SCS, 1977) identifies the soils in this area as Udorthents-Urban land complex. These soils are typically altered well drained to excessively drained soils that have been cut, filled, or eroded (SCS, 1977). The soils at this location are not consistent with this soil type, based on the description presented in the table below. The soils that were observed at this location would be better classified as an Adrian Soil Series, which have a surface horizon that is formed from decomposing herbaceous plants, underlain by a sand and gravel. These soils have the characteristic histic epipedon, and pockets of coarse sand were observed in the lower horizon. The soils in this location were likely formed when this area was more permanently flooded, prior to the breaching of the Allendale Pond dam.

In addition, a sheen was observed in the standing water in the test pit dug at this location. There was also a strong, oil like odor present during the excavation of the test pit.

Depth (bgs)	Description	Munsel Color Code	Comments
0-6"	Ai, fine silty loam, Oi, fibric materials	10YR3/2	
6-18"	B, fine silty loam, hemic to sapric material (highly decomposed organic material)	7.5YR 3/0	(free/standing water at 18")

The mean number of organisms per sample at this station was 7.2, and the community was numerically dominated by the earthworm *Lumbricus rubellus.* A total of six invertebrate taxa were collected at this station, including four earthworm species.

A total of 2 person-hours was required to collect 135 grams of earthworm tissue using digging and electroshocking methods.

Experimental Station LPX-4004

Habitat /Soil Profile: The area sampled is located in the floodplain behind the North Providence Boys&Girls Club adjacent to the Woonasquatucket River. The floodplain in this area was a red maple (Acer rubrum) dominated forest. The understory was dominated by red maple (Acer ruburn) saplings, dogwoods *(Cornus* sp.), sweet pepper bush *(Clethra alnifolia)* and grape vines *(Vitus labrusca* and *riparid).* The herbaceous layer, where the canopy was open, was dominated by jewel weed *(Impatiens capensis).*

The Soil Survey of Rhode Island identifies the soils in the area of this sample location as Podunk fine sandy loam (Pp) (SCS, 1977). These soils are typically formed in floodplains and are characterized by a relatively thin dark brown to black surface horizon underlain by a dark yellowish brown to yellowish brown subsoil. These soils typically exhibit signs of a fluctuating water table in the subsoil (i.e., mottles). The surface and subsurface horizons are typically fine sandy loam and the substratum grain size is typically much coarser and contains gravelly sized material.

The soils in the location that was sampled are consistent with the soils as identified and described in the Soil Survey of Rhode Island for this area. The soil in this location had a thin black surface

horizon underlain by a lighter subsoil. The substratum was not exposed while characterizing this soil, however as shown in the table below the soil did become more coarse with depth, which is consistent with the Podunk soil series. In addition, redoxymorphic features (e.g., mottles) were observed in the subsoil at this location.

Depth (bgs)	Description	Munsel Color Code	Comments
0-6"	A, fine sandy loam	10YR2/2	
6-≥"	C, coarse sand and gravel (2-4" dia, round)	10YR5/4	Likely historic stream bed, river deposited material

The mean riumfJef dFbrganisms per sample at this statidh was 6.4, and the community was numerically dominated by the earthworm *Aporrectodea rosea.* A total of six invertebrate taxa were collected at this station, including two earthworm species.

A total of 3.75 person-hours was required to collect 135 grams of earthworm tissue using digging and electroshockdng methods.

Experimental Station LPX-4006

Habitat /Soil Profile: The area of floodplain sampled at this location occurred in the back yard of a residential property that was adjacent to Lyman Mill Pond. The location that was sampled was in a corner of the back lawn that was adjacent to the Lyman Mill Pond. The trees in the vicinity of the sampling location included a large Northern catalpa *(Catalpa speciosa),* a small red maple *(Acer rubrum),* and a balsam fir *(Abies balsamed).* There were several large dogwood shrubs in between the waters edge and the area of floodplain sampled. The ground surface were the sample plot was located was dominated by managed grass, and surrounded on the water-side by jewel weed *(Impatiens capensis),* nettles *(Urtica dioica),* purple loosestrife *(Lythrum salicarid),* and narrow leaved cattail *(Typha angustifolia).*

The Soil Survey of Rhode Island (SCS, 1977) identifies the soils in the area of this sample location as Merrimac urban complex (MU). These soils are typically composed of Merrimac soils, urban land and other soils (SCS, 1977). The soils at this location would be considered urban land, as they are composed of fill material, and are therefore consistent with the soils described in the Soil Survey (SCS, 1977). The soils at this location were considered to be filled material based on the amount of glass, wood ash, and anthroprogenic detritus that was observed in the B horizon as shown in the table below.

Depth (bgs)	Description	Munsel Color Code	Comments
2-0"	O, horizon		grass/lawn and leaf litter.
0^"	A, sandy silt	10YR2/1	likely fill material
4-20"	B, coarse gravelly sand, includes some fines	10YR4/2	fill material - glass, wood ash, anthropromorphic detritus prevelent

The mean number of organisms per sample at this station was 8.8, and the community was numerically dominated by the earthworm *Lumbricus rubellus*. A total of six invertebrate taxa were collected at this station, including two earthworm species.

A total of 3.5 person-hours was required to collect approximately 120 grams of earthworm tissue using digging and electroshocking methods.

Experimental Station LPX-4007

Habitat /Soil Profile: The location sampled is located in a slight depression, approximately 10 feet from the edge of Lyman Mill Pond. The area that was sampled was mostly devoid of shrub and herbaceous vegetation. The shrub vegetation, which dominated the area surrounding the sample plot included high bush blueberry *(Vaccinium corymbosum),* dogwoods ~~*(Cornus*~~ sp:); arrow wood *(Viburnum* sp.), sweet pepper bush *(Clethra alnifolia)* and red maple *(Acer rubrum)* saplings. The herbaceous species in the surrounding area included sensitive fern *(Onoclea sensibilis),* poison ivy *(Toxicodendron radicans),* and Virginia creeper *(Parthenocissus quincuefolid).*

The Soil Survey of Rhode Island identifies the soils in the area of this sample location as Merrimac sandy loam, 3 to 8 percent slope (MmB). These soils are usually formed in outwash plains and are typically well drained. The upper soil horizon consists of a dark brown sandy loam (i.e., about 8 inches thick), this horizon is typically underlain by a yellowish brown sandy loam subsoil, approximately 17 inches thick. The substratum is typically a yellowish brown gravelly sand, which can extend to a depth of 60 inches or more (SCS, 1977).

The soils in the area sampled are not consistent with the soil description presented in the Soil Survey (SCS, 1977). The sample plot occurred in a slight depression, which appeared to function as a drainage for a small area of wetland adjacent to Lyman Mill Pond. The area was not flooded at the time of sampling but appeared to show signs that water did flow through the area at times of high water and or heavy preciptation (i.e., the lack of herbaceous vegetation and leaf litter as well as exposed roots and scouring). The soils appeared to be formed from deposition of finer materials. The upper soil horizon and subsoil consisted of dark brown silty sands, with accumulations organic material (i.e., Bhs horizons). A brief description of the soil horizons is presented in the table below. The differences observed in the sample plot, as compared to the mapped units from the Soil Survey (SCS, 1977) are likely due to the location on the land surface, as the plot did occur in a slight depression within the small floodplain of Lyman Mill Pond. This area was not mapped in the Soil Survey because it is a relatively small area.

Depth (bgs)	Description	Munsel Color Code	Comments
0-3"	A, coarse silty sand	10YR 2/3 soil matrix, with 10YR 7/3 med.-coarse sand, mottles	0-2" dense root mat
3-12"	Bhs, fine silty sand	10YR2/2	Very dark brown
12-20"	Bhs, silt	10YR4/1	Dark brown

The mean number of organisms per sample at this station was 13.2, and the community was numerically dominated by the earthworm *Lumbricus rubellus.* A total often invertebrate taxa were collected at this station, including four earthworm species.

A total of only 1 person-hour was required to collect approximately 120 grams of earthworm tissue using digging and electroshocking methods.

4.0 DISCUSSION

The floodplain soil invertebrate communities along the Woonasquatucket River, were comprised of organisms that are typically found in wetland and forested habitats. In general, across all stations earthworms numerically dominated the floodplain soil community and were almost three times more abundant than the number of non-annelid organisms (Table 1). The mean total number of organisms collected from each station was higher at experimental Stations CMS-4001 and LPX-4007 (15.8 and 13.2, respectively) than at any of the four reference stations. The lowest mean number of organisms collected from a station was 4.4 organisms per core collected at reference Station RWR-5002. Earthworm abundance was also highest at experimental Stations CMS-4001 and LPX^4007 (12.6 and 11.4, respèctively), but was lowest at experimental Station CMS-4003.

The numerically dominant earthworms collected across all sites were *Lumbricus rubellus* (red marsh worm) and *Aporrectodea rosea* (pink soil worm). Both of these species have been previously reported from Providence County, Rhode Island (Reynolds 1973). *L. rubellus* is one of the most widely distributed and abundant species in northeastern North America and is a surface dwelling species that has adapted to a variety of habitats (Reynolds personal communication) including stream banks (Reynolds et al 1974). *A. rosea,* previously reported as *Eisenia rosea* or *Allolobophora rosea,* is common in the northern United States and Canada, but is never the dominant species (Reynolds, personal communication; Reynolds 1973). *A. rosea* inhabits surface soil in fields, gardens, pastures, forests, under leaves and rocks, and is common on stream or lake banks (Reynolds 1973, Reynolds et al 1974). *Dendrodrilus rubidus* (european bark worm), previously reported as *Dendrobaena rubida,* was the numerically least abundant worm across all stations and was found at only two stations, RWR-5001 and CMS-4002. This species is common throughout North America usually under bark of decaying logs, stream banks, compost piles, and manure (Reynolds personal communication). *Aporrectodea longa* was the only worm species restricted to one station, LPX-4007. This species is found in New England states and eastern Canadian provinces but is not a dominant or abundant species in these areas (Reynolds personal communication). It is a deep burrowing species that has been reported from cultivated soil, gardens, pastures, and woodlands (Reynolds personal communication).

In general, the earthworms collected during this survey were surface dwelling (< 6 inches bgs) cosmopolitan species, which are commonly found in a variety of habitats and soil types. The mean Catch Per Unit Effort (CPUE) to collect 120 grams of earthworm tissue (the minimum amount required for tissue analysis) across all stations was 4.4 person-hours. Stations RWR-5004 and LPX-4007 required only 0.9 and 1 person-hour respectively to collect 120 grams of tissue, whereas Station RWR-5001 required 9.75 hours to collect 67 grams, or 17.5 hours to collect 120 grams of tissue. Earthworm collection CPUE was less from experimental stations adjacent to the Site (mean = 3.1 person-hours, Stations CMS^OOl to LPX 4007) than the CPUE required at reference stations upstream of the Site (mean = 6.8 person-hours, Stations RWR-5001 to RWR-5004).

This metric is a measure of the relative abundance of earthworms in each of the sample plots. Lower CPUE implies that conditions were more suitable for supporting greater numbers of earthworms since less effort was required to collect a standard amount of tissue. Although the CPUE metric provides a means of evaluating among station differences that may be attributable to the effects of chemical stressors, it is also influenced by variability in habitat suitability, sampling technique, and other factors.

Across all stations combined, Coleoptera, which included primarily Elateridae (click beetles) and Carabidae (ground beetles), and Crustacea (sowbugs) were the dominant non-earthworm taxa. Both beetles and sowbugs are commonly found in forested habitats. The numerically least abundant non-earthworm taxon was Diplopoda (millipedes), which was also the only non-earthworm taxon that was collected at only one station (LPX-4006).

All of the organisms found throughout the floodplain soil samples collected along the Woonasquatucket River are commonly found in forested and woodland areas along stream banks. The earthworms are all common species and have been previously reported from Rhode Island. Impact assessment metrics, similar to EPA's Rapid Bioassessment Protocols (Plafkin et al 1989, Barbour et al 1999), are not available for floodplain soil invertebrates. In general, floodplain soil communities downstream of the Site had mean densities similar to or greater than densities found at upstream reference stations. Also, the number of taxa found at stations downstream of the Centredale Manor Site were generally greater than what was found upstream of the Site. Organisms found at upstream reference stations were also found at downstream stations; no organisms were restricted to upstream stations exclusively.

In conclusion, no adverse impacts from the Centredale Manor Site were evident in the floodplain soil communities along the Woonasquatucket River. This conclusion is based on the similarity of the metric values found at experimental stations relative to the reference stations. In general, the mean total abundance of organisms and number of taxa found at experimental stations was greater than at reference stations. Also, the CPUE to collect earthworms for tissue analysis was lower at experimental stations than at reference stations. However since several factors, such as soil composition, organic matter percent composition, and even percent moisture may interact to increase habitat suitability, how these factors affect suitability for each earthworm species on a microhabitat scale is unknown (Reynolds personal communication).

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BIOASSESSMENT REPORT OF THE ICHTHYOPLANKTON COMMUNITY IN GREYSTONE MILL POND, LYMAN MILL POND, AND ASSAPUMPSETT POND, NORTH PROVIDENCE, RHODE ISLAND

April 2002

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

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1.0 INTRODUCTION

The Centredale Manor Superfund Site (the Site), consisting of approximately 9.04 acres, is located in North Providence, Rhode Island, just south of Route 44 on the eastern bank of the Woonasquatucket River. The main area of the Site is known as 2072 and 2074 Smith Street. The Site consists of reaches of the Woonasquatucket River associated with Allendale Pond and Lyman Mill Pond and includes all contaminated areas within this area as well as any other location to which contamination from that area has come to be located, or from which that contamination came.

Currently, two high rise buildings (Centredale Manor and Brook Village, both federally subsidized, senior housing complexes) are located in the main area of the Site, which is zoned for residential occupancy. In addition to the buildings, the main area is covered by roadway and parking lots. On the eastern portion of the main area is a drainage swale that begins near the northern portion of the main area and extends south, then curves to the west and discharges south of the main area into the Woonasquatucket River and Allendale Pond.

The Site was used for disposal of wastes containing hazardous substances. Between approximately 1940 and 1970, USEPA has reason to believe that the main area of the Site was the location of a chemical manufacturing facility (which produced hexachlorophene, among other chemicals) and an incineration-based drum recycling facility. The first housing complex was built in approximately 1976. The second high rise was built in 1982. Construction records show that hazardous substances were removed from the Site during the construction of the second complex. Samples indicate the presence of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and other contaminants in soil and sediment at the main portion of the Site as well as river sediment and floodplain soils downstream.

Beginning in May 2001, Normandeau Associates, Inc. (NAI) worked with Harding ESE to collect community composition data on fish, benthic macroinvertebrates, emergent aquatic insects, ichthyoplankton, and floodplain soil invertebrates near the Site. Bioassessment reports produced from these data will be incorporated into the Baseline Ecological Risk Assessment for the Centredale Manor Restoration Superfund Site to assess effects from the Site on these communities. The following report describes the findings of the ichthyoplankton community bioassessment.

2.0 METHODS

Larval fish (ichthyoplankton) sampling was conducted two times, during 2-9 May and during 13-14 June 2001. Samples were collected using a 0.5-m diameter, 1.5-m long, 500 µm mesh plankton net towed on the surface from a boat. During the May sampling event, three replicate surface tows each were collected from four locations in Lyman Mill Pond (Stations LPX 1, LPX 2, LPX 3, LPX 4) (Figure 2), three locations in Greystone Mill Pond (GMP 1, GMP 2, GMP 3) (Figure 2), and two locations in Assapumpsett Pond (ASP 1, ASP 2) (Figure 1). During the June sampling event, three replicate surface tows were collected from the same four locations in Lyman Mill Pond and from the same three locations in Greystone Mill Pond. Because of the difficulties encountered during the May sampling event, no sampling was conducted at Assapumpsett Pond in June.

Also, during both time periods, qualitative dipnet samples were collected from two locations (Stations TRCN and TRCU) in the Allendale Reach Tailrace, which runs along the eastern boundary of the site. Ichthyoplankton samples from the tailrace were collected by hand using a dipnet because the

shallow depth and small size of the tailrace precluded the use of a boat for the collection of ichthyoplankton. A total of 35 dips using a 500 µm mesh dipnet were composited for each sample.

The volume of water filtered for each towed sample was approximately 50 m^3 (±10 m^3), which was determined using a General Oceanics flowmeter mounted in the mouth of the net. Flowmeter readings were recorded on an ichthyoplankton rough calculation sheet, so that an approximate sample volume could be calculated. The tow distance used in this calculation was obtained from the observed number of flowmeter counts per second for each tow, using the General Oceanics graph for the Model 2030 flowmeter with standard rotor. Tow volume was calculated by multiplying tow distance by the surface area of the net mouth opening.

Aquatic macrophytes, which were extremely abundant during May sampling in Assapumpsett Pond, prevented effective sampling at that location; no clear channel could be found that would allow a complete sample to be collected without clogging the net. Therefore flowmeter measurements from Assapumpsett Pond during the May sample are questionable. Several tows were attempted in May but were discarded due to clogging with macrophytes. A four inch trash pump was also used to collect ichthyoplankton samples in areas where aquatic macrophytes were not as abundant; however, even pump sampling proved to be futile because of the amount of plant material that was entrained during sampling. Due to the difficulty collecting samples in May, samples were not collected in Assapumpsett Pond in June.

Ichthyoplankton samples were individually placed in a labeled sample container and preserved with 10% formalin. The samples were taken to NAI's biological laboratory for sorting, identification, and enumeration of the species present.

In the laboratory, formalin was rinsed from the samples through a 500 µm mesh sieve and all samples were sorted in their entirety. All fish eggs and larvae were identified to species except for Centrarchidae (sunfish) which were identified to genus. Ichthyoplankton data for each tow or dipnet sample are presented as density (no./100m^3) or no./dip for each species per replicate in Section 3.0.

During sample processing, Quality Assurance/Quality Control procedures provided in the FSP for ichthyoplankton sample processing were followed and documented.

Water quality data, including temperature (°C), dissolved oxygen (mg/l), conductivity (µmhos/cm^2) and pH (standard units) were collected on the surface at each sampling location at the conclusion of ichthyoplankton sampling. During 2-3 May, water quality was measured with an Horiba Model U-10 meter. During 8-9 May and June, water quality was measured using a YSI-85 oxygen, conductivity, salinity, and temperature meter and an Oakton™ hand-held pH meter Model 2 35624-23. Water quality samples were collected at the conclusion of sampling at each station.

3.0 RESULTS

3.1 EGGS

The majority of eggs collected across all stations during May belonged to Centrarchidae (sunfish and bass family). The eggs of two additional species, *Esox niger* (chain pickerel) and *Morone americana* (white perch), were also collected (Table 1). Eggs were collected from both stations in Assapumpsett Pond (ASP 1, ASP 2) and from all stations in Greystone Mill Pond during May. No eggs were

Table 1. Mean Number of Ichthyoplankton (No./100 m^3) Collected from Surface Tows from Assapumpsett Pond (ASP), Lyman Mill Pond (LPX) and Greystone Mill pond (GMP) during May and June, 2001.

Station		ASP1[1]	ASP2[1]	GMP1	GMP2	GMP3	LPX1	LPX2	LPX3	LPX4
Sample Date		3 May	3 May	3 May	3 May	8 May	8 May	8 May	8 May	8 May
Taxa										
Catostomidae										
Catostomus.commersoni	larvae					126.81	5.49	0.55		
Centrarchidae	*eggs*		*1.50*	*10.11*	*292.30*	*1.53*				
	larvae									
Lepomis sp.	larvae	11.82	2.30						5.06	0.58
Micropterus salmoides	larvae									
Pomoxis sp.	larvae									
Esocidae										
Esox niger	*eggs*	*2.36*								
	larvae	15.94	0.79							
Ictaluridae										
Ameirus nebulosus	larvae				1.04					
Percidae										
Etheostoma olmstedi	larvae					3.06				
Percichthydae										
Morone americana	*eggs*	*14.07*								

Station		GMP1	GMP2	GMP3	LPX1	LPX2	LPX3	LPX4
Sample Date		13 June	13 June	13 June	13 June	14 June	14 June	14 June
Taxa								
Catostomidae								
Catostomus commersoni	larvae			0.81	0.78	0.70		
Centrarchidae	larvae							
Lepomis sp.	larvae	32.97				15.61		2.97
Micropterus salmoides	larvae				0.79			
Pomoxis sp.	larvae					0.70		
Cyprinidae	*eggs*			*33.33*				
	larvae					2.14	0.81	2.68
Esocidae								
Esox niger	larvae							
Ictaluridae	larvae							
Ameirus nebulosus	larvae							
Percidae								
Etheostoma olmstedi	larvae					33.13		
Percichthydae								
Morone americana	larvae	0.67						

[1] Not sampled in June.

collected from Lyman Mill Pond. In June, eggs were only collected from the Greystone Mill Pond upper impoundment station (GMP 3). All eggs collected in June were Cyprinidae (minnow family).

In Assapumpsett Pond in May, two species of larvae were collected, *Lepomis sp.* (sunfishes) and *Esox niger*. Throughout the pond, larvae of *E. niger* were slightly more abundant than *Lepomis* sp., although catches of both species were much higher at Station ASP 1 than at Station ASP 2.

3.2 LARVAE

In Greystone Mill Pond during May, *Catostomus commersoni* numerically dominated ichthyoplankton larvae followed by *Etheostoma olmstedi* (tessellated darter) and *Ameirus nebulosus* (brown bullhead). In May, larvae were only collected from the middle and upper impoundment stations (GMP 2 and GMP 3 respectively). In June, *Lepomis* sp. was the overwhelmingly numerically dominant species followed by *C. commersoni* and *Morone americana* (white perch). Also in June, no larvae were collected from the Greystone Mill Pond middle impoundment station (GMP 2).

In Lyman Mill Pond during May, two species of larvae were collected, *Catostomus commersoni* and *Lepomis* sp. Abundance of both species was similar. During June, *Etheostoma olmstedi* was the numerically dominant species, followed by *Lepomis* sp., Cyprinidae, *C. commersoni, Micropterus salmoides* (smallmouth bass), and *Pomoxis* sp. (black and white crappie). Larvae were collected from all stations, although the highest catch was from Station LPX 2.

33 TAILRACE SAMPLES

The tailrace confluence station (TRCN) and tailrace upstream station (TRCU) dipnet samples, located in the Allendale Tailrace Reach, collected two species of larval fish, *Catostomus commersoni* and *Notropis hudsonius* (spottail shiner) (Table 2). No eggs were collected from the Allendale Tailrace Reach. Larval fish were only collected during the May sample and numerical abundance was slightly higher at the downstream station (TRCN) near the confluence with the Woonasquatucket River.

Table 2. Total catch of dipnet samples (No./35 dips) in tailrace stations TRCN and TRCU during May and June 2001.

Station	TRCN		TRCU	
Date	9 May	14 June	9 May	14 June
Species				
Catostomus commersoni	2	0	1	0
Notropis hudsonius	5	0	2	0

3.4 WATER QUALITY

Water quality during ichthyoplankton collections in May and June were typical of impoundments where submerged aquatic vegetation is abundant, although dissolved oxygen values were somewhat high in May. Low precipitation and wanner temperatures may have resulted in lower dissolved oxygen concentrations in the Lyman Mill Pond during June sampling (Table 3).

Table 3. Water quality data collected from Assapumpsett Pond (ASP), Lyman **Mill** Pond (LPX), Greystone Mill Pond and the Allendale Reach Tailrace Areas (TRCN and TRCU) during May and June 2001.

	ASP1	ASP2	GMP1	GMP2	GMP3	LPX1	LPX4	TRCN	TRCU
SAMPLE DATE	2 May	3 May	3 May	3 May	5 May	5 May	9 May	9 May	9 May
Temperature (°C)	19.3	21.3	21.7	20.2	17.8	20.2	17.4	19.8	17.1
Dissolved Oxygen (mg/1)	U.6	10.8	10.27	9.2	8.8	8.0	6.0	10.3	9.9
pH	6.8	7.1	7.11	**6.71**	7.0	7.0	6.9	7.1	7.1
Specific Conductance (µmhos/cm^2)	201	027	222	225	189	208	209	213	353

	GMP1	GMP2	GMP3	LPX1	LPX2	LPX3	LPX4	TRCN	TRCU
SAMPLE DATE	13 June	13 June	13 June	14 June	14 June	14 June	14 June	14 June	14 June
Temperature (°C)	22.4	22.4	23.0	20.9	21.9	23.2	24.6	20.1	19.4
Dissolved Oxygen (mg/1)	5.8	8.7	7.9	6.8	4.9	5.8	6.9	8.1	8.0
pH	6.1	7.4	7.6	6.2	6.6	7.4	7.3	7.8	7.6
Specific Conductance (µmhos/cm^2)	200	200	190	230	230	200	230	310	340

4.0 DISCUSSION

The fish eggs and larvae found in the Centredale Manor Study area are typical offish species that spawn during this time of the year. However, it is difficult to make an accurate assessment of the ichthyoplankton community within a body of water without frequent sampling periods across the entire range of the spawning season within that body of water. Therefore, only representatives of species spawning and hatching at or near the sampling time when ichthyoplankton samples were collected would be see in the samples.

Species like *Esox niger* (chain pickerel), *Micropterus salmoides* (largemouth bass) and *Lepomis macrochirus* (bluegill) spawn relatively early in the spring; indeed, *E. niger* will spawn soon after ice out. Cyprinid and bullhead species spawn somewhat later in the spring and into the summer months. Additionally, most centrarchid and bullhead species guard their young in their nests until the fiy reach post-larval (juvenile) sizes (Scott & Crossman, 1973). Therefore, larvae of these species would not be present in the water column and, consequently, would not be collected in the samples.

The relatively high numbers of *Catostomus commersoni* larvae and centrarchid eggs in the Greystone Mill Pond and Lyman Mill Pond May samples corresponded to the peak of their spawning season. The June samples were dominated by cyprinid eggs and *Lepomis sp.* larvae in Greystone Mill Pond and by *Etheostoma olmstedi* and *Lepomis* sp. in Lyman Mill Pond. The June samples also showed the post peak of centrarchid, *Esox niger,* and *Morone americana* eggs, and the peak of cyprinid eggs. This change in the dominant egg taxon from Centrarchidae in May to Cyprinidae in June and the increased number *of Lepomis* sp. larvae in June shows the natural succession offish species in Greystone Mill Pond and Lyman Mill Pond during May and June.

In conclusion, no adverse impacts of the Centredale Manor Site on the ichthyoplankton communities in Greystone Mill Pond, Lyman Mill Pond, and Assapumpsett Pond were evident.

5.0 LITERATURE CITED

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BIOASSESSMENT REPORT OF THE EMERGENT AQUATIC INSECT COMMUNITY IN GREYSTONE MILL POND, LYMAN MILL POND, AND ALLENDALE POND NORTH PROVIDENCE, RHODE ISLAND

April 2002

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

BIOASSESSMENT REPORT OF THE EMERGENT AQUATIC INSECT COMMUNITY IN GREYSTONE MILL POND, LYMAN MILL POND, AND ALLENDALE POND NORTH PROVIDENCE, RHODE ISLAND

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1.0 INTRODUCTION

The Centredale Manor Superfund Site (the Site), consisting of approximately 9.04 acres, is located in North Providence, Rhode Island, just south of Route 44 on the eastern bank of the Woonasquatucket River. The main area of the Site is known as 2072 and 2074 Smith Street. The Site consists of reaches of the Woonasquatucket River associatedwith Allendale Pond and Lyman Mill Pond and includes all contaminated areas within this area as well as any other location to which contamination from that area has come to be located, or from which that contamination came.

Currently, two high rise buildings (Centredale Manor and Brook Village, both federally subsidized, senior housing complexes) are located in the main area of the Site, which is zoned for residential occupancy. In addition to the buildings, the main area is covered by roadway and parking lots. On the eastern portion of the main area is a drainage swale that begins near the northern portion of the main area and extends south, then curves to the west and discharges south of the main area into the Woonasquatucket River and Allendale Pond.

The Site was used for disposal of wastes containing hazardous substances. Between approximately 1940 and 1970, USEPA has reason to believe that the main area of the Site was the location of a chemical manufacturing facility (which produced hexachlorophene, among other chemicals) and an incineration-based drum recycling facility. The first housing complex was built in approximately 1976. The second high rise was built in 1982. Construction records show that hazardous substances were removed from the Site during the construction of the second complex. Samples indicate the presence of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and other contaminants in soil and sediment at the main portion of the Site as well as river sediment and floodplain soils downstream.

Beginning in May 2001, Normandeau Associates, Inc. (NAI) worked with Harding ESE to collect community composition data on fish, benthic macroinvertebrates, emergent aquatic insects, ichthyoplankton, and floodplain soil invertebrates near the Site. Bioassessment reports produced from these data will be incorporated into the Baseline Ecological Risk Assessment for the Centredale Manor Restoration Superfund Site to assess effects from the Site on these communities. The following report describes the findings of the emergent aquatic insect community bioassessment.

2.0 METHODS

Five aquatic insect emergence traps were deployed in each of the following areas: Greystone Mill Pond, Lyman Mill Pond, and Allendale Pond in the general vicinity of the tree swallow *(Tachycineta bicolor)* population study nest boxes (Figures 1 and 2). The emergence traps, purchased from Bioquip Products, were pyramid shaped enclosures constructed of Lumalite screening that measured 2.4 m high and 2m by 2m at the base. Each trap enclosed an area that was $4m^2$. In Greystone Mill Pond and Lyman Mill Pond, traps were supported by three-fourths inch diameter electrical conduit that was inserted into a wooden frame. Floats were attached to the frame to enable the traps to float on the surface of the water; each trap was anchored to the substrate to prevent movement. The Field Sampling Plan (FSP, Harding ESE 2001) stated that each trap would cover 2 m^2 of the water's surface and the traps would be deployed after tree swallow egg hatch and before nestlings were collected for tissue analysis. However, trap deployment was delayed until late June to avoid reducing the tree swallow forage base. Since traps were deployed late, larger traps were purchased from Bioquip Products to increase sampling efficiency and reduce mobilization time.

In Allendale Pond, the breaching of Allendale Pond dam during March 2001 changed the habitat from a shallow pond to a shallow stream. Traps deployed in this pond were supported with three-fourths inch diameter electrical conduit that was inserted into the submerged substrate. Flowing water and shallow depth precluded floating the traps.

Five emergence traps were deployed in each pond on 19, 20, and 21 June 2001 at Greystone Mill Pond, Lyman Mill Pond, and Allendale Pond respectively (Figures 1 and 2) and were retrieved on 24 July 2001. Each trap was sampled seven times during deployment.

Traps were sampled by opening the side of the trap and extracting insects using forceps and a suction device (Insect Vac made by Bioquip®); traps were sampled approximately every two to five days. Although the FSP stated that traps would be sampled every two days, the duration between sampling events was increased to every 3-5 days due to the slower than anticipated jate ofbiomass accumulation in the traps.

All insects were removed from the traps and frozen with dry ice until they were processed in the laboratory. Insects were processed for tissue analysis; a subsample of 1-2 specimens of each taxon was preserved in alcohol in a labeled sample container and taken to Normandeau's biological analytical laboratory for identification to the lowest practical taxonomic level (i.e., genus or family). QA/QC procedures provided in the FSP for processing emergent aquatic insect samples were followed. Numerical abundance of major taxonomic groups (Odonata, Trichoptera, Diptera) was visually estimated.

3.0 RESULTS

Emergent aquatic insect traps in Greystone Mill Pond and Lyman Mill Pond successfully collected emerging insects throughout the sampling period. However the breaching of Allendale Pond Dam and the lack of precipitation during field studies resulted in water levels constantly dropping during the sampling period. When the dropping water level caused the Allendale Pond traps to be stranded on dry shoreline, traps were relocated over submerged substrate in an effort to collect emerging insects; however no emergent aquatic insects were collected in the Allendale Pond traps.

Greystone Mill Pond had three emergence traps located in the lower (southern) portion of the impoundment and two traps located in the upper (northern) portion of the impoundment (Figure 2). Habitat conditions at all five locations were similar and had a predominately mud substrate, 3 foot depth, and an abundance of submerged aquatic vegetation. A total of 12.83 grams of aquatic insects were collected from all traps combined as follows:

GMP-EI-5001	2.09 grams
GMP-EI-5002	3.06 grams
GMP-EI-5003	1.57 grams
GMP-EI-5004	3.24 grams
GMP-EI-5005	2.87 grams
TOTAL	12.83 grams

The coenagrionid damselfly *Enallagma* sp. was the numerically dominant taxon and comprised approximately 64% of the insects collected. The numerical abundance of other organisms collected during sampling were the aeshnid dragonfly *Boyeria* sp. (8 % composition), the leptocerid caddisflies

Triaenodes sp. (0.5 % composition) and *Oecetis* sp. (0.5 % composition), and the non-biting midge family Chironomidae (26 % composition).

Lyman Mill Pond had two traps set in the lower (southern) portion of the impoundment and three traps set in a cove in the upper (northern) portion of the impoundment (Figure 3). Habitat conditions at all locations were similar to conditions in Greystone Mill Pond, i.e., mud substrate, 3 foot depth, and an abundance of submerged aquatic vegetation. A total of 7.52 grams of aquatic insects were collected from all traps combined as follows:

LPX-EI-4006	2.21 grams
LPX-EM007	1.84 grams
LPX-EI-4008,	0.79 grams
LPX-EI-4009	2.49 grams
LPX-EI-4010	0.19 grams
TOTAL	7.52 grams

The emergent aquatic insect collections from Lyman Mill Pond were overwhelmingly numerically dominated by the damselfly *Enallagma* sp., which comprised approximately 89% of the insects collected. The numerical abundance of other organisms collected during sampling included the dragonfly *Boyeria* sp. (1% composition), the caddisflies *Triaenodes* sp. (0.5% composition) and *Oecetis* sp. (0.5% composition), and the non-biting midge family Chironomidae (9% composition).

4.0 DISCUSSION

Emergent aquatic insect sampling in Greystone Mill Pond and Lyman Mill Pond did not indicate substantial differences in the taxonomic composition between the two ponds. The same taxa were found in both ponds; however the relative abundances of *Enallagma* sp. and Chironomidae found in each pond was different. Both ponds were numerically dominated by *Enallagma* sp.; however the percent composition of this genus in Greystone Mill Pond (reference pond) was 64%, whereas at Lyman Mill Pond (experimental pond) this genus comprised 89% of the emerging insect community. Also, Chironomidae comprised 26% of the emerging insect community in Greystone Mill Pond (reference pond) yet comprised 9% of the emerging aquatic insect community in Lyman Mill Pond (experimental pond). Both ponds were generally comprised of organisms that had biotic index values considered moderately tolerant to pollution. Biotic index values for *Enallagma* sp., *Oecetis* sp., and Chironomidae is 8 and the value for *Triaenodes* sp. is 6; however the value for *Boyeria* sp. is 2 (Bode etal. 1995).

The FSP for this study stated that calculations for total abundance, diversity (Shannon-Weiner), eveness (Pielou's), and Hilsenhoff Biotic Index would be calculated for each pond and sampling location. However because of the small size of the tissue samples, which precluded removing subsamples of organisms for community analysis, these metrics were not calculated. The FSP also stated that abundance and biomass data would be presented on a Catch Per Unit Effort (CPUE) basis, but since all traps were sampled an equal number of times (i.e., seven times), calculating CPUE was unnecessary.

The only major difference between the emerging aquatic insect communities was the biomass of tissue that was collected from each pond. A total of 12.83 grams of emergent aquatic insects were

collected from Greystone Mill Pond, whereas at Lyman Mill Pond, a total of 7.52 grams of tissue were collected. This difference is not significant (T-test, p=0.05).

In conclusion, since there was no significant difference in total biomass and the taxonomic composition of the emergent aquatic insect communities were similar at both Greystone Mill Pond and Lyman Mill Pond, no substantial adverse impacts from the Site to the emergent aquatic insect community in Lyman Mill Pond was indicated.

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Appendix A

Emergent Aquatic Insect Raw Count Data

EMERGENT AQUATIC INSECT RAW DATA COUNTS FROM LYMAN MILL POND, NORTH PROVIDENCE, RI.

STATION	SAMPLE DATE	*tnaliagma* sp.	*Boyeria* sp.	*Oecetis* sp.	*Triaenodes* sp.	Chironomidae
LPX-4006	25-Jun-Ol	8		3		50
	28-Jun-Ol	62				
	3-Jul-Ol	29	1			
	9-Jul-01	29	1			
	ll-Jul-01	8				
	13-Jul-01		TRAP	EMPTY		
	16-Jul-01	12	2			
LPX-4007	25-Jun-Ol	5				
	28-Jun-Ol	33				
	3-Jul-Ol		TRAP	EMPTY		
	9-Jul-01	32				
	ll-Jul-01	7	2			3
	13-Jul-01		TRAP	EMPTY		
	16-Jul-01	14				1
LPX-4008	25-Jun-Ol		TRAP	EMPTY		
	28-Jun-Ol	31				
	3-Jul-Ol	41				
	9-Jul-01	10				
	ll-Jul-01	17				
	13-Jul-Ol		TRAP	EMPTY		
	16-Jul-01	23				
LPX-4009	25-Jun-Ol		TRAP	EMPTY		
	28-Jun-Ol	51				
	3-Jul-Ol	23				
	9-Jul-01	44				
	ll-Jul-01	13				
	13-Jul-Ol		TRAP	EMPTY		
	16-Jul-01	26				
LPX-4010	25-Jun-Ol		TRAP	EMPTY		
	28-Jun-Ol	6			2	
	3-Jul-Ol	4			2	
	9-Jul-01	2				
	ll-Jul-01	3				
	13-Jul-Ol		TRAP	EMPTY		
	16-Jul-01		TRAP	EMPTY		
	TOTAL	533	6	3	4	**54**

BENTHIC MACROINVERTEBRATE BIOASSESSMENT REPORT OF THE WOONASQUATUCKET RIVER, NORTH PROVIDENCE, RHODE ISLAND

April 2002

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

BENTHIC MACROINVERTEBRATE BIOASSESSMENT REPORT OF THE WOONASQUATUCKET RIVER, NOR*TH PROVIDENCE, RHODE ISLAND

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1.0 INTRODUCTION

The Centredale Manor Superfund Site (the Site), consisting of approximately 9.04 acres, is located in North Providence, Rhode Island, just south of Route 44 on the eastern bank of the Woonasquatucket River. The main area of the Site is known as 2072 and 2074 Smith Street. The Site consists of reaches of the Woonasquatucket River associated with Allendale Pond and Lyman Mill Pond and includes all contaminated areas within this area as well as any other location to which contamination from that area has come to be located, or from which that contamination came.

Currently, two high rise buildings (Centredale Manor and Brook Village, both federally subsidized, senior housing complexes) are located in the main area of the Site, which is zoned for residential occupancy. In addition to the buildings, the main area is covered by roadway and parking lots. On the eastern portion of the main area is a drainage swale that begins near the northern portion of the main area and extends south, then curves to the west and discharges south of the main area into the Woonasquatucket River and Allendale Pond.

The Site was used for disposal of wastes containing hazardous substances. Between approximately 1940 and 1970, USEPA has reason to believe that the main area of the Site was the location of a chemical manufacturing facility (which produced hexachlorophene, among other chemicals) and an incineration-based drum recycling facility. The first housing complex was built in approximately 1976. The second high rise was built in 1982. Construction records show that hazardous substances were removed from the Site during the construction of the second complex. Samples indicate the presence of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and other contaminants in soil and sediment at the main portion of the Site as well as river sediment and floodplain soils downstream.

Beginning in May 2001, Normandeau Associates, Inc. (NAI) worked with Harding ESE to collect community composition data on fish, benthic macroinvertebrates, emergent aquatic insects, ichthyoplankton, and floodplain soil invertebrates near the Site. Bioassessment reports produced from these data will be incorporated into the Baseline Ecological Risk Assessment for the Centredale Manor Restoration Superfund Site to assess effects from the Site on these communities. The following report describes the findings of the benthic macroinvertebrate community bioassessment.

2.0 METHODS

2.1 BENTmC MACKOINVERTEBRATE SAMPLING

Benthic macroinvertebrate kick samples were collected from nine sampling stations in flowing sections of the Woonasquatucket River during 3-5 July 2001 (Figures 1 and 2). The Field Sampling Plan (FSP, Harding ESE 2001) stated that benthic data would be collected from ten stations; three stations above Greystone Mill Pond near the Smithfield Waste Water Treatment Plant (WWTP); three stations between Route 44 and Allendale Pond; two stations below Allendale Pond; and two stations below Assapumpsett Pond. However, it was noted during the site reconnaissance that the flow in the river reach adjacent to the WWTP was affected by the Greystone Mill Pond dam and that this area was not suitable for the benthic macroinvertebrate study. Following discussion with USEPA and ACOE, two of these three locations were relocated to the river reach between the Greystone Mill Pond dam and Route 44. These two relocated stations became the upstream reference locations for the study. The third location was added to the river reach adjacent to the Site to allow a more precise

assessment of the effects of ground water discharge on the stream macroinvertebrate community. The downstream location proposed in Assapumpsett Brook was eliminated following discussion with USEPA because of the poor habitat condition observed at the proposed location during the site reconnaissance (Figures 1 and 2).

A total often individual locations were sampled from each station by placing a 500µm mesh dip net perpendicular to the substrate and agitating the substrate immediately upstream of the net. Kick net sampling field methods followed general procedures provided in Barbour (1999). Five representative samples were collected from fast water habitats and five representative samples were collected from slow water habitats at each station. Fast water and slow water habitats were determined by visually comparing habitats within a sampling station. Approximately two square meters of substrate were sampled from each station. Both fast water and slow water habitat samples were composited to provide one sample at each station.

2.2 HABITAT ASSESSMENT SAMPLING

At each benthic macroinvertebrate sampling station, the physical habitat of the river was evaluated using the habitat assessment matrix developed for the Rapid Bioassessment Protocols (RBPs) in Barbour et al. (1999). The 1999 version of the RBP habitat assessment matrix provides assessment metrics for high gradient streams and separate, more appropriate metrics for low gradient streams. The Woonasquatucket River habitat was evaluated using the 1999 high gradient assessment metrics. Ten metrics were evaluated on a numerical scale of 0 to 20 (lowest to highest quality respectively) for each sampling reach. The ratings were totaled and compared to a reference condition to provide a final habitat ranking; scores increased as habitat quality increased. Total scores for a reach ranged from 0 to 200, therefore, in general, scores 150 to 200 indicated excellent habitat quality, scores 100 to 149 indicated good habitat quality, scores 50 to 99 indicated fair habitat quality, and scores 0 to 49 indicated poor habitat quality.

2.3 LABORATORY ANALYSIS

The FSP stated that samples would be sorted by removing organisms from randomly selected grids in a gridded enamel pan until a minimum of 300 organisms was removed from the sample. However, to increase sample sorting efficiency, the samples were divided into quarters (or eighths for Station GMP 1) using a plexiglass divider to reduce sample volume. Then quarters were sorted individually until a minimum of 300 organisms was removed from each sample. Once sorting was initiated in a quarter, all animals were removed from that quarter. In all cases, more than 300 organisms were identified from a sample. Organisms removed during the sorting process were identified to the lowest practical taxonomic level (usually genus and species). All QA/QC procedures provided in the FSP were followed and documented.

2.4 DATA ANALYSIS

Benthic data were analyzed using seven biological metrics (parameters) to assess the data. These metrics integrate population community and functional feeding group characteristics to produce a single evaluation of biotic integrity. The seven metrics used in this evaluation are listed below.

Taxa Richness - Taxa richness is the number of distinct taxa (types of organisms) in a sample. For example, if two genera of mayfly, one genus of caddisfly, and five genera of midges were found in a sample, regardless of the number of individuals in each group, the taxa richness of the sample would be 8. The number of distinct taxa was determined using the following counting rules:

1. Higher level taxonomic identifications (e.g., Phylum, Class, Order, Family) were not counted as a separate taxon if lower taxonomic levels (i.e., genus or species) were found in that sample.
2. Higher level taxonomic identifications (e.g., Phylum, Class, Order, Family) were not counted toward taxa richness *unless* they were the only representative.
3. Insect pupae were ignored in all calculations.

Biotic Index - The biotic index is a ranking based on literature-reported values of the relative sensitivity of **a** taxon **to** organic pollution stress caused primarily by the presence of oxygen-demanding substances in the water. This index was developed by Hilsenhoff (1982) to summarize the tolerances of benthic macroinvertebrates at the generic taxonomic level.

Values range from 0 (sensitive) to 10 (tolerant), i.e., lower values indicate less impaired conditions. This metric was calculated by multiplying the mean number of individuals of a taxon by its assigned Rhode Island tolerance value, which were provided by Bode (1988) and Bode et al. (1995). All of these products were summed, and divided by the total number of individuals of each taxon that was assigned a tolerance value.

$$HBI = \frac{\text{rijaj}}{N}$$

Where: n_i = the number of individuals of the "i"th taxon;
a_i = the index value of that taxon;
N = the total number of individuals in the sample assigned a Biotic Index Value

Ratio of Scrapers to Filtering Collectors - Scrapers are benthic macroinvertebrates that feed on algae and bacteria growing on the substrate (periphyton). Filtering collectors feed on fine particulate material that is suspended in the water. The predominance of either functional feeding group reflects an abundance of their food source, and the two feeding groups are usually compared as a ratio. The more this ratio differs from a value of 1.0, the greater the imbalance in the proportion of these two food resources. A low ratio indicates either a relatively high abundance of particulate food or a low abundance of periphyton, whereas a high ratio indicates either a high abundance of periphyton or a low abundance of particulate material. A high ratio may also indicate the presence of toxicants adsorbed onto fine organic particulate material that has become available as food for filtering collectors.

Ratio of Ephemeroptera, Plecoptera, and Trichoptera (EPT) to **Chironomidae abundance** - Non-biting midges in the insect family Chironomidae are often abundant in the benthic macroin vertebrate community and are generally tolerant of environmental stress. The ratio of abundance of the sensitive EPT taxa to the abundance of the tolerant Chironomidae is a measure of community balance. Good biotic conditions are reflected by a relatively high ratio. Macroinvertebrate communities experiencing environmental stress may exhibit a low

EPT/Chironomidae ratio due to a disproportionate high number of the tolerant midges. Chironomids tend to become increasingly dominant along a gradient of increasing organic enrichment or heavy metals concentration (Ferrington 1987).

Percent Contribution of the Dominant Family - The percent contribution of the most abundant taxon to the total number of organisms found in a sample is a measure of balance in the benthic community. If the dominant taxon accounts for a large percentage of the individuals present, it is an indication of stress because the community is dominated by one taxon, whereas unstressed communities typically exhibit a more evenly balanced abundance among several taxa.

EPT Richness Index - Three groups of benthic insects are considered particularly sensitive to pollution, and the number of distinct taxa among them generally increases with increasing water quality. These groups (orders), Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) are collectively referred to as the EPT taxa. The EPT Index is calculated by counting the number of EPT taxa represented in each sample, similar to calculating taxa richness. Low values for this metric indicate potentially stressful conditions.

Community Loss Index — The community loss index measures the loss of benthic taxa in samples from an experimental station compared to those found at the reference station, and is calculated as follows:

$$\text{Community Loss Index} = \frac{d-a}{c}$$

Where: a= number of taxa common to both samples
c= total number of taxa present at the experimental station
d= total number of taxa present at the reference station

The value of this index can range from 0 to infinity, and increases as the test station becomes increasingly dissimilar to the reference station.

Benthic data were evaluated using procedures and scoring criteria described in EPA's Rapid Bioassessment Protocols m (Plafkin et al. 1989). Each metric was given a score based on its percent comparability to the reference data using the following criteria:

Metric	BIOLOGICAL SCORING CRITERIA			
	6	4	2	0
1. Taxa Richness (exp./ref.* 100)	>80%	60-80%	40-60%	<40%
2. HilsenhofTBiotic Index (ref7exp.*100)	>85%	70-85%	50-70%	<50%
3. Scraper to Filterer Abundance Ratio (exp./ref.* 100)	>50%	35-50%	20-35%	<20%
4. EPT to Chironomidae Abundance Ratio (exp./ref. * 100)	>75%	50-75%	25-50%	<25%
5. Percent Contribution of the Dominant Taxon (actual value)	<20%	20-30%	30^0%	>40%
6. EPT Richness (expVref.* 100)	>90%	80-90%	70-80%	<70%
7. Community Loss Index (actual value)	<0.5	0.5-1.5	1.5-4.0	>4.0

For comparisons against experimental Stations APX 1, APX 2, APX 3, APX 4, WRL 1, and WRL 2, mean values of metrics from Stations GMP 1 and GMP 2 were used as reference data. Also, sediment sampling previously conducted in Greystone Mill Pond indicated that some PCB contamination may

be present in the sediments (Tetra Tech NUS Inc. 1999) and may have affected downstream reaches. Since Stations GMP 1 and GMP 2 were downstream of Greystone Mill Pond, mean reference data (mean value of Stations GMP 1 and GMP 2), as well as data from Stations GMP 1 and GMP 2 individually, were compared to an off-site control station (Station RAB 1) to determine whether the reference data were representative of unimpaired conditions.

Metric scores for each experimental station were totaled and compared to the total metric score for the reference data. Reference data total scores used for comparison against experimental data (i.e., RAB 1 and mean value of GMP 1 and GMP 2) automatically received an optimal score of 6 for each metric, except for percent contribution of the dominant taxon, which would be less than optimal if a single taxon comprised greater than 20 percent of the benthic community at that station (Plafkin et al. 1989). The percent comparison between the total scores for each station provided a final evaluation of the biological condition category (see below).

BIOASSESSMENT

% Comparison to Ref. Score	Biological Condition Category	Attributes
>83%	Nonimpaired	Comparable to the best situation to be expected within an ecoregion. Balanced trophic structure. Optimum community structure (composition and dominance) for stream size and habitat quality.
54-79%	Slightly Impaired	Community structure less than expected. Composition (species richness) lower than expected due to the loss of some intolerant forms. Percent contribution of tolerant forms increases.
21-50%	Moderately Impaired	Fewer species due to loss of most intolerant forms. Reduction in EPT index.
<17%	Severely Impaired	Few species present If high densities of organisms, then dominated by one or two taxa.

3.0 RESULTS

Benthic macroinvertebrate communities at sampling stations throughout the Woonasquatucket River and Assapumpsett Pond outlet stream were consistent with benthic communities typically found in moderately high gradient streams in southern New England. Habitat and biological data results are presented below by station.

Table 1. Physical and water quality characteristics and habitat assessment scores for benthic macroinvertebrate sampling stations on the Woonasquatucket River in the vicinity of Centerdale Manor, RI during July 2001.

	HABITAT ASSESSMENT						
STATION	SUBSTRATE/ COVER	EMBEDDEDNESS	VELOCITY/ DEPTH REGIME	SEDIMENT DEPOSITION	CHANNEL FLOW STATUS	CHANNEL ALTERATION	RIFFLE FREQUENCY
RAB1	20	20	14	19	19	17	17
GMP1	14	14	19	19	19	18	8
GMP2	12	13	15	14	18	20	12
APX1	14	15	15	19	19	19	18
APX2	17	15	14	19	19	15	16
APX3	18	16	14	20	20	15	19
APX4	14	15	14	15	18	17	13
WRL1	13	11	19	7	14	20	20
WRL2	13	11	17	8	14	20	20

STATION	BANK STABILITY	VEGETATIVE PROTECTION	RIPARIAN VEG. ZONE WIDTH	TOTAL SCORE	*f*/COMPARISON (ypREF. STA.	HABITAT VALUE
RAB1	20	16	8	170	100	EXCELLENT
GMPI	18	16	4	149	88	GOOD
GMP2	16	15	13	148	87	GOOD
APX1	16	15	18	168	113	EXCELLENT
APX2	16	9	8	148	100	GOOD
APX3	16	8	8	154	104	EXCELLENT
APX4	12	16	18	152	102	EXCELLENT
WRL1	18	18	12	152	102	EXCELLENT
WRL2	18	18	12	151	102	EXCELLENT

	SUBSTRATE % COMPOSITION				*WATER QUALITY*						
STATION	BOULDER	COBBLE	GRAVEL	SAND	TEMPERATURE *CO*	DISSOLVED OXYGEN (mg/1)	CONDUCTIVITY (micromhos/cm[1])	pH	MEAN DEPTH	MEAN SLOW WATER VELOCITY (fps)	MEAN FAST WATER VELOCITY (fps)
RABI	20	70	10		20.2	6.0	237.3	7.5	0.4	0.1	1.7
GMPI	25	28	22	25	23.1	6.7	209.0	7.5	1.1	0.7	2.9
GMP2	20	60	20		21.4	6.8	193.5	6.9	0.7	1.3	2.3
APX1	10	40	20	30	21.9	5.5	199.0	7.4	1.2	1.1	2.4
APX2	25	45		30	21.7	5.4	200.0	7.6	1.4	1.0	2.6
APX3	50	30	20		23.7	6.3	209.0	6.9	0.8	0.2	2.1
APX4	10	40	~35	15	23.6	6.5	207.5	6.9	1.4	2.4	4.0
WRL1	55		45		23.4	7.4	210.0	7.4	1.2	1.1	2.1
WRL2	5	50		45	25.2	7.0	2000.0	7.1	1.5	0.9	2.1

Station RAB 1 (Offsitc Control Station)

This station was sampled on 3 July 2001 and was located in the outlet downstream of Assapumpsett Pond at the surface water sampling Station RAB-SW-5004 (Figure 2). The substrate was 20% boulder, 70% cobble, and 10% gravel, mean water depth was 0.4 feet, mean slow water current velocity was 0.1 feet per second (fps), mean fast water current velocity was 1.7 fps, and stream width was 3 to 6 feet (Table 1). The habitat assessment score for this station was 170, indicating excellent habitat for macroinvertebrates.

The numerically dominant taxon at this location was the flatworm *Dugesia tigrina.* This species comprised 19% of the benthic community. Other taxa that represented greater than 10% of the benthic community at this station were the net-spinning caddisfly *Hydropsyche betteni* and the chironomids *Polypedilum favum* and *Micrōcylloepus pusillus* (Appendix A). This station had the highest biotic index value (more tolerant) of any station (Table 2).

Station GMP 1 (Upstream Reference Station)

This station was sampled on 3 July 2001 and was located in the outlet of Greystone Mill Pond at surface water sampling Station RWR-SW-5002 (Figure 1). The benthic sample was collected from five riffle and five run habitats and composited into one sample. Stream width was 30 feet, mean depth was 1.1 feet, mean slow water velocity was 0.7 fps, mean fast water velocity was 2.9 fps, and substrate composition was 25% boulder, 28% cobble, and 22% gravel. Approximately 90 percent of the substrate in the fast water areas was covered with attached algae, but no algae was visible in slow water areas (Table 1). The habitat score for this station was 149, indicating good habitat to support benthic macroinvertebrates.

The numerically dominant taxon at this location was the black fly *Simulium* sp., which comprised 27.2% of the benthic community. The only other taxon that represented greater than 10% of the benthic community was the midge *Tvetenia vitracies.* This station had the lowest metric values for biotic index (more sensitive), scraper to filterer ratio (more impaired), and EPT to Chironomidae abundance ratio (more impaired), and the highest value for percent contribution of the dominant taxon (more impaired) (Appendix A). The low value for EPT to Chironomidae abundance ratio was also seen at Station APX 1.

Bioassessment metric comparisons between this station and the off-site control data (Station RAB 1) were **100** percent or higher for three metrics, taxa richness, biotic index, and EPT richness. These three metrics, in addition to community loss index, received optimal scores of 6. EPT to Chironomidae abundance ratio and percent contribution of the dominant taxon received a score of 4. Scraper to filterer ratio received a score of 2. The total metric score for this station was 34, which was 81.0% of the off-site control station data score, indicating non-impairment to slight-impairment at this station (Table 2).

Station GMP 2 (Upstream Reference Station)

This station was sampled on 3 July 2001 and was located in the outlet of Greystone Mill Pond at surface water sampling Station RWR-SW-5001, downstream of Station GMP 1 (Figure 1). The benthic sample was collected from a riffle habitat, which had a stream width of 20 to 30 feet, a mean depth of 0.7 feet, a mean slow water velocity of 1.3 fps, and a mean fast water velocity of 2.3 fps. Substrate composition was 20% boulder, 60% cobble, and 20% gravel; approximately 5% of the

Table 2. Metric values, percent comparison of experimental and reference data, and biological condition scores for benthic macroinvertebrate data collected from the Woonasquatucket River, RI during 3-5 July 2001.

	RAW DATA									
	Control	Reference								
	RAB1	GMP1	GMP2	GMP mean	APX 1	APX 2	APX 3	APX 4	WRL 1	WRL 2
taxa richness	36	36	35	35.5	29	35	34	26	39	35
biotic index	6.54	5.76	6.42	6.09	6.21	5.90	5.99	6.30	5.81	6.58
scraper/filterer	0.06	0.02	0.15	0.09	0.13	0.10	0.07	0.03	0.26	0.22
EPT/Chir abundance	1.3	0.7	1.0	0.84	0.7	0.8	0.8	1.4	0.8	0.9
% dominant taxon	19.0	27.2	12.6	19.9	16.5	15.8	14.3	21.4	16.2	25.2
EPT richness	7	8	5	6.50	6	7	6	6	9	8
community loss index	0	0.32	0.29	0.31	0.77	0.59	0.56	0.85	0.47	0.57
	METRIC COMPARISON									
taxa richness*	100.0	100.0	97.2	98.6	81.7	98.6	95.8	73.2	109.9	98.6
biotic index*	100.0	113.5	101.9	107.4	98.1	103.2	101.7	96.7	104.8	92.6
scraper/filterer*	100.0	33.3	250.0	141.7	152.9	117.6	82.4	35.3	305.9	258.8
EPT/Chir abundance*	100.0	51.9	76.3	64.1	88.1	94.0	96.4	167.9	97.6	104.8
% dominant taxon[b]	19.0	27.2	12.6	19.9	16.5	15.8	14.3	21.4	16.2	25.2
EPT richness'	100.0	114.3	71.4	92.9	92.3	107.7	92.3	92.3	138.5	123.1
community loss indcx[b]	0	0.32	0.29	0.22	0.77	0.59	0.56	0.85	0.47	0.57
	METRIC SCORE									
taxa richness	6	6	6	6	6	6	6	4	6	6
biotic index	6	6	6	6	6	6	6	6	6	6
scraper/filterer	6	2	6	6	6	6	6	4	6	6
EPT/Chir abundance	6	4	6	4	6	6	6	6	6	6
% dominant taxon	6	4	6	6	6	6	6	4	6	4
EPT richness	6	6	4	6	6	6	6	6	6	6
community loss index	6	fi	6	6	4	4	4	4	fi	4
TOTAL SCORE	42	34	40	40	40	40	40	34	42	38
SCORE % COMP. TO REF.	100.0	81.0	95.2	95.2	95.2	95.2	95.2	81.0	100.0	90.5
DEGREE OF IMPAIRMENT		NON/ SLIGHT	NON	NON	NON	NON	NON	NON/ SLIGHT	NON	NON

[a] percent comparison
[b] actual metric value

substrate was covered with plant detritus (Table 1). The habitat score for this station was 148, indicating good habitat to support benthic macroinvertebrates.

The numerically dominant taxon at this station was the net-spinning caddisfly *Hydropsyche belteni,* no other taxon comprised greater than 10% of the benthic community at this station (Appendix A). This station had the lowest values of any station for percent contribution of the dominant taxon (less impaired), EPT richness (more impaired), and community loss index (less impaired) (Table 2).

Bioassessment metric comparisons between this station and the off-site control data (Station RAB 1) were 100% or higher for only two metrics, biotic index, and scraper to filterer abundance ratio. All metrics, except for EPT richness, received optimal scores of 6; EPT richness received a score of 4. The total metric score for this station was 40, which was 95.2% of the off-site control station data score; therefore no impairment was seen at this station.

Station APX 1

This station sampled on 4 July 2001 and was located in the Woonasquatucket River approximately 100 feet downstream of the Route 44 bridge at surface water sampling Station WRC-SW-4001 (Figure 1). Stream width at this location was 20 to 30 feet, mean depth was 1.2 feet, mean slow water current velocity was 1.1 fps and mean fast water current velocity was 2.4 fps (Table 1). Substrate composition at this station was 10% boulder, 40% cobble, 20% gravel, and 30% sand. The habitat assessment score for this station was 168, indicating excellent benthic macroinvertebrate habitat. The habitat score compared to the mean habitat score for GMP 1 and GMP 2 (reference data) was greater than 100%, which indicates that the benthic macroinvertebrate habitat at Station APX 1 was comparable to the reference habitat and should support a comparable benthic community.

The numerically dominant taxon at this station was the net-spinning caddisfly *H. betleni* (Appendix A). The only other taxon that comprised greater than 10% of the benthic community was the midge *Rheotanytarsvs* sp. This station had the lowest value (more impaired) for EPT to Chironomidae abundance ratio (Table 2). This low value for EPT to Chironomidae abundance ratio was also seen at Station GMP 1.

Bioassessment metric percent comparisons between this station and the reference data (mean values of GMP 1 and GMP 2) were 81% or higher; therefore all metrics that required percent comparisons with the reference data (i.e., taxa richness, biotic index, scraper to filterer ratio, EPT to Chironomidae abundance ratio, and EPT richness) received optimal scores of 6. Percent composition of the dominant taxon was 16.5%, which because it was less than 20%, received a score of 6. Community loss index was 0.77, which resulted in a score of 4. The total metric score for this station was 40, which was 95.2% of the reference data score; therefore no impairment was seen at this station.

Station APX 2

This station sampled on 4 July 2001 and was located in the Woonasquatucket River near the southern end of Brook Village Estates at surface water sampling Station WRC-SW-4002 (Figure 1). Stream width at this location was 20 to 25 feet, mean depth was 1.4 feet, mean slow water velocity was 1.0 fps, and mean fast water velocity was 2.6 fps (Table 1). Substrate composition at this station was 25% boulder, 45% cobble, and 30% sand. The habitat assessment score for this station was 148, indicating good benthic macroinvertebrate habitat. The habitat score comparison against the mean habitat scores for GMP 1 and GMP 2 was 100%, which indicates that the benthic macroinvertebrate

habitat at this location was comparable to the reference habitat and should support a comparable benthic community.

The numerically dominant taxon at this station was the midge *Rhcotanylarsm* sp. (Appendix A). No other taxon comprised greater than 10% of the benthic community at this station.

Bioassessment metric percent comparisons between this station and the reference data (mean values of GMP 1 and GMP 2) were 94% or higher; therefore all metrics that required percent comparisons with the reference data (i.e., taxa richness, biotic index, scraper to filterer ratio, EPT to Chironomidae abundance ratio, and EPT richness) also received optimal scores of 6 (Table 2). Percent composition of the dominant taxon was 15.8%, and received a score of 6. Community loss index was 0.59, which resulted in a score of 4. The total metric score for this station was 40, which was 95.2% of the reference data score; therefore no impairment was seen at this station.

Station APX 3

This station sampled on 3 July 2001 and was located in the Woonasquatucket River near the middle of Centredale Manor at surface water sampling Station WRC-SW-4003 (Figure 1). Stream width at this location was 20 to 25 feet, mean depth was 0.8 feet, mean slow water velocity was 0.2 fps, and mean fast water velocity was 2.1 fps (Table 1). Substrate composition at this station was 50% boulder, 30% cobble, and 20% gravel. The habitat assessment score for this station was 154, indicating excellent benthic macroinvertebrate habitat. The habitat score comparison against the mean habitat scores for GMP 1 and GMP 2 was greater than 100%, which indicates that the benthic macroinvertebrate habitat at Station APX 3 was comparable to the reference habitat and should support a comparable benthic community.

The numerically dominant taxon at this station was the net-spinning caddisfly *H. belteni* (Table 2). The only other taxon that comprised greater than 10% of the benthic community was the midge *Rheotanytarsus* sp. (Table 2).

Bioassessment metric percent comparisons between this station and the reference data (mean values of GMP 1 and GMP 2) were 82% or higher; therefore all metrics except for community loss index received optimal scores of 6. The community loss index value was 0.56, which resulted in a score of 4. The total metric score for this station was 40, which was 95.2% of the reference data score; therefore no impairment was seen at this station.

Station APX 4

This station sampled on 3 July 2001 and was located in the Woonasquatucket River adjacent to the southern tip of the southern cap area at surface water sampling Station WRC-SW-4004 (Figure 1). Stream width at this location was 20 to 25 feet, mean depth was 1.4 feet, mean slow water velocity was 2.4 fps and mean fast water velocity was 4.0 fps (Table 1). This station had the fastest current velocity of all stations that were sampled. Substrate composition at this station was 10% boulder, 40% cobble, 35% gravel, and 15% sand. The habitat assessment score for this station was 152, indicating excellent benthic macroinvertebrate habitat. The habitat score comparison against the mean habitat scores for GMP 1 and GMP 2 was greater than 100%, which indicates that the benthic macroinvertebrate habitat at Station APX 4 was comparable to the reference habitat and should support a comparable benthic community.

The numerically dominant taxon at this station was the net-spinning caddisfly *H. beileni* (Table 2). Other taxa that comprised greater than 10% of the bcnthic community were the oligochaete worm *Nais* sp. and the black fly *Simulium* sp. (Appendix A). This station had the highest community loss index (more impaired), and the lowest value for taxa richness (more impaired) (Table 2).

Bioassessment metric percent comparisons between this station and the reference data (mean values of GMP 1 and GMP 2) were 90% or higher for three metrics, biotic index, EPT to Chironomidae abundance ratio, and EPT richness, and all three metrics received optimal scores of 6. However, taxa richness, scraper to filterer abundance ratio, percent contribution of the dominant taxon, and community loss index received scores of 4. The total metric score for this station was 34, the lowest score of any station, which was 81.0% of the reference data score, indicating non to slight impairment.

Station **WRL** 1

This station sampled on 4 July 2001 and was located in the Woonasquatucket River approximately 300 feet downstream of the bridge that crosses the river downstream of Allendale Dam, near surface water sampling Station WRI-SW-4005 (Figure 2). Stream width at this location was 30 feet, mean depth was 1.2 feet, mean slow water velocity was 1.1 fps and mean fast water velocity was 2.1 fps (Table 1). Substrate composition at this station was 55% boulder and 45% gravel. The habitat assessment score for this station was 152, indicating excellent benthic macroinvertebrate habitat. The habitat score compared to the mean habitat scores for GMP 1 and GMP 2 was greater than 100%, which indicates that the benthic macroinvertebrate habitat at Station WRL 1 was comparable to the reference habitat and should support a comparable benthic community.

The numerically dominant taxon at this station was the oligochaete *Nais* sp. (Table 2). The only other taxon that comprised greater than 10% of the benthic community was the philopotamid caddisfly *Chimarra* sp. This station had the highest values for taxa richness (less impaired), scraper to filterer abundance ratio (less impaired), and EPT richness (less impaired) (Table 2).

Bioassessment metric percent comparisons between this station and the reference data (mean values of GMP 1 and GMP 2) were 97% or higher for all metrics, and all metrics received optimal scores of 6, including percent contribution of the dominant taxon and community loss index. The total metric score for this station was 42, which was 100% of the reference data score, indicating no impairment.

Station **WRL** 2

This station sampled on 5 July 2001 and was located in the Woonasquatucket River approximately 30 feet downstream of the bridge that crosses the river downstream of Allendale Dam, near surface water sampling Station WRI-SW-4004 (Figure 2). Stream width at this location was 30 feet, mean depth was 1.5 feet, mean slow water current velocity was 0.9 fps, and mean fast water current velocity was 2.1 fps (Table 1). Substrate composition at this station was 5% boulder, 50% cobble, and 45% sand. The habitat assessment score for this station was 151, indicating excellent benthic macroinvertebrate habitat. The habitat score compared to the mean habitat scores for GMP 1 and GMP 2 was greater than 100%, which indicates that the benthic macroinvertebrate habitat at Station WRL 2 was comparable to the reference habitat and should support a comparable benthic community.

This station was the only station that had water quality values substantially different than all of the other stations. Specific conductance at Station WRL 2 was 2000 micromhos per cm^2, almost ten times the value found at all other stations.

The numerically dominant taxon at this station was the oligochaete *Nais* sp. (Appendix A). No other taxon comprised greater than 10% of the benthic community. This station did not have any metric values that were highest or lowest, although values for biotic index and percent contribution of the dominant taxon were relatively high, indicating more impairment (Table 3).

Bioassessment metric percent comparisons between this station and the reference data (mean values of GMP 1 and GMP 2) were 91% or higher for all metrics and received optimal scores of 6; however, percent contribution of the dominant taxon and community loss index received scores of 4. The total metric score for this station was 38, which was 90.5% of the reference data score, indicating no impairment.

4.0 DISCUSSION

Benthic macroinvertebrate sampling stations in the Woonasquatucket River had generally good to excellent habitat for supporting benthic communities. Subtle differences in the benthic communities may be due to slight differences in the physical habitat characteristics found at each station. Substrate composition at most stations was predominantly boulders, cobble, and gravel with some interstitial sand. Current velocity was slowest at Station RAB 1 and was fastest at Station APX 4. Slow water current velocity ranged from 0.1 fps at Station RAB 1 to 2.4 fps at Station APX 4. Fast water current velocity ranged from 1.7 fps at Station RAB 1 to 4.0 fps at Station APX 4.

Water quality at all stations was good and appeared suitable to support diverse and unimpaired benthic communities. Water temperature ranged from 20.2 to 25.2°C, dissolved oxygen ranged from 5.4 at Station APX 2 to 7.4 ppm at Station WRL 1. The pH values were within normal ranges, from 6.9 to 7.5 standard units. Specific conductance at one station (WRL 2) was the only water quality parameter where an extremely high level was seen. Specific conductance at Station WRL 2 was measured at 2000 micromhos per cm^2. All other stations had specific conductance values that ranged from 193.5 to 237.5 micromhos per cm^2. However the high specific conductance level at Station WRL 2 did not appear to adversely affect the benthic community at this station since the bioassessment results indicated no impairment.

Benthic macroinvertebrate communities at all stations sampled in the Woonasquatucket River, except Stations GMP 1 and APX 4, showed no signs of impairment. Benthic data from Stations GMP 1 and APX 4 indicated non-impairment to slight-impairment.

Taxa richness was high at all stations; no less than 26 taxa were found at each station. Benthic communities that are impaired typically have low values for taxa richness when compared to reference communities. Station APX 4 had the lowest value for taxa richness, but Station GMP 1 had the second highest number of taxa when compared to all stations.

Percent composition of the dominant taxon was moderately low across all stations. Only three stations had the dominant taxon comprising greater than 20 percent of the benthic community, Stations GMP 1, APX 4, and WRL 2. This is somewhat surprising since benthic communities, even from slightly impaired habitats, will often be numerically dominated by one or a few species.

Biotic index values were in the moderately tolerant range (5.76 to 6.58). This metric received a score of 6 at all stations. The moderate tolerance range of biotic index values across all stations is somewhat expected. The Hilsenhoff Biotic Index was originally developed to assess organic pollution effects in Wisconsin streams (Hilsenhoff 1982) and is not as sensitive at discriminating effects of dioxin and PCB contamination.

The scraper to filterer abundance ratio was low across all stations. This metric reflects the riffle/run community food base and provides insight into the nature of potential disturbance factors (Plafkin et al. 1989). Specialized feeders, such as scrapers, are more sensitive organisms and are thought to be well represented in healthy streams (Barbour et al. 1999). Generalists, such as collectors and filterers, have a broader range of acceptable food materials than specialists (Cummins and Klug 1979), and are more tolerant to pollution that may alter availability of certain food. However, increased numbers of filterers, which would reduce scraper to filterer ratios, can also be a function of the dominant food resource available. Filterers consume fine particulate organic matter (FPOM) in the water column using filtering mechanisms such as specialized appendages or mouthparts and nets. Tailwaters downstream of impoundments have an abundance of plankton, which provide a rich source of FPOM to downstream benthic communities. Reference Station RAB 1 was located in the tailwater of Assapumpsett Pond dam, GMP 1 and GMP 2 were located within 1500 feet of Greystone Mill Pond dam, and experimental Stations WRL 1 and WRL 2 were located within 300 feet of Allendale Pond dam. Therefore the low values for scraper to filterer ratio would be expected from these stations.

Stations APX 1, APX 2, APX 3, and APX 4 were located slightly more than ½ mile downstream of Greystone Mill Pond dam and would not be expected to be influenced by plankton abundance as much as upstream stations that are closer to the dam. If periphyton abundance at these four stations was limited, which would therefore reduce the abundance of scrapers, low values for scraper to filterer ratios found at these stations would be seen and their scraper to filterer ratio values would be comparable to communities found below impoundments.

EPT to Chironomidae abundance ratio received an optimal score of 6 at all stations except GMP 1. EPT richness received an optimal score of 6 at all stations. These two metrics are closely related because as impairment increases values for both metrics would be reduced due to decreased numbers of pollution sensitive EPT taxa and increased numbers of tolerant Chironomidae. Across all stations, moderate values for both metrics were seen. A reduction in EPT taxa and/or an increase in chironomid abundance is often one of the first indicators of impairment caused by environmental stress (Plafkin et al 1989), neither of which was seen in the Woonasquatucket River benthic communities.

Percent contribution of the dominant taxon is also a good indicator of toxic impairment. Benthic communities dominated by relatively few species indicates environmental stress (Plafkin et al. 1989). Under stressful conditions, sensitive species are lost from the community and more tolerant organisms tend to fill the niches made available. Under extremely stressful conditions, hyperdominance can be seen where one or two species may comprise 40 to 50% of the benthic community. None of the stations in the Woonasquatucket River had numerical dominance by a single taxon greater than 27.2%, and most stations had percent contribution of the dominant taxon below 20%. All stations except GMP 1 received an optimal score of 6 for this metric.

Community loss index is a measure of the taxonomic similarity between stations. Experimental stations where impacts are seen will usually have benthic communities with different taxa than

reference stations. Community loss index values less than 0.5 are generally accepted as being within normal variability between benthic communities. Five of the six experimental stations received a score of 4 for this metric, with the highest score seen at Station APX 4.

Benthic communities from two of the eight stations sampled in the Woonasquatucket River indicated non-impairment to slight-impairment, GMP 1 and APX 4. At GMP 1, low values for scraper to filterer abundance ratio, EPT to Chironomidae abundance ratio, and percent contribution of the dominant taxon were responsible for reducing the total score to 34, whereas at Station APX 4, low values for taxa richness, scraper to filterer abundance ratio, percent contribution of the dominant taxon, and community loss index resulted in a total score of 34. A clearly defined bioassessment category could not be determined for these two stations because the percent comparability of total scores between experimental and reference stations was 81%. Non impaired conditions are assigned when percent comparability between experimental and reference stations is-83 percent or greater and slight impairment is indicated when percent comparability is 54 to 79%. Therefore, the benthic communities at Stations GMP 1 and APX 4 indicate conditions between non impairment and slight impairment.

In conclusion, benthic macroinvertebrate communities in the Woonasquatucket River, downstream of the Centredale Manor Superfund Site, did not show substantial levels of impairment. Analysis of benthic data from six of the eight stations sampled indicated no impairment and two stations indicated either no impairment or slight impairment.

5.0 LITERATURE CITED

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Appendix A

Benthic Community Data

Data Listing For Centredale Manor Benthic Study

Sample ID	Date	Station	Replicate	Taxon	Functional Group	Count
168458	07/03/01	GMP1	1			
				Baetis sp.	CG	53
				Caecidotea sp.	SH	12
				Caenis sp.	CG	2
				Ceratopsyche sparna	CF	13
				Cheumatopsyche sp.	CF	13
				Chimarra aterrima	CF	1
				-diimarra obscurus	CF	5
				Chironomini	CG	1
				Derosp.	CG	7
				Dugesia tigrina	PR	42
				Erpobdella punctata	PR	5
				Eukiefferiella sp.	CG	2
				Helisoma sp.	SC	1
				Helobdella stagnalis	PR	1
				Hemerodromia sp.	PR	1
				Hyalella azteca	CG	16
				Hydrachnida	PR	1
				Hydropsyche betteni	CF	72
				Limnodrilus sp.	CG	15
				Naididae	CG	4
				Nais sp.	CG	35
				Orthocladius sp.	CG	7
				Oulimnius latiusculus	SC	2
				Parametriocnemus sp.	CG	18
				Pisidium sp.	CF	1
				Polypedilum flavum	SH	18
				Polypedilum sp.	SH	2
				Pristina sp.	CG	5
				Prostoma graescense	PR	1
				Rheocricotopus sp.	CG	31
				Rheotanytarsus sp.	CF	18
				Simulium sp.	CF	216
				Slavina appendiculata	CG	6
				Stenonema sp.	SC	6
				Stylaria fossularis		7
				Stylaria lacustris	CG	7
				Tanytarsus sp.	CF	29
				Thienemanniella sp.	*CG*	1
				Thienemannimyia gr.	PR	9
				Tvetenia vitracies	CG	109

Data Listing For Centredale Manor Benthic Study

Sample ID	Date	Station	Replicate	Taxon	Functional Group	Count
168459	07/03/01	APX4	1			
				Baetis sp.	CG	23
				Caecidotea sp.	SH	19
				Cardiocladius sp.	PR	16
				Cheumatopsyche sp.	CF	15
				Chimarra aterrima	CF	7
				Chimarra obscurus	CF	2
				Chironomini	CG	2
				Hemerodromia sp.	PR	1
				Hydropsyche betteni	CF	92
				Limnodrilus sp.	CG	4
				Nais sp.	CG	83
				Nematoda		2
				Orthocladius sp.	CG	13
				Parametriocnemus sp.	CG	3
				Pisidiumsp.	CF	10
				Polypedilum flavum	SH	7
				Pristina sp.	CG	4
				Prostoma graescense	PR	1
				Rheocricotopus sp.	CG	3
				Rheotanytarsus sp.	CF	26
				Simulium sp.	CF	45
				Stenelmis sp.	SC	1
				Stenonema sp.	SC	6
				Stylodrilus heringianus	CG	13
				Tanytarsus sp.	CF	21
				Thienemannimyia gr.	PR	5
				Tvetenia vitracies	CG	7

Data Listing For Centredale Manor Benthic Study

Sample ID	Date	Station	Replicate	Taxon	Functional Group	Count
168460	07/03/01	APX3	1			
				Baetis sp.	CG	23
				Caecidotea sp.	SH	21
				Cardiocladius sp.	PR	9
				Cheumatopsyche sp.	CF	26
				Chimarra aterrima	CF	10
				Chimarra obscurus	CF	6
				Crangonyx sp.	CG	1
				Cryptochironomus fiilvus gr.	PR	1
				Dero sp.	CG	4
				Dugesia tigrina	PR	2
				Erpobdella punctata	PR	3
				Hyalella azteca	CG	1
				Hydropsyche betteni	CF	60
				Limnodrilus sp.	CG	1
				Lumbricidae	CG	1
				Naididae	CG	4
				Nais sp.	CG	33
				Orthocladius sp.	CG	6
				Paramietriocnemus sp.	CG	6
				Phaenopsectra sp.	SC	1
				Polypedilum flavum	SH	15
				Polypedilum laetum	SH	3
				Polypedilum scalaenum gr.	SH	2
				Pristina sp.	CG	8
				Pristinella sp.		2
				Prostoma graescense	PR	1
				Rheocricotopus sp.	CG	10
				Rheotanytarsus sp.	CF	45
				Simulium sp.	CF	19
				Slavina appendiculata	CG	3
				Stenonema sp.	SC	14
				Stylodrilus heringianus	CG	3
				Tanytarsini	CF	23
				Tanytarsus sp.	CF	26
				Thienemannimyia gr.	PR	3
				Tvetenia vitracies	CG	24

Data Listing For Centredale Manor Benthic Study

Sample ID	Date	Station	Replicate	Taxon	Functional Group	Count
168461	07/04/01	APX2	1			
				Antocha sp.	CG	2
				Baetis sp.	CG	25
				Caecidotea sp.	SH	32
				Cardiocladius sp.	PR	5
				Cheumatopsyche sp.	CF	32
				Chimarra aterrima	CF	3
				Chimarra obscurus	CF	1
				Chironomini	CG	2
				Crangonyx sp.	CG	2
				Cricotopus bicinctus	CG	3
				Diamesa sp.	CG	3
				Dugesia tigrina	PR	13
				Erpobdella punctata	PR	3
				Helobdella stagnalis	PR	2
				Hyalella azteca	CG	10
				Hydropsyche betteni	CF	36
				Lumbricidae	CG	3
				Micrasema sp.	SH	16
				Musculium sp.	CF	1
				Nais sp.	CG"	32
				Nematoda		6
				Orconectes sp.	CG	1
				Parametriocnemus sp.	CG	5
				Pisidium sp.	CF	3
				Polypedilum fla\iim	SH	5
				Pristinella sp.		2
				Rheocricotopus sp.	CG	5
				Rheotanytarsus sp.	CF	67
				Simulium sp.	CF	2
				Slavina appendiculata	CG	4
				Stenelmis sp.	SC	1
				Stenonema sp.	SC	17
				Stylodrilus heringianus	CG	10
				Tanytarsus sp.	CF	31
				Thienemannimyia gr.	PR	8
				Tipula sp.	SH	I
				Tvetenia vitracies	CG	30

Data Listing For Centredale Manor Benthic Study

Sample ID	Date	Station	Replicate	Taxon	Functional Group	Count
168462	07/04/01	APX1	1			
				Antocha sp.	CG	2
				Baetis sp.	CG	11
				Caecidotea sp.	SH	18
				Cheumatopsyche sp.	CF	18
				Chimarra obscurus	CF	1
				Cricotopus sp.	SH	5
				Dero sp.	CG	13
				Dugesia tigrina	PR	6
				Helobdella stagnalis	PR	2
				Hydropsyche betteni	CF	60
				Limnodrilus hoffmeisteri	CG	2
				Limnodrilus sp.	CG	8
				Micrasema sp.	SH	4
				Nais sp.	CG	24
				Nematoda		1
				Pisidium sp.	CF	5
				Polypedilum flavum	SH	5
				Polypedilum halterale gr.	SH	10
				Prostoma graescense	PR	3
				Rheocricotopus sp.	CG	11
				Rheotanytarsus sp.	CF	56
				Simulium sp.	CF	2
				Slavina appendiculata	CG	3
				Stenelmis sp.	SC	4
				Stenonema sp.	SC	17
				Stylodrilus heringianus	CG	9
				Tanytarsus sp.	CF	22
				Thienemanniella sp.	CG	1
				Thienemannimyia gr.	PR	12
				Tvetenia vitracies	CG	28

Data Listing For Centredale Manor Benthic Study

Sample ID	Date	Station	Replicate	Taxon	Functional Group	Count
168463	07/04/01	WRL1	1			
				Antocha sp.	CG	1
				Baetis sp.	CG	19
				Caecidotea sp.	SH	7
				Cardiocladius sp.	PR	8
				Ceratopsyche sparna	CF	7
				Cheumatopsyche sp.	CF	16
				Chiman-a aterrima	CF	8
				Chimaira obscurus	CF	14
				Chimarrasp.	CF	59
				Cryptochironomus fulvus gr.	PR	1
				Dero sp.	CG	13
				Dugesia tigrina	PR	3
				Erpobdella punctata	PR	1
				Glossosoma sp.	SC	2
				Helobdella stagnalis	PR	2
				Hydrachnida	PR	1
				Limnodrilus sp.	CG	3
				Lumbricidae	CG	3
				Micrasema sp.	SH	2
				Nais sp.	CG	83
				Nematoda		2
				Parametriocnemus sp.	CG	27
				Pisidium sp.	CF	8
				Polypedilum flavum	SH	13
				Polypedilum halterale gr.	SH	1
				Polypedilum laetum	SH	1
				Pristina sp.	CG	1
				Prostoma graescense	PR	1
				Rheocricotopus sp.	CG	21
				Rheotanytarsus sp.	CF	47
				Simulium sp.	CF	10
				Slavina appendiculata	CG	1
				Stenelmis sp.	SC	24
				Stenonema sp.	SC	23
				Stylodrilus heringianus	CG	12
				Tanytarsus sp.	CF	22
				Thienemanniella sp.	CG	2
				Thienemannimyia gr.	PR	7
				Tvetenia vitracies	CG	33
				Vejdovskyella comata	CG	2

Data Listing For Centredale Manor Benthic Study

Sample ID	Date	Station	Replicate	Taxon	Functional Group	Count
168464	07/05/01	WRL2	1			
				Amnicola limosa	SC	1
				Ancyronyx variegata	CG	1
				Baetis sp.	CG	6
				Caecidotea sp.	SH	7
				Caenis sp.	CG	1
				Ceratopsyche sparna	CF	3
				Cheumatopsyche sp.	CF	13
				Chimarra atcrrima	CF	9
				Chimarra obscurus	CF	18
				Chironomus sp.	CG	1
				Cricotopus bicinctus	CG	2
				Dero flabelliger	CG	3
				Dero sp.	CG	23
				Dugesia tigrina	PR	9
				Erpobdella punctata	PR	1
				Helobdella stagnalis	PR	1
				Hydropsyche betteni	CF	12
				Lumbriculidae	CG	1
				Mooreobdella sp.		3
				Nais sp.	CG	86
				Nematoda		1
				Parametriocnemus sp.	CG	10
				Pisidium sp.	CF	11
				Polypedilum flavum	SH	11
				Prostoma graescense	PR	3
				Rheocricotopus sp.	CG	5
				Rheotanytarsus sp.	CF	30
				Simulium sp.	CF	2
				Slavina appendiculata	CG	1
				Stenelmis sp.	SC	8
				Stenochironomus sp.	CG	1
				Stenonema sp.	SC	16
				Stylodrilus heringianus	CG	11
				Tanytarsus sp.	CF	17
				Thienemannimyia gr.	PR	2
				Tipulidae	SH	1
				Tvetenia vitracies	CG	10

Appendix B

Habitat Assessment Field Sheets

PHYSICAL CHARACTERIZATIONAVATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME Assapumsett Trib. cr	LOCATION
STATION #S24B L RIVERMILE 1	STREAM CLASS
LAT ____ LONG ____	RIVER BASIN
STORET*	AGENCY
INVESTIGATORS DM, CF	
FORM COMPLETED BY DM	DATE 3^J^7 01 TIME ~~0^S&~~ (AM) PM	REASON FOR SURVEY bioassessment

WEATHER CONDITIONS

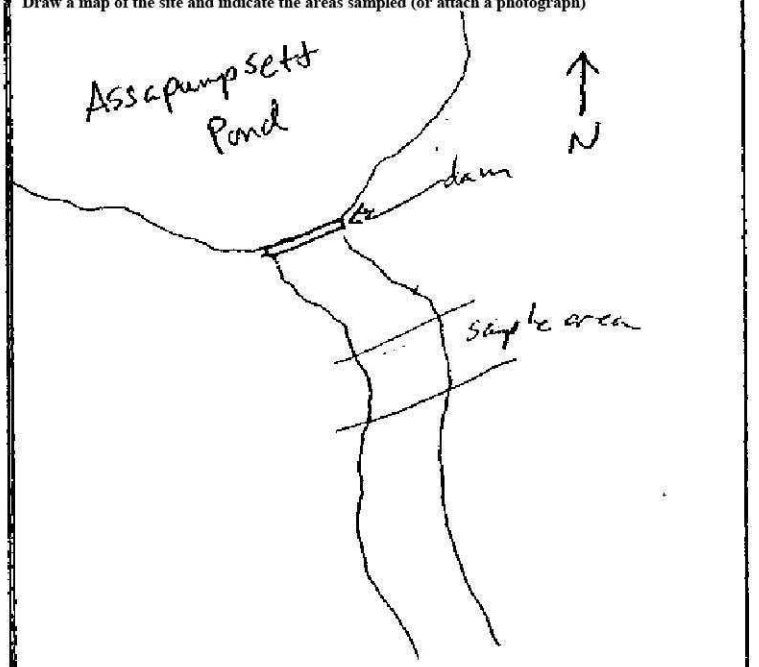
Now		Past 24 hours
Q	storm (heavy tain)	Q
Q	tain (steady rain)	Q
Q	showers (intermittent)	Q
__%Q	y.cloud cover	Q__%
O—	clear/sunny	

Has there been a heavy rain in the last 7 days? Q Yes ©"No

Air Temperature/C^ C

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
Q'Pcrennia! Q Intermittent Q Tidal

Stream Type
Q Coldwater ~~Q~~ Warmwater

Stream Origin
Q Glacial Q Spring-fed
Q Non-glacial montane Q Mixture p(origins
Q Swamp and bog CB Uther Artificial pond

Catchment Area ____ Vnr

R-AB 1

PHYSICAL CHARACTERIZATIONAVATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
Q Fores) SXfommercial
Q Field/Paslurc Q Industrial
Q Agricultural Q Other_____
SM<csidcntial

Local Watershed NPS Pollution
©'^No evidence Q Some potential sources
Q Obvious sources

Local Watershed Erosion
(JH<fone Q Moderate Q Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indiei'te the dominant type and record the dominant species present
BrTrecs Q Shrubs Q Grasses Q Herbaceous
dominant species present_____

1NSTREAM FEATURES

Estimated Reach Length 75 m
Estimated Stream Width 2 m
Sampling Reach Area 3 m²
Areainkra^J(m^{1}xl000)_____ km²
Estimated Stream Depth _p">_ m
Surface Velocity _____ m/sec
(at thatweg)

Canopy Cover
Q Partly open Q Partly shaded ©-Shaded

High Water Mark_____ m

Proportion ofJReach Represented by Stream
Morphology Types
☒ Riffle 25 % Q Run 2-S~~V<>
☐ Pool_____ %

Channelized Q Yes ☒ No
Dam Present ☒ Yes Q No

LARGE WOODY DEBRIS

LWD _____ m²
Density of LWD _____ mVkm² (LWD/ reach area)

AQUATIC VEGETATION

Indicate the dominant type »nd record the dominant species present
Q Rooted emergent SJiCootcd submcrgent *_ ^ „£>. U Rooted floating Q Free floating
Q Floating Algae Q Attached Algae
dominant species present_____
Portion of the reach with aquatic vegetation, hh %

WATER QUALITY

Temperature 3.0 > 2> * C
Specific Conductance 237.3
Dissolved Oxygen 6.01
pH _____
Turbidity _____
WQ Instrument Used YSI85

Water Odors
O-tformal/None Q Sewage
O Petroleum Q Chemical
Q Fishy Q Other_____

Water Surface Oils
Q Slick Q Sheen Q Globs Q Flecks
O-Kbne Q Other_____

Turbidity (if not measured)
BC*lear Q SlighUy turbid Q Turbid
Q Opaque Q Stained Q Other_____

SEDIMENT/ SUBSTRATE

Odors
Q'Normal Q Sewage Q Petroleum
Q Chemical Q Anaerobic Q None
Q Other_____

Oils
a^bsent Q Slight Q Moderate Q Profuse

Deposits
Q Sludge Q Sawdust Q Paper fiber Q Sand
Q Relict shells Q Other_____

Looking at stones which are not deeply embedded, are the undersides black in color?
QYes *OWo*

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	25
Boulder	> 256 mm (10")	•2-O			
Cobble	64-256 mm (2.5"-10")	7 0	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64mm(0.r-2.5-)	1 V			
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME Ass. Pumpsett Tailwater	LOCATION
STATION # RA-B RIVERMILE	STREAM CLASS
LAT LONG	RIVER BASIN
STORET*	AGENCY
INVESTIGATORS DPM, CF	
FORM COMPLETED BY DPM	DATE 3 July 01 TIME 0956 AM PM
REASON FOR SURVEY bio assessment	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and po(transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2, Embcddedness	Gravel, cobble, and boulder particles arc 0-25% surrounded by fine sediment Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment
SCORE	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3- Vdocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is>0.5m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 (19) MjU^- 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Sutus	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 (19) 18 17 16	15 J4- 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or orcogmg absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments: evidence of past channelization, i.e.. dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 /I7y)16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio oLdistance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous. placement of boulders or other large, natural obstruction is important	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 {fV^16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. '5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE____(LB)	Left Bank (I<y 9	8 7 6	5 4 3	2 I 0
SCORE____(RB)	Right Bank(I£) 9	8 7 6	5 4 3	.2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immedjate riparian zone covered by native vegetation, including trees, understory shrubs. or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE _<LB)	Left Bank 10 9	CO 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10. 9	(V 7 6	5 4 3	2 1 . 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	LcftBank 10 . 9	8 7 6	n 4 (R)	2 1 0/
SCORE ___ (RB)	Right Bank 10 . 9	8 7 6	5 4 (3)	2 1 . v.o.

(Use if observations are collected by more than one sampling reach)

Total Score _____

PHYSICAL CHARACTERIZATIONAVATER QUALITY FIELD DATA SHEET
(FRONT)

Below

STREAM NAME Greystone Mill Pond	LOCATION
STATION # GMP2 RIVERMILE	STREAM CLASS
LAT LONG	RIVER BASIN
STORET*	AGENCY
INVESTIGATORS DFm, CF	
FORM COMPLETED BY DFm	DATE 3July01 TIME 1055 (AM) PM
REASON FOR SURVEY Diawse 6 f tn Kjt	

WEATHER CONDITIONS

Now		Past 24 hours
Q	storm (heavy rain)	Q
Q	rain (steady rain)	Q
Q	showers (intermittent)	Q
50 Q	%cloud cover	Q %
Q	clear/sunny	Q

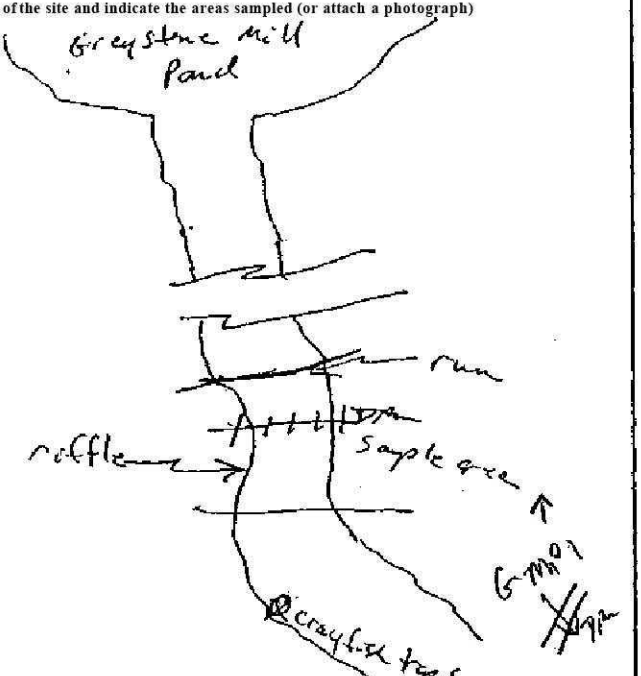
Has there been a heavy rath in the last 7 days? Q Yes Sffo

Air Temperature ^-? * C

Other

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
Perennial Q Intermittent Q Tidal

Stream Type ^^
Q Coldwater Owarmwater

Stream Origin
Q Glacial Q Spring fed
Q Non-glacial montane Q Mixture of origins
Q Swamp and bog Other pond outlet

Catchment Area km²

GMP2

PHYSICAL CHARACTERIZATIONAVATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** SH^rest Q Commercial Q Field/Pasture Q Industrial Q Agricultural Q Other_____ (•^Residential **Local Watershed NPS Pollution** Q No evidence Q Some potential sources Q Obvious sources **Local Watershed Erosion** Q None Q Moderate Q Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** SMrces • Shrubs QGrasses Q Herbaceous **dominant species present**_____
INSTREAM FEATURES	**Estimated Reach Length**_____m **Estimated Stream W i d t h** 2 - / Q m **Sampling Reach Area** _<P_ m **Are* in km[1]* (m[1]. 1000)**__km* **Estimated Stream Depth** Q~l (_m **Surface Velocity**_____m/sec **(at thalweg)** **Canopy Cover** Q Partly open Q Partly shaded Shaded **High Water Mark** __1__m **Proportion of Reach Represented by Stream Morphology Types** *• ^—^ iSKRiffic (TO % Q-foin &O % Q Pool_____% **Channelized** Q Yes Q No **Dam Present** OWcs Q No
LARGE WOODY DEBRIS	**LWD** _____m' **Density of LWD** _____jnVknr'(LWD/ reach area)
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** Q Rooted emergent Q Rooted submergent Q Rooted floating D Free floating Q Floating Algae ©"Attached Alga*- moss **dominant species present**_____ **Portion of the reach with aquatic vegetation** 25 %
WATER QUALITY	**Temperature** 21.4 °C **Specific Conductance** 195.5 **Dissolved Oxygen** 6.75 **pH** 6.9 **Turbidity** _____ WQ Instrument Used H S2^- E^ **Wajer Odors** QiNormal/None Q Sewage Q Petroleum Q Chemical Q Fishy O Other_____ **Water Surface Oils** Q Slick Q Sheen Q Globs Q Flecks Q-Nonc Q Other_____ **Turbidity (if not measured)** QKiear Q Slightly turbid Q Turbid Q Opaque Q SUined Q Other_____
SEDIMENT/ SUBSTRATE	**Odors** QfJormal • Sewage Q Petroleum Q Chemical Q Anaerobic Q None Q Other_____ Oils, QKbsent Q Slight Q Moderate • Profuse Deposits Q Sludge Q Sawdust Q Paper fiber QSand Q Relict shells Q Other_____ **Looking at stones which are not deeply embedded, are the undersides black in color?** QYcs Q-No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	r
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")	20	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64mm(0.r-2.5")	60			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME Quine Creek	LOCATION
STATION 6MC2 RIVERMILE	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET*	AGENCY
INVESTIGATORS DPM, CF	
FORM COMPLETED BY DPM	DATE 3 July 01 TIME 1055 (AM) PM — REASON FOR SURVEY

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations: presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
2. Embedded ness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment
SCORE	20 19 18 17 16	i3£i£g3"yaa 11	10 v Ji.t-^i^^^K	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 *mfs*, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	®iij^W>12. 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	W£*iife'ti ?.ji'l.i'~ii	io -:.-*..a$&%^	5 4 3 2 1 0

EMPJ

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e.. dredging, (greater than past 20 yr) may be present, but recent channelization is not present	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	(wy 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Rimes (er bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous. placement of boulders or other large, natural ' obstruction, is important	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of>25.
SCORE	20 fe/fc · 17 16	15 14 13 (12^11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE __ JLB) LeftBank	10 9	(?) 7 6	5 4 3	. 2 1 0
SCORE____(RB) Right Bank	10 9	(V) 7 6	5 4 3	2. . 1 .. 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. ^	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 1	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height
SCORE __ (LB) LeftBank	10 9	8 (V) 6	5 4 3	2 1 .0
SCORE ___ (RB) Right Bank	10\ 9	(?) 7 6	5 4 3	2 1.^Vi.-0i;
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE____(LB) LeftBank	10 9	8 7. 6	CO 4 3	2 1 -V 6-
SCORE ___ (RB) Right Bank	10 9	00 7 6	5 4 3	2 1 i 0"

Be sure to be over looked bro- der than sampling reach

Total Score _____

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

below Greystone

STREAM NAME Mill Pond	LOCATION
STATION # GMPL RIVERMILE	STREAM CLASS
LAT LONG	RIVER BASIN
STORET#	AGENCY
INVESTIGATORS DPm, HH	
FORM COMPLETED BY DPm	DATE 3 July 01 TIME 1341 AM (PM)
	REASON FOR SURVEY

WEATHER CONDITIONS

Now

- Q storm (heavy rain)
- Q rain (steady rain)
- Q showers (intermittent)
- %Q %cloud cover
- clear/sunny

Past 24 hours

- Q
- U
- O
- %

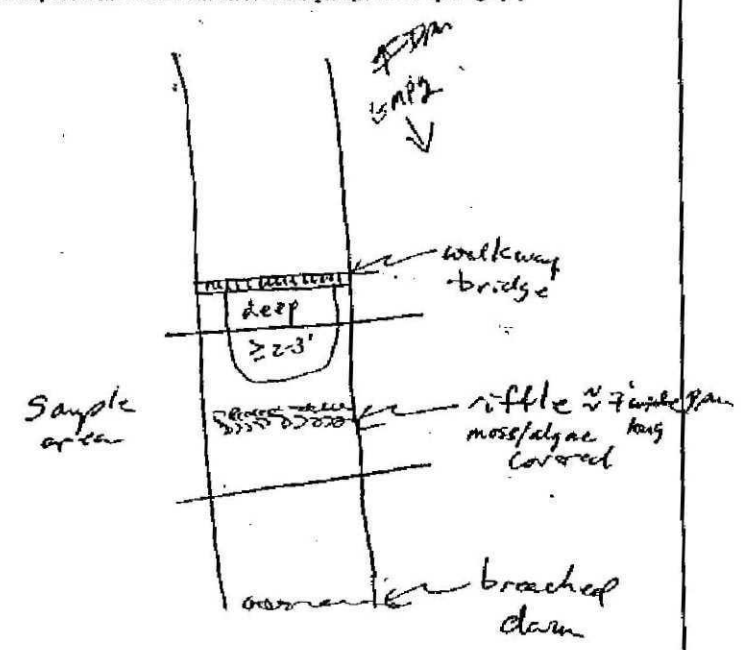
Is there been a heavy rain in the last 7 days?
O Yes SHIS'

Air Temperature Itf

Other

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
Q Perennial Q Intermittent Q Tidal

Stream Type
Q Coldwater Q Warmwater

Stream Origin
Q Glacial
Q Non-glacial montane
Q Swamp and bog
Q Mixture of origins
Bijther

Catchment Area _____ km²

(fflf'

PHYSICAL CHARACTERIZATIONAVATER QUALITY FIELD DATA SHEET
(BACK)

WATERSHED FEATURES	Predominant Surrounding Landusc Q Forest (D-Commcrcial Q Field/Pasture Q Industrial Q Agricultural Q Other_____ Q Residential Local Watershed NPS Pollution Q No evidence Q Some potential sources Q Obvious sources Local Watershed Erosion CffNone Q Moderate Q Heavy
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and-record the dominant species present Q Trees uTShrubs Q Grasses Q Herbaceous dominant species present _____
INSTREAM FEATURES	Estimated Reach Length __/ &__m Estimated Stream Width __(D__m Sampling Reach Area _____m' Area in km^1 (m'xlOOO) _____km^2 Estimated Stream Depth 0.2 riffle 0.5-1.0 run Surface Velocity (at thalweg) _____m/sec Canopy Cover s^~ Q Partly open CIT artly shaded Q Shaded High Water Mark __(___m Proportion of Reach Represented by Stream MorphotogyTypes Q Pool_____% Channelized Q Yes Q No Dam Present O-?es Q No
LARGE WOODY DEBRIS	LWD _____m^2 Density of LWD _____mVktrf (LWD/ reach area)
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present Q Rooted emergent Q Rooted submergenl Q Rooted floating Q Free floating Q Boating Algae ©'Attached Algae _--poit" c only dominant species present _ ^_____ Portion of the reach with aquatic vegetation 10 % riffle only
WATER QUALITY	Temperature^^j fl_"C Specific Conductance 209 Dissolved Oxygen IP« 7 pH 7.5 Turbidity WQ Instrument Used ty J>dL &5 Water Odors Q-Normal/None Q Sewage Q Petroleum Q Chemical Q Fishy Q Other_____ Water Surface Oils Q Slick Q Sheen Q Globs Q Recks B-fJone Q Other_____ Turbidity Of not measured) Q Clear Q Slightly turbid Q Turbid Q Opaque Q Stained Q Other_____
SEDIMENT/ SUBSTRATE	Odors (jmormal Q Sewage Q Petroleum Q Chemical Q Anaerobic Q None Q Other_____ Oils^ QKAbsent Q Slight Q Moderate Q Profuse Deposits Q Sludge Q Sawdust Q Paper fiber QSand Q Relict shells Q Other_____ Looking at stones which are not deeply embedded, are the undersides black In color? Q Yes 8Mfo

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)				ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach (riffle / run)		Substrate Type	Characteristic	% Composition In Sampling Area
Bedrock				Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10") 25	50				
Cobble	64-256 mm (2.5"-10" 28	50	5"	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5") 22		45			
Sand	0.06-2mm (gritty) 25		50	Marl	grey, shell fragments	
Silt	0.004-0.06 mm					
Clay	<: 0.004 mm (slick)					

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME ff	LOCATION
STATION #G-MP1 RIVERMILE	STREAM CLASS
LAT LONG	RIVER BASIN
STORET*	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE TIME AM PM / REASON FOR SURVEY

Habitat Parameter	Condition Category *			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs. undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of ncwfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment	Gravel, cobble, and boulder panicles are 50-75% surrounded by fine sediment	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 nVs, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions. constrictions, and bends; moderate deposition of pools prevalent	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates arc mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

C-mp 1

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE____(LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE____(RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of (he streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height
SCORE____(LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right BanV 10 9	(8) 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian rone <6 meters: little or no riparian vegetation due to human activities.
SCORE____(LB)	Left Bank 10 9	8 7 6	5 4 3	4?- 1 0
SCORE ___ (RB)	Right Bonk 10 9	8 7 6	5 4 3	1 0

Total Score _____

PHYSICAL CHARACTERIZATIONAVATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION
STATION ff/I/X_W__ RIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS .CF	
FORM COMPLETED BY	DATE 3 July 01 TIME /6? < «T AM ^[>0 / REASON FOR SURVEY

WEATHER CONDITIONS

Now

- Q storm (heavy rain)
- Q tain (steady rain)
- Q showers (intermittent)
- [Ot <K Q %cloud cover
- Q clear/sunny

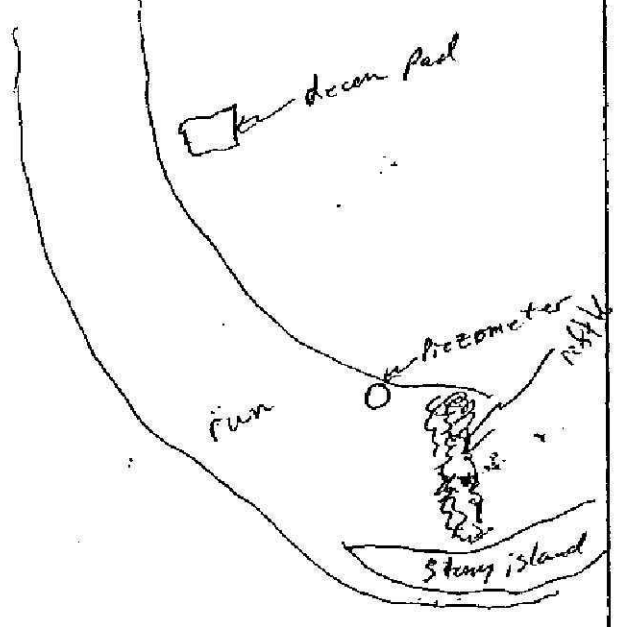
Past 24 hours

- Q
- Q
- 2 Q %

Has there Been a heavy rain in the last 7 days?
Q Yes Q No 27
Air Temperature: 26 °C
Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
tSKPerennial Q Intermittent Q Tidal

Stream Origin
Q Glacial
Q Non-glacial montane
Q Swamp and bog
Q Spring-fed
Q Mixture of origins
Q Other_____

Stream Type J
Q Coldv.-ater . (B^/armwater

Catchment Area_____km²

APX4

PHYSICAL CHARACTERIZATIONAVATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landuse
QTorest ©'Commercial
Q Field/Pasture Q Industrial
Q Agricultural Q Other_____
Q Residential

Local Watershed NFS Pollution
Q No evidence (i^Some potential sources
Q Obvious sources

LocaJ-Watershed Erosion
O-None Q Moderate Q Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type andrecord the dominant species present
Q Trees IfUJfirubs Q Grasses Q Herbaceous
dominant species present _____

INSTREAM FEATURES

Estimated Reach Length 10 m
Estimated Stream Width 7-8 m
Sampling Reach Area J> m'
Areainkm'(m'xlOOO)_____km'
Estimated Stream Depth 0 <3 m
Surface Velocity_____m/scc
(at thalweg)

Canopy Cover
Q'Partly open Q Partly shaded Q Shaded
High Water Mark ~~~ m
Proportion of Reach Represented by Stream Morphology Types Q-Run 50 %
Q-Pool: 122 %
Somewhat
Channelized Yes No
Dam Present Q Yes No

LARGE WOODY DEBRIS N/A

LWD _____m'
Density of LWD _____mVkm' (LWD/ reach area)

AQUATIC VEGETATION N/A

Indicate the dominant type and record the dominant species present
Q Rooted emergent Q Rooted submergent Q Rooted floating Q Free floating
Q Floating Algae Q Attached Algae
dominant species present_____
Portion of the reach with aquatic vegetation_____%

WATER QUALITY

Temperature -2-3 I 0" C
Specific Conductance 207.5
Dissolved Oxygen "% S>
pH 6 > *f
Turbidity
WQ Instrument Used YSI 85

Water Odors
Q"fJbrmal/None Q Sewage
Q Petroleum Q Chemical
Q Fishy Q Other_____

Water SuKace Oils
Q Slick Q Sheen Q Globs Q Flecks
G-Nbne Q Other_____

Turbidity (if not measured)
<B<Tlear Q Slightly turbid Q Turbid
Q Opaque Q Stained Q Other_____

SEDIMENT/ SUBSTRATE

Odors
H^Normal Q Sewage Q Petroleum
Q Chemical Q Anaerobic Q None
Q Other_____

Oils-
Si-Absent Q Slight Q Moderate Q Profuse

Deposits
Q Sludge Q Sawdust Q Paper fiber Q Sand
Q Relict shells Q Other_____

Looking at stones which **arc** not deeply embedded, are the undersides black in color?
QYes &f(o

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add tip to **100%**)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")	lo			
Cobble	64-256 mm (2.5"-10")	JLSL	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1 "-2.5")	35			
Sand	0.06-2mm (gritty)	JJi-	Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET— HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION *njtfyi °(* RIVERMILE	STREAM CLASS	
LAT LONG	RIVER BASIN	
STORET*	AGENCY	
INVESTIGATORS *~P/"«-* *C ^*		
FORM COMPLETED BY	DATE *3"'^HO 1* TIME *11 1 5* AM PM	REASON FOR SURVEY

Frame 2 Simplified Habitat Assessment

Habitat I*»r»met5r	Condition Category			
	Optimal	Subopfimal*	Marginal	Poor
I. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	fcjVtffs?43 12 -IK	10 9 8 7 6	5 4 3 2 1 0
2. Embedded ness *n*	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment
SCORE	20 19 18 17 16	*jSr)H;* 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 ofthc 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions. constrictions, and bends; moderate deposition of pools prevalent	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	*£/$)* 14i;13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel. and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	$@ti:-'J4.>ii3!. 12 11	*i 0 —:3.-Z/$';£t3'Ctl/^*	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e.. dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 lx>? 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous. placement of boulders or other large, natural obstruction is important	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 (13^12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ <LB)	Left Bank 10 9	8 7 CO	5 4 3	2 1 P »
SCORE ___ (RB)	Right Bank 10 9	8 7 (6^	5 4 3	.A : » : . D .
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs. or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not wcll-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left, Bank 10 9	(%J 7 6	5 4 3	2 1 TO -»
SCORE ___ (RB)	Right Bank 10 9	/6 7 6	5 4 3	2 V.. y «0 n.
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	(8) 7 6	5 4 3	2 • ?$£$3
SCORE ___ (RB)	Right Benk(10 \ 9	8 7 6	5 4 3	2 i ::«i

Total Score _____

PHYSICAL CHARACTERIZATIONAVATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION
STATION mAPX3 RIVERMILE	STREAM CLASS
LAT LONG	RIVER BASIN
STORET#	AGENCY
INVESTIGATORS Ppm, CF	
FORM COMPLETED BY Ppm	DATE 3 July 07 TIME 1400 AM PM / REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
Q	storm (heavy rain)	Q
Q	ninfriadynin)	Q
Q	showers (intermittent)	Q
100 %Si—	Vocloud cover	Q ___%
Q	clear/sunny	O—

Has there been a heavy rain in the last 7 days? Q Yes Q No

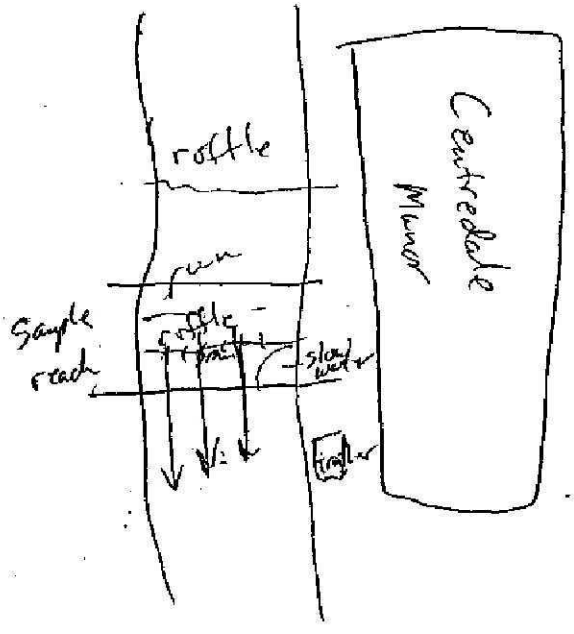
. . 7 % <To

A,r Temperature^'C

Other

SITE LOCATION/MAP

Draw a map of the site »nd indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stpiam Subsystem
CTPerennial Q Intermittent Q Tidal

Stream Origin
Q Glacial Q Spring-fed
Q Non-glacial montane Q Mixture of origins
Q Swamp and bog Q Other_____

Stream Type
QColdwater Q Warmwater

Catchment Area_____km²

APx 3

PHYSICAL CHARACTERIZATIOrs'/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landusc
(STorest Q Commercial
Q Field/Pasture Q Industnal
Q Agricultural Q Olhcr_____
©""Residential

Local WatershedNPS Pollution
Q No evidence B!om« potential sources
Q Obvious sources

Local Watershed Erosion
O-None Q Moderate Q Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
IBTYees B'Shrubs Q Grasses Q Herbaceous
dominant species present_____

INSTREAM FEATURES

Estimated Reach Length 10 m
Estimated Stream Width 7-8 m
Sampling Reach Area 3 m²
Area in km' (m'xlOOO) _____km²
Estimated Stream Depth 0' 3 m
Surface Velocity _____m/sec (at thalweg)

Canopy Cover
Q Partly open (&"Partly shaded Q Shaded
High Water Mark_____m
Proportion of Reach Represented by Stream Morphology Types
Q-Riffle 00 %- ⊡Run 40 %
Q Pool_____%
Channelized S^es Q No rip rap on Left bank
Dam Present Q Yes Q-No

LARGE WOODY DEBRIS

LWD _____m²
Density of LWD _____m²/km² (LWD/ reach area)

AQUATIC VEGETATION

N/A

Indicate the dominant type and record the dominant species present
Q Rooted emergent Q Rooted submergent Q Rooted floating Q Free floating
Q Floating Algae Q Attached Algae
dominant species present_____
Portion of the reach with aquatic vegetation ____%

WATER QUALITY

Temperature 23*!?'" C
Specific Conductance 209
Dissolved Oxygen (!) 3
pH 6.9
Turbidity_____
WQ Instrument Used YSI 85

Wajtr Odors
G"Normal/None Q Sewage
Q Petroleum Q Chemical
Q Fishy Q Other_____

Water Surface Oils
Q Slick Q Sheen Q Globs Q Flecks
(D-None Q Other_____

Turbidity (if not measured)
5>CTear Q Slightly turbid Q Turbid
Q Opaque Q Suined Q Other_____

SEDIMENT/ SUBSTRATE

Odors
(D-Kormal Q Sewage Q Petroleum
Q Chemical D Anaerobic Q None
Q Other_____

Oils
%>kbsent Q Slight Q Moderate Q Profuse

Deposits
Q Sludge Q Sawdust Q Paper fiber QSand
Q Relict shells Q Other_____

Looking at stones which are not deeply embedded, are the undersides black in color?
d Yes O*?o

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition In Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")	50	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1 "-2.5")	30			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION
STATION *AP/C3___ RIVERMILE_____	STREAM CLASS
LAT _____ LONG_____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS ~y0vL, C/^	
FORM COMPLETED BY ~~XP/^—	DATE 2A2L^°f sr\ TIME tr&O 7AM (U) / REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	^ j14 S w 43i 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment
SCORE	^•^ftfAfeJ7: ®	^3->«Q3L>12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow *or* slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE	20 19 18 17 16		10 J> 8 < 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	14 13 12 11 10	9 8 7 6 5	4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	£i&3!£V-J.3' 12 11 10	9 8 7 6 5	4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e.. dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	(f| 14 13 12 II	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. in streams where riffles are continuous. placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat;— distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 /f<T)18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence oferosionorbank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	(£) 7 6	5 4 3	2 I 0
SCORE ___ (RB)	Right Bank 10 9	(f) 7 6	5 4 3	I. "... 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs. or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	LeftBank 10 9	8 f 6	5 4 3	2 O 0
SCORE ___ (RB)	Right Bank 10 9	8 &) 6	5 4 3	V. 2 . ' 1 . . s * 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	LeftBank 10 9	8 7 6	5 4 3	2 i
SCORE ___ (RB)	Right Bank 10 9	/tf7 7 6	5 4 3	2 i

Total Score _____

PHYSICAL CHARACTERIZATIONAVATER QUALITY FIELD DATA SHEET
(FRONT)

Weaversquaticket River

STREAM NAME ^il~(^J^-^j7iKt^-y/h^	LOCATION
STATION ItAf/- X RIV ERMILE	STREAM CLASS
LAT LONG	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS -p/%->-^	
FORM COMPLETED BY CL	DATE fOu^fo/ /* TIME a^/i, AM / CM	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
Q	storm (heavy rain)	Q
Q	rain (steady rain)	Q
Q	showers (intermittent)	Q
1&2 %S	%cloud cover	BT/≤P%
Q	clear/sunny	Q

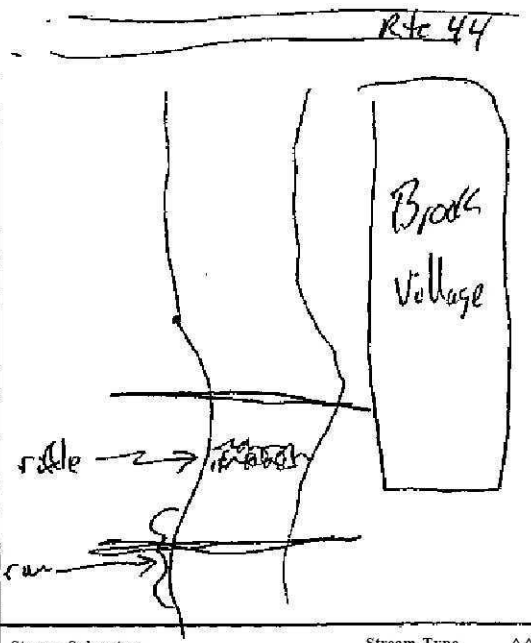
Has there been,* heavy rain in the last 7 days?
Q Yes Q-Nb

Air Temperature*^-*' C

rwhw wlaer

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
QTcrennial Q Intermittent Q Tidal

Stream Origin
Q Glacial Q Spring-fed
Q Non-glacial montane Q Mixture of origins
Q Swamp and bog Q Other_____

Stream Type ^ ^
Q Coldwater QWarmwater

Catchment Area_____krn²

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimat	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e.. dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted, tnstream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	(f5) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffle* ?©Tben*S)—	Occurrence of riffles relatively frequent; ratio oTdistance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important	Occurrence of riffles infrequent; distance between riffles, divided by the width oT the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1
SCORE ___ (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 O—
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs. or nonwoody macrophytcs; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the strcambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambanV vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height
SCORE___(LB)	LeftBank 10 9	8 7 6	* «fa	(*) i .o
SCORE ___ (RB)	Right Bank 10. 9	8 fi\ 6 ^	5 4 3	2 1, r^Qy
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities hive impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	UftBank 10 9	8 7 6	5 4 3	2 » *{&
SCORE ___ (RB)	Right Bank 10 9	(T) 7 6	5 4 3	2 i M>'

Total Score _____

Photo 1 on Mondo

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION
STATION *j\£E 2~___ RIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET*	AGENCY
INVESTIGATORS ~p/Uf <£ ←	
FORM COMPLETED BY	DATE ^.I.V.V ° /^ TIME aj72'_ /*J FM — REASON FOR SURVEY

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs. undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are noj new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix or stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	iOy.yi^'J'/j^^i-'jj^/yij?	(if^l^ti 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (stow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by I velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	-iMHW!i3*MM«V ** - --	10 4si&.'k<i-i-&	5 4 3 2 1 0
4. Sediment Deposition	little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new barr, 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is expose^.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 (19) 18 17 16	15 14 13 12 11	10 y 9. *^8*! ? Jl' ifS^l	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	(Is) **14** **13** 12 **11**	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles • relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. **Bank** Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE____(RB)	Right Bank 10 9	(8) 7 6	5 4 3	**2** **1** P.
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height
SCORE____(LB)	Left Bank 10 9	8 7 6	5 4 QS	(2) 1 0
SCORE____(RB)	Right Bank 10 9	8 (7) 6	5 4 3	2
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE___(LB)	LeftBank 10 9	8 7 6	5 4 3	2 1
SCORE___(RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1

Habitat parameters to be evaluated broader than sample reach

Total Score _____

Photo 1 on Mandta

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHFFT
(FRONT)

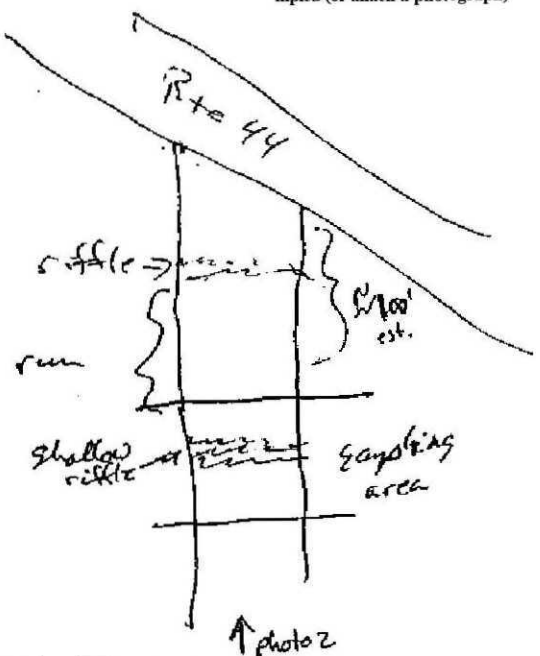
STREAM NAME	LOCATION
STATION # AR-1 RIVERMILE	STREAM CLASS
LAT ____ LONG ____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS DPm, CL	
FORM COMPLETED BY DPm	DATE 4July01 TIME 1030 (AM) PM
	REASON FOR SURVEY

WEATHER CONDITIONS

Now

LI	storm (heavy rain)	Q	
Q	rain (steady rain)	Q	Air Temperature ^ 1 y /r
U	showers (intermittent)	Q	
50%	Vocloud cover	[illegible]	Other:
Q	clear/sunny		

SITE LOCATION/MAP Draw , map of the site and indicate the areas s. mpled (or anach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
Perennial ☐ Intermittent ☐ Tidal

Stream Type
• Coldwater C^Varmwater

Stream Origin
UTGlacial Q Spring-fed
Q Non-glacial montane D Mixture of origins
Q Swamp and bog , Q Other____

Catchment Area____km²

Bioassessment Protocols For Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition - Form 1

A-5

AF x 1

PHYSICAL CHARACTERIZATIONAVATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	Predominant Surrounding Landuse Q Forest Q Commercial Q Field/Pasture Q Industrial QAgricuHura! Q Other_____ ^Residential Local Watershed NPS Pollution &f4o evidence Q Some potential sources Q Obvious sources Local Watershed Erosion OfNone Q Moderate Q Heavy
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type »nd record the dominant species present O-Trecs Q Shrubs O.Grasses Q Herbaceous dominant species present_____
INSTREAM FEATURES	Estimated Reach Length *fC>* m Estimated Stream Width 7-8 m Sampling Reach Area 3 m² Area in km" (m'x 1000)__ km² Estimated Stream Depth *0<.">* m Surface Velocity_____m/sec (it thalweg) Canopy Cover Q Partly open 0-Partly shaded Q Shaded High Water Mark *f* m Proportion of Reach Represented by Stream Morphology Types OTiffle *50* % Q Run *50* % Q Pool_____% Channelized Q Yes »i5o Dam Present Q Yes Q-flo
LARGE WOODY DEBRIS	LWD _____ m² Density of LWD _____ mVkm² (LWD/ reach area)
AQUATIC VEGETATION N/A	Indicate the dominant type and record the dominant species present Q Rooted emergent Q Rooted submergent Q Rooted floating Q Free floating Q Floating Algae Q Attached Algae dominant species present_____ Portion of the reach with aquatic vegetation_____%
WATER QUALITY	Temperature ^-/'7 °C Specific Conductance 199 Dissolved Oxygen 5.5 pH 7.4 Turbidity _____ WQ Instrument Used W-£J-.0 <> Water Odors QNormal/None Q Sewage Q Petroleum Q Chemical Q Fishy O Other_____ Water Surface Oils Q Slick Q Sheen Q Globs Q Hecks S-flone Q Other_____ Turbidity (if not measured) STClear Q Slightly turbid Q Turbid Q Opaque Q Sulned Q Other_____
SEDIMENT/ SUBSTRATE	Odors 0 Normal Q Sewage Q Petroleum Q Chemical Q Anaerobic Q None Q Other_____ Ojk w Absent Q Slight • Moderate Q Profuse Deposits Q Sludge Q Sawdust Q Paper fiber QSand Q Relict shells Q Other_____ Looking at stones which are not deeply embedded, are the undersides black in color? Q Yes B-tfo

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	slicks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")	10			
Cobble	64-256 mm (2.5"-10")	40	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1 "-2.5")	20			
Sand	0.06-2mm (gritty)	Jin	Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
CTay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION # ^_M__ RJVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS —p/V C.L-		
FORM COMPLETED BY	**DATE** 4 July 01 **TIME** T23h <*MJ PM	REASON FOR SURVEY

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish coven mix of snags, submerged logs. undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20^0% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	%&«.$) 13 12 11	10 9 X 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	(15°) 14 13 12 11	10 9 8 7 6	5 4 ЛЧ ^ I 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 nVs, deep is > 0.5 m)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE	ao..i?v:ii^..n-^/	*(is)* 14 ,13 12 11	10 -9. ^<. vj. £	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions. constrictions, and bends; moderate deposition of pools prevalent	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 (19) 18 17 16	••]S• 14 13 .12 11	10 •'• 9^ ^8£?£ 3K <ll	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel. and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 (19) 18 17 16	15 14. 13 12 11	10 5. 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptinial	Marginal	Poor
6. Channel Alteration	Channelization or dredging absenl or minimal; stream wuh normal panem.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is noi present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat gTeatly altered or removed entirely.
SCORE	20 *fl*<) 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relalively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous. placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of>25.
SCORE	20 19 *fo)\l* 16	15 14 13 12 11	10 9 " 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	(K) 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	<® 7 6	5 4 3	.2 1 . o
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs. or nonwoody macTophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential lo any great extent; more than one-half of the potential pianl stubble height remaining.	50-70% of the stieambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of strcambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE____(LB)	Left Bank 10 9	8 (7) 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	(*) 7 6	5 4 3	2 1.X.0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 ©	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 ra)	8 7 6	5 4 3	2 1

Total Score _____

WRL 1

PHYSICAL CHARACTERJZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES

Predominant Surrounding Landusc
(S'Forest Q Commercial
Q Field/Pasture Q Industrial
Q Agricullural Q Other_____
Q-Residemial

Local Watershed NPS Pollution
Q No evidence ~I"Some potential sources
Q Obvious sources

Local Watershed Erosion
Q-Mone Q Moderate Q Heavy

RIPARIAN VEGETATION (18 meter buffer)

Indicate the dominant type and record the dominant species present
~Kfrces • Shrubs Q Grasses Q Herbaceous
dominant species present_____

INSTREAM FEATURES

Estimated Reach Length 40 13 m
Estimated Stream Width 10 m
Sampling Reach Area 3 m²
Area in km² (m'x 1000) _____krn
Estimated Stream Depth 0.3 m
Surface Velocity_____m/sec
(at thatweg)

Canopy Cover
Q Partly open Q Partly shaded Shaded
High Water Mark 1 m
Proportion of Reach Represented by Stream Morphology Types
~HSffle 2.T % Q-R\in 3-f %
QPool_____%
Channelized Q Yes ~No
Dam Present S>Yes Q No

LARGE WOODY DEBRIS

LWD _____m²
Density of LWD _____m'/Vm- (LWD/ reach area)

AQUATIC VEGETATION

N/A

Indicate the dominant type and record the dominant species present
Q Rooted emergent Q Rooted submergent Q Rooted floating Q Free floating
Q Floating Algae Q Attached Algae
dominant species present_____
Portion of the reach with aquatic vegetation ____%

WATER QUALITY

Temperatur23.4 " C
Specific Conductance gA(O
Dissolved Oxygen 7^1
pH 7.4
Turbidity =
WQ Instrument Used 10J-0

Water Odors
QrtJormal/None Q Sewage
Q Petroleum Q Chemical
Q Fishy Q Other_____
Water Surface Oils
Q Slick Q Sheen Q Globs Q Flecks
O*!one Q Other_____
Turbidity (if not measured)
B"Clear Q Slightly turbid Q Turbid
Q Opaque Q Suined Q Othcr_____

SEDIMENT/ SUBSTRATE

Odors
ICNormal Q Sewage Q Petroleum
Q Chemical Q Anaerobic Q None
Q Other_____
Oils
~Absent Q Slight Q Moderate Q Profuse

Deposits
Q Sludge Q Sawdust Q Paper fiber QSand
Q Relict shells Q Other_____
Looking at stones which are not deeply embedded, arethe undersides black in color?
Q Yes 5Mfo

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	%• Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	>256 mm (10")				
Cobble	64-256 mm (2.5"-10")	55	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1 "-2.5")	X"10^1			
Sand	0.06-2mm (gritty)	45	Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION
STATION IIUJf^L_| RIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET*	AGENCY
INVESTIGATORS ~~p/^-^ C*—	
FORM COMPLETED BY	DATE V ^ J j ^ O i ~^ TIME ~f(<Ti~_ AM (™O	REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
Q	storm (heavy rain)	Q
O	rain (steady rain)	Q
Q	showers (intermittent)	Q
100 %	%cloud cover	100 %
Q	clear/sunny	Q

Has there beeij-* heavy rain in the last 7 days? Q Yes ■No

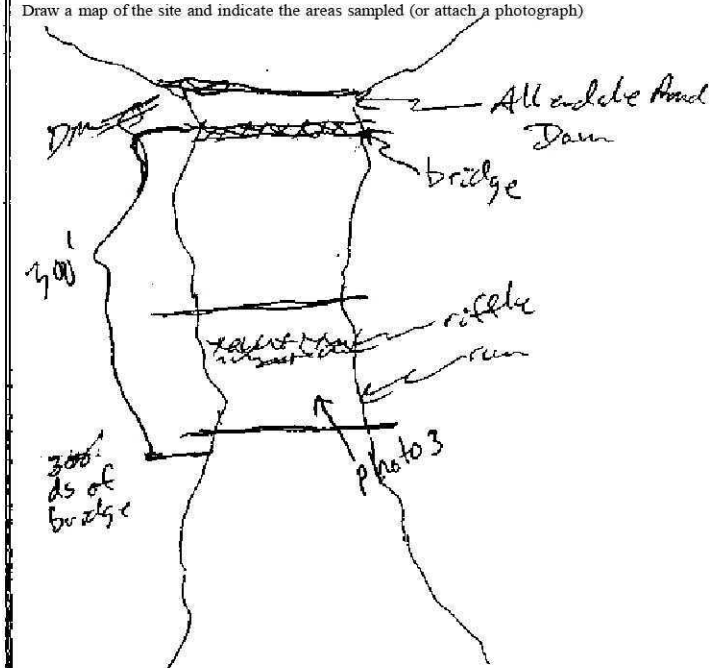
O U r<C^

Air Temperature ^ T^C

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
MPerennial Q Intermittent Q Tidal

Stream Origin
Sitc actial Q Spring-fed
Q Non-glacial montane Q Mixture of origins
Q Swamp and bog Q Other_____

Stream Type
□ Coldwater ■ Warmwater

Catchment Area_____km²

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION
STATION # WRL 1 RIVERMILE	STREAM CLASS
LAT LONG	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS ^jfa~, CL	
FORM COMPLETED BY DAn	DATE 4 July 01 TIME 1452 AM (PM) REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs. undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 /f?^12 11	10 9 8 7	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediu%nt.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 fd)	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 ^ ?L 'X^
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions. constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 U	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amoant of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel. and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated in reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	/20y* 19 18 17 16	15 14 13 12 U.	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between *riffles divided by width* of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided *by the width of the* stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; *distance between riffles* divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between *riffles divided by the* width of the stream is a ratio of >25.
SCORE	/2Qi) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 *fy*	8 7 6	5 4 3	2 I 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 (9J	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	LeftBank 10 9	8 7 6	5 4 3	0) 1 0
SCORE ___ (RB)	Right Bank (uT) 9	8 7 6	5 4 3	2 1 0

Total Score _____

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION
STATION #i>O/^LXRIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS -TJ?/3M , Cf^	
FORM COMPLETED BY	DATE S-]y^^1 O^M1 ^^ TIME_/<"3^ / Vy REASON FOR SURVEY

WEATHER CONDITIONS

Now		Past 24 hours
Q	storm (heavy rain)	a
Q	rain (steady rain)	a
Q	showers (intermittent)	a
___%Q	%cloud cover	Q %2%
0	clear/sunny	Q

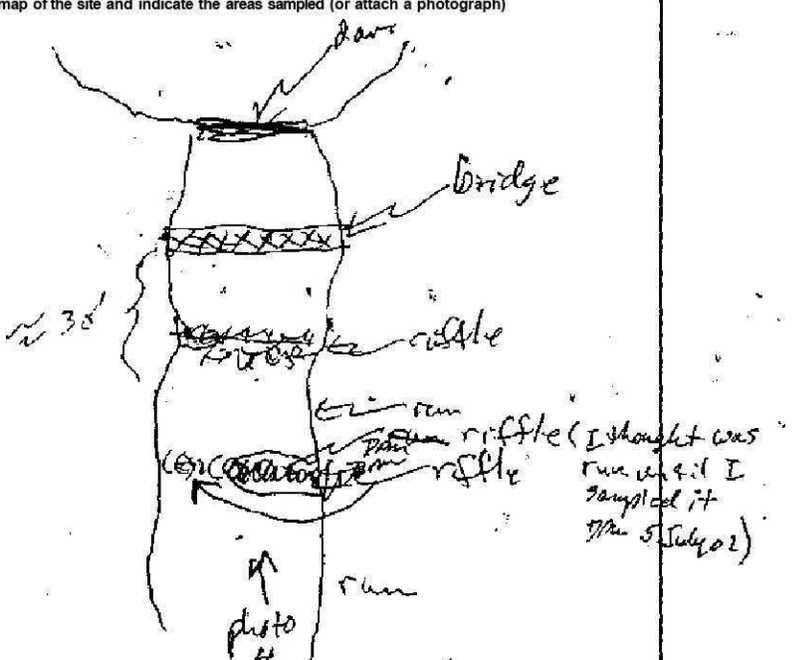
Has there beenji heavy rain in the last 7 days?
Q Yes GH^T

Air Temperature 29^C

Other_____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
Q Perenial Q Intermittent Q Tidal

Stream Type
Q Cold water O^Warmwater

Stream Origin
Q/Glacial
Q Non-glacial montane
Q Swamp and bog
Q Spring-fed
Q Mixture of origins
Q Other_____

Catchment Area_____km²

WRL2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	Predominant Surrounding Landusc (ft"forcst Q Commercial Q Field/Pasture Q Industrial Q Agricultural Q Other_____ Q Residential Local WatershcdN-PS Pollution Q No evidence €J Some potential sources Q Obvious sources Local Watershed Erosion G'None Q Moderate Q Heavy
RIPARIAN VEGETATION (18 meter buffer)	IndUate the dominant type and record the dominant species present OS-Trees Q Shrubs Q Grasses Q Herbaceous dominant species present_____
INSTREAM FEATURES	Estimated Reach Length __J'__m Estimated Stream Width _I 0__m Sampling Reach Area __O__m' Area in km' (m'xl000)_____km' Estimated Stream Depth _0Q__m Surface Velocity_____m/sec (at thalweg) Canopy Cover Q Partly open Q Partly shaded ©'Shaded High Water Mark __(^__m Proportion of Reach Represented by Stream Morphology-Types Qjiiffle C P % ErRun CO % Q Pool % _____ Channelized Q Yes OfJo
LARGE WOODY DEBRIS N/A	LWD _____m' Density of LWD _____m'/km' (LWD/ reach area) Dam Present Q-Yes Q No
AQUATIC VEGETATION N/A	Indicate the dominant type and record the dominant species present Q Rooted emergent Q Rooted submergent Q Rooted floating Q Free floating Q Floating Algae Q Attached Algae dominant species present_____ Portion of the reach with aquatic vegetation_____%
WATER QUALITY	Temperature 25.7°C Specific Conductance _^ P00 Dissolved Oxygen 7.0 pH 7.1 Turbidity ____ WQ Instrument Used _ \V>Y: 85__ Wafer Odors SfiQormal/None Q Sewage Q Petroleum Q Chemical Q Fishy Q Other_____ Water Surface Oils Q Slick Q Sheen Q Globs O Flecks O^Ione Q Other_____ Turbidity (if not measured) SKflear Q Slightly turbid Q Turbid Q Opaque Q Stained Q Other_____
SEDIMENT/ SUBSTRATE	Odtirs CSn^ormal Q Sewage Q Petroleum Q Chemical Q Anaerobic Q None Q Other_____ Oils EfAbsent Q Slight Q Moderate Q Profuse Deposits Q Sludge Q Sawdust Q Paper fiber Q Sand Q Relict shells Q Other_____ Looking at stones which are not deeply embedded, are the undersides black in color? Q Yes -Ortfo

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")	5			
Cobble	64-256 mm (2.5M0")	50	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64mm(0.r-2.5")				
Sand	0.06-2mm (gritty)	45	Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION
STATION* W / ^ L ^ RIVERMILE	STREAM CLASS
LAT LONG	RIVER BASIN
STORET *n*	AGENCY
INVESTIGATORS '~T?/9n £ fZZ	
FORM COMPLETED BY	DATE 'ŪJuMjQ 1 TIME ./fJJQ AM PM / REASON FOR SURVEY

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
I. Epifeunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs. undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of s,Uble habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	jjjj ^ .^13)12 11	10 9 f;,- /•• S••	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 •: 17, 16	15 -14 13 12 (11^	10 9 8 .7 ,;6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow arc missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE	2009 18 (Vl)j6	.I5".:)4 ,13 12 11	10 9 . 8 ,; 7 .6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions. constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	i20w>19 18-.-i.7r .16,	15,v.l4 13r12. 11	10 9 (i) 7 S	5 4 3 2 1 0
5.-Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 ^ 19 .18 17 16	15. (14 | 13 12 11	10 9 .8 .7 6,	.5 ;,4 :3 ,; 2 ;;.1 ; ,0

LRL2

HABITAT ASSESSMENT IKU, DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted, instream habitat greatly altered or removed entirely.
SCORE	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural nhsiruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE___(LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE___(RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class ofplantsisnotwell. represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambanK vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE___(LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE___(RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE___(LB)	Left Bank 10 9	8 7 6	5 4 3	(2) 1 0
SCORE___(RB)	Right Bank (10) 9	8 7 6	5 4 3	2 1 0

Total Score _____

BIOASSESSMENT REPORT OF THE FISH COMMUNITY IN THE WOONASQUATUCKET RIVER, NORTH PROVIDENCE, RHODE ISLAND

April 2002

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

BIO ASSESSMENT REPORT OF THE FISH COMMUNITY IN THE WOONASQUATUCKET RIVER, NORTH PROVIDENCE, RHODE ISLAND

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R-19041.001

April 2002

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1.0 INTRODUCTION

The Centredale Manor Superfund Site (the Site), consisting of approximately 9.04 acres, is located in North Providence, Rhode Island, just south of Route 44 on the eastern bank of the Woonasquatucket River. The main area of the Site is known as 2072 and 2074 Smith Street. The Site consists of reaches of the Woonasquatucket River associated with Allendale Pond and Lyman Mill Pond and includes all contaminated areas within this area as well as any other location to which contamination from that area has come to be located, or from which that contamination came.

Currently, two high rise buildings (Centredale Manor and Brook Village, both federally subsidized, senior housing complexes) are located in the main area of the Site, which is zoned for residential occupancy. In addition to the buildings, the main area is covered by roadway and parking lots. Dn the eastern portion of the main area is a drainage swale that begins near the northern portion of the main area and extends south, then curves to the west and discharges south of the main area into the Woonasquatucket River and Allendale Pond.

The Site was used for disposal of wastes containing hazardous substances. Between approximately 1940 and 1970, USEPA has reason to believe that the main area of the Site was the location of a chemical manufacturing facility (which produced hexachlorophene, among other chemicals) and an incineration-based drum recycling facility. The first housing complex was built in approximately 1976. The second high rise was built in 1982. Construction records show that hazardous substances were removed from the Site during the construction of the second complex. Samples indicate the presence of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and other contaminants in soil and sediment at the main portion of the Site as well as river sediment and floodplain soils downstream.

Beginning in May 2001, Normandeau Associates, Inc. (NAI) worked with Harding ESE to collect community composition data on fish, benthic macroinvertebrates, emergent aquatic insects, ichthyoplankton, and floodplain soil invertebrates near the Site. Bioassessment reports produced from these data will be incorporated into the Baseline Ecological Risk Assessment for the Centredale Manor Restoration Superfund Site to assess effects from the Site on these communities. The following report describes the findings of the fish community bioassessment.

2.0 MATERIALS AND METHODS

2.1 IMPOUNDMENT SAMPLES

Index of Biotic Integrity (IBI) samples were collected from three impoundments on 25 and 26 June 2001. The three impoundments, Lyman Mill Pond (LPX), Greystone Mill Pond (GMP) and Assapumpsett Pond (ASP) represented experimental, reference, and offsite control sampling locations respectively, and were located in the vicinity of the Centredale Manor EPA Superfund Site. The experimental site, Lyman Mill Pond, was located approximately 3,200 feet downstream of the Centredale Manor Site (Figure 1. The upstream reference site was located on Greystone Mill Pond, approximately 2,800 feet upstream of the Site on the Woonasquatucket River. The offsite control site was located on Assapumpsett Pond, which was an impoundment on Assapumpsett Brook, a tributary to the Woonasquatucket River (Figure 2). IBI samples were collected from two stations each on Lyman Mill Pond and Greystone Mill Pond, and one station on Assapumpsett Pond.

Reference Station GMP 1 was located in the lower section of Greystone Mill Pond along the western shore. This section was 3 to 5 feet deep, had no visible flow, and had cover provided by submerged aquatic vegetation. Reference Station GMP 2, located at the upper end of Greystone Mill Pond, had a depth of 1.5 to 3 feet, visible flow and cover provided by submerged aquatic vegetation.

Experimental Station LPX I was located in the lower reach of Lyman Mill Pond along the western shore. Station depth ranged between 3 to 5 feet, had no visible flow and cover provided by submerged aquatic vegetation. Station LPX 2, located in the middle of the Lyman Mill impoundment along the eastern shore, had a depth of 1.5 to 5 feet, visible flow, and cover provided by overhanging trees and submerged aquatic vegetation.

Assapumpsett Pond had only one IBl sampling location (ASP 1) because of the small pond size and a homogeneous habitat throughout the pond, which consisted of no flow, heavy growth of submerged aquatic vegetation, and a depth of 3 to 5 feet.

An electrofishing boat with a Coffelt Model VVP-15 system was used to conduct the survey. The Coffelt system was set on DC pulse at 300 volts and an output of 5 to 7 amperes. Samples were collected along the shoreline at idle speed for a duration of 10 minutes. All captured fish were placed in a live well, identified to species, weighed to the nearest gram, had total length measured to the nearest millimeter, and released. During fish processing, observations of deformities, lesions, and tumors were noted in the field notebook. Representative samples were photodocumented. Scale samples were also removed from representative specimens of each species. The fishes' sex would have been recorded if semen or eggs were discharged during sample processing; however no attempt was made to dissect the fish to determine its sex, because dissecting the fish would have compromised the integrity of the tissue sample.

2.2 STREAM SAMPLES

IBl samples were collected from three stream locations on the Woonasquatucket River during 28 June, 29 June, and 4 July 2001. The sampling areas were the river reach below Greystone Mill dam but above the Centredale Manor Site (RWR 1), the Allendale Reach (APX 1) immediately downstream of the tailrace confluence with the Woonasquatucket River, and the Lyman Mill Reach (LPX 3) downstream of Allendale Pond (Figures 1 and 2). Reference Station RWR 1 was 10% riffle and 90% run habitat, 1 to 2 feet deep, had a coarse substrate comprised of boulders, cobble and sand, a current velocity estimated at 1 to 2 feet per second and cover provided by overhanging trees. Station APB 1 was located just downstream of the southern capped area of the Centredale Manor Site and consisted of 75% riffle and 25% run habitat, substrate composition similar to the RWR I station, a depth of 1 to 2 feet, offstream overhead canopy cover, and current velocities of 1 to 3 feet per second. Station LPX 3 was located approximately 300 feet below the breached Allendale dam. This station consisted of 75% riffle and 25% run habitat, a cobble, sand and gravel substrate with depths between 1 to 2 feet, offstream overhead canopy cover, and current velocities estimated between 1 to 2 feet per second.

Two Coffelt model BP-2 backpack electroshockers along with two scap-netters were used to conduct the survey. The surveys were conducted along 100 meters of stream, which was measured with a GPS unit. Sampling was conducted downstream to upstream ending in a riffle area. Block nets were not used at the end of sampling areas do to high flows. All fish captured were kept alive in buckets filled with river water, identified to species, weighed to the nearest gram, had total length measured to

the nearest millimeter, and released. The fishes' sex would have been recorded if semen or eggs were discharged during sample processing. No attempt was made to dissect the fish to determine its sex, because dissecting the Fish would have compromised the integrity of the tissue sample.

The FSP stated that seven IBI stations would be sampled, two stations each in Greystone Mill Pond, Lyman Mill Pond, and Allendale Pond, and one station in Assapumpsett Pond. Samples in Greystone Mill Pond (GMP 1, GMP 2), Lyman Mill Pond (LPX 1, LPX 2), and Assapumpsett Pond (ASP 1) were sampled as stated in the FSP; however because of the Allendale Pond dam breach, the two samples scheduled for that area were relocated to downstream of Allendale Pond dam (LPX 3) and upstream of Route 44 on the Woonasquatucket River (RWR 1). Also, an additional stream station was sampled immediately downstream of the tailrace confluence (APX 1).

2.3 RATING CRITERIA

IBI metrics from experimental stations (LPX 1, LPX 2, summed values of LPX 1 and LPX 2) were rated against reference data (GMP 1, GMP 2, summed values of GMP 1 and GMP 2) by calculating the percent comparability of the experimental data to the reference data for metrics M1, M2, M3, M4, M5 and M10. The percent comparability of each metric was given a score based on the criteria provided in Table 2-1. In addition, for metrics M6, M7, M8, M9, Mi1 and Ml2, actual metric values (percent composition of the sample) were scored according to the criteria provided in Table 2-1. Individual metric scores were then summed to determine the total IBI score for each station (minimum score=12, maximum score=60) and the station's integrity class was determined by comparing the station's total score with the criteria provided in Table 2-2.

Table I. Scoring Criteria for IBI Metrics used in the Northeastern U.S. Region (based on Karr's original scoring criteria; Plafkin, et al. 1989).

		Score		
Description	Metrics	5	3	1
Total number of species'	M1	>67%	33-67%	<33%
Number of benthic insectivores[1]	M2	>67%	33-67%	<33%
Number of water column species'	M3	>67%	33-67%	<33%
Number of sucker species'	M4	>67%	33-67%	<33%
Number of intolerant species[1]	M5	>67%	33-67%	**<33%**
Percent white sucker[2]	M6	<10%	10-25%	**>25%**
Percent omnivores[2]	M7	<20%	20-45%	**>45%**
Percent insectivores[2]	M8	>45%	20-45%	**<20%**
Percent top carnivores[2]	M9	>5%	1-5%	<1%
Density of individuals'	MIO	>67%	33-67%	<33%
Percent hybrids[2]	Mi1	0%	0-1%	**>1%**
Percent diseased individuals[2]	M12	<1%	1-5%	**>5%**

[1] Rated against a reference station.
[1] Actual metric value.

Table 2. Index score interpretation criteria (based on Karr's original scoring criteria; Plafkin, et al 1989).

IBI	Integrity Class	Characteristics
58-60	Excellent	Comparable to pristine conditions, exceptional assemblage of species.
48-52	Good	Decreased species richness, intolerant species in particular; sensitive species present.
40^4	Fair	Intolerant and sensitive species absent; skewed trophic structure.
28-34	Poor	Top carnivore and many expected species absent or rare; omnivores and tolerant species dominant.
12-22	Very poor	Few species and individuals present; tolerant species dominant; diseased fish frequent.

For this assessment, experimental Station LPX 1 was compared to reference Station GMP 1, experimental Station LPX 2 was compared to reference Station GMP 2, and combined experimental data from LPX 1 and LPX 2 was compared to combined reference data from GMP 1 and GMP 2. Additionally, because elevated levels of PCBs were found in the sediments at Greystone Mill during previous investigations (Tetra Tech NUS, 1999), the reference data were also compared against an IBI sample from Assapumpsett Pond (offsite control).

2.4 DESCRIPTION OF METRICS

Species Richness and Composition Metrics.

These metrics assess the species richness component of diversity and the health of resident taxonomic groupings and habitat guilds of fishes. Two of the metrics assess assemblage composition of tolerant and intolerant species.

Metric 1. Total number offish species. This number decreases with increased degradation; hybrids and introduced species are not included (Rainbow trout were considered as native for this study).

Metric 2. Number of benthic insectivores. These species (e.g., tessellated darter) are sensitive to degradation resulting from siltation and benthic oxygen depletion because they feed and reproduce in benthic habitats. Many smaller species live within the rubble interstices, are weak swimmers, and spend their entire lives in an area of 100-400 m^2.

Metric 3. Number of water column species. These pool species (e.g., spottail shiner) decrease with increased degradation of pools and instream cover. Most of these fish feed on drifting and surface invertebrates and are active swimmers.

Metric 4. Number of sucker species. These species (e.g., white sucker) are sensitive to physical and chemical habitat degradation and commonly comprise most of the fish biomass in streams. These are long-lived species and provide a multiyear integration of physiochemical conditions.

Metric 5. Number of intolerant species. This metric distinguishes high and moderate quality sites using species that are intolerant of various chemical and physical perturbations. Intolerant species (e.g., rainbow trout) are typically the first to disappear following a disturbance. Species classified as intolerant should only represent the 5-10% most susceptible species; otherwise this becomes a less discriminating metric.

Metric 6. Proportion (%) individuals as white sucker. This metric is the reverse of Metric 5. It distinguishes low from moderate quality waters. These species show increased distribution or abundance despite historical degradation of surface waters, and they shift from incidental to dominant in disturbed sites.

Trophic Composition Metrics

The following metrics evaluate the quality of the energy base and trophic dynamics of the fish assemblage. Traditional process studies, such as community production and respiration, are time consuming to conduct and the results are equivocal; distinctly different situations can yield similar results. The trophic composition metrics offer a means to evaluate the shift toward more generalized foraging that typically occurs with increased degradation of the physicochemical habitat.

Metric 7. Proportion of individuals as omnivores. The percent of omnivores (e.g., golden shiner) in the community increases as the physical and chemical habitat deteriorates. Omnivores are defined as species that consistently feed on substantial proportions of plant and animal material.

Metric 8. Proportion of individuals as insectivores. Invertivores, primarily insectivores (e.g., tessellated darter) are the dominant trophic of most North American surface waters. As the invertebrate food source decreases in abundance and diversity due to habitat degradation (e.g., anthropogenic stressors), there is a shift from insectivorous to omnivorous fish species. This metric evaluates the midrange of biological conditions.

Metric 9. Proportion of individuals as top carnivores. The top carnivore metric discriminates between systems with high and moderate integrity. Top carnivores (e.g., largemouth bass) are species that feed, as adults, predominantly on fish, other vertebrates, or crayfish.

Fish Abundance and Condition Metrics.

The last three metrics indirectly evaluate population recruitment, mortality, condition, and abundance. Typically, these parameters vary continuously and are time consuming to estimate accurately. Instead of such detailed population attributes or estimates, general population parameters are evaluated. Indirect estimation is less variable and much more rapidly determined.

Metric 10. Density of Individuals. This metric evaluates population abundance and varies with region and stream size for small streams. It is expressed as catch per unit effort, either by area, distance or time sampled. Generally, sites with lower integrity support fewer individuals, but in some nutrient poor regions, enrichment increases the number of individuals.

Metric 11. Proportion of individuals as hybrids. This metric is an estimate of reproductive isolation or the suitability of the habitat for reproduction. Generally as environmental degradation increases the percent of hybrids also increases, but the proportion of simple lithophils (fish that spawn in clean swept interstitial gravel and cobble substrates) decreases. However, minnow hybrids are found in

some high quality streams, hybrids are often absent from highly impacted sites, and hybridization is rare and difficult to detect.

Metric 12. Proportion of individuals with disease, tumors, fin damage and skeletal anomalies. This metric depicts the health and condition of individual fish. These conditions occur infrequently or are absent from minimally impacted reference sites but occur frequently below point sources and in areas where toxic chemicals are concentrated. They are excellent measures of subacute effects of chemical pollution and the aesthetic value of game and nongame fish.

2.5 TOLERANCE AM) TROPHIC GUILDS

Table 2-3 lists all fish species collected during BBI sampling near the Centredale Manor Site. Tolerance and trophic guilds were assigned according to Barbour et al. (1999).

3.0 RESULTS

Fifteen fish species were collected during the EBI sampling at the Centredale Manor Site from 4 experimental sampling stations and 4 reference stations. Experimental Stations LPX 1 and LPX 2 were impoundment samples, while Stations LPX 3 and APB 1 were stream samples. Impoundment samples were rated against Stations GMP 1 and GMP 2, and stream stations rated against reference stream Station RWR 1 (Appendix A).

Table 3. Tolerance and Trophic Guilds of Fish Collected during IBI Sampling at the Centredale Manor Restoration Superfund Project Site.

Species	Trophic Level	Tolerance
Black/White crappie	P	**M**
Pumpkinseed/Redbreast sunfish	I,G	M
Bluegill	I,G	**T**
Spottail shiner	I,G	**M**
American eel	P	T
White sucker	O,G	T
Brown/Yellow bullhead	I,G	T
Chain pickerel	P	M
Golden shiner	O,G	T
Largemouth bass	P	**M**
Rainbow trout	P	**I**
Tessellated darter	**I**	**M**

Legend:

I	Insectivore	T	Tolerant
P	Piscivore	M	Moderately tolerant
O	Omnivore	I	Intolerant
G	General ist		

3.1 IMPOUNDMENT STATIONS

3.1.1 Reference Stations

The Greystone Mill Pond impoundment reference stations contained a total of 9 species. Golden shiner, redbreast sunfish, brown bullhead, chain pickerel, largcmouth bass, and American eel inhabited the lower (southern) portion of the impoundment (Station GMP 1). Two fish were aged from GMP 1, one redbreast sunfish (4 years) and one largemouth bass (6 years). Rainbow trout, white sucker, pumpkinseed, largemouth bass, chain pickerel, and brown bullhead occupied the upper (northern) portion of the impoundment (Station GMP 2). In the upper (northern) section of Greystone Mill Pond, three species offish were aged, two white suckers (5 years each), one pumpkinseed (5 years), and one largemouth bass (7 years).

Golden shiner (33% composition) and chain pickerel (22% composition) dominated the fish community in the lower (southern) portion of Greystone Mill Pond (GMP 1). White sucker (32% composition), brown bullhead, and chain pickerel (both at 21% composition), comprised most of the catch in the upper (northern) section (GMP 2). However, 10% of the fish collected at GMP 2 consisted of rainbow trout, an intolerant species.

The Assapumpsett Pond off-site reference sample (Station ASP 1, Appendix A) contained 6 species offish, mainly bluegill, but also pumpkinseed, redbreast sunfish, black crappie, brown bullhead and American eel. The most abundant species in this pond were sunfishes (79%), primarily bluegill (37% of the total catch). Fish aged from this pond included one black crappie (2 years), three bluegill (one each 3,4, and 5 years), two pumpkinseed (both 3 years), and three redbreast sunfish (one each 4,5, and 6 years).

3.1.2 Experimental Stations

Of the 11 species present in the Lyman Mill impoundment, black crappie, pumpkinseed, bluegill, and spottail shiner occupied the lower (southern) portion of the impoundment (Station LPX 1). Fish aged from this staion included two black crappie (3 years each), one pumpkinseed (3 years), and two bluegill (3 and 4 years each). American eel, white sucker, brown bullhead, chain pickerel, golden shiner, white crappie, and largemouth bass were present in the upper (northern) portion of the impoundment (Station LPX 2). Only two fish could be aged from this station, one white crappie (4 years) and one bluegill (5 years).

The Lyman Mill lower impoundment (LPX 1) fish assemblage consisted of centrarchids (bluegill, pumpkinseed, and black crappie), which comprised 86% of the total catch, and one cyprinid species, spottail shiner (14%). The upper section of Lyman Mill Pond (LPX 2) was dominated by golden shiner (25%), followed by largemouth bass and American eel (both at 17%). With the exception of largemouth bass and eel, all of the species within this impoundment were moderately to highly tolerant and were general ist feeders.

3.2 STREAM STATIONS

The Lyman Mill reach sample (Station LPX 3) contained 8 species, which are commonly collected in shallow, fast moving streams: American eel, brown bullhead, tessellated darter, golden shiner, juvenile bluegill, chain pickerel, white sucker, and largemouth bass. Species found in the Allendale reach sample (Station APX 1) included American eel, brown bullhead, tessellated darter, and white

sucker. The reference stream sample (Station RWK 1), located upstream of the Centredale Site, contained the same species as the Allendale reach plus two additional species, chain pickerel and yellow bullhead.

The most abundant species in the Allendale reach were white sucker (57% composition), and brown bullhead (22% composition), both highly tolerant species. In contrast, the most abundant species in the Lyman Mill reach were tessellated darter (61% composition), and white sucker (20% composition). Darter species are considered more moderately tolerant to adverse physiochemical conditions.

3.3 METRIC ANALYSIS

Scores from individual samples ranged between 46 and 60 and were rated as fair to excellent, respectively (Table 3-1). The combined score for the Lyman Mill impoundment samples (LPX1+LPX2) was 50. Further comparison between the Greystone Mill lower impoundment (Station GMP1) and the Assapumpsett Pond sample (Station ASP1) resulted in a score of 54. Appendix A shows complete scores for each metric on every sample.

Table 4. IBI scores for Allendale Reach, Lyman Mill Pond, and Greystone Mill Pond. Centredale Manor Restoration Superfund Project Site, North Providence, Rhode Island.

Sample	Location	Reference	Score
LPX 1	Lyman Mill lower impoundment	GMP 1	60
LPX2	Lyman Mill upper impoundment	GMP 2	46
LPX 1+2	Combined Lyman Mill sample	GMP 1+2(combined)	50
LPX 3	Lyman Mill stream reach	RWR 1 (stream)	56
APX 1	Allendale upper reach	RWR 1	46
GMP 1	Greystone Mill lower impoundment	ASP 1	54
ASP 1	Assapumpsett pond	GMP 1	54

Most of the species collected in the study area were moderate to tolerant species. However, rainbow trout was included in the rating criteria because it was the only intolerant species found. This species was most likely introduced during previous stocking programs.

Station LPX 2 contained double the number of species from Station LPX 1. However, habitats at the two areas differed enough (wide, slow, deep moving waters at LPX 1 compared to narrow, shallow, somewhat faster moving water at LPX 2) to contain different fish species.

Limited age data were obtained from fish scales removed during the fish tissue collection effort but were not used for the IBI assessment (Appendix B). Mean ages for white sucker were as follows: 4.7 years in Allendale Reach, 5.3 years in Greystone Mill Pond, and 4.7 years of age in Lyman Mill Pond. For largemouth bass: 6.5 years in Lyman Mill Pond, 5.2 years in Greystone Mill Pond, 4.5 years in Assapumpsett Pond, and 5.0 years of age in Manton Pond (no bass were found in Allendale Reach). Bluegills collected in Assapumpsett Pond had an average age of 4.1 years and pumpkinseeds in Lyman Mill Pond averaged 6.0 years of age.

4.0 DISCUSSION

Overall, the fish assemblages that inhabit the impoundments near the Centredale Manor Superfund Site appear to be in relatively good condition. The Allendale Reach Stream sample (Station APX 1) and the Lyman Mill Pond upper impoundment sample (LPX 2) seemed to be the most affected areas that were evaluated (rated fair to good at 46). Since these two stations are near to the Site (Figures 1 and 2), these data indicate that had the Allendale Dam not been breached earlier in the year, scores from an IBI sample of these lower stations may have shown the greatest impact. The high score of the lower Lyman Mill sample (LPX I) against the lower Greystone Mill Pond (GMP 1) reference likely was due to the presence of generalist species like bluegill and pumpkinseed. These species are primarily insectivores, and will feed from the bottom, mid water and surface, depending on food availability. These fish are considered well suited to the normally harsh conditions typical of the northeastern U.S. region (Scott & Crossman, 1973).

Choosing the appropriate reference station for comparing similar habitats was important to obtain the most accurate scores in terms of species richness and composition metrics. When comparing the species richness and composition metrics between samples, all rated very well against the respective reference samples, i.e., there is no noticeable difference in the species composition of the fish communities between impoundments. Trophic composition and abundance and condition metrics showed the weak points in the areas sampled; mainly the noted absence of intolerant species in the Allendale Pond and Lyman Mill Pond areas, and the dominance of highly tolerant species like brown bullhead and white sucker. Even though rainbow trout found in the upper Greystone Mill Pond (GMP 2) area were most likely part of a put-and-take fishery, their presence and apparent healthy condition (no parasites, sores or missing scales, etc.) is a good indicator of the ability of that reservoir to support this very intolerant species?]

The high relative abundance of generalist feeders (sunfishes and bullheads) and white sucker indicate that Allendale Reach and Lyman Mill Pond are low to moderate quality habitats, since these species tend to shift from incidental to dominant in disturbed ecosystems (Barbour et al. 1999). This was particularly evident in the Allendale Reach (APX 1) sample where 56 % of the sample consisted of white sucker. In comparison, the Lyman Mill Pond stream sample (LPX 3) contained a more diverse trophic composition (22% omnivores and 60% insectivores), thereby rating much closer to the reference (RWR 1) sample.

Two types of disease were noticed (skin sores and black spot disease), but only in fish collected from the upper Lyman Mill Pond Station (LPX 2). It is possible that these individuals originated in the Allendale reach and moved down to Lyman Mill after losing their preferred habitat due to the breaching of the Allendale Dam. The presence of disease in individual fish is an indicator of the chronic effects of chemical pollution because it seldom occurs in minimally impacted areas, but is more common below point sources and in areas where toxic chemicals are concentrated (Barbour, et al 1999).

5.0 LITERATURE CITED

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Appendix A

IBI Metric Calculations

Appendix A. Listing of Reference samples. IBI samples and Scores for the Centerdale Manor Superfund Site

Impoundment Sample — Reference Station

LPX1 Species	trophic level	Number caught	% of catch	GMP1 Species	trophic level	Number caught	% of catch
Black crappie	P	2	28.6	Golden shiner	O/G	3	33.3
Pumpkinseed	I/G	2	28.6	Redbreast sunfish	I/G	1	11.1
Bluegill	I/G	2	28.6	Brown bullhead	I/G	1	11.1
Spottail shiner	I	1	14.3	Chain pickerel	P	2	22.2
Totals	4 spp.	7	100	Largemouth bass	P	1	11.1
				American eel	P	1	11.1
				totals	6 spp.	9	100.0

Description	Metrics	Sample/Ref.	Value	Score	5	3	1
Total # of species	M1	4/6	67%	5	>67	33-67	<33
# of benthic inseclivores	M2	2/2	100%	5	>67	33-67	<33
# of water column spp.	M3	4/6	67%	5	>67	33-67	<33
# of sucker spp.	M4	0/0	100%	5	>67	33-67	<33
# of intolerant spp.	MS	0/0	100%	5	>67	33-67	<33
% white sucker	M6	0/0	0%	5	<10	10-25	>25
% omnivores	M7	0/33.3	0%	5	<20	20^15	>45
% insectivores	M8	71.5/22.2	72.00%	5	>45	20-45	<20
% top carnivores	M9	28.6/44.4	29%	5	>5	1-5	<1
Density of individuals	M10	7/9	78%	5	>67	33-67	<33
% hybrids	M11	0/0	0%	5	0	0-1	>1
% diseased individuals	M12	0/0	0%	5	<1	1-5	>5
Total score				60	excellent		

Impoundment Sample — Reference Station

LPX2 Species	trophic level	Number caught	% of catch	GMP2 Species	trophic level	Number caught	% of catch
American eel	P	2	16.7	Rainbow trout	P	2	10.5
White sucker	O/G	1	8.3	White sucker	O/G	6	31.6
Brown bullhead	I/G	1	8.3	Largemouth bass	P	1	5.3
Chain pickerel	P	1	8.3	Brown bullhead	I/G	4	21.1
White crappie	P	1	8.3	Pumpkinseed	I/G	1	5.3
Bluegill(1)	I/G	1	8.3	Chain pickerel	P	4	21.1
Golden shiner(2)	O/G	3	25.0	Golden shiner	O/G	1	5.3
Largemouth bass	P	2	16.7	totals	7 spp.	19	100
Totals	8 spp.	12	100				

(1) sore on right
(2) black spot disease

Description	Metrics	Sample/Ref.	Value	Score	5	3	1
Total # of species	M1	8/7	114%	5	>67	33-67	<33
# of benthic insectivores	M2	4/4	100%	5	>67	33-67	<33
# of water column spp.	M3	4/3	133%	5	>67	33-67	<33
# of sucker spp.	M4	1/1	100%	5	>67	33-67	<33
# of intolerant spp.	M5	0/1 (1)	50%	3	>67	33-67	<33
% white sucker	M6	8.3/31.6	8.00%	5	<10	10-25	>25
% omnivores	M7	33.3/36.9	33%	3	<20	20-45	>45
% insectivores	M8	16.6/26.4	17%	1	>45	20-45	<20
% top carnivores	M9	50/36.9	50%	5	>5	1-5	<1
Density of individuals	M10	12/19	63%	3	>67	33-67	<33
% hybrids	M11	0/0	0%	5	0	0-1	>1
% diseased individuals	M12	33.3/0	33%	1	<1	1-5	>5
Total score				46	fair/good		

Both IBI samples and Reference samples consisted of electroshocking shoreline sections of a reservoir for 10 minutes.
The lower and upper Lymansville impoundment samples were rated against the lower and upper Greystone Mill impoundment samples
(1) Only one intolerant species was found, rainbow trout, which is an introduced species. Rating of 50% is a compromise.

Appendix A (cont.) Combined Sample IBI Scores

Impoundment Sample

LPX1+ LPX2

Species	Trophic level	Number caught	% of catch
Black crappie	P	2	10.5
Pumpkinseed	I/G	2	10.5
Bluegill	I/G	2	10.5
Spottail shiner	I	1	5.3
American eel	P	2	10.5
White sucker	O/G	1	5.3
Brown bullhead	I/G	1	5.3
Chain pickerel	P	1	5.3
White crappie	P	1	5.3
Bluegill(i)	I/G	1	5.3
Golden shiner(2)	O/G	3	15.8
Largemouth bass	P	2	10.5
Totals	11 spp	19	100.0

(1) sore on right
(2) black spot disease

Reference Station

GMP1 + GMP2

Species	Trophic level	Number caught	% of catch
Golden shiner	O.G	4	14.3
Redbreast sunfish	I/G	1	3.6
Brown bullhead	I/G	5	17.9
Chain pickerel	P	6	21.4
Largemouth bass	P	2	7.1
American eel	P	1	3.6
Rainbow trout	P	2	7.1
White sucker	O/G	6	21.4
Pumpkinseed	I/G	1	3.6
Totals	9 spp	28	100.0

Description	Metrics	Sample/Ref.	Value	Score	5	3	1
Total # of species	M1	11/9	122%	5	>67	33-67	<33
# of benthic insectivores	M2	4/3	133%	5	>67	33-67	<33
# of water column spp.	M3	5/4	125%	5	>67	33-67	<33
# of sucker spp.	M4	1/1	100%	5	>67	33-67	<33
# of intolerant spp.	M5	0/1	50%	3	>67	33-67	<33
% white sucker	M6	5.3/21.4	5%	5	<10	10-25	>25
% omnivores	M7	21.1/35.7	21%	3	<20	20-45	>45
% insectivores	M8	36.9/25.1	37%	3	>45	20-45	<20
% top carnivores	M9	42.1/39.2	42%	5	>5	1-5	<1
Density of individuals	M10	19/28	68%	5	>67	33-67	<33
% hybrids	M11	0/0	0%	5	0	0-1	>1
% diseased individuals	M12	21.1/0	21%	1	<1	1-5	>5
Total score				50	good		

Appendix A (cont.) IBI Scores, Stream Samples.

Stream Sample

LPX3

Species	trophic level	Number caught	% of catch
American eel	P	3	5.9
Brown bullhead	I/G	3	59
Tessellated darter	1	31	60.8
Golden shiner	O/G	1	2.0
Bluegill	I/G	1	2.0
Chain pickerel	P	1	2.0
White sucker	O/G	10	19.6
Largemouth bass	P	1	2.0
Total	8 spp.	51	100

Reference Station

RWR1

Species	trophic level	Number caught	% of catch
Chain pickerel	P	3	9.7
Brown bullhead	I/G	2	65
Yellow bullhead	I/G	4	12.9
White sucker	O/G	12	38.7
Tessellated darter	I	7	22.6
American eel	P	3	9.7
Totals	6 spp.	31	100

Description	Metrics	Sample/Ref.	Value	Score	5	3	1
Total # of species	M1	8/6	133.0%	5	>67	33-67	<33
# of benthic insectivores	M2	2/2	100.0%	5	>67	33-67	<33
it of water column spp.	M3	3/2	150.0%	5	>67	33-67	<33
# of sucker spp.	M4	1/1	100.0%	5	>67	33-67	<33
U of intolerant spp.	M5	0/0	100.0%	5	>67	33-67	<33
% white sucker	M6	19.6/38.7	19.6%	3	<10	10-25	>25
%omnivores	M7	21.6/38.7	21.6%	3	<20	20-45	>45
% insectivores	M8	60.8/22.6	60.8%	5	>45	20^5	<20
% top carnivores	M9	9.9/19.4	9.9%	5	>5	1-5	<1
Density of individuals	M10	51/31	165.0%	5	>67	33-67	<33
% hybrids	M11	Or0	0.0%	5	0	0-1	>1
% diseased individuals	M12	0/0	0.0%	5	<1	1-5	>5
Total score				56	good/excellent		

Stream Sample

APX1

Species	trophic level	Number caught	*V,* of catch
American eel	P	5	4.3
Brown bullhead	I/G	10	21.7
Tessellated darter	I	5	10.9
White sucker	O/G	26	56.5
Totals	4 spp.	46	100

Reference Station

RWR1

Species	trophic level	Number caught	% of catch
Chain pickerel	P	3	9.7
Brown bullhead	I/G	2	6.5
Yellow bullhead	I/G	4	12.9
White sucker	O/G	12	38.7
Tessellated darter	1	7	22.6
American eel	P	3	9.7
Totals	6 spp.	31	100

Description	Metrics	Sample/Ref.	Value	Score	S	3	1
Total # of species	M I	4/6	67%	5	>67	33-67	<33
tt of benthic insectivores	M2	2/3	67%	5	>67	33-67	<33
# of water column spp.	M3	2/3	67%	5	>€7	33-67	<33
# of sucker spp.	M4	1/1	100%	5	>67	33-67	<33
# of intolerant spp.	M5	0/0	100%	5	>67	33-67	<33
% white sucker	M6	56.5/38.7	57%	1	<10	10-25	>25
% omnivores	M7	56.5/38.7	57%	1	<20	20-45	>45
% insectivores	M8	10.9/22.6	11%	1	>45	2rW5	<20
% top carnivores	M9	4.3/19.4	4%	3	>5	1-5	<1
Density of individuals	M10	46/31	148%	5	>67	33-67	<33
% hybrids	M11	0/0	0%	5	0	0-1	>1
% diseased individuals	M12	0/0	0%	5	<1	1-5	>5
Total score				46	fair/good		

Both samples and the reference station were based on 100 meters of stream electrofished. ending on a riffle.

Appendix A(cont.) Reference Station Ratings

Reference Comparison Sample				Reference Station			
GMP1 Species	Trophic level	Number caught	% of catch	ASP1 Species	Trophic level	Number caught	% of catch
Golden shiner	O. (B.I)	3	33.3	Black crappie	P	1	5.3
Redbreast sunfish	I/G	1	11.1	Bluegill	I/G	7	36.8
Grown bullhead	I/G	1	11.1	Pumpkinseed	I	4	21.1
Chain pickerel	P	2	22.2	Redbreast sunfish	I	4	21.1
Largemouth bass	P	1	11.1	Brown bullhead	I/G	1	5.3
American eel	P	1	11.1	American eel	P	2	10.5
Totals	6spp.	9	100.0	Totals	6spp.	19	100.0

Description	Metrics	Sample/Ref.	Value	Score	5	3	1
Total # of species	M1	6/6	100%	5	>67	33-67	<33
# of benthic insectivores	M2	2/2	100%	5	>67	33-67	<33
# of water column spp.	M3	3/2	150%	5	>67	33-67	<33
# of sucker spp.	M4	0/0	100%	5	>67	33-67	<33
# of intolerant spp.	M5	0/0	100%	5	>67	33-67	<33
% white sucker	M6	0/0	0%	5	<10	10-25	>25
% omnivores	M7	33.3/0	33%	3	<20	2(M5	>45
% insectivores	M8	22.2/64.3	22%	3	>45	20-45	<20
% top carnivores	M9	44.4/15.8	44%	5	>5	1-5	<1
Density of individuals	M10	9/19	47%	3	>67	33-67	<33
% hybrids	M11	0/0	0%	5	0	0-1	>1
% diseased individuals	M12	0/0	0%	5	<1	1-5	>5
Total score				54	good/excellent		

Appendix B

Fish Age Data

Sample: RWR-IBI-1 **Waterbody: Woonasquatucket River above Rte. 44**

Species	Length (mm)	Weight (g)	Lesions/Other	Age
Chain Pickerel	205	60	none	
	102	6	none	
	82.	3	none	
Brown Bullhead	105	19	none	
	150	60	none	
Yellow Bullhead	112	27	none	
	145	49	none	
	116	24	none	
	158	52	none	
White Sucker	45	1	none	
	42	1	none	
	33	1	none	
	40	1	none	
	36	1	none	
	38	1	none	
	45	1	none	
	30	1	none	
	40	1	none	
	45	1	none	
	40	1	none	
	45	1	none	
Tessellated Darter	66	4	none	
	80	5	none	
	28	1	none	
	65	4	none	
	70	3	none	
	65	3	none	
	75	6	none	
American Eel	490	—	none	
	495	220	none	
	480	230	none	

Fish Tissue Samples

Location: Assapumpsett Pond
Species: **Largemouth** Bass / Bluegill

Weight (g)	Length (mm)	Lesions/Other	Sample #	Age	Comments
312	290	hook scars	RAB-LB-5001	4	
145	221	hook scars	RAB-LB-5002	4	2 fish composite
550	354	none	RAB-LB-5003	5	
500	340	hook scars	RAB-LB-5004	5	
165	203	none	RAB-BG-5003	6	6 fish composite
112	182	none	RAB-BG-5004	4	3 fish composite
135	196	none	RAB-BG-5005	4	3 fish composite
110	176	none	RAB-BG-5006	4	9 fish composite
160	202	none	RAB-BG-5007	5	2 fish composite
125	191	none	RAB-BG-5008	5	3 fish composite
50	136	none	RAB-BG-5009	2	6 fish composite
85	160	none	RAB-BG-5010	3	13 fish composite

Location: Assapumpsett Pond
Species: American Eel /Brown Bullhead

Weight(g)	Length(mm)	Lesions/Other	Sample	Age	Comment
300	518	none	RAB-AE-5001		
160	427	none	RAB-AE-5002		
110	400	none	RAB-AE-5003		
190	471	none	RAB-AE-5004		
90	359	none	RAB-AE-5005		2 fish composite
880	390	none	RAB-BB-5001		
390	320	none	RAB-BB-5002		

Location: Manton Pond
Species: Largemouth Bass

Weight(g)	Length(mm)	Lesions/Other	Sample	Age
630	332	none	MAP-LB-4001	6
460	363	none	MAP-LB-4002	5
360	281	none	MAP-LB-4003	4

Fish Tissue Samples

Location: Greystone **Mill** Pond
Species: White Sucker

Weight (g)	Length (mm)	Lesions/Other	Sample #	Age
1100	430	lamprey mark	GMP-WS^001	5
1700	504	none	GMP-WS^002	5
1500	478	none	GMP-WS^003	5
1200	451	none	GMP-WS-4004	6
1200	438	left ventral scars	GMP-WS-4005	5
1200	448	none	GMP-WS-4006	5
1700	485	none	GMP-WS-4007	5
1600	501	none	GMP-WS_4008	6
1500	493	none	GMP-WS-4009	
1300	481	none	GMP-WS-4010	6

Location:Greystone Mill Pond
Species: American Eel

Weight(g)	Length(mm)	Lesions/Other	Sample	Age
260	541	none	GMP-AE-4001	
130	402	none	GMP-AE-4002	
210	480	lamprey mark on tail	GMP-AE-4003	
180	453	none	GMP-AE^1004	
210	435	none	GMP-AE-4005	
130	394	none	GMP-AE^006	
230	492	none	GMP-AE-4007	
60	317	none	GMP-AE-4008	
90	360	none	GMP-AE-4008	
100	361	none	GMP-AE-4009	
70	318	none	GMP-AE-4009	
320	530	none	GMP-AE^010	

Location: Greystone Mill Pond
Species: Largemouth Bass

Weight (g)	Length (mm)	Lesions/Other	Sample #	Age
490	318	none	GMP-LB^001	5
690	351	none	GMP-LB-4002	6
1500	436	none	GMP-LB-4003	7
570	322	none	GMP-LB^004	6
1200	390	none	GMP-LB^005	6
850	346	none	GMP-LB-4006	5
680	337	none	GMP-LB-4007	5
670	350	none	GMP-LB^008	5
520	333	none	GMP-LB-4009	4
210	242	none	GMP-LB-4010	3

Fish Tissue Samples

Location: Lymansville Pond
Species: White Sucker

Weight (g)	Length (mm)	Lesions/Other	Sample #	Age
1600	510	none	LPX-WS-4001	6
1800	545	hemorrhage on throat	LPX-WS^002	6
1400	475	none	LPX-WS-4003	4
1200	480	none	LPX-WS-4004	5
1450	480	none	LPX-WS-4005	5
1050	460	none	LPX-WS4006	4
1100	450	none	LPX-WS^007	3
1000	440	none	LPX-WS^008	4
900	415	none	LPX-WS-4009	5
900	420	dermal hemorrhage	LPX-WS^010	5

Location: Lymansville Pond
Species: **American Eel**

Weight(g)	Length(mm)	Lesions/Other	Sample	Age
310	525	none	LPX-AE-4001	
220	460	none	LPX-AE-4002	
150	430	none	LPX-AE-4003	
170	430	none	LPX-AE-4004	
300	490	none	LPX-AE-4005	
90	340	none	LPX-AE-4006	
100	390	none	LPX-AE-4006	
80	350	none	LPX-AE-4007	
60	310	none	LPX-AE-4007	
80	356	none	LPX-AE-4008	
100	367	none	LPX-AE-4008	
190	442	none	LPX-AE4009	
110	366	none	LPX-AE-4010	
105	383	none	LPX-AE^010	

Location: Lymansville Pond
Species: Largemouth Bass

Weight(g)	Length(mm)	Lesions/Other	Sample	Age
375	286	none	LPX-LB-4001	5
300	267	none	LPX-LB-4002	5
275	260	none	LPX-LB-4002	
350	281	none	LPX-LB-4003	5
1060	427	dermal hemorrhage	LPX-LB-4004	8
870	400	none	LPX-LB-4005	8
1200	424	none	LPX-LB-4006	8
880	390	none	LPX-LB-4007	7
890	388	none	LPX-LB-4008	
288	410	none	LPX-LB-4009	6
1100	377	none	LPX-LB-4010	
130	159	none	LPX-PS-4009	
120	170	none	LPX-PS-4009	
110	162	none	LPX-PS4009	
180	187	none	LPX-PS-4010	6
150	182	none	LPX-PS-4010	
160	180	none	LPX-PS-4010	

Sample: LPX-IBI-3 **Waterbody: Woonasquatucket River below Allendale Pond**

Species	Length (mm)	Weight (g)	Lesions/Other	Age
American Eel	620	540	none	
	545	430	none	
	470	200	none	
Brown Bullhead	166	67	none	
	85	22	female	
	90	10	none	
Tessellated Darter	68	5	none	
	73	4	none	
	53	2	none	
	50	2	none	
	78	4	none	
	47	1	none	
	52	2	none	
	50	2	none	
	55	2	none	
	48	1	none	
	55	2	none	
	55	2	none	
	57	2	none	
	46	1	none	
	31	1	none	
Golden Shiner	65	3	none	
Bluegill	58	3	none	
Chain Pickerel	85	3	none	
White Sucker	37	1	none	
	38	1	none	
	38	1	none	
	42	1	none	
	40	1	none	
	32	1	none	
	30	1	none	
	35	1	none	
	38	1	none	
	32	1	none	
Largemouth Bass	38	1	none	

Sample: APB-IBI-1 Waterbody: Woonasquatucket River below tailrace

Species	Length (mm)	Weight (g)	Lesions/Other	Age
American Eel	425	145	none	
	360	105	none	
Brown Bullhead	108	14	none	
	92	8	none	
	116	24	none	
	98	13	none	
	96	11	none	
	107	14	none	
	89	9	none	
	92	10	none	
	101	17	none	
	92	11	none	
Tessellated Darter	65	4	none	
	54	2	none	
	55	2	none	
	53	2	none	
	58	2	none	
White Sucker	104	12	none	
	134	30	none	
	108	15	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	
	30	1	none	

Fish Age Results from IBI Samples

Sample: LPX-IBI-1 Waterbody: Lymansville Pond- southern section

Species	Length (mm)	_Wei_ght (g)	Lesions/Other	Age
Black Crappie	200	135	none	3
	242	230	none	3
Pumpkinseed	141	100	none	
	168	145	none	3
Bluegill	118	30	none	3
	152	100	none	4
Spottail Shiner	24	—	none	

Sample: LPX-IBI-2 Waterbody: Lymansville Pond- northern section

Species	**Length** (mm)	**Weight (g)**	Lesions/Other	**Age**
American Eel	305		none	
	410		none	
White Sucker	522	1500	none	
Brown Bullhead	278	345	none	
Chain Pickerel	350	275	none	
White Crappie	234	200	none	4
Bluegill	196	150	sore on right caudal area	5
Golden Shiner	72	4	black spot disease	
	80	5	none	
	72	4	none	
Largemouth Bass	35	...	none	
	33	...	none	

Sample: **GMP-IB1-1** Waterbody: Greystone Mill Pond- southern section

Species	Length (mm)	Weight (g)	Lesions/Other	Age
Golden Shiner	62	4	none	
	46	2	none	
	52	2	none	
Redbreast Sunfish	173	120	none	4
Brown Bullhead	262	270	none	
Chain Pickerel	410	500	none	
	185	35	none	
Largemouth Bass	322	570	none	
American Eel	380	---	none	

Appendix C

Field Data Sheets

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME Lymansville	LOCATION LPX-1B1-2	
STATION # 2 RIVERMILE	STREAM CLASS	
LAT LONG	RIVER BASIN	
STORET #	AGENCY	
GEAR	INVESTIGATORS	
FORM COMPLETED BY	DATE 6-25-01 TIME 1205 AM PM	REASON FOR SURVEY

SAMPLE COLLECTION	How were the fish captured? ☐ back pack ☐ tote barge ☒ other Shocboat Block nets used? ☐ YES ☒ NO Sampling Duration Start time 1205 End time 1215 Duration 10 Stream width (in meters) Max [illegible] Mean 12V
HABITAT TYPES	Indicate the percentage or each habitat type present. ☐ pools ___% ☐ riffles ___% ☐ roots ___% ☐ Runs ___% ☐ Snags ___% ☐ Submerged Macrophytes ___% ☒ Other (Impoundment) 100 %
GENERAL COMMENTS	Yabscline.

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm) U (25 SPECIMEN MAX SUBSAMPLE)	WEIGHT (g) W				ANOMALIES* D	E	F	L	M	S	T	Z
Am. Eel	2	305	—											
		410	—											
White Sucker	1	522	1500											
S. Redhorse	1	278	345											
Chain Pickerel	1	350	275											

Px-T(3J-2

FISH SAMPLING FIELD DATA SHEET (BACK) 2/2

	SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)/WEICHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
								D	E	F	L	M	S	T	Z
P	White Crappie	1	73 f	TJSO											
	Pliyff	j	196	/ 5°											
								10 Sarron right flank							
V/D	Golden Shiner	3	11	Y											
			80	S				GUck. 3/ of Wisc.							
			72	4											
P	Largemouth Bass	2	35'												
			3i>												
													1	1	

* ANOMALY CODES: D = dcfomiitics: E = eroded fins; F = fungus; L = lesions: M = multiple DELT anomalies; S = emaciated; Z = other

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME (^ (^ ^ ^ ^ ^ u M."(.f	LOCATION ~f /M j5 - | 6' - \
STATION it_____ RIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET n	AGENCY
GEAR	INVESTIGATORS
FORM COMPLETED BY	DATE to-T-S-o* TIME IH-\5 AM (jjy) / REASON FOR SURVEY

SAMPLE COLLECTION	How were the fish captured? Q back pack Q tote_barce Q other .\li.oc/c &^^"
	Block nets used? Q YES J^NO
	Sampling **Duration** Start lime /^^r End lime /^^ Duration / o
	Stream width (in meters) Max 3 o^/ + Mean A-3Q-r+
HABITAT TYPES	**Indicate the percentage of each habitat type present** Q Riffles____% Q Pools____% a Runs____% Q Snags____% Q Submerged Macrophytes % GC Other ( )___%
GENERAL COMMENTS	Sunrise

	SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mmy WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES D	E	F	L	M	S	T	Z
	Golden Shiner	3	b i.	4											
			46	2											
			52	2-											
I	Redbreast Sunfish	1	173	/?*											
	Brown Bullhead	I	2(^2	21o								11			
L	Chain Pickerel	2	410	500								11			
			185	35*											

Mr

COMP-EBI-1

FISH SAMPLING FIELD DATA SHEET (BACK)

2/2

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)AVEIGHT (R) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
Largemouth	1	322	357											
A^ ffeu	1	380												
									1					
	1								1					
	1								1					
	1													

ANOMALY CODES: D = defomiilics; E = eroded Hns; F = fungus; L = lesions; M = multiple DELT anomalies; S = emaciated; Z = olher

FISH SAMPLING FIELD DATA SHEET (FRONT)

page I of 2

STREAM NAME p\SM>,.-opr	LOCATION f\5 9 J SI • t		
STATION # _____ RIVERMILE _____	STREAM CLASS		
LAT _____ LONG _____	RIVER BASIN		
STORET *H*	AGENCY		
GEAR	INVESTIGATORS		
FORM COMPLETED BY	DATE &~?£"° ' TIME d^^IK" &) PM	REASON FOR SURVEY	

SAMPLE COLLECTION	How were the fish captured? Q back pack Q tote barce Mother f\^XII7ho^\7 Block ne(s used? D YES # NO Sampling Duration Start lime C'f^ °? End time 07-5"-5 Duration /0 .1A*^ jy Stream width (in meters) Max ,,'§ ji*\ Mean JS>O ~
HABITAT TYPES	Indicate the percentage of each habitat type present Q Riffles ____% Q Pools ____% Q Runs ____% Q Snags ____% Q'Submerged Macrophytes, f-p % 0 Other (;if\ po^-CH v< 1)_/pjP_%
GENERAL COMMENTS	Sluvel: nesam pie

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mmyWEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z
CyUdC CA / A	1	178	1o											
G lues:ill	"7	^	≤0	127	30				1					
		193	150	u	AT		Hopefuls							
		202	no											
		^	05											
		1^0	50											
Pumpkinseed	H	127	5"o											
		IDS'	?o											
		))Z.	Z S											
		I?>°	Go											
Redbreast Sunfish	4	166	I0O											
		180	/is				2 Blacks pot disease							
		*/&&	tee											
		199	85											

ASP-IBI-1 FISH SAMPLING FIELD DATA SHEET (BACK) 2/2

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)AVEIGHT (R) (25 SPECIMEN MAX SUBSAMPLE)	ANOMALIES* D	E	F	L	M	S	T	Z
Brown Bullhead	1									
			escaped							
Am Eel	2									
			escaped 1							
X										

* ANOMALY CODES: D = defom\iiics; E = eroded (Ins; F = fungus; L = lesions; M - multiple DELT anomalies; S = eniacialed; Z - other

FISH SAMPLING FIELD DATA SHEET (FRONT)

page ? of 1

STREAM NAME /IUC>-C(AJ-C f)?(], 1O>1'\	LOCATION
STATION It RIVERMILE	STREAM CLASS
LAT LONG	RIVER BASIN
STORET n	AGENCY
GEAR Tu)O -WC repaire electrosh n(ks)	INVESTIGATORS
FORM COMPLETED BY"+ Z-Stf-^yerS	DATE Z~$3li>\c t)^ TIME)fT^ AM fat) / REASON FOR SURVEY

152-3
1539

SAMPLE COLLECTION	How were the fish captured? (Hijack pack Q tote barge Q other Block nets used? Q YES Q^JO +-\oo-j i~a.y ^S-fc S'"^-i/^S Sampling Duration Start time /JTJ*3 End lime /*>S~f Duration 36 min Stream width (wJuetere) Max Mean «5V^ ->3
HABITAT TYPES	**Indicate the percentage of each habitat type present** Q Rifnes^1^ % Q Pools % Q Runs 35% Q Snags % Q Submerged Macrophytes % Q Other ( ) %
GENERAL COMMENTS	Stream width 5, 317 X 3 pm 3 reds 4:55 ad

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm) AVEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) leni^ OTTy; len wt					ANOMALIES D	E	F	L	M	S	T	Z
Am. eel	5	425	145											
		360	105											
brown bullhead	10	108	1Y	107	14									
		11	8	89	9									
		UL	24	92	10									
		98	13	101	17-									
		96	11	92	11									
Tessellated darter	5	..	4											
		TV-	2											
		5S:	2											
		53	2											
		5%	2											
White Sucker	2 Ob	104	17-											
		134	30											
		108	15											
23 Ad+		10	<1											
			-											

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mtn)AVEIGHT (R) (25 SPECIMEN MAX SUBSAMPLE)					ANOMALIES*							
							D	E	F	L	M	S	T	Z

FISH SAMPLING FIELD DATA SHEET (FRONT)

page 1 of

STREAM NAME y.ymmsville		LOCATION LPKT31.3	
STATION # _____ RIVERMILE _____		STREAM CLASS	
LAT _____ LONG _____		RIVER BASIN	
STORET tf		AGENCY	
GEAR 2- &-< IN-ink K Shocking		INVESTIGATORS	
FORM COMPLETED B Y ^ ^ ^f1£2K/~		DATE Z93'u.^e_ O 1. TIME if)?.c XM "VM	REASON FOR SURVEY

SAMPLE COLLECTION	**How were the fish captured?** J2^back pack Q tote barge Q other _____ **Block nets used?** Q YES H^NO - [illegible] '/"TO fast **Sampling Duration** Start time 0^? C> End time /010' Duration _*/O_____ **Stream width (in meters)** **Max**_____ **Mean**_____
HABITAT TYPES	**Indicate the percentage of each habitat type present** Q-ftimcs?.5~ % Q Pools____% Q-Runs£^% O Snags____% Q Submerged Macrophytes ____% Q Other (_____)____%
GENERAL COMMENTS	

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mmyWEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) L W L W L/W	ANOMALIES* D E F L M S T Z
Am. Eel	3	620 540	
		Sis i30	
		470 200	
brown bullhead	3	)&& <^"7	1
		85 2-2-	
		90 /O P	
Tessellated darter	31	68 •5" y^ j 55/2	
		13 y 52 X. 55/2	
		JT3 2 so 2 57/2	
		-TO <£ S5~ 2 46/1	
		1-2 Y 18 1 21/1	
Golden Shiner	1	65 3	

LRX-IBI-3

FISH SAMPLING FIELD DATA SHEET (BACK)

2/2

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mmJ/WEIGHT (R) (25 SPECIMEN MAX SUBSAMPLE) /-- LJ					ANOMALIES* D	E	F	L	M	S	T	Z
bluegill	1	sS	3											
u														
Chain Pickerel	1	8.5	3											
white sucker	10	31-	1	3x2	(									
		38	\	so	\									
		38	\	3.r	|								
		v^	1	38	v									
		40	I	3-1-	1									
largemouth bass	1	38	\											

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION
STATION # T\IO R. I RIVERMILE	STREAM CLASS
LAT ____ LONG ____	RIVER BASIN
STORET *U*	AGENCY
GEAR 2 -backpack electroshocr	INVESTIGATORS
FORM COMPLETED BY -f 1-- 5 Ca- <** f*o'5 DM	DATE 9Jul01 TIME 1445 AM (PM) / REASON FOR SURVEY

SAMPLE COLLECTION	How were the fish captured? Ettiack pack Q tote barge Q other ____ Block nets used? Q YES oUb -rlo& ~k'D S^c*^ 9^jpk-ej. u-fs Sampling Duration Start time 1401 End time 1430 Duration 60min Stream width On meters) Max ____ Mean ____ N 75'
HABITAT TYPES	**Indicate the percentage of each habitat type** present Riffles fc' % Q Pools ____ % BJfuns-f^ % Q Snags ____ % Q Submerged Macrophytes ____ % D Other ( ) ____ %
GENERAL COMMENTS	missed - 2 small suckers, 1 large (≈400 mm) sucker, 2 [illegible] associated darter

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm) WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE) len	wt	len	wt	wt	ANOMALIES D	E	F	L	M	S	T	Z
chain pickerel	3	205~	60											
		102	6											
		ZX	.3											
brown bullhead	2	151	19											
		150	Coa											
yellow bullhead	i	145	27											
		145	HI											
		f'(o	24											
		js'B	f2~											
White Sucker	12	1/5"	1	3?	1	40 1								
		HX.	f	45	1	45 1								
		33	1	do	i									
		Vo	I	Vo	1									
		36	)	45	I									

length = mm
weight = g

EMAP-IBI-2 FISH SAMPLING FIELD DATA SHEET (BACK) 2/2

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm) L	WEIGHT(g) W	ANOMALIES D	E	F	L	M	S	T	Z
Pumpkinseed	1	)5"S	95								
Rhein Pickerel	4	215	70								
		242	90								
		1\S	lo								
		h$	6°								
Golden Shiner	f	loo	10								
				1			1			1	
											S
											SJ
											T

ANOMALY CODES: D = dcfonmilies; E = eroded fins; F = fungus; L =• lesions; M •= multiple DELT anomalies: S = emaciated; Z - other

FISH SAMPLING FIELD DATA SHEET (FRONT)

STREAM NAME Lyman Slough	LOCATION L9)< -161• V.	
STATION# 1 RIVERMILE	STREAM CLASS	
LAT ____ LONG ____	RIVER BASIN	
STORET #	AGENCY	
GEAR E-F St.	INVESTIGATORS	
FORM COMPLETED BY MJ	DATE 6-3-01 TIME 1020 (AM) PM	REASON FOR SURVEY

SAMPLE COLLECTION	How were the fish captured? Q back pack Q lotc barge fit? other Shoreline Block nets used? Q YES 0 NO Sampling Duration Start time 1010 End time 1020 Duration 10 minutes **Stream width (in meters)** Max 11.1 to Mean 13.4
HABITAT TYPES	**Indicate the percentage of each habitat type present** O Riffles____% Q Pools____% Q Runs____% O Snags____% Q Submerged Macrophytes____% Q Other (/* AK/V**_* * TS/Oo %
GENERAL COMMENTS	Snoreline sample

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)	WEIGHT (g) (25 SPECIMEN MAX SUBSAMPLE)	ANOMALIES* D	E	F	L	M	S	T	Z
Black Crappie	2	100	135								
		247	270								
Pumpkinseed	2	1^	100	1							
		188	145								
Bluegill	2	11^	50	1							
		152	100								
Spot-Tail Shiner	f	7M									

Wt.

ft.

FISH SAMPLING FIELD DATA SHEET (BACK)

SPECIES	TOTAL (COUNT)	OPTIONAL: LENGTH (mm)AVEICIIT (R) (25 SPECIMEN MAX SUBSAMPLE)	ANOMALIES* D	E	F	L	M	S	T	Z

Appendix D

Age Determination from Scales or Spines Standard Operating Procedures

NORMANDEAU ASSOCIATES/RMC DIVISION

PROCEDURE NO. EF13
Rev. 3 (Mar. 1997)

AGE DETERMINATION FROM SCALES OR SPINES

Approved By: Robert W. Blye, Jr. 3/12/97

Robert W. Blye, Jr.
Sr. Vice President

Dated

INFORMATION
COPY ONLY

REVISION SHEET

Rev. No.	Page	Section or Paragraph
1	Title page and organizational changes	
2	Title page, revision sheet added, pages renumbered	
2	EF13-3	1.0,2.0
2	EF13-4	4.0
2	EF13-5	6.2,7.1.4
2	EF13-8	8.4,10.0
3	Title page updated	
3	EF13-3	2.0,3.2
3	EF13-4	4.8; 5.4; 6.2; 7.1.3
3	EF13-5	7.1.7; 7.2.8
3	EF13-6	11.0
3	Enclosure 1 added	

AGE DETERMINATION OF FISHES FROM SCALES OR SPINES

1.0 PURPOSE

This document describes the procedure for age determination of fishes.

2.0 SCOPE

This procedure applies to all Division personnel who age fish using scales or spines.

3.0 REFERENCES

3.1 Cating,J. P. 1953. Determining age of Atlantic shad from their scales. U.S. Fish. Wfldl. Serv. Bull. 54:187-199.

3.2 *Devries, D. R. andR. V. Frie. 1996. Determination of age and growth. Pages 483-512 in B. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.*

3.3 Judy, M. H. 1961. Validity of age determination from scales of marked American shad. U. S. Fish. Wildl. Serv. BuU. 185:161-169.

3.4 Lagler, K. F. 1966. Freshwater fishery biology. Wm. C. Brown Co., Dubuque, Iowa.

3.5 Marcy, B. C. 1969. Age determinations from scales of Alosa pseudoharengus (Wilson) and Alosa aestivalis Mitchein in Connecticut waters. Trans. Amer. Fish. Soc. 98(4):622-630.

3.6 Marzolf, R. C. 1955. Use of pectoral spines and vertebrae for determining age and rate of growth of channel catfish. Jour. Wildl. Mgmt 19(2):243-249.

3.7 Tesch, F. W. 1971. Age and growth. Pages 93123 in Ricker, ed Methods for the assessment of fish production in freshwater. IBP Handbook No. 3, BlackweU, Oxford.

3.8 Wahtola,C. H.J., and J.B.Owen. 1970. A decalcification technique for sectioning pectoral spines.

4.0 APPARATUS

The following equipment (or equivalent) as applicable is needed:

4.1 Dissecting tools
4.2 Slides (cellulose acetate or glass)
4.3 Vials
4.4 Scale cleansing solution (e.g., 2% KOH)
4.5 Decalcification agent (e.g., HCl solution)
4.6 Scale press
4.7 Scale projector

7.2.10 Measure distance to each annulus (nearest mm) along a line from the focus to the midpoil.—- of either lobe of the section. Identify spine section(s) measured if permanent mount is made.

7.2.11 Record all age assignments and spine measurements on data sheet.

8.0 QUALITY CONTROL

8.1 All scales and spines and subsequent age data are appropriately identified to insure proper reference to field collection and other processing (e.g., length, weight) information.

8.2 Age determinations are made independently by two investigators or the same investigator on two-separate occasions.

8.3 Independent scale or spine readings from the same specimens are not included in study results if a common set of data can not be agreed upon.

8.4 Initials of biologists and date are recorded on age data sheets/scale envelopes.

8.5 Scale samples, scale impressions and portions of spines are retained per study specifications.

9.0 REPORTING

Results of age and growth studies shall be reported per client or study specifications.

10.0 RECORDS

The following records are retained by the responsible laboratory per study specifications. In lieu of such, the records will be retained for a period of at least three (3) years.

10.1 Scale samples, impressions, and spines.

10.2 All age data sheets/scale envelopes.

11.0 ENCLOSURE

1 Box 16.1 Conventions for Age Determinations (from Devries andFrie, 1996; see Reference 3.2)

Enclosure J

Procedure EF13

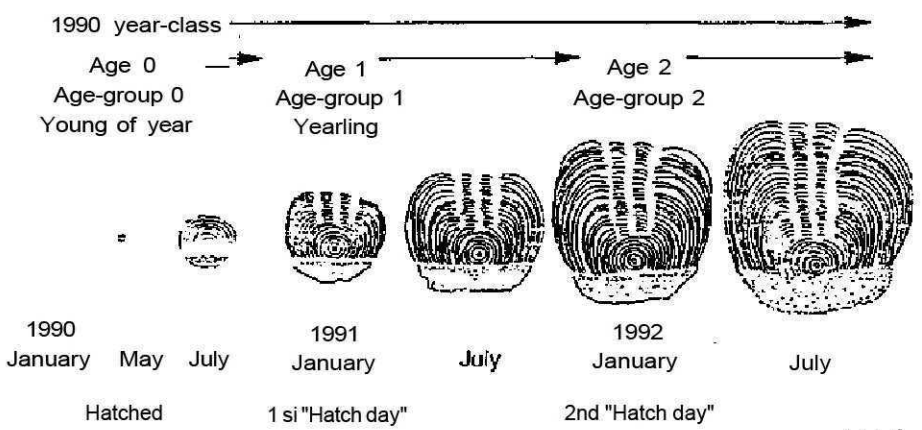
FROM:

Devries, D. R-, and R. V. Frie. 1996. Determination of age and growth. Pages 483-512 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Box 16.1 Conventions for Age Designations

A great deal of confusion centers around the nomenclature used to designate fish ages. Although both Roman and Arabic numerals are used to designate fish age. we use .Arabic numerals to designate the current year of life of a fish, as recommended by the American Fisheries Society in its guides for authors each year. Because the time at which fish lay down an annual mark differs among species and regions, we consider fish to have completed their current year of life on 1 January in the northern hemisphere and 1 July in the southern hemisphere (see figure below: Hile 1950: Jearld 1983). We do not use a plus sign to designate growth between the last annulus and the edge of the hard part (for fish aged with hard parts), as has previously been done. For example, a northern hemisphere fish that is spawned and hatched in spring of one year is designated as age 1 for an entire year beginning on 1 January of the next year (see figure below). Similarly, a northern hemisphere fish is considered to be age 4 during the period between 1 January of its fourth year of life and 1 January of its fifth year of life (see figure below). Finally, a fish is considered to be age 0 (or young of year) during the time from hatching until the next 1 January.

Conventions for age designations



1 of 1

(Rev. 3/97J

U.S. FISH AND WILDLIFE SERVICE

ANURAN CALL SURVEY OF THE WOONASQUATUCKET RLVER IN THE VICINITY OF THE CENTREDALE MANOR SUPERFUND SITE NORTH PROVIDENCE, RHODE ISLAND

OCTOBER, 2001

ANURAN CALL SURVEY OF THE WOONASQUATUCKET RIVER IN THE VICINITY OF THE CENTREDALE MANOR SUPERFUND SITE NORTH PROVIDENCE, RHODE ISLAND

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October, 2001

Introduction

At the request of the U.S. Environmental Protection Agency (EPA), staff from the New England Field Office of the U.S. Fish and Wildlife Service (FWS) conducted a survey of calling frogs on the Woonasquatucket River in the vicinity of the Centredale Manor Superfund Site. The study site consisted essentially of four contiguous impounded areas on the Woonasquatucket River in North Providence, Rhode Island, one of which is defined as a Superfund Site. The purpose of the survey was to determine if there was a notable difference in species and numbers between areas impacted by dioxin and reference areas.

Methods

Identification of Monitoring Stations:

Monitoring stations were chosen by EPA and FWS. Monitoring station locations were chosen upstream of the contamination, within the area of contamination, downstream of the contamination, and one location on a tributary stream. The specific locations of the monitoring stations were chosen based on the apparent availability of habitat (surface water, aquatic vegetation, and lack of water current), and the ability to survey as large an area as possible.

Nine monitoring stations were chosen. Three were upstream of the contamination (Rangely Court, Green Property on Chamberlain Road, and Adams Road); two were in Allendale Impoundment which is the most contaminated area (Stevens Street and Wiscasset Avenue); two were in the next lower impoundment, Lymansville Impoundment (Warren Street and Oak Street); one was in the next lower impoundment, the Manton Impoundment (Brennan Oil); and one was on an impounded area of Assapumpsett Brook, which drains into the Lymansville Impoundment (Assapumpsett Pond). Maps with rough locations of the monitoring stations are provided in Figures 1 and 2 at the end of the report.

Call Counts:

The anuran call count protocol was based on the protocol used in the North American Amphibian Monitoring Program (NAAMP). NAAMP protocols were fashioned after the long-running Wisconsin Frog and Toad Survey (Mossman *el al.* 1998). The protocol establishes four separate monitoring periods to account for frog species that call at different times during the spring mating season. For Rhode Island the monitoring periods are: floating (depending on when wood frogs begin to call); April 10 to April 25; May 10 to May 31; and June 15 to June 31 (Dr. Peter Paton, University of Rhode Island, NAAMP coordinator for the State of Rhode Island, pers. comm.). The first monitoring period is for wood frogs *(Rana sylvatica),* spring peepers *{Pseudacris crucifer),* and possibly American toads *{Bufo americanus).* The second is for spring peepers, American toads, northern leopard frogs *{Rana pipiens),* and pickerel frogs *{Rana palustris).* The third is for northern leopard frogs, pickerel frogs, green frogs *{Rana clamitans),* gray treefrogs *{Hyla versicolor),* Fowler's toads *{Bufo woodhousei fowleri),* and spadefoot toads

(Scaphiopus holbrooki holbrooki). The fourth is for bullfrogs *(Rana catesbeiana),* green frogs, gray treefrogs, Fowler's toads, and eastern spadefoot toads. However, each calling period is temperature-dependent and, therefore, may vary from year to year. The first monitoring period requires a minimum air temperature of 42 °F; the second requires a minimum air temperature of 50 °F; the third requires a minimum air temperature of 50°F; and the fourth requires a minimum air temperature of 55°F. The other requirements for monitoring include little wind and no rain significant enough to impair the ability to hear calling frogs at a distance. Observations are expected to take place between one-half hour after sunset and 2:00 am.

In 2001, NAAMP was interested in comparing a three-minute listening period to a five-minute listening period. Therefore, observations were recorded for a three-minute period and then an additional two minutes. Because the intent of the NAAMP survey is to record population trends over time, the protocol does not require that individual frog calls be counted but rather that a Call Index Value (CIV) be recorded. A CIV of 1 is recorded when calls can be counted and calls do not overlap. A CIV of 2 is recorded when calls can be distinguished and some overlap. A CIV of 3 is recorded when there is a full chorus, which means that calls are continuous and overlapping. Additional data to be recorded include: start time and end time, temperatures at start and end time, sky conditions, wind conditions, and whether there was any noise during the listening period that would hamper the ability to hear the frogs.

For this survey we followed the NAAMP protocol with a few modifications. First, we attempted to conduct surveys on two nights within each monitoring period understanding that frog activity varies from night to night even when conditions appear optimal. Also, in addition to recording the CIV we attempted to estimate the number of individuals calling, which we recorded in parentheses after the CIV numbers.

Monitoring was conducted by the same two people at each event. At the end of the listening period at each station, the two listeners compared observations. At some monitoring stations the two listeners intentionally stood some distance apart to maximize the area of coverage. At the end of the listening period, the listeners conferred and came to agreement on the locations from which individuals were heard calling from and, therefore, developed the best estimate of the number of calling individuals.

Each survey was conducted in a slightly different sequence to reduce any influence that the time of evening could have on frog calling. Also, if there was a question about the lack of activity at a site, particularly the first site monitored in the evening, the site was remonitored at the end of the evening.

The data sheets used were developed for NAAMP surveys conducted on national wildlife refuges in the northeast.

Results

Surveys were conducted on four nights: April 24, April 30, June 5, and June 26. This effort was not fully coordinated until after the wood frogs would have been expected to stop calling, although a few wood frogs were heard in one location on April 24. Wood frogs use vernal pools exclusively and since little of this habitat is present in the study area we were not concerned about this omittance. The spring of 2001 was exceptionally cold and rainy, particularly during the month of May, so we had difficulty coordinating nights with acceptable weather conditions. We believe that these cold conditions tended to postpone some of the mating activity, so although we did not manage to conduct any surveys in May, we did manage to hear all of the expected species during the April and June surveys.

Below are descriptions of the monitoring locations and the results for each location. Results are also summarized in Table 1. Copies of the field data sheets are provided at the end of the report.

Rangely Court Park - This is the most upstream station and is considered a reference site. A small dam, Upper Esmund Dam, impounds water and some of the area is vegetated with emergent vegetation. The west side of the river is treed; the east side has shrubs and mowed grass and is near a busy road. Listening was conducted from the forested west edge upstream enough to lose the overpowering noise of the water flowing over the dam. Monitoring from this side also minimized traffic noise from the road on the east side. We heard very few frogs at this site. One pickerel frog was heard during the first two surveys, one green frog during the third survey, and one green and one bullfrog during the fourth survey.

Green Property - This property is located at the end of Chamberlain Road. Grassed yard extends to the edge of the river on the east side. On the west side of the river is a water treatment plant which creates a loud hum. There is a complex of vegetation on both sides of the river. During the April 24 survey, wood frogs were heard on the west side of the river suggesting the presence of vernal pool habitat. Observations were conducted from a lawn on the east side of the river. Pickerel frogs and green frogs were heard in abundance at this location. A bullfrog and a small number of spring peepers were also heard during the surveys.

Adams Road - This site is also a reference site just downstream of the Green Property. Grassed yard extends to the eastern shore of the river. The opposite shore is vegetated with trees but houses are not far behind. There are patches of emergent vegetation throughout the area. This area was abundant with frogs including spring peepers, pickerel frogs, American toads, green frogs, and bullfrogs.

Stevens Street - This monitoring location is in the upper end of the Allendale Impoundment, which is the most contaminated of the impoundments. This area is mostly forested/scrub-shrub wetland with the main river channel flowing along the west bank and small streams braiding throughout the rest of the area. A narrow (about a foot wide), shallow (several inches deep) water channel with a gentle flow is present next to the east bank where the monitoring took

The Table 1. Frog species heard (Call Index Value- with approximate number of individuals in parentheses) during a frog call survey on the Woonasqatucket River in North Providence, Rhode Island in the spring of 2001. The call survey was conducted as part of an assessment of the Centredale Manor Superfund Site. Values given are the maxima of four surveys.

Site	Species Heard (Call Index Value and Number of Individuals ( ))							
	Spring Peeper	Wood Frog	Pickerel Frog	American Toad	Fowler's Toad	Green Frog	Bullfrog	Gray Tree frog
Rangely Court	0	0	1(D	0	0	1(1)	HO	0
Green Property	K)	1(2)	1(5)	0	0	1(6)	HI)	()
Adams Road	1(3)	0	1(4)	1(2)	0	2(8)	1(3)	0
Stevens Street	0	0	0	0	0	0	0	0
Wiscasset Street	0	0	0	0	2(4)	0	0	0
Warren Street	2()	0	2(8)	1(2)	1(3)	2(6)	1(2)	0
Oak Street	0	0	1(3)	0	0	0	1(2)	0
Brennan Oil	0	0	1(3)	0	0	0	1(2)	0
Assapumpsett Pond	30	0	HD	2(4)	0	2(7)	1(2)	0

" Call Index Value: l=Calls can be counted, no overlapping; 2=Calls can be distinguished, some overlapping; 3=Full chorus, calls continuous and overlapping.

place. No frogs were heard in this area during any of the survey dates. However, the Allendale Dam breached in early April of 2001 causing dewatering of the impoundment with the exception of the stream channels.

562 Wiscasset Ave. - Monitoring of this location took place from a large ledge on the eastern shore of the impoundment which allowed for hearing over a large area, from the dam up to near the Stevens Street monitoring location. There was very little water in the impoundment for the first two surveys, but it was about one-third full for the second two surveys. No frogs were heard during the first two surveys. Fowler's toads were heard (four and three individuals, respectively) during the second two surveys. At least one toad was clearly heard in the water of the impoundment. The others could have been near the impoundment on the upland. However, since this is the only water body in the area, it was presumed that all of the toads were breeding in the Allendale Impoundment (due to private buildings and fencing it was impossible to precisely determine the locations of the calling toads).

Warren Street - This monitoring station is located toward the upper end of the Lymansville Impoundment. Contamination in this impoundment is approximately an order of magnitude less than in the Allendale Impoundment (EPA pers. comm.). This site probably had the highest abundance and diversity of frogs of all the monitoring locations. Species heard included: spring peeper, pickerel frog, American toad, Fowler's toad, green frog, and bullfrog.

Oak Street - Monitoring from this location was conducted from a yard that jutts into the Lymansville Impoundment, providing for a large listening area. Trees, lawns, and houses edge the shoreline. The water has patches of emergent vegetation. This area also had high numbers and diversity of frogs including: spring peeper, pickerel frog, American toad, green frog, bullfrog, and one gray treefrog.

Brennan Oil - This is the only monitoring location in the Manton Impoundment because the impoundment is relatively small. The monitoring location was sited in about the only area with emergent vegetation. Listening occurred from a parking lot on the east bank. There is a factory on the west bank that has a loud hum. There is a lot of pavement around the river at this point. This site had a few pickerel frogs and bullfrogs.

Pond on Assapumpsett Brook - This is a small tributary to the Woonasquotucket River that empties into the Lymansville Impoundment. This is a reference site and the only site that is not located on the Woonasquotucket River. It is a small impounded area surrounded by houses. It has a parking lot at the east end and emergent/scrub-shrub wetland and forest at the west end. The monitoring location was at the end of Bowen Street overlooking the scrub-shrub wetland. The pond is a distance down a sloped yard but we did not have permission from the landowner to use the yard. This site had the most spring peepers of any of the sites, as well as one pickerel frog, American toads, green frogs and bullfrogs.

Discussion

This survey faced a number of complicating factors. One was the weather. The spring of 2001 was exceptionally cold and rainy making it difficult to coordinate a night with acceptable survey conditions, particularly during the month of May. Also, unexpected strong winds developed during the April 24 survey. However, there was a lot of frog calling activity that evening so we continued the survey. A second complicating factor is the heavily-developed nature of the area, so there are lots of sources of noise. Noise issues that we faced include: traffic, water flowing over dams, sirens, airplanes, helicopters, factory noises, water treatment plant noises, and local people stopping us to ask questions. A third factor was the difficult access to the site. We planned around this when we set up the monitoring stations, however, on one occasion we wanted to specifically determine the locations of the Fowler's toads in or around the Allendale Impoundment and we were unable to get close to them because of buildings and fences. A fourth factor, was that the Allendale Dam breached in April 2001, causing a drastic change in habitat during the breeding season. The site converted from an impoundment to a habitat resembling mudflat with a stream running through it. In June, a small area of ponding developed just behind the dam.

However, we feel that we got calling data on every species expected in the study area. The two possible species that we did not hear within the study area are northern leopard frog and spadefoot toad, and only one gray treefrog was heard. The northern leopard frog is primarily a species of wet meadows and grasslands so would not necessarily be expected within the study area. Also, the northern leopard frog appears to be declining in numbers throughout the northeast for unknown reasons. The spadefoot toad is a species which is exceptionally difficult to document as they are nocturnal, they completely burrow themselves into sandy soils, and they tend to mate during heavy night-time rainstorms. Since the NAAMP protocol discourages surveying during heavy rains, this species would not be expected to be observed during normal survey periods (Tyning 1990). The lack of gray treefrogs is not easy to explain, especially since gray treefrogs were heard calling in other areas around Providence on the survey nights.

This study was not designed for statistical analysis, therefore, interpretation is qualitative. In general, there appeared to be a reasonable abundance of frogs at all of the listening stations with the exception of Rangely Court, Stevens Street, and Wiscasset Avenue. Rangely Court was chosen because the emergent vegetation above the dam suggested that the area offered good frog habitat. However, there was observable water current in the area so the current may have been too strong for most frog species. The few frogs that were heard were in the same locations *(ie,* a green frog was heard from about the same location as where we had heard a pickerel frog during previous surveys) each time so there may be only a few pockets of habitat that are suitable.

Both Stevens Street and Wiscasset Avenue are in the Allendale Impoundment. The results for the Allendale Impoundment are difficult to interpret because of the breaching of the dam in April. Because the habitat was disturbed during the breeding season, and the site was greatly de-watered, it is difficult to discern whether the lack of frogs was due to contamination or because

of the habitat disturbance. It is also difficult to discern why only Fowler's toads appeared to be breeding in the Allendale Impoundment. Fowler's toads are reported to use shallow water habitats and river margins (Dickerson 1969). They are also associated with sandy upland (Conant 1975; Green 1989). It is possible that this is the only species that will tolerate the present habitat conditions: shallow water impoundment with fairly strong stream current. We presume that there is sandy upland nearby.

However, it should be noted that Fowler's toad is a relatively terrestrial animal in contrast to the relatively aquatic life history of some of the other species of anurans, particularly green frogs and bullfrogs. Fowler's toads only take to the water to breed. The eggs hatch in approximately one week, and the tadpoles metamorphose in 40 to 60 days (DeGraaf and Rudis 1992). In contrast, green frog adults live primarily along the edge of the water and hibernate underwater. The eggs hatch in three to five days but it takes one to two years for the tadpoles to metamorphose (DeGraaf and Rudis 1992). Bullfrogs are also highly aquatic and the tadpoles can take two to three years to transform (DeGraaf and Rudis 1992). There is some evidence that the late-stage tadpoles are the most vulnerable to the effects of contaminants, and that the jelly coating around the eggs offers some protection from water-borne contaminants (Henry 2000). Further, overwintering tadpoles have close epidermal contact with sediments. Therefore, there is reason to believe that Fowler's toads may be less vulnerable to aquatic contamination than more aquatic species.

No frogs were heard from the Stevens Street monitoring location. This is the upper end of the Allendale Impoundment which is scrub-shrub/forested wetland with rivulets braiding through it. This area would not be expected to be prime breeding habitat because of the lack of standing water (we were unable to enter the site to know for sure). However, it would not be unreasonable to expect a few frogs to be in the area or call in the area, particularly gray treefrogs that use forested habitats and do not always call adjacent to their breeding habitat (Tyning 1990). It does appear from the survey that the frog population in the LymansviUe Impoundment (Warren Street and Oak Street) which is contaminated, but to a lesser degree than the Allendale Impoundment, has a fairly large and diverse population of breeding frogs.

We would like to note that the number of individual frogs recorded at Assampumpsett Pond may have been greater if we were standing closer to the pond during monitoring. The call of the pickerel frog is particularly hard to hear as it is a soft snore which is often emitted under water (Conant 1975). According to Conant (1975), spring peepers often prefer habitats where trees and shrubs are standing either in the water or nearby. This site may have had the highest population of spring peepers because of the presence of the scrub-shrub wetland.

Summary** and **Conclusions

Based on our survey, it appears that most of the study area has a breeding population of frogs comparable to other highly disturbed sites. However, some sites are in question. Rangely Court Park (a reference site), Stevens Street and Wiscasset Avenue (Allendale Impoundment) appear to

have poorly-represented anuran populations. The low population of calling frogs at Rangely Court Park may be due to water current that is too strong to provide quality frog habitat. The possible reason for the lack of frogs at the Allendale Impoundment is more difficult to discern because of the change in habitat due to the breaching of the dam. The fact that there was a relatively large and diverse population of calling frogs in the Lymansville Impoundment and that Fowler's toads were present in the Allendale Impoundment, might suggest that the lack of frogs in the Allendale Impoundment is due to physical habitat conditions rather than to contamination. However, it is noted that the life history of the Fowler's toad may make it less vulnerable to aquatic contamination than more aquatic species. Also, this study only assessed the presence of calling males. It did not assess the success of the reproduction effort.

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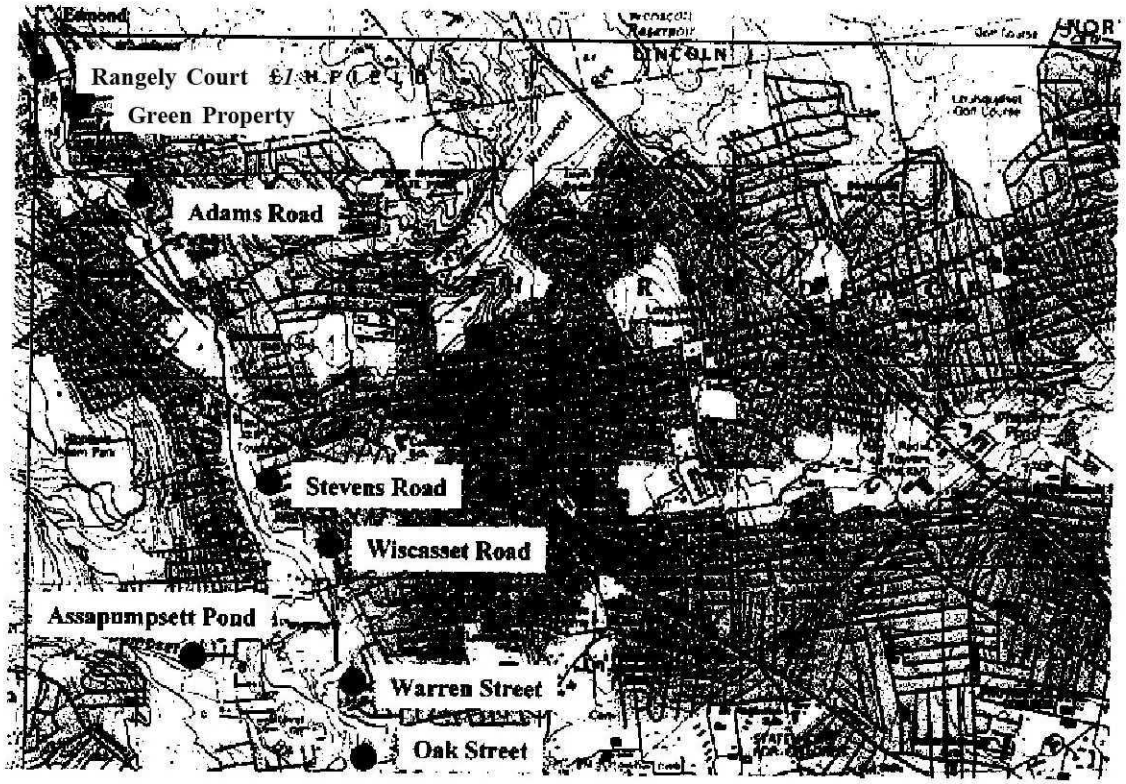


Figure 1. Locations of the frog call monitoring sites on the Woonasquatucket River in Providence, Rhode Island.

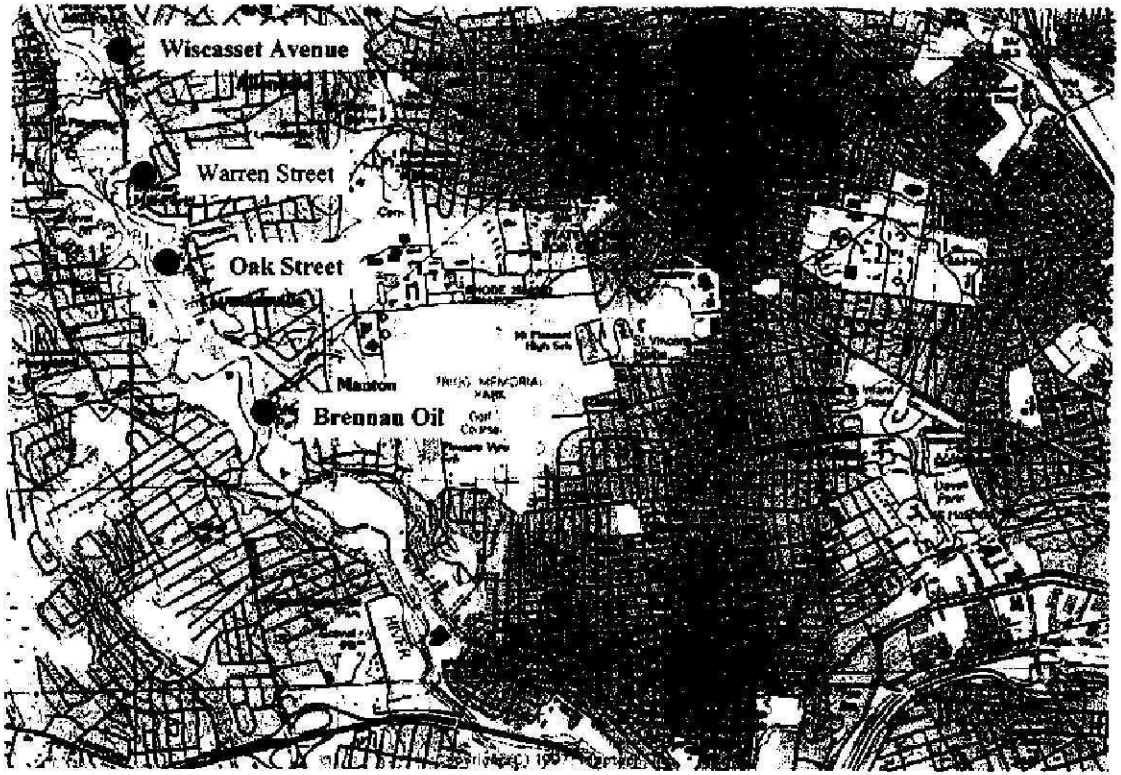


Figure 2. Location of the frog call monitoring sites on the Woonasquatucket River in North Providence, Rhode Island.

FWS Anuran Call Count Survey

L. Eaton - TooJe.

Observer: K.)7 1 a o n C.Uj (USFWS) -RefegfeRoute: Centralak Manor Pr RI Survey Date: 4/24/01 Run Number: 1

Survey Data

	Time	Temp (°F)	Wind Scale	Sky Code
Start	8:25 pm	78°	3	1
Finish	10:45 pm	62°	3	2

*but had strong gusts of wind in middle of survey

Point Data

	Hangeley Court		Chamberlain Rd		Adams Rd		Stiegs St.		Stewart Wescosset Rd	
Start Time	8:30 pm		8:50 pm		9.70 pm		9:23 pm		9:35	
Air Temperature (°F)	26C 78.8°F						18C 64.4°F			
Sky Code	1		1		1		2		2	
Was noise a factor? (/ = yes) *See notes	Yes		Yes		Yes		No		No	
Did you take a timeout? (/= yes)	rxO		Yes		no		No		No	
Species Heard:	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.
Spring peeper			1	1	1(3)	1(3)				
Am. toad					1(1a)	1(1a)				1
pickerel frog	1(1)*	1(1)	1131	1(3)	1(2)	1(2)				
Wood frog			1(2)	1(2)						

Comments:

Call Index Value: 1 = Calls can be counted, no overlapping. 2 = Calls can be distinguished, some overlapping. 3 = Full chorus, calls continuous and overlapping.

Sky Code: 0 = Clear / few clouds. 1 = Partly cloudy / variable. 2 = Cloudy (broken) or overcast. 4 = Fog / Smoke
5 = Drizzle / light rain 7= Snow *8 = Showers *(do not conduct survey)*

Wind Scale: 0 = Smoke rises vertically. *4 =Small branches move, raises dust and loose paper.
1 = Light air movement, smoke drifts. *5 = Small trees in leaf begin to sway, crested wavelets.
2 = Wind felt on face, leaves rustle. *6 = Large branches in motion.
3 = Gentle breeze, leaves and small twigs in motion. • *Unacceptable wind strengths for survey.*

Revised Feb. 2001

FVVS Anuran Call Count Survey

* Number no parenthesis ( ) is number of frogs heard.

Continuation Sheet 2

Refuge Route: Crotwell Mallard

Survey Date: 4/2/11

Point Data

	6		33 Oak St.		Brennan Cir 8		Brady Pond 9		10	
Start Time	9:46		/0:a0		/Otis'		/o; 30			
Air Temperature (°F)							/7C 6 3 /^			
Sky Code	2		5		5		4			
Was noise a factor? (/ = yes)	Wind		Mo		Yes		lOo			
Did you take a timeout? (/= yes)	No		fOc>		No		JOo			
Species **Heard:**	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.
Pickerel frog	2(8?)	2(8?)	2(5)	2(5)	1(2)	1(2)	1(1)	1(6)		
Am. 4ocxdL°	: (A)	1(2)	2(2)	2(2)			2(4)	2(4)		
Spring peeper J : J	2	2					3	3		

No ^

4/24/11

Listening Point

1. //reo. arnayog\>j deOG.'ci o-P £oa coJI\s *jui.*<±≤*Lp*\ 4o/) \CT*JLL but determined pickerel fro, ise and noise from water flow^oo ooer H-Wx C^CX.W- CAKAJO CL -pnD^^er^. 50 we walked shoreline opposite #140. Could hear -

Uifl. revisited site at end of night and was still Store quiet.

2. Noise issues included a loud hum from water treatment plant across the river, wind chimes in the yard, and the wind started to get stronger. Mr. Green - the landowner - interrupted us to say that after 2 minutes so listening period had a timeout. The peepers we heard were rurf un t)VJ _^nLnuu>L_£x^tc tXAXa^ /fc^ud^ red'M-r were downstream so are probably same peepers as for Site #3. Heard wood frogs across river - sounded like they ^LXMJJL near waste water treatment plant - estimated 2 animals calling but could have been more.

3. POOISX — "Wc^-ft'o in distance & wind. Peepers probably the same group as #2.

4. Some background noise but no frogs. Gentleman at house #40 came out to see what we were doing. He mentioned he used to catch lots of frogs of diffrent species there when he was a kid.

Notes

5. In d JO stood ~ 15 yards apart to make sure we were hearing the whole area. The place was silent. Impoundment was more devastated than two weeks ago.

6. Strong wind blowing) difficult.

7- Good listening spot.

?. Fō<crkrog aoiAiss nvK-^ nud^s ≤x lot o-P noise.

?. Only noise factor was the toads which called CJDOA-» nuously and made it hard to hear the pickerel frogs.

FWS Anuran Call Count Survey

L. Eaton-Poole

Observer X. HOilon? u JtefageTtoute:(j^o4yexjq^Vji-> Y^WpcY^ Survey Date: -VA? O/C / Run Number __^2-

Providence, RI

Survey Data

	Time	Temper)	Wind Scale	Sky Code
Start	?:30 Pm	bL>°	/	/
Finish	/O:30oro	bio^0	/	/

Assapumpsett Point Dal.. Lymansville Impound (Riverdale)

	Brock Road		Brennan Ct.		OaJd 5t		Warren Ave		Wiscasset Rd	
Start Time	?:3c)		F.'SO Pin		9100 ?xr>		9.75'Sm		9:30	
Air Temperature (°F)	66°		66°							
Sky Code	/		J		j		/			
Was noise a factor? (/ - yes)	rl		Y			\)	N			
Did you take a timeout? (•= yes)	rsi		N		N		N			
Species Heard:	3 min.	5 min.	3 min.	5 rain.	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.
Spring peeper	3	3								
Pickerel frog			/C3^	)(3^	)Cs)	1 (5)	2(7)	Ms?)		

Comments: ?... 5oere. +O-ctory noise & temporary siren.
5. Impoundment looks like mudflat w/ fast moving stream running through - no standing water.

Call Index Value: I = Calls can be counted, no overlapping. 2 = Calls can be distinguished, some overlapping. 3 = Full chorus, calls continuous and overlapping

Sky Code: 0 = Clear / few clouds. 1 = Partly cloudy / variable. 2 = Cloudy (broken) or overcast. 4 = Fog / Smoke
5 = Drizzle / light rain 7 = Snow *8 = Showers *(do not conduct survey)*

Wind Scale: 0 = Smoke rises vertically. *4 =Small branches move, raises dust and loose paper.
1 = Light air movement, smoke drifts. *5 = Small trees in leaf begin to sway, crested wavelets.
2 = Wind felt on face, leaves rustle. *6 = Large brandies in motion.
~" 3 " Gentle breeze, leaves and small twigs in motion. • *Unacceptable wind strengths for survey.*

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FWS Anuran Call Count Survey

Note: L) refers to number oP individuals calling.

Continuation Sheet 2

Refige Route: Allendale Manor

Survey Date: 4/30/
Run #2

Point Data

	*(Allendale) Stacys St. 6		Adams Rd 7		Chamberlain Ridge Rd 8		Raggedy Court 9		10	
Start Time	9:40		9:55		/GWO		10:30			
Air Temperature (°F)							66°			
Sky Code	1		1		1		1			
Was noise a factor? (/ = yes)	N		N		Yes		N			
Did you take a timeout? (/ - yes)	N		N		K\					
Species Heard:	**3 min.**	**5 min.**	**3 min.**	**5 min.**	**3 min.**	**5 min.**	**3 min.**	**5 min.**	**3 min.**	**5 min.**
Pickerel			1(4)	1(4)	1 ds-)	1(5)	1(1)	1 C)		
Am. Toad		Ø	/CO	1(1)						

Comments: (o. Slow movi stream ~~it~~ exists near this point.
7. Am. toad JLS off in distance.
8. Noise from water treatment plant. Thought may have heard ?j Traffic nodjch quieter than ~~it~~ season in the distance. ~~it~~ have green frog once.

Call Index Value: 1 = Calls can be counted, no overlapping. 2 = Calls can be distinguished, some overlapping. 3 = Full chorus, calls continuous and/or overlapping.

Sky Code: 0 - Clear / few clouds. 1 = Partly cloudy / variable. 2 = Cloudy (broken) or overcast 4 = Fog / Smoke
S = Drizzle / light rain 7 = Snow *8 = Showers *(do not conduct survey)*

Wind Scale: 0 = Smoke rises vertically. *4 = Small branches move, raises dust and loose paper.
1 = Light air movement smoke drifts. *5 = Small trees in leaf begin to sway, crested wavelets.
2 = Wind felt on face, leaves rustle. *6 = Large branches in motion.
3 = Gentle breeze, leaves and small twigs in motion. * *Unacceptable wind strengths for survey.*

FWS Anuran Call Count Survey

* Also went to opposite side **or** Allendale to listen. No frogs * stream noise very loud.

FWS Anuran Call Count Survey

Observer L. Fasten-Poole K. Munney (USFWS) &tfSge Route: Ce O4ve A J>e.)TV...y-y Survey Date: G/S^A5/ Run Number 15

Survey Data

	Time	Temp(°F)	Wind Scale	Sky Code
Start	8:55 pm	63°	A	1
Finish	11:45 pm	57°	3	1

Point Data

	1 Beauty Quiet	2 Green Hop	3 Adams St	4 Hwy 5	5
Start Time	8:55 pm	9:11 pm	9:35 pm	9:55 pm	10:05
Air Temperature (°F)	63°	1			
Sky Code	/	/		/	/
Was noise a factor? (• - yes)	traffic water rushing	Yes - airplane, wind, frogs	N	yes - siren	
Did you take a timeout? (•= yes)	N	N	N	N	

Species Heard:	1 3 min.	1 5 min.	2 3 min.	2 5 min.	3 3 min.	3 5 min.	4 3 min.	4 5 min.	5 3 min.	5 5 min.
green frog	/Ci)	/(1)	1(3)	1(3)	1(4)	1(4)				
ij | c J			1(2)	1(^)		/CO				
t - · · ·									2(4)	2(4)

Comments: ^ & //cndale 3^tpci>o><AaL£Art has more water on it than previous surveys- about layer 1/3 had shallow water. We heard 4 fowler's toads. One was definitely in the impoundment. The other 3 sounded more distant. We

J "

Call Index Value: 1 = Calls can be counted, no overlapping. 2 = Calls can be distinguished, some overlapping. 3 = Full chorus, calls continuous and overlapping

Sky Code: 0 = Clear / few clouds. 1 = Partly cloudy / variable. 2 = Cloudy **(broken) or** overcast 4 = Fog / Smoke
5 » Drizzle / **light rain** 7 = **Snow** *8 = Showers *(do **not** conduct survey)*

Wind Scale: 0 = Smoke rises vertically. *4 =Small branches move, raises dust and loose paper.
1 ° Light air movement, smoke drifts. *5 = Small trees in leaf begin to sway, crested wavelets.
2 = Wind felt on face, leaves rustle. *6 = Large brandies in motion.
3 = Gentle breeze, leaves and small twigs in motion. * *Unacceptable wind strengths for survey.*

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FWS Anuran Call Count Survey

locate specific position but could not find exactly. The

Continuation Sheet 2

-Refuge" Route: C» Pbredale Manor Survey Date: 5-2

Assawoset B-b2: Point Data

	6		7		8		9		10	
Start Time	10:55		11:10		11:20		11:35			
Air Temperature ("F)										
Sky Code	1		/		I		I			
Was noise a factor? (• = yes)			Some traffic noise		N		N			
Did you take a timeout? (/» yes)	N		N		N		J			
Species Heard:	**3min.**	**5min.**	**3min.**	**5min.**	**3 rain.**	**5min.**	**3min.**	**5min.**	**3min.**	**5min.**
Green frog	2(7)	2(7)		/	2(5)	2(5)	2(6)	2(6)		
Bullfrog	1 (0			A	/C0	S ( ))				
Pickerel frog			J L		1(2)	1(2)	1(3)	1(3)		
Fowler's toad				/			(^3J	1(3)		
	1									

Comments: ^/l JL,t-J^octcVv conditions seemed good this did not seem like a particularly active night for frogs. Plan to survey again the week of June 18.

Call Index Value: I = Calls can be counted, no overlapping. 2 = Calls can be distinguished, some overlapping. 3 » Full chorus, calls continuous and overlapping

Sky Code: 0 - Clear / few clouds. 1 = Partly cloudy / variable. 2 = Goudy (broken) or overcast 4 = Fog / Smoke
.5 • Drizzle / light rain 7 = Soow *8 = Showers *(do not conduct survey)*

Wind Scale: 0 = Smoke rises vertically. *4 'Small branches move, raises dust and loose paper.
1 = Light air movement, smoke drifts. *5 » Small trees in leaf begin to sway, crested wavelets.
2 = Wind felt on face, leaves rustle. *6 = Large branches in motion.
3 = Gentle breeze, leaves and small twigs in motion. * *Unacceptable wind strengths for survey.*

FWS Anuran Call Count Survey

FWS Anuran Call Count Survey

Observer: Laura Eaton-Poole / Ken Mumney Refuge Route: Gatedale Manor Survey Date: 6/21 Run Number: 04

Survey Data

	Time	Temp(F)	Wind Scale	Sky Code
Start	6:30	76°	1	0
Finish	11:15	66°	1	0

Point Data

	Assawoman Point 1		Brenda Dr. 2		Oak St. 3		Warren St. 4		Stockton Access 5	
Start Time	9:10		9:25		9:35				10:00	
Air Temperature (F)	76°									
Sky Code	0									
Wts noise t factor? (•-yes)	no		Yes factory noise		no		Yes-Very loud air conditioner		no	
Did you take a timeout? (/ - yes)										
Species Heard:	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.
queen frog	1(3)	1(2)	1(2)	1(2)	1(4)	1(6)	1(5)	1(5)		
bullfrog			1(2)	1(2)	1(3)	1(3)	1(2)	1(2)		
Gray tree frog					0	1(1)				
Fowlers toad									*1(3)	1(3)

Comments: *The Fowler's -JTJ(?X:IS dici fVCJ4 "5ciunt like thea LL>er<l. in the impoundme They searched 1. the far edge on the upland but since impoundment 4 is the only water body Presume this is breed.no s.t

Call Index Value: 1 = Calls can be counted, no overlapping. 2 = Calls can b distinguished, some overlapping. 3.- Full chorus, calls continuous and overlapping,

Sky Code: 0 - Dear / few clouds. 1 = Partly doudy / variable. 2 = Cloudy (broken) or overcast 4 = Fog/Smoke
5 - Dazzle / light rain 7 = Snow *g = showers *(do not conduct survey)*

-mdScale: 0 = Smoke rises vertically. *4=Small brandies move, raises dust and loose paper.
1«Light air movement, smoke drifts. *5 = Small trees in leaf begin to sway, crested wavelets.
2 = Wind felt on fece, leaves rustic. *6 = Large brandies in motion.
3 ~ Gentle breeze, leaves and small twigs in motion. * *Unacceptable wind strengths for survey.*

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Continuation Sheet 2

Refuge Route <Q Oakdale Manor

Survey Date: 1/

Point Data

	Steven St 6		7		8		Rangely Court- 8		Assapunkpaset 10	
StartTime	10:10		10:25		10:35		10:47		11:10	
Air Temperature (T)										
Sky Code										
Was noise a factor? (/ - yes)	no		no		no		no		no	
Did you take a timeout? (/ - yes)										
Species Heard:	**3mia.**	**5 Bin.**	**3mia.**	**5 nin.**	**3mio.**	**5min.**	**3min.**	**5min.**	**3 BCB.**	**5 Bin.**
Green frog			2(8)	^)	1(6)	ilb)		i(1)		.*/22.
UcY\£W,	*		,C>	1(3)	1(1)	Id),	1(1)			1(3)
)										
	-	V								
	t									

Comments: *" Km k*oyd <i -Wee-fa)? ^f:in distance. Real faint - could not verify was v.rt & had not heard at previus stated.
Pkd pt and of survey because _ lack activity at the beginning

Call Index Value: 1 = Calls can be counted, no overlapping. 2 - Calls can be distinguished, some overlapping. 3 = Full chorus, calls continuous and overlapping.

SkyCodr 0-Qear/ few clouds. I - Partly cloudy / variable. 2 • Cloudy (broken) or overcast 4 - Fog / Smoke
5 = Drizzle / light rain 7»Soow *t = Shav(en (do not conduct survey)

Wind Scale: 0 = Smoke rises vertically. •4=Small branches move, raises dust and loose paper.
1 - Light air movement, smoke drifts. *5 - Small trees in leaf begin to sway, crested wavdets.
2 - Wind felt on face, leaves rustle. *6 = Large branches in motion.
3 = Gentle breeze, leaves and small twigs in motion. • *Unacceptable-wind strengths for survey.*

U.S. FISH AND WILDLIFE SERVICE

ANURAN CALL SURVEY OF THE WOONASQUATUCKET RLVER IN THE VICINITY OF THE CENTREDALE MANOR SUPERFUND SITE NORTH PROVIDENCE, RHODE ISLAND

SEPTEMBER,2002

ANURAN CALL SURVEY OF THE WOONASQUATUCKET RIVER IN THE VICINITY OF THE CENTREDALE MANOR SUPERFUND SITE NORTH PROVIDENCE, RHODE ISLAND

By Laura Eaton-Poole
U.S. Fish and Wildlife Service
New England Field Office
70 Commercial Street
Suite 300
Concord, NH 03301

September, 2002

Introduction

At the request of the U.S. Environmental Protection Agency (EPA), staff from the New England Field Office of the U.S. Fish and Wildlife Service (FWS) conducted a survey of calling anuran amphibians (frogs and toads) on the Woonasquatucket River in the vicinity of the Centredale Manor Superfund Site in the spring of 2001. The purpose of the survey was to determine if there was a notable difference in species and numbers of anuran amphibians between areas containing dioxin and reference areas. The study site consisted of four contiguous impounded areas on the Woonasquatucket River in North Providence, Rhode Island, one of which, the Allendale Impoundment, is defined as a Superfund Site. The purpose of the survey was to determine if there was a notable difference in species and numbers between areas impacted by dioxin and reference areas. However, in the spring of 2001, the Allendale Dam breached, causing the impoundment to greatly de-water. The dam was rebuilt in the spring of 2002. EPA requested that the anuran call survey be repeated given the change in habitat at the Allendale Impoundment.

Methods

Identification of Monitoring Stations:

In 2001, monitoring stations were chosen by EPA and FWS. Anuran call monitoring station locations were chosen upstream of the contamination, within the area of contamination, downstream of the contamination, and one location on a tributary stream. The specific locations of the monitoring stations were chosen based on the apparent availability of anuran habitat (surface water, aquatic vegetation, and lack of water current), and the ability to survey as large an area as possible.

Nine monitoring stations were chosen. Three were upstream of the contamination (Rangely Court, Chamberlain Road, and Adams Road); two were in the Allendale Impoundment which is the most contaminated area (Stevens Street and Wiscasset Avenue); two were in the next lower impoundment, Lymansville Impoundment (Warren Street and Oak Street); one was in the next lower impoundment, the Manton Impoundment (Brennan Oil); and one was on an impounded area of Assapumpsett Brook, which drains into the Lymansville Impoundment (Assapumpsett Pond). Maps with rough locations of the monitoring stations are provided in Figures 1 and 2 at the end of the report. However, the Rangely Court monitoring station did not work well in 2001; very few anurans were heard at the site possibly because the water current in the area was too strong to provide good anuran habitat. Therefore, we searched for a site to replace Rangely Court. Therefore, we selected Georgiaville Pond, the next impoundment north. Most of this impoundment is open water with little emergent vegetation. The only accessible location that looked appropriate was at the north end of the pond. This location is shown in Figure 1.

Call Counts:

The anuran call count protocol was based on the protocol used in the North American Amphibian Monitoring Program (NAAMP). NAAMP protocols were fashioned after the long-running Wisconsin Frog and Toad Survey (Mossman *et al.* 1998). The protocol establishes four separate

monitoring periods to account for anuran species that call at different times during the spring mating season. For Rhode Island the monitoring periods are: "floating" (depending on when wood frogs begin to call); April 10 to April 25; May 10 to May 31; and June 15 to June 31 (Dr. Peter Paton, University of Rhode Island, NAAMP coordinator for the State of Rhode Island, pers. comm.). The first monitoring period is for wood frogs *(Rana sylvatica),* spring peepers *(Pseudacris crucifer),* and possibly American toads *{Bufo americanus).* The second is for spring peepers, American toads, northern leopard frogs *(Rana pipiens),* and pickerel frogs *(Rana palustris).* The third is for northern leopard frogs, pickerel frogs, green frogs *(Rana clamitans),* gray treefrogs *(Hyla versicolor),* Fowler's toads *(Bufo woodhousei fowleri),* and spadefoot toads *(Scaphiopus holbrooki holbrooki).* The fourth is for bullfrogs *(Rana catesbeiana),* green frogs, gray treefrogs, Fowler's toads, and eastern spadefoot toads. However, each calling period is temperature-dependent and, therefore, may vary from year to year. The first monitoring period requires a minimum air temperature of 42°F; the second requires a minimum air temperature of 50°F; the third requires a minimum air temperature of 50°F; and the fourth requires a minimum air temperature of 55 °F. The other requirements for monitoring include little wind and no rain significant enough to impair the ability to hear calling anurans at a distance. Observations are expected to take place between one-half hour after sunset and 2:00 am.

Observations were recorded for a five-minute period. Because the intent of the NAAMP survey is to record population trends over time, the protocol does not require that individual anuran calls be counted but rather that a Call Index Value (CIV) be recorded. A CIV of 1 is recorded when calls can be counted and do not overlap. A CIV of 2 is recorded when calls can be distinguished and some overlap. A CIV of 3 is recorded when there is a full chorus, which means that calls are continuous and overlapping. Additional data recorded includes: start time and end time, temperatures at start and end time, sky conditions, wind conditions, and whether there was any noise during the listening period that would hamper the ability to hear the anurans. Data were recorded on data sheets developed for NAAMP surveys conducted on national wildlife refuges.

The surveys followed the NAAMP protocol with a few modifications. First, we attempted to conduct surveys on two nights within each monitoring period understanding that anuran activity varies from night to night even when conditions appear optimal. Also, in addition to recording the CIV we attempted to estimate the number of individuals calling, which we recorded in parentheses after the CIV numbers.

Monitoring was conducted by two individuals. At the end of the listening period at each station, the two listeners compared observations. At some monitoring stations the two listeners intentionally stood some distance apart to maximize the area of coverage. At the end of the listening period, the listeners conferred and came to agreement on the locations of calling individuals and, thus, developed the best estimate of the number of calling individuals at a monitoring station. If there was a question about the lack of activity at a site, particularly the first site monitored in the evening, the site was remonitored at the end of the evening.

Results

In 2002, surveys were conducted on five nights: April 8, May 6, May 23, June 13, and July 2. The end of March was exceptionally warm, therefore, wood frogs started calling early and may have finished before this survey started. However, wood frogs use vernal pools exclusively and since little of this habitat is present in the study area we were not concerned about this omittance. Most of the month of April was exceptionally cold and rainy, therefore, it was difficult to coordinate nights with exceptabie weather conditions. These cold conditions may have postponed some of the mating activity, so although only one survey was conducted in April, all of the species expected were heard during the other survey periods. The last survey on July 2 was conducted a few days beyond the recommended monitoring window. However, this proved to be the most productive night of all the surveys indicating that no data was missed by conducting the last survey a little later than the suggested protocol.

Below are descriptions of the monitoring stations and the results for each station. Results for 2001 are summarized in Table 1 and results for 2002 are summarized in Table 2. Copies cf the field data sheets are provided at the end of the report.

Georgiaville Pond- This is the most upstream station and is considered a reference site. This site has a field and forest edge and aquatic vegetation in the pond. Unfortunately, Interstate 295 is nearby and created enough noise to make hearing frogs difficult at times. During the first survey a reasonable chorus of spring peepers was heard, and a small number of spring peepers was heard during the second and third surveys. During the fourth and fifth surveys, one bullfrog was heard each time, and the call seemed to come from about the same location each time suggesting that it was the same frog.

Chamberlain Road or Green Property - This is considered a reference site. Grassed yard extends to the edge of the river on the east side. On the west side of the river a water treatment plant creates a loud hum. There is a complex of aquatic vegetation on both sides of the river. Observations were conducted from the lawn on the east side of the river. In 2001, up to four pickerel frogs and four green frogs were heard in this location, as well as up to two bullfrogs and two spring peepers. Similarly, in 2002, up to four pickerel frogs and four green frogs were heard, as well as two bullfrogs, two spring peepers, and one American toad.

Adams Road - This site is also a reference site just downstream of the Green Property. Grassed yard extends to the eastern shore of the river. The opposite shore is vegetated with trees but houses are not far from the trees and shore. There are patches of emergent vegetation throughout the area. In 2001, anurans were relatively abundant including up to three spring peepers, four pickerel frogs, two American toads, eight green frogs, and three bullfrogs. The results for 2002 were similar except no American toads were heard. In 2002, up to two spring peepers were heard, four pickerel frogs, five green frogs, and four bullfrogs.

Table 1. Anuran species heard (Call Index Value[1] with number of individuals in parentheses)during a call survey on the Woonasquatucket River in North Providence, Rhode

Island in the spring of 2001. The call survey was conducted as part of an assessment of the Centredale Manor Superfund Site. Values given are the maximum of four surveys.

Site	Species Heard ("Call Index Value and Number of Individuals in							
	Spring Peeper	Wood Frog	Pickerel Frog	American Toad	Fowler's Toad	Green Frog	Bullfrog	Gray Treefrog
Rangely Court	0	0	1(1)	0	0	KD	KD	0
Chamberlain Road	1()	1(2)	1(5)	0	0	1(6)	KD	0
Adams Road	1(3) *	0	1(4)	1(2)	0	2(8)	1(3)	0
Stevens Street	0	0	0	0	0	0	0	0
Wiscasset Avenue	0	0	0	0	2(4)	0	0	0
Warren Street	2()	0	2(8)	1(2)	1(3)	2(6)	1(2)	0
Oak Street	0	0	2(5)	1(2)	0	1(6)	1(3)	1(1)
Brennan Oil	0	0	1(3)	0	0	1(2)	1(2)	0
Assapumpsett Pond	3()	0	1(1)	2(4)	0	2(7)	1(2)	0

[1] Call Index Value: 1=Calls can be counted, no overlapping; 2=Calls can be distinguished, some overlapping; 3=Full chorus, calls continuous and overlapping.

Table 2. Anuran species heard (Call Index Value[1] with number of individuals in parentheses)during a call survey on the Woonasquatucket River in North Providence, Rhode Island in the spring of 2002. The call survey was conducted as part of an

assessment of the Centredale Manor Superfund Site. Values given are the maximum of five surveys.

Site	Species Heard (Call Index Value and Number of Individuals ())					
	Spring Peeper	Pickerel Frog	American Toad	Fowler's Toad	Green Frog	Bullfrog
Georgiaville Pond	2(7)	0	0	0	0	KD
Chamberlain Road	1(2)	1(4)	1(1)	0	1(4)	1(2)
Adams Road	1(2)	1(4)	0	0	1(5)	1(4)
Stevens Street	1(2)	1(1)	0	0	1(4)	0
Wiscasset Avenue	0	0	1(1)	1(2)	1(2)	Kl)
Warren Street	KD	2(7)	0	1(1)	K5)	1(1)
Oak Street	0	2(6)	0	0	1(3)	1(1)
Brennan Oil	0	1(3)	0	0	1(2)	1(2)
Assapumpsett Pond	3()	1(1)	0	0	2(10)	1(1)

[1] Call Index Value: l=Calls can be counted, no overlapping; 2=Calls can be distinguished, some overlapping; 3=Full chorus, calls continuous and overlapping.

Stevens Street - This monitoring location is at the upper end of the Allendale Impoundment, which is the most contaminated of the impoundments. In 2001, because of the breached dam, this area was mostly forested/scrub-shrub wetland with the main river channel flowing along the west bank and small streams braiding throughout the rest of the area. In 2001, no frogs were heard in this area during any of the survey dates. In 2002, this area was completely flooded and one pickerel frog, two spring peepers, and up to four

green frogs were heard.

Wiscasset Ave. - This monitoring station is located about in the middle of the AJlendale Impoundment on the east shore. The east shore has a narrow buffer of trees and then houses and yards. The west shore is mostly parking lots and industry. Monitoring of this location took place from a large ledge which allowed for hearing over a large area, from the dam up to near the Stevens Street monitoring station. In 2001, there was little water in the impoundment for the first two surveys, but it was about one-third full for the subsequent two surveys. No anurans were heard during the first two surveys. Fowler's toads were heard (four and three individuals, respectively) during the third and fourth surveys. In 2002, the impoundment was full. No anurans were heard during the first and fourth surveys, but two green frogs were heard during the second survey and one American toad was heard after the five minute listening period had ended. During the third survey one American toad was heard again as well as two green frogs. During the fifth survey, one green frog, one bullfrog, and two Fowler's toads were heard.

Warren Street - This monitoring station is located toward the upper end of the Lymansville Impoundment. Contamination in this impoundment is approximately an order of magnitude less than in the Allendale Impoundment (EPA pers. comm). In 2001, this site had the highest abundance and diversity of frogs of all the monitoring locations. A moderate chorus of spring peepers was heard, as well as up to eight pickerel frogs, two American toads, three Fowler's toads, six green frogs, and two bullfrogs. In 2002, the abundance of anurans appeared to be lower, with only one individual spring peeper heard, up to seven pickerel frogs, one Fowler's toad, five green frogs, one bullfrog, and no American toads.

Oak Street - Monitoring from this location was conducted from a yard that extends into the Lymansville Impoundment, providing listening over a relatively large area. Trees, lawns, and houses edge the shoreline. The water has patches of emergent vegetation. In 2001, up to five pickerel frogs were heard, two American toads, six green frogs, three bullfrogs, and one gray treefrog. In 2002, the abundance and diversity was a little lower with up to six pickerel frogs, three green frogs, and one bullfrog heard.

Brennan Oil - This is the only monitoring location in the Manton Impoundment because the impoundment is relatively small. The monitoring location was sited in about the only area with emergent vegetation. Listening occurred from a parking lot on the east bank. A factory on the west bank produces a loud hum. There is a lot of pavement around the river in this area. In 2001, up to three pickerel frogs, two green frogs, and two bullfrogs were heard. The results for 2002 were identical to 2001.

Pond on Assapumpsett Brook - Assapumpsett Brook is a small tributary to the Woonasquatucket River that empties into the Lymansville Impoundment. This is a reference site and the only site that is not located on the Woonasquatucket River. The pond is a small impounded area of the brook that is mostly surrounded by houses, except at the west end where there is a relatively large area of forest and scrub-shrub wetland. The monitoring location is at the end of Bowen Street overlooking the scrub-shrub wetland. The pond is a distance down a sloped yard from the monitoring location, but we did not have permission from the landowner to use the yard. In

2001, this site had a full chorus of spring peepers as well as one pickerel frog, four American toads, two green frogs, and two bullfrogs. In 2002, we again heard a full chorus of spring peepers, one pickerel frog, up to ten green frogs, and one bullfrog. It is likely that the low number of pickerel frogs heard is due to the fact that this species' call is a low snore that is difficult to hear at a distance. Therefore, there were probably more pickerel frogs present than were detected.

Discussion

In the 2001 report, we discussed some of the challenges faced in monitoring. In 2001, it was cold and rainy in May making it difficult to coordinate a suitable night for monitoring. In 2002, the cold rains came in April, again making it difficult to find suitable nights for sampling. However, we seemed to collect data on the species we would expect in the area, with the exception of the gray treefrog and wood frog. These two species were heard in limited numbers, one and two, respectively, in 2001 suggesting that habitat is limited for them in the study area. Ambient noise was a problem in both years. The study area is a suburban/ industrial area with noise from cars, sirens, airplanes, helicopters, barking dogs, and factories. Due to scheduling difficulties, the last survey was conducted a little later than the protocol recommends. However, it proved to be the most productive of the sampling nights, therefore, it appears that we did not miss important call data as a result.

The station-specific sampling results for 2001 and 2002 were relatively similar. One difference between the two years is that we replaced the northern most station, Rangely Park, with a station farther north, Georgiaville Pond. However, the Georgiaville Pond site proved to be about as productive as Rangely Park. We believe that the anuran productivity at Rangely Park may have been low because there was too much water current at the site to make it attractive to anurans. We do not have an explanation for the relatively low productivity at Georgiaville Pond.

There were some changes in species observed at some of the sites between the two years. For example, American toads were heard at Adams Road in 2002 but not in 2001, and green frogs were heard at Oak Street and Brennan Oil in 2002 but not in 2001. There were also some differences in the numbers of individuals of a species heard at a site between the two years. For example, we heard a moderate chorus of spring peepers at Warren Street in 2001 and only one individual spring peeper in 2002. However, some variation in numbers and species is to be expected between years.

The most substantial difference in observations between the two years, was that in 2001, only Fowler's toads, three total, were heard in the Allendale Impoundment. In 2002, two spring peepers, one pickerel frog, four green frogs, one American toad, and two Fowler's toads were heard in the Allendale Impoundment. Although the calling activity in 2002 may not have been impressive, it was dramatically greater than in 2001. This suggests that frogs were missing from the Allendale Impoundment in 2001 because of lack of water. It appears that anurans began to colonize the site once water/habitat was provided.

Although there is some discussion of amphibian population fluctuations, movements, dispersal, and colonization in the literature, these aspects of amphibian natural history are difficult to study and are, thus, not well understood. However, Pechmann *et al.* (1991) reported that changes or differences in hydrology, such as drought or differing pond hydroperiods, accounted for changes or differences in breeding population sizes of four amphibian species in South Carolina. Dodd and Charest (1988) reported that differences in activity patterns between years were likely due to differences in temperatures, rainfall amounts, and hydroperiods. This information, in concert with simple logic, leads us to conclude that the timing of the presence/absence of water in the Allendale Impoundment would be critical to the presence/absence of a breeding anuran population.

Since the Allendale Impoundment was relatively dry during autumn 2001 and winter 2002, it is unlikely that anurans hibernated there. Anurans inhabiting the impoundment in spring 2002 were probably migrants from upstream and downstream, and, therefore, had reduced exposure to contaminants in sediments of the Allendale Impoundment. Since this study made no attempt to determine whether reproduction was successful, and since anurans are relatively mobile, it may be difficult to determine whether the Allendale Impoundment is toxic to frogs without evaluating endpoints in addition to the number of calling males.

Summary and Conclusions

The species and abundances of calling frogs heard were relatively similar between the two years. The major difference noted is that in 2001 only a small number of Fowler's toads were heard in the Allendale Impoundment, while in 2002, four species of anurans, in small numbers, were heard in the Allendale Impoundment.. This suggests that by rebuilding the dam and allowing the impoundment to fill with water, a small number of breeding males were able to recolonize the site. However, since these animals did not likely hibernate at the site, they cannot serve as an indicator of the toxicity of the sediments to hibernating adults. Therefore, EPA may want to evaluate additional endpoints than just presence/absence of calling males to determine whether the Allendale Impoundment is a hospitable environment for reproducing anurans.

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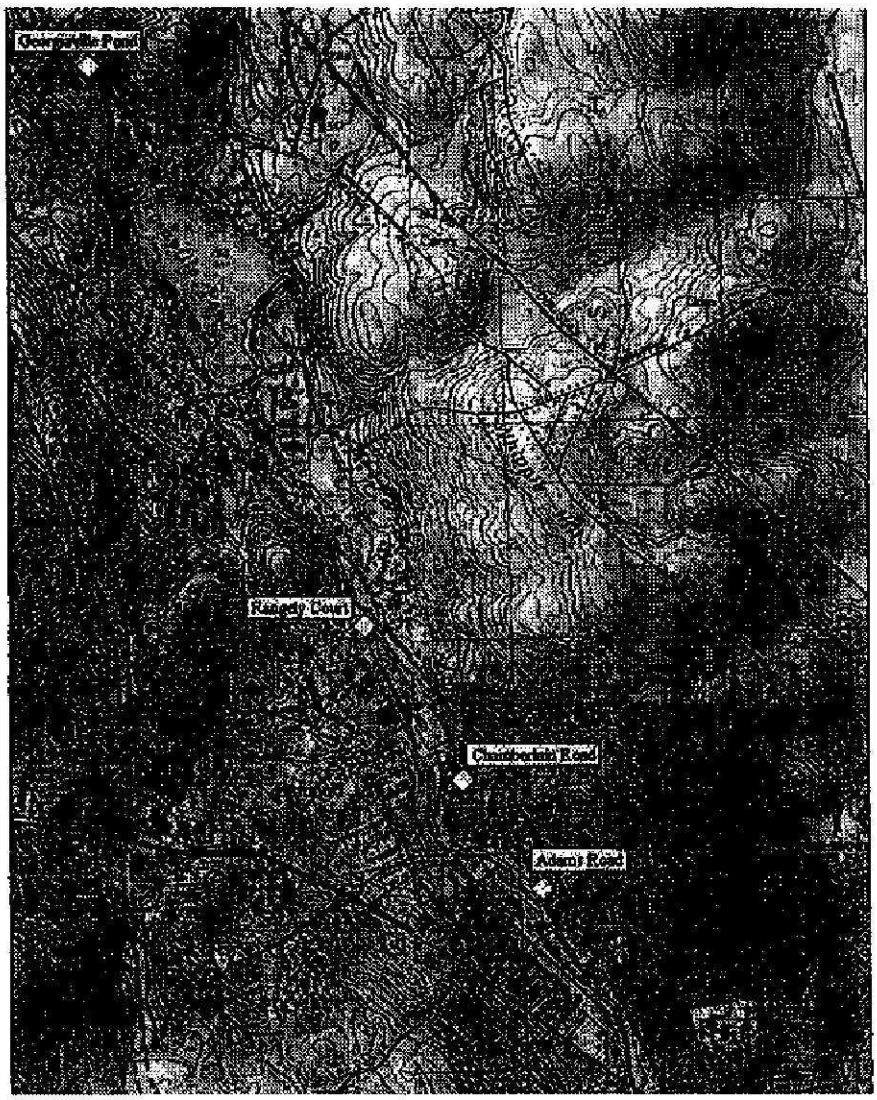


Figure 1. The four northerly monitoring stations for the anuran call survey conducted on the Woonasquatucket River in the vicinity of the Centredale Manor Superfund Site, North Providence, Rhode Island. The Rangely Court station was used in 2001 and the Georgiaville Pond station was used in 2002. The other stations were used in both years.

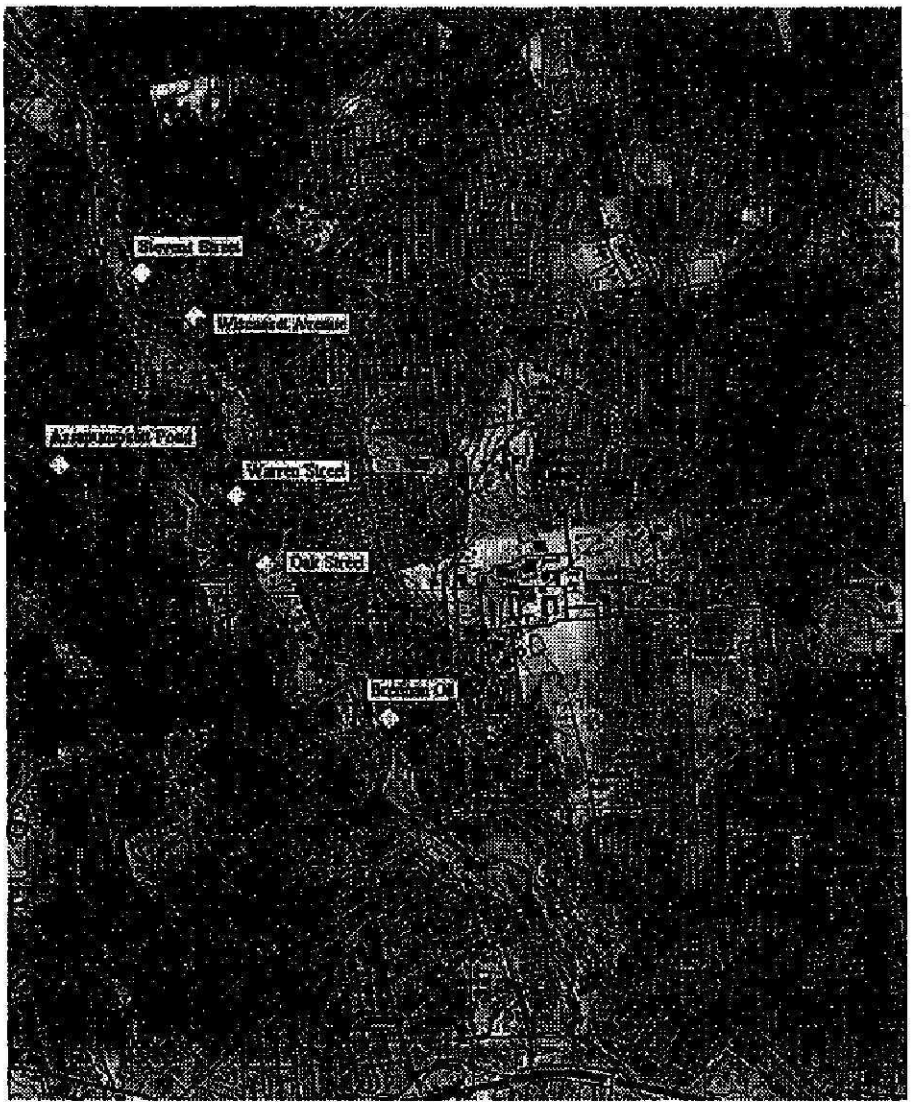


Figure 2. The six southerly monitoring stations used for the anuran call survey on the Woonasquatucket River in the vicinity of the Centredale Manor Superfiind Site, North Providence, Rhode Island. All six stations were used in both 2001 and 2002.

FWS Anuran Call Count Survey

L. Eaton-Poole

>b*rvcn K. Mumney (USFWS) Route: CrcXreAi le. Manor Survey Date: V/Y/O^ RunNumben _J_

Survey Data

	Time	TcmpfF)	Wind Scale	Sky Code
Start	8:00 pm	46°	/	2
Finish	10:20 pm	43°	/	2

Georgiaville Point Data A^A cr>5 Stevens Wiscasset

	1		2		3		4		5	
Start Tune	^ OOprn		8:20		8:35		8:50		9:05	
Air Temperature (*F)										
Sky Code	A		2		2		2		2	
Was noise a factor? (•-yes)	/4»Ghv\)rL>J		\vOJKJ(							
Did you take a timeout? (•- yes)	N		N		/A		N		hi	
Species Heard:	3 min.	5 min.	3 min.	S min.	3 min.	5 rain.	3 min.	5 min.	3 min.	5 min.
Opr»ng pc^-p^*-		"¥,6)								
Pickerel frog				i(.s)		i6")		,(1)		C

Comments: -£ hidxO "5^-X - V£p\<xce:5 Rargely Court Park

1 (v) = / = CJXS \ Index Value (6) = estimated number individuals

*ll Index Value: 1 = Calls can be counted, no overlapping. 2 = Calls can be distinguished, some overlapping. 3 * Full chorus, calls continuous and overlapping.

Icy Code: 0-Clear/few clouds. I = Partly cloudy / variable. 2 = Cloudy (broken) or overcast 4 = Fog/Smoke
5 » Drizzle / light rain 7 = Snow *8 » Showers *(do not conduct survey)*

*fm'' 'c: 0" Smoke rises vertically. *4 ^Small branches move, raises dust and loose paper.
1 * Light air movement, smoke drifts. *5 •= Small trees in leaf begin to sway, crested wavelets.
2 - Wind felt on face, leaves rustle. *6 = Large brandies in motion.
3 •= Gentle breeze, leaves and small twigs in motion. • *Unacceptable wind strengths for survey.*

evised Feb. 2001

Continuation Sheet 2

Route: Centredale YDa oar

Survey Date: 4/8/0c

Point Data

	Warren 6		7		8		no Assaquam 9		10	
Start Time	9/^6		9 / ^		JO:OO		/0:15			
Air Temperature (T)										
Sky Code	2		2		2		2			
Was noise a factor? (/ = yes)	A»fp la_nc- ·fix'		Factory Noise							
Did you take a timeout? (• - yes)	N		N		N		N			
Species Heard:	**3min.**	**Smin.**	**3min.**	**5min.**	**3min.**	**5min.**	**3 min.**	**Smin.**	**3 min.**	**5 min.**
57p/.na -TV."-*^-								3C>		
Pickerel frog		1(4)		J(c)		1(1)				
J										

Comments:

Index Value: 1 = Calls can be counted, no overlapping. 2 = Calls can be distinguished, some overlapping. 3 = Full chorus, calls continuous and overlapping.

Icy Code: 0 - Clear / few clouds. I » Partly cloudy / variable. 2 = Cloudy (broken) or overcast 4 = Fog/Smoke
5 "**Drizzle /light rain** 7 - Snow *8 - Showers *(do not conduct survey)*

(find Scale: **0 - Smoke rises vertically.** »4 =**Small branches owve, raises dust and loose paper.**
1» Light air movement, smoke drifts. *S " **Small trees in leaf begin to sway,** crested wavelets.
2 -= Wind **felt** on face, **leaves** rustle. *6 •= **Large** branches **in** motion.
3 «• Gentle breeze, leaves and small twigs in motion. * *Unacceptable vrind strengths for survey.*

FWS Anuran Call Count Survey

FWS Anaran Call Count Survey

A., £0^00-T00le,

Observer K. POULXYO/' a [redacted] Route: Centredale Manor Survey Date: 6/6/03 Run Number. 2

Survey Data

	Time	Temp(°F)	Wind Scale	Sky Code
Start	8:28 pm	60°	.3	-2.
Finish	10:20 pm	54°	.3	2

Georgiaville Chant PointData AcV.ms Stevens Wiscasset

	1		2		3		4		5	
Start Time	8:28		8:53		9:03		9.75-		S."30	
Air Temperature (°F)	60°		59°							
Sky Code	2									
Was noise a factor? (•-yes)	Highway		Sewage treatment		Car no:5e.					
Did you take a timeout? (/- yes)			plant no.se.							
Species Heard:	3 min.	S min.	3 min.	5 min.	3 min.	S min.	3 min.	5 min.	3 min.	S min.
Spring peeper		3.(7)		1(2)		1(2)		1(1)		
Am. toad				16)						*
D^ c' f... FCC&EXC4 "TTQ^Q,,				1(4)		1(4)		,Y.V		
(_ on frog				1(1)				1(4)		1(.2)
	V									

Commeats: * 1 American toad called «A after surve.. Pi finished

ZaU Index Value: 1 = Calls can be counted, no overlapping. 2 = Calls can be distinguished, some overlapping. 3 « Full chorus, calls continuous and overlapping.

iky Code: 0 = Clear / few clouds. I = Partly cloudy / variable. 2 = Cloudy (broken) or overcast 4 = Fog/Smoke
5 » Drizzle / light rain 7 - Snow *8 - Showers *(do not conduct survey)*

tfv -de: 0= Smoke rises vertically. *4 "Small branches move, raises dust and loose paper.
1- Light air movement, smoke drifts. •S-SmaO trees in leaf begin to sway, crested wavelets.
2-Wind felt on face, leaves rustle. *6"' Large brandies in motion.
3 •= Gentle breeze, leaves and small twigs in motion. * *Unacceptable wind strengths for survey.*

levtsed Feb. 2001

Continuation Sheet 2

[redacted] Route. CentreAxle Manor Survey Date: 5/6/0-

Point Data

Warren Assa Pump

	6		7		8		9		W	
Start Time	9:44		9:50		/dlo 3		/0 1 /S""			
Air Temperature (T)							54°			
Sky Code										
Was noise a factor? (/ - yes)					Factory noise					
Did you take a timeout? (• - yes)										
Spedes Heard:	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.
≤5 pr\ca,'piop/'		1(1)						1(3)		
Pickerel frog		Mn)		2(6)		1(3)		1(1)		
J										
		-								
	t									

Comments:'

illlndoc Value: 1 "Calls can be counted, no overlapping. 2 = Calls can be distinguished, some overlapping. 3 =• Full chorus, calls continuous and overlapping.

kyCode: O-Clcar/ few clouds. I-Partly cloudy/variable. 2-Cloudy (broken) or overcast 4-Fog/Smoke
S-Drizzle/light rain 7"Snow * 8 - Showers *(do not conduct survey)*

rtnd Scale: 0» Smoke rises vertically. *4'Small branches move, raises dust and loose paper.
I- Light air movement, smoke drifis. *5 - Small trees in leaf begin to sway, crested wavelets.
2 -Wind felt on face, leaves rustic. *6 = Large branches h motion.
3 = Gentle breeze, leaves and small twigs in motion. • *Unacceptable Hind strengths for survey.*

FWS Anuran CaU Count Survey

Observer I. Eaton-Poole (USFWS) Refuge Route: CerXrfiA^i Ik. Manor Survey Date: 5/63/6 Run Number 3

Survey Data

	Time	TempCF)	Wind Scale	Sky Code
Start	9:00	(oO°	1	o
Finish	//•'60	51°	1 .	O

Point Data Coraiaville Chap Adams Stevens Wiscasset

	^1		2		3		4		5	
Start Tune	10:55		9:03		9!15		9.<aL		9 •Wo	
Air Temperature (°F)	^} °									
Sky Code	n									
Was noise a factor? (/-yes)	Highway									
Did you take a timeout? (/- yes)	N									
Species Heard:	**3 rain.**	**5 min.**	**3 min.**	**S min.**	**3 min.**	**5 min.**	**3 min.**	**5 min.**	**3 min.**	**5 min.**
^C-^n -Ong				1(3)				1(4)		1(2)
Bickerel frog				1(1)		1(1)				
Spring pe. O		*1( )				"ifrV				
/-_^1-mr>X										1(1)
	V									

C^-oniiincntST * Had difficulty hearing over-4Yaffic noise so did no~t. estimate number calling.

^11 Index Value: I » Calls can be counted, no overlapping. 2 = Calls can be distinguished, some overlapping. 3 = Full chorus, calls continuous and overlapping.

iky Code: 0 = Clear /fcvr clouds. 1 «= Partly cloudy / variable. 2 = Cloudy (broken) or overcast 4 = Fog/Smoke
5-Drizzle / light rain 7 = Snow *8 • Showers *(do not conduct tune))*

ffv ie: 0 = Smoke rises vertically. *4 °SmaU branches move, raises dust and loose paper.
I" Light air movement, smoke drifts. *5 = Smafl trees in leaf begin to sway, crested wavelets.
2-Wind felt on fece, leaves rustic. *6 = Large braaencs in motion.
3 •= Gentle breeze, leaves and small twigs in motion. * *Unacceptable wind strengths for survey.*

levised Feb. 2001

FWS **Anuran Call Count** Survey

Continuation Sheet 2

Route: Centredale Manor

Survey Date: 5/23/

Point Data

Warren Oak Brennan Assapumet

	6		7		8		9		10	
Start Time	9:s~a		V6-VO5-''		10:15		/o:30 "			
Air Temperature (T)							51°			
Sky Code										
Was noise a factor? (• - yes)	dogs barking									
Did you take a timeout? (• - yes)										
Species Heard:	3mia.	Smia.	3mia.	Smin.	3min.	5min.	3min.	5mia.	3 mia.	5 min.
Pickerel frog		1(4)		1(4)		1(2)				
Green frog		16^						id)		
		f								
	t									

Comments:

^4il Index Value: I = Calls can be counted, no overlapping. 2 = Calls can be distinguished, some overlapping. 3 = Full chorus, calls continuous and overlapping.

ikyCode: 0-Clear/fcvr clouds. 1 - Partly cloudy / variable. 2 » Cloudy (broken) or overcast 4 = Fog/Smoke
S - Drizzle / light rain 7 "Snow *8 = Showers *(do not conduct survey)*

Yind Scale: 0=Smoke rises vertically. *4=6man branches move, raises dust and loose paper.
1 ••Light air movement, smoke drifts. *5 -Small trees in leafbegin to sway, crested wavelets.
2 • Wind felt oa face, leaves rusde. *6-Large branches in motion.
3 = Gcritle breeze, leaves and small twigs in motion. * *Unacceptable wind strengths for survey.*

FWS Anuran Call Count Survey

)bserven Laur Greg nfYAf^e -s4o fcfii»e Route: (_r rrW cVvAe. h f h on^Survey Date: (DJ)3/0^L Run Number: V

(DSFWS

Survey Data

	Time	TempCF)	Wind Scale	Sky Code
Start	9:10 pm	SI °	/	2
Finish	11:10	5C °	1	2

Chamberlain

Point Data

Georgiaville AAbons Stevens Wiscasset

	0l	2	3	4	5
Start Tune	9.V0	9:25	jros'	9:45	10:05
Air Temperature ("F)	57 °				
Sky Code	2				
Was noise a factor? (S - yes)	Highway				
Did you take a timeout? (/= yes)					

Species Heard:	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.	3 min.	5 min.
Bullfrog		V(.E")		1(2)		1(2)				
Green frog				1(4)		J(4")		1(3)		0
	V									

CcmnKaits: Du-rprv^'u-Y2 H \oCucAiue night

UI Index Value: I = Calls can be counted, no overlapping. 2 = Calls can be distinguished, some overlapping. 3 = Full chorus, calls continuous and overlapping.

ky Code: 0 - Clear / few clouds. 1 - Partly cloudy / variable. 2 = Cloudy (broken) or overcast 4 = Fog / Smoke
5-Drizzle/light rain 7 " Snow *8 = Showers *(do not conduct turvly)*

fw" 'le: 0 = Smoke rises vertically. *4 "Small branches move, raises dust and loose paper.
1" Light air movement, smoke drifts. *5« Small trees in kaf begin to sway, crested wavelets.
2-Wind felt on fecc, leaves rustic. *6 = Large branches ta motion.
3 "= Gentle breeze, leaves and small twigs in motion. * *Unacceptable wind strengths for survey.*

evised Feb. 2001

FWS Anuran Call Count Survey

Continuation Sheet 2

Route: Centre Xville Manor Survey Date: 6/13/00

Point Data

Wooded ...no Assa.pump

	6		7		8		9		10	
Start Time	/o:sf-o		7OV30		/O-VO		/O -5t)			
Air Temperature (T)										
Sky Code										
Was noise a factor? (• = yes)							dogs barkin			
Did you take a timeout? (• - yes)										
Species Heard:	3 mia.	Smut.	3min.	5min.	3min.	5min.	3min.	5min.	3min.	5min.
r* P		1(4)		i(0				ib)		
Bullfrog				1(1)		/C0				
	t									

Comments:

all Index VaJue: I = Calls can be counted, no overlapping. 2 = Calls can be distinguished, some overlapping. 3 = Full chorus, calls continuous and overlapping.

ky Code: 0 - Clear / few clouds. I = Partly cloudy / variable. 2 - Cloudy (broken) or overcast 4 = Fog/Smoke
5 = Drizzle /light rain 7* Snow *8 = Showers *(do not conduct survey)*

'ad Scale: 0 - Smoke rises vertically. M =Small branches move, raises dust and loose paper.
1 • Light air movement, smoke drifts. *S = Small trees in leaf begin to sway, crested wavelets.
2 •= Wind felt on face, leaves rustic. *6 •= Large branches in motion.
3 = Gentle breeze, leaves and small twigs in motion. * *Unacceptable yrind strengths for survey.*

FWS Anuran Call Count Survey

FWS Anuran Call Count Soryey

Laura Eaton-Poole (WSFu)

Jfaserver Jennifer Alleman (LEPA contractor) Route: Centredale Manor Survey Date 7/6/02 RmNumber 5

Survey Data

	Time	Temp(F)	Wind Scale	Sky Code
Start	9:15 pm	[illegible]	0	0
Finish	11:30 pm	[illegible]	0	0

Point Data

	Georgiaville 1		2		Adams 3		Stevens 4		Wiscasset 5	
Start Tune	9:15		9:35		9" V<		/0/60		•/0'K	
Air Temperature f^F)	85°									
Sky Code	0									
Was noise a factor? (/<• yes)	Highway fire crackers		N		N		N		N	
Did you take a timeout? (/ - yes)	N		N		N		N		N	
Species Heard:	3 rain.	5 min.	3 min.	5 min.	3 min.	5 rain.	3 min.	5 min.	3 min.	5 min.
Bullfrog		1(1)		1(2)		1(4)				1(1)
Green Frog				1(4)		1(5)		,(cf)		1.1)
Fowler's Toad										+'^-^y'
	V									

Comments: J O ") # Outside brackets is CIV or Call Index Value
inside brackets is estimated number of individuals.

dl Index Value: I« Calls can be counted, no overlapping. 2 = Calls can be distinguished, some overlapping. 3 * Full chorus, calls continuous and overlapping.

7 Code: 0-Clear/ few clouds. I = Partly cloudy / variable. 2 = Cloudy (broken) or overcast 4 = Fog/Smoke
5-Drizzle/light rain 7 = Soow * 8» Showers *(do not conduct survej)*

m s: 0-Smoke rises vertically. *4 -Small branches move, raises dust and loose paper.
l».Light air movemeot, smoke drifts. *5 " Small trees in leaf begin to sway, crested wavelets.
2 - Wind Wt on face, leaves rustic. *6 = Large braocte in motion.
3 "Gentle breeze, leaves and small twigs in motion. * *Unacceptable wind strengths for survey.*

wised Feb. 2001

Continuation Sheet 2

Route: Centredale. YYr\ c^r>^ Survey Date: 7/2/0

Point Data

Warren Assapumpp

	6		7		8		9		10	
Start Time	10:40		•V-tf 'sO'		11:00		n:i<r •"			
Air Temperature (T)							90°			
Sky Code							0			
Wis noise a factor? (/-yes)	Factory buzz 1						ivl			
Did you take a timeout? (• - yes)										
^pedes Heard:	3min.	5 min.	3 min.	5mfn.	3min.	5 min.	3 min.	5 min.	3 min.	5 min.
Bullfrog		1(1)		1(1)		1(2)		1(1)		
Green frog		i(r)		1(2)		1(2)		*2(?)		
/^leirys 40aA		70)								
		-								
		t								

Comments: ^"Quuil CX- , n»v^ f oV". Qreer l -fop. co-WfV\ boL> ooVic*'^ toe li<s)cn 4rDro f^ -fot) -iojr

-Y^ n>ou^ jvru^, IOJULO /O i*^o, iuaPs

all Indcc Value: 1 = Calls can be counted, no overlapping. 2 * Calls can be distinguished, some overlapping. 3 » Full chorus, calls continuous and overlapping.

Icy Code: 0- Clear/ few douds. 1 - Partly cloudy / variable. 2 - Cloudy (broken) or overcast 4-Fog/Smoke
5-Drizzle/light rain 7 - Soow *8 " Staowen *(da not conduct survey)*

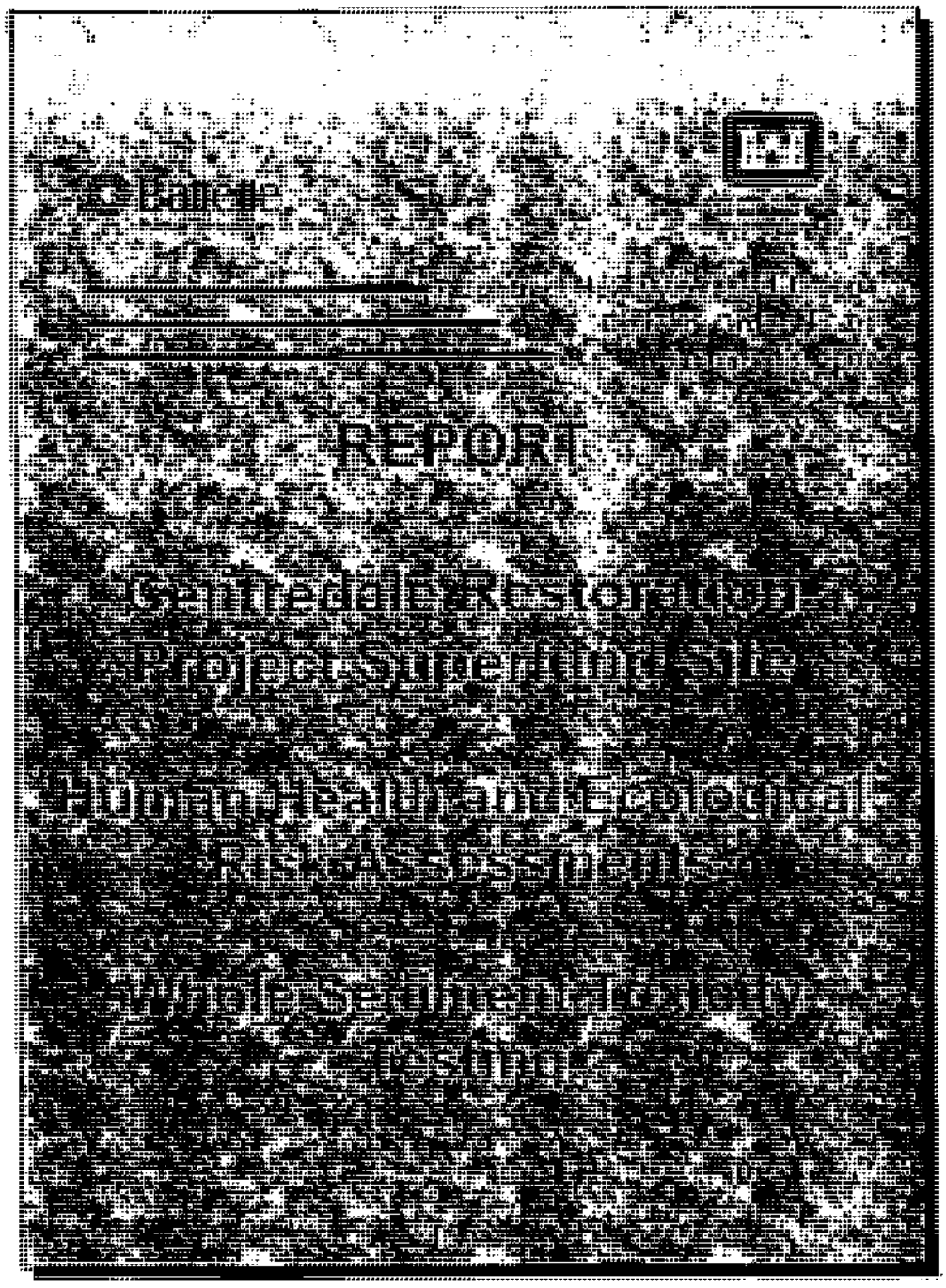
'ind Scale 0- Smoke rises vertically. »4-5mafl branches move, raises .dust and loose paper.
1 - Ught air movement, smoke drifls. *5 - Small trees in fcafbegb to sway, crested wavelets.
2 - Wlrid felt on face, leaves rustic »6 = Large branches in motion.
3 = Gentle breeze, leaves and small twigs in motion. * *Unacceptable wind strengths for survey.*

FWS **Anuran Call Count Survey**

APPENDIX F

SEDIMENT TOXICITY TEF REPORT

RECEIVED
17 Jan 02
via Fax



©Baffeiie
. . . Putting Technology To Work
Duxbury Operations
397 Washington Street
Duxbury, Massachusetts 02332
Telephone 781-934-0571
Fax:781-934-2124

January 16, 2002

RECEIVED JAN 02 via Fax

Ms. Laureen Borochaner
U.S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, Massachusetts 07142-2751

CONTRACT NO: Contract No. DACW33-01-D-0004
DELIVERY ORDER: 01
SUBMnTAL OF DELIVERABLE: Whole Sediment Toxicity Testing

Dear Ms. Borochanen

Enclosed please find two (2) copies of the final letter report for Whole Sediment Toxicity Testing prepared under Delivery Order 01, Centredale Restoration Project Superfund Site Human Health and Baseline Ecological Risk Assessments. This is a deliverable submitted under Task 20 of Delivery Order 01.

This document has received an internal quality assurance review at Great Lake Environmental Center and has been reviewed by a senior scientist for technical accuracy and completeness.

Please call William Steinhauer at (781) 934-0571 if you have technical questions regarding this submittal. Refer all contractual questions to Mr. David Sullivan at die same number.

Sincerely,

William Steinhauer
Project Manager

for KF
Karen Foster
Program Manager

end.

cc: C. Rosiu, USEPA/R1
A. Beliveau, USEPA/R1
P. Cook, USEPA/NHEERL
N. Richardson, Harding ESE

Final

Centredale Restoration Project Superfund Site
Human Health and Ecological Risk Assessments
Whole Sediment Toxicity Testing

Submitted to

Department of the Army
U.S. Army Corps of Engineers
North Atlantic Division
New England District

Contract No. DACW33-01-D-0004
Delivery Order No. 01

January 16, 2002

Prepared by

Great Lakes Environmental Center
739 Hastings Street
Traverse City, MI 49686
231-941-2230

for

BATTELLE DUXBURY OPERATIONS
397 Washington Street
Duxbury, MA 02332
781-934-0571

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... Putting Technology To Work

GLEC

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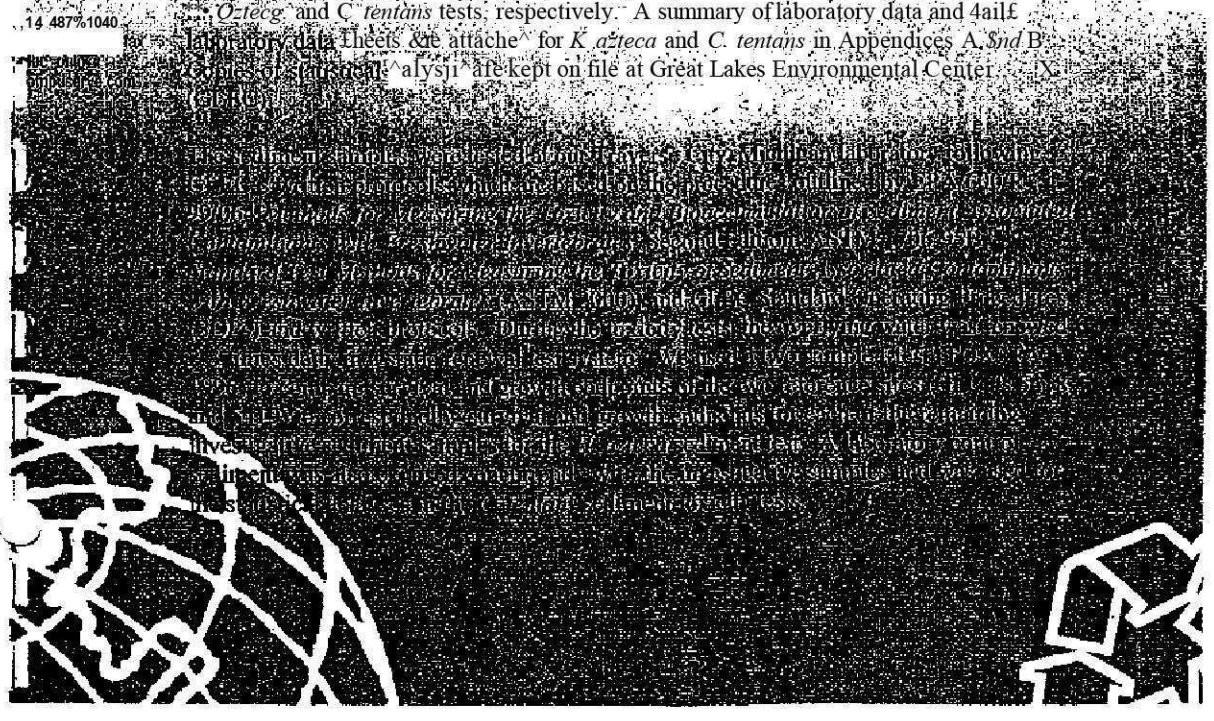
January 11,2002

Mr. Bill Steinhauer
Battelle Ocean Sciences
397 Washington Aver—
Duxbury, MA 02332

RE: FINAL REPORT: CENTRED ALE WHOLE SEDIMENT TOXICITY TESTING

•Dear Bill:

We have completed our analysis of the *Hyalella azteca* 42-day whole sediment survival, growth and reproduction, and *Chironomus tentans* survival, growth, emergence and reproduction whole sediment toxicity tests'performed on eight sediment samples collected for the Battelle-EPA Centredale Manor whole sediment toxicity assessment. The sample numbers (GLC and Battelle) and toxicity test results are summarized in Tables 1 through 4 for the *H azteca* tests and in Tables 6-9 for the *C. tentans* tests. Water quality data for the overlying water is summarized for each sediment sample tested in Tables 5 and 10 for the *Oztecg* and C *tentans* tests, respectively. A summary of laboratory data and 4ail£ laboratory data sheets &e attache^ for *K azteca* and *C. tentans* in Appendices A *Snd* B. Copies of [illegible] ^alysji ^ are kept on file at Great Lakes Environmental Center [illegible]



RESULTS

Hyalelld azteca

The results indicate that both laboratory and reference control sediments exceeded the minimum *Hyalella* survival (80%) and growth (0.15 mg) criteria (Tables 1-4) and the overlying water quality measurements were within the acceptable limits as specified in the protocol. Consequently, the *H. azteca* whole sediment toxicity tests are valid assessments of sediment toxicity. A summary of the water quality data for the *H. azteca* tests is provided in Table 5.

There was a significant reduction ($P \leq 0.05$) in survival after 10-days of exposure in two (GLC #s 5420 and 5424) of the investigative samples, and in four samples (GLC#s 5420, 5422, 5423 and 5424) after 28-days and 42-days of exposure when compared to the reference control sediments (5418 and 5419). Growth (mg average dry weight) was significantly reduced in three (GLC#s 5420, 5421, 5424) samples after 28-days of exposure when compared to the reference sediments (Table 1 A). There was no significant reduction in growth for any samples after 42-days of exposure. It is important to note that the test organisms are transferred to clean water after 28-days and not exposed, to sediment for the remainder of the test. Therefore, this may help explain why there was no reduction in growth in the remaining surviving organisms after 42 days of exposure. The average dry weight of the test organisms in all sediments were well above the minimum requirement of 0.15 mg. Reproduction (average number of young per female) was very similar between laboratory and reference control samples, and in five of the investigative samples (GLC#s 5421, 5422, 5423, 5424 and 5425) and notably less than the control samples in one (GLC# 5420) of the Investigativesamples (Table 4). Statistically significant differences ($p \leq 0.05$) between the test data are noted in Table 4.

Chironomus tentans

The laboratory control sediment organisms exceeded the minimum survival and growth criteria for an acceptable control for the *C. tentans* test. The reference control sediments met the minimum growth criteria, but not the minimum survival criteria. Reference control sediment (GLC 5418) met the minimum requirements for acceptable control survival for day 20 and 49 of the test, while the 10-day survival of 68.7, was just below the acceptable level of 70%, and reference control sediment (GLC 5419) did not meet the minimum survival criteria for the 10, 20 or 49 day survival endpoints. Therefore, we feel these reference sediments were not suitable control sediments for the *C. tentans* whole sediment toxicity tests. Consequently, the laboratory control results Were used for the statistical analyses (Tables 6-9). The overlying water quality measurements were within the acceptable limits specified in the testing protocol. A summary of the water quality measurements is provided in Table 10 for the *C. tentans* tests.

There was a significant ($P \leq 0.05$) reduction in the survival of all the investigative samples after

10,20 and 49 days when compared to the laboratory sediment control. One sample (GLC 5423) had 100 percent mortality at the 10-day endpoint (Table 6). Growth (measured as ash free dry weight) was significantly reduced in one sample (GLC# 5420), and another sapple (GLC# 5423) had 100 percent mortality in all replicates (Tab'le 8). Reproduction (average number of eggs produced per female) was very similar between the laboratory and reference control samples, and in the remaining five investigative samples (Table 7). However, the number of egg cases produced was much lower in sample GLC# 5420 (3 egg cases compared to 36 produced by the control organisms), apd nonexistent in GLC# 5423 (100 percent mortality). Statistically significant differences^ <; 0.05) between the test data are" noted in Table 9.

SUMMARY AND DISCUSSION

It is important to understand when interpreting whole sediment toxicity test data that not all of the"endpoints(j.e., survival, reproduction, emergence and growth) are necessarily related, nor are the endpoints equally reliable. For example, *C. tentans* had poor survival in some sediments but all of the organisms that survived in those sediments emerged to an adult phase. All of the investigative^amples had at least two test endpoints that were significantly different from control or reference sediments/The 49-day survival data for^ll of the investigative sediments and the reference sediments for the *C. tentans* test showed a significant difference when compared to the laboratory control sediment. Two of the samples that were tested (GLC#s 5420 and 5423) showed an effect in four out of six measured endpoints (Table 1 A). Sample GLC# 5423 was acutely toxic to C *iintans,* (i.e., greater than. 50 percent (100%) were dead at 10 days). Sample GLC# 5423 was not acutely toxic to *H. azteca,* however, the 42-day survival was affected. *C. tentans* survival, growth and reproduction and *H. gzteca* survival and reproduction were also affected for the GLC# 542*0 sample.

Overall, it appears that survival was the more sensitive endpoint for both species. *H. azteca* survival was significantly (p^0.05) reduced in four of the sediment samples (GLC#s 5420, 5422, 5423, and 5424), whereas growth was significantly reduced in three of those same four sediment samples (GLC#s 5420, 5422, and 5424). Similarly, *C 'tentans* survival was significantly reduced in **all** but one of the reference sediments, whereas growth and reproduction of the surviving organisms was reduced in only two of the test sediment samples. *C. tentans* is the more sensitive test organism because both the acute and chronic survival was significantly affected, in all the investigative samples and one of thereference sediment samples.

The principal water quality parameters (ammonia/dissolved oxygen and temperature) that have the potential to affect the survival and growth of the organisms, were all measured at concentrations or levels that have been demonstrated to not adversely affect either test organism. There was virtually no correlation between total ammonia in the overlying water and reduced survival (r^2 <; 0.19; 0.001-0.19) for both *C. tentans* and *H. azteca.* The highest"total ammonia concentration was measured in the overlying water of sample GLC# 5420 at 2.18 mg/L. However, that concentration of total ammonia is less than the known lethal effect concentration

for *H. azteca,* which is the more sensitive test species to ammonia [1]. Dissolved oxygen concentrations were also maintained above the known survival criteria for these test organisms [2]. During the tests, when dissolved oxygen dropped below 2.5 mg/L, the renewal frequency of the overlying water was increased to three times daily and feeding was either reduced or stopped until the dissolved oxygenxoricentration in the overlying" water increased to greater than 2.5 mg/L. Temperature was always maintained within the 23±1 °C criteria throughout the toxicity tests. All water quality measurements were performed with overlying water samples just prior to their renewal'. Therefore, the chemistry results (D.O. pH and ammonia) reflect the oldest test solutions and would indicate the lowest D.O. level, for example, to which the organisms would have been exposed. Based on these data, it is clear that the routine water quality parameters measured during the toxicity tests did "not contribute to the toxicity of these sediment samples.

If you have any questions, oHf you would like additional information, please contact either me or Pam Smith at (231) 941-2230. Thank you for the opportunity to provide this service to Battelle and we look forward to continuing to provide environmental services to you in the future.

Sincerely,

Dennis J. McCauley
Principal Research Scientist/
Manager of Operations'

DJM:drh

[1] U.S, Environmental Protection Agency. 1999. Up-date of Ambient Water Quality Criteria for Ammonia, USEPA, Office of Water. EPA-822-R-99-014. August 1998.

[2] USEPA. 1999. ^*Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates,* Second Edition; EPA/600/R-99/064. Office of Water.

TABLE 1A. WHOLE SEDIMENT TOXICITY TEST ENDPOINTS WITH STATISTICALLY SIGNIFICANT DIFFERENCES BETWEEN THE CONTROL AND/OR REFERENCE SEDIMENTS

	GLEC Sediment Sample Identification Numbers					
Test Endpoint	5420	5421	5422	5423	5424	5425
C. tentans 49 day survival	x	x	x	x	x	x
C. tentans 20 day growth	x			x		
C. tentans reproduction (# of egg cases)	x			x		
H. azteca 42 day survival	x		x	x	x	
H. azteca 42 day growth						
H. azteca reproduction (avg # of young)	x	x'				x

Table 1

Comparison of Screening Level 10-d *Chironomus tentans* Survival Bioassay Results and Sediment Analytical Chemistry

Eastland Woolen Mill, Corinna, Maine

Location	Survival	Transformed Survival[a]	Total Chlorobenzene[b]	Total PAHs[c]	Total Pesticides[c]	Lead[c]	Nickel[c]	Chromium[c]	Zinc[c]
	%	%	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Reference	80%	2.214297436	0	0	0	0	0	0	0
RS-99-14	76%	2.117647277	0	3,340	177	28	18	45	197
RS-99-42	21%	0.952067636	4,110	5,550	167	40	23	110	632
RS-99-43	1%	0.200334842	10,300	17,660	376	75	19	312	1,086
RS-99-53	14%	0.766994008	7,330	5,212	353	58	23	114	388
RS-99-51	52%	1.610807001	3,140	2,290	71	47	20	68	176
RS-99-50	62%	1.813162178	760	1,113	9	294	25	29	171
RS-99-85	4%	0.402715842	7,700	7,600	1,687	218	46	414	2,294
RS-99-49	63%	1.83381853	1,070	22,730	97	40	20	16	153
RS-99-96	64%	1.854590436	0	1,000	21	69	25	305	421
RS-99-97	71%	2.004241647	0	2,338	12.2	7.2	12.3	30.8	64.3

Notes:

a. Arc sine transformation ($p' = 2 \arcsin [p]^{A0.5}$) to stabilize error term variances.

b. Validated field GC results.

c. Unvalidated CLP results; totals are approximate pending validation; selected inorganics based on exceedances of benchmarks and reference concentrations.

TABLE 1. 10,28, AND 42 DAY SURVIVAL SUMMARY FOR THE 42-DAY *HYALELLA AZTECA* SURVIVAL, GROWTH AND REPRODUCTION WHOLE SEDIMENT TOXICITY TESTS FOR THE CENTRED ALE WHOLE SEDIMENT TOXICITY ASSESSMENT

GLC NUMBER	TEST MATERIAL (BATTELLE NUMBER)	% SURVIVAL DAY 10*	% SURVIVAL DAY 28**	% SURVIVAL DAY 42***
LAB. CONTROL		95.0	94.2	92.5
5418	RAB SD 5008 0000 01	95.0	95.0	93.8
5419	GMDSD 5007 0000 01	87.5	95.0	97.5
5420	APBSD 4008 0000 01	70.0	88.3	82.5
5421	LPXSD 40110000 01	80.0	94.2	91.3
5422	APB SD 4009 0000 01	100.0	85.0	80.0
5423	APBSD 4010 0000 01	90.0	78.3	73.8
5424	LPXSD 4012 0000 01	73.3®	81.7	77.5
5425	LPXSD 4013 0000 01	87.5	97.5	92.5

* Percent survival based on data from four replicates
** Percent survival based on data from twelve replicates
*** Percent survival based on data from eight replicates
® Percent survival based on data from three replicates

TABLE 2. REPRODUCTIVE DATA SUMMARY FOR THE 42-DAY *HYALELLA AZTECA* SURVIVAL, GROWTH AND REPRODUCTION WHOLE SEDIMENT TOXICITY TESTS FOR THE CENTREDALE WHOLE SEDIMENT TOXICITY ASSESSMENT

GLC NUMBER	TEST MATERIAL (BATTELLE NUMBER)	DAY 35 TOTAL YOUNG REPRO.	DAY 42 TOTAL YOUNG REPRO.	TOTAL YOUNG REPRO.	MALES	FEMALES
LAB. CONTROL		**98**	164	262	**36**	**38**
5418	RAB SD 5008 0000 01	**135**	152	287	**44**	31
5419	GMD SD 5007 0000 01	122	193	315	**31**	45
5420	APB SD 4008 0000 01	21	**74**	**95**	30	**36**
5421	LPXSD4011 0000 01	**86**	**98**	1S4	**39**	33
5422	APB SD 4009 0000 01	**76**	139	215	**32**	31
5423	APB SD 4010 0000 01	**18**	186	204	**29**	30
5424	LPXSD4012 0000 01	**92**	101	193	**29**	34
5425	LPXSD4013 0000 01	**29**	140	169	**37**	**37**

TABLE 3. *HYALELLA AZTECA* 28 AND 42 DAY AVERAGE DRY WEIGHT (GROWTH) AND 42 DAY TOTAL YOUNG PRODUCTION SUMMARY FOR THE CENTRED ALE WHOLE SEDIMENT TOXICITY ASSESSMENT.

GLC NUMBER	**TEST MATERIAL (BATTELLE NUMBER)**	**DAY 28 AVERAGE DRY WEIGHT (mg)***	**DAY 42 AVERAGE DRY WEIGHT** (mg) **	**DAY 42 TOTAL YOUNG REPRODUCTION** ***
LAB. CONTROL		0.349	0.361	262
5418	RABSD 5008 0000 01	0.424	0.348	287
5419	GMD SD 5007 0000 01	0.417	0.325	315
5420	APBSD 4008 0000 01	0.263	0.315	95
5421	LPXSD 4011 0000 01	0.268	0.339	184
5422	APBSD 4009 0000 01	0.309	0.418	215
5423	APBSD 4010 0000 01	0.397	0.491 *I*	204
5424	LPXSD 4012 0000 01	0.288	0.438	193
5425	LPXSD4013 0000 01	0.326	0.331	169

• Average weight based on data from four replicates
Average weight based on data from eight replicates
*** Total young production based on all surviving replicates

TABLE 4. SUMMARY OF THE 10-DAY, 28-DAY, AND 42 DAY *HYALELLA AZTECA* SURVIVAL, GROWTH AND REPRODUCTION FOR THE CENTREDALE WHOLE SEDIMENT TOXICITY ASSESSMENT

GLC NUMBER	TEST MATERIAL (BATTELLE NUMBER)	PERCENT SURVIVAL 10-DAY *	PERCENT SURVIVAL 28-DAY **	PERCENT SURVIVAL 42-DAY ***	28-DAY AVERAGE DRY WEIGHT (mg)*	42-DAY AVERAGE DRY WEIGHT (ms) ***	AVE# YOUNG/ FEMALE
LAB. CONTROL		95.0	94.2	92.5	0.349	0.361	6.9
5418 (RS)"	RAB SD 5008 0000 01	95.0	95.0	93.8	0.424	0.348	9.3
5419 (RS)[A]	GMDSD 5007 0000 01	87.5	95.0	97.5	0.417	0.325	7.0
5420	APB SD 4008 0000 0r"	70.0®	88.3®	82.5®	0.263®	0.315	2.6
5421	LPXSD 40110000 01	80.0	94.2	91.3	0.268®	0.339	5.6
5422	APB SD 4009 0000 01	100.0	85.0®	80.0®	0.309	0.418	6.9
5423	APB SD 4010 0000 01	90.0	78.3®	73.8®	0.397	»' **0.494'***	6.8
5424	LPXSD 4012 0000 01	73.3®	81.7®	77.5®	0.288®	0.438	5.7
5425	LPXSD 4013 0000 01	87.5	97.5	92.5	0.326	0.331	4.6

* Percent survival based on data from four replicates
** Percent survival based on data from twelve replicates
*** Percent survival based on data from eight replicates
® Significantly less than Reference Site Control Data (p0.05)
^ GLC #s 5418 and 5419 are Centredale Reference Sites

TABLE 5 SUMMARY OF MEASURED OVERLYING WATER QUALITY CHEMISTRY FOR THE 42-DAY *HYALELLA AZTECA* SURVIVAL, GROWTH AND REPRODUCTION WHOLE SEDIMENT TOXICITY ASSESSMENT WITH CENTREDALE SEDIMENT SAMPLES

SEDIMENT	WATER QUALITY CHEMISTRY							
CONTROL	Temp. (°C)	pH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	22.9	7.39	6.8	256.8	100.5	143	0.28	0.01
SL Dev.	0.25	0.17	0.67	12.47	4.43	12.38	0.23	0.005
n =	86	35	35	12	4	4	3	7
GLC#5418	Temp. (°C)	pH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	22.9	7.31	6.15	261.0	105.5	112	0.30	0.01
St Dev.	0.21	0.23	1.01	19.94	25.37	19.04	0.28	0.005
n =	86	35	35	12	4	4	3	7
GLC#5419	Temp. (°C)	pH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	22.9	7.18	6.03	253.1	101.5	122	0.42	0.01
St. Dev.	0.23	0.27	1.07	18.81	24.24	16.81	0.60	0.005
n =	86	35	35	12	4	4	3	7
GLC# 5420	Temp. (°C)	pH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	22.8	6.99	5.24	236.1	91.0	137	1.52	0.01
SL Dev.	0.28	0.36	1.63	23.38	11.83	23.18	1.30	0.005
n =	86	35	35	12	4	4	3	7
GLC# 5421	Temp. (°C)	pH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	23.0	7.14	6.34	253.8	91.5	134	0.40	0.01
St Dev.	0.22	0.28	0.88	19.25	10.63	6.93	0.33	0.005
n=	86	35	35	12	4	4	3	7
GLC# 5422	Temp. (°C)	pH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	22.8	7.02	5.50	240.8	90.5	123	0.53	0.01
St Dev.	0.30	0.32	1.32	48.05	13.20	26.20	0.60	0.005
n=	86	35	35	12	4	4	3	7
GLC# 5423	Temp. (°C)	pH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	23.0	7.15	5.88	259.2	99.5	135	0.28	0.01
St Dev.	0.26	0.25	0.97	19.85	4.12	5.03	0.24	0.005
n=	86	35	35	12	4	4	3	7
GLC#5424	Temp. (°C)	pH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	22.9	7.12	6.21	247.1	94.5	127	0.26	0.01
St Dev.	0.29	0.27	0.81	20.38	11.47	11.49	0.07	0.005
n=	86	35	35	12	4	4	3	7
GLC#5425	Temp. (°C)	pH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	22.9	7.13	6.14	255.0	93.5	129	0.97	0.01
StDev.	0.09	0.31	0.97	17.13	11.36	17.09	1.51	0.005
n=	86	35	35	12	4	4	3	7

TABLE 6. 10,28, AND 49 DAY SURVIVAL SUMMARY FOR THE *CHIRONOMUS TENTANS* SURVIVAL, GROWTH, EMERGENCE AND REPRODUCTION WHOLE SEDIMENT TOXICITY TESTS FOR THE CENTRED ALE WHOLE SEDIMENT TOXICITY ASSESSMENT

GLC NUMBER	TEST MATERIAL (BATTELLE NUMBER)	PERCENT SURVIVAL DAY 10*	PERCENT SURVIVAL DAY 20**	PERCENT SURVIVAL DAY 49***	PERCENT ADULT EMERGED @
LAB. CONTROL		95.8	95.8	66.7	85.9
5418	RAB SD 5008 0000 01	68.7	70.8	74.0	94.4
5419	GMDSD 5007 0000 01	**41.7**	41.7	35.4	97.1
5420	APB SD 4008 0000 01	43.7	41.7	47.9	26.1
5421	LPXSD4011 0000 01	20.8	50.0	47.9	100.0
5422	APB SD 4009 0000 01	52.1	62.5	32.3	71.0
5423	APB SD 4010 0000 01	**0.0**[b]	—	—	—
5424	LPX SD 4012 0000 01	27.1	58.3	50.0	100.0
5425	LPX SD 4013 0000 01	25.0	62.5	52.1	100.0

Percent survival based on larvae from four replicates

*** Percent survival based on larvae, pupae, and adults from four replicates

Percent survival based on larvae, pupae, and adults from eight replicates

@ Percent adult emergence of those surviving after Day 49.

b There was 100 percent mortality in all twelre replicates after 10-days for sample GLC# 5423.

TABLE 7. REPRODUCTIVE DATA SUMMARY FOR THE *CHIRONOMUS TENTANS* SURVIVAL, GROWTH, EMERGENCE AND REPRODUCTION WHOLE SEDIMENT TOXICITY TESTS FOR THE CENTRED ALE WHOLE SEDIMENT TOXICITY ASSESSMENT

GLC NUMBER	TEST MATERIAL (BATTELLE NUMBER)	#1°EGG* CASES OVIPOSITED	MEAN#1° EGGS" PRODUCED	#2° EGG CASES[b] OVIPOSITED	MEAN #2° EGGS[b] PRODUCED	# MALES EMERGED	# FEMALES EMERGED
LAB. CONTROL		23	997	13	239	23	32
5418	RAB SD 5008 0000 01	32	1366	20	295	24	43
5419	GMDSD 5007 0000 01	14	1441	13	328	18	15
5420	APB SD 4008 0000 01	2	1219	1	224	8	4
5421	LPXSD4011 0000 01	26	1279	18	259	11	35
5422	APB SD 4009 0000 01	13	1291	10	300	6	16
5424	LPXSD4012 0000 01	29	1213	19	263	15	33
5425	LPXSD4013 0000 01	21	1268	18	3.77	26	24

1 ° = Number of primary egg cases or eggs produced.
2° = Number of secondary egg cases or eggs produced.

TABLE 8. 20-DAY ASH-FREE DRY WEIGHTS (AFDW) FOR THE *CHIRONOMUS TENTANS* SURVIVAL, GROWTH, EMERGENCE AND REPRODUCTION WHOLE SEDIMENT TOXICITY TESTS FOR THE CENTRED ALE SEDIMENT TOXICITY ASSESSMENT

GLC NUMBER	TEST MATERIAL (BATTELLE NUMBER)	DAY 20 MEAN AFDW (mg/organism)*
LAB. CONTROL	n/a	1.106
5418	RABSD 5008 0000 01	1.780
5419	GMDSD 5007 0000 01	2.173
5420	APB SD 4008 0000 01	0.685
5421	LPXSD4011 0000 01	1.937
5422	APB SD 4009 0000 01	1.900
5423**	APB SD 4010 0000 01	—
5424	LPXSD 4012 0000 01	1.729
5425	LPXSD 4013 0000 01	1.799

* Mean ash free dry weight (AFDW) based on data from four replicates
** 0% survival at day 10

TABLE 9. SUMMARY OF *CHIRONOMUS TENTANS* SURVIVAL, GROWTH, EMERGENCE AND REPRODUCTION FOR THE CENTREDALE WHOLE SEDIMENT TOXICITY ASSESSMENT (INCLUDING LARVAE, PUPAE, AND ADULTS)

GLC NUMBER	TEST MATERIAL (BATTELLE NUMBER)	PERCENT SURVIVAL DAY 10*	PERCENT SURVIVAL DAY 20*	PERCENT SURVIVAL DAY 49 **	DAY 20 AFDW (mg/ organism)*	#1°EGG CASES OVIPOSITED	MEAN#1° EGGS PRODUCED
LAB. CONTROL	n/a	95.8	95.8	66.7	1.106	23	997
5418 (RS)[A]	RAB SD 5008 0000 01	68.7	70.8	74.0	1.780	32	1366
5419 *(RSy*	GMD SD 5007 0000 01	41.7	41.7	35.4	2.173	14	1441
5420	APB SD 4008 0000 01	43.7®	41.7®.	47.9®	0.685®	2@	1219
5421	LPXSD4011 0000 01	20.8®	50.0®	47.9®	1.937	26	1279
5422	APB SD 4009 0000 01	52.1®	62.5®	32.3®	1.900	13	1291
5423	APB SD 4010 0000 01	0.0®	…	…	….	…	…
5424	LPXSD 4012 0000 01	27.1®	58.3®	50.0®	1.729	29	1213
5425	LPX SD 4013 0000 01	25.0®	• 62.5®	52.1®	1.799	21	1268

* Percent survival based on data from four replicates
** Percent survival based on data from.eight replicates
@ Significantly less than Laboratory Control Data (psO.05)
[A] GLC #s 5418 and 5419.are Centredale Reference Sites

TABLE 10. SUMMARY OF MEASURED OVERLYING WATER QUALITY CHEMISTRY FOR THE *CHIRONOMUS TENTANS* SURVIVAL, GROWTH, EMERGENCE AND REPRODUCTION WHOLE SEDIMENT TOXICITY ASSESSMENT WITH CENTRED ALE SEDIMENT SAMPLES

SEDIMENT	WATER QUALITY CHEMISTRY							
CONTROL	Temp. CC)	pH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	23.0	6.95	4.0	264.2	99.0	117	0.36	0.01
St. Dev.	0.43	0.22	1.01	17.17	6.22	32.72	0.20	0.005
n =	101	45	45	14	4	4	4	7
GLC#5418	Temp. (°C)	PH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	23.1	6.83	3.6	246.1	97.5	97	0.45	0.01
St. Dev.	0.45	0.16	1.02	13.04	26.3	29.86	0.27	0.005
n =	101	45	45	14	4	4	4	7
GLC#5419	Temp. rc>	PH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	23.0	6.78	3.42	239.9	90.5	103	1.02	0.01
St. Dev.	0.43	0.16	0.98	9.34	14.73	48.15	0.53	0.005
n =	101	45	45	14	4	4	4	7
GLC# 5420	Temp. (°C)	PH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	22.9	6.70	2.70	234.2	80.5	74	2.18	0.01
St. Dev.	0.41	0.18	1.22	18.97	26.15	47.54	1.34	0.005
n =	101	45	45	14	4	4	4	7
GLC# 5421	Temp. CC)	PH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	23.0	6.79	3.63	248.1	99.5	77	0.64	0.01
St. Dev.	0.45	0.18	0.97	16.51	24.68	45.33	0.18	0.005
n =	101	45	45	14	4	4	4	7
GLC# 5422	Temp. CC)	PH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	22.8	6.76	3.31	239.4	97.0	59.5	0.96	0.01
St. Dev.	0.42	0.18	0.99	22.69	38.97	49.97	0.41	0.005
n =	101	45	45	14	4	4	4	7
GLC# 5423	Temp. CC)	PH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	23.0	6.91	4.3	268.0	82	72	0.27	0.02
St. Dev.	0.18	0.28	1.09	24.27				
n =	22	11	11	3	1	1	1	1
GLC# 5424	Temp. (°C)	PH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	22.7	6.82	4.16	241.4	83.5	108.5	0.55	0.01
St. Dev.	0.29	0.19	1.08	12.67	19.28	30.91	0.48	0.005
n =	101	45	45	14	4	4	4	7
GLC# 5425	Temp. CC)	pH (s.u.)	D.O. (mg/L)	Sp. Cond. µmho's	Alk. (mg/L)	Hard. (mg/L)	Ammonia (mg/L)	Chlorine (mg/L)
Mean	22.8	6.81	4.03	250.1	83.5	78	1.98	0.01
St. Dev.	0.28	0.15	1.02	18.76	2.94	58.59	1.32	0.005
n =	101	45	45	14	4	4	4	7

APPENDIX A

HYALELLA AZTECA LABORATORY DATA

Battt. . Centredale *Hyalella azteca* Replicate Data.

		SURVIVAL (%)			GROWTH (mg)		REPRODUCTION (# young])				
Control	Rep	10-Day	28-Day	42-Day	28-Day	42-Day	35-Day	42-Day	Total	Males	Females
	1		100	100		0.2770	11	20	31	5	5
	2		100	90		0.3730	5	29	34	4	5
	3		100	100		0.3130	16	17	33	6	4
	4		100	100		0.3430	4	20	24	6	4
	5		90	100		0.3200	36	21	57	3	7
	6		90	90		0.3810	2	16	18	5	4
	7		70	70		0.4560	9	14	23	3	4
	8		90	90		0.4210	15	27	42	4	5
	9		100		0.3290						
	10		100		0.3190			Total #	262		38
	11		100		0.3640						
	12		90		0.3830		Ave. # Young/Female		6.9		
	13	90									
	14	100									
	15	90									
	16	100									
	Mean	95	94.2	92.5	0.3488	0.3605	12.3	20.5	53.1		
	Maximum	100	100	100	0.3830	0.4560	36	29	262		
	Minimum	90	70	70	0.3190	0.2770	2	14	6.894737		

Battelle Centredale *Hyalella azteca* Replicate Data.

5418	Rep	SURVIVAL (%) 10-Day	28-Day	42-Day	GROWTH (mg) 28-Day	42-Day	REPRODUCTION (# young) 35-Day'	42-Day	Total	Males	Females
	1		90	90		0.3890	15	21	36	6	3
	2		90	90		0.3640	25	23	48	4	5
	3		100	100		0.3180	19	27	46	6	4
	4		90	90		0.3620	5	6	11	7	2
	5		100	100		0.3410	5	17	22	5	5
	6		100	90		0.3770	27	34	61	3	6
	7		100	90		0.3240	31	2	33	8	1
	8		100	100		0.3070	8	22		5	5
	9		90		0.3980						
	10		90		0.3960			Total #	257		31
	11		100		0.4670						
	12		100		0.4360		Ave. # Young/Female		8.3		
	13	100									
	14	90									
	15	100									
	16	90									
	Mean	95	95.8	93.8	0.4243	0.3478	16.9	19.0	58.0		
	Maximum	100	100	100	0.4670	0.3890	31	34	257		
	Minimum	90	90	90	0.3960	0.3070	5	2	8.290323		

Batte,.- Oentredale *Hyalella azteca* Replicate Data.

C

		SURVIVAL (%)			GROWTH (mg)		REPRODUCTION (# young)				
5419	Rep	10-Day	28-Day	42-Day	28-Day	42-Day	35-Day	42-Day	Total	Males	Females
	1		100	100		0.3130	22	39	**61**	**3**	6
	2		100	90		0.3160	24	31	55	**4**	5
	3		100	100		0.3010	2	0	**2**	**1**	8
	4		100	100		0.3040	18	45	**63**	**3**	7
	5		100	100		0.3620	20	28	**48**	**4**	6
	6		90	90		0.3470	11	26	37	**3**	6
	7		100	100		0.3470	14	7	**21**	**7**	3
	8		100	100		0.3070	11	17	**28**	**6**	4
	9		70		0.2540						
	10		90		0.4220			Total #	315		45
	11		100		0.5070						
	12		90		0.4840		Ave. # Young/Female		7.0		
	13	100									
	14	100									
	15	**80**									
	16	70									
	Mean	**87.5**	95.0	97.5	0.4168	0.3246	**15.3**	**24.1**	**63.7**		
	Maximum	100	**100**	100	0.5070	0.3620	**24**	**45**	**315**		
	Minimum	70	70	90	0.2540	0.3010	2	0	**2**		

Battelle Centredale *Hyalella azteca* Replicate Data.

5420	Rep	SURVIVAL (%) 10-Day	28-Day	42-Day	GROWTH (mg) 28-Day	42-Day	REPRODUCTION (# young) 35-Day	42-Day	Total	Males	Females
	1		90	90		0.2860	2	2	4	5	4
	2		90	90		0.3060	0	23	23	4	5
	3		80	80		0.2850	10	17	27	2	6
	4		90	70		0.2730	2	4	6	3	4
	5		100	90		0.2790	0	7	7	3	6
	6		100	100		0.2750	1	7	8	6	4
	7		90	70		0.3990	4	7	11	5	2
	8		70	70		0.4140	2	7	9	2	5
	9		90		0.2330						
	10		80		0.4550			Total #	95		36
	11		100		0.1220						
	12		80		0.2410		Ave. # Young/Female		2.6		
	13	60									
	14	80									
	15	80									
	16	60									
	Mean	70	88.3	82.5	0.2628	0.3146	2.6	9.3	19.3		
	Maximum	80	100	100	0.4550	0.4140	10	23	95		
	Minimum	60	70	70	0.1220	0.2730	0	2	2.638889		

Batten Jentredale *Hyalella azteca* Replicate Data.

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5421	Rep	SURVIVAL (%) 10-Day	28-Day	42-Day	GROWTH (mg) 28-Day	42-Day	REPRODUCTION (# young) 35-Day	42-Day	Total	Males	Females
	1		90	80		0.3230	9	10	19	5	3
	2		100	100		0.2780	12	9	21	5	5
	3		100	100		0.3210	14	10	24	6	4
	4		100	90		0.2910	17	20	37	4'	5
	5		100	100		0.3520	8	12	20	6	4
	6		90	90		0.4120	6	11	17	5	4
	7		80	80		0.3750	12	5	17	4	4
	8		80	90		0.3580	8	21	29	4	4
	9		100		0.2200						
	10		100		0.2780.			Total #	184		33
	11		90		0.3090						
	12		100		0.2640		Ave. # Young/Female		5.6		
	13	90									
	14	60									
	15	80									
	16	90									
	Mean	80	94.2	91.3	0.2678	0.3388	10.8	12.3	37.4		
	Maximum	90	100	100	0.3090	0.4120	17	21	184		
	Minimum	60	80	80	0.2200	0.2780	6	5	5.575758		

Battelle Centredale *Hyalella azteca* Replicate Data.

5422	Rep	SURVIVAL (%) 10-Day	28-Day	42-Day	GROWTH (mg) 28-Day	42-Day	REPRODUCTION (# young) 35-Day	42-Day	Total	Males	Females
	1		100	90		0.3400	6	32	38	4	5
	2		90	90		0.3990	15	31	46	4	5
	3		60	50		0.3380	14	16	30	2	2
	4		90	90		0.4660	2	16	18	6	3
	5		80	70		0.4530	12	7	19	4	3
	6		90	90		0.4680	5	6	11	6	3
	7		70	60		0.4770	15	15	30	1	5
	8		90	100		0.4020	7	16	23	5	5
	9		90		0.323						
	10		80		0.161			Total #	215		31
	11		100		0.396						
	12		80		0.354		Ave. # Young/Female		6.9		
	13	100									
	14	100									
	15	100									
	16	100									
	Mean	100	85.0	80.0	0.3085	0.4179	9.5	17.4	43.7		
	Maximum	100	100	100	0.3960	0.4770	15	32	215		
	Minimum	100	60	50	0.1610	0.3380	2	6	6.935484		

Battfc... Jentredale *Hyalella azteca* Replicate Data.

C

5423	Rep	SURVIVAL (%) 10-Day	28-Day	42-Day	GROWTH (mg) 28-Day	42-Day	REPRODUCTION (# young) 35-Day	42-Day	Total	Males	Females
	1		90	90		0.4220	1	15	16	b	4
	2		70	70		0.5140	6	27	33	3	4
	3		70	70		0.5260	3	26	29	3	4
	4		80	80		0.5040	4	34	38	3	5
	5		90	70		0.5340	2	22	24	4	3
	6		100	100		0.3960	2	22	24	5	5
	7		70	70		0.4570	0	20	20	4	3
	8		50	40		0.5780	0	20	20	2	2
	9		80		0.4940						
	10		90		0.2740			Total #	204		30
	11		80		0.3790						
	12		70		0.4390		Ave. # Young/Female		6.8		
	13	80									
	14	80									
	15	100									
	16	100									
	Mean	90	78.3	73.8	0.3965	0.4914	2.3	23.3	41.5		
	Maximum	100	100	100	0.4940	0.5780	6	34	204		
	Minimum	80	50	40	0.2740	0.3960	0	15	6.8		

Battelle Centredale *Hyalella azteca* Replicate Data.

5424	Rep	SURVIVAL (%) 10-Day	28-Day	42-Day	GROWTH (mg) 28-Day	42-Day	REPRODUCTION (# young) 35-Day	42-Day	Total	Males	Females
	1		100	100		0.3180	11	5	16	6	4
	2		**90**	**90**		0.3060	12	9	21	3	6
	3		100	100		0.3580	29	17	46	4	6
	4		100	100		0.3760	14	13	27	2	8
	5		**60**	**60**		0.4830	12	21	33	3	3
	6		**40**	**40**		0.5180	1	3	4	3	1
	7		**30**	**30**		0.7500	5	3	8	2	1
	8		100	100		0.3960	8	30	38	6	5
	9		80		0.2950						
	10		80		0.3140			Total #	193		34
	11		100		0.1950						
	12		100		0.3470		Ave. # **Young/Female**		5.7		
	13	60									
	14	80									
	15										
	16	80									
	Mean	73.333	**81.7**	77.5	0.2878	0.4381	**11.5**	**12.6**	**39.2**		
	Maximum	80	100	100	0.3470	0.7500	**29**	**30**	**193**		
	Minimum	60	**30**	**30**	0.1950	0.3060	**1**	**3**	**4**		

A

Battelie Centredale *Hyalella azteca* Replicate Data.

		SURVIVAL (%)			GROWTH (mg)		REPRODUCTION (# young)				
5425	Rep	10-Day	28-Day	42-Day	28-Day	42-Day	35-Day	42-Day	Total	Males	Females
	1		100	100		0.3870	4	22	26	5	**5**
	2		**90**	**90**		0.2960	7	20	27	4	**5**
	3		100	**90**		0.3240	2	12	14	5	**4**
	4		100	**90**		0.2610	2	17	19	4	**5**
	5		100	100		0.3400	11	19	30	5	**5**
	6		**90**	**90**		0.3740	0	27	27	3	**6**
	7		100	**90**		0.2980	3	19	22	4	**5**
	8		100	**90**		0.3640	0	4	4	7	**2**
	9		**90**		0.2940						
	10		100		0.2680			Total #	169		**37**
	11		100		0.3460						
	12		100		0.3970		**Ave. # Young/Female**		**4.6**		
	13	**90**									
	14	**80**									
	15	**90**									
	16	**90**									
	Mean	**87.5**	**97.5**	**92.5**	0.3263	0.3305	**3.6**	**17.5**	**34.3**		
	Maximum	**90**	**100**	**100**	0.3970	0.3870	**11**	**27**	**169**		
	Minimum	**80**	**90**	**90**	0.2680	0.2610	**0**	**4**	**4**		

GLEC Great Lakes Environmental Center [redacted]

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 1Q
WATERBATH _J_

Date: 8-31-01
GLC# 5418
Test Material: fiflfe-So-SOOfi- 6n00-01
Test Species: *Hyalella azteca*
Technician Initials: 305/mw

Food: YTC Batch # 6-8-01
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: £v.
7:45 am renewal
7:u pm renewal

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 21
^Screens

Replicate	Temperature °C •	DO mVL	1 ml YTC Fed	pH s.u	Con^oertvity umos	Observations /10 Day Survival Data for Replicates 13, 14, 15, 16
1			P*			NAV
2						
3						
4 *	22.9					
5						
6						
7						FOS
8						FOS
9						
10						
11						
12						NAV
13 *	22.9					#organisms surviving: |0
14						^organisms surviving: 9f
15						//organisms surviving: / 0
If						// inisms surviving 9 / 7

NX=3B5

GLEC [redacted]

Great Lakes Environmental Center

Hyalella azteca'42 Day Life Cycle Test

TEST DAY: 28 Chronic Survival/Reproduction fWater Only)

WATERBATH 1

Date: 8-29-01
GLC# 5418
Test Material: fjAfe" SD -5008 -<?Pa<> • 01
Test Species: *Hyalello azteca*
Technician Initials: 5BS /HM

No. Organisms/Chamber: 10
Food: YTC Batch *H* *-9-01
Age/Source of Organisms: *7-Zd AMz. /ECT*
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: ^
Q\0t> am renewal: pm renewal: *i'Oo*

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23

M Screens

Replicate	Temp. °C	FED	pH s.u.	D.O. mg/L	Conductivity /itnos	Alkalinity mg/L	Hardness mg/L	Ammonia mg/L	Observations on Sediment/ Behavior of Hyalella
1		k4							^transferred to water only: 9
2									^transferred to water only: 9
3 *	23.1		7.58	6.1	239	96	HM 124	0.43	^transferred to water only: 10
4									//transferred to water only: M
5									^transferred to water only: j Q
6									^transferred to water only: Q
7									//transferred to water only: [Q
8									^transferred to water only: 1 Q
9									//surviving: °j ADW: 0. 5^
10*	53.0								//surviving: ^ ADW: 0 . 3 ^ ^
II									//surviving: $ ADW: 0 - 4 ^ 7
12						>-j.			//surviving: N ADW: 0 -H^Q;

QC=5BS

hyaiella uztecu *2 *hny* LircOyctc Test
TEST DAY: 35 Water Only/Reproduction
WATERBATH _J_

Date: 9-5-01
GLC#: 5418
Test Material: f^ffft- SD·5008· 33P0 - 01
Test Species: HYAIC11a OZTECA
Technician Initials: JBS / HM / MW

Food: YTC Batch U 9-9-01
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: £
JBS 1145 am renewal
cf K' pm renewal

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23

Rcplicnte	Tcmpernture °C	1 ml YTC Fed	pH s.u.	D.O. mg/L	Observations
1		iy			//young) ^ //gravid 3 //surviving ^ Icf
2					//young "c^ • 5 //gravid \ //surviving °\ IC P
3 *	22.9		•7.33	7.9	^young \ °\ //gravid \ , //surviving IO 2 c P
4					//young .S #gravid \ ^surviving ^ 1 C^
5					#young ^5 //gravid \ //surviving % **1 cr**
6 *	22.9		7.MS	. *1.2*	#young ^>^^ //gravid ^ ^surviving \ Q \ C f
7					//young '3> 1 //gravid 5) ^surviving n **3 cf**
8		↓			//younu o //gravid 3> //survivinj» I ^ ^ ^ **p**

QC=JBS

[redacted]

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 42 WATER ONLY

WATERBATH _1

Date: 9-12-01
GLC# 5418
Test Material: EAfe- S>-SooS"C£Oft- 81
Test Species: *Hyalella azteca*
Technician Initials: JBS /MW

No. Organisms/Chamber /o
Age/Source of Organisms: 7-Xdays jgq-..
jDverlying Water: Dechlorinated municipal water

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23

9:00 AM renewed

Replicate	Temperature °C	Observations 42-Day Survival Hyalella				
I		# surviving adults 0	//young ai	//females 2	//males £	//gravid O
2 *	22.9	# surviving adults 0	#young 23	//females 5	//males ^	#gravid ^
3		# surviving adults 10	#young 37	//females tj	#males £?	//gravid j
4		# surviving adults 9	//young 6	//females a	//males 7	#gravid 1
5		# surviving adults 10	//young 17	#females 5	//males £	#gravid ^
6		U surviving adults 9-	//young 34	//females 6	^rnale? 3	#gravid 1
7 ¥	33.2	// surviving adults 0 1	//young 2	//females [	#males P	//gravid (^)
8		# surviving adults 10	//young ps	//females S	//males 5	//gravid 1

51 44

QC=JBS

13 C3

GLEC 5419

Great Lakes Environmental Center

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 10
WATERBATH _L

Date: 8-11-01 Food: YTC Batch # 6-8-01 Test System: 175 mL Delivery System
GLC# 5419 Overlying Water: Dechlorinated municipal water Photoperiod: 16:8
Test Material: (;)17Vv <r> - SDo"?_- ot>(?o-o) # of Daily Renewals : JbL Test Temperature (°C): 21
Test Species: *Hyalella azteca* ~) :L| f am renewal
Technician Initials: lli /MW 7: SO pm renewal "bfecreens
T

Replicate	Temperature °C •	DO mg/L	1 ml YTC Fed	pH s.u.	Condjiciivfty µmos	Observations/10 Day Survival Data for Replicates 13, 14, 15, 16
1			PS			NAV
2						NfY^ P'Ob
3						IAV
4 *	22.9					NAV
5						FOS
6						FOS
7						
8						
9						FOS
10						FOS
11						FOS
12						NAY FOS
13 *	22.9					^organisms surviving: \ (^
14						#organisms surviving: \0
15			↓			//organisms surviving: 0
If						//• jiiisnis survivinu: 0

GC = 3 BS

GLEC 5419

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 28 Chronic Survival/Reproduction (Water Only)

WATERBATH 1

Date: 8-29-01
GLC# 5419
Test Material: Q mo - S p *500 7 - QOOO - oT
Test Species: *Hyalella azteca*
Technician Initials: JBS/HM

No. Organisms/Chamber: 10
Food: YTC Batch # f-9-01
Age/Source of Organisms: " 7 - ^ 5 /ECT
.. Overlying Water: Dechlorinated municipal water
# of Daily Renewals: <P
tf\oo am renewal: pm renewal: *b'.oo.*

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23
El Screens

Replicnte	Temp. °C	FED	pH s.u.	D.O. mg/L	Conductivity //mos	Alkalinity mg/L	Hardness mg/L	Ammonia mg/L	Observations on Sediment/ Behavior of Hyalella
I		Fed							^transferred to water only: | Q
2									^transferred to water only: \Q 5.GP
3 *	23.i		7.57	5.8	228	96	IH-o	0.36	^transferred to water only: *j(j*
4									//transferred to water only: *j(J*
5									^transferred to water only: *[Q*
6									^transferred to water only:
7									transferred to water only: *[Q*
8									^transferred to water only: *1/r)*
9									^surviving: ' -"] ADW:Q.^5H
10 *	22.9								^surviving: °\ ADW: Q . 'tj^
11									^surviving: \0 ADW: Q % 507
12		+							#surviving: ADW: 0 -H^M

QC=JBS

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GLEC [redacted]

Great Lakes Environmental Center

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 10
WATERBATH 1

Date: 8-11-01
GLC# 5420
Test Material: A^ft-SD- *Horff-* oooo-Oi
Test Species: *Hyalella azteca*
Technician Initials: JBS

Food: YTC Batch # 6-8-01
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: «3v
7:45 am renewal
7,30 pm renewal

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23

SScreens

Replicate	Temperature °c •	DO mg/L	1 ml YTC Fed	A	ConcUicifdty wi\os	Observations /10 Day Survival Data for Replicates 13, 14, 15, 16
1			JBS			NAV red/brown fungus/bacteria
2						
3						
4 *	22.8					
5						
6						√WAV !
7						IAV
8						KJftV ^
9						NAV
10						IAV
11						**MM 0**
12						W W • f
13 *	22.6					^organisms surviving: (, ^-...
14						#organisras surviving: §
15			√			//organisms surviving: 8
If						ik •nisms surviving s7

Cr - JBS

GLEC [redacted]

Great Lakes Environmental Center

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 28 Chronic Survival/Reproduction (Water Only)

WATERBATH _] _ I

Date: 8-29-01
GLC# 5430
Test Material: fifb' SD- 4008- CTOOO-Q 1
Test Species: *Hyalella azteca*
Technician Initialsj^>jB5 / HM, I (lm

No. Organisms/Chamber: 10
Food: YTC Batch // 8 - ^
Age/Source of Organisms: 7-8 days /ECT
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: ^
qico am renewal: pm renewal: £ '•"^

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23

^Screens

Replicate	Temp. °C	FED	pH s.u.	D.O. mg/L	Conductivity *fimos*	Alkalinity mg/L	Hardness mg/L	Ammonia mg/L	Observations on Sediment/ Behavior of Hyalella
1		&4							^transferred to water only: ^
2									^transferred to water only: °j -3- *CP*
3 *	32/7		7.35	5,0	236	168	84	2.09	^transferred to water only: *f*
4									^transferred to water only: 7
5									transferred to water only: /0
6									//transferred to water only: /O
7									^/transferred to water only: 9
8									//transferred to water only: "7
9									//surviving: Cj ° ADW: Q , 2.33
10 *	sat								^surviving: ^ *O* ADW: § *LICQ*
11									//surviving: IQ ADW: 0. 1X2
12		V							^surviving: *T* ADW: Q) . ^H\

QC=JBS

GLEC

Hyalella azteca 42 bay Lne Cycle Test

TEST DAY: 35 Water Only/Reproduction

WATERBATH __

Date: 9-5-01
GLC# 5420
Test Material: APB· SP 4008· 0000·01
Test Species: i«jiallela azteca
Technician Initials: JBS/MW

Food: YTC Batch # 8-9-01
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: <?
9:45 am renewal
915 pm renewal

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23

Replicate	Temperature °C	1 ml YTC Fed	pH s.u.	D.O. mg/L	Observations	
1		dfw			#young ^ //gravid 3 //surviving °i	
2		V)			//young 0 //gravid £ //surviving °|	ICP
3 *	23.1		7.40	to	#young)Q //gravid ^ #surviving •7	ICP
4					flyoung ^ #gravid) //surviving 7	
5					#young 0 //gravid <P. ^surviving <j	ICP
6 *	22.9		7.43	If	//young j //gravid ^ //surviving 1^	ICP
7					//young 1j //gravid J //surviving 7 •	
8					//youn>, J^ //gravid P //surviving 7	JCP

QC=JBS

GLEC

[redacted]

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 42 WATER ONLY

WATERBATH _J_

Date: 9-12-01
GLC# 5420
Test Material: APS • SD-4008 • oOoD' OI
Test Species: *Hyalella azteca*
Technician Initials: JBS / mJD

No. Organisms/Chamber 10
Age/Source of Organisms \l-%d*^?> / e of
Overlying Water: Dechlorinated municipal water

Test System: 175 ml Delivery System
PhotoperioJi: 16:8
Test Temperature (°C): 23.

Q'.oo Ad. Recd

Replicate	Temperature °C	Observations 42-Day Survival Hyalella					
1		# surviving adults 9	//young <A	//females ^j	#males 5"	//gravid J
2 *	23.1	# surviving adults 9	//young Q -^	//females £>	//males *j	//gravid (")
3		# surviving adults 8	//young]*-j	^females (^	//males P	#gravid /
4		# surviving adults 7	#young U	//females *L]	//males J	//gravid I
5		# surviving adults 9	#young ^	//females fa	#males 2	//gravid (2)
6		*it* surviving adults 10	//young "'y	//females M	//males (y	//gravid CJ
7 *	23.1	*H* surviving adults 1	//young ~|	//females $.	//males £	//gravid Q)
8		# surviving adults 7	#young rj	//females 5"	#males Q.	#gravid 0

46 30

QC-JBS

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GLEC 5491

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 10
WATERBATH 1

Date: 8-11-01
GLC# 5491
Test Material: A LPx -SD-401-0000-01
Test Species: *Hyalella azteca*
Technician Initials: JBS

Food: YTC Batch U 6-8-01
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: 2*
7:45 am renewal
7:30 pm renewal

Test System: 175 mL Delivep/ System
Photoperiod: 16:8
Test Temperature (°C): 23
^Screens

Replicate	Temperature °C •	ao/ mgnl,	1 ml YTC Fed	pH s.u.	Cond^c^M!y / ' V	Observations /10 Day Survivnl Data for Replicates 13, 14, 15, 16
I			✓			Dil't
2			✓			NAV
3			✓			)
4 *	22.9		✓			)
5			✓			)
6			✓			)
7			✓			)
8			✓			)
9			✓			/WKs/
10			✓			IAV
11			✓			TV/IW
12			✓			NAV
13 *	&<		✓			^organisms surviving: M
14			✓			//organisms surviving: (,,
15			✓			//organisms surviving: o
16			✓			//(nisms survivinu: 7

AV = JBS

GLEC 5421

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 28 Chronic Survival/Reproduction fWater Only)

WATERBATH 1

Date: 8-29-01
GL # 5421
Test Material: M^X-Sp- qoii-QOoa-o<
Test Species: *H vale I la azteca*
Technician Initials: 3B | HM

No. Organisms/Chamber: 10
Food: YTC Batch # jT-9-0
Age/Source of Organisms: /^Acu^s /ECT
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: ^ jS^Screens
9:00 am renewal: pm renewal: (.:oi

Test System: 175 mL • Delivery System
Photoperiod: \ 16:8:
Test Temperature (°C): 23

Rcplicnte	Temp. °C	FED	PH s.u.	D.O. mjG/L	Conductivity /^mos	Alkalinity rng/L	Hardness mg/L	Ammonia mg/L	Observations on Sediment/ Behavior of Hyalella
I		Fed							#transferred to water only: 9
2									^transferred to water only: [Q
3 ^	23.2		7.59	6.5	248	136 HM	94	0.69	^transferred to water only: 1 VJ
4									fftransferred to water only: i Q^
5									^transferred to water only: \ 0
• 6									•3^ c- i«^is P\ r^L p ^ r S p. #transferred to water only: ^
7									/^transferred to water only: ^
8 •									^transferred to water only: ^
9									^surviving: 0 -ADW:0.^O
10*	23.1								^surviving: I 0 ADW:Q, ^~J^
II									^surviving: ^ ADW:0-3>^
12									#SUrVivitQi: [Q ADW: QjXlo^

QC =535

GLEC 5421

Page C

Hyalella azteca 42 bay Lire Cycle Test

TEST DAY: 35 Water Only/Reproduction

WATERBATH _J_

Date: 9-5-01
GLC#: 5421
Test Material: LPVc - SD-40H- oo^o- pi
Test Species: \ifjaHiia azteca
Technician Initials: JBS / HM / mw

Food: YTC Batch U 8-9-01
Overlying Water: Dechlorinated municipal water
ti of Daily Renewals: j*
:45 am renewal
Qi {<£ pm renewal

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 21

Replicate	Temperature °C	•1 ml YTC Fed	pH s.u.	D.O. mg/L	Observations
1		fed			//young 9 //gravid 3 //surviving 9 icp
2		A)/			//young j 3^ //gravid 3 //surviving 10 Id?
3 *	23.1		7.M	8.0	//young 1[1]- #gravid 3 #surviving io 2 cp
4					#young |~| //gravid 4 //surviving 9 icp
5					//young % //gravid 2 //surviving 10 1 Cf
6 *	23.1		7.^	*IS*	//young kj % #gravid 3 //surviving % ^ cp
7		↓			//young 1c^ //gravid 4 //surviving % 1 cp
8					//young % //gravid 2 //surviving % 1 CP

QC=JBS

5421

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 42 WATER ONLY

WATERBATH J

Date: 9-12-01
GLC# 5421
Test Material: LPX-SD-4011-0000-01
Test Species: *Hyalella azteca*
Technician Initials: JBS/AM

No. Organisms/Chamber 10
Age/Source of Organisms: 7-8 days/ TLCT
.Overlying Water: Dechlorinated municipal water

Test System: "' 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23

9:00 Am renewal

Replicate	Temperature °C	Observations 42-Day Survival Hyalella				
1		U surviving adults r	#young /Q	//females 3	//males S	//gravid 0
2 *	23.2	# surviving adults JO.	//young 1	//females 5	^rnales S	//gravid ^2
3		# surviving adults 10	#young JQ	//females H	//males' 6	//gravid 3
4		# surviving adults <f	#young 20	//females 5	//males M	//gravid O
5		•# surviving adults /Q	#young M	//females H	//males fc>	//gravid I
6		// surviving adults <?	//young //	//females M	//males 6	//gravid |
7 ¥	W\	U surviving adults r	//young 5	//females H	//males M	//gravid c?-
8		# surviving adults 1	#young 2021	//females 4	//males Li	#gravid 0

•9 39

#8 QC: JBS

8 weighed

GLBC

Great Lakes Environmental Center

5432

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 10

WATERBATH_L '

Date: 2-))~0\
GLC#: 5432
Test Material:- ftP6-Sfr. fCo^ - 0005:0
Test Species: *Hyalella azteca*
Technician Initials: JBS/mw

Food: YTC Batch # 6-8-01
Overlying Water: Dechlorinated municipal water
U of Daily Renewals: £*
7-i^f am renewal
"7.'jo P^m renewal

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 21

X Screens

Replicate	Temperature °c •	D.O/ mOL	1 ml YTC Fed	pH s.u	Cond Vctiy.ky'	Observations /10 Day Survival Data for Replicates 13, 14, 15, 16
1			B			NAN
2						
3						
4 *	22.6					
5						
6						
7						
8						
9						
10						
11						
12						NAV
IS * ""	22.2				^organisms surviving: 10	22.2
14 -					^organisms surviving: j Q	->^
15					//organisms surviving: 10	
16					//(nisms surviving- \0	//•thy

/OF JBS

GLEC 5422

Great Lakes Environmental Center

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 28 Chronic Survival/Reproduction fWater Only)

WATERBATH 1

Date: 8-29-01
GLC# 5422
Test Material: ftPfrSrv H 009-ccoo-ot
Test Species: *Hyalella azteca*
Technician Initials: Jg? /BM

No. Organisms/Chamber: 10
Food: YTC Batch # 8-9-01
Age/Source of Organisms: *1-tdtijS /ECT*
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: £ (^Screens
q-oa am renewal: pm renewal: *(,'.&?*

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23

Replicate	Temp. °C	FED	pH s.u.	D.O. mg/L	Conductivity ^mos	Alkalinity mg/L	Hardness mg/L	Ammonia mg/L	Observations on Sediment/ Behavior of Hyalella
I		Fed							^transferred to water only: cA^Sp* rA f 1
2									#transferred to water only:
3 *	39.?		7.59	5.5	230	90	1M-0	0.59	transferred to water only: 4^ (Q
4									^transferred to water only: M
5									^transferred to water only: ^
6									^transferred to water only: 9
7									^transferred to water only: 7
8									transferred to water only: ^
9									^surviving: ^ " ADW: 0/i33
10 *	W.7								^surviving: 9 ADW: Q.i^(
11									^surviving: \(~) ADW: o.2>^
12									#surviving: 0 ADW: *rO.'bSH*

Qc -JBS

GLEC

Great Lakes Environmental Center

Hyalella azteca 42 Day Life Cycle Test.

TEST DAY: 35 Water Only/Reproduction

WATERBATH _]_

Date: 9-5-01 | Food: YTC Batch # 8-9-01 | Test System: 175 mL Delivery System

GLC#: SVX> | Overlying Water: Dechlorinated municipal water | PhotOPeriod: 16:8

Test Material: Mb- Si)- HOCft-<T)i•5 r) - O) | # of Daily Renewals: 3 | Test Temperature (°C): 23

Test Species: Un*i\/}& a^tcra | f*yc am renewal

Technician Initials: 3'B$ MW | 915 pm renewal

Replicate	Temperature °C	1 ml YTC Fed	pH s.u.	D.O. mg/L	Observations
1					#young ^ #gravid 3> ^surviving °i 2CP
2					#young IC #gravid 0 ^surviving °i 2C?*
3 *	22.9		7.03	4*	#young jLj #gravid] #surviving S 1CP
4					#young^ . #gravid ") #surviving 9 UP
5					#young J ⇧[#gravid Qk. #surviving 7 1CP
6 *	23.0		7.08	7-1	#young 5" #gravid 0- #surviving 9 \a>
7					Wyoung)5 #gravid } #surviving £ 1CP
8					^young ~] ^gravid Q. #surviving 10 let

QLF=JBS

GLEC

Great Lakes Environmental Center

5429

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 42 WATER ONLY

WATERBATH J_

Date: 9-12-01

GLC# 5429

Test Material:

Test Species: *Hyalella azteca*

Technician Initials: JBS

No. Organisms/Chamber I'O

Age/Source of Organisms: !•% j<d<u^s JE-TL

_Overlying Water: ~~Dechlorinated municipal water~~

Test System: 175 mL Delivery System

Photoperiod: 16:8

Test Temperature (°C): ~~23~~

9:00 AM renewed

Replicate	Temperature °C	Observations 42-Day Survival Hyalella				
1		# surviving adults M	//young 3<3	//females 5"	#males ^|	//gravid /
2 *	23.2	# surviving adults ^	//young 31	//females 5"	//males *f	//gravid ^
3		# surviving adults $	//young jk	//females <2	#males A	//gravid Q
4		# surviving adults n	wyoung)'>	//females 3	//males 4	#gravid 1
5		# surviving adults "/	//young 7	//females 3	//males ^|	//gravid (3
6		# surviving adults ^	//young t?	//females 3	#males ^,	//gravid \
7 V	23.1	# surviving adults fcj	//young |2 ,	//females 5"	//males j	//gravid Q_
8		# surviving adults JQ	//young jo	//females S"	//males 5T	#gravid)

L # 3 4 weighed

QC=SB?

GLEC Great Lakes Environmental Center

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Hyalella azteca 42 Day Life Cycle Test

TEST DAY: ifl i
WATERBATH JJL >

Date: 8-11-01
GLC#: 5433
Test Material: /\?h • Sb • 4010-0000: 0)
Test Species: *HyahUajtzteca*
Technician Initials: JBS *ifY\fi)*

Food: YTC Batch # 6-8-01
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: &*
7:45 am renewal
s-T.30 pm renewal

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23
W Screens

Replicate	Temperature °C	DO mg/L	1 ml YTC Fed	K	Con^cUyfty'	Observations /10 Day Survival Data for Replicates 13, 14, 15, 16
I			Ph			NAV
2						
3						
4	23.4					
5						FOS
6						
7						
8						
9						
10						
11						
12						NAV FOS
13	22.9					#organisms surviving: 9 O
14						#organisms surviving: ^ J
15						^organisms surviving: [0
16						#c nisms surviving: 1 0

NAV = TBS

GLEC [redacted]

Hyalella azteca ^,1 Day Life Cycle Test

TESTDAY: 28 Chronic Survival/Reproduction (Water Only)

WATERBATH 2

Date: 8-29-01
GLC# 5423
Test Material: t\?ft-Si) -MQIO-_oaoQ-oI
Test Species: *Hyalella azteca*
Technician Initials: 3"?S m^

No. Organisms/Chamber: 10
Food: YTC Batch # 8-9-01
Age/Source of Organisms: 7-8da^3 /ECT
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: J-
Q'oo am renewal: pm renewal: 6:00

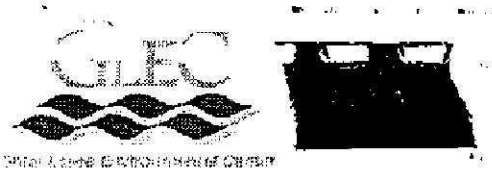
Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23

^Screens

Rcplicntc	Temp. °C	FED	pH s.u.	D.O. mg/L	Conductivity	Alkalinity mg/L	Hardness mg/L	Ammonia mg/L	Observntions on Sediment/ Behavior of Hyalella
1		Fed							^transferred to water only: ^j 1cp
2									^transferred to water only: ^J 1cp
3 *	229		7.61	5.7	243	1 Oo	140	0-HO	^transferred to water only: 7 1cp
4									^transferred to water only: Q
5									^transferred to water only: C]
6									^transferred to water only: I 0
7									^transferred to water only. ~7
8									#transferred to water only. 5> •
9									#surviving: ^ ADW: p^H^M
* 10 *	224								^surviving: [ADW: Q, ^ t |
11									Surviving: ^ ADW: 0-2)11
12		↓							#surviving: 1 ADW: 0, MS)^0)

QC=JBS

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Hydiellidlizteca 42 Day Lite Oycic t'est
TEST DAY: 35 Water Only/Reproduction
WATERBATH JL

Date: 9-5-01
GLCU 5423
Test Material: ^APB-SD-4010-0000-01
Test Species: j^jn lelle azkca
Technician Initials: 385 / V\M / MW

Food: YTC Batch fl 8-9-01
Overlying Water: DechloTinated municipal water
# of Daily Renewals: j)
<f y;- am renewal
£≥≤" pm renewal

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23

Replicate	Temperature °C	1 ml YTC Fed	pH s.u.	D.O. mg/L	Observations
1		fe)			#young 1 //gravid 3 ^surviving ^ 3 c p
2					//young to //gravid 3 //surviving 1 ICf
3 *	23.3		7.S)	7.4	//young 3 //gravid 3 //surviving 1 iep
4					//young 4 //gravid 2 //surviving ? s^cP
5					//young 2 //gravid 3 //surviving 6
6 *	33.4		7.5/	7.t	//young 2 //gravid 2 ^surviving 10
7					//young 0 //gravid 2 //surviving 7 2 c P
8					//young 0 //gravid M //surviving 4-

QC=JBS

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Great Lakes Environmental Center

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 42 WATER ONLY

WATERBATH £

Date: 9-12-01
GLC# 5423
Test Material: J\Vh- SD- ^Q1OOOoo-Q)
Test Species: *Hyalella azteca*
Technician Initials: JBS / MW

No. Organisms/Chamber 10
Age/Source of Organisms: 2: 8 d 4 5 / ETZ
.Overlying Water: Dechlorinated municipal water

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23

f:00Am renewal

Replicate	Temperature °C	Observations 42-Day **Survival Hyalella**					
1		# surviving adults 9	//young \S	#females H	#males 5	#gravid ‹p2	
2 *	23.6	# surviving adults 1	//young 71	//females H	#males 3	//gravid j^	
3		# surviving adults 1	//young 21*	//females H	#males i	//gravid |	
4		# surviving adults ¥	#young 34	//females 5'	#males 3	//gravid Q,	
5		# surviving adults 7	//young 22	#females 3	#males 4	#gravid 1	
6		// surviving adults !O	//young 22	//females S'	//males 5"	//gravid c3	
7 *	23.4	ft surviving adults 7	//young ^0	//females 3	//males 4	//gravid <O	
8		# surviving adults H	//young 20	//females 2	//males 2	//gravid |	

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QC=JBS

GLEC

5424

Hyalella azteca 42 Day Life Cycle Test

TEST DAY:. 1Q
WATERBATH _A

Date: 8-11-01
GLC# 5424
Test Material: LPx-SO-4012-0000-01
Test Species: *Hyalellajjzteca*
Technician Initials: SBS

Food: YTC Batch # 6-8-01
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: *3s*
*-f'M<^* am renewal
7'50 pm renewal

TestSysfem: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23

^Screens

Replicate	Temperature °C	-co/ mViL	1 ml YTC Fed	pH s.u.	ConiKj^rivTty	Observations /10 Day Survival Data for Replicates 13, 14, 15, 16
1			i5			NAV
2						
3						
4 *	23.1					FOS
5						FOS
6						0
7						
8						
9						
10						0
11						FOS
12						kWJ^ FD4.
13 *	22.8					^organisms surviving:
14						^organisms surviving: $
15			1			//organisms surviving: £) ^fr
If						/K nisms surviving 2>

OK. = SBS

5424

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 28 Chronic Survival/Reproduction (Water Only)

WATERBATH_ ft.

Date: 8-29-01
GLC# 5424
Test Material: U>X- so- Hoi2-acatxx 61
Test Species: *Hyalella azteca*
Technician Initials: 388 /HM/AM

No. Organisms/Chamber: 10
Food: YTC Batch # 8-9-01
Age/Source of Organisms: J^-clays /ECT
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: 3
<7#> am renewal: pm renewal: £ ."00

Test System: 175 mL .Deliver/ System
Photoperiod: 16:8
Test Temperature (°C): 23
_ [^Screens

Replicate	Temp. °C	FED	pH s.u.	D.O. mg/L	Conductivity //mos	Alkalinity mg/L	Hardness m£/L	Ammonia mg/L	Observations on Sediment/ Behavior of Hyalella
1		Fd							^transferred to water only: /Q
2		S							^transferred to water only: 9 J- CP
3	22.6		7.63	SO	235	96	112	0.57	^transferred to water only: jQ
4									^transferred to water only: /o 3- C?
5									^transferred to water only: 4 •
6									/^transferred to water only: 4
7									^transferred to water only: -2
8									^transferred to water only: /O
9									^surviving: ^ ADW: ^ , ^ 5
10*	22.3								^surviving: ^ ADW: Q , 5 (^
11									Surviving: \0 ADW: 0 < 1^3 .
12		↓							tfsurvivine: |0 ADW: (J)i 3 ^ 1

QC-385

5424

Hyalellc (:ca 42 Day Life Cycie fesi

TEST DAY: 35 Water Only/Reproduction

WATERBATH _ £_

Date: 9-5-01 | Food: YTC Batch U 8-9-01 | Test System: 175 mL Delivery System

GLC# 5424 | Overlying Water: Dechlorinated municipal water | Photoperiod: 16:8

Test Material: LP^ - Sft- 4012-0050-01 | # of Daily Renewals: ^ | Test Temperature (°C): 21

Test Species: \\yti\ella azteca | 9:45 am renewal

Technician Initials: JBS / HM / mU | 95 pm renewal

Replicate	Temperature °C	1 ml YTC Fed	pH s.u.	D.O. mg/L	Observations
1					//young I \ #gravid ^V" ^surviving 10
2		IT			//young I "3s, //gravid 5 ^surviving 9) lop
3 V	2S.3		7.5)	in	#young '^^ //gravid io //surviving |o 3 C P
4					//young | n" #gr'avid .3 #surviving \o
5					^young \ ^ #gravid ^ ^surviving (0
6 V	3V3		1S1	7.8	//young \ //gravid | //surviving 4 i ep
7					//young ^ //gravid \ //surviving 3 \ Cf
8					//young o o //gravid 5> //surviving I 1 3 C P

QC=JBS

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5424

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 42 WATER ONLY

WATERBATH A

Date: 9-12-01
GLC# 5424
Test Material: LPX- Sf)- L(or2.-QcCC'~c>|
Test Species: *Hyalella azteca*
Technician Initials: JBS/AM

No. Organisms/Chamber 10
Age/Source of Organisms: 7- 8 days / EOT
Overlying Water: Dechlorinated municipal water

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23

9:00 Am received

Replicate	Temperature °C	Observations 42-Day Survival Hyalella				
1		# surviving adults 10	#young J5	//females ^j	#males ^>	#gravid (
2 *	23.5	# surviving adults 9	//young 7	//females *b*	//males 3	//gravid 3
3		# surviving adults 10	#young / 7	//females ^	#males ^j	#gravid *3*
4		// surviving adults IQ	#young 13	//females 9	#males ^)	//gravid *3*
5		# surviving adults 6	//young 3 /	^females 3	#males 3	//gravid Q.
6		// surviving adults 4	//young 5	//females 1	//males 3	//gravid |
7 *	33.3	*H* surviving adults 3	//young 3>	//females • |	//males c3	//gravid Q
8		# surviving adults //	//young 5>O	//females *S*~	#males ^	//gravid 0

34 29

QC-JBS

GLC

5425

HyalelSudeca 42 Day Life Cycle Test

C

TESTDAY 10

WATERBATH 2

Date: 8-11-01

GLC# S425

Test Material: LPX-50-HQ]3-0CVSA-G>

Test Species: *Hyolello azteca*

Technician Initials: SBS

Food: YTC Batch # 8-8-01

Overlying Water: Dechlorinated municipal water

# of Daily Renewals: &<

η^2/r am renewal

*j<-? Q pm renewal

Test System: 175 mL Delivery System

Photoperiod: 16:8

Test Temperature (°C): 21

X Screens

Replicate	Temperature °C	DO mg/L	1 ml YTC Fed	PH/ A	Condl^6iiytty UptfOSK	Observations /10 Day Survival Data for Replicates 13, 14, 15, 16
1						WAV
2						
3						
4 *	23.4					
5						
6						
7						
8						
9						
10						
11						
12						/v/w - - , 1
13 *	23.1					^organisms surviving: 9
14						^organisms surviving: 8
15						//organisms surviving: 9
U»						///(disms surviving 9 1

AV = 3AC

5425

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 28 Chronic Survival/Reproduction Water Only)

WATERBATH _ £_

Date: 8-29-01
GLC# 5425
Test Material: LPS-SD-4013-onc-,o-o'>
Test Species: *Hyalella azteca*
Technician Initials: JB5 *I* HM

No. Organisms/Chamber: 10
Food: YTC Batch # 8-9-01
Age/Source of Organisms: 7 - S ^ ^ / E C T
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: #
Cj',00 am renewal: pm renewal: £ :.*QO*

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23
K,
JZ^Screens

Replicate	Temp. °C	FED	pH s.u.	D.O. mg/L	Conductivity */j.mos*	Alkalinity mg/L	Hardness mg/L	Ammonia mg/L	Observations on Sediment/ Behavior of Hyalella
1		Fed							^transferred to water only: JQ
2									^transferred to water only: ^
3 *	22.7		7.60	6.0	257	92	132	0.45	transferred to water only: (Q
4									^transferred to water only: |Q
5									transferred to water only: |Q *I*-?*
6									transferred to water only: W
7									^transferred to water only: I Q
8									transferred to water only: {J
9									#surviving: ^ A D W : ^ , ^ 1 |
10 *	22.3								^surviving: [0 ADW: 6 , X^V
11									#surviving: \O ADW: O i "^ 4 ^
12		↓							#surviving: \ 0 ADW: 0» ?ϕ t 1

QC = JBS

Great Lakes Environmental Center

5425

Hyalell (ica 42 Day Liie Cycle lest

TEST DAY: 35 Water Only/Reproduction

WATERBATH *JL*

C

Date: 9-5-01
GLC# 5425
Test Material: *L'PJL'* 5D- 1/013 -0000-01
Test Species: Hyalella flg-fcca
Technician Initials: OffS / HM/mW

Food: YTC Batch # 8-9-01
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: ^
9:45 am renewal
0|15 pm renewal

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 21

Replicate	Temperature °C	1 ml YTC Fed	pH s.u.	D.O. mg/L	Observations
1		A)			//young H //gravid ^ //surviving ID
2					//young 7 //gravid ,2 //surviving 0, 3<P
3 *	23.4		7,51	7.9	//young 2 //gravid j //surviving 9 *UP*
4					//young a //gravid tP //surviving O| *let*
5					//young II //gravid S^ //surviving lo q cp
6 V	23.2		7.S7	8.0	//young o //gravid 3> //surviving °1 I cp
7					//young 3 //gravid o^ //surviving 1o f^p
8					//young o //gravid \ #surviving IO

#6 - animals grey color to them.

QC=JBS

5425

Hyalella azteca 42 Day Life Cycle Test

TEST DAY: 42 WATER ONLY

WATERBATH A

Date: 9-12-01

GLC# 5425

Test Material: Uh-Sb- L/0)E'ODOC>-: 01

Test Species: Hyale/Ia azteca

Technician Initials: JBS

No. Organisms/Chamber: IV

Age/Source of Organisms: 7-1' days /ECT

Overlying Water: Dechlorinated municipal water

Test System: 175 mL Delivery System

Photoperiod: 16:8

Test Temperature (°C): 23

9:00 AM renewal

Replicate	Temperature °C	Observations 42-Day Survival Hyalella				
I		# surviving adults -*f)Q (JBS)	//young ff	^females £"	//males 5"	//gravid $L
2 *	2V[1]*	# surviving adults ^	//young "^Q	//females 5"	//males *j	#gravid <P.
3		// surviving adults ^	#young)}	//females ^	//males £~	//gravid I
4		// surviving adults ^j	#young J7	//females 6"	#males M	//gravid !
5		# surviving adults]0	//young) ^	//females 5"	#males ^j~	//gravid |
G		// surviving adults 9	//young 57	//females £	//males $	//gravid (
7 *	23.3	// surviving adults 9[	//young)^ •	//females 5"	//males H	//gravid Q
8		# surviving adults ^	//young ^"4	//females ^	#males ~J	#gravid (^)

57 57

QC=JBS

ftieai Lakes Environmental Center

CHRONIC .^XICITY TEST - WEIGHT DATA

TEST MATERIAL: Battelle Sed- Cotradale

WEIGH DATE: 8- 13-01

TYPE/MODEL OF DRYING OVEN: Hs M

TEST NUMBER:

TEST DATE: D&14 M3-

OVEN TEMPERATURE CC): 6O

TECHNICIAN'S INITIALS: JBS

DRYING DURATION (HOURS): 24

TEST SPECIES: f W / ^ aztcca

TREATMENT LEVEL	REP. NUMBER	A WEIGHT OF PAN AND FRY (g)	B WEIGHT OF OVEN-DRIED PANS (g)	A-B TOTAL DRY FRY WEIGHT (g)	C NUMBER OF FRY WEIGHTED	A-B/C AVERAGE DRY FRY WEIGHT (mg)	BIOMASS WEIGHT (mg)
CorV'Tr^	1	0.95916	QASk>31	n.ooan	10	0.277	
	2	0. q\,lfy	0.4b0Hl>	0.00336	<\	0A11	
	3	0.96339	OA(,OM	D.OOM	10	0.313	
	4	0.96456	O.%))2	o.oom	10	<9,34J	0.361
	<r$	0.%za\	0.96001	0.00 $20	10	Q:l*o	
	z6	QASbOS	0.95262	0.0O3M3	9	0.281	
	Xi	0.15SSI7	0AS0OZ	0.001)1	7	0.456	
	firt	OAStef*	ofisam	Q.oom	1	0.421	
5418	1	QASZM	0.94867	0.0O3SD	0	0.381	
	2	0.95476	0.95148	O.oc>w2		0.3£4	
	3	0AS)$a	0.W80H	0.001)2	10	0.3)?	
	4	0.96492	0.4UU	0.001%	9	0.362	
INITIAL DRY WEIGHTS	A						0.348
	B						

Great Lakes Environmental Center

CHRONIC TOXICITY TEST - WEIGHT DATA

(Cont'd.)

TEST MATERIAL:_____ WEIGH DATE:_____ TYPE/MODEL OF DRYING OVEN:_____

TEST NUMBER:_____ TEST DATE:_____ OVEN TEMPERATURE PC):_____

TECHNICIAN'S INITIALS:_____ DRYING DURATION (HOURS):_____ TEST SPECIES:_____

TREATMENT LEVEL	REP. NUMBER	A WEIGHT OF PAN AND FRY (g)	B WEIGHT OF OVEN-DRIED PANS (g)	A-B TOTAL DRY FRY WEIGHT (g)	C NUMBER OF FRY WEIGHTED	A-B/C AVERAGE DRY FRY WEIGHT (mg)	BIOMASS WEIGHT (mg)
5418 (cont'd)	~~#5~~	OAHVO	0.94529	0.003M\	10	O.!M\	0.3MS
	~~#6~~	0.95051	0.94712	o.oom	9	0. S77	/
	#7	0.94375	0.94083	0.00292	9	0.324	/
	#i	o.imso	0.94443	o.oow	10	0.307	/
5419	1	0.94728	0.94446	O.ooa©	JBS ~~10~~ 9	O.3I3	\
	2	0.94656	0.94372	0.oow	9	0.3It	\
	3	0.94453	0.94182	0.00271	JBS ~~10~~ 9	0-30)	\
	4	L»1HM^3	o.gmw	0.00304	)D	0.30M	\ 0.325
	* S	0.95770	0.95408	O.D034^	JO	0. 3W	/
	~~6~~	0.95362	o>qsoso	o.oom	c\	0.3 47	/
	~~7~~	0.96353	OALOOL	0.00347	10 •	0.347	/
	*%	0.98706	0.98399	0.00307	\0	D.3O7	/ .
INITIAL DRY WEIGHTS	A						
	B						

Gieni Lakes Environmental Center

CHRONIC vyXICITY TEST - WEIGHT DATA

(cont'd.)

TEST MATERIAL:_____ WEIGH DATE:_____ TYPE/MODEL OF DRYING OVEN:_____

TEST NUMBER:_____ TEST DATE:_____ OVEN TEMPERATURE (°C):_____

TECHNICIAN'S INITIALS:_____ DRYING DURATION (HOURS):_____ TEST SPECIES:_____

TREATMENT LEVEL	REP. NUMBER	A WEIGHT OF PAN AND FRY (g)	B WEIGHT OF OVEN-DRIED PANS (g)	A-B TOTAL DRY FRY WEIGHT (g)	C NUMBER OF FRY WEIGHTED	A-B/C AVERAGE DRY FRY WEIGHT (mg)	BIOMASS WEIGHT (mg)
SMPC	1	0.98740	OAwn	0.OQZS1	9	0.286	\
	2	0.98636	0.98361	O.OOZIS	9	0.306	\
	3	0.98427	O.°\2\°\°\	coom	%	0.285	\
	4	0.97524	0.97333	0.00)1)	7	o m	\ (5.3IS
	*S	0.98375	O.W\M	o.oom	°i	0.279	/
	Z%	0.97249	o.wm	o.cmis	10	0.275	/
	2-1	0.97330	0.410S)	0.0057^	7	0. IM	/
	<I	OMSIO	OAfMO	O.OOCtfO	7	0.414	/
5421	1	0.97750	0.97492	O.ooxg	2	a3as	\
	2	0Al°\O2	OAILZO	6.oom	10	0418	\
	3	0AI1(A	DM Hi	O.OOM	10	0.321	\
	4	0.97929	0.91UI	0.oo%Z	.1	0.291	'a 331
INITIAL DRY WEIGHTS	A						
	B						

Great Lakes Environmental Center

CHRONIC TOXICITY TEST - WEIGHT DATA (Cont'd)

TEST MATERIAL:_____ WEIGH DATE:_____ TYPE/MODEL OF DRYING OVEN:_____

TEST NUMBER:_____ TEST DATE:_____ OVEN TEMPERATURE (°C):_____

TECHNICIAN'S INITIALS:_____ DRYING DURATION (HOURS):_____ TEST SPECIES:_____

TREATMENT LEVEL	REP. NUMBER	A WEIGHT OF PAN AND FRY (g)	B WEIGHT OF OVEN-DRIED PANS (g)	A-B TOTAL DRY FRY WEIGHT (g)	C NUMBER OF FRY WEIGHTED	A-B/C AVERAGE DRY FRY WEIGHT (mg)	BIOMASS WEIGHT (mg)
5421 (CO* °)	*<	O.WUO	0.98308	0.001SZ	)D	0,3S2	0.339
	26	0.98925	0.98554	o.ooyi]	0	O.HO	/
	2-1	0.98784	0.98484	0.00300	S	0. us	/
	48	0.WJM	0.Q900tf	o.oom	8	o.isi	/
5422	1	aw7£	0.^?^S*44	O.Ooiot,	9	0.340	
	2	1.00231	0.^^?S7^	0.001S*]	9	0.3^^	
	3	^&r\.oo\4i	\,OO0loT.	O.OD\^S	4	0.33S	
	4	IGOLDS	\.oo)H	O.OOH)<]	^t J	0.466	\OAM
	xS	\. oo&o	1.00573	0.003)7	7	0. HS3	/
	yio	1.0073M	1.00303	0.OOM^	9	0.468	/
	j$t	1.00377	1,00041	O.ooUL	t	a M77	/
	«I	1.000^3	0.WS")	o.oonoz	•10	0.402	/
INITIAL DRY WEIGHTS	A						
	B						

pvm f^"-t

Gie.il Lakes Environmental Center

CHRONIC .LxICITY TEST - WEIGHT DATA

(cont'd)

TEST MATERIAL:_____ WEIGH DATE:_____ TYPE/MODEL OF DRYING OVEN:_____

TEST NUMBER:_____ TEST DATE:_____ OVEN TEMPERATURE CO:_____

TECHNICIAN'S INITIALS:_____ DRYING DURATION (HOURS):_____ TEST SPECIES:_____

TREATMENT LEVEL	REP. NUMBER	A WEIGHT OF PAN AND FRY (g)	B WEIGHT OF OVEN-DRIED PANS (g)	A-B TOTAL DRY FRY WEIGHT (g)	c NUMBER OF FRY WEIGHTED	A-B/C AVERAGE DRY FRY WEIGHT (mg)	BIOMASS WEIGHT (mg)
5423	1	0.99524	0.99126	0.00398	9	0.442	
	2	0.99250	0. ??g"70	0.00 HO	1	0.514	
	3	0.99388	0. WOZO	0.0OU&	7	0.53fe	
	4	0. ^736/_	0.98958	0.OOHO1	/	O.SOH	0.494
	x5	0.99065	•OAtW	o.ooim	7	**0.5SM**	/
	26	0. °t°!S76	o, °i °mo	O.OOMk	ID	0.396	/
	3-7	0. ^°f/7o	0. ? f 750	0.00 330	7	0.HS7	/
	A	0.98239	Q,°l?ooZ	**0.003*1**	4	0.578	/
5424	1	0.99771	O.°i°\HS3,	**0.0OSK**	10	**0.3)£**	\
	2	0.99729	0. <??</£·</	a oozis	9	**^.304**	\
	3	o. J96& r	0. 9^3h	D.ooist	10	0J«	\
	4	0.9.9269	Q_t 73n3	**O.0O37C**	jo	0.37t	OMii
INITIAL DRY WEIGHTS	A						
	B						

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CHRONIC TOXICITY TEST - WEIGHT DATA

© C T D (cont'd)

TEST MATERIAL:_____ WEIGH DATE:_____ TYPE/MODEL OF DRYING OVEN:_____

TEST NUMBER:_____ TEST DATE:_____ OVEN TEMPERATURE (°C):_____

TECHNICIAN'S INITIALS:_____ DRYING DURATION (HOURS):_____ TEST SPECIES:_____

TREATMENT LEVEL	REP. NUMBER	A WEIGHT OF PAN AND FRY (g)	B WEIGHT OF OVEN-DRIED PANS (g)	A-B TOTAL DRY FRY WEIGHT (g)	C NUMBER OF FRY WEIGHTED	A-B/C AVERAGE DRY FRY WEIGHT (mg)	BIOMASS WEIGHT (mg)
5424 (cont'd.)	X$	0.98523	o. 9 ms	0.00^0	6	0.423 •	0.438
	26	0. 7 ^ ?z	0> °(TO>1S	0.00 W	4	O.S\%	/
	31	0.97881	0. 97656	0. oons	3	0.150	/
	K\	o. ?rs^	0.97T/6	0.00m>\»	11	am	/
5425	1	0.98121	0.^113^	O.OOIZI	10	o.wi	\
	2	0.11)02	0.96842	0.00266	9	0.296	\
	3	0. Q1LW	O.WiOlo	0.ODWL	<\	0.324	\
	4	0.97883	0.4UW	aooassr	0\	0.26i	\ 0.351
	X*	0MO31	0A7M1	0.00mo	10	o.mo	/
	26	0.97456	0.97119	D.OOttl	1	O.37M	/
	37	0, <l?554	0.98291	0.00aa	<\	0.298	/
	* *	0.98337	OAtOCft	0.003^?		a36M	/
INITIAL DRY WEIGHTS	A						
	B						

APPENDIX B

CHIRONOMUS TENTANS LABORATORY DATA

Battelit. ^dntredale *Chironomus tentans* Replicate Data.

C

CONTROL	SURVIVAL (%)			GROWTH (mg)	REPRODUCTION	
Rep	10-Day	20-Day	49-Day	20-Day	Males	Females
1			58.3 (1 larva, 6 adults)		1	5
2			41.7 (5 adults)		3	2
3			83.3 (10 adults)		2	8
4			50 (6 adults)		3	3
5			66.7 (8 adults)		6	2
6			58.3 (1 larva, 6 adults)		1	5
7			66.7 (3 larvae, 5 adults)		2	3
8			66.7 (4 larvae, 4 adults)		2	2
9		100 (9 larvae, 3 adults)		1.2170		
10		100 (12 larvae)		0.9890		
11		91.7(11 larvae)		1.1540	3 (hatched early)	2 (hatched early)
12		91.7 (10 larvae, 1 adult)		1.0650		
13	83.3					
14	100		5 adults hatched off early			
15	100					
16	100				TOTAL	TOTAL
Mean	95.8	**95.8**	66.7	1.1063		
Maximum	100	100	83.3	1.217	23	32
Minimum	83.3	**91.7**	41.7	0.989		

Rep	*it* 1° Egg Cases	# Eggs Produced	# 2° Egg Cases	# Eggs Produced
1	2	1470-1066	0	
2	1	1260	1	295
3	7	1025-1166-1246-1117-1755-427-845	4	167–345–272–330
4	3	1037-1274-250	2	359–50
5	2	780-1375	1	236
6	4	979-34-1367-893	2	251-216
7	2	818-1495	2	75-234
8	0		0	
Early Emerged	2	655-593	1	272
TOTAL	23	Mean eggs per 1° egg case = 997	13	Mean eggs **per** 2° **egg case** * **239**

Battelle Centredale *Chironomus tentans* Replicate Data.

5418	SURVIVAL (%)			GROWTH (mg)	REPRODUCTION	
Rep	10-Day	20-Day	49-Day	20-Day	Males	Females
1			58.3 (0 larvae, 7 adults)		2	5
2			75 (4 larvae, 5 adults)		0	5
3			83.3 (0 larvae 10 adults)		6	4
4			75 (0 larvae, 9 adults)		3	6
5			75 (0 larvae, 9 adults)		2	7
6			75 (0 larvae, 9 adults)		3	6
7			50 (0 larvae, 6 adults)		1	5
8			100(0 larvae, 12 adults)		7	5
9		100		1.4920		
10		25		2.2300		
11		58.3		1.7500		
12		100		1.6460		
13	66.7					
14	75					
15	50					
16	83.3				TOTAL	TOTAL
Mean	68.8	70.8	74.0	1.7795		
Maximum	83.3	100	100		24	43
Minimum	50	25	50			

Rep	# 1° Egg Cases	# Eggs Produced	# 2° Egg Cases	# Eggs Produced
1	2	1820-7767	2	352-495
2	0		0	
3	3	1332-1650-2006	3	189-254-432
4	6	1060-1575-1518-1575-1617-1612	6	252-247-37-45-260-840
5	7	1260-227-1165-476-1292-1656-2408	4	270-150-264-756
6	6	1305-373-1434-1895-1329-1909	2	204-307
7	3	1280-1068-1365	2	143-184
8	5	1020-1733-513-1949-515	1	223
TOTAL	32	Mean eggs per 1° egg case = 1365.8	20	Mean eggs per 2° egg case = 295.2

Battelk ^ntredale *Chironomus tentans* Replicate Data.

5419	SURVIVAL (%)			GROWTH (mg)	REPRODUCTION	
Rep	**10-Day**	**20-Day**	**49-Day**	20-Day	**Males**	Females
1			33.3 (0 larvae, 4 adults)		2	2
2			8.3 (0 larvae, 1 adult)		1	0
3			50 (0 larvae, 6 adults)		4	2
4			58.3 (1 larvae, 6 adults)		2	4
5			50 (0 larvae, 6 adults)		3	3
6			0		0	0
7			0		0	0
8			83.3 (0 larvae, 10 adults)		6	4
9		8.3		2.6800		
10		50		2.2970		
11		0				
12		75		1.5410		
13	58.3					
14	25	4 adults hatched off early				
15	58.3					
16	25				TOTAL	TOTAL
Mean	**41.7**	**41.7**	35.4	**2.1727**		
Maximum	**58.3**	75	83.3	2.6800	18	15
Minimum	25	0	0	1.5410		

Rop	# 1° Egg Cases	# Eggs Produced	# 2° Egg Cases	# Eggs Produced
1	2	1360-458	1	110
2	0		0	
3	2	1623-1232	2	364-208
4	4	1335-1110-1880-2153	4	352-406-418-400
5	3	1203-1836-1611	3	227-552-231
6	0		0	
7	0		0	
8	3	1256-731-2288	3	198-260-538
TOTAL	**14**	**Mean eggs per 1° egg case = 1441.1**	**13**	**Mean eggs per 2° egg case • 328**

Battelle Centredale *Chironomus tentans* Replicate Data.

5420	SURVIVAL (%)			GROWTH (mg)	REPRODUCTION	
Rep	10-Day	20-Day	49-Day	20-Day	Males	Females
1			41.7 (5 larvae, 0 adults)		0	0
2			33.3 (4 larvae, 0 adults)		0	0
3			33.3 (2 larvae, 2 adults)		0	2
4			83.3 (6 larvae, 4 adults)		3	1
5			33.3 (2 larvae, 2 adults)		2	0
6			58.3 (5 larvae, 2 adults)		2	0
7			50 (5 larvae, 1 adult)		1	0
8			50 (5 larvae, 1 adult)		0	1
9		66.7		0.8610		
10		8.3		0.4900		
11		33.3		0.7880		
12		58.3		0.6000		
13	25					
14	58.3					
15	50					
16	41.7				TOTAL	TOTAL
Mean	43.8	41.7	#DIV/0!	0.6848		
Maximum	58.3	66.7	0	0.8610	8	4
Minimum	25	8.3	0	0.4900		

Rep	# 1° Egg Cases	# Eggs Produced	# 2° Egg Cases	# Eggs Produced
1	0		0	
2	0		0	
3	1	1776	1	224
4	0		0	
5	0		0	
6	0		0	
7	0		0	
8	1	662	0	
TOTAL	2	Mean eggs per 1° egg case = 1219	1	Mean eggs per 2° egg case = 224

Battelle usntredale *Chironomus tentans* Replicate Data.

5421	SURVIVAL (%)			GROWTH (mg)	REPRODUCTION	
Rep	10-Day	20-Day	49-Day	20-Day	Males	Females
1			8.3 (0 larvae, 1 adult)		1	0
2			58.3 (0 larvae, 7 adults)		2	5
3			58.3 (0 larvae, 7 adults)		2	5
4			66.7 (0 larvae, 8 adults)		1	7
5			41.7(0 larvae, 5 adults)		3	2
6			58.3 (0 larvae, 7 adults)		1	6
7			33.3 (0 larvae, 4 adults)		0	4
8			58.3 (0 larvae, 7 adults)		1	6
9		58.3		1.8440		
10		66.7		1.8940		
11		41.7		1.5560		
12		16.7		2.4550		
13	8.3					
14	33.3	2 adults hatched off early				
15	**16.7**					
16	25				TOTAL	TOTAL
Mean	20.8	50.0		1.9373		
Maximum	33.3	**66.7**		2.4550	11	35
Minimum	8.3	**16.7**		1.5560		

Rep	n 1° Egg Cases	# Eggs Produced	# 2° Egg Cases	# Eggs Produced
1	0		0	
2	5	1105-1343-1740-1402-1836	4	260-236-313-332
3	4	1307-1787-2247-1843	4	224-312-355-409
4	6	1034-1512-1445-1261-793-240	4	140-308-350-66
5	2	1637-299	2	177-46
6	3	250-930-1434	2	180-357
7	0		0	
8	6	1137-1096-1207-1217-1559-1590	2	339-256
TOTAL	26	**Mean eggs per 1° egg case = 1278.9**	18	**Mean eggs per 2° egg case * 258.9**

Battelle Centredale *Chironomus tentans* Replicate Data.

5422	SURVIVAL (%)			GROWTH (mg)	REPRODUCTION	
Rep	**10-Day**	**20-Day**	**49-Day**	**20-Day**	Males	Females
1			50 (1 larvae, 5 adults)		0	5
2			33.3 (0 larvae, 4 adults)		1	3
3			25 (0 larvae, 3 adults)		1	2
4			41.7(0 larvae, 5 adults)		3	2
5			58.3 (2 pupae, 5 adults)		1	4
6			50 (6 larvae, 0 adults)		0	0
7			0		0	0
8			0		0	0
9		83.3		1.6020		
10		50		1.7830		
11		50		2.2370		
12		66.7		1.9790		
13	41.7					
14	50					
15	66.7					
16	50				TOTAL	TOTAL
Mean	52.1	**62.5**	0.0	1.9003		
Maximum	66.7	83.3	**0**	2.2370	6	**16**
Minimum	**41.7**	50	**0**	1.6020		

Rap	**# 1° Egg Cases**	**# Eggs Produced**	# 2° Egg Cases	# Eggs Produced
1	**5**	976-1544-1448-1494-1591	**3**	229-308-282
2	**2**	1389-1663	**2**	252-375
3	**2**	1188-848	**2**	264-256
4	**1**	728	**1**	504
5	**3**	1109-1168-1628	**2**	278-251
6	**0**		**0**	
7	**0**		**0**	
8	**0**		**0**	
TOTAL	13	Mean eggs per 1° egg case = 1290.7	10	Mean eggs per 2° egg case «= 299.9

Battels ^entredale *Chironomus tentans* Replicate Data.

5423	SURVIVAL (%)			GROWTH (mg)	REPRODUCTION	
Rep	10-Day	20-Day	49-Day	20-Day	Males	Females
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13	0					
14	0					
15	0					
16	0				TOTAL	TOTAL
Mean	0.0			#DIV/0!		
Maximum	0					0
Minimum	0					

Rep	*U* 1° Egg Cases	# Eggs Produced	# 2° Egg Cases	# Eggs Produced
1				
2				
3				
4				
5				
6				
7				
8				
TOTAL	0	Mean eggs per 1° egg case >=		Mean eggs per 2°egg case >=

Battelle Centredale *Chironomus tentans* Replicate Data.

5424	SURVIVAL (%)			GROWTH (mg)	REPRODUCTION	
Rep	10-Day	20-Day	49-Day	20-Day	Males	Females
1			41.7(0 larvae, 5 adults)		2	3
2			25 (0 larvae, 3 adults)		1	2
3			58.3 (0 larvae, 7 adults)		2	5
4			100(0 larvae, 12 adults)		5	7
5			58.3 (0 larvae, 7 adults)		1	6
6			25 (0 larvae, 3 adults)		2	1
7			41.7(0 larvae, 5 adults)		1	4
8			50 (0 larvae, 6 adults)		1	5
9		58.3		1.7570		
10		66.7		1.4560		
11		41.7		1.8820		
12		66.7		1.8240		
13	33.3					
14	25					
15	25					
16	25				TOTAL	TOTAL
Mean	27.1	58.4		1.7298		
Maximum	33.3	**66.7**		1.8820	15	33
Minimum	25	**41.7**		1.4560		

Rep	#1° Egg Cases	# Eggs Produced	# 2° Egg Cases	# Eggs Produced
1	3	720-1154-1648	1	550
2	2	1485-100	0	
3	5	1201-299-1638-1549-1260	4	150-238-452-354
4	7	1152-1256-1011-1204-1092-1166-1220	6	304-243-242-204-75-179
5	5	1254-1254-2384-1879-1675	4	294-191-285-270
6	1	955	0	
7	2	57-1476	0	
8	4	940-1428-1118-1592	4	234-254-182-304
TOTAL	**29**	Mean eggs per 1° egg case * 1212.7	**19**	Mean eggs per 2° egg case « 263.4

Battelle Centredale *Chironomus tentans* Replicate Data.

5425	SURVIVAL (%)			GROWTH (mg)	REPRODUCTION	
Rep	10-Day	20-Day	49-Day	20-Day	Males	Females
1			50 (0 larvae, 6 adults)		5	1
2			50 (0 larvae, 6 adults)		3	3
3			33.3 (0 larvae, 4 adults)		2	2
4			83.3 (0 larvae, 10 adults)		4	6
5			50 (0 larvae, 6 adults)		2	4
6			41.7(0 larvae, 5 adults)		3	2
7			50 (0 larvae, 6 adults)		4	2
8			58.3 (0 larvae, 7 adults)		3	4
9		33.3		2.4780		
10		50		1.7350		
11		91.7		1.4990		
12		75		1.4820		
13	16.7					
14	41.7					
15	33.3					
16	8.3				TOTAL	TOTAL
Mean	25.0	62.5		1.7985		
Maximum	41.7	91.7		2.4780	26	24
Minimum	8.3	33.3		1.4820		

Rep	# 1° Egg Cases	# Eggs Produced	# 2° Egg Cases	# Eggs Produced
1	1	1548	1	464
2	3	672-572-1691	3	389-345-277
3	2	1448-1340	2	390-438
4	6	887-992-1599-1815-1685-1751	5	260-429-362-440-548
5	4	1095-1448-707-584	3	302-836-50
6	0		0	
7	1	1086	1	363
8	4	1440-1652-1212-1408	3	403-249-240
TOTAL	21	Mean eggs per 1° egg case = 1268.2	18	Mean eggs per 2° egg case = 376.9

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52/46 = 54.2
57/46 (65)

Chironomus tentans Life Cycle Test
Chronic Measurements

(64)

control rep 1 [redacted]

Date: 8/23/01
GLC #: Parma Control
Replicate #: 1
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
		Primary	Secondary	Primary	Secondary	
	8/23					*ho •
	8/24					"ho
	8/26	8/30		mo		'ill)
8/26						- Va
	8/31	9/2		\QU>Lf		9/3
Aux 9/2						9/7
	9/11					9/14
Art. 'Vn						9/15
1						

Great Lakes Environmental Center

Control rep 2

Chiro>\,cus tentans Life Cycle Test
Chronic Measurements

Date: 8/23/01
GLC #: Parma Control
Replicate #: C-2
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
cf	?	Primary	Secondary	Primary	Secondary	
8/19						8/22
8/19						8/22
8/20						8/26
JBS 8/21	8/21	%	8/24	1260	295	8/26
	8/22					8/26
		« 1				

GLEC

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Chironomus tentans Life Cycle Test
Chronic Measurements

Date: 8/10
}LC #: Parma Control
leplicate #: 3
"echnician Initials: JBS

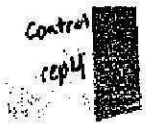


Date of Emergence ♂	Date of Emergence ♀	Date of Egg Mass Primnry	Date of Egg Mass Secondary	Number of Eggs Primary	Number of Eggs Secondary	Date Adult Died
	8/19	8/22	8/23	logs	167	8/26
She						8/26
	8/20					8/26
	8/29	8/30	9/1	1166	3HS	9/2
Aux, 8/29						9/5
	8/30	8/31	9/1	1246	272	9/3
	8/31	9/1		1117		9/5
	9/1	~~9/1~~ 9/3	~~9/1~~ ~~9/3~~ ~~9/4~~	1755	330	9/5
	9/2	9/4		427		9/6
9/2						~~9/5~~ 9/8
	9/7	9/9		~~1755~~ 845		9/9
Aux. 9/8						9/10

Chiron (^ te/itott? Life Cycle Test
Chronic Measurements

Western Lakes Environmental Center

3ate: 8/23/01
3LC #\ ?&**> Control
leplicate #: M •
Technician Initials: JBS



Date of Emergence	Date of Egg Mass		Number of Eggs		Date Adult Died
	Primary	Secondary	Primary	Secondary	
8/19	8/23		/0S7		8/26
8/20					8/26
8/22					'67
8/22	$hs	8/25	1274	359	^6-7
8/24					9/2
8/24	8/27	8/29	250	50	8/29
					-

GLEC
Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

control rep 5 [redacted]

Date: 8/23/01
3LC #: Perma Control
Replicate #: J
Technician Initials: JBS

Dnte of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
cf	?	Primary	Secondary	Primary	Secondary	
%•)						tech error - escaped
8/22						8/27
8/22						« ^
	JBS 8/24 22	8/23	8/26	780	P3G	JBS 8/27 8/26
	8/25	8/26		137S		JBS 8/26 8/27
8/26						8/31
%\>						9/2
8/28						9/4

Ciiiron (tenians Life cycle Test
Chronic Measurements

C

Date: 8/23/01
3LC #: Parma Control
leplicate #: 6
Pechnician Initials: JBS

control rep6

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
d[1]	?	Primary	Secondary	Primary	Secondary	
8/20						8/26
	8/21	8/22	8/24	979	251	8/26
	8/25	8/24	8/26 JBS	3M		8/30
	8/26	8/29		1367		y,
lvt. 8/30						9/5
	9/2	9/3	9/5	893	216	9/7
	9/17					9/20

GLEC

Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

Date: 8/23/01
GLC #: JV>n Control
Replicate #: 7
Technician Initials: JBS

[redacted]

Dnte of Emergence		Dnte of Egg Mass		Number of Eggs		Date Adult Died
		Primary	Secondary	Primary	Secondary	
	8/21					8/24
8/25						8/28
	fits	8/27	8/29	818	75	8/29
	8/27	8/30	9/1	1495	234	9/2
						8/24
wx. 8/29						
lux. yi						9/4

Great Lakes Environmental Center

Chiro), v .s tentans Life Cycle Test
Chronic Measurements

Date: 8/23/01
GLC#: Parma Control
Replicate #: /f
Technician Initials: JBS



Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
		Primary	Secondary	Primary	Secondary	
8/19						8/25
	8/20					8/26
	8/20					8/26
8/22						8/26

GLEC
Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

Date: 8/23/01
GLC#: Pmm Control
Replicate #: 1
Technician Initials: JBJ



Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
		Primary	Secondary	Primary	Secondary	
8/19						8/24
8/19						8/24
	8/20	8/21		883		8/24

WJIJL

Cmrono (tenians juule tycle **Test**
Chronic Measurements

)ate: 8/27/01
JLC #: Parna Control
Leplicate #:)2-
'echnician Initials: JBS

Control 12 [redacted]

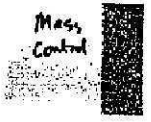
Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
<f	9	Primary	Secondary	Primary	Secondary	
8/19						8/22
9/9						

GLEC

Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

Date: 8/23/01
3LC #: Parma Control
Replicate #: Mass Control
Technician Initials: JBS



Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
		Primary	Secondary	Primary	Secondary	
8/19						8/24
8/19						8/25
8/19						8/22
	8/19	8/20	8/21	655"	272	8/23
	8/19	8/20		593		8/24

Natural Resources Defense Center

Chirom (; *tentans* jufe cycle 1 est
Chronic Measurements

[redacted]

Date: 8/23/01
GLC #: 5418
Replicate #: J
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
0'	?	Primary	Secondary	Primary	Secondary	
	8/21					8/27
	8/24					8/27
	^ 4					8/30
	2/jo	8/31	9/3	\S90	352	fls
Aux. 8/30						9/3
	»/«	y,	9/3	1767	495	9/6
9/2						1/M
I/a						<Vs
					1	
						1
					1 1	

GLEC
Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

[redacted]

Date: 8/23/01
GLC #: 5M1S
Replicate #: ^
Technician Initials: JBS

Date of Emergence	Date of Egg Mass		Number of Eggs		Date Adult Died
	Primary	Secondary	Primary	Secondary	
^//					%
Art. 9/H					9/7
Aux. 9/7					%
Aux. 9/7					9/12
9/16 5PM					%
9/16 5PM					%
9/17					9/20
9/18					9/20

Great Lakes Environmental Center

Chiron v i *tentans* Life Cycle Test
Chronic Measurements

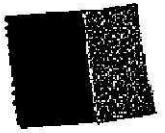
[redacted]

Date: 8/23/01
GLC #: 5418
Replicate #: 3
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
d'	?	Primary	Secondary	Primary	Secondary	
%\'						8/26
'/»						8/26
8/23						8/26
8/27						^ ^
	8/28	*/M	9/1	133X	189	9/2
	9/31	9/1	9/3	I US©	-55"/	915
						9/7
9/4						9/9
	9/6	9/7	9/9	2006	432	V»
AUX 9/9					1	9/13
	'V.B		J		1	9/20
				1		

GLEC
Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements



Date: 8/23/01
GLC #: 5418
Replicate #: H
Technician Initials: ES

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
d[1]	?	Primary	Secondary	Primary	Secondary	
8/23						8 1/2 yet
	8/24	8/25	8/27	1OtoO	252	8 10%
	$ln	8/30	)>	(S7S	247	VLP
Aux. 8/29						9/3
	Vi	I/a.	9/3	I cr *vcf*	37	9/6
1/1						*11?*
%						9/12
	9/6	9/7	*lit*	157S	145	9/10
	1/7	9/8	9/9	1617	260	9/12
	1/1?	9/13	9/15	1612	890	9/16
W. %						Qt 1/tip
		•				

Great Lakes Environmental Center

Chiron X ./ *tentans* Life Cycle Test
Chronic Measurements

C

[redacted]

Date: 8/23/01
GLC #: 5418
Replicate #: S
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs "		Date Adult Died
cT ' ?		Primary	Secondary	Primary	Secondary	
	8/22	8/27		1260		8/27
8/23						8/29
	8/26	8/27 383 8/31		227		9/1
8/27						y/
	8/29	8/30	y, •	1165	270	9/1
	8/30	8/31		476		^/^
	^/^	°I/3L	'/9	1292	ISO	^^
	Vi	9/2	9/4	1656	W	^/u
Day Mine From ^^ ^^fe^ V/						9/10
	9/3	383 9/9 9/15	Vi*	383 264 2408	756	9/8
						1

V9/of - /TEL PS

GLEC

Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

[redacted]

Date: 8/23/01

/JT p JC— <=sq if=

Replicate #: G?

Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
<r	?	Primary	Secondary	Primary	Secondary	I
8/20						8/26
	8/21	8/22		1305		8/22
	8/22	8/24		373		8/26
8/28						9/2
	8/28	8/29	9/1	1M-JH	;>OH	9/1
	8/29	8/30	rA\	UK	307	9/2
8/30						9/3
	mo	AM ~~8/31~~ 9/1		AM ~~307~~ 329		%
	9/1	9/2		1909		9/5
Aux. 9/4						9/9
		*				

Ckiront \..J tentans Life Cycle Test
Chronic Measurements

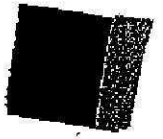
[redacted]

Date: 8/23/01
GLC#: 5418
Replicate #: 2
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
cf.	?	Primary	Secondary	Primary	Secondary	
	8/29	^/		1280		9/3
	8/30	9/1	9/3	1068	/a	%
	8/30	9/1	9/3	1365	184	%
Av<. ?/M						8/5 JBS 9/7
Avx. 8/31						9/7
9/5						%
	9/7					9/11
	9/12					9/16

GLEC
Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements



Date: 8/23/01
GLC #: 5M / 8
Replicate #: X
Technician Initials: JBJ

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
cf	?	Primary	Secondary	Primary	Secondary	
8/19						8/26
8/19						8/26
8/22						8/28
8/27						9/3
	8/28	8/29	8/31	1020	223	Vz.
8/29						9/6
8/31						9/7
	9/3	9/6		1733		9/6
	9/5	9/8		513		Vi
	9/6	9/9	9/10 SS	1949		9/10
Aux. 9/7						JBJ 9/X. "/n
	9/8	9/11		515		9/14

9/9

9/14

Great Lakes Environmental Center

Chiront ^..j tentans Life Cycle Test
Chronic Measurements

5419
rc01

Date: 8/23/01
GLC #: fS"419
Replicate #: 1
Technician Initials: 3" t2S

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
a'	9	Primary	Secondary	Primary	Secondary	
8/21						8/sM
	8/23	8/24	8/25	1360	110	8/28
	8/23	8/26		458		i/i
8/28						8/29
Aux. 8/31	8/305					9/6
					—	
				1		
			1	1		
			1	1		

GLEC

Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

Rep 2

Date: 8/23/01
3LC #: 5419
Replicate #: 2
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
		Primary	Secondary	Primary	Secondary	
8/20						8/23
				1	1	
						1

Great Lakes Environmental Center

Chirom (. tentans Life Cyble Test
Chronic Measurements

Rep 3

Date: 8/23/01
GLC #: gHI*9
Replicate #: ^
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
cf	?	Primary	Secondary	Primary	Secondary	
8/19						8/24
8/19						8/24
8/21						8/24
	8/25	8/30	9/1	1623	364	JBS 8/29 9/1
	8/29	8/30	Yi	1232	208	9/2
Aux. 8/29						9/4
9/5						9/8

GLEC
Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

Rep 4 [redacted]

Date: Thil6
GLC #: 5419
Replicate #: M
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
cf	?	Primary	Secondary	Primary	Secondary	
8/25						9/1
V?						918
	9/2	9/3	9/5	1335	352	9/6
~~2nd 9/2~~	9/8	V1	9/13	1110	406	~~9/8~~ JBS 9/13
Aux. 9/8 JBS						9/9 (JE)
~~9/9~~ PS	11-1	9/10	9/11	1W	418	9/14
* Aux 9/9						7/5"
	9/10	9/11	9/12	2153	400	9/15
						1
					1	

* to replace JE

Chiron^ C j tentans **Life Cycle Test**
Chronic Measurements

Reps [redacted]

Date: 8/21^1
GLC#: 5419
Replicate #: 5
Technician Initials: 3-TSS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
c?	?	Primary	Secondary	Primary	Secondary	
8/20						8/24
8/24						%7
8/25						f/3,
	8/27	8/28	8/30	1203	227	8/SI
	9/2	9/3	115	1836	552	9/5
Jflui7!s "i/a						9/9/9/9
	9/5	Vis	?/2	1611	231	9/11
			1			

GLEC
Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

Rep 6

Date: 8/27/01
3LC#L 5419
leplicate #: 6
"echnician Initials: TB5

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
cf	?	Primary	Secondary	Primary	Secondary	

The Lake Environmental Center

Chiront L^ *tentans* Life Cycle Test
Chronic Measurements

Rep 7 [redacted]

Date: 8/23/01
•JL*^ ft. 3419
Replicate #: 1
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
c? '	?	Primary	Secondary	Primary	Secondary	

Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

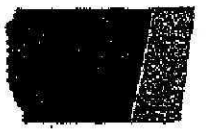
Date: 8/23/01
GLC #: 5419
Replicate #: 8
Technician Initials: JBS

rep8 [redacted]

Date of Emergence	Date of Egg Mass		Number of Eggs		Date Adult Died
	Primary	Secondary	Primary	Secondary	
% •					8/26
8/19					8/19
					^M
#*?					8/26
8/22					8/22
8/23	oi odds	8/27	1256	198	8/28
8/25	8/26	8/28	731	‰	8/31
8/25				=__	8/31
8/28					9/5
8/31	Vi	9/3	2288	538	9/5
	•		[redacted]		

Great Lakes Environmental Center

Chiro. ..^s[1] *tentans* Life Cycle Test
Chronic Measurements



Date: 8/23/01
GLC#: 5420
Replicate #: \
Technician Initials: JSS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
♂	♀	Primary	Secondary	Primary	Secondary	

Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

[redacted]

Date: Ihik21
GLC #: 5420
Replicate #: 3-
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date **Adult Died**
♂	♀	Primary	Secondary	Primary	Secondary	

GLEC
Great Lakes Environmental Center

Chiront C *ientans* Life Cycle Test
Chronic Measurements



Date: 8/23/01
GLC #: 5420
Replicate #: 3
Technician Initials: CTB>

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
		Primary	Secondary	Primary	Secondary	
	9/9	9/11	4/13	ITU	224	9/8
Aux. 9/10						9/15
	9/9					9/20
		*	—			

GLEC

Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements



Date: 8/23/01
GLC#: 5420
Replicate #: M
Technician Initials: J8S

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
		Primary	Secondary	Primary	Secondary	
8/29						9/3
9/10						9/14
9/11						9/14
	9/16					9/17

Great Lakes Environmental Center

Chirotentans Life Cycle Test
Chronic Measurements



Date: 8/23/01
GLC #: 5420
Replicate #: 5
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
♂	♀	Primary	Secondary	Primary	Secondary	
9/11						9/11
					1	

Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements



Date: 8/23/01
GLC #: 5420
Replicate #: E
Technician Initials: JBS

Dnte of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
		Primary	Secondary	Primary	Secondary	
9/10						%
9/11	38♀					9/14

Chironomus tentans Life Cycle Test
Chronic Measurements

[redacted]

Date: 8/23/01
GLC#: 5420
Replicate #: 1
Technician Initials: d"B}>

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
. . <?	9	Primary	Secondary	Primary	Secondary	
-Vi						9/3
				1		
		*		1		

Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

[redacted]

Date: 8/23/01
GLC#: 5420
Replicate #: 8
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
<f	?	Primary	Secondary	Primary	Secondary	
	9/8	9/9		35 9/9 62		9/15 9/13 JBS
Aux. 9/8						9/15

Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

5421
rep 1

Date: 8/21
GLC #: 5421
Replicate #: 1
Technician Initials: JM

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
♀	♂	Primary	Secondary	Primary	Secondary	
8/29						9/5
		*				

Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

5421
rep 2

Date: 8/27/01
GLC #: 5421
Replicate #: ^
Technician Initials: JBS

Dnte of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
o'	?	Primary	Secondary	Primary	Secondary	
	8/22	8/25	8/27	1105	260	8/29
8/24						8/jo
	8/25	8/28	8/30	J-3MS	2%	8/31
	8/28	8/29		1740		9/3.
	8/30	9/1	9/3	1402	313	9/5
Aux. 8/31						9/7
	9/1	9/2	•Ms	1836	332	9/7
9/3						9/8

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Great Lakes Environmental Center

CTuror* ^ "icruarij Uife v>j-de .3t
Cnronic Measurements

5421
rep3

Date: 8/23/01
GLC #: 5421
Replicate #: B
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
		Primary	Secondary	Primary	Secondary	
8/22	8/22 mw					8/28
	•?/aa	8/25	8/27	1307	224	8/25
	7/an					8/28
8/28						Vs
	"?/^	8/29	%\	mi	312	aA
	8/29	8/30	Vi	2247	355	</3
	8/31	Vi	9/3	1843	409	9/5
			1		1	
		. 1	II	1 .		

Great Lakes Environmental Center

Chironomiis tentans Life Cycle Test
Chronic Measurements

5421
rep4

Date: 8/23/01
GLCIt: 5421
Replicate #: H
Technician Initials: JBS

Dnte of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
cf	?	Primary	Secondary	Primary	Secondary	
	8/29	V'	9/3	1034	WO	%
Aux. 8/31						f/Co
	9/6	"r	9/9	1515k	308	9/9(TE)
% > HO! ·						9/9 9/10 9/11
	9/7	«/r	9/10	1445	350	9/11
	9/8	9/10 11	9/11 9/11	\%\	66	9/11
	9/9	%*		~~1261~~		9/12
	"/ID	9/13		793		9/14
•Vio						9/15
	9/11	9/13		740		9/16
Aux ♂ 9/15						1/17
Aux ♂ 9/15						9/17

....o r

Cmron (icma.ni juite \:.ycle Test

Chronic Measurements

5421
rep 5

Date: 8/23/01
GLC #: 5421
Replicate //: 5T
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
d	9	Primary	Secondary	Primary	Secondary	
8/21						8/26
8/23						8/30
	8/25	8/26	%	IfeT)	177	8/26
	8/25	8/28	8/30	299	46	9/1
8/26						8/30

Chironomiis tentans Life Cycle Test
Chronic Measurements

5421
rep6 [redacted]

Date: 8/23/01
SLC #: 5421
Replicate #: (^
Technician Initials: JBS

Dnte of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
Cf	?	Primary	Secondary	Primary	Secondary	
	8/27					^
	9/2					9/3
	9/2	I/Co		250		?/te
	9/3					9/7
Aux. 9/3						<?
	9/5	lit	9/8	930	180	9/10
	9/6	9/8	111	143f	357	f/l
Aux. 9/7						9/13
Aux. 9/7						"/u
9/8						"/ii
		*				

Chron(Hyalella Life Cycle Test
Cnronic Measurements

Great Lakes Environmental Center

5421
rep 7

Date: 8/23/01
GLC #: 5421
Replicate #: 1
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
a	?	Primary	Secondary	Primary	Secondary	
	8/25					8/31
	y/as					8/31
	8/27					*Vi*
	‰					1/S
			—			
			1			

GLEC
Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

5421
rep8
[redacted]

Date: 8/21/01
GLC#: 54M
Replicate #: ff
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Datp Adult Died
<?	?	Primary	Secondary	Primary	Secondary	
8/21						8/27
	8/22	8/23		1137		8/26
	8/22	8/24	8/25	1096	339	8/27
	8/24	8/25	8/27	lxn	asrt	8/29
	8/24	8/25		W		8/29
	8/25	8/26		1559		8/29
	8/26	8/27		1590		8/30
					= =	
		*				

Great Lakes Environmental Center

Ciutor (s^ntans Life Cycle Test
Cnronic Measurements

5420
Rep1

Date: 8/27/01
GLC #: 2122
Replicate //: 1
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
cf	?	Primary	Secondary	Primary	Secondary	
	8/30	2h1	9/2	976	229	9/4
Aux. 8/30						9/4
	9/2	%		1544		9/10
	^/^	9/4	9/7	1448	308	^/^
Aux 9/10						9/11
	9/7	V?	9/10	1494	282	9/10
	1/1	9/10		Js^j		9/12
Aux. 9/11						9/16

GLBL

Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

5422 Repa

Date: 8/23/01
GLC #: 5422
Replicate #: C
Technician Initials: JBS

Dnte of Emergence		Dnte of Egg Mass		Number of Eggs		Date Adult Died
cT	?	Primary	Secondary	Primary	Secondary	
	8/28	8 Ho	y,	13$*?	252	• Y1
Aux. 8/29						9/2
8/30	8/305					9/2
	9hi	9/1	9/3	1668	375	^h
	9/3					III
Aux. 9/4						9/9
		*				

Great Lakes Environmental Center

CTiiror"(Cnronic Measurements

5422 rep3

Date: 8/23/01
GLC #: 5422
Replicate #: 3
Technician Initials: JBS

Dnte of Emergence		Dnte of Egg Mnss		Number of Eggs		Date Adult Died
d	?	Primary	Secondary	Primary	Secondary	
8/24						8/27
	8/31	9/2	9/3	1188 9/1	264	f/Q,
Aux. Male 9/1						*h
	9/2	V	9/4	848	256	Vie
		1				

Chironomus tentans Life Cycle Test
Chronic Measurements

5422
rep4

Date: 8/27/01
GLC #: 54aa
Replicate #: 4
Technician Initials: JBJ

Date of Emergence		Date of Egg Mass		Number of Eggs		[1] Date Adult Died
		Primary	Secondary	Primary	Secondary	
8/20						8/26
	8/20	8/21	8/21	728	504	8/22
%i						8/26
	8/22					8/26
8/23						8/26
				=1		
		*				

Great Lakes Environmental Center

Control Organisms Life Cycle Test
Curonic Measurements

5422
R-05

Date: 8/23/01
GLC #: 5422
Replicate *if*: 6>
Technician Initials: JBS

Date of Emergence		**Dnte of** Egg Mass		Number of Eggs		**Date Adult Died**
0' •	**?**	Primary	Secondary	Primary	Secondary	
	8/23	8/25	8/26	1109	278	8/29
	8/23	8/25	8/27	1168	251	8/29
/						8/31
	8/30	9/5		1628		9/3
	8/31					117
~~JBS~~ Aux. 8 Aux. 9/4						9/9

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Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

5422
rep e

Date: 8/27/09
GLC #: 5422
Replicate #: e
Technician Initials: JBS

Dnte of Emergence		Date of Egg Mnss		Number of Eggs		Date Adult Died
♂	♀	Primary	Secondary	Primary	Secondary	

Great Lakes Environmental Center

Ciuror (Hyalella Life-Cycle Test

Cnronic Measurements

C

5-28 rep 1

Date: skik
GLC #: 5M 22
Replicate #: 1
Technician Initials: JBS

Dnte of Emergence		Date of Egg Mnss		Number of Eggs		Dnte Adult Died
0"	♀	Primnry	Secondary	Primnry	Secondnry	

Chironomiis tentans Life Cycle Test
Chronic Measurements

Date: 8/23/01
GLC #: 5422
Replicate #: F
Technician Initials: JBS

Rep 8
5-8-5

Dnte of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
♂	♀	Primary	Secondary	Primary	Secondary	

Great Lakes Environmental Center

Chiro ...tans Life-Cycle Test
cnronic Measurements

5424
repl

Date: 8/23/01
GLC #: 5424
Replicate #: 1
Technician Initials: JBJ

Dnte of Emergence <f	9	Date of Egg Mass Primary	Secondary	Number of Eggs Primary	Secondary	Date Adult Died
8/24						'fa
8/24						8/30
	8/28 mw	8/26	8/26	38-8x 720	550	8/28
	8/26	8/27		ns-q		y,
	9/10	9/11		1648		9/15
Avx. 9/10						1/13

Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

5424
rep 2

Date: 8/23/01
GLC#: 5424
Replicate #: D
Technician Initials: JBS

Dnte of Emergence		Date of Egg Mnss		Number of Eggs		Date Adult Died
		Primary	Secondary	Primary	Secondary	
7/«						8/29
	8/25	I/O.		"Wis		8/28
	9/5	9/8		(00		
Aux. 9/5						9/21

Great Lakes Environmental Center

Ciilrof ('s tentans Life-Cycle Test
Cnronic Measurements

5424
rep3

Date: 8/22/01
GLCtt: 5424
Replicate #: 6
Technician Initials: JBJ

D/ite of Emergence		Dnte of Egg Mnss		Number of Eggs		Date Adult Died
		Primary	Secondary	Primary	Secondary	
8/25						8/30
8/25						9/2
	8/25	8/26	8/28	ipol-	385 299 150	8/30
	8/26	8/28 385 462		299		8/30
	8/29	?/jo	y,	1638	Si?	9/3
	9/2	9/3	1/sr	1549	452	9/8
to AUX ♂ 9/2						%
Aux 9/4						vr
	9/5	9/10	"<r 1	iato	t£H 1	9/10
					1	
					1	
					1	

GLEL

Great Lakes Environmental Center

Chironomiis tentans Life Cycle Test
Chronic Measurements

5424
rep4 [redacted]

Date: 8/23/CM
GLC #: 5424
Replicate #: ____ Id ____
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
cf	**?**	Primary	Secondary	Primary	Secondary	
8/23						8/26
8/24						%
8/26						8/31
8/27						8/31
	8/27	8/28	8/30	1152	304	9/1
	8/27	8/29	*h	1251	243	9/3
	8/30	8/31	9/2	1011	242	9/4
	8/30	8/31	9/2	1204	204	9/4
	8/30	8/31	9/3	1092	75	9/6
9/1						VU>
	9/2	%	9/8	1166	179	*lit*
	9/5	9/6		1220		9/10
kvx 9/6		1				9/10

Great Lakes Environmental Center

Ceriodaphnia dubia Life Cycle Test
Chronic Measurements

5424
Tef S

Date: 8/23/01
GLC #: 5424
Replicate #: 5
Technician Initials: JBS

Date of Emergence	Date of Egg Mass		Number of Eggs		Date Adult Died
	Primary	Secondary	Primary	Secondary	
8/31	9/3	9/4	1254	294	9/10
9/1	9/3	9/5	1859	191	9/9
~~AF Aux 8/31~~ 9/2					9/9
9/5	9/7		2384		9/7
	9/7	A/1-	1879	285	~~9/8 JBS~~
9/6 ~~FE~~	~~9/8 JBS~~				~~FE~~ JBS 9/11
9/8	9/10 ~~9/8 JBS~~ ← JBS 9/9 9/10		1675	710	9/13
9/9					9/13
	..			J	

Chironomus tentans Life Cycle Test
Chronic Measurements

5424
rep 6

Date: 8/23/01
GLC#: SHAM
Replicate *U*: 6
Technician Initials: JBS

Dnte of Emergence		Dnte of Egg Mass		Number of Eggs		Date Adult Died
♂	♀	Primary	Secondary	Primary	Secondary	
1/22.						8/27
	8/22	8/23		1SS		Usn
8/29						9/2

Great Lakes Environmental Center

C/tiron (*% lentans* Life cycle 1 tst
Chronic Measurements

5424
rep 7

Date: 8/23/01
GLC #: 5424
Replicate #: 7
Technician Initials: JDS

Dnte of Emergence	Date of Egg Mass		Number of Eggs		Dale Adult Died
	Primary	Secondary	Primary	Secondary	
	8/25				8/29
	8/27	9/2	57		^3
	8/29	9/3	1476		9/3
	8/29				V3
8/30					9/3

Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

5424
rep8

Date: 8/27/01
GLC #: 5424
Replicate #: 8
Technician Initials: JBS

Dnte of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
cf	**?**	Primary	Secondary	Primary	Secondary	
	%•)	8/31	9/1	940	234	9/4
8/30						9/7
	8/30	>k\	"/a	1428	254	9/5
	9/4	"It	111	1118	1»	9/10
	V					9/10
Aux. 9/7						9/14
	9/11	"t0	9/14	1592	So[1]/	9/16

Great Lakes Environmental Center

Ciilroi (s tentans Life Cycle Test
Chronic Measurements

5425
rep1

Date: 8/23/01
GLC#: 5425
Replicate #: 1
Technician Initials: (TJS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
		Primary	Secondary	Primary	Secondary	
*/ao						8/26
8/22						8/27
8/23						8/31
	8/23	8/284	'fa	1548	464	8/29
8/25						9/1
Tito						y,

Great Lakes Environmental Center

Uiironomiis temans JLiie cycie 1 est
Chronic Measurements

5425
rep 2

Date: 8/23/01
GLC #: S^aS
Replicate *ft:* ōi
Technician Initials: ŪBS

Dnte of Emergence		Date of Egg Mnss		Number of Eggs		Date Adult Died
a	?	Primary	Secondary	Primary	Secondary	
	8/23	8/26	8/27	672	389	8/29
	8/24	8/26	8/27	572	345	8/29
	8/24	8/26	8/27	1691	277	8/30
8/25						8/28
8/28						I/a
8/29						9/5

Great Lakes Environmental Center

Chiro (fs:ellans Life Cycle Test
Chronic Measurements

5425
rep 3

Date: 8/21/01
GLC #: 5425
Replicate //: 3
Technician Initials: JBS

Date of Emergence <?	Date of Emergence ?	Date of Egg Mass Primary	Date of Egg Mass Secondary	Number of Eggs Primary	Number of Eggs Secondary	Date Adutt Died
8/21						8/27
	8/22	8/23	8/25	1448	390	8/27
8/23						8/30
	8/25	~~8/28~~ 8/26	8/28	Mo	43?	8/30
		1				
					1	•

Great Lakes Environmental Center

Churonomus tertians Lriic t^ycte Test
Chronic Measurements

5425
rep 4

Date: 8/23/01
GLC *U*: 5425
Replicate *ft*: H
Technician Initials: JB

Dnte of Emergence		Date of Egg Mnss		Number of Eggs		Date Adult Died
♂	9	Primnry	Secondary	Primary	Secondary	
8/23						8/29
	8/23	8/24	8/26	887	260	8/28
	8/29	8/30	9/1	992	429	9/2
	8/29	8/30	y,	IffW	362	9/2
8/29						9/3
8/31						1/4
	9/3	9/4		I? IS"		u
9/4						9/6
	9/7	9/8	9/10	1685	440	9/10
	9/7	9/8	9/10	1751	548	9/12
Aux. 9/7						9/12

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ChironS^s tentans Life Cycle Test
Chronic Measurements

5425
rep 7

Chironomus tentans Life Cycle Test
Chronic Measurements

5425
rep 5

Date: 8/23/01
GLC #: 5425
Replicate *ft:* 5
Technician Initials: JBS

Date of Emergence ♂	Date of Emergence ♀	Dnte of Egg Mass Primary	Dnte of Egg Mass Secondary	Number of Eggs Primnry	Number of Eggs Secondary	Date Adult Died
8/22						8/25
	8/23	8/24	8/27	1095	302	8/28
	8/24	8/25	8/28	1448	836	8/28
	8/24	~~8/28~~ 8/26	~~8/28~~ 8/30	707		8/29
	8/25	8/26	8/29	584	50	8/29
8/26						?h\

Great Lakes Environmental Center

Chironomiis tentans Life Cycle Test
Chronic Measurements

5425 [redacted]

Chironomus tentans Life Cycle Test
Chronic Measurements

5425 rep 8 [redacted]

Date: 8/23/01
GLC #: 5425
Replicate #: 8
Technician Initials: JBJ

Date of Emergence	Date of Egg Mass		Number of Eggs		Date Adult Died
	Primary	Secondary	Primary	Secondary	
8/22					8/25
8/22	8/23	8/25	1440	403	8/25
8/23					8/29
8/26	8/27	8/29	1652	249	8/31
8/28	8/29		1212		9/1
8/30	9/2		1408	240	9/6
1//					9/4

d

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GLEC
Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

5425
rep 7

Date: 8/23/01
GLC #: 5425
Replicate #: 7
Technician Initials: JBS

Date of Emergence		Date of Egg Mass		Number of Eggs		Date Adult Died
♂	♀	Primary	Secondary	Primary	Secondary	
8/22						8/28
	? :«	8/24	Fa	1086	363	8/27
8/24						8/29
8/26						Vi
	9/8					Vi
9/9						9/14
			= =	= — = = _		

GLEC

Great Lakes Environmental Center

Chironomus tentans Life Cycle Test
Chronic Measurements

5425
rep 8

Date: 8/21/01
GLC #: 5425
Replicate #: 8
Technician Initials: JBJ

Date of Emergence * 9		Date of Egg Mass Primary	Date of Egg Mass Secondary	Number of Eggs Primary	Number of Eggs Secondary	Date Adult Died
8/22						8/25
	8/22	8/23	8/25	1440	4^)3	8/25
8/23						8/29
	8/26	8/27	8/29	1652	249	8/31
	^/^	8/29		1212		1/i
	8/30	9/2	"'J	1408	240	%
1//						9/4
					— —	
			—			

Great Lakes Environmental Center

Control

Cftiro (*as tentans* Life Cycle Test

TEST DAY: 10
WATERBATH 3

C

Date: 8-10-01
GLC#"
Test Material: ñt/*v*> ci«vfvgi
Test Species: *ChironormtsJBiHatis*
Technician Initials: 3 BS UR O

Food: Tetrafin
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: Ox
9:30 am renewal -j 15
pm renewal

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 21

Screens

Ammonia = 0.47 mg/L

Replicate	Temperature °C	DO mg/L	1.5 ml Fed	pH s.u.	Conductivity /zmos	Observations /10 Day Survival Data for Replicates 13,14, 15,16
1			fed			2AV
2						1AV
3 *	24.0	3.2	(	6.94	255	IVAV
4						1VA-V
5						)AV
6						NAV
7						NAV
S						NAV
9						i 1AV
10						1AV
11						NAV
12						
13						^organisms surviving: \Q /^\
14 *"	23.2	M		6.88	257	^organisms surviving:)« ^
15						^organisms surviving: | ^ ^
16						J/Q lisms survivinu:)& Pr\

LX=JBS

Great Lakes Environmental Center

Control [redacted]

Chironomus tentans Life Cycle Test

TEST DAY: 20 Survival/Growth

WATERBATH 3

Hate: g-gfl-fll
GLCtt
Test Material: P&fmc Control
Test Species: *Chironomus ten fans*
Technician Initials: 7%8 { V\AA

No. Organisms/Chamber: 12
Food: Tetrafin-
Age/Source of Organisms:
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: Ay
)A>V\ am renewal: pm renewal: 7:30
2:30 PS

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23

X Screens
46/48 - 95.8%

Replicate	Temp. °C	FED	pH s.u.	D.O. mg/L	Conductivity /imos	Alkalinity mg/L	Hardness mg/L	Ammonia mg/L	Observations on Sediment/ Behavior of Chironomus
1									iNAV
2									1♂
3									2 adult
4									1 adult
5 ¥	as.)		6.92	4.2	248	loe	130,	0.53	
6									1 adult
7									
8									↓NAV 2 adults
9									^surviving: ^ ADW: \.1ff} QJJJ:
10									^surviving: 12 ADW: 0.989
11									^surviving: 11 (ADW: |. 15H
12 *	22.9		6.96						^surviving: 10V ADW: 1-0^5
A1									NAV 6+4 adults
A2									
A3									
A4									↓ NAV

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Great Lakes Environmental Center

Control [redacted]

Uuro (*is tentans* Life Cycle Test

TEST DAY: H^

WATERBATH 3>

Date: <?-18-01
GLC#
Test Material: Parma Control
Test Species: Chironomus teutons
Technician Initials: JBS

Food: Tetrafin
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: ^
[1] am renewal
pm renewal

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Tejmperature (°C): 21

•Screens

Replicate	Tempcrnture °C	I ml YTC Fed	PH s.u.	D.O. mg/L	Conductivity /zmos	Hardness (mg/L)	Alkalinity (mg/L)	Ammonia (mR/L)	Observations
1			7.00	4.5	240	68	U	0.34	# larvae^*)^?pupae ^
2									# larvae^) # pupae c)
3									# larvae^ # pupae O
4									# larvaec!) # pupae O
5 *	22.9								# larvae^) # pupae/)
6									U larvae / # pupae Q
7									# larvae 3 # pupae Q
8 *	22.6								# larvae M # pupae £)

(QC=JBS)

GLEC [redacted]

Chironomiis ientans Life Cycle Test

TEST DAY: W
WATERBATH 3

Date: 8-10-01
GLC# 5418
Test Material: llAVPs -S.D 5008 0000 ?1 # of Daily Renewals: 3*
Test Species: *Chironomiis Ientans*
Technician Initials: ^^

Food: Tetrafin
Overlying Water: Dechlorinated municipal water
9:30 am renewal
7:15 pm renewal

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 21
V
ZsScreens

Ammonia- 0.46 mg/L

Replicate	Temperature °C	DO mg/L	1.5 ml Fed	pH *s.u.*	Conductivity *fimos*	Observations /10 Day Survival Data for Replicates 13, 14, 15, 16
1			1			
2			1			
3 *	^ 7	3.2	1	k.fo	266	1
4			1			
5			1			
6						
7						
8						
9						
10						
11						
12						
13						^organisms surviving: ^ A1
14 *	533	4.2		k.$\	243	^organisms surviving: 7 /33[1]
15						^/organisms surviving: 6 $J
16						//or -us surviving: 10 AH

f\J\f\J fMl\fii'i^t\ 4-iVi il

f r^-^ f^^i GK JRS

GLC [redacted]

*Chiroi v .s tehtans LA*fei cycle rest

TEST DAY: 20 Survival/Growth

WATERBATH 2>

Date: 8-20-01

GLC# 5418

Test Material: PAfe .<:o <:nn<& OaOO Q)

Test Species: *Chironomus teutons*

Technician Initials: 3B£ / HM

No. Organisms/Chamber: 12

Food: Tetrafin !

Age/Source of Organisms:

Overlying Water: Dechlorinated municipal water

# of Daily Renewals: Av

JA ,^am renewal: pm renewal: 7 .< 3 Z>

Test System: 175 mL Delivery System

Photoperiod: 16:8

Test Temperature (°C): 21

X Screens

34/48 = 70$L

Replicate	Temp. °C	FED	pH s.u.	D.O. mg/L	Conductivity //mos	Alkalinity mg/L	Hardness mg/L	Ammonia mg/L	Observations on Sediment/ Behavior of Chironomus
1									m
2									NAV
3									IAV
4									NAV
5 *	23.1		t.7t	5.1	242	102	128	0.69	
6									adult male
7									
8									rWAV
9									^surviving: jj ^^ADW: |.q^^
10									^surviving: Qy^S^ADW-. ^,7S>
11									#surviving: "J ADW: \,150
12 *	23.1		6.73						#survivine: I <7\ ADW: I. ^ Mo
A1									NAV
A2									
A3		V							
A4									,WfW

QC=JBS





Chironomus tentans Life Cycle Test

TEST DAY: H^
WATERBATH _1_

Date: 1'18-01
GLCH 3H)2
Test Material: RARSD 5008 CDOC) 6]
Test Species: Chironomts tentans
Technician Initials: JBS

Food: Tetrafin
Overlying Water: Dechlorinated municipal water
# of Daily Renewals:
am renewal
pm renewal

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): XL

•Screens

Replicate	Temperature °C	1 ml YTC Fed	pH s.u.	D.O. mg/L	Conductivity //mos	Hardness (mg/L)	Alkalinity (mg/L)	Ammonia (mgTL)	Observations
1			6.99	4.5	229	70	96	0-0b	# larvae Q //pupae O
2									# larvae ^j # pupae ^}
3									# larvae ^) # pupae Q)
4									# larvae ^) # pupae £)
5 *	m								# larvae Q # pupae (3
6									# larvae (_) U pupae (^)
7									U larvae Q # pupae £)
8 *	52.8								# larvae 0 # pupae <^)

QC-JBS

Great Lakes Environmental Center

5419

C7iir6. V .*us tentans* Life Cycle Test

TEST DAY: 10
WATERBATH 3

Date: 8-10-01
GLC# 5419
Test Material: CVAQ S& .SftOl *fthOO* ft I ff of Daily Renewals: fy
Test Species: *Chironomus tentans*
Technician Initials: ?fe IYIffU^

Food: Tetradn
Overlying Water: Dechlorinated municipal water
<\';\o am renewal
7;1S pm renewal

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23
aScreens

Ammonia = 0.77 mg/L

Replicnte	Tempernture °C	DO mg/L	1.5 ml Fed	pH s.u.	Conductivity //mos	Observations /10 Dny Survival Dnta for Replicntes 13, 14, 15, 16
1			KW			WAV
2						
3 *	23.4	3.3		6.70	237	
4						
5						
6						fungus
7						
8						
9						
10						
11						
12						
13						^organisms surviving: 7
14 *	23.3	MD		6.80	242	^organisms surviving: 3
15						^organisms surviving: 7
16						//organisms surviving: 3

DE = JRC

GLC

5^1

Chironomus tentans Life Cycle Test

TEST DAY: 20 Survival/Growth

WATERBATH 3

Date: 6- 20-01

GLC# 5419

Test Material: GM& 50 5001 O0Q0 01

Test Species: *Chironomus teutons*

Technician Initials: 35* / \\tA. # of Daily Renewals: &*

lO'^O am renewal: pm renewal: "l--3^

No, Organisms/Chamber: 12

Food: Tetrafln

Age/Source of Organisms:

Overlying Water: Dechlorinated municipal water

Test System: 175 mL Delivery System

Photoperiod: 16:8

Test Temperature (°C): 21

X Screens

20/48 = 41.7%

Replicate	Temp. °C	FED	pH s.u.	D.O. mg/L	Conductivity µmos	Alkalinity mg/L	Hardness mg/L	Ammonia mg/L	Observations on Sediment/ Behavior of Chironomus
1									NAV
2									fungus 1 adult
3									
4									NAV
5	23.2		6.69	4.2	235	96	172	0.78	IAV 1 adult 1 chided
6									IAV
7									NAV
8									NAV 2 adults
9									^surviving: 1 ADW:^ .250 1 adult
10									^surviving: 6 ADW^ .297 male
II									^surviving: 0 ADW: —
12**	23.1		6.70						#survivine: 9 ADW: 1.$4\
A1									NAV +4 adults
A2									
A3									
A4									WttSl"

Great Lakes Environmental Center

5419

Chiro (ts tentans Life-Cycle esC

TEST DAY: *H

WATERBATH 3

Date: 9-18-01

GLC#: 5419

Test Material: C / A & S D. 2007 0006 01

Test Species: *Chironomus tentans*

Technician Initials: *1W>*

Food: Tetrafin

Overlying Water: Dechlorinated municipal water

# of Daily Renewals: \

8:30 am renewal

pm renewal

Test System: 175 mL Delivery System

Photoperiod: 16:8

Test Temperature (°C): 21

•Screens

Replicate	Tempernturc °C	1 ml YTC Fed	pH s.u.	D.O. mg/L	Conductivity ^mos	Hardness (mg/L)	Alkalinity (mg/L)	Ammonia (mg/L)	Observations
1			*1.01*	3.8	232	68	108	0.71	# larvae Ô # pupae<O
2									# larvae ?J # pupae Q ^^
3									# larvae O # pupae <^)
4									#' larvae | # pupae (3
5 *	*m*								# larvae £) # pupae O
6									# larvae (^) # pupae <^f fungus
7									*U* larvae O # pupae O^fl^-^fe^
8 *	aa.7								# larvae ^> # pupae O

QC=JBJ

GLEC [redacted]

Chironomus tentans Life Cycle Test

TEST DAY: 10
WATERBATH 3

Date: Z-IO-O]
GLC#: [illegible]
Test Material: APR SD 4008 /VW) oT #
Test Species: *Chironomus teutons*
Technician Initials: 71?>

Food: Tetrafin
Overlying Water: Dechlorinated municipal water
of Daily Renewals: 3x
?#0 am renewal
7*^5 pm renewal
1:00 afternoon

Test System: • * 175 mL: Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23
^Screens

AMMONIA = 1.93 mg/L

Replicate	Temperature °C	DO mg/L	1.5 ml Fed	pH s.u.	Conductivity *fimos*	Observations/10 Day Survival Data for Replicates 13, 14, 15, 16
1			A3			NAV red/brown bac/fungus
2						
3 *	23.5	2.6		6.59	262	
4						
5						
6						
7						
8						
9						
10						**0**
11						0
12						
13						^organisms surviving: 3
14 *	22.7	31*		6.70	255	//organisms surviving: 7
15						//organisms surviving: *fj*
16						//or (s surviving: 5

*4ms**



C7//r0; ^ *u tentans* Life Cycle iest

TEST DAY: 20 Survival/Growth

WATERBATH _3_

Date: g-30-01

GLC# 5420

Test Material: *A2& SO* 4808 000001

Test Species: *Chiranonms tentans*

Technician Initials: JBS / HM

No. Organisms/Chamber: 12

Food: Tetrafin I

Age/Source of Organisms:

Overlying Water: Dechlorinated municipal water

# of Daily Renewals: jy

JO *tO am renewal: pm renewal: *l\^0*

afternoon: 3:00 pm

Test System: 175 mL Delivery System

Photoperiod: 16:8

Test Temperature (°C): 23

lyScreens

20/48 = 41.7%

Replicate	Temp. °C	FED	PH *SM.*	D.O. mg/L	Conductivity ^mos	Alkalinity mg/L	Hardness mg/L	Ammonia mg/L	Observations on Sediment/ Behavior of Chironomus
1									NAV BHV
2									
3									1
4									
5 ^	22.6		6.63	5.1	242.	100	132	AW	
6									
7									
8									FOS
9									#surviving: *% ADW: f) ; ^> (
10									<H^t>~. Teach i-iwnei > ^surviving: ADW: C\A^
11									Surviving: *\ ADW: §T$$
12 *	22.6		t.m						#surviving:7 ADW: O'^>CD
A1									NAV
A2			-						
A3		\							
A4									

&C-T&

Great Lakes Environmental Center

Chironomus tentans Life Cycle Test

TEST DAY: *H
WATERBATH _ i _

Date: 9-18-01
GLOf 5430
Test Material: AP& fk 1008 ft&Y) Ol # of
Test Species: *Chironomus tentans*
Technician Initials: JBS

Food: Tetrafin
Overlying Water: Dechlorinated municipal water
Daily Renewals:.
gvw am renewal
P^m renewal
T 15

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23
•Screens

Replicate	Temperature °C	1 ml YTC Fed	pH s.u.	D.O. mg/L	Conductivity /^mos	Hardness (mg/L)	Alkalinity (mg/L)	Ammonia (mg/L)	* Observations
1			^0?	3.5	235		)ofc	/•7C?	»# larvae^j -^ *U* pupae O
2									# larvae W # pupae •• O
3									# larvae ^ # pupae
4									*U* larvae (P # pupae
5 *	22.7								# larvae <- # pupae O
6									# larvae # pupae (^)
7									# larvae Q *U* pupae Q
8 X-	22.3								# larvae ^ # pupae CZ-)

AI- 19

QC=JBS

Great Lakes Environmental Center

5421

CItiro (is tentans jLife cycle Test"

TEST DAY: 10
WATERBATH 3

Date: S'10-O\
GLC# 5421
Test Material: LPX sp 4-Q\| 0000 Q\
Test Species: *Chirdnomus tentcms*
Technician Initials: JBS

Food: Tetrafin
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: ^ ;
9:30 am renewal
7:15 pm renewal

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 21

00 Screens

Ammonia- 0.51 mg/L

Replicate	Temperature °C	DO mg/L	1.5 ml Fed	pH s.u.	Conductivity /imos	Observations /10 Day Survival Data for Replicates 13,14, 15,16
1			JP			NAV fungus|bacteria
2						
3 *	23.5	3.9		6.61	37J	
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						^organisms surviving: I f\)
14 *	33.2	4.1		6.78	242	//organisms surviving: p f\y
15						//organisms surviving: O(ft
16			S			//or 'sins survivinu: 3 NAV

QC =JBS

UTLEL 5421 [redacted]

Chironomus tentans Life Cycle Test

TEST DAY: 20 Survival/Growth

WATERBATH 3

Date: 8-20-01
GLCfl 5421
Test Material: U P * SD H-flU 0000 01
Test Species: *Chironomus tentans*
Technician Initials: JBS / HM

No. Organisms/Chamber: 12
Food: Tetrafin
Age/Source of Organisms:
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: 3*
10:30am renewal: pm renewal: "]:30

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 22

^Screens
24/48 = 50%

Replicate	Temp. °C	FED	pH s.u.	D.O. mg/L	Conductivity /zmos	Alkalinity mg/L	Hardness mg/L	Ammonia mg/L	Observations on Sediment/ Behavior of Chironomus
1									1 deqa Lcxn/qe NAV BAV
2									
3									
4									
5 *	23.1		fc.10	5.3	237	98	1 Ho	0.76	
6									
7									
8									
9									Surviving: 7 ADW: 1.844 + 1 weighed for tissue ID
10									^surviving: % / ADW: 1.894
11									#surviving: 6 ADW: 1.556
12 *	23.2		6.73						#survivine: 2 ADW: 2.455
A1									NAV + 2 adults
A2									
A3									
A4									

QC = JBS

Great Lakes Environmental Center

5421

Uib (ius tentans Life Cycle Test

TEST DAY: *H*\

WATERBATH *1*

Date: ^1'i^0\ Food: Tetrafin Test System: 175 mL Delivery System

GLCft 5M3-1 Overlying Water: Dechlorinated municipal water Photoperiod: 16:8

Test Material: 1 PY SD> LVO\1 CDQO CiT # of Daily Renewals: I Test Temperature (°C): 21

Test Species: *Chironomvs tentam* 8:30 am renewal

Technician Initials: 3& pm renewal •Screens

Replicate	Temperature °C	I ml YTC Fed	pH s.u.	D.O. mg/L	Conductivity	Hardness (mg/L)	Alkalinity (mg/L)	Ammonia (mg/L)	Observations
1			*l.Cfi*	4.1	229	·66	104	0.46	# larvae *0* *U* pupae C
2									# larvae Cy # pupae *O*
3									# larvae (Q # pupae £2
4									# larvae cy # pupae c)
5 *	23.3								# larvae^) *U* pupaeO
6									# larvae *Q* *U* pwpae (^)
7									# larvae^) ' # pupae (^)
8 *	22.9								# larvae^) # PjJ£ae CD

AD- 19

GK.'-JBS

1,

GLEC 5422

Great Lakes Environmental Center

Chironomiis tentans Life Cycle Tjest

TEST DAY: 10 *I*
WATERBATH 3

Date: $-lo-o\
GLC# 5422
Test Material: *hf& £D 4009 00001*
Test Species: *Chirononms tentans*
Technician Initials: J &/f%>

Food: Tetrafin
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: 3*
<\'\p am renewal
7:15 pm renewal
1:00 afternoon

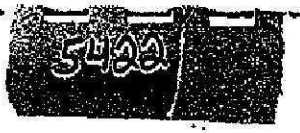
Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 21

✓ B! Screens

Ammonia = 0.58 mg/L

Replicate	Temperature °C	DO mg/L	1.5 ml Fed	pH s.u.	Conductivity /^mos	Observations /10 Day Survival'Pata for Replicates 13, 14, 15, 16
1						AiAV ^Vrtfoi
2						
3 *	22.6	1.7		*Ul*	238	
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						^organisms surviving: O 0 Al
14 *	35-1	9.6		4.73	234	//organisms surviving: 'fO *fO*
15						//organisms surviving: 8Ci *pfi,*
16						//organisms surviving: 10 AV





Churoh C. .s tentans ofeXycle *i* est

TEST DAY: 20 Survival/Growth

WATERBATH S

Date: 8-20-01

GLC# 5422

Test Material: APfe &K 4009 0^0.0 0\'

Test Species: *Chironormts tentans*

Technician Initials: OBS A-\M

No. Organisms/Chamber: 12

Food: Tetrafin

Age/Source of Organisms:

Overlying Water: Dechlorinated municipal water

# of Daily Renewals: &[1]*

)j ;2° am renewal: pm renewal: 7*. 28

Test System: 175 mL Delivery System

Photoperiod: 16:8

Test Temperature *(°C)*: 23

Screens

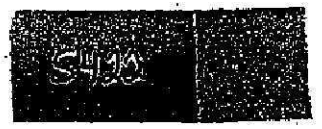
30/48 = 62.5%

Replicate	Temp. °C	FED	pH s.u.	D.O. mg/L	Conductivity //mos	Alkalinity mg/L	Hardness mg/L	Ammonia mg/L	Observations on Sediment/ Behavior ofChironomus
1									!?0S W A/^
2									
3									
4									2adults
5 *	22.8		6.86	4.3	233	96	128	0.40	1pupae
6									
7									
8									
9									Surviving: .fc) ADW: |, (,62
10									^surviving: 6 ADW: | , T ^ 3
11									#surviving: (j> . ADW: 2 N ^ 3 ^
12 *	22.6		t.7S						^surviving: ^I^^^ADW. \.°\1^\
A1									NAW
A2									
A3									
A4									

1

QC = JBS

Great Lakes Environmental Center



Chironomus tentans Life Cycle Test

. TEST DAY: *H
WATERBATH 3

Date: 9-18-01
GLC# 5432
Test Material: ^PR £D *HCCi'f~?X5C)6"0* # of Daily Renewals: 1
Test Species: *Chironomus tentans* <£ *3o*
Technician Initials: JBS

Food: Tetrafin
Overlying Water: Dechlorinated municipal water
am renewal
pm renewal

Test System: 175 mL Delivery System
Photoperibd: 16:8
Test temperature (°C): 23

•Screens

Replicate	Temperature °C	I ml YTC Fed	pH s.u.	D.O. mg/L	Conductivity //mos	Hardness (mg/L)	Alkalinity (mg/L)	Ammonia (mg/L)	Observations
1			7.10	4.0	226	50	112	1.23	# larvae J # pupae *(j*
2									# larvae Q # pupae (^
3									# larvae 0 # pupae 0
4									# larvae {7 # pupae Q
5 *	22.9								# larvae 0 # pupae *fi*
6									# larvae o # pupae 0
7									# larvae C # pupae 0
8 *	22.6								# larvae 0 # pupae Q

A3- 14

GC=58)

r—i r-n Bin* f—n

Great Lakes Environmental Center

Utiro. C is tentans jLifncycle 1 est

TEST DAY: 10
WATERBATH _at

Date: 8-10-01
GLC# 5423
Test Material: A^B Sfr j-QIQ Q(Y)Q O\ #
Test Species: *Chironomus tentans*
Technician Initials: "tt>

Food: Tetrafin
Overlying Water: Dechlorinated municipal water
of Daily Renewals: £x
4'-%° am renewal
-)WS pm renewal

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature *CO;* 23

05creens

Ammonia = 0.48 mg/L

Replicate	Temperature °C	DO mg/L	1.5 ml Fed	pH s.u.	Conductivity µmos	Observations /10 Day Survival Data for Replicates 13, 14, 15,16
1						ivAA/ fwss
2						1
3 *	22.9	IS		(>.W	253	
4						
5						
6						
7						
8						
9						
10						
11						
12						
13				•		^organisms surviving: O /^-j
14 *	22.6	4,3		6.88	255	#organisms surviving: 0 *Pfo*
15						#organisms surviving: 0 ft>
16						*Uor* sms survivine: ^ Hn T

GC = JBS

GLEC

Great Lakes Environmental Center

5424 [redacted]

Chironomiis tentans Life Cycle Test

TEST DAY: 10

WATERBATH . &

Date: %r-10-01

GLCU 5MQM

Test Material: UfX SD 4*013 0000 01

Test Species: *Chironomiis tenfans*

Technician Initials: ^"BS

Food: Tetrafin

Overlying Water: Dechlorinated municipal water

# of Daily Renewals:

4:30 am renewal

7:15 pm renewal

Test System: 175 mL Delivery System

Photoperiod: 16:8

Test Temperature (°C): 21

Y

©Screens

A mm on[1] in – 0.41 mg/L

Replicate	Temperature °C	DO mg/L	1.5 ml Fed	pH s.u.	Conductivity //mos	Observations/IO Day Survival Data for Replicates 13, 14, 15, 16
1						NAV
2			A)			
3 *	22.3	4.5		6.82	5, Ho	
4						
5						
6						
7						
8						
9						
10						
It						
12						
13						^organisms surviving: H~ Pr\
14 *	.as. i	4.7		6.91	240	^organisms surviving: (5 na*
15						^organisms surviving: O ^
16						//on s surviving: 3 AA AJAV

GLEC

5425 [redacted]

Chirortumus tentans Life Cycle Test

TEST DAY: 10
WATERSATH . &

Date: 8-10-01
GLC# 5425
Test Material: LPK SD 4013.0000 01
Test Species: *Chironomus tentans*
Technician Initials: 58*|fl\\fl | UK\

Food: Tetrafin
Overlying Water: •/ Dechlorinated municipal water
# of Daily Renewals:..^
9:30 am renewal
7:15 pm renewal

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 21

©Screens

Ammonia =266 mg/L

Replicate	Temperature °C	DO mg/L	1.5 ml Fed	pH s.u.	Conductivity /imos	Observations /10 Day Survival Data for Replicates 13, 14, 15, 16
1						MAN fungus
2						) 1
3 *	22.6	4.2		6.82	^"7T-	
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						#organisms surviving: ^ *b* I
14 *	22.4	MS		6.85	240	^organisms surviving: 5 *pfy* \
15						//organisms surviving: ^ R3 j
U,						//on :ms survivinu: 1 ttM ^ V/ T

» / _-ro ^

Great Lakes Environmental Center

5425

Chiron .ius tertians LifeX^cIe Test
TEST DAY: 20 Survival/Growth
WATERBATH *Si*

Date: 8-20-01
GLC# 5425
Test Material: *LPt- 5>O Woj^ • oooo* (c)
Test Species: *Chironomi/s fenfans*
Technician Initials: JBS / HM

No. Organisms/Chamber: 12
Food: Tetrafin
Age/Source of Organisms: <24 hrs in (•bost;
Overlying Water: Dechlorinated municipal water
# of Daily Renewals: &*
/{?; *lo* am renewal: pm renewal: 7; *%Q*

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23

M Screens
30/28 = 62.5%

Replicate	Temp. °C	FED	pH s.u.	D.O. mg/L	Conductivity /imos	Alkalinity mg/L	Hardness mg/L	Ammonia mg/L	Observations on Sediment/ Behavior of Chironomus
1									ladol+imle. W %$$*>
2									
3									
4									
5 *	22.9		6.78	5.4	238	98	14-M-	Ken	BHV
6									
7									
8									
9									#surviving: M ADW: *QMIY*
10									#surviving: b w^t^^J ADW: 1*5
11									#surviving:)) ADW: } . ^ ^
12 *	&-%		6.73						^surviving: 9 ADW: I *M%%*
A1									^ AV
A2									
A3									
A4 I									

QC = JBS

Replicate	jmperature °C	[1 ml YTC (Fed	pH s.u.	PoTo.	Conductivity //mos	nardness 1 (mg/L)	Alkalinity 1 (mg/L)	Ammonia (mg/L)	Observations
1			7.07	3.8	217	66	104	610	# larvae 0 # pupae O
2									# larvae C> # pupae Q
3									# larvae £) # pupae 0
4									# larvae 0 # pupae G
5 *	XL?								# larvae d-) # pupae CD
6									# larvae /w # pupae (^)
7									# larvae Q #pupae 0
8 *	Oil								# larvae ^P # pupae (^)

A2 - 1♀
A'- 2♀

QC=3D5

5424

Chiron tentans Life-Cycle Test

TEST DAY: 20 Survival/Growth

WATERBATH <Q

Date: 8-20-01
GLC# 5424
Test Material: LPV SD 19 QQQO O:
Test Species: *Chironomus, teutons*
Technician Initials: Jfc" *I* HM

No. Organisms/Chamber: 12
Food: Tetrafin
Age/Source of Organisms:
Overlying Water: Dechlorinated municipal water
# of Daily Renewals"" &*
\0'>£> am renewal: pm renewal: 7 - 3 ^

Test System: 175 mL Delivery System
Photoperiod: 16:8
Test Temperature (°C): 23

X Screens

28/48 = 58.3%

Replicate	Temp. °C	FED	pH s.u.	D.O. mg/L	Conductivity µmos	Alkalinity mg/L	Hardness mg/L	Ammonia mg/L	Observations on Sediment/ Behavior ofChifonomus
1									N"fY/ •&&•
2									
3									
4									
5 *	23.0		6.64	5,4-	239	98	14-0	0<toV	
6									
7									1
8									
9									^surviving: ^ 1 ADW:), 757
10									^surviving: T ADW: \,M5t?
11									^surviving: 5 ADW: 1 -W³-
12 *	22.7		6.69						#survivin a: T ADW: 1?^^ iftW
A1									NAW
A2									
A3		A							
A4 · I						1			

QC = JBS

Great Uikes Environmental Center

~~CHRONIC TOXICITY TEST - WEIGHT DATA~~

TEST MATERIAL: C.antredale

TEST NUMBER: 5519 ~ DO

TECHNICIAN'S INITIALS: HM — 8/22/01
AM — 8/23/01 JBS - 9/7/01

WEIGH DATE: 8/22/01

TEST DATE: Day 20

DRYING DURATION (HOURS): -3Aixrs

TYPE/MODEL OF DRYING OVEN: Precision

OVEN TEMPERATURE CO: UP °

TEST SPECIES: On.vV^orfiU.< tentans

TREATMENT LEVEL	REP. NUMBER	A WEIGHT OF PAN AND FRY & CO" (q)	B /Ijrt WEIGHT OF ~~OVEN-DRIED PANS~~ PAN + CHRO @ 550° (g)	A-B TOTAL DRY FRY WEIGHT (q)	C NUMBER OF FRY WEIGHTED	A-B/C AVERAGE DRY FRY WEIGHT (mgL	BIOMASS WEIGHT {mg)
Con-tiro 1	9 A	1.003 S3	0. ?<?/£"?	0.01095	9	uns	
	10 /	1.00343	0. 99156	0.onn	12	0.98[illegible] ~~1.540~~ JBS	1.10fe
	11%	^ - / (^	0. 98500	0.01269	11	US[1]-]	/
	12 A	1.00081	0. 98792	o.oiots	10	i:ots	/
5418	9 A	Looiol°!	0. 98739	0.0\°mo	13	1.492	
	lo ?	.98525	a. <??0 7i	0.00446	2	^ ^ • ^	1.780
	11 A	.99335	0. 9811O	0.01225	7	1.750	/
	12 A	1.00714	(?. Cjf73f	6.01175	12	1.646	/
SM-H	1 /	.97801	0. 77 S33	0.00268	1	3. WO	
	b /	.99516	0. 9?/3?	0.01378	6	~~10.110~~ 2.29	2.173
	11 %	he C-Kir.a	———			~~2.297~~ JBS	/
	12 A	^131	0. 98344	0.01387	9	JBS ~~2.297~~ 1.541	/
INITIAL DRY WEIGHTS	A						
	B						

Great Lakes Environmental Center

CHRONIC TOXICITY TEST - WEIGHT DATA

TEST MATERIAL: RcrTT?. UP. AC.OE - Centredale

WEIGH DATE: 8/22/01

TYPE/MODEL OF DRYING OVEN: TM ue. M

TEST NUMBER: s5SS \ °1 ~~ QQ

TEST DATE: Day 20

OVEN TEMPERATURE (°C): uo~

TECHNICIAN'S INITIALS:

DRYING DURATION (HOURS): 24 hrs.

TEST SPECIES: C VN i ropomus tentans

TREATMENT LEVEL	REP. NUMBER	A WEIGHT OF PAN AND FRY @ 60°C (g)	B /b^/ WEIGHT OF ~~OVEN-DRIED PANS~~ PAN+CH=(g) @ 550°C	A-B TOTAL DRY FRY WEIGHT (g)	C NUMBER OF FRY WEIGHTED	A-B/C AVERAGE DRY FRY WEIGHT (mg)	BIOMASS WEIGHT (mg)
5420	9 ~	.99098	0.98409	0-001,2^	8	0.%\	
	6 i	-^1 134	Q.170*5	Q.OOOH^	1	SBJ ~~3.683~~ 0.490	\ 0.685
	11 8	.98557	0. 9824a	0.DW5	4	0.788	/
	12 A	« ^ s n	0. 9809/	0.ocmw	7	O.loCO	/
5421	9 x	.98953	0. 9276.2	o,om\	7	1. ?MM	
	10 /	.99207	0. 97692	0.01SI5	^ \	SBJ ~~10.188~~ 1.844	\ 1.937
	11 %	.98405	a 176*7	0.0011g	5	1.556	/
	•\A	•°1?3LkJ	O.17770 J	0,00491	2	2.455	/
5422	^/C	9i 0 0 ^ 0 9 1 8 8 ^) 0	0. V^3£	0.0)1,00-	10	1.602	\
	10 £	^ 1 ^ 1 S .	(7. J4T0.C	6.001V	H \	1.783	\
	t1 ^	.98396	0. ?70^y	o.omz	6	~~12.605~~ 2.23 TM	\ 1,900
	12 A	.9 9 9 1 9j 9 1 6 1	0.9757Y	O.OtttS	s^7	I5TM	/ -
INITIAL DRY WEIGHTS	A						
	B						

Great Lakes Environmental Center

CHRONIC TOXICITY TEST - WEIGHT DATA

TEST MATERIAL: CPntredelle

WEIGH DATE: 8/22/01

TYPE/MODEL OF DRYING OVEN: Piuo M

TEST NUMBER: 5519~00

TEST DATE: Day 20

OVEN TEMPERATURE CO: 60°

TECHNICIAN'S INITIALS:

DRYING DURATION (HOURS): 5 M- Vs V"-^ -

TEST SPECIES: Tentans

TREATMENT LEVEL	REP. NUMBER	A WEIGHT OF PAN AND FRY (g)	B fa* WEIGHT OF ~~OVEN-DRIED PANS~~ PAN + CHAFF	A-B TOTAL DRY FRY WEIGHT (9)	C NUMBER OF FRY WEIGHTED	A-B/C AVERAGE DRY FRY WEIGHT (mg)	BIOMASS WEIGHT (mg)
5423	°i /	\ /					
	lo X	\ /					
	11 %	/ \					
	12 ~~A~~	/ \					
5424	*) /	.96955	0.95725	0.01230	7	1.757	\
	(5 £	.97019	o. ?£~?5y	O.OWiS	8	~~11.988~~ 1.456	\ i-7^
	11 X	o.96811	0.?5~?7Q	0.00°m\	5	1.882	/
	12 ~~£~~	."114-01	0. 95fy$	0.01459	8	1.824	/
5425	<\ s	.96793	0. ysYQci	O.ooW	4	2MV	\
	lo ^	.96423	0. 7573?	0.00m	4	~~1.670~~ 1.715	\ 1.799
	II A	.98098	0. 96W?	0.01649	11	IMW	/
	12 ~~4~~	o.~?.OJ~?i^	0.96602	O.DKW	9	(.MS?	/
INITIAL DRY WEIGHTS	A						
	B						