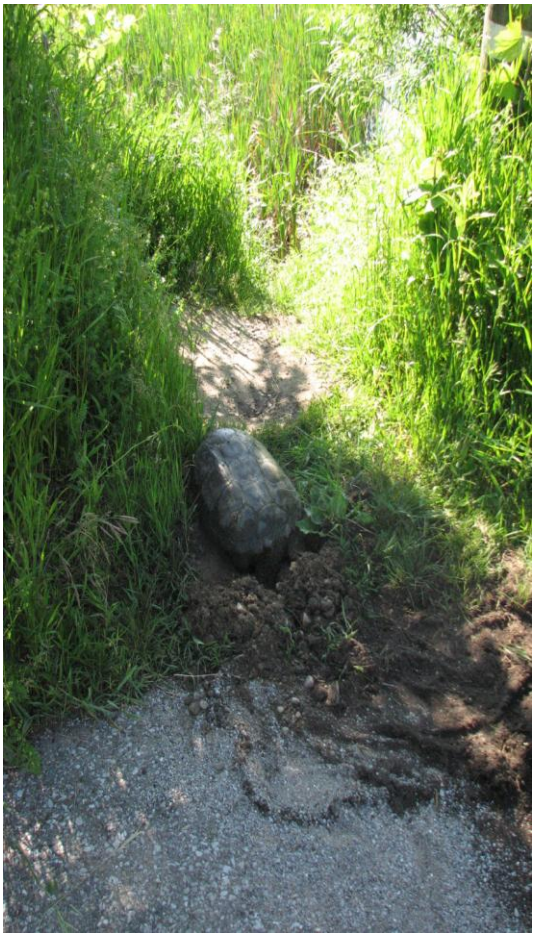
Durham Region Coastal Wetland Monitoring Project:
6-Year Technical Report

Module 4 – Wetland Status



June 2010

Environment Canada
Canadian Wildlife Service

Environnement Canada
Service canadien de la faune

Central Lake Ontario Conservation

Project support gratefully acknowledged from:

DURHAM REGION

Environment Canada Environnement Canada

Central Lake Ontario Conservation

GANARASKA REGION CONSERVATION AUTHORITY

ONTARIO POWER GENERATION
Darlington Nuclear

TORONTO AND REGION Conservation
for The Living City

PREFACE

The Durham Region Coastal Wetland Monitoring Project: 5-Year Technical Report is published in four modules. Each module may be read independently however, in successive order they constitute a complete document. This segment, Module 1, contains the executive summary, introduction and description of the assessment methods. The scope of the project is examined along with a complete description of the study sites. Wetland assessment methods are described and focus the use of Indices of Biological Integrity (IBIs). Module 2 includes the geophysical condition of Durham Region coastal wetlands. It describes the water and sediment quality, water levels and changes in adjacent land cover. The condition of biological communities, including macroinvertebrates, amphibians, birds, fish, and submerged aquatic vegetation is presented in Module 3. A summary of wetland status is presented in Module 4 where the components of the preceding modules are compiled offering a detailed description of changes and trends in overall condition of each Durham Region coastal wetland over the study period.

This report describes the Durham Region Coastal Wetland Monitoring Project (DRCWMP) in considerable detail and is intended for a technical audience who are interested in using this information to inform their own monitoring projects or to gain specific information about the wetlands included in this report.

TABLE OF CONTENTS

WETLAND STATUS

Table 1. A summary of average index scores (out of 100) and ranks (see shaded key) for water quality (WQI, based on Chow-Fraser (2006)), submerged aquatic vegetation (SAV – IBI), fish (fish – IBI), bird and amphibian communities (bird – IBI and amphibian – IBI, respectively) in 18 Durham Region wetlands throughout the study period. Note that cells with no values indicate that sampling was not performed at the wetland.

Durham Region Wetland	WQI	SAV – IBI	Fish – IBI	Bird – IBI	Amphibi-an – IBI	Macroinverte-brate – IBI
Rouge River Marsh	-1.45	17.90	25.00	34.2	27.51	70.92
Frenchman's Bay Marsh	-1.17	20.0	48.70		21.31	48.16
Hydro Marsh	-1.69	0.00	52.40		41.47	37.37
Duffins Creek Marsh	-1.49	1.2	49.10		6.78	39.77
Carruthers Creek Marsh	-2.74	2.6	47.30	3.7	8.13	40.99
Cranberry Marsh	-1.35				30.29	
Lynde Creek Marsh	-1.32	1.3	50.00	53.9	23.87	34.95
Whitby Harbour Marsh*	-1.35		9.40			49.64
Corbett Creek Marsh	-1.68	35.7	40.20	31.00	8.81	51.90
Pumphouse Marsh	-2.55			33.60	33.13	
Oshawa Creek Marsh*	-0.56					
Oshawa Second Marsh	-1.71	55.99	26.50	62.20	30.70	40.45
McLaughlin Bay Marsh	-2.69	6.10	35.30	57.20	33.75	48.66
Gold Point Marsh*	-1.65					
Westside Marsh	-1.55	5.90	51.50	84.70	7.32	52.50
Bowmanville Marsh	-1.59	12.20	59.70	38.70	12.67	33.72
Wilmot Creek Marsh	-1.44	50.30	46.80	37.20	34.04	36.85
Port Newcastle Marsh	-1.07	7.80	55.60	38.10	23.01	21.51
Shading Key**: Poor / Fair	Good	Very Good		Excellent		

* data available for 2007 only

** note that for water quality data naming of ranks/conditions are different (due to the nature of the index) such that poor=highly degraded, fair=very degraded, good=moderately degraded

Bowmanville Marsh

Wetland Statistics – Bowmanville Marsh	
Location	Municipality of Clarington
Wetland Type	Drowned River-mouth
Vegetation Types	Marsh 92%, Swamp 8%
Wetland Size (hectares)	33
Watershed Size (hectares)	16 590
Percent Natural Cover in Watershed	36

Report Card – Bowmanville Marsh			
	Years	**Condition**	**Trend**
Water Quality	2002 – 2007	Very Degraded	Stable
Submerged Aquatic Vegetation	2002 – 2007	Poor	Stable
Amphibians	2002 – 2004, 2006, 2007	Poor	Stable
Birds	2003, 2005 – 2007	Fair	Stable
Fish	2003 – 2007	Good	Stable
Macroinvertebrates	2003 – 2007	Fair	Stable

Detailed Description:

Water Quality

Years: 2003 – 2007
Mean WQI±SD = -1.53 ± 0.23 (based on all months of data)
Range = -1.88 – -1.27
Rating (based on mean): Very Degraded
Temporal Trends (significant where $p<0.05$; marginally significant where $p<0.1$):
WQI (all months of data): No
Raw water parameters (July data): Turbidity (increasing, marginally)

Table 2. Mean water quality parameters (July) and WQIs (July/all months in 2004) for Bowmanville Marsh, 2002 – 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity*	NO_3	WQI**
Bowmanville Marsh	2002	-	-	-	7.58	-	-
Bowmanville Marsh	2003	23.26	7.65	489.33	48.65	2.01	-1.88
Bowmanville Marsh	2004	20.25	8.00	495.00	8.83	0.97	-1.51/ -1.47
Bowmanville Marsh	2005	25.36	7.76	585.33	13.93	0.20	-1.42
Bowmanville Marsh	2006	26.63	8.03	705.67	81.52	0.33	-1.27
Bowmanville Marsh	2007	22.50	7.70	364.67	80.29	0.27	-1.59

* values based on multiple readings taken typically in July (see water quality chapter for details)
** for 2004, a WQI value calculated for water sampling performed in July is indicated and is followed by an average WQI for all months of water collection in that year; other years of data are based on water sampling in July.

Findings:

- WQI values for every year consistently rated as “very degraded”

- Turbidity: ranges in daily means for all months (not shown in Table 5-2) = 7.58 – 81.52 with 26% (8/31) turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing means of all water quality parameters, Bowmanville Marsh exhibited: 1) the lowest mean value of NH_4 for collections in 2005 and 2006 (not shown), 2) the highest mean chlorophyll *a* level (not shown) and, 3) was among the highest for mean turbidity during the study period using both July only data and all months of data.

Submerged Aquatic Vegetation Community

Years: 2002 – 2007
Mean IBI±SD = 18.76 ± 5.39
Range = 12.25 – 27.38
Condition/Rating (based on mean): Poor
Temporal Trends (significant where $p<0.05$; marginally significant where $p<0.1$):
IBI: Decreasing (marginally)
Raw IBI Metrics: FQI, decreasing (marginally) or could not be performed due to ties (i.e., SINT and PINT)

Table 3. Submerged aquatic vegetation community metrics and IBIs for Bowmanville Marsh, 2002 – 2007.

Wetland	Year	SINT	PINT	FQI	PCOV	SNAT	SAV – IBI
Bowmanville Marsh	2002	0.81	0.67	4.77	3.13	4.32	27.38
Bowmanville Marsh	2003	0	0	2.65	1.79	2.88	14.63
Bowmanville Marsh	2004	0.20	0.07	3.53	3.69	3.46	21.90
Bowmanville Marsh	2005	0.54	0.49	3.51	2.29	2.62	18.89
Bowmanville Marsh	2006	0	0	3.12	1.31	4.32	17.50
Bowmanville Marsh	2007	0	0	2.27	1.41	2.45	12.25

Findings:

- Overall, total number of all species: range = 7 (2003, 2006, 2007) – 14 (2002); total (all years): 18 species (of which 17 were native) and two turbidity-intolerant species found (flat-stemmed pondweed and slender naiad).
- Among years, comparing five IBI metric scores for Bowmanville Marsh (Table 5-3): highest metric scores were found in 2002 for SINT (0.1 turbidity-intolerant species/quadrat), PINT (3.5% cover turbidity-intolerant species/quadrat), FQI (3.9, with the white-water lily found frequently (cc=5)) and SNAT (1.5 native species/quadrat) resulting in the highest IBI score for that year; absence of turbidity-intolerant species in 2003, 2006 and 2007; range in total percent coverage=13.1%/quadrat (2006) to 36.9%/quadrat (2004).
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Bowmanville Marsh fell within the range of means for other wetlands and exhibited no minimum or maximums in community metrics.

Fish Community

Years: 2003 – 2007
Mean IBI±SD = 43.14 ± 12.64

Range = 26.53 – 59.69
Condition/Rating (based on mean): Good
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: No (SNAT, SCEN, NNAT, PBNI and BYPE) or could not be performed due to ties (i.e., PPIS)

Table 4. Fish community metrics and IBIs for Bowmanville Marsh, 2003 – 2007. The results of two sampling efforts in 2004 are also provided.

Wetland	Year	SNAT	SCEN	PPIS	NNAT	PBNI	BYPE	Fish – IBI
Bowmanville Marsh	2003	4.78	4.29	0	1.67	9.95	5.51	43.65
Bowmanville Marsh - 1	2004	5.58	5.72	2.35	1.50	8.41	0	39.26
Bowmanville Marsh - 2	2004	4.25	4.91	2.01	1.35	7.43	0	33.24
Bowmanville Marsh	2005	7.57	6.13	0	5.49	10.00	0.20	49.60
Bowmanville Marsh	2006	1.33	0	7.78	0.15	6.62	0.04	26.53
Bowmanville Marsh	2007	9.26	6.44	0	10.00	9.97	0.14	59.69

Findings:

- Overall, total number of all species: range = 6 (2006) – 12 (2004); total (all years): 16 species (of which 14 are native), two centrarchid species and three piscivorous species found.
- Among years, comparing six IBI metric scores for Bowmanville Marsh (Table 5-4): highest metric scores were found in 2007 for SNAT (3.9 native species/transect), SCEN (0.9 centrarchid species/transect) and NNAT (22.3 native individuals/transect) resulting in the highest IBI score for that year; only eight fish were caught in 2006 (including three carp), which contributed to the low metric scores and IBI found in that year. Note large jump in IBI value in two consecutive years (2006, 2007).
- Among all Durham Region wetlands, comparing means of thirteen raw metrics for all years of sampling, Bowmanville Marsh exhibited: 1) the highest mean number of turbidity-intolerant species/transect (highest ever in 2007); 2) the lowest mean number of non-indigenous species/transect; 3) the lowest mean number of non-indigenous fish/transect; 4) the highest mean number of native cyprinid species/transect (highest ever in 2007); and, 5) the lowest mean percent of non-indigenous biomass/transect (PBNI; resulting in the highest mean metric score at this wetland relative to other wetlands).

Breeding Bird Community

Years: 2003, 2005 – 2007
Mean IBI±SD = 38.24 ± 7.35
Range (based on mean): 26.45 – 45.76
Condition/Rating: Fair
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: No or could not be performed due to ties (i.e., SAMNO)

Table 5. Breeding bird metrics and IBIs for Bowmanville Marsh, 2002 – 2003, 2005 – 2007.

Wetland	Year	SAMNO	PMNO	PNAF	Bird – IBI
Bowmanville Marsh	2002	2.92	2.67	8.14	45.76
Bowmanville Marsh	2003	0	1.50	9.79	37.65
Bowmanville Marsh	2005	0	0.88	7.05	26.45
Bowmanville Marsh	2006	0	2.80	10.00	42.68
Bowmanville Marsh	2007	0	2.39	9.22	38.68

Findings:

- Overall, total number of all bird species: range = 8 (2002) – 14 (2007); total (all years): 23 species, one area-sensitive marsh nesting obligate species (Least Bittern, a federally and provincially recognized threatened species-at-risk) plus two marsh nesting obligate species (Swamp Sparrow and Virginia Rail) and seven non-aerial forager species.
- Among years, comparing three IBI metric scores for Bowmanville Marsh (Table 5-5): highest metric scores were found in 2002 for SAMNO (0.17 area-sensitive marsh nesting obligates/station) and in 2006 for PMNO (9.35 marsh nesting obligates/station) and PNAF (83.26% non-aerial foragers/station); no area-sensitive marsh nesting species were detected in 2003-2007 resulting in relative lower IBI scores in those years.
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Bowmanville Marsh exhibited no minimum or maximum mean values for marsh bird metrics.

Amphibian Community

Years: 2002 – 2004, 2006, 2007
Mean IBI±SD = 12.67 ± 12.38
Range = 0 – 29.07
Condition/Rating (based on range): Poor
Temporal Trends (significant where $p<0.05$):
IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 6. Amphibian community metrics and IBIs for Bowmanville Marsh, 2002 – 2004, 2006, and 2007.

Wetland	Year	rTOT	rWOOD	pWOOD	Amphibian – IBI
Bowmanville Marsh	2002	1.22	2.50	5.00	29.07
Bowmanville Marsh	2003	1.22	0	0	4.07
Bowmanville Marsh	2004	0	0	0	0
Bowmanville Marsh	2006	2.44	0	0	8.13
Bowmanville Marsh	2007	1.63	1.67	3.33	22.09

Findings:

- Overall, total number of all species, range = 0 (2004) – 2 (2006); total (all years): three species found, which include American Toad, Chorus Frog, and Spring Peeper, of which two are woodland species. A single Chorus Frog, detected in 2002, was only occurrence of this species found in Durham Region wetlands.
- Among years, comparing three IBI metric scores for Bowmanville Marsh (Table 6): highest metric scores were found in 2002 for rWOOD (2.50 woodland species

(expected)/station) and pWOOD (5.00 woodland species/station) and in 2006 for rTOT (2.44 total species (expected)/station). No woodland species were recorded in 2003 and 2006 resulting in low amphibian metric scores in those years.

- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Bowmanville Marsh has the minimum mean value for the rTOT amphibian metrics.

Macroinvertebrate Community

Years: 2003 – 2007
Mean IBI±SD = 28.53 ± 16.19
Range = 7.76 – 51.37
Condition/Rating (based on range): Poor – Good
Temporal Trends (significant where $p<0.05$):
IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 7. Macroinvertebrate metrics and IBIs for Bowmanville Marsh, 2003 – 2007.

Wetland	Year	NETG	NFAM	PCRM	PTRI	PDIP	Macroinvert-ebrate – IBI
Bowmanville Marsh	2003	1	40	95.17	0	80.20	7.76
Bowmanville Marsh	2004	6	108	402.55	1.32	73.23	51.37
Bowmanville Marsh	2005	2	57	90.99	0	43.62	29.47
Bowmanville Marsh	2006	3	45	80.57	0	55.14	20.32
Bowmanville Marsh	2007	1	48	155.28	0	29.24	33.72

Findings:

- Overall, total number of families, range = 40 (2003) – 108 (2004).
- Among years, comparing the IBI metric scores for Bowmanville Marsh (Table 7): highest metric scores were found in 2004 for NETG (# of Ephemeroptera and Trichoptera genera), NFAM (# of families), PCRM (% Crustacea + Mollusca), and PTRI (% Trichoptera). The highest PDIP (% Diptera) occurred in 2003.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Bowmanville Marsh exhibited no minimum or maximum mean values for invertebrate metrics

Carruthers Creek Marsh

Wetland Statistics – Carruthers Creek Marsh	
Location	Town of Ajax
Wetland Type	Drowned River-mouth protected by a Barrier Beach
Vegetation Types	Marsh 24%, Swamp 76%
Wetland Size (hectares)	116
Watershed Size (hectares)	3 812
Percent Natural Cover in Watershed	25

Report Card – Carruthers Creek Marsh			
	Years	**Condition**	**Trend**
Water Quality	2002 – 2007	Very Degraded	Stable
Submerged Aquatic Vegetation	2002, 2004 – 2007	Poor	Unknown
Amphibians	2004, 2005, 2007	Fair	Unknown
Birds	2005 – 2007	Poor	Unknown
Fish	2003, 2006, 2007	Fair	Unknown
Macroinvertebrates	2003 – 2007	Fair	Stable

Detailed Description:

Water Quality

Years: 2002 – 2007
Mean WQI±SD = -1.97 ± 0.47 (based on all months of data)
Range = -2.74 – - 1.51
Rating (based on mean): Very Degraded
Temporal Trends (significant where $p<0.05$):
WQI (all months of data): No
Raw water parameters (July or August data): Water temperature, increasing

Table 8. Mean water quality parameters (July or August) and WQIs (July or August/all months) for Carruthers Creek Marsh, 2002 – 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity*	NO_3	WQI**
Carruthers Creek Marsh	2002	-	-	-	91.90	-	-
Carruthers Creek Marsh	2003	21.54	8.02	681.33	-	3.31	-1.72
Carruthers Creek Marsh	2004	21.09	7.53	850.33	14.20	0.97	-1.77/ -1.94
Carruthers Creek Marsh	2005	24.66	9.06	785.67	-	0.15	-1.96
Carruthers Creek Marsh	2006	25.37	7.65	492.00	72.33	1.70	-1.51
Carruthers Creek Marsh	2007	29.07	8.13	1237.67	25.67	0.10	-2.74

* values based on multiple readings taken typically in July (see water quality chapter for details)
** for 2004, a WQI value calculated for water sampling performed in July is indicated and is followed by an average WQI for all months of water collection in that year; other years of data are based on water sampling in either July (2003, 2004, 2005) or August (2006, 2007).

Findings:

- WQI values for years 2003 – 2006 rated as "very degraded" and in 2007 rated as "highly degraded"
- Turbidity: ranges in daily means for all months (not shown in Table 5-7) = 1.98 – 108.33 with 52% (12/23) turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing means of all water quality parameters, Carruthers Creek Marsh was among the highest for mean turbidity during the study period using both July only data and all months of data (not shown).

Submerged Aquatic Vegetation Community

Years: 2002, 2004 – 2007
Mean IBI±SD = 1.57 ± 2.36
Range = 0 – 5.31
Condition/Rating (based on range): Poor
Temporal Trends (significant where $p<0.05$):
IBI: Could not be performed due to ties
Raw IBI Metrics: Could not be performed due to ties

Table 9. Submerged aquatic vegetation community metrics and IBIs for Carruthers Creek Marsh, 2002 and 2004 – 2007.

Wetland	Year	SINT	PINT	FQI	PCOV	SNAT	SAV – IBI
Carruthers Creek Marsh	2002	0	0	0	0	0	0
Carruthers Creek Marsh	2004	0	0	0	0	0	0
Carruthers Creek Marsh	2005	0	0	0	0	0	0
Carruthers Creek Marsh	2006	0	0	1.23	0.56	0.86	5.31
Carruthers Creek Marsh	2007	0	0	0.57	0.42	0.29	2.56

Findings:

- Overall, total number of all species: range = 1 (2004, 2005) – 4 (2006); total (all years): 4 species (all of which were native) and no turbidity-intolerant species found during study period.
- Among years, comparing five IBI metric scores for Carruthers Creek Marsh (Table 5-8): highest metric scores were found in 2006 for FQI (1.00/quadrat), PCOV (5.60%/quadrat) and SNAT (0.30 native species/quadrat) resulting in the highest IBI score for that year; no SAV species were found in 2002, 2004 and 2005.
- Comparing means of all five raw metrics for all years of sampling, Carruthers Creek Marsh was among the three Durham Region wetlands where no turbidity-intolerant species were found during the study period.

Fish Community

Years: 2003, 2006, 2007
Mean IBI±SD = 36.56 ± 9.49
Range = 29.46 – 47.34
Condition/Rating (based on mean): Fair
Temporal Trends (significant where $p<0.05$):

IBI: Could not be performed due to low sample size (i.e. number of years)
Raw IBI Metrics: Could not be performed due to low sample size (i.e. number of years)

Table 10. Fish community metrics and IBIs for Carruthers Creek Marsh, 2003, 2006 – 2007.

Wetland	Year	SNAT	SCEN	PPIS	NNAT	PBNI	BYPE	Fish – IBI
Carruthers Creek Marsh	2003	4.78	5.72	0	2.73	4.44	0	29.46
Carruthers Creek Marsh	2006	3.98	6.54	0	0.99	7.48	0.74	32.89
Carruthers Creek Marsh	2007	9.56	8.18	0.21	10.00	0	0.46	47.34

Findings:

- Overall, total number of all species = 8 for each year; total (all years together): 12 (of which 11 are native), four centrarchid species and one piscivorous species found.
- Among years, comparing six IBI metric scores for Carruthers Creek Marsh (Table 5-9): highest metric scores were found in 2007 for SNAT (4.0 native species/transect), SCEN (1.1 centrarchid species/transect), PPIS (0.3% piscivore biomass/transect) and NNAT (29.0 native individuals/transect) resulting in the highest IBI score for that year; no piscivores or yellow perch caught in 2003 which contributed to the low metric scores and IBI found in that year.
- Among all Durham Region wetlands, comparing means of thirteen raw metrics for all years of sampling, along with Hydro Marsh, Pumphouse Marsh and Whitby Harbour Wetland Complex, no turbidity intolerant species were caught in Carruthers Creek Marsh in any study year.

Breeding Bird Community

Years: 2005 – 2007
Mean IBI±SD = 18.98 ± 13.41
Range = 3.68 – 28.65
Condition/Rating (based on mean): Poor
Temporal Trends (significant where $p<0.05$):
IBI: Could not be performed due to low sample size (i.e. number of years)
Raw IBI Metrics: Could not be performed due to low sample size (i.e. number of years)

Table 11. Breeding bird community metrics and IBIs for Carruthers Creek Marsh, 2005 – 2007.

Wetland	Year	SAMNO	PMNO	PNAF	Bird – IBI
Carruthers Creek Marsh	2005	0	3.41	5.18	28.65
Carruthers Creek Marsh	2006	0	1.69	5.69	24.62
Carruthers Creek Marsh	2007	0	0.48	0.62	3.68

Findings:

- Overall, total number of all bird species: range = 7 (2007) – 27 (2006); total (all years): 33 species, no area-sensitive marsh nesting obligate species, three marsh nesting obligate species and 15 non-aerial forager species.

- Among years, comparing three IBI metric scores for Carruthers Creek Marsh (Table 5-10): highest metric scores were found in 2005 for PMNO (11.37 marsh nesting obligates/station) and in 2006 for PNAF (43.80% non-aerial foragers/station) while the lowest scores for those metrics were found in 2007; no area-sensitive species were detected in any study year.
- Comparing means of all three raw metrics for all years of sampling, Carruthers Creek Marsh was among the eight Durham Region wetlands where no area-sensitive species were detected; also, Carruthers Creek Marsh had the lowest mean values of PMNO and PNAF of all wetlands during the study period.

Amphibian Community

Years: 2005, 2007
Mean IBI±SD = 8.13 ± 0
Range = N/A
Condition/Rating (based on range): Poor
Temporal Trends (significant where p<0.05):

IBI: Could not be performed due to low sample size (i.e. number of years)
Raw IBI Metrics: Could not be performed due to low sample size (i.e. number of years)

Table 12. Amphibian community metrics and IBIs for Carruthers Creek Marsh, 2005 and 2007.

Wetland	Year	rTOT	rWOOD	pWOOD	Amphibian - IBI
Carruthers Creek Marsh	2005	2.44	0	0	8.13
Carruthers Creek Marsh	2007	2.44	0	0	8.13

Findings:

- Overall, total number of all species = 1 (2005) and 2 (2007); total (all years): three species found, which include American Toad, Green Frog, Northern Leopard Frog of which none are woodland species.
- Metric scores did not change between years, comparing three IBI metric scores for Carruthers Creek Marsh (Table 11):, rTOT (2.44 total species (expected)/station), rWOOD (0 woodland species (expected)/station) or pWOOD (0 woodland species/station).
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Carruthers Creek Marsh shared the minimum mean values for the rWOOD and pWOOD amphibian metrics along with Corbett Creek Marsh, Duffins Creek Marsh and Westside Marsh.

Macroinvertebrate Community

Years: 2003 – 2007
Mean IBI±SD = 38.88 ± 11.29
Range = 19.04 – 46.64
Condition/Rating (based on range): Poor – Good
Temporal Trends (significant where p<0.05):

IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 13. Macroinvertebrate metrics and IBIs for Carruthers Creek Marsh, 2003 – 2007.

Wetland	Year	NETG	NFAM	PCRM	PTRI	PDIP	Macroinvert-ebrate – IBI
Carruthers Creek Marsh	2003	1	42	162.92	0	66.57	19.04
Carruthers Creek Marsh	2004	3	110	381.77	0	62.69	44.90
Carruthers Creek Marsh	2005	1	57	177.67	0.57	26.02	46.64
Carruthers Creek Marsh	2006	3	51	111.58	0	9.35	42.83
Carruthers Creek Marsh	2007	1	60	133.87	0	24.02	40.99

Findings:

- Overall, total number of families, range = 42 (2003) – 110 (2004).
- Among years, comparing the IBI metric scores for Carruthers Creek Marsh (Table 13): highest metric scores were found in 2004 and 2006 for NETG; 2004 for NFAM and PCRM; 2005 for PTRI; and 2003 for PDIP
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Carruthers Creek Marsh exhibited no minimum or maximum mean values for invertebrate metrics

Corbett Creek Marsh

Wetland Statistics – Corbett Creek Marsh	
Location	Town of Whitby
Wetland Type	Drowned River-mouth with Barrier Beach
Vegetation Types	Marsh 76%, Swamp 24%
Wetland Size (hectares)	28
Watershed Size (hectares)	1 463
Percent Natural Cover in Watershed	21

Report Card – Corbett Creek Marsh			
	Years	**Condition**	**Trend**
Water Quality	2002 – 2007	Very Degraded	Stable
Submerged Aquatic Vegetation	2002, 2004 – 2007	Fair	Stable
Amphibians	2002 – 2007	Poor	Unknown
Birds	2002 – 2004, 2006, 2007	Good	Stable
Fish	2003, 2005 – 2007	Good	Stable
Macroinvertebrates	2003 – 2009	Good	Stable

Detailed Description:

Water Quality

Years: 2002 – 2007
Mean WQI±SD = -1.77 ± 0.38 (based on all months of data)
Range = -2.35 – -1.29
Rating (based on range): Very Degraded
Temporal Trends (significant where p<0.05):
WQI (all months of data): No
Raw water parameters (July or August data): No

Table 14. Mean water quality metrics (July or August) and WQIs (July or August/all months in 2004) for Corbett Creek Marsh, 2002 – 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity*	NO_3	WQI**
Corbett Creek Marsh	2002	-	-	-	11.14	-	-
Corbett Creek Marsh	2003	24.89	7.79	1711.67	5.52	2.95	-1.78
Corbett Creek Marsh	2004	19.04	7.63	1499.00	8.08	0.87	-1.90/ -1.74
Corbett Creek Marsh	2005	26.04	7.21	2670.00	9.56	0.30	-2.35
Corbett Creek Marsh	2006	25.80	8.02	1095.00	7.09	0.40	-1.29
Corbett Creek Marsh	2007	22.83	7.81	1635.67	12.42	1.00	-1.68

* values based on multiple readings taken typically in July (see water quality chapter for details)
** for 2004, a WQI value calculated for water sampling performed in July is indicated and is followed by an average WQI for all months of water collection in that year; other years of data are based on water sampling in either July (2003 – 2006) or August (2007).

Findings:

- WQI values consistently rated as “very degraded” with the exception of in 2005 where rated as “highly degraded”.
- Turbidity: ranges in daily means for all months (not shown in Table 5-12) = 3.60 – 72.12 with 17% (5/29) turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing means of all water quality parameters, Corbett Creek Marsh exhibited the highest mean value of conductivity during the study period (the highest ever in 2005).

Submerged Aquatic Vegetation Community

Years: 2003 – 2007
Mean IBI±SD = 39.49 ± 9.66
Range = 31.11 – 52.17
Condition/Rating (based on mean): Fair
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: No (FQI, PCOV and SNAT) or could not be performed due to ties (i.e., SINT and PINT)

Table 15. Submerged aquatic vegetation community metrics and IBIs for Corbett Creek Marsh, 2003 – 2007.

Wetland	Year	SINT	PINT	FQI	PCOV	SNAT	SAV – IBI
Corbett Creek Marsh	2003	0	0	6.31	2.41	6.91	31.27

Corbett Creek Marsh	2004	1.21	1.31	8.47	5.10	10.00	52.17
Corbett Creek Marsh	2005	1.21	0.47	8.16	3.80	10.00	47.26
Corbett Creek Marsh	2006	0.81	0.16	5.77	2.77	6.05	31.11
Corbett Creek Marsh	2007	0	0	6.93	3.28	7.63	35.67

Findings:

- Overall, total number of all species: range = 12 (2003) – 15 (2005); total (all years): 27 species (of which 24 were native) and three turbidity-intolerant species found (flat-stemmed pondweed, northern water milfoil and slender naiad).
- Among years, comparing five IBI metric scores for Corbett Creek Marsh (Table 5-13): highest metric scores were found in 2004 for SINT (0.15 turbidity-intolerant species/quadrat), PINT (6.88% cover turbidity-intolerant species/quadrat), FQI(6.89, with the white-water lily and water star-grass found frequently), PCOV (50.95%/quadrat) and SNAT (3.55 native species/quadrat) resulting in the highest IBI score for that year; absence of turbidity-intolerant species in 2003 and 2007.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Corbett Creek Marsh had the highest mean number of native species/quadrat (SNAT, 2.85 native species/quadrat) during the study period.

Fish Community

Years: 2003, 2005 – 2007
Mean IBI±SD = 41.06 ± 17.45
Range = 27.06 – 65.90
Condition/Rating (based on mean): Good
Temporal Trends (significant where $p<0.05$):
IBI: No
Raw IBI Metrics: No (SNAT, SCEN, SNAT, PBNI) or could not be performed due to ties (i.e., PPIS and BYPE)

Table 16. Fish community metrics and IBIs for Corbett Creek Marsh, 2003 and 2005 – 2007.

Wetland	Year	SNAT	SCEN	PPIS	NNAT	PBNI	BYPE	Fish – IBI
Corbett Creek Marsh	2003	3.29	3.68	0	1.22	8.05	0	27.06
Corbett Creek Marsh	2005	10.00	10.00	7.37	5.72	6.00	0.45	65.90
Corbett Creek Marsh	2006	2.99	1.84	3.90	1.72	8.19	0	31.06
Corbett Creek Marsh	2007	3.45	4.91	0	0.90	10.00	4.88	40.23

Findings:

- Overall, total number of all species: range = 5 (2003, 2007) – 9 (2005); total (all years): 11 species (of which nine are native), two centrarchid species and one piscivorous species found.
- Among years, comparing six IBI metric scores for Corbett Creek Marsh (Table 5-14): highest metric scores were found in 2005 for SNAT (4.2 native species/transect), SCEN (1.6 centrarchid species/transect), PPIS (10.5% piscivore biomass/transect) and NNAT (21.2 native individuals/transect) resulting

in the highest IBI score for that year; no piscivores or yellow perch caught in 2003 which contributed to the low metric scores and IBI found in that year.

- Among all Durham Region wetlands, comparing means of thirteen raw metrics for all years of sampling, Corbett Creek Marsh exhibited the lowest mean biomass of native fish/transect (lowest ever in 2003).

Breeding Bird Community

Years: 2002 – 2004, 2006, 2007
Mean IBI±SD = 42.14 ± 10.90
Range = 31.01 – 60.31
Condition/Rating (based on mean): Good
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: No or could not be performed due to ties (i.e., SAMNO)

Table 17. Breeding bird community metrics and IBIs for Corbett Creek Marsh, 2002 – 2004, 2006, and 2007.

Wetland	Year	SAMNO	PMNO	PNAF	Bird – IBI
Corbett Creek Marsh	2002	0	4.50	7.93	41.44
Corbett Creek Marsh	2004	0	1.88	10.00	39.58
Corbett Creek Marsh	2005	0	8.21	9.88	60.31
Corbett Creek Marsh	2006	0	2.73	8.78	38.34
Corbett Creek Marsh	2007	0	2.62	6.68	31.01

Findings:

- Overall, total number of all bird species: range = 10 (2003, 2007) – 15 (2004); total (all years): 30 species, no area-sensitive marsh nesting obligate species, four marsh nesting obligate species and 18 non-aerial forager species found. Also, the only occurrence of a common nighthawk in Durham Region wetlands was reported here in 2006, a species which is recognized as threatened by COSEWIC.
- Among years, comparing three IBI metric scores for Corbett Creek Marsh (Table 5): highest metric scores were found in 2004 for PMNO (27.38 marsh nesting obligates/station) which contributed the high IBI score in that year and in 2003 for PNAF (90.00% non-aerial foragers/station); no area-sensitive species were detected in any study year.
- Comparing means of all three raw metrics for all years of sampling, Corbett Creek Marsh was among the eight Durham Region wetlands where no area-sensitive species were detected during the study period.

Amphibian Community

Years: 2004 – 2007
Mean IBI±SD = 8.81 ± 1.36
Range = 8.13 – 10.84
Condition/Rating (based on mean): Poor
Temporal Trends (significant where p<0.05):

IBI: Could not be performed due to ties
Raw IBI Metrics: Could not be performed due to ties

Table 18. Amphibian community metrics and IBIs for Corbett Creek Marsh, 2004 – 2007.

Wetland	Year	rTOT	rWOOD	pWOOD	Amphibian – IBI
Corbett Creek Marsh	2004	3.25	0	0	10.84
Corbett Creek Marsh	2005	2.44	0	0	8.13
Corbett Creek Marsh	2006	2.44	0	0	8.13
Corbett Creek Marsh	2007	2.44	0	0	8.13

Findings:

- Overall, total number of all species, range = 1 (2007) – 3 (2004); total (all years): three species found, which include American Toad, Green Frog, Northern Leopard Frog, none of which are woodland species.
- Among years, comparing three IBI metric scores for Corbett Creek Marsh (Table 16): metric scores for rWOOD did not change (0 woodland species (expected)/station) as with pWOOD (0 woodland species/station). The highest rTOT metric score was in 2004 (3.25 total species (expected)/station). No woodland species were recorded from 2004 to 2007 resulting in low amphibian IBIs in those years.
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Corbett Creek Marsh shared the minimum mean values for the rWOOD and pWOOD amphibian metrics along with Carruthers Creek Marsh, Duffins Creek Marsh and Westside Marsh.

Macroinvertebrate Community

Years: 2003 – 2007
Mean IBI±SD = 40.35 ± 9.28
Range = 26.73 – 51.9
Condition/Rating (based on range): Fair – Good
Temporal Trends (significant where $p<0.05$):
IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 19. Macroinvertebrate metrics and IBIs for Corbett Creek Marsh, 2003 – 2007.

Wetland	Year	NETG	NFAM	PCRM	PTRI	PDIP	Macroinvert-ebrate – IBI
Corbett Creek Marsh	2003	2	52	143.37	0	98.40	26.73
Corbett Creek Marsh	2004	1	101	453.82	0	53.74	45.05
Corbett Creek Marsh	2005	0	46	200.06	0	17.81	39.26
Corbett Creek Marsh	2006	1	53	131.21	0	14.25	38.82
Corbett Creek Marsh	2007	2	67	153.22	0	14.87	51.90

Findings:

- Overall, total number of families, range = 52 (2003) – 101 (2004).
- Among years, comparing the IBI metric scores for Corbett Creek Marsh (Table 19): highest metric scores were found in 2003 and 2007 for NETG, 2004 for NFAM, and 2003 for PDIP
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Corbett Creek Marsh exhibited a minimum of 0 for PTRI

Cranberry Marsh

Wetland Statistics – Cranberry Marsh	
Location	Town of Whitby
Wetland Type	Barrier Beach
Vegetation Types	Marsh 75%, Swamp 25%
Wetland Size (hectares)	43
Watershed Size (hectares)	166
Percent Natural Cover in Watershed	57

Report Card – Cranberry Marsh			
	Years	**Condition**	**Trend**
Water Quality	2002 – 2007	Very Degraded	Stable
Submerged Aquatic Vegetation	2003 – 2006	Fair	Stable
Amphibians	2002 – 2007	Good	Improving
Birds	2002 – 2006	Very Good	Stable
Fish	-	Not applicable	Not applicable
Macroinvertebrates	2003 – 2006	Fair	Stable

Detailed Description

Water Quality

Years: 2002 – 2007
Mean WQI±SD = -1.19 ± 0.57 (based on all months of data)
Range = -2.06 – -0.62
Rating (based on mean): Very Degraded
Temporal Trends (significant where $p<0.05$):
WQI (all months of data): No
Raw water parameters (July or August data): Turbidity, increasing and NO_3, decreasing; also significant seasonal trend (increase) in turbidity found in 2004, 2005 and 2006

Table 20. Mean water quality metrics (July or August) and WQIs (July or August/all months in 2004) for Cranberry Marsh, 2002 – 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity*	NO_3	WQI**
Cranberry Marsh	2002	-	-	-	4.17	-	-
Cranberry Marsh	2003	19.05	7.26	441.83	4.28	3.71	-1.15
Cranberry Marsh	2004	21.77	8.12	394.00	7.46	0.93	-0.76/ -0.77
Cranberry Marsh	2005	24.75	7.83	617.33	9.50	0.07	-2.06
Cranberry Marsh	2006	29.13	8.17	362.00	15.15	0.17	-0.62
Cranberry Marsh	2007	21.53	7.61	577.50	30.38	0.00	-1.35

* values based on multiple readings taken typically in July (see water quality chapter for details)
** for 2004, a WQI value calculated for water sampling performed in either July or August is indicated and is followed by an average WQI for all months of water collection in that year; other years of data are based on water sampling in either July (2003 – 2006) or August (2007).

Findings:

- WQI values variable among years with ratings of "moderately degraded" (2004 and 2006) and "very degraded" (2003 and 2007) with the lowest rating of highly degraded" in 2005.
- Turbidity: ranges in daily means for all months (not shown in Table 5-17) = 2.31 – 47.84 with 13% (3/24) turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing means of all water quality parameters, Cranberry Marsh exhibited: 1) the lowest mean value for conductivity (the lowest ever in 2006), 2) the highest mean value of total phosphorus (not shown) for water collections in 2003 – 2005 and 3) the highest value of chlorophyll a reported in any Durham Region wetlands in 2007.

Submerged Aquatic Vegetation Community

Years: 2003 – 2006
Mean IBI±SD = 29.49 ± 13.37
Range = 10.49 – 41.00
Condition/Rating (based on mean): Fair
Temporal Trends (significant where $p<0.05$):
IBI: No
Raw IBI Metrics: No (FQI, PCOV and SNAT) or could not be performed due to ties.

Table 21. Submerged aquatic vegetation community metrics and IBIs for Cranberry Marsh, 2003 – 2006.

Wetland	Year	SINT	PINT	FQI	PCOV	SNAT	SAV – IBI
Cranberry Marsh	2003	0.40	0.01	5.25	6.12	6.19	35.94
Cranberry Marsh	2004	0.00	0.00	6.91	6.25	7.34	41.00
Cranberry Marsh	2005	0.00	0.00	6.08	2.14	7.06	30.55
Cranberry Marsh	2006	0.00	0.00	1.94	0.86	2.45	10.49

Findings:

- Overall, total number of all species: range = 6 (2006) – 16 (2003); total (all years): 25 species (of which 22 were native) and one turbidity-intolerant species found (northern water milfoil).
- Among years, comparing five IBI metric scores for Cranberry Marsh (Table 5-18): highest metric scores were found in 2003 for SINT (0.05 turbidity-intolerant species/quadrat) and PINT (0.06% cover turbidity-intolerant species/quadrat) and in 2004 for FQI(5.61/quadrat), PCOV (62.50%/quadrat) and SNAT (2.55 native species/quadrat) resulting in the highest IBI score for that year; absence of turbidity-intolerant species in 2004 to 2006; lowest values for all metrics were found in 2006 when the SAV IBI dropped into the "poor" range.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Cranberry Marsh fell within the range of means for other wetlands and exhibited no minimum or maximums in community metrics.

Fish Community

Sampling not conducted due to low water levels.

Breeding Bird Community

Years: 2002 – 2006
Mean IBI±SD = 77.54 ± 10.02
Range = 64.39 – 90.50
Condition/Rating (based on mean): Very Good
Temporal Trends (significant where $p<0.05$):
IBI: No
Raw IBI Metrics: No

Table 22. Breeding bird community metrics and IBIs for Cranberry Marsh, 2002 – 2006.

Wetland	Year	SAMNO	PMNO	PNAF	Bird – IBI
Cranberry Marsh	2002	10.00	5.70	3.61	64.39
Cranberry Marsh	2003	7.50	10.00	7.68	83.93
Cranberry Marsh	2004	10.00	10.00	7.15	90.50
Cranberry Marsh	2005	2.50	10.00	10.00	75.00
Cranberry Marsh	2006	5.00	10.00	7.16	73.87

Findings:

- Overall, total number of all bird species: range = 13 (2005) – 26 (2003); total (all years): 36 species, one area-sensitive marsh nesting obligate species (American Coot) plus seven marsh nesting obligate species and 11 non-aerial forager species.
- Among years, comparing three IBI metric scores for Cranberry Marsh (Table 5-19): highest metric scores were found in 2002 and 2004 for SAMNO (1.00 and 0.86 area-sensitive marsh nesting obligates/station, respectively), from 2003 to 2007 for PMNO (range=39.03% – 61.18% marsh nesting obligates/station) and in 2005 for PNAF (84.43% non-aerial foragers/station); low scores for PMNO and PNAF in 2002 contributed to the low IBI value in that year.
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Cranberry Marsh had the highest mean values for SAMNO and PMNO of all wetlands in the study.

Amphibian Community

Years: 2002, 2003
Mean IBI±SD = 30.29 ± 31.33
Range = 8.13 – 52.44
Condition/Rating (based on mean): Good
Temporal Trends (significant where p<0.05):
IBI: Could not be performed due to low sample size (i.e. number of years)
Raw IBI Metrics: Could not be performed due to ties

Table 23. Amphibian community metrics and IBIs for Cranberry Marsh, 2002 – 2006.

Wetland	Year	rTOT	rWOOD	pWOOD	Amphibian – IBI
Cranberry Marsh	2002	2.44	0	0	8.13
Cranberry Marsh	2003	4.07	5.00	6.67	52.44

Findings:

- Overall, total number of all species, range = 3 (2002) – 5 (2003); total (all years): five species found, which include American Toad, Green Frog, Northern Leopard Frog, Spring Peeper and Wood Frog, of which two are woodland species.
- Among years, comparing three IBI metric scores for Cranberry Marsh (Table 20): highest metric scores were found in 2003 for rTOT (4.07 total species (expected)/station), rWOOD (5.00 woodland species (expected)/station) and pWOOD (6.67 woodland species) which contributed to the high amphibian IBI for that year.
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Cranberry Marsh exhibited no minimum or maximum mean values for amphibian metrics.

Macroinvertebrate Community

Years: 2003 – 2006
Mean IBI±SD = 38.80 ± 9.09
Range = 31.59 – 51.95
Condition/Rating (based on range): Fair – Good
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 24. Macroinvertebrate metrics and IBIs for Cranberry Marsh, 2003 – 2006.

Wetland	Year	NETG	NFAM	PCRM	PTRI	PDIP	Macroinvert-ebrate – IBI
Cranberry Marsh	2003	0	33	246.69	0	21.19	34.16
Cranberry Marsh	2004	7	73	445.19	0	8.09	51.95
Cranberry Marsh	2005	1	44	142.53	0	2.64	37.51
Cranberry Marsh	2006	0	31	171.23	0	0	31.59

Findings:

- Overall, total number of families, range = 31 (2006) – 73 (2004).
- Among years, comparing the IBI metric scores for Cranberry Marsh (Table 24): highest metric scores were found in 2004 for NETG, NFAM, and PCRM. The highest PDIP occurred in 2003.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Cranberry Marsh exhibited the maximum mean of PCRM and a minimum of PTRI.

Duffins Creek Marsh

Wetland Statistics – Duffins Creek Marsh	
Location	City of Pickering and Town of Ajax
Wetland Type	Drowned River-mouth protected by a Barrier Beach
Vegetation Types	Marsh 88%, Swamp 12%
Wetland Size (hectares)	78
Watershed Size (hectares)	28 653
Percent Natural Cover in Watershed	37

Report Card – Duffins Creek Marsh			
	Years	**Condition**	**Trend**
Water Quality	2002 – 2007	Very Degraded	Improving
Submerged Aquatic Vegetation	2002, 2004, 2006, 2007	Poor	Stable
Amphibians	2002 – 2005, 2007	Poor	Unknown
Birds	2005, 2006	Good	Unknown
Fish	2003 – 2007	Fair	Stable
Macroinvertebrates	2003 – 2007	Good	Stable

Detailed Description:

Water Quality

Years: 2002 – 2007

Mean WQI±SD = -1.78 ± 0.48 (based on all months of data)
Range = -2.42 – -1.16
Rating (based on mean): Very Degraded
Temporal Trend (significant where p<0.05):
WQI (all months of data): Increasing (i.e., improving)
Raw water parameters (July or August data): pH, increasing

Table 25. Mean water quality metrics (July or August) and WQIs (July or August/all months in 2004) for Duffins Creek Marsh, 2002 – 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity*	NO_3	WQI**
Duffins Creek Marsh	2002	-	-	-	18.42	-	-
Duffins Creek Marsh	2003	25.02	7.89	629.83	1.46	3.79	-2.42
Duffins Creek Marsh	2004	21.69	8.11	627.67	35.61	1.07	-2.01/ -1.912
Duffins Creek Marsh	2005	25.98	8.19	910.00	-	0.00	-1.90
Duffins Creek Marsh	2006	26.43	8.27	417.67	88.54	0.13	-1.16
Duffins Creek Marsh	2007	26.34	8.72	375.67	30.82	0.57	-1.49

* values based on multiple readings taken typically in July (see water quality chapter for details)
** for 2004, a WQI value calculated for water sampling performed in July is indicated and is followed by an average WQI for all months of water collection in that year; other years of data are based on water sampling in either July (2003, 2004, 2005) or August (2006, 2007).

Findings:

- Based on WQI values, water quality appears to have improved from "highly degraded" in 2003 to "very degraded" from 2004 to 2007.
- Turbidity: ranges in daily means for all months (not shown in Table 5-21) = 1.46 – 122.38 with 70% (21/30) turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing means of all water quality parameters, Duffins Creek Marsh was among the highest for mean turbidity using both July only data and all months of data during the study period.

Submerged Aquatic Vegetation Community

Years: 2002, 2004, 2006 and 2007
Mean IBI±SD = 3.12 ± 3.84
Range = 0.75 – 9.76
Condition/Rating (based on mean): Poor
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: No

Table 26. Submerged aquatic vegetation community metrics and IBIs for Duffins Creek Marsh, 2002, 2004, 2006 and 2007.

Wetland	Year	SINT	PINT	FQI	PCOV	SNAT	SAV – IBI
Duffins Creek Marsh	2002	0.00	0.00	0.23	0.01	0.14	0.75
Duffins Creek Marsh	2004	0.00	0.00	0.25	0.01	0.14	0.80
Duffins Creek Marsh	2006	0.00	0.00	2.35	0.95	1.58	9.76
Duffins Creek Marsh	2007	0.00	0.00	0.16	0.32	0.10	1.15

Findings:

- Overall, total number of all species: range = 2 (2004) – 6 (2006); total (all years): eight species (all of which were native) and no turbidity-intolerant species found.
- Among years, comparing five IBI metric scores for Duffins Creek Marsh (Table 5-22): highest metric scores were found in 2006 for FQI (1.91/quadrat), PCOV (9.50%/quadrat) and SNAT (0.55 native species/quadrat) resulting in the highest IBI score for that year; absence of turbidity-intolerant species in all years; very low values for all metrics with the exception of 2006.
- Comparing means of all five raw metrics for all years of sampling, Duffins Creek Marsh was among the three Durham Region wetlands where no turbidity-intolerant species were found during the study period.

Fish Community

Years: 2003 – 2007
Mean IBI±SD = 33.66 ± 10.26
Range = 23.23 – 49.05
Condition/Rating (based on mean): Fair
Temporal Trends (significant where $p<0.05$):
IBI: No
Raw IBI Metrics: No (SCEN, NNAT, BYPE) or could not be performed due to ties (SNAT, PPIS, PBNI)

Table 27. Fish community metrics and IBIs for Duffins Creek Marsh, 2003 – 2007. The results of two sampling efforts in 2004 are also provided.

Wetland	Year	SNAT	SCEN	PPIS	NNAT	PBNI	BYPE	Fish – IBI
Duffins Creek Marsh	2003	7.44	4.09	0	2.10	1.36	0.62	26.01
Duffins Creek Marsh - 1	2004	6.37	3.27	5.13	1.89	5.23	0.06	36.59
Duffins Creek Marsh - 2	2004	5.98	0.92	0	1.59	7.34	1.10	28.21
Duffins Creek Marsh	2005	4.78	0	0	1.24	10.00	6.55	37.62
Duffins Creek Marsh	2006	3.98	1.64	0	1.92	5.69	0.71	23.23
Duffins Creek Marsh	2007	4.78	0.92	7.60	1.99	10.00	4.14	49.05

Findings:

- Overall, total number of all species: range = 4 (2005) – 16 (2004, over two surveys); total (all years): 19 species (of which 16 are native), two centrarchid species and two piscivorous species found, including three Chinook Salmon in 2005 (which were not included in PPIS metric).
- Among years, comparing six IBI metric scores for Duffins Creek Marsh (Table 5-23): highest metric scores were found in 2007 for PPIS (10.9% piscivore biomass/transect) and PBNI (0.0% non-indigenous biomass/transect) resulting in the highest IBI score for that year; no piscivores and few yellow perch caught in 2006 which contributed to the low metric scores and IBI found in that year. Note large jump in IBI value in two consecutive years (2006, 2007).
- Among all Durham Region wetlands, comparing means of all thirteen raw metrics for all years of sampling, Duffins Creek Marsh exhibited: 1) the highest mean percent specialist biomass/transect; 2) the lowest mean number of native individuals/transect (NNAT); 3) the lowest mean number of centrarchid

species/transect (SCEN); and, 4) the highest mean biomass of yellow perch/transect (highest ever in 2005 where BYPE equal to 36.4 g/transect).

Breeding Bird Community

Years: 2005, 2006
Mean IBI±SD = 41.17 ± 2.46
Range = 39.43, 42.91
Condition/Rating (based on mean): Good
Temporal Trends (significant where p<0.05):

IBI: Could not be performed due to low sample size (i.e. number of years)
Raw IBI Metrics: Could not be performed due to low sample size (i.e. number of years)

Table 28. Breeding bird community metrics and IBIs for Duffins Creek Marsh, 2005 and 2006.

Wetland	Year	SAMNO	PMNO	PNAF	Bird – IBI
Duffins Creek Marsh	2005	0	5.85	7.02	42.91
Duffins Creek Marsh	2006	0	4.22	7.61	39.43

Findings:

- Overall, total number of all bird species: 23 species in 2006 and 24 in 2005; total (all years): 28 species, no area-sensitive marsh nesting obligate species, three marsh nesting obligate species and 14 non-aerial forager species.
- Among years, comparing three IBI metric scores for Duffins Creek Marsh (Table 5-24): highest metric scores were found in 2005 for PMNO (19.50% marsh nesting obligates/station) and in 2006 for PNAF (58.53% non-aerial foragers/station) resulting in similar IBI scores for the two years; no area-sensitive species were detected in any study year.
- Comparing means of all three raw metrics for all years of sampling, Duffins Creek Marsh was among the eight Durham Region wetlands where no area-sensitive species were detected during the study period.

Amphibian Community

Years: 2005, 2007
Mean IBI±SD = 6.78 ± 9.59
Range = 0 – 13.56
Condition/Rating (based on mean): Poor
Temporal Trends (significant where p<0.05):

IBI: Could not be performed due to low sample size (i.e. number of years)
Raw IBI Metrics: Could not be performed due to ties

Table 29. Amphibian community metrics and IBIs for Duffins Creek Marsh, 2005 and 2007.

Wetland	Year	rTOT	rWOOD	pWOOD	Amphibian – IBI
Duffins Creek Marsh	2005	0	0	0	0
Duffins Creek Marsh	2007	4.07	0	0	13.56

Findings:

- Overall, total number of all species, range = 0 (2005) – 3 (2007); total (all years): three species found, which include American Toad, Green Frog, and Northern Leopard Frog, of which none are woodland species.
- Among years, comparing three IBI metric scores for Duffins Creek Marsh (Table 25): highest metric scores were found in 2007 for rTOT (4.07 total species (expected)/station). No woodland species were recorded in either year resulting in low amphibian IBIs.
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Duffins Creek Marsh shared the minimum mean values for the rWOOD and pWOOD amphibian metrics along with Corbett Creek Marsh, Carruthers Creek Marsh and Westside Marsh.

Macroinvertebrate Community

Years: 2003 – 2007
Mean IBI±SD = 42.79 ± 23.95
Range = 4.82 – 69.42
Condition/Rating (based on range): Poor – Very Good
Temporal Trends (significant where $p<0.05$):
IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 30. Macroinvertebrate metrics and IBIs for Duffins Creek Marsh, 2003 – 2007.

Wetland	Year	NETG	NFAM	PCRM	PTRI	PDIP	Macroinvert-ebrate – IBI
Duffins Creek Marsh	2003	1	30	101.70	0	134.59	19.04
Duffins Creek Marsh	2004	3	108	306.14	2.13	40.07	44.90
Duffins Creek Marsh	2005	2	62	205.20	2.29	9.51	46.64
Duffins Creek Marsh	2006	3	53	147.59	0.67	1.81	42.83
Duffins Creek Marsh	2007	2	52	73.99	0.65	9.04	40.99

Findings:

- Overall, total number of families, range = 30 (2003) – 108 (2004).
- Among years, comparing the IBI metric scores for Duffins Creek Marsh (Table 30): highest metric scores were found in 2004 for NETG, NFAM, and PCRM. The highest PTRI occurred in 2005 and the highest PDIP in 2003.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Duffins Creek Marsh exhibited no minimum or maximum mean values for invertebrate metrics

Frenchman's Bay Marsh

Wetland Statistics – Frenchman's Bay Marsh	
Location	City of Pickering
Wetland Type	Barrier beach with permanent opening to Lake Ontario
Vegetation Types	Marsh 99%, Swamp 1%
Wetland Size (hectares)	39
Watershed Size (hectares)	1 652
Percent Natural Cover in Watershed	31

Report Card – Frenchman's Bay Marsh			
	Years	**Condition**	**Trend**
Water Quality	2002 – 2007	Very Degraded	Stable
Submerged Aquatic Vegetation	2004, 2006, 2007	Poor	Unknown
Amphibians	2002, 2003, 2007	Poor	Unknown
Birds	2005, 2006	Fair	Unknown
Fish	2003, 2005 – 2007	Good	Stable
Macroinvertebrates	2002 – 2007	Fair	Improving

Detailed Description:

Water Quality

Years: 2002 – 2007
Mean WQI±SD = -1.17 ± 0.88 (based on all months of data)
Range = -2.25 – 0.19
Rating (based on mean): Very Degraded
Temporal Trends (significant where $p<0.05$):
WQI (all months of data): No
Raw water parameters (July or August data): Water temperature and pH, increasing

Table 31. Mean water quality metrics (July or August) and WQIs (July or August/all months for 2004) for Frenchman's Bay Marsh, 2002 – 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity*	NO_3	WQI**
Frenchman's Bay Marsh	2002	25.01	6.96	403.00	8.64	0.67	0.19
Frenchman's Bay Marsh	2003	23.81	7.90	603.33	-	0.65	-2.25
Frenchman's Bay Marsh	2004	18.92	7.82	448.00	6.07	0.53	-1.12/ -1.13
Frenchman's Bay Marsh	2005	26.32	7.96	577.00	-	0.00	-1.49
Frenchman's Bay Marsh	2006	27.43	-	479.00	13.51	0.53	-
Frenchman's Bay Marsh	2007	27.95	8.92	467.00	15.11	0.63	-1.17

* values based on multiple readings taken typically in July (see water quality chapter for details)
** for 2004, a WQI value calculated for water sampling performed in July is indicated and is followed by an average WQI for all months of water collection in that year; other years of data are based on water sampling in either July (2002 – 2006) or August (2007).

Findings:

- WQI values variable among years with ratings of "good" in 2002 (corresponding to the highest WQI score for a Durham Region wetland in this study), "very degraded" in 2004, 2005 and 2007 and "highly degraded" in 2003.
- Turbidity: ranges in daily means for all months (not shown in Table 5-26) = 3.85 – 30.49 with 4% (1/23) turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing means of all water quality parameters, Frenchman's Bay Marsh fell within the range of means for other wetlands.

Submerged Aquatic Vegetation Community

Years: 2004, 2006 and 2007
Mean IBI±SD = 10.75 ± 8.72
Range = 2.70 – 20.01
Condition/Rating (based on mean): Poor
Temporal Trends (significant where p<0.05):

IBI: Could not be performed due to low sample size (i.e. number of years)
Raw IBI Metrics: Could not be performed due to low sample size (i.e. number of years)

Table 32. Submerged aquatic vegetation community metrics and IBIs for Frenchman's Bay Marsh, 2004, 2006 and 2007.

Wetland	Year	SINT	PINT	FQI	PCOV	SNAT	SAV – IBI
Frenchman's Bay Marsh	2004	0	0	0.49	0.57	0.29	2.70
Frenchman's Bay Marsh	2006	0.40	0.20	1.88	0.71	1.58	9.54
Frenchman's Bay Marsh	2007	1.61	2.47	2.13	2.93	0.86	20.01

Findings:

- Overall, total number of all species: range = 4 (2004) – 7 (2006); total (all years): 11 species (of which nine were native) and two turbidity-intolerant species found (northern water milfoil and tape grass).
- Among years, comparing five IBI metric scores for Frenchman's Bay Marsh (Table 5-27): highest metric scores were found in 2007 for SINT (0.20 turbidity-intolerant species/quadrat), PINT (12.99% cover turbidity-intolerant species/quadrat), FQI (1.73/quadrat) and PCOV (29.33%/quadrat) resulting in the highest IBI score for that year which placed SAV condition into the "fair" category; highest score for SNAT in 2006 (0.55 native species/quadrat).
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Frenchman's Bay Marsh fell within the range of means for other wetlands and exhibited no minimum or maximums in community metrics.

Fish Community

Years: 2003, 2005 – 2007
Mean IBI±SD = 45.00 ± 11.08
Range = 30.01 – 56.42
Condition/Rating (based on mean): Good
Temporal Trends (significant where p<0.05):

IBI: No
Raw IBI Metrics: No

Table 33. Fish community metrics and IBIs for Frenchman's Bay Marsh, 2003 and 2005 – 2007.

Wetland	Year	SNAT	SCEN	PPIS	NNAT	PBNI	BYPE	Fish – IBI
Frenchman's Bay Marsh	2003	5.87	8.03	8.42	3.02	0.85	0.76	44.91
Frenchman's Bay Marsh	2005	6.95	8.03	2.23	3.17	7.42	6.05	56.42
Frenchman's Bay Marsh	2006	1.96	2.01	6.36	0.74	6.95	0	30.01
Frenchman's Bay Marsh	2007	4.25	7.36	10.00	2.58	4.13	0.88	48.66

Findings:

- Overall, total number of all species: range = 8 (2005) – 15 (2003); total (all years): 21 species (of which 17 are native), five centrarchid species and two piscivorous species found.
- Among years, comparing six IBI metric scores for Frenchman's Bay Marsh (Table 5-28): highest metric scores were found in 2005 for SNAT (2.9 native species/transect), SCEN (1.1 centrarchid species/transect), NNAT (11.7 native individuals/transect), BYPE (33.6 g yellow perch) as well as the highest metric score for PBNI (8.1% non-indigenous biomass/transect) resulting in the highest IBI score for that year; in 2006, relatively fewer numbers of fish caught may have contributed to the low metric scores in that year (i.e., was approximately equal to at least one-third of the catch of other study years).
- Among all Durham Region wetlands, comparing means of thirteen raw metrics for all years of sampling, Frenchman's Bay Marsh exhibited: 1) the lowest mean number of native species/transect (SNAT); and 2) the lowest percent generalist biomass/transect.

Breeding Bird Community

Years: 2005, 2006
Mean IBI±SD = 35.87 ± 15.53
Range = 24.89, 46.85
Condition/Rating: Fair
Temporal Trends (significant where $p<0.05$):
IBI: Could not be performed due to low sample size (i.e. number of years)
Raw IBI Metrics: Could not be performed due to low sample size (i.e. number of years)

Table 34. Breeding bird community metrics and IBIs for Frenchman's Bay Marsh, 2005 and 2006.

Wetland	Year	SAMNO	PMNO	PNAF	Bird – IBI
Frenchman's Bay Marsh	2005	2.92	4.64	6.50	46.85
Frenchman's Bay Marsh	2006	0	2.88	4.59	24.89

Findings:

- Overall, total number of all bird species: 24 species in 2005 and 31 in 2006; total (all years): 36 species, one area-sensitive marsh nesting obligate species (Least Bittern, a federally and provincially recognized threatened species-at-risk) plus four marsh nesting obligate species and eight non-aerial forager species.

- Among years, comparing three IBI metric scores for Frenchman's Bay Marsh (Table 5-29): highest metric scores were found in 2005 for SAMNO (0.17 area-sensitive marsh nesting obligates/station), PMNO (15.47% marsh nesting obligates/station) and PNAF (49.99% non-aerial foragers/station) resulting in the high IBI score in that year.
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Frenchman's Bay Marsh exhibited no minimum or maximum mean values for marsh bird metrics.

Amphibian Community

Years: 2002, 2007
Mean IBI±SD = 21.31 ± 22.47
Range = 5.42 – 37.20
Condition/Rating (based on mean): Poor
Temporal Trends (significant where p<0.05):
IBI: Could not be performed due to low sample size (i.e. number of years)
Raw IBI Metrics: Could not be performed due to low sample size (i.e. number of years)

Table 35. Amphibian community metrics and IBIs for Frenchman's Bay Marsh, 2002 and 2007.

Wetland	Year	rTOT	rWOOD	pWOOD	Amphibian – IBI
Frenchman's Bay Marsh	2002	3.66	2.50	5.00	37.20
Frenchman's Bay Marsh	2007	1.63	0	0	5.42

Findings:

- Overall, total number of all species, range = 1 (2007) – 4 (2002); total (all years): four species found, which include American Toad, Green Frog, Northern Leopard Frog and Spring Peeper, of which one is a woodland species.
- Among years, comparing three IBI metric scores for Frenchman's Bay Marsh (Table 30): highest metric scores were found in 2002 for rTOT (3.66 total species (expected)/station), rWOOD (2.50 woodland species (expected)/station) and pWOOD (5.00 woodland species/station) which contributed to the higher amphibian IBI for that year. No woodland species were found in 2007 resulting in low amphibian IBIs in that year.
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Frenchman's Bay Marsh exhibited no minimum or maximum mean values for amphibian metrics.

Macroinvertebrate Community

Years: 2002 – 2007
Mean IBI±SD = 30.00 ± 14.52
Range = 9.16 – 48.16
Condition/Rating (based on range): Poor – Good
Temporal Trends (significant where p<0.05):
IBI: Yes
Raw IBI Metrics: Could not be performed due to ties

Table 36. Macroinvertebrate metrics and IBIs for Frenchman's Bay Marsh, 2002 – 2007.

Wetland	Year	NETG	NFAM	PCRM	PTRI	PDIP	Macroinvert-ebrate – IBI
Frenchman's Bay Marsh	2002	2	49	144.35	0	58.92	26.29
Frenchman's Bay Marsh	2003	1	24	131.52	0	84.51	9.16
Frenchman's Bay Marsh	2004	1	68	300.32	0	63.88	20.77
Frenchman's Bay Marsh	2005	1	30	197.36	1.27	37.84	31.99
Frenchman's Bay Marsh	2006	3	38	218.27	0	25.24	43.67
Frenchman's Bay Marsh	2007	2	56	143.18	1.88	28.67	48.16

Findings:

- Overall, total number of families, range = 24 (2003) – 68 (2004).
- Among years, comparing the IBI metric scores for Frenchman's Bay Marsh (Table 36): highest metric scores were found in 2006 for NETG, 2004 for NFAM and PCRM, 2007 for PTRI, and 2003 for PDIP
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Frenchman's Bay Marsh exhibited no minimum or maximum mean values for invertebrate metrics

Gold Point Marsh

Wetland Statistics – Gold Point Coastal Wetland	
Location	City of Oshawa
Wetland Type	Drowned River-mouth with Barrier Beach
Vegetation Types	Marsh 65%, Swamp 35%
Wetland Size (hectares)	4
Watershed Size (hectares)	294
Percent Natural Cover in Watershed	11

Report Card – Gold Point Coastal Wetland			
	Year	**Condition**	**Trend**
Water Quality	2007	Very Degraded	Unknown
Submerged Aquatic Vegetation	-	Not Applicable	-
Amphibians	-	Not Applicable	-

Birds	-	Not Applicable	-
Fish	-	Not Applicable	-
Macroinvertebrates	-	Not Applicable	-

Detailed Description:

Water Quality

Year: 2007
WQI = -1.65
Rating: Very Degraded
Temporal Trends (significant where p<0.05):
WQI: Could not be performed due to low sample size
Raw water parameters: Could not be performed due to low sample size

Table 37. Mean water quality metrics (August) and WQI (August) for Gold Point Marsh, 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity	NO_3	WQI
Gold Point Marsh	2007	23.48	8.16	2155.00	14.67	1.55	-1.65

Findings:

- Turbidity values equal to 8.64 NTU and 14.67 NTU with no turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing values of all water quality parameters, Gold Point Marsh fell within the range of means for other wetlands.

Submerged Aquatic Vegetation Community

No surveys were conducted in 2007.

Fish Community

No surveys were conducted in 2007.

Breeding Bird Community

No surveys were conducted in 2007.

Amphibian Community

No surveys were conducted in 2007.

Macroinvertebrate Community

No surveys were conducted in 2007.

Hydro Marsh

Wetland Statistics – Hydro Marsh	
Location	City of Pickering
Wetland Type	Barrier beach
Vegetation Types	Marsh 98%, Swamp 2%
Wetland Size (hectares)	26
Watershed Size (hectares)	1 071
Percent Natural Cover in Watershed	30

Report Card – Hydro Marsh			
	Years	**Condition**	**Trend**
Water Quality	2002 – 2007	Very Degraded	Stable
Submerged Aquatic Vegetation	2002, 2004 – 2007	Poor	Stable
Amphibians	2002, 2003, 2007	Poor	Unknown
Birds	2005, 2006	Fair	Unknown
Fish	2003, 2005 – 2007	Good	Improving
Macroinvertebrates	2003 – 2007	Poor	Stable

Detailed Description:

Water Quality

Years: 2002 – 2007
Mean WQI±SD = -1.67 ± 0.46 (based on all months of data)
Range = -2.08 – -0.93
Rating (based on mean): Very Degraded
Temporal Trends (significant where $p<0.05$):
WQI (all months of data): No
Raw water parameters (July or August data): No

Table 38. Mean water quality metrics (July or August) and WQIs (July or August/all months for 2004) for Hydro Marsh, 2002 – 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity*	NO_3	WQI**
Hydro Marsh	2002	-	-	-	11.80	-	-
Hydro Marsh	2003	23.64	7.56	908.17	-	0.45	-2.08
Hydro Marsh	2004	20.94	7.77	741.00	8.53	0.80	-1.67/ -1.63
Hydro Marsh	2005	26.35	7.77	1012.00	23.00	0.15	-2.01
Hydro Marsh	2006	25.23	7.30	601.67	17.82	0.80	-0.93
Hydro Marsh	2007	29.01	8.16	740.00	42.50	0.27	-1.69

* values based on multiple readings taken typically in July (see water quality chapter for details)
** for 2004, a WQI value calculated for water sampling performed in July is indicated and is followed by an average WQI for all months of water collection in that year; other years of data are based on water sampling in either July (2002 – 2006) or August (2007).

Findings:

- WQI values variable among years with ratings of “moderately degraded” in 2006, “very degraded” in 2004 and 2007 and “highly degraded” in 2003 and 2005.

- Turbidity: ranges in daily means for all months (not shown in Table 5-32) = 6.26 – 48.48 with 25% (5/20) turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing means of all water quality parameters, Hydro Marsh fell within the range of means for other wetlands.

Submerged Aquatic Vegetation Community

Years: 2002, 2004 - 2007
Mean IBI±SD = 1.28 ± 1.46
Range = 0 – 3.66
Condition/Rating (based on mean): Poor
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: No (FQI) or could not be performed due to ties (SINT, PINT, PCOV and SNAT)

Table 39. Submerged aquatic vegetation community metrics and IBIs for Hydro Marsh, 2002 and 2004 - 2007.

Wetland	Year	SINT	PINT	FQI	PCOV	SNAT	SAV – IBI
Hydro Marsh	2002	0	0	0.16	0.01	0.10	0.54
Hydro Marsh	2004	0	0	0.12	0.01	0.14	0.55
Hydro Marsh	2005	0	0	0.37	0.02	0.43	1.63
Hydro Marsh	2006	0.40	0.95	0.31	0.03	0.14	3.66
Hydro Marsh	2007	0	0	0	0	0	0

Findings:

- Overall, total number of all species: 1 (2002, 2007) and 2 (2004, 2005, 2006); total (all years): four species (all of which were native) and no turbidity-intolerant species found.
- Among years, comparing five IBI metric scores for Hydro Marsh (Table 5-33): highest metric scores were found in 2006 for SINT (0.05 turbidity-intolerant species/quadrat), PINT (5.00% cover turbidity-intolerant species/quadrat), and PCOV (0.25%/quadrat) and in 2005 for FQI (0.3/quadrat) and SNAT (0.15 native species/quadrat); no SAV species found in 2007.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Hydro Marsh had the lowest mean values for FQI and percent cover per quadrat (PCOV) during the study period.

Fish Community

Years: 2003, 2005 – 2007
Mean IBI±SD = 41.13 ± 16.10
Range = 17.24 – 52.43
Condition/Rating (based on mean): Good
Temporal Trends (significant where p<0.05):
IBI: Increasing (i.e., improving)
Raw IBI Metrics: No (SNAT, PPIS, NNAT, PBNI, BYPE) or could not be performed due to ties (i.e., SCEN)

Table 40. Fish community metrics and IBIs for Hydro Marsh, 2003, 2005 – 2007.

Wetland	Year	SNAT	SCEN	PPIS	NNAT	PBNI	BYPE	Fish – IBI
Hydro Marsh	2003	2.79	2.45	0	2.23	2.88	0	17.24
Hydro Marsh	2005	6.11	7.36	10.00	1.38	3.21	0.34	47.33
Hydro Marsh	2006	5.26	5.15	5.93	2.08	9.90	0.20	47.53
Hydro Marsh	2007	6.15	10.00	6.20	3.93	4.23	0.95	52.43

Findings:

- Overall, total number of all species: range = 8 (2003, 2007) – 9 (2005, 2006); total (all years): 15 species (of which 13 were native), four centrarchid species and two piscivorous species found.
- Among years, comparing six IBI metric scores for Hydro Marsh (Table 5-34): highest metric scores were found in 2007 for SNAT (2.6 native species/transect), SCEN (1.4 centrarchid species/transect), NNAT (14.6 native individuals/transect), and BYPE (5.3 g yellow perch/transect) resulting in the highest IBI score for that year; lowest metric scores for SNAT (1.2 native species/transect), SCEN (0.3 centrarchid species/transect) and no piscivores or yellow perch in 2003 contributed to the low metric scores and IBI found in that year. Note while a similar numbers of fish were caught in 2003 and 2007, a large number of pumpkinseed were caught in 2007 (54) relative to number in 2003 (4) which contributed to the relatively higher values observed for four of the six metrics.
- Among all Durham Region wetlands, comparing means of thirteen raw metrics for all years of sampling, along with Carruthers Creek Marsh, Pumphouse Marsh and Whitby Harbour Wetland Complex, no turbidity intolerant species were caught in Hydro Marsh in any study year.

Breeding Bird Community

Years: 2005, 2006
Mean IBI±SD = 35.34 ± 14.05
Range = 25.40, 45.27
Condition/Rating (based on mean): Fair
Temporal Trends (significant where $p<0.05$):

IBI: Could not be performed due to low sample size (i.e. number of years)

Raw IBI Metrics: Could not be performed due to low sample size (i.e. number of years)

Table 41. Breeding bird community metrics and IBIs for Hydro Marsh, 2005 and 2006.

Wetland	Year	SAMNO	PMNO	PNAF	Bird – IBI
Hydro Marsh	2005	0	6.21	7.37	45.27
Hydro Marsh	2006	0	1.43	6.19	25.40

Findings:

- Overall, total number of all bird species: 10 species in 2005 and 21 in 2006; total (all years): 22 species, no area-sensitive marsh nesting obligate species, four marsh nesting obligate species and nine non-aerial forager species.
- Among years, comparing three IBI metric scores for Hydro Marsh (Table 5-35): highest metric scores were found in 2005 for PMNO (20.71% marsh nesting

obligates/station) and PNAF (56.67% non-aerial foragers/station) resulting in the high IBI score in that year; no area-sensitive species were detected in any study year. .

- Comparing means of all three raw metrics for all years of sampling, Hydro Marsh was among the eight Durham Region wetlands where no area-sensitive species were detected during the study period.

Amphibian Community

Years: 2002, 2007
Mean IBI±SD = 41.47 ± 58.64
Range = 0 – 82.93
Condition/Rating (based on mean): Good
Temporal Trends (significant where p<0.05):
IBI: Could not be performed due to low sample size (i.e. number of years)
Raw IBI Metrics: Could not be performed due to low sample size (i.e. number of years)

Table 42. Amphibian community metrics and IBIs for Hydro Marsh, 2002 and 2007.

Wetland	Year	rTOT	rWOOD	pWOOD	Amphibian – IBI
Hydro Marsh	2002	4.88	10.00	10.00	82.93
Hydro Marsh	2007	0	0	0	0

Findings:

- Overall, total number of all species, range = 0 (2007) – 2 (2002); total (all years): two species found, which include Spring Peeper and Wood Frog, of which both are woodland species.
- Among years, comparing three IBI metric scores for Hydro Marsh (Table 36): highest metric scores were found in 2002 for rTOT (4.88 total species (expected)/station), rWOOD (10.00 woodland species (expected)/station) and pWOOD (10.00 woodland species/station) which contributed to the high amphibian IBI for that year. No amphibian species were found in 2007 and resulting in low amphibian IBIs in that year.
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Hydro Marsh exhibited the maximum mean value for the rWOOD amphibian metric.

Macroinvertebrate Community

Years: 2003 – 2007
Mean IBI±SD = 12.53 ± 14.71
Range = 0.00 – 37.37
Condition/Rating (based on range): Poor – Fair
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 43. Macroinvertebrate metrics and IBIs for Hydro Marsh, 2003 – 2007.

Wetland	Year	NETG	NFAM	PCRM	PTRI	PDIP	Macroinvert -ebrate –

							IBI
Hydro Marsh	2003	0	27	62.21	0	181.53	0.00
Hydro Marsh	2004	4	68	160.18	0	140.92	6.67
Hydro Marsh	2005	0	45	116.04	0	56.21	13.54
Hydro Marsh	2006	1	37	75.06	0	97.03	5.05
Hydro Marsh	2007	1	53	158.62	0.44	35.41	37.37

Findings:

- Overall, total number of families, range = 27 (2003) – 68 (2004).
- Among years, comparing the IBI metric scores for Hydro Marsh (Table 43): highest metric scores were found in 2004 for NETG, NFAM, and PCRM. The highest PTRI occurred in 2007 and the highest PDIP in 2003.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Hydro Marsh exhibited the highest average PDIP.

Lynde Creek Marsh

Wetland Statistics – Lynde Creek Marsh	
Location	Town of Whitby
Wetland Type	Drowned River-mouth protected by a Barrier Beach
Vegetation Types	Marsh 58%, Swamp 42%
Wetland Size (hectares)	157
Watershed Size (hectares)	13 098
Percent Natural Cover in Watershed	30

Report Card – Lynde Creek Marsh			
	Years	**Condition**	**Trend**
Water Quality	2002 – 2007	Very Degraded	Stable
Submerged Aquatic Vegetation	2002 – 2007	Poor	Deteriorating
Amphibians	2002 – 2007	Fair	Unknown
Birds	2002 – 2007	Good	Stable
Fish	2003 – 2007	Good	Stable
Macroinvertebrates	2002 – 2007	Fair	Stable

Detailed Description:

Water Quality

Years: 2002 – 2007
Mean WQI±SD = -1.89 ± 0.38 (based on all months of data)
Range = -2.27 – -1.32

Rating (based on mean): Very Degraded
Temporal Trends (significant where p<0.05):
WQI (all months of data): No
Raw water parameters (July or August data): Water temperature, increasing, pH, increasing (marginally) and conductivity, decreasing (marginally)

Table 44. Mean water quality metrics (July or August) and WQIs (July or August/all months for 2004) for Lynde Creek Marsh, 2002 – 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity*	NO_3	WQI**
Lynde Creek Marsh	2002	20.75	7.07	722.33	23.95	0.67	-1.54
Lynde Creek Marsh	2003	20.77	7.90	701.67	43.66	4.83	-2.27
Lynde Creek Marsh	2004	21.56	7.61	640.33	132.91	1.27	-1.71/ -1.96
Lynde Creek Marsh	2005	28.34	8.08	895.00	19.71	0.20	-2.06
Lynde Creek Marsh	2006	24.30	7.81	611.00	51.73	0.43	-2.16
Lynde Creek Marsh	2007	24.70	8.78	550.67	26.23	0.23	-1.32

* values based on multiple readings taken typically in July (see water quality chapter for details)
** for 2004, a WQI value calculated for water sampling performed in July is indicated and is followed by an average WQI for all months of water collection in that year; other years of data are based on water sampling in either July (2003 – 2007) or August (2002).

Findings:

- WQI values variable among years with ratings of "very degraded" in 2002, 2004 and 2007 and "highly degraded" in 2003, 2005 and 2006.
- Turbidity: ranges in daily means for all months (not shown in Table 5-37) = 8.11 – 132.91 with 52% (24/46) turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing means of all water quality parameters, Lynde Creek Marsh was among the highest for mean turbidity during the study period.

Submerged Aquatic Vegetation Community

Years: 2002 – 2007
Mean IBI±SD = 8.80 ± 8.04
Range = 1.30 – 22.22
Condition/Rating (based on mean): Poor
Temporal Trends (significant where p<0.05):
IBI: Decreasing (i.e., deteriorating)
Raw IBI Metrics: Decreasing FQI, PCOV, SNAT and could not be performed due to ties (i.e., SINT and PINT)

Table 45. Submerged aquatic vegetation community metrics and IBIs for Lynde Creek Marsh, 2002 – 2007.

Wetland	Year	SINT	PINT	FQI	PCOV	SNAT	SAV – IBI
Lynde Creek Marsh	2002	0	0	2.91	1.04	2.69	13.28
Lynde Creek Marsh	2003	0	0	4.21	2.80	4.10	22.22
Lynde Creek Marsh	2004	0	0	1.68	0.95	2.09	9.42
Lynde Creek Marsh	2005	0	0	1.08	0.56	0.86	5.00

Lynde Creek Marsh	2006	0	0	0.49	0.01	0.29	1.58
Lynde Creek Marsh	2007	0	0	0.35	0.16	0.14	1.30

Findings:

- Overall, total number of all species: range = 2 (2002) – 9 (2002); total (all years): 15 species (of which 12 were native) and no turbidity-intolerant species found.
- Among years, comparing five IBI metric scores for Lynde Creek Marsh (Table 5-38): highest metric scores were found in 2003 for FQI (3.42 where white water lily was found frequently in 2002 – 2005 but not in later years), PCOV (27.98%/quadrat) and SNAT (1.43 native species/quadrat); absence of turbidity-intolerant species during study period.
- Comparing means of all five raw metrics for all years of sampling, Lynde Creek Marsh was among the three Durham Region wetlands where no turbidity-intolerant species were found during the study period.

Fish Community

Years: 2003 – 2007
Mean IBI±SD = 46.49 ± 9.64
Range = 34.34 (average of two sampling efforts in 2004) – 59.82
Condition/Rating (based on mean): Good
Temporal Trends (significant where $p<0.05$):

IBI: No
Raw IBI Metrics: BYPE, increasing (based on average of two sampling efforts)

Table 46. Fish community metrics and IBIs for Lynde Creek Marsh, 2003 – 2007. The results of two sampling efforts in 2004 are also provided.

Wetland	Year	SNAT	SCEN	PPIS	NNAT	PBNI	BYPE	Fish – IBI
Lynde Creek Marsh	2003	4.78	4.68	3.92	2.90	8.16	0	40.73
Lynde Creek Marsh - 1	2004	3.35	1.47	0	0.86	6.80	0.08	20.94
Lynde Creek Marsh - 2	2004	5.98	4.42	5.80	5.45	6.99	0	47.74
Lynde Creek Marsh	2005	7.47	6.44	10.00	3.65	6.76	1.58	59.82
Lynde Creek Marsh	2006	5.74	5.15	6.82	1.54	8.04	1.26	47.59
Lynde Creek Marsh	2007	7.77	4.60	0	3.27	8.46	5.87	49.96

Findings:

- Overall, total number of all species: range = 8 (2005) – 17 (for two sampling efforts in 2004); total (all years): 20 species (of which 18 are native), four centrarchid species and four piscivorous species found.
- Among years, comparing six IBI metric scores for Lynde Creek Marsh (Table 5-39): highest metric scores were found in 2005 for SCEN (0.9 centrarchid species/transect), PPIS (18.9% piscivore biomass/transect) and NNAT (13.5 native individuals/transect) resulting in the highest IBI score for that year; as an average of two sampling efforts, the lowest IBI was found in 2004 due in part to the low metric values in one sampling effort relative to the other.
- Among all Durham Region wetlands, comparing means of three raw metrics for all years of sampling, Lynde Creek Marsh exhibited no minimum or maximum mean values for fish metrics.

Breeding Bird Community

Years: 2002 – 2007
Mean IBI±SD = 49.73 ± 6.39
Range = 41.00 – 57.50
Condition/Rating (based on mean): Good
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: No or could not be performed due to ties (i.e., SAMNO)

Table 47. Breeding bird community metrics and IBIs for Lynde Creek Marsh, 2002 – 2007.

Wetland	Year	SAMNO	PMNO	PNAF	Bird – IBI
Lynde Creek Marsh	2002	0	4.05	8.86	43.00
Lynde Creek Marsh	2003	0	2.35	9.97	41.00
Lynde Creek Marsh	2004	2.19	6.37	8.71	57.50
Lynde Creek Marsh	2005	0	5.81	9.46	50.90
Lynde Creek Marsh	2006	0	6.47	9.15	52.00
Lynde Creek Marsh	2007	0	6.86	9.34	53.90

Findings:

- Overall, total number of all bird species: 16 species (2003) to 20 species (2005, 2006); total (all years): 41 species, one area-sensitive marsh nesting obligate species (Black Tern, a provincially-recognized special concern species-at-risk) plus four marsh nesting obligate species and 18 non-aerial forager species.
- Among years, comparing three IBI metric scores for Lynde Creek Marsh (Table 5-40): highest metric scores were found in 2004 for SAMNO (0.13 area-sensitive marsh nesting obligates/station, which contributed to the highest IBI score for that year), in 2007 for PMNO (22.86% marsh nesting obligates/station) and in 2003 for PNAF (79.29% non-aerial foragers/station).
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Lynde Creek Marsh exhibited no minimum or maximum mean values for marsh bird metrics.

Amphibian Community

Years: 2002 – 2007
Mean IBI±SD = 23.87 ± 21.40
Range = 3.25 – 59.76
Condition/Rating (based on mean): Fair
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 48. Amphibian community metrics and IBIs for Lynde Creek Marsh, 2002 – 2007.

Wetland	Year	rTOT	rWOOD	pWOOD	Amphibian – IBI
Lynde Creek Marsh	2002	1.63	0	0	4.07
Lynde Creek Marsh	2003	0.98	0	0	3.25
Lynde Creek Marsh	2004	2.44	2.50	5.00	33.13

Lynde Creek Marsh	2005	2.44	2.00	4.00	28.13
Lynde Creek Marsh	2006	1.46	1.00	2.00	14.88
Lynde Creek Marsh	2007	2.93	5.00	10.00	59.76

Findings:

- Overall, total number of all species, range = 0 (2006) – 2 (2002 and 2005); total (all years): four species found, which include American Toad, Green Frog, Spring Peeper and Wood Frog, of which two are woodland species. Note that Wood Frog was found in four of the six study years (i.e., 2004 - 2007).
- Among years, comparing three IBI metric scores for Lynde Creek Marsh (Table 41): highest metric scores were found in 2007 for rTOT (2.93 species (expected)/station), rWOOD (5.00 woodland species (expected)/station) and pWOOD (10.00 woodland species/station) which contributed to the high amphibian IBI for that year. No woodland species were found in 2002 and 2003 resulting in the low amphibian IBIs in those years.
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Lynde Creek Marsh exhibited no minimum or maximum mean values for amphibian metrics.

Macroinvertebrate Community

Years: 2002 – 2007
Mean IBI±SD = 34.68 ± 15.80
Range = 3.24 – 45.40
Condition/Rating (based on range): Poor – Good
Temporal Trends (significant where $p<0.05$):

IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 49. Macroinvertebrate metrics and IBIs for Lynde Creek Marsh, 2002 – 2007.

Wetland	Year	NETG	NFAM	PCRM	PTRI	PDIP	Macroinvert-ebrate – IBI
Lynde Creek Marsh	2002	3	49	100.96	0.77	6.92	43.49
Lynde Creek Marsh	2003	0	39	91.99	0	110.58	3.24
Lynde Creek Marsh	2004	4	91	379.41	0	27.62	45.40
Lynde Creek Marsh	2005	1	50	185.31	0.61	33.34	40.42
Lynde Creek Marsh	2006	3	55	123.31	0	29.91	40.56
Lynde Creek Marsh	2007	0	50	164.28	0	23.78	34.95

Findings:

- Overall, total number of families, range = 39 (2003) – 91 (2004).
- Among years, comparing the IBI metric scores for Lynde Creek Marsh (Table 49): highest metric scores were found in 2004 for NETG, NFAM, and PCRM. The highest PTRI occurred in 2002 and highest PDIP in 2003.

- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Lynde Creek Marsh exhibited no minimum or maximum mean values for invertebrate metrics

McLaughlin Bay Marsh

Wetland Statistics – McLaughlin Bay Marsh	
Location	City of Oshawa and Municipality of Clarington
Wetland Type	Barrier Beach
Vegetation Types	Marsh 86%, Swamp 14%
Wetland Size (hectares)	44
Watershed Size (hectares)	209
Percent Natural Cover in Watershed	69

Report Card – McLaughlin Bay Marsh			
	Years	**Condition**	**Trend**
Water Quality	2002 – 2007	Highly Degraded	Stable
Submerged Aquatic Vegetation	2003 – 2007	Poor	Unknown
Amphibians	2002, 2003, 2005 – 2007	Fair	Unknown
Birds	2004 – 2007	Very Good	Stable
Fish	2003, 2005 – 2007	Fair	Stable
Macroinvertebrates	2003 – 2007	Fair	Stable

Detailed Description:

Water Quality

Years: 2002 – 2007
Mean WQI±SD = -2.43 ± 0.26 (based on all months of data)
Range = -2.69 – -2.18
Rating (based on mean): Highly Degraded
Temporal Trends (significant where $p<0.05$):
WQI (all months of data): No
Raw water parameters (July data): pH, increasing, turbidity, increasing (marginally); also significant seasonal trend (increase) in turbidity found in 2003 and 2007

Table 50. Mean water quality metrics (July) and WQIs (July/all months for 2004) for McLaughlin Bay Marsh, 2002 – 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity*	NO_3	WQI**
McLaughlin Bay Marsh	2002	-	-	-	38.28	-	-
McLaughlin Bay Marsh	2003	27.18	8.02	1515.00	48.05	0.18	-2.18
McLaughlin Bay Marsh	2004	21.84	8.12	1576.67	55.63	1.83	-2.76/ -2.61
McLaughlin Bay Marsh	2005	29.39	8.75	562.67	55.18	0.23	-2.23
McLaughlin Bay Marsh	2006	24.50	-	1060.33	50.21	0.00	-
McLaughlin Bay Marsh	2007	23.37	9.12	1176.67	77.58	0.00	-2.69

* values based on multiple readings taken typically in July (see water quality chapter for details)
** for 2004, a WQI value calculated for water sampling performed in July is indicated and is followed by an average WQI for all months of water collection in that year; other years of data are based on water sampling in July.

Findings:

- WQI values for every year consistently rated as "highly degraded" with the lowest mean WQI value of all Durham Region wetlands during the study period.
- Turbidity: ranges in daily means for all months (not shown in Table 5-42) = 16.90 – 156.13 NTU with 74% (20/27) turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing means of all water quality parameters, McLaughlin Bay Marsh exhibited the lowest mean NO_3 and was among the highest for mean turbidity and pH during the study period.

Submerged Aquatic Vegetation Community

Years: 2003 – 2007
Mean IBI±SD = 1.48 ± 2.60
Range = 0 – 6.07
Condition/Rating (based on range): Poor
Temporal Trends (significant where $p<0.05$):
IBI: Could not be performed due to ties
Raw IBI Metrics: Could not be performed due to ties

Table 51. Submerged aquatic vegetation community metrics and IBIs for McLaughlin Bay Marsh, 2003 – 2007.

Wetland	Year	SINT	PINT	FQI	PCOV	SNAT	SAV – IBI
McLaughlin Bay Marsh	2003	0	0	0.31	0.06	0.14	1.01
McLaughlin Bay Marsh	2004	0	0	0	0	0	0
McLaughlin Bay Marsh	2005	0	0	0	0	0	0
McLaughlin Bay Marsh	2006	0	0	0	0.16	0	0.32
McLaughlin Bay Marsh	2007	0.40	0.95	0.80	0.59	0.29	6.07

Findings:

- Overall, total number of all species: range = 0 (2004) – 4 (2007); total (all years): six species (of which four were native) and one turbidity-intolerant species found (northern water milfoil).
- Among years, comparing five IBI metric scores for McLaughlin Bay Marsh (Table 5-43): highest metric scores were found in 2007 for SINT (0.05 turbidity-intolerant species/quadrat), PINT (5.00% cover turbidity-intolerant species/quadrat), FQI

(0.65/quadrat), PCOV (5.90%/quadrat) and SNAT (0.10 native species/quadrat) resulting in the highest IBI score for that year.

- Among all Durham Region wetlands, comparing means of all five raw metrics, McLaughlin Bay Marsh had the lowest mean number of native species per quadrat during the study period.

Fish Community

Years: 2003, 2005 – 2007
Mean IBI±SD = 39.75 ± 11.85
Range = 30.53 – 57.15
Condition/Rating (based on mean): Fair
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: PBNI, increasing (which is shown below as standardized metric decreasing) or could not be performed due to ties (PPIS)

Table 52. Fish community metrics and IBIs for McLaughlin Bay Marsh, 2003 and 2005 – 2007.

Wetland	Year	SNAT	SCEN	PPIS	NNAT	PBNI	BYPE	Fish –IBI
McLaughlin Bay Marsh	2003	4.44	7.36	0	1.58	6.43	1.80	36.01
McLaughlin Bay Marsh	2005	8.96	6.44	0	10.00	5.44	3.44	57.15
McLaughlin Bay Marsh	2006	6.11	5.72	0	1.83	2.54	2.12	30.53
McLaughlin Bay Marsh	2007	6.83	9.46	0.72	1.77	1.97	0.44	35.33

Findings:

- Overall, total number of all species: range = 5 (2003) – 12 (2005); total (all years): 13 species (of which 10 are native), three centrarchid species and one piscivorous species found.
- Among years, comparing six IBI metric scores for McLaughlin Bay Marsh (Table 5-44): highest metric scores were found in 2005 for SNAT (3.8 native species/transect), NNAT (34.1 native individuals/transect) and BYPE (19.1 g yellow perch/transect) resulting in the highest IBI score for that year. Note there was a large number of gizzard shad caught in 2005 (212 individuals) which contributed to the high metric scores (i.e., SNAT, NNAT and PBNI) in this year relative to other years.
- Among all Durham Region wetlands, comparing means of thirteen raw metrics for all years of sampling, McLaughlin Bay Marsh exhibited: 1) the highest mean number of centrarchid species/transect (SCEN); and, 2) the lowest mean number of native cyprinid species/transect (equal to zero in three out of four study years).

Breeding Bird Community

Years: 2002 – 2007
Mean IBI±SD = 68.06 ± 14.59
Range = 57.17 – 89.17
Condition/Rating: Very Good
Temporal Trends (significant where p<0.05):

IBI: No
Raw IBI Metrics: No or could not be performed due to ties (i.e., SAMNO)

Table 53. Breeding bird community metrics and IBIs for McLaughlin Bay Marsh, 2004 – 2007.

Wetland	Year	SAMNO	PMNO	PNAF	Bird – IBI
McLaughlin Bay Marsh	2004	0	7.89	10.00	59.65
McLaughlin Bay Marsh	2005	8.75	8.00	10.00	89.17
McLaughlin Bay Marsh	2006	0	9.87	10.00	66.23
McLaughlin Bay Marsh	2007	0	7.15	10.00	57.17

Findings:

- Overall, total number of all bird species: range = 7 species (2004) – 12 species (2006, 2007); total (all years): 24 species, one area-sensitive marsh nesting obligate species (Black Tern, a provincially-recognized special concern species-at-risk) plus six marsh nesting obligate species and 13 non-aerial forager species.
- Among years, comparing three IBI metric scores for McLaughlin Bay Marsh (Table 5-45): highest metric scores were found in 2005 for SAMNO (0.50 area-sensitive marsh nesting obligates/station, which contributed to the highest IBI score for that year), in 2006 for PMNO (32.90% marsh nesting obligates/station) and for all years, scores equal to 10.00 for PNAF (range=80.24%-92.86% non-aerial foragers/station).
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, McLaughlin Bay Marsh exhibited the highest mean value for PNAF (equal to 86.89% non-aerial foragers/station) during the study.

Amphibian Community

Years: 2002, 2003, 2005 – 2007
Mean IBI±SD = 33.75 ± 25.17
Range = 0 – 58.13
Condition/Rating (based on mean): Fair
Temporal Trends (significant where $p<0.05$):
IBI: Could not be performed due to low sample size (i.e. number of years)
Raw IBI Metrics: Could not be performed due to ties

Table 54. Amphibian community metrics and IBIs for McLaughlin Bay Marsh, 2002, 2003, and 2005 – 2007.

Wetland	Year	rTOT	rWOOD	pWOOD	Amphibian – IBI
McLaughlin Bay Marsh	2002	2.44	5.00	10.00	58.13
McLaughlin Bay Marsh	2003	2.44	5.00	10.00	58.13
McLaughlin Bay Marsh	2005	2.44	2.50	5.00	33.13
McLaughlin Bay Marsh	2006	0	0	0	0
McLaughlin Bay Marsh	2007	0.81	1.67	3.33	19.38

Findings:

- Overall, total number of all species, range = 0 (2006) – 2 (2002, 2005); total (all years): four species found, which include American Toad, Green Frog, Spring Peeper and Wood Frog, of which two are woodland species.
- Among years, comparing three IBI metric scores for McLaughlin Bay Marsh (Table 46): highest metric scores were found in 2002 - 2003 for rTOT (2.44 total species (expected)/station), in 2002 and 2003 for rWOOD (5.00 woodland species (expected)/station) and pWOOD (10.00 woodland species/station) which contributed to the high amphibian IBI for those years. No amphibian species were found in 2006 resulting in the low amphibian IBI in that year.
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, McLaughlin Bay Marsh exhibited the maximum mean value for the pWOOD amphibian metric.

Macroinvertebrate Community

Years: 2003 – 2007
Mean IBI±SD = 35.34 ± 10.65
Range = 20.20 – 48.66
Condition/Rating (based on range): Poor – Good
Temporal Trends (significant where $p<0.05$):
IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 55. Macroinvertebrate metrics and IBIs for McLaughlin Bay Marsh, 2003 – 2007.

Wetland	Year	NETG	NFAM	PCRM	PTRI	PDIP	Macroinvert-ebrate – IBI
McLaughlin Bay Marsh	2003	2	24	174.01	1.69	24.72	37.89
McLaughlin Bay Marsh	2004	4	91	361.07	4.27	102.66	39.43
McLaughlin Bay Marsh	2005	1	36	63.51	0.60	22.67	20.20
McLaughlin Bay Marsh	2006	3	32	105.78	1.60	26.09	30.50
McLaughlin Bay Marsh	2007	4	40	42.98	6.78	29.33	48.66

Findings:

- Overall, total number of families, range = 40 (2003) – 108 (2004).

- Among years, comparing the IBI metric scores for McLaughlin Bay Marsh (Table 55): highest metric scores were found in 2004 for NFAM, PCRM, and PDIP. 2004 and 2007 were tied for the highest NETG, the highest PTRI occurred in 2007.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, McLaughlin Bay Marsh had the highest average PTRI.

Oshawa Creek Marsh

Wetland Statistics – Oshawa Creek Coastal Wetland	
Location	City of Oshawa
Wetland Type	Drowned River-mouth protected by a Barrier Beach
Vegetation Types	Marsh 41%, Swamp 59%
Wetland Size (hectares)	20
Watershed Size (hectares)	12 048
Percent Natural Cover in Watershed	24

Report Card – Oshawa Creek Coastal Wetland			
	Year		
Water Quality	2007	Moderately Degraded	Unknown
Submerged Aquatic Vegetation	-	Not Applicable	-
Amphibians	2007	Poor	Unknown
Birds	-	Not Applicable	-
Fish	-	Not Applicable	-
Macroinvertebrates	-	Not Applicable	-

Detailed Description:

Water Quality

Years: 2007
WQI = -0.56
Rating: Moderately Degraded
Temporal Trends (significant where $p<0.05$):
WQI: Could not be performed due to low sample size
Raw water parameters: Could not be performed due to low sample size

Table 56. Water quality metrics (August) and WQI (August) for Oshawa Creek Coastal Wetland, 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity	NO_3	WQI
Oshawa Creek Coastal Wetland	2007	19.33	8.21	392.75	18.98	2.13	-0.56

Findings:

- Turbidity values equal to 11.13 NTU and 18.98 NTU with no turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing means of all water quality parameters, Oshawa Creek Coastal Wetland was among the lowest for conductivity during the study period.

Submerged Aquatic Vegetation Community

No surveys were conducted in 2007.

Fish Community

No surveys were conducted in 2007.

Breeding Bird Community

No surveys were conducted in 2007.

Amphibian Community

Years: 2007
IBI = 5.42
Condition/Rating: Poor

Table 57. Amphibian community metrics and IBI for Oshawa Creek Coastal Wetland, 2007.

Wetland	Year	rTOT	rWOOD	pWOOD	Amphibian - IBI
Oshawa Creek Coastal Wetland	2007	1.63	0	0	5.42

Findings:

- Overall, total number of all species found equal to one (American Toad); no woodland species were found.
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, along with Westside Marsh and Duffins Creek Marsh, Oshawa Creek Coastal Wetland exhibited the lowest value for rWOOD and pWOOD whereby no woodland species were found in any study year.

Macroinvertebrate Community

No surveys were conducted in 2007.

Oshawa Second Marsh

Wetland Statistics – Oshawa Second Marsh	
Location	City of Oshawa
Wetland Type	Barrier Beach
Vegetation Types	Marsh 69%, Swamp 31%
Wetland Size (hectares)	133
Watershed Size (hectares)	10 705
Percent Natural Cover in Watershed	24

Report Card – Oshawa Second Marsh			
	Years	**Condition**	**Trend**
Water Quality	2002 – 2007	Very Degraded	Improving
Submerged Aquatic Vegetation	2002, 2003, 2005 – 2007	Good	Improving
Amphibians	2002 – 2007	Fair	Stable
Birds	2002 – 2007	Very Good	Stable
Fish	2005 – 2007	Fair	Unknown
Macroinvertebrates	2003, 2005 – 2007	Good	Unknown

Detailed Description:

Water Quality

Years: 2002 – 2007
Mean WQI±SD = -1.41 ± 0.23 (based on all months of data)
Range = -1.74 – -1.17
Rating (based on mean): Very Degraded
Temporal Trends (significant where $p<0.05$):
WQI (all months of data): Increasing (i.e., improving)
Raw water parameters (July or August data): Water temperature, increasing; also significant seasonal trend (increase) in turbidity found in 2005

Table 58. Mean water quality metrics (July or August) and WQIs (July or August/all months for 2004) for Oshawa Second Marsh, 2002 – 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity*	NO_3	WQI**
Oshawa Second Marsh	2002	-	-	-	4.48	-	-
Oshawa Second Marsh	2003	24.80	8.91	1090.17	4.29	0.14	-1.74
Oshawa Second Marsh	2004	17.14	7.67	746.00	-	1.60	-1.39/ -1.53
Oshawa Second Marsh	2005	25.50	7.18	873.67	10.56	0.23	-1.21
Oshawa Second Marsh	2006	25.73	7.99	674.00	3.35	0.27	
Oshawa Second Marsh	2007	26.43	7.31	1059.00	10.58	0.17	-1.17

* values based on multiple readings taken typically in July (see water quality chapter for details)
** for 2004, a WQI value calculated for water sampling performed in August is indicated and is followed by an average WQI for all months of water collection in that year; other years of data are based on water sampling in either July (2003, 2005 – 2007) or August (2004).

Findings:

- WQI values for every year consistently rated as "very degraded"
- Turbidity: ranges in daily means for all months (not shown in Table 5-49) = 3.35 – 34.08 with 4% (1/24) turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing means of all water quality parameters, Oshawa Second Marsh exhibited: 1) the lowest mean turbidity value during the study period, and 2) the lowest mean total phosphorus value for water collections in 2004 and 2005 (not shown in Table 5-49).

Submerged Aquatic Vegetation Community

Years: 2002, 2003, 2005 – 2007
Mean IBI±SD = 55.99 ± 20.77
Range = 31.25 – 80.91
Condition/Rating (based on mean): Good
Temporal Trends (significant where $p<0.05$):
IBI: Increasing (i.e., improving)
Raw IBI Metrics: FQI and SNAT increasing or could not be performed due to ties (i.e., SINT and PINT)

Table 59. Submerged aquatic vegetation community metrics and IBIs for Oshawa Second Marsh, 2002, 2003, and 2005 – 2007.

Wetland	Year	SINT	PINT	FQI	PCOV	SNAT	SAV – IBI
Oshawa Second Marsh	2002	0	0	5.31	5.73	4.59	31.25
Oshawa Second Marsh	2003	0	0	5.03	9.01	6.05	40.17
Oshawa Second Marsh	2005	3.22	2.56	8.44	4.72	9.07	56.03
Oshawa Second Marsh	2006	7.25	7.36	10.00	8.79	7.06	80.91
Oshawa Second Marsh	2007	4.84	0.95	10.00	10.00	10.00	71.56

Findings:

- Overall, total number of all species: range = 9 (2002) – 13 (2005, 2007); total (all years): 19 species (of which 17 were native) and one turbidity-intolerant species found (northern water milfoil).
- Among years, comparing five IBI metric scores for Oshawa Second Marsh (Table 5-50): highest metric scores were found in 2006 for SINT (0.90 turbidity-intolerant species/quadrat), PINT (38.74% cover turbidity-intolerant species/quadrat), and FQI (8.76/quadrat, where slender waterweed and white water lily were frequently found) and in 2007 for FQI (9.45/quadrat), PCOV (108.7%/quadrat) and SNAT (4.35 native species/quadrat) where metric scores were equal to 10; no turbidity-intolerant species were found in 2002 or 2003.
- Comparing means of all five raw metrics, Oshawa Second Marsh had the highest mean values for SINT (0.38 turbidity-intolerant species/quadrat), PINT (11.44% cover turbidity-intolerant species/quadrat), FQI (6.70/quadrat), and PCOV (78.21%/quadrat) metrics of all Durham Region wetlands during the study period.

Fish Community

Years: 2005 – 2007

Mean IBI±SD = 37.68 ± 9.97
Range = 26.49 – 45.60
Condition/Rating (based on mean): Fair
Temporal Trends (significant where p<0.05):

IBI: Could not be performed due to low sample size (i.e. number of years)
Raw IBI Metrics: Could not be performed due to low sample size (i.e. number of years)

Table 1. Fish community metrics and IBIs for Oshawa Second Marsh, 2005 – 2007.

Wetland	Year	SNAT	SCEN	PPIS	NNAT	PBNI	BYPE	Fish – IBI
Oshawa Second Marsh	2005	10.00	7.36	0	10.00	0	0	45.60
Oshawa Second Marsh	2006	6.77	7.36	0	10.00	0	0.44	40.94
Oshawa Second Marsh	2007	5.80	6.31	0	3.70	0	0.08	26.49

Findings:

- Overall, total number of all species = 6 (2006) and 7 (2005, 2007); total (all years): nine species (of which eight were native), two centrarchid species and no piscivorous species found.
- Among years, comparing six IBI metric scores for Oshawa Second Marsh (Table 5-51): highest metric scores were found in 2005 for SNAT (4.3 native species/transect), SCEN (1.0 centrarchid species/transect) and NNAT (38.9 native individuals/transect) resulting in the highest IBI score for that year. No piscivores caught in any year and PBNI was low due to large numbers of goldfish caught (range in numbers = 30 – 69 from 2005 to 2007); in addition, fewer numbers of fathead minnow, pumpkinseed and banded killifish contributed to lower SNAT and NNAT metric values in 2007 relative to other years.
- Among all Durham Region wetlands, comparing means of thirteen raw metrics for all years of sampling, Oshawa Second Marsh exhibited: 1) the highest mean number of native species/transect (SNAT, highest in 2005 of all wetlands); 2) highest mean number of non-indigenous species/transect (highest ever in 2005 and 2006) due to large collections of goldfish; and 3) along with two other wetlands (i.e., Pumphouse Marsh and Whitby Harbour Wetland Complex) was the only wetland where no piscivorous fish were collected.

Breeding Bird Community

Years: 2002 – 2007
Mean IBI±SD = 68.96 ± 14.97
Range = 51.49 – 93.15
Condition/Rating (based on mean): Very Good
Temporal Trends (significant where p<0.05):

IBI: No
Raw IBI Metrics: No or could not be performed due to ties (i.e., SAMNO)

Table 2. Breeding bird community metrics and IBIs for Oshawa Second Marsh, 2002 – 2007.

Wetland	Year	SAMNO	PMNO	PNAF	Bird – IBI
Oshawa Second Marsh	2002	0	6.88	8.56	51.49

Oshawa Second Marsh	2003	0	7.79	10.00	59.28
Oshawa Second Marsh	2004	2.92	7.82	10.00	69.13
Oshawa Second Marsh	2005	10.00	8.31	9.64	93.15
Oshawa Second Marsh	2006	7.50	6.05	10.00	78.51
Oshawa Second Marsh	2007	0	9.67	9.00	62.22

Findings:

- Overall, total number of all bird species: 26 species (2003) to 37 species (2005); total (all years): 59 species, four area-sensitive marsh nesting obligate species (American Bittern, American Coot and Black Tern (provincially-recognized special concern species-at-risk) and Least Bittern (provincially and federally-recognized threatened species-at-risk) plus six marsh nesting obligate species and 25 non-aerial forager species. A Bald Eagle, a provincially-recognized endangered species-at-risk, was also detected during the study period at Oshawa Second Marsh.
- Among years, comparing three IBI metric scores for Oshawa Second Marsh (Table 5-52): highest metric scores were found in 2005 for SAMNO (0.83 area-sensitive marsh nesting obligates/station, which contributed to the highest IBI score for that year), in 2007 for PMNO (32.24% marsh nesting obligates/station) and scores equal to 10.00 in 2003, 2004, and 2006 for PNAF (range=80.61%-82.02% non-aerial foragers/station).
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Oshawa Second Marsh exhibited no minimum or maximum mean values for marsh bird metrics.

Amphibian Community

Years: 2002 – 2007
Mean IBI±SD = 30.70± 10.03
Range = 20.67 – 44.21
Condition/Rating (based on mean): Fair
Temporal Trends (significant where $p<0.05$):
IBI: No
Raw IBI Metrics: No or could not be performed due to ties (i.e., rTOT and pWOOD)

Table 3. Amphibian community metrics and IBIs for Oshawa Second Marsh, 2002 – 2007.

Wetland	Year	rTOT	rWOOD	pWOOD	Amphibian – IBI
Oshawa Second Marsh	2002	2.17	1.67	3.33	23.90
Oshawa Second Marsh	2003	2.03	1.67	2.50	20.67
Oshawa Second Marsh	2004	3.46	2.50	5.00	36.52
Oshawa Second Marsh	2005	2.85	3.75	6.67	44.21
Oshawa Second Marsh	2006	1.77	3.18	6.36	37.73
Oshawa Second Marsh	2007	3.14	1.07	2.14	21.17

Findings:

- Overall, total number of all species: 3 (2002) and 5 (2003 - 2006); total (all years): six species found, which include American Toad, Green Frog, Gray

Treefrog, Northern Leopard Frog, Spring Peeper and Wood Frog, of which three were woodland species. Oshawa Second Marsh was one of two Durham Region wetlands where Gray Treefrog was found (and detected in both 2004 and 2006).

- Among years, comparing three IBI metric scores for Oshawa Second Marsh (Table 53): highest metric scores were found in 2005 for rWOOD (3.75 woodland species (expected)/station) and pWOOD (6.67 woodland species/station) which contributed to the high amphibian IBI for that year; the highest score for rTOT was found in 2004 (3.46 total species (expected)/station).
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Oshawa Second Marsh exhibited no minimum or maximum mean values for amphibian metrics.

Macroinvertebrate Community

Years: 2003 – 2007
Mean IBI±SD = 44.98 ± 6.33
Range = 39.09 – 52.49
Condition/Rating (based on range): Good
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 60. Macroinvertebrate metrics and IBIs for Oshawa Second Marsh, 2003, 2005 – 2007.

Wetland	Year	NETG	NFAM	PCRM	PTRI	PDIP	Macroinvert-ebrate – IBI
Oshawa Second Marsh	2003	1	45	236.24	1.53	15.50	52.49
Oshawa Second Marsh	2005	2	46	158.95	1.95	15.51	47.90
Oshawa Second Marsh	2006	4	54	86.36	0	28.26	39.09
Oshawa Second Marsh	2007	3	47	184.03	0	39.42	40.45

Findings:

- Overall, total number of families, range = 45 (2003) – 54 (2006).
- Among years, comparing the IBI metric scores for Oshawa Second Marsh (Table 60): highest metric scores were found in 2006 for NETG and NFAM. The highest PCRM occurred in 2003, highest PTRI in 2005, and the highest PDIP in 2007.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Oshawa Second Marsh exhibited no minimum or maximum mean values for invertebrate metrics

Port Newcastle Marsh

Wetland Statistics – Port Newcastle Wetland	
Location	Municipality of Clarington
Wetland Type	Drowned River-mouth
Vegetation Types	Marsh 52%, Swamp 48%
Wetland Size (hectares)	11
Watershed Size (hectares)	7 814
Percent Natural Cover in Watershed	44

Report Card – Port Newcastle Wetland			
	Years	**Condition**	**Trend**
Water Quality	2002 – 2007	Moderately Degraded	Stable
Submerged Aquatic Vegetation	2004 – 2007	Poor	Deteriorating
Amphibians	2003 – 2007	Fair	Unknown
Birds	2003 – 2007	Fair	Unknown
Fish	2003, 2005 – 2007	Good	Stable
Macroinvertebrates	2003 – 2007	Fair	Deteriorating

Detailed Description:

Water Quality

Years: 2002 – 2007
Mean WQI±SD = -0.96 ± 0.63 (based on all months of data)
Range = -1.42 – 0.15
Rating (based on mean): Moderately Degraded
Temporal Trends (significant where $p<0.05$):
WQI (all months of data): No
Raw water parameters (July data): pH, increasing; also significant seasonal trend (decrease) in turbidity found in 2006

Table 61. Mean water quality metrics (July) and WQIs (July/all months for 2004) for Port Newcastle Wetland, 2002 – 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity*	NO_3	WQI**
Port Newcastle Wetland	2002	-	-	-	8.03	-	-
Port Newcastle Wetland	2003	21.32	7.78	544.67	8.96	3.04	-1.27
Port Newcastle Wetland	2004	17.81	7.99	493.00	34.79	1.13	-1.31/ -1.42
Port Newcastle Wetland	2005	26.04	8.27	542.00	20.81	0.80	-1.21
Port Newcastle Wetland	2006	23.40	8.40	493.33	7.07	1.67	0.15
Port Newcastle Wetland	2007	26.21	8.81	389.00	11.25	1.30	-1.07

* values based on multiple readings taken typically in July (see water quality chapter for details)
** for 2004, a WQI value calculated for water sampling performed in July is indicated and is followed by an average WQI for all months of water collection in that year; other years of data are based on water sampling in July.

Findings:

- WQI values for every year consistently rated as “very degraded” with the exception in 2006 where water quality was rated as “good” (second highest value for a Durham Region wetland); highest mean WQI of all 15 annually surveyed Durham Region wetlands.
- Turbidity: ranges in daily means for all months (not shown in Table 5-54) = 1.79 – 41.26 NTU with 21% (3/14) turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing means of all water quality parameters, Port Newcastle Wetland fell within the range of means for other wetlands.

Submerged Aquatic Vegetation Community

Years: 2004 – 2007
Mean IBI±SD = 17.49 ± 11.20
Range = 7.79 – 33.60
Condition/Rating (based on mean): Poor
Temporal Trends (significant where $p<0.05$):
IBI: Decreasing (i.e., deteriorating)
Raw IBI Metrics: PCOV and SNAT, decreasing or could not be performed due to ties (i.e., SINT and PINT)

Table 62. Submerged aquatic vegetation community metrics and IBIs for Port Newcastle Wetland, 2004 – 2007.

Wetland	Year	SINT	PINT	FQI	PCOV	SNAT	SAV – IBI
Port Newcastle Wetland	2004	0.81	0.97	6.24	3.89	4.90	33.60
Port Newcastle Wetland	2005	0	0	2.72	2.32	2.59	15.26
Port Newcastle Wetland	2006	0	0	2.85	1.80	2.02	13.32
Port Newcastle Wetland	2007	0.40	0.24	1.53	0.86	0.86	7.79

Findings:

- Overall, total number of all species: range = 6 (2006) – 12 (2004); total (all years): 15 species (of which 13 were native) and two turbidity-intolerant species found (flat-stemmed pondweed and tape grass).
- Among years, comparing five IBI metric scores for Port Newcastle Wetland (Table 5-55): highest metric scores were found in 2004 for SINT (0.10 turbidity-intolerant species/quadrat), PINT (5.11% cover turbidity-intolerant species/quadrat), FQI (5.08/quadrat), PCOV (38.85%/quadrat) and SNAT (1.70 native species/quadrat); absence of turbidity-intolerant species in 2005 and 2006 and lowest values for FQI (1.24/quadrat), PCOV (8.60%/quadrat) and SNAT (0.30 native species/quadrat) in 2007.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Port Newcastle Wetland fell within the range of means for other wetlands and exhibited no minimum or maximums in community metrics.

Fish Community

Years: 2003, 2005 – 2007
Mean IBI±SD = 41.24 ± 14.69
Range = 26.40 – 55.55

Condition/Rating (based on mean): Good
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: No (SNAT, NNAT, PBNI, BYPE) or could not be performed due to ties (SCEN, PPIS)

Table 63. Fish community metrics and IBIs for Port Newcastle Wetland, 2003, and 2005 – 2007.

Wetland	Year	SNAT	SCEN	PPIS	NNAT	PBNI	BYPE	Fish – IBI
Port Newcastle Wetland	2003	2.66	4.09	0	0.96	6.44	1.69	26.40
Port Newcastle Wetland	2005	6.90	6.54	0.12	10.00	6.99	0.67	52.04
Port Newcastle Wetland	2006	4.78	2.45	0	1.89	6.15	3.30	30.96
Port Newcastle Wetland	2007	6.37	6.54	5.37	5.22	7.07	2.76	55.55

Findings:

- Overall, total number of all species: range = 5 (2003) – 14 (2007); total (all years): 18 species (of which 16 are native), four centrarchid species and two piscivorous species found.
- Among years, comparing six IBI metric scores for Port Newcastle Wetland (Table 5-56): highest metric scores were found in 2007 for SCEN (0.9 centrarchid species/transect, same as in 2005), PPIS (7.7% piscivore biomass/transect) and lowest PBNI (9.2% non-indigenous biomass/transect) resulting in the highest IBI score for that year; the highest scores for native individuals was in 2005 when numerous golden shiner and pumpkinseed were collected (SNAT=2.9 native species/transect and NNAT=24.0 native individuals/transect).
- Among all Durham Region wetlands, comparing means of thirteen raw metrics for all years of sampling, Port Newcastle Wetland exhibited: 1) the highest mean biomass of native fish (the highest ever in 2007 which was due in part to the collection of a large number of brown bullhead).

Breeding Bird Community

Years: 2003 – 2007
Mean IBI±SD = 35.79 ± 5.28
Range = 29.88 – 42.14
Condition/Rating (based on mean): Fair
Temporal Trends (significant where p<0.05):
IBI: Could not be performed due to ties
Raw IBI Metrics: No or could not be performed due to ties (i.e., SAMNO)

Table 64. Breeding bird community metrics and IBIs for Port Newcastle Wetland, 2003 – 2007.

Wetland	Year	SAMNO	PMNO	PNAF	Bird – IBI
Port Newcastle Wetland	2003	0	4.29	8.36	42.14
Port Newcastle Wetland	2004	0	2.22	6.74	29.88
Port Newcastle Wetland	2005	0	1.30	7.91	30.72
Port Newcastle Wetland	2006	0	1.43	10.00	38.10
Port Newcastle Wetland	2007	0	2.14	9.29	38.10

Findings:

- Overall, total number of all bird species: range = 17 species (2003) to 34 species (2004, 2005); total (all years): 25 species, no area-sensitive marsh nesting obligate species, one marsh nesting obligate species (Swamp Sparrow) and 15 non-aerial forager species.
- Among years, comparing three IBI metric scores for Port Newcastle Wetland (Table 5-57): highest metric scores were found in 2003 for PMNO (14.29% marsh nesting obligates/station) and in 2006 for PNAF (80.95% non-aerial foragers/station); no area-sensitive marsh nesting obligates found during the study period.
- Comparing means of all three raw metrics for all years of sampling, Port Newcastle Wetland was among the eight Durham Region wetlands where no area-sensitive species were detected during the study period.

Amphibian Community

Years: 2003 – 2007
Mean IBI±SD = 23.01 ± 29.51
Range = 0 – 74.40
Condition/Rating (based on mean): Fair
Temporal Trends (significant where p<0.05):
IBI: Could No
Raw IBI Metrics: Could not be performed due to ties

Table 65. Amphibian community metrics and IBIs for Port Newcastle Wetland, 2003 – 2007.

Wetland	Year	rTOT	rWOOD	pWOOD	Amphibian - IBI
Port Newcastle Wetland	2003	4.88	0	0	16.27
Port Newcastle Wetland	2004	7.32	5.00	10.00	74.40
Port Newcastle Wetland	2005	4.88	0	0	16.27
Port Newcastle Wetland	2006	0	0	0	0
Port Newcastle Wetland	2007	2.44	0	0	8.13

Findings:

- Overall, total number of all species: 0 (2006) and 3 (2003 - 2005); total (all years): four species found, which include American Toad, Green Frog, Northern Leopard Frog, and Spring Peeper, of which one is a woodland species.
- Among years, comparing three IBI metric scores for Port Newcastle Wetland (Table 58): highest metric scores were found in 2004 for rTOT (7.32 total species (expected)/station), rWOOD (5.00 woodland species (expected)/station) and pWOOD (10.00 woodland species/station) which contributed to the high amphibian IBI for that year; no woodland species were found in 2003, 2005 – 2007 which resulted in the relatively lower IBI scores during that period.
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Port Newcastle wetland exhibited the highest mean total species (expected)/station (rTOT, 7.32 total species/station) of all Durham Region wetlands.

Macroinvertebrate Community

Years: 2003 – 2007
Mean IBI±SD = 33.68 ± 13.74
Range = 21.51 – 55.07
Condition/Rating (based on range): Fair – Good
Temporal Trends (significant where p<0.05):
IBI: Yes
Raw IBI Metrics: Could not be performed due to ties

Table 66. Macroinvertebrate metrics and IBIs for Port Newcastle Wetland, 2003 – 2007.

Wetland	Year	NETG	NFAM	PCRM	PTRI	PDIP	Macroinvert-ebrate – IBI
Port Newcastle Wetland	2003	5	44	171.63	5.56	73.60	55.07
Port Newcastle Wetland	2004	8	109	243.15	0	82.18	39.55
Port Newcastle Wetland	2005	1	47	76.18	0.57	31.25	25.18
Port Newcastle Wetland	2006	2	44	121.39	0	35.71	27.10
Port Newcastle Wetland	2007	3	47	54.83	0.70	129.29	21.51

Findings:

- Overall, total number of families, range = 44 (2003, 2006) – 109 (2004).
- Among years, comparing the IBI metric scores for Port Newcastle Wetland (Table 66): highest metric scores were found in 2004 for NETG, NFAM, and PCRM. The highest PTRI occurred in 2003 and the highest PDIP in 2007.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Port Newcastle Wetland exhibited no minimum or maximum mean values for invertebrate metrics

Pumphouse Marsh

Wetland Statistics – Pumphouse Marsh	
Location	City of Oshawa
Wetland Type	Barrier Beach
Vegetation Types	Marsh 78%, Swamp 22%
Wetland Size (hectares)	7
Watershed Size (hectares)	55
Percent Natural Cover in Watershed	23

Report Card – Pumphouse Marsh			
	Years	**Condition**	**Trend**
Water Quality	2002 – 2007	Very Degraded	Stable
Submerged Aquatic Vegetation	2003 – 2006	Fair	Deteriorating
Amphibians	2003 – 2006	Fair	Unknown

Birds	2004 – 2007	Fair	Deteriorating
Fish	2003, 2006	Fair	Unknown
Macroinvertebrates	2003 – 2006	Good	Stable

Detailed Description:

Water Quality

Years: 2002 – 2007
Mean WQI±SD = -1.68 ± 0.77 (based on all months of data)
Range = -2.55 – -1.00
Rating (based on mean): Very Degraded
Temporal Trends (significant where p<0.05):
WQI (all months of data): No
Raw water parameters (July data): Water temperature, increasing

Table 67. Mean water quality metrics (July) and WQIs (July/all months for 2004) for Pumphouse Marsh, 2002 – 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity*	NO_3	WQI**
Pumphouse Marsh	2002	-	-	-	18.83	-	-
Pumphouse Marsh	2003	21.61	7.70	889.67	5.88	2.12	-1.28
Pumphouse Marsh	2004	21.99	8.48	864.33	8.28	0.60	-1.17/ -1.11
Pumphouse Marsh	2005	28.67	8.05	1730.00	30.64	0.15	-2.47
Pumphouse Marsh	2006	30.67	9.79	520.00	5.86	0.50	-1.00
Pumphouse Marsh	2007	34.97	8.98	1819.00	28.07	0.53	-2.55

* values based on multiple readings taken typically in July (see water quality chapter for details)
** for 2004, a WQI value calculated for water sampling performed in July is indicated and is followed by an average WQI for all months of water collection in that year; other years of data are based on water sampling in July.

Findings:

- WQI values varied with ratings of “moderately degraded” in 2006, “very degraded” in 2003 and 2004 and “highly degraded” in 2005 and 2007.
- Turbidity: ranges in daily means for all months (not shown in Table 5-59) = 1.74 – 75.00 with 9% (2/23) turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing means of all water quality parameters, Pumphouse Marsh exhibited: 1) the highest mean water temperature (highest of all wetlands in 2007), 2) the highest mean pH (highest of all wetlands in 2006) and, 3) the highest mean NH_3 in water samples collected in 2005 and 2006 of all Durham Region wetlands.

Submerged Aquatic Vegetation Community

Years: 2003 – 2006
Mean IBI±SD = 24.94 ± 22.58
Range = 7.66 – 56.28
Condition/Rating (based on mean): Fair
Temporal Trends (significant where p<0.05):

IBI: Decreasing (i.e., deteriorating)

Raw IBI Metrics: FQI, PCOV and SNAT, decreasing or could not be performed due to ties (i.e., SINT and PINT)

Table 68. Submerged aquatic vegetation community metrics and IBIs for Pumphouse Marsh, 2003 – 2006.

Wetland	Year	SINT	PINT	FQI	PCOV	SNAT	SAV – IBI
Pumphouse Marsh	2003	1.21	0.31	7.62	9.00	10.00	56.28
Pumphouse Marsh	2004	0	0	3.62	5.21	4.46	26.58
Pumphouse Marsh	2005	0	0	2.37	0.25	2.02	9.26
Pumphouse Marsh	2006	0	0	2.12	0.13	1.58	7.66

Findings:

- Overall, total number of all species: range = 5 (2005, 2006) – 12 (2003); total (all years): 12 native species (all of which were native) and one turbidity-intolerant species found (slender naiad).
- Among years, comparing five IBI metric scores for Pumphouse Marsh (Table 5-60): highest metric scores were found in 2003 for SINT (0.15 turbidity-intolerant species/quadrat), PINT (1.66% cover turbidity-intolerant species/quadrat), FQI (6.19/quadrat), PCOV (90.0%/quadrat) and SNAT (3.80 native species/quadrat); no turbidity-intolerant species found in 2004 – 2006 and lowest metric values for FQI (1.72/quadrat), PCOV (1.25%/quadrat) and SNAT (0.55 native species/quadrat) found in 2007.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Pumphouse Marsh fell within the range of means for other wetlands and exhibited no minimum or maximums in community metrics.

Fish Community

Years: 2003, 2006
Mean IBI±SD = 30.50 ± 5.48
Range = 26.63, 34.37
Condition/Rating (based on mean): Fair
Temporal Trends (significant where $p<0.05$):

IBI: Cannot be performed due to low sample size (i.e., too few years)

Raw IBI Metrics: Cannot be performed due to low sample size (i.e., too few years)

Table 69. Fish community metrics and IBIs for Pumphouse Marsh, 2003 and 2006.

Wetland		SNAT	SCEN	PPIS	NNAT	PBNI	BYPE	Fish – IBI
Pumphouse Marsh	2003	5.98	0	0	10.00	0	0	26.63
Pumphouse Marsh	2006	6.57	10.00	0	4.05	0	0	34.37

Findings:

- Overall, total number of all species: four (2003) and six (2006); total (all years): seven species (of which six are native), three centrarchid species and zero piscivorous species found.
- Among years, comparing six IBI metric scores for Pumphouse Marsh (Table 5-61): highest metric scores were found in 2006 for SNAT (2.8 native

species/transect) and SCEN (1.8 centrarchid species/transect where no centrarchid species were found in 2003) resulting in the highest IBI score for that year. Note that a large number of fathead minnows were collected in 2003 resulting in the high NNAT metric score in that year (484 individuals).

- Among all Durham Region wetlands, comparing means of all thirteen raw metrics for all years of sampling, Pumphouse Marsh exhibited: 1) the highest mean percent generalist biomass/transect (highest of all wetlands in 2003); 2) the highest mean percent of numbers of non-indigenous fish/transect (highest ever in 2006); and, 3) the highest mean percent biomass of non-indigenous species/transect (PBNI), due largely to the large number of goldfish collected (37 and 60 in 2003 and 2006, respectively, in four sampled transects). The highest mean number of native individuals/transect (NNAT) was also found (highest ever in 2003) relative to other wetlands due to a large collection of fathead minnows. The lowest mean percent specialist biomass/transect of all wetlands (equal to zero in 2003) as well as no piscivores or yellow perch was also found in Pumphouse Marsh during the two year study period.

Breeding Bird Community

Years: 2004 – 2007
Mean IBI±SD = 39.63 ± 4.93
Range = 33.60 – 45.56
Condition/Rating (based on mean): Fair
Temporal Trends (significant where $p<0.05$):
IBI: Decreasing (i.e., deteriorating)
Raw IBI Metrics: No or could not be performed due to ties (i.e., SAMNO)

Table 70. Breeding bird community metrics and IBIs for Pumphouse Marsh, 2004 – 2007.

Wetland	Year	SAMNO	PMNO	PNAF	Bird – IBI
Pumphouse Marsh	2004	0	4.75	8.92	45.56
Pumphouse Marsh	2005	0	2.14	10.00	40.48
Pumphouse Marsh	2006	0	1.82	9.85	38.89
Pumphouse Marsh	2007	0	4.15	5.93	33.60

Findings:

- Overall, total number of all bird species: range = 2 species (2005) – 14 species (2006, 2007); total (all years): 25 species, no area-sensitive marsh nesting obligate species, two marsh nesting obligate species (Swamp Sparrow and Virginia Rail) and 12 non-aerial forager species.
- Among years, comparing three IBI metric scores for Pumphouse Marsh (Table 5-62): highest metric scores were found in 2004 for PMNO (15.83% marsh nesting obligates/station) and in 2005 for PNAF (100.00% non aerial foragers/station, where a total of only two species were detected).
- Comparing means of all three raw metrics for all years of sampling, Pumphouse Marsh was among the eight Durham Region wetlands where no area-sensitive species were detected during the study period.

Amphibian Community

Years: 2003 – 2006

Mean IBI±SD = 33.13 ± 28.87
Range = 8.13 – 58.13
Condition/Rating (based on mean): Fair
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 71. Amphibian community metrics and IBIs for Pumphouse Marsh, 2003 – 2006.

Wetland	Year	rTOT	rWOOD	pWOOD	Amphibian – IBI
Pumphouse Marsh	2003	2.44	0	0	8.13
Pumphouse Marsh	2004	2.44	0	0	8.13
Pumphouse Marsh	2005	2.44	5.00	10.00	58.13
Pumphouse Marsh	2006	2.44	5.00	10.00	58.13

Findings:

- Overall, total number of all species: range = 1 (2004) – 3 (2003, 2006); total (all years): four species found, which include American Toad, Green Frog, Northern Leopard Frog, and Wood Frog, of which one is a woodland species.
- Among years, comparing three IBI metric scores for Pumphouse Marsh (Table 63): highest metric scores were found in 2005 and 2006 for rWOOD (5.00 woodland species (expected)/station) and pWOOD (10.00 woodland species/station) which contributed to the high amphibian IBI for those year; similar rTOT scores were found for all study years (2.44 total species (expected)/station).
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Pumphouse Marsh exhibited no minimum or maximum mean values for amphibian metrics.

Macroinvertebrate Community

Years: 2003 – 2006
Mean IBI±SD = 46.21 ± 18.29
Range = 21.23 – 61.11
Condition/Rating (based on range): Fair – Very Good
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 72. Macroinvertebrate metrics and IBIs for Pumphouse Marsh, 2003 – 2006.

Wetland	Year	NETG	NFAM	PCRM	PTRI	PDIP	Macroinvert-ebrate – IBI
Pumphouse Marsh	2003	3	54	211.14	0	11.98	58.57
Pumphouse Marsh	2004	11	121	294.33	1.25	44.91	61.11

Pumphouse Marsh	2005	0	37	45.42	0	5.13	21.23
Pumphouse Marsh	2006	3	49	136.10	0	12.39	43.94

Findings:

- Overall, total number of families, range = 37 (2005) – 121 (2004).
- Among years, comparing the IBI metric scores for Pumphouse Marsh (Table 72): highest metric scores were found in 2004 for NETG, NFAM, PCRM, PTRI, and PDIP.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Pumphouse Marsh had the highest average NFAM.

Rouge River Marsh

Wetland Statistics – Rouge River Marsh	
Location	Cities of Toronto and Pickering
Wetland Type	Drowned River-mouth
Vegetation Types	Marsh 64%, Swamp 36%
Wetland Size (hectares)	56
Watershed Size (hectares)	33 289
Percent Natural Cover in Watershed	24

Report Card – Rouge River Marsh			
	Years	**Condition**	**Trend**
Water Quality	2003 – 2007	Very Degraded	Stable
Submerged Aquatic Vegetation	2004, 2006, 2007	Poor	Unknown
Amphibians	2003 – 2007	Poor	Unknown
Birds	2003 – 2007	Good	Stable
Fish	2003, 2005 – 2007	Fair	Stable
Macroinvertebrates	2003 – 2007	Good	Stable

Detailed Description:

Water Quality

Years: 2003 – 2007
Mean WQI±SD = -1.74 ± 0.28 (based on all months of data)
Range = -2.06 – -1.45
Rating (based on mean): Very Degraded
Temporal Trends (significant where $p<0.05$):
WQI (all months of data): No
Raw water parameters (July or August data): No

Table 73. Mean water quality metrics (July or August) and WQIs (July or August/all months in 2004) for Rouge River Marsh, 2003 – 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity*	NO_3	WQI**
Rouge River Marsh	2003	23.05	7.65	899.50	-	3.93	-2.06
Rouge River Marsh	2004	19.61	7.73	839.67	13.09	0.80	-1.53/ -1.58
Rouge River Marsh	2005	25.70	7.50	1172.00	17.00	0.07	-1.87
Rouge River Marsh	2006	24.57	-	740.33	32.09	1.03	-
Rouge River Marsh	2007	25.15	7.39	963.67	10.99	0.00	-1.45

* values based on multiple readings taken typically in July (see water quality chapter for details)
** for 2004, a WQI value calculated for water sampling performed in July is indicated and is followed by an average WQI for all months of water collection in that year; other years of data are based on water sampling in either July (2003 – 2006) or August (2007).

Findings:

- WQI values rated as "very degraded" in 2004, 2005 and 2007 and "highly degraded" in 2003.
- Turbidity: ranges in daily means for all months (not shown in Table 5-64) = 9.01 – 60.55 with 20% (4/20) turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing means of all water quality parameters, Rouge River Marsh exhibited: 1) the lowest mean value of pH, and 2) the lowest mean chlorophyll *a* for water collections in 2003, 2005 and 2007 (not shown in Table 5-64).

Submerged Aquatic Vegetation Community

Years: 2004, 2006, 2007
Mean IBI±SD = 15.76 ± 4.57
Range = 10.51 – 18.86
Condition/Rating (based on mean): Poor
Temporal Trends (significant where $p<0.05$):
IBI: Cannot be performed due to low sample size (i.e., too few years)
Raw IBI Metrics: Cannot be performed due to low sample size (i.e., too few years)

Table 74. Submerged aquatic vegetation community metrics and IBIs for Rouge River Marsh, 2004, 2006 and 2007.

Wetland	Year	SINT	PINT	FQI	PCOV	SNAT	SAV – IBI
Rouge River Marsh	2004	0	0	1.94	1.74	1.58	10.51
Rouge River Marsh	2006	0	0	3.65	3.34	2.45	18.86
Rouge River Marsh	2007	0.27	0.07	3.71	3.27	1.63	17.90

Findings:

- Overall, total number of all species: range = 2 (2002) – 7 (2004, 2006); total (all years): 13 species (of which 12 were native) and one turbidity-intolerant species found (tape grass).

- Among years, comparing five IBI metric scores for Rouge River Marsh (Table 5-65): highest metric scores were found in 2007 for SINT (0.03 turbidity-intolerant species/quadrat), PINT (0.37% cover turbidity-intolerant species/quadrat), and FQI (3.02/quadrat) and in 2006 for PCOV (33.35%/quadrat) and SNAT (0.85 native species/quadrat); no turbidity-intolerant species found in 2004 and 2006.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Rouge River Marsh fell within the range of means for other wetlands and exhibited no minimum or maximums in community metrics.

Fish Community

Years: 2003, 2005 - 2007
Mean IBI±SD = 38.78 ± 12.43
Range = 25.04 – 49.88
Condition/Rating (based on range): Fair
Temporal Trends (significant where $p<0.05$):
IBI: No
Raw IBI Metrics: No (SNAT, SCEN, NNAT, PBNI, BYPE) or could not be performed due to ties (PPIS)

Table 75. Fish community metrics and IBIs for Rouge River Marsh, 2003, 2005 – 2007.

Wetland		SNAT	SCEN	PPIS	NNAT	PBNI	BYPE	Fish – IBI
Rouge River Marsh	2003	5.26	3.68	0	2.54	6.58	0.83	31.48
Rouge River Marsh	2005	7.47	8.28	3.19	3.34	6.63	1.01	49.88
Rouge River Marsh	2006	6.64	4.09	10.00	2.22	5.34	0.94	48.72
Rouge River Marsh	2007	4.10	3.15	0	2.28	5.50	0	25.04

Findings:

- Overall, total number of all species: range = 7 (2007) – 13 (2006); total (all years): 16 species (of which 14 are native), two centrarchid species and three piscivorous species (i.e., bowfin, northern pike and largemouth bass) found.
- Among years, comparing six IBI metric scores for Rouge River Marsh (Table 5-66): highest metric scores were found in 2005 for SNAT (3.1 native species/transect), SCEN (1.1 centrarchid species/transect), NNAT (12.4 native individuals/transect) and BYPE (5.6 g yellow perch/transect) as well as the highest metric score for PBNI (10.5% non-indigenous biomass/transect) resulting in the highest IBI score for that year. No piscivores and yellow perch caught in 2007 which contributed to the low IBI found in that year relative to other years.
- Among all Durham Region wetlands, comparing means of all thirteen raw metrics for all years of sampling, Rouge River Marsh exhibited no minimum or maximum means values for fish metrics.

Breeding Bird Community

Years: 2003 – 2007
Mean IBI±SD = 44.81 ± 9.89

Range = 34.21 – 58.44
Condition/Rating: Good
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: No or could not be performed due to ties (i.e., SAMNO)

Table 76. Breeding bird community metrics and IBIs for Rouge River Marsh, 2003 – 2007.

Wetland	Year	SAMNO	PMNO	PNAF	Bird – IBI
Rouge River Marsh	2003	0	2.00	10.00	40.00
Rouge River Marsh	2004	0	8.00	9.53	58.44
Rouge River Marsh	2005	0	5.47	10.00	51.56
Rouge River Marsh	2006	0	1.95	10.00	39.83
Rouge River Marsh	2007	0	2.63	7.63	34.21

Findings:

- Overall, total number of all bird species: range = 4 species (2003) – 19 species (2006, 2007); total (all years): 29 species, no area-sensitive marsh nesting obligate species, two marsh nesting obligate species and 15 non-aerial forager species.
- Among years, comparing three IBI metric scores for Rouge River Marsh (Table 5-67): highest metric scores were found in 2004 for PMNO (26.67% marsh nesting obligates/station) and in 2003, 2005, and 2006 for PNAF equal to 10.00 (range=87.07%-100.00% non-aerial foragers/station); relatively lower metric scores in 2007 contributed to the lower IBI despite the high species richness observed in that year.
- Comparing means of all three raw metrics for all years of sampling, Rouge River Marsh was among the eight Durham Region wetlands where no area-sensitive species were detected during the study period.

Amphibian Community

Years: 2003 – 2007
Mean IBI±SD = 27.51 ± 23.81
Range = 8.13 – 66.27
Condition/Rating (based on mean): Fair
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 77. Amphibian community metrics and IBIs for Rouge River Marsh, 2003 – 2007.

Wetland	Year	rTOT	rWOOD	pWOOD	Amphibian – IBI
Rouge River Marsh	2003	2.44	0	0	8.13
Rouge River Marsh	2004	4.88	5.00	10.00	66.27
Rouge River Marsh	2005	2.44	1.67	3.33	24.80
Rouge River Marsh	2006	2.44	0	0	8.13
Rouge River Marsh	2007	4.07	1.67	3.33	30.22

Findings:

- Overall, total number of all species: range = 2 (2003, 2006) – 5 (2005); total (all years): seven species found, which include American Toad, Bullfrog (only one found in Durham Region wetlands), Green Frog, Gray Treefrog (found in only one other Durham Region wetlands), Northern Leopard Frog, Spring Peeper and Wood Frog, of which three are woodland species.
- Among years, comparing three metric scores for Rouge River Marsh (Table 68): highest metric scores were found in 2004 for rTOT (4.88 total species (expected)/station) and in 2004 for rWOOD and pWOOD (5.00 woodland species (expected)/station and 10.00 woodland species/station, respectively) which contributed to the high amphibian IBIs in those years; no woodland species were found in 2003 and 2006, resulting in the low IBI scores for those years.
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Rouge River Marsh exhibited no minimum or maximum mean values for amphibian metrics.

Macroinvertebrate Community

Years: 2003 – 2007
Mean IBI±SD = 49.67 ± 14.28
Range = 35.68 – 70.92
Condition/Rating (based on range): Fair – Good
Temporal Trends (significant where $p<0.05$):
IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 78. Macroinvertebrate metrics and IBIs for Rouge River Marsh, 2003 – 2007.

Wetland	Year	NETG	NFAM	PCRM	PTRI	PDIP	Macroinvert-ebrate – IBI
Rouge River Marsh	2003	7	47	63.98	2.88	115.09	39.53
Rouge River Marsh	2004	11	104	245.25	2.53	27.62	56.67
Rouge River Marsh	2005	3	50	129.06	0.65	13.84	45.53
Rouge River Marsh	2006	6	43	56.5	0	34.75	35.68
Rouge River Marsh	2007	5	63	116.22	3.99	15.86	70.92

Findings:

- Overall, total number of families, range = 43 (2003) – 104 (2004).
- Among years, comparing the IBI metric scores for Rouge River Marsh (Table 78): highest metric scores were found in 2004 for NETG, NFAM, and PCRM. The highest PTRI occurred in 2007 and the highest PDIP in 2003.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Rouge River Marsh had the highest average NETG.

Westside Marsh

Wetland Statistics – Westside Marsh	
Location	Municipality of Clarington
Wetland Type	Barrier Beach
Vegetation Types	Marsh 86%, Swamp 13%, Fen 1%
Wetland Size (hectares)	40
Watershed Size (hectares)	549
Percent Natural Cover in Watershed	28

Report Card – Westside Marsh			
	Years	**Condition**	**Trend**
Water Quality	2002 – 2007	Very Degraded	Stable
Submerged Aquatic Vegetation	2004 – 2007	Poor	Stable
Amphibians	2003 – 2007	Poor	Unknown
Birds	2002 – 2007	Very Good	Stable
Fish	2005 – 2007	Fair	Unknown
Macroinvertebrate	2003 – 2007	Fair	Improving

Detailed Description:

Water Quality

Years: 2003 – 2007
Mean WQI±SD = -1.92 ± 0.41 (all months of data)
Range = -2.25 – -1.50
Rating (based on mean): Very Degraded
Temporal Trends (significant where $p<0.05$):
WQI (all months of data): No
Raw water parameters (July data): No; also significant seasonal trends in turbidity found in 2004 and 2007 (i.e., decrease and increase, respectively)

Table 79. Mean water quality metrics (July) and WQIs (July/all months in 2004) for Westside Marsh, 2002 – 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity*	NO_3	WQI**
Westside Marsh	2002	-	-	-	17.50	-	-
Westside Marsh	2003	24.35	7.74	945.50	30.19	1.42	-2.23
Westside Marsh	2004	21.11	7.87	879.33	17.15	0.39	-1.91/ -1.87
Westside Marsh	2005	26.97	8.08	1525.83	20.05	0.28	-2.25
Westside Marsh	2006	26.50	7.34	632.00	15.27	0.10	-1.50
Westside Marsh	2007	25.43	8.11	1254.33	21.40	0.37	-1.55

* values based on multiple readings taken typically in July (see water quality chapter for details)
** for 2004, a WQI value calculated for water sampling performed in July or August is indicated and is followed by an average WQI for all months of water collection in that year; other years of data are based on water sampling in July.

Findings:

- WQI values rated as "very degraded" in 2004, 2006 and 2007 and "highly degraded" in 2003 and 2005.
- Turbidity: ranges in daily means for all months (not shown in Table 5-69) = 9.39 – 69.43 with 30% (7/23) turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing means of all water quality parameters, Westside Marsh fell within the range of means for other wetlands.

Submerged Aquatic Vegetation Community

Years: 2004 – 2007
Mean IBI±SD = 9.06 ± 10.15
Range = 0 – 23.62
Condition/Rating (based on mean): Poor
Temporal Trends (significant where $p<0.05$):
IBI: No
Raw IBI Metrics: No or could not be performed due to ties (i.e., SINT and PINT)

Table 80. Submerged aquatic vegetation community metrics and IBIs for Westside Marsh, 2004 – 2007.

Wetland	Year	SINT	PINT	FQI	PCOV	SNAT	SAV – IBI
Westside Marsh	2004	0	0	0	0	0	0
Westside Marsh	2005	0	0	1.47	0.61	1.31	6.78
Westside Marsh	2006	2.02	2.63	3.54	0.74	2.88	23.62
Westside Marsh	2007	0	0	1.38	0.54	1.01	5.86

Findings:

- Overall, total number of all species: range = 8 (2007) – 13 (2006); total (all years): 20 species (of which 17 were native) and one turbidity-intolerant species found (northern water milfoil).
- Among years, comparing five IBI metric scores for Westside Marsh (Table 5-70): highest metric scores were found in 2006 for SINT (0.25 turbidity-intolerant species/quadrat), PINT (13.87% cover turbidity-intolerant species/quadrat), FQI

(2.88/quadrat), PCOV (7.35%/quadrat) and SNAT (1.00 native species/quadrat); no SAV species were found in 2004 and no turbidity-intolerant species were found in 2005 and 2007.

- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Westside Marsh fell within the range of means for other wetlands and exhibited no minimum or maximums in community metrics.

Fish Community

Years: 2005 – 2007
Mean IBI±SD = 38.93 ± 11.18
Range = 30.14 – 51.51
Condition/Rating (based on mean): Fair
Temporal Trends (significant where p<0.05):
IBI: Cannot be performed due to low sample size (i.e., too few years)
Raw IBI Metrics: Cannot be performed due to low sample size (i.e., too few years)

Table 81. Fish community metrics and IBIs for Westside Marsh, 2005 – 2007.

Wetland	Year	SNAT	SCEN	PPIS	NNAT	PBNI	BYPE	Fish – IBI
Westside Marsh	2005	7.17	3.15	0	3.43	3.58	0.75	30.14
Westside Marsh	2006	5.68	6.44	0.08	1.45	6.61	0.83	35.15
Westside Marsh	2007	6.57	5.52	3.01	4.86	10.00	0.95	51.51

Findings:

- Overall, total number of all species: 7 (2007) and 9 (2005 and 2006); total (all years): 13 species (of which 12 are native), four centrarchid species and one piscivorous species found (largemouth bass).
- Among years, comparing six IBI metric scores for Westside Marsh (Table 5-71): highest metric scores were found in 2007 for PPIS (4.3% piscivore biomass/transect), NNAT (18.0 native individuals/transect) and PBNI (zero non-indigenous fish caught) resulting in the highest IBI score for that year; some common carp caught in 2005 and 2006 and no piscivores caught in 2005 contributed to the lower metric scores in 2005 and 2006.
- Among all Durham Region wetlands, comparing means of thirteen raw metrics for all years of sampling, Westside Marsh exhibited no minimum or maximum mean values for fish metrics.

Breeding Bird Community

Years: 2002 – 2007
Mean IBI±SD = 66.04 ± 9.79
Range = 57.67 – 84.73
Condition/Rating (based on mean): Very Good
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: No or could not be performed due to ties (i.e., SAMNO)

Table 82. Breeding bird community metrics and IBIs for Westside Marsh, 2002 – 2007.

Wetland	Year	SAMNO	PMNO	PNAF	Bird – IBI
Westside Marsh	2002	0	10.00	10.00	66.67
Westside Marsh	2003	0	9.74	7.56	57.67
Westside Marsh	2004	0	10.00	9.15	63.83
Westside Marsh	2005	0	8.93	8.72	58.84
Westside Marsh	2006	0	10.00	9.34	64.47
Westside Marsh	2007	5.83	10.00	9.59	84.73

Findings:

- Overall, total number of all bird species: range = 10 species (2003, 2007) – 19 species (2005); total (all years): 27 species, one area-sensitive marsh nesting obligate species (Least Bittern, a federally and provincially recognized threatened species-at-risk) plus five marsh nesting obligate species and 14 non-aerial forager species.
- Among years, comparing three IBI metric scores for Westside Marsh (Table 5-72): highest metric scores were found in 2007 for SAMNO (0.33 area-sensitive marsh nesting obligates/station, which contributed to the highest IBI score for that year), scores equal to 10.00 in 2002, 2004, 2006 and 2007 for PMNO (range=33.33%-41.35% marsh nesting obligates/station) and a score equal to 10.00 in 2002 for PNAF (77.01% non-aerial foragers/station).
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Westside Marsh exhibited no minimum or maximum mean values for marsh bird metrics.

Amphibian Community

Years: 2003 – 2007
Mean IBI±SD = 7.32 ± 4.45
Range = 0 – 12.20
Condition/Rating (based on mean): Poor
Temporal Trends (significant where $p<0.05$):
IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 83. Amphibian community metrics and IBIs for Westside Marsh, 2003 – 2007.

Wetland	Year	rTOT	rWOOD	pWOOD	Amphibian – IBI
Westside Marsh	2003	2.44	0	0	8.13
Westside Marsh	2004	0	0	0	0
Westside Marsh	2005	2.44	0	0	8.13
Westside Marsh	2006	3.66	0	0	12.20
Westside Marsh	2007	2.44	0	0	8.13

Findings:

- Overall, total number of all species: range = 0 (2004) – 2 (2006, 2007); total (all years): two species found, which include American Toad and Green Frog, of which none are woodland species.
- Among years, comparing three IBI metric scores for Westside Marsh (Table 73): highest metric score was found in 2006 for rTOT (3.66 total species

(expected)/station); no woodland species were found in any year resulting in the overall low IBI scores for all study years.

- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Westside Marsh shared the minimum mean values for the rWOOD and pWOOD amphibian metrics along with Carruthers Creek Marsh, Duffins Creek Marsh and Corbett Marsh.

Macroinvertebrate Community

Years: 2003 – 2007
Mean IBI±SD = 31.80 ± 16.30
Range = 13.34 – 52.50
Condition/Rating (based on range): Poor – Good
Temporal Trends (significant where $p<0.05$):
IBI: Yes
Raw IBI Metrics: Could not be performed due to ties

Table 84. Macroinvertebrate metrics and IBIs for Westside Marsh, 2003 – 2007.

Wetland	Year	NETG	NFAM	PCRM	PTRI	PDIP	Macroinvert-ebrate – IBI
Westside Marsh	2003	1	35	133.79	0	52.93	13.34
Westside Marsh	2004	1	92	366.32	0	42.20	37.38
Westside Marsh	2005	2	38	122.00	0	52.91	17.13
Westside Marsh	2006	3	49	154.45	0.91	46.37	38.63
Westside Marsh	2007	3	38	213.58	1.32	11.34	52.50

Findings:

- Overall, total number of families, range = 35 (2003) – 92 (2004).
- Among years, comparing the IBI metric scores for Westside Marsh (Table 84): highest metric scores were found in 2004 for NFAM and PCRM. The highest NETG occurred in 2006, 2007; highest PTRI in 2007; and the highest PDIP in 2003, 2005.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Westside Marsh exhibited no minimum or maximum mean values for invertebrate metrics

Whitby Harbour Marsh

Wetland Statistics – Whitby Harbour Wetland Complex	
Location	Town of Whitby
Wetland Type	Barrier Beach
Vegetation Types	Marsh 76%, Swamp 24%
Wetland Size (hectares)	8
Watershed Size (hectares)	2 847
Percent Natural Cover in Watershed	19

Report Card – Whitby Harbour Wetland Complex			
	Year	**Condition**	**Trend**
Water Quality	2007	Very Degraded	Unknown
Submerged Aquatic Vegetation	-	Not Applicable	-
Amphibians	-	Not Applicable	-
Birds	-	Not Applicable	-
Fish	2007	Poor	Unknown
Macroinvertebrates	2007	Good	Unknown

Detailed Description:

Water Quality

Year: 2007
WQI = -1.35
Rating: Very Degraded
Temporal Trends (significant where p<0.05):
WQI (all months of data): Could not be performed due to low sample size
Raw water parameters (August data): Could not be performed due to low sample size

Table 85. Water quality metrics (August) and WQI (August) for Whitby Harbour Wetland Complex, 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity	NO_3	WQI
Whitby Harbour Wetland Complex	2007	24.60	8.00	704.50	17.28	18.55	-1.355

Findings:

- Turbidity values equal to 17.28 NTU and 20.69 NTU for two readings with no turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing means of all water quality parameters, Whitby Harbour Wetland Complex had the highest NO_3 concentration of any wetland during the study.

Submerged Aquatic Vegetation Community

No surveys were conducted in 2007.

Fish Community

Years: 2007
Mean IBI = 9.43
Range = None
Condition/Rating: Poor
Temporal Trends (significant where p<0.05):
IBI: Cannot be performed due to low sample size (i.e., too few years)
Raw IBI Metrics: Cannot be performed due to low sample size (i.e., too few years)

Table 86. Fish community metrics and IBIs for Whitby Harbour Wetland Complex, 2007.

Wetland	Year	SNAT	SCEN	PPIS	NNAT	PBNI	BYPE	Fish – IBI
Whitby Harbour Wetland Complex	2007	2.39	0	0	0.87	2.40	0	9.43

Findings:

- Overall, total number of all species = 8; seven native species found, no centrarchid or piscivorous species or yellow perch found contributing to low overall fish IBI score. Gizzard shad (native fish) and common carp (non-indigenous fish) were the most commonly caught fish.
- While there is only one year of data available, comparing metric values of thirteen raw metrics with mean metrics at all Durham Region wetlands, no centrarchid species, piscivorous species (similar to Oshawa Second Marsh and Pumphouse Marsh), turbidity intolerant species (similar Carruthers Creek Marsh and Hydro Marsh) and yellow perch (similar to Pumphouse Marsh) were found at Whitby Harbour Wetland Complex in 2007.

Breeding Bird Community

No surveys were conducted in 2007.

Amphibian Community

No surveys were conducted in 2007.

Macroinvertebrate Community

Years: 2007
Mean IBI±SD = 49.64
Range = N/A
Condition/Rating (based on range): Good
Temporal Trends (significant where p<0.05):
IBI: Unknown
Raw IBI Metrics: Could not be performed due to ties

Table 87. Macroinvertebrate metrics and IBI for Whitby Harbour Wetland Complex, 2007.

Wetland	Year	NETG	NFAM	PCRM	PTRI	PDIP	Macroinvert-ebrate – IBI
Whitby Harbour Wetland Complex	2007	0	16	81.56	0	0.56	49.64

Findings:

- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling. Whitby Harbour Wetland Complex had the lowest average PDIP.

Wilmot Creek Marsh

Wetland Statistics – Wilmot Creek Marsh	
Location	Municipality of Clarington
Wetland Type	Drowned River-mouth protected by a Barrier Beach
Vegetation Types	Marsh 71%, Swamp 29%
Wetland Size (hectares)	27
Watershed Size (hectares)	9 882
Percent Natural Cover in Watershed	37

Report Card – Wilmot Creek Marsh			
	Years	**Condition**	**Trend**
Water Quality	2002 – 2007	Very Degraded	Stable
Submerged Aquatic Vegetation	2003 – 2007	Fair	Improving
Amphibians	2002 – 2007	Fair	Unknown
Birds	2002 – 2007	Fair	Stable
Fish	2003, 2004, 2006, 2007	Good	Stable
Macroinvertebrates	2003 – 2007	Good	Stable

Detailed Description:

Water Quality

Years: 2002 – 2007
Mean WQI±SD = -1.16 ± 0.37 (all months of data)
Range = -1.56 – -0.61
Rating (based on mean): Very Degraded
Temporal Trends (significant where $p<0.05$):
WQI (all months of data): No

Raw water parameters (July data): NO_3, increasing

Table 88. Mean water quality metrics (July) and WQIs (July/all months for 2004) for Wilmot Creek Marsh, 2002 – 2007.

Wetland	Year	Water Temp	pH	Conductivity	Turbidity*	NO_3	WQI**
Wilmot Creek Marsh	2002	-	-	-	2.98	-	-
Wilmot Creek Marsh	2003	20.95	8.25	587.83	17.74	0.93	-1.05
Wilmot Creek Marsh	2004	17.24	7.90	526.67	11.98	2.43	-0.70/ -1.14
Wilmot Creek Marsh	2005	22.73	7.86	655.00	26.75	3.20	-1.56
Wilmot Creek Marsh	2006	20.22	7.91	659.00	3.73	6.47	-0.61
Wilmot Creek Marsh	2007	20.55	8.69	630.00	14.04	6.50	-1.44

* values based on multiple readings taken typically in July (see water quality chapter for details)
** for 2004, a WQI value calculated for water sampling performed in July is indicated and is followed by an average WQI for all months of water collection in that year; other years of data are based on water sampling in July.

Findings:

- WQI values varied among years and rated as “moderately degraded” or “very degraded”.
- Turbidity: ranges in daily means for all months (not shown in Table 5-76) = 0.69 – 26.75 with 0% (0/16) turbidity guidelines exceedences (i.e., over 30 NTU) for study period.
- Among all Durham Region wetlands, comparing means of all water quality parameters, Wilmot Creek Marsh exhibited: 1) the lowest mean value for water temperature, and 2) the highest mean NO_3 concentration of the 15 annually monitored Durham Region wetlands during the study period.

Submerged Aquatic Vegetation Community

Years: 2003 – 2007
Mean IBI±SD = 27.75 ± 13.47
Range = 15.37 – 50.27
Condition/Rating (based on mean): Fair
Temporal Trends (significant where $p<0.05$):
IBI: Increasing (i.e., improving)
Raw IBI Metrics: FQI, increasing or could not be performed due to ties (i.e., SINT and PINT)

Table 89. Submerged aquatic vegetation community metrics and IBIs for Wilmot Creek Marsh, 2003 – 2007.

Wetland	Year	SINT	PINT	FQI	PCOV	SNAT	SAV – IBI
Wilmot Creek Marsh	2003	0	0	3.17	2.36	2.16	15.37
Wilmot Creek Marsh	2004	0.20	0.03	4.27	1.95	3.60	20.10
Wilmot Creek Marsh	2005	0	0	4.34	5.68	2.59	25.22
Wilmot Creek Marsh	2006	0	0	5.24	5.19	3.46	27.77
Wilmot Creek Marsh	2007	0.81	0.34	8.77	6.44	8.78	50.27

Findings:

- Overall, total number of all species: range = 7 (2005) – 18 (2007); total (all years): 23 species (of which 21 were native) and two turbidity-intolerant species found (flat-stemmed pondweed and slender naiad).
- Among years, comparing five IBI metric scores for Wilmot Creek Marsh (Table 5-77): highest metric scores were found in 2007 for SINT (0.10 turbidity-intolerant species/quadrat), PINT (1.77% cover turbidity-intolerant species/quadrat), FQI (7.13/quadrat, where Richardson's clasping leaved pondweed and arum-leaved arrowhead were found), PCOV (64.38%/quadrat) and SNAT (3.05 native species/quadrat) which placed SAV condition into the "good" category for that year; no turbidity-intolerant species found in 2003, 2005 and 2006.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Wilmot Creek Marsh fell within the range of means for other wetlands and exhibited no minimum or maximums in community metrics.

Fish Community

Years: 2003, 2004, 2006, 2007
Mean IBI±SD = 46.15 ± 8.42
Range = 35.90 – 56.47
Condition/Rating (based on mean): Good
Temporal Trends (significant where $p<0.05$):
IBI: No
Raw IBI Metrics: No (SCEN, PPIS, PBNI, BYPE) or could not be performed due to ties (SNAT, NNAT)

Table 90. Fish community metrics and IBIs for Wilmot Creek Marsh, 2003, 2004, 2006, and 2007. The results of two sampling efforts in 2004 are also provided.

Wetland	Year	SNAT	SCEN	PPIS	NNAT	PBNI	BYPE	Fish – IBI
Wilmot Creek Marsh	2003	6.64	4.91	10.00	2.34	6.60	3.40	56.47
Wilmot Creek Marsh - 1	2004	3.98	1.64	9.98	2.37	9.44	0.62	46.72
Wilmot Creek Marsh - 2	2004	4.18	0.92	7.88	3.27	9.28	0.90	44.06
Wilmot Creek Marsh	2006	6.64	5.72	0	2.34	3.19	3.65	35.90
Wilmot Creek Marsh	2007	5.38	6.44	10.00	1.42	3.18	1.69	46.84

Findings:

- Overall, total number of all species: range = 10 (2006) – 13 (2003, 2004); total (all years): 18 species (of which 15 were native), three centrarchid species and four piscivorous species, including Chinook salmon (which is not included in the PPIS metric calculation), found.
- Among years, comparing six IBI metric scores for Wilmot Creek Marsh (Table 5-78): highest metric score was found in 2003 for PPIS (29.3% piscivore biomass/transect, in part due to catches of four northern pike) with consistent high scores for other metrics resulting in the highest IBI score for that year. PPIS scores can vary as no piscivores caught in 2006 but high metric score in 2007 (10.00) due to catches of northern pike and bowfin.
- Among all Durham Region wetlands, comparing means of thirteen raw metrics for all years of sampling, Wilmot Creek Marsh exhibited the highest mean percent of piscivore biomass/transect (highest of all wetlands in 2003) including the fact that no piscivores were caught in 2006.

Breeding Bird Community

Years: 2002 – 2007
Mean IBI±SD = 37.05 ±14.30
Range = 14.97 – 56.98
Condition/Rating (based on mean): Fair
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: No or could not be performed due to ties (i.e., SAMNO)

Table 91. Breeding bird community metrics and IBIs for Wilmot Creek Marsh, 2002 – 2007.

Wetland	Year	SAMNO	PMNO	PNAF	Bird – IBI
Wilmot Creek Marsh	2002	0	2.36	2.14	14.97
Wilmot Creek Marsh	2003	0	7.10	10.00	56.98
Wilmot Creek Marsh	2004	0	4.36	9.19	45.18
Wilmot Creek Marsh	2005	0	3.00	8.73	39.12
Wilmot Creek Marsh	2006	0	2.00	6.65	28.83
Wilmot Creek Marsh	2007	0	3.61	7.56	37.24

Findings:

- Overall, total number of all bird species: range = 7 species (2002) – 14 species (2004); total (all years): 28 species, no area-sensitive marsh nesting obligate species, four marsh nesting obligate species and 18 non-aerial forager species.
- Among years, comparing three IBI metric scores for Wilmot Creek Marsh (Table 5-79): highest metric scores were found in 2003 for PMNO (23.65% marsh nesting obligates/station) and PNAF equal to 10.00 (95.24% non-aerial foragers/station) which contributed to the highest IBI found in that year; no area-sensitive marsh nesting obligates found during the study period.
- Comparing means of all three raw metrics for all years of sampling, Wilmot Creek Marsh was among the eight Durham Region wetlands where no area-sensitive species were detected during the study period.

Amphibian Community

Years: 2002 – 2007
Mean IBI±SD = 34.04 ± 23.72
Range = 8.13 – 66.27
Condition/Rating (based on mean): Fair
Temporal Trends (significant where p<0.05):
IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 92. Amphibian community metrics and IBIs for Wilmot Creek Marsh, 2002 – 2007.

Wetland	Year	rTOT	rWOOD	pWOOD	Amphibian – IBI
Wilmot Creek Marsh	2002	4.88	5.00	10.00	66.27
Wilmot Creek Marsh	2003	2.44	1.67	3.33	24.80
Wilmot Creek Marsh	2004	2.44	1.67	3.33	24.80
Wilmot Creek Marsh	2005	0.81	1.67	3.33	19.38
Wilmot Creek Marsh	2006	3.25	5.00	10.00	60.84
Wilmot Creek Marsh	2007	2.44	0	0	8.13

Findings:

- Overall, total number of all species: two (2003, 2005, 2007) and 3 (2002, 2004, 2006); total (all years): five species found, which included American Toad, Green Frog, Northern Leopard Frog, Spring Peeper, and Wood Frog, of which two are woodland species.
- Among years, comparing three IBI metric scores for Wilmot Creek Marsh (Table 80): highest metric score was found in 2002 for rTOT (4.88 total species (expected)/station), and in 2002 and 2006 for rWOOD (5.00 woodland species (expected)/station) and pWOOD (10.00 woodland species/station, tied with value in 2006); no woodland species were found in 2007 resulting in the lowest IBI score for that year.
- Among all Durham Region wetlands, comparing means of all three raw metrics for all years of sampling, Wilmot Creek Marsh exhibited no minimum or maximum mean values for amphibian metrics.

Macroinvertebrate Community

Years: 2003 – 2007
Mean IBI±SD = 41.44 ± 7.88
Range = 31.49 – 52.31
Condition/Rating (based on range): Fair – Good
Temporal Trends (significant where $p<0.05$):
IBI: No
Raw IBI Metrics: Could not be performed due to ties

Table 93. Macroinvertebrate metrics and IBIs for Wilmot Creek Marsh, 2003 – 2007.

Wetland	Year	NETG	NFAM	PCRM	PTRI	PDIP	Macroinvert-ebrate – IBI
Wilmot Creek Marsh	2003	2	45	188.37	0	53.86	31.49
Wilmot Creek Marsh	2004	7	83	382.12	0.66	3.24	52.31
Wilmot Creek Marsh	2005	0	43	200.92	0	3.51	41.94
Wilmot Creek Marsh	2006	4	42	135.11	0	4.89	44.59
Wilmot Creek Marsh	2007	1	40	153.32	0.52	7.40	36.85

Findings:

- Overall, total number of families, range = 40 (2007) – 83 (2004).
- Among years, comparing the IBI metric scores for Wilmot Creek Marsh (Table 93): highest metric scores were found in 2004 for NETG, NFAM, PCRM, and PTRI. The highest PDIP occurred in 2003.
- Among all Durham Region wetlands, comparing means of all five raw metrics for all years of sampling, Wilmot Creek Marsh exhibited no minimum or maximum mean values for invertebrate metrics