ENVIRONMENTAL STATEMENT
VOLUME 2
APPENDIX 9.8 – PSYM SURVEY REPORT

Great Wolf Resorts

BICESTER GOLF COURSE

PSYM Survey Report

wsp

Great Wolf Resorts

BICESTER GOLF COURSE

PSYM Survey Report

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wsp

Great Wolf Resorts

BICESTER GOLF COURSE

PSYM Survey Report

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CONTENTS

TABLES

FIGURES

APPENDICES

APPENDIX A

PSYM ANALYSIS OUTPUT

APPENDIX B

SITE PHOTOGRAPHS

EXECUTIVE SUMMARY

Following the completion of an Invertebrate Habitat Assessment in March 2018, WSP UK Ltd (WSP) was commissioned by Great Wolf Resorts (GWR) to undertake Predictive SYstem for Multimetrics (PSYM) surveys on ponds located on the land at Bicester Health Club and Spa off the A4095, hereafter referred to as 'the Site'.

The Site comprises nine of the existing 18-hole golf course which forms part of the wider site also occupied by the Bicester Hotel Golf and Spa. The redevelopment is understood to include:

▪ the creation of a 500-bed all-inclusive resort hotel, with an indoor pool and leisure complex, targeted at families; and
▪ access to be taken from A4095, which runs along the northern boundary of the Site.

The scheme is referred to hereafter as the 'Proposed Development'.

The report covers the Site's potential to support important aquatic macroinvertebrate assemblages.

A number of ponds located in the north-west of the Site were the focus of assessment utilising the PSYM methodology.

Based on the results of the PSYM surveys, a single pond was assessed as a Habitat of Principal Importance (HPI) under Section 41 of the of the Natural Environment and Rural Communities NERC Act (2006).

Several ponds support populations of great crested newt *Triturus cristatus* and/or common toad *Bufo bufo* which are Species of Principal Importance (SPI) in accordance with the requirements of Section 41 of the NERC Act (2006). The presence of these protected species therefore elevates the remaining ponds to HPI in accordance with the requirements of Section 41 of the NERC Act (2006).

Recommendations for pond management, mitigation and compensatory habitat provision are provided within this report.

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1. INTRODUCTION

1.1. PROJECT BACKGROUND

1.1.1. Great Wolf Resorts (GWR) are planning a redevelopment of land to the north-west of the Bicester Golf Hotel and Spa off the A4095.

1.1.2. The Site comprises nine of the existing 18-hole golf course which forms part of the wider site also occupied by the Bicester Health Club and Spa. This report refers to the wider site for context and study area for the purposes of the pre-application considerations.

1.1.3. The redevelopment of the Site is understood to include:

- the creation of a 500-bed all-inclusive resort hotel, with an indoor pool and leisure complex, targeted at families and golf enthusiasts; and
- the creation of an access road to be taken from the A4095, which runs along the northern boundary of the Site.

1.1.4. This scheme will hereafter be referred to as the 'Proposed Development'.

1.2. ECOLOGICAL BACKGROUND

1.2.1. The 'Survey Area' was defined north-west quadrant of the golf course, see Figure 1.

1.2.2. Habitats within the Survey Area are predominately managed grassland, plantation woodland, hedgerow and scrub with intermittent ponds.

1.2.3. Land use surrounding the Site is mixed with the village of Chesterton to the east, Bignell Park Farm to the north and predominately arable land to the west and south. The M40 runs along the west boundary of the Survey Area. Land to the east of the Survey Area is currently under development.

1.2.4. A habitat assessment survey (WSP, 2018) identified several ponds with potential to support important assemblages of aquatic macroinvertebrates and recommended further surveys.

1.3. SCOPE OF REPORT

1.3.1. Great Wolf Resorts (GWR) commissioned WSP UK Ltd to:

- Complete a Predictive SYstem for Multimetrics (PSYM) survey on ponds identified as capable of supporting important aquatic macroinvertebrate assemblages (hereafter referred to as macroinvertebrates).
- Provide survey data to Freshwater Habitats Trust (FWHT) for calculation of PSYM metrics.
- Provide recommendations for habitat management, mitigation and compensatory habitat provision as appropriate.

BICESTER GOLF COURSE
Project No.: 70042711 | Our Ref No.: 70042711-016
Great Wolf Resorts

WSP
April 2019
Page 1 of 12

2. METHODS

2.1. DESK STUDY

2.1.1. The desk study involved reviewing data collected during other surveys and various sources including:

- Existing ecological records requested from Thames Valley Records Centre (TVERC) as part of the Preliminary Ecological Appraisal (WSP, 2018a), for invertebrates which are legally protected species and species of conservation importance within a 2 km radius of the centre of the Site.
- Bicester Golf Course Invertebrate Habitat Assessment and Hairstreak Butterfly Survey Report (WSP, 2018b); used to identify ponds with potential to support important assemblages of macroinvertebrates.
- Bicester Golf Course Great Crested Newt Survey Report (WSP, 2018c); used to identify records of amphibians of conservation importance, to assist in classification of ponds using PSYM.

2.2. PREDICTIVE SYSTEM FOR MULTIMETRICS (PSYM)

2.2.1. The standard method used to survey ponds is the PSYM methodology (Pond Action, 2002).

2.2.2. A total of ten ponds were identified for assessment. Table 2-1 below list the ponds selected for PSYM and they are displayed in Figure 2. Numbering follows the Great Crested Newt Survey Report (WSP, 2018c).

Table 2-1 - Ponds identified for PSYM survey.

Pond	Grid Reference
2	SP 54774 21811
5	SP 54805 21907
6	SP 54883 21908
7	SP 54895 21842
8	SP 54896 21797
9	SP 54926 21795
10	SP 55001 21691
11	SP 55151 21641
12	SP 55210 21673
13	SP 55113 21540

2.2.3. All wetland plants present within the outer edge of each pond were recorded. A pond net or grapnel was used to sample deeper areas. Plants were identified to species level in the field; where this was not possible, plants were photographed or bagged, and identified in the laboratory.

WSP
April 2019
Page 2 of 12

BICESTER GOLF COURSE
Project No.: 70042711 | Our Ref No.: 70042711-016
Great Wolf Resorts

2.2.4. Macroinvertebrate sampling consisted of three-minute hand-net sweeps within each mesohabitat (e.g. flooded marginal grasses or gravel bottomed shallows) present. A further minute was spent searching the water surface and under stones and logs in marginal areas. Samples of macroinvertebrates were identified to family level in the field.

2.2.5. Plant species and macroinvertebrate family data was processed using the following PSYM indices:

2.2.6. Plants:

- number of submerged and marginal (not floating) species (SM) – indicates species richness of a site;
- number of uncommon plant species (U) – measures conservation value of a community; and
- trophic ranking score (TRS) – indicates nutrient tolerance on a scale of 1 to 10 (10 = very tolerant).

2.2.7. Macroinvertebrates:

- average score per taxon (ASPT) – indicates average pollution tolerance of macroinvertebrates within a community;
- number of Odonata and Megaloptera families (OM) – indicates long-term quality of a pond as larvae have a long aquatic life stage; and
- number of Coleoptera families (CO) – indicates the habitat quality and diversity of a pond.

2.2.8. Observed data was compared with predicted values generated by the FWHT to calculate ecological quality indices (EQIs). EQIs are expressed as a ratio, the observed value against a national value for ponds of this type under national reference conditions. An EQI greater or equal to 1 denotes a pond exceeding the expected value.

2.2.9. EQIs are then used to inform the Index of Biological Integrity (IBI), which is interpreted as an overall percentage and quality class. The quality classes range from Very Poor to Good.

- 0-25% = very poor;
- 26%-50% = poor;
- 51%-75% = moderate;
- 76%-100% = good.

2.2.10. Ponds meeting Good quality qualify as Habitats of Principal Importance (HPI) in accordance with the requirements of the NERC Act (2006).

2.2.11. HPI can also be designated by the presence of a Species of Principal Importance (SPI), such as those listed in accordance with the requirements of Section 41 of the NERC Act (2006), species on Schedule 5 and 8 of the Wildlife and Countryside Act, and species listed in Annex II of Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (1992).

2.3. INCIDENTAL RECORDS

2.3.1. A list of incidental species from conservation-interest groups was made from each waterbody. This information may provide additional supporting information as to the quality of each pond and the wider macroinvertebrate community. Conservation value was assigned according to the Community Conservation Index (Chadd and Extence, 2004).

2.3.2. The Community Conservation Index classifies all macroinvertebrates according to their rarity, and ascribes each a score from 1 to 10, where 1 is very common and 10 is Endangered (Red Data Book

BICESTER GOLF COURSE
Project No.: 70042711 | Our Ref No.: 70042711-016
Great Wolf Resorts

WSP
April 2019
Page 3 of 12

1). This index is recognised as a valid, nationwide method of assessing conservation importance of macroinvertebrate at the community level.

2.4. DATES OF SURVEY AND PERSONNEL

2.4.1. Surveys were conducted on the 7th and 8th August 2018 by competent aquatic ecologists with experience of conducting macroinvertebrate surveys in a range of aquatic habitats, both of whom were members of the Chartered Institute of Ecology and Environmental Management (CIEEM). Surveyors had between one and nine years' experience.

2.5. EVALUATION

2.5.1. The value of the Site was evaluated using CIEEM guidance (CIEEM, 2018). This guidance recommends that valuation of site importance is made with reference to a geographical framework, e.g. a site is of local, regional, national value etc.

2.6. LIMITATIONS

2.6.1. Ponds 9, 10 and 12 were dry at the time of survey, and therefore were unable to be assessed. This is likely to be due in part to the unseasonably dry weather. However, this does not mean that the pond should be regarded as low-quality habitat. Many ponds experience natural fluctuations in water levels and can occasionally dry out. The biota that use these habitats will be adapted to living in ponds that dry out, it is likely that they will leave the pond and return when water levels return to normal.

2.6.2. Ponds 9, 10 and 12 returned records of great crested newt prior to drying out, and therefore qualify as HPI in accordance with the requirements of the NERC Act (2006).

2.6.3. Overall, the limitations above are not considered to be significant in relation to the survey data and there is no requirement for further survey.

WSP
April 2019
Page 4 of 12

BICESTER GOLF COURSE
Project No.: 70042711 | Our Ref No.: 70042711-016
Great Wolf Resorts

3. RESULTS AND EVALUATION

3.1. DESK STUDY

3.1.1.   The requested information from TVERC returned no records of macroinvertebrates which are legally protected species and/or species of conservation importance.

3.1.2.   Great crested newt *Triturus cristatus* and common toad *Bufo bufo* were recorded from seven ponds (see Table 3-1 (adapted from WSP, 2018c)). These species are protected under UK legislation and influence the status of ponds classified under PSYM.

3.1.3.   Smooth newts *Lissotriton vulgaris* were recorded in all ponds, with the exception of Pond 13.

Table 3-1 - Records of protected amphibians in PSYM ponds

Protected Amphibian	Ponds where present
Great crested newt	2, 5, 6, 7, 8, 9, 10, 11[1], 12
Common toad	5, 11, 13

3.2. Predictive System for Multimetrics (PSYM)

3.2.1.   All ponds identified for PSYM survey were visited in August 2018. Ponds 9, 10 and 12 were dry at the time of survey.

3.2.2.   The PSYM classification and key outputs are summarised in Table 3-2. Full PSYM output data is presented in Appendix A.

Table 3-2 - Summary of PSYM habitat quality classifications and key outputs

Pond	TRS (Trophic ranking score)	Submerged + marginal plant species EQI	ASPT EQI	Odonata + Megaloptera families EQI	Coleoptera families EQI	IBI (%)	PSYM quality category
2	8.33	0.38	0.96	1.21	0.79	72	**Moderate**
5	7.7	0.29	0.95	0.69	0.81	67	**Moderate**
6	7.48	0.55	0.93	1.04	0.81	78	**Good**
7	7.68	0.38	0.89	0.68	0.54	61	**Moderate**

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[1] Eggs only, indicating pond not of significant value for this species.

BICESTER GOLF COURSE
Project No.: 70042711 | Our Ref No.: 70042711-016
Great Wolf Resorts

WSP
April 2019
Page 5 of 12

Pond	TRS (Trophic ranking score)	Submerged + marginal plant species EQI	ASPT EQI	Odonata + Megaloptera families EQI	Coleoptera families EQI	IBI (%)	PSYM quality category
8	8.6	0.22	0.94	1.37	0.81	67	**Moderate**
11	8.27	0.43	1.00	0.36	0.27	50	**Poor**
13	7.9	0.43	0.97	0.00	0.27	39	**Poor**

3.2.3. Trophic ranking scores were elevated for all ponds which indicates plant communities which are associated with eutrophic (nutrient-rich) conditions.

3.2.4. The EQIs for submerged and marginal plant species were low across all ponds, this reflects a lack of species richness recorded during the surveys.

3.2.5. The EQIs for ASPT was slightly less than 1 (reference condition) in all ponds except for Pond 11, suggesting that the macroinvertebrate community included more pollution sensitive species than would be expected under reference (no environmental stress) conditions.

3.2.6. Three ponds demonstrated good numbers of Odonata (dragonflies) and Megaloptera (alderflies) families, exceeding what would be expected under reference conditions. The remaining ponds had a reduced number of Odonata and Megaloptera families.

3.2.7. The number of Coleoptera (beetle) families recorded was generally lower than would be expected, but several ponds demonstrated good numbers with only a slight deviation from reference conditions.

3.2.8. The overall IBI was average for most ponds when compared to reference conditions. Correspondingly, the PSYM classification for all but one pond was categorised as Moderate or below.

3.2.9. Only Pond 6, which was categorised as Good, qualifies as a HPI based solely upon species composition or habitat assemblage.

3.2.10. As summarised in section 3.1.2, several ponds support populations of great crested newt and/or common toad which are SPI in accordance with the requirements of Section 41 of NERC Act (2006).

3.2.11. The presence of these protected species therefore elevates the following six ponds to HPI in accordance with the requirements of Section 41 of NERC Act (2006): Ponds 2, 5, 7, 8 and 13.

3.3. INVASIVE NON-NATIVE SPECIES

3.3.1. Canadian waterweed *Elodea canadensis* was recorded from Ponds 5, 6, 7, 8, 11 and 12.

3.4. INCIDENTAL RECORDS

3.4.1. Several specimens from conservation-interest groups were identified during the surveys and are listed in Table 3-3.

WSP
April 2019
Page 6 of 12

BICESTER GOLF COURSE
Project No.: 70042711 | Our Ref No.: 70042711-016
Great Wolf Resorts

Table 3-3 - Incidental taxa from conservation-interest groups

Species Name	Common Name	Ponds where present	Conservation value
Aeshna cyanea	Southern hawker	5, 6, 8	2 - Common
Anax imperator	Emperor dragonfly	7	5 – Local
Enallagma cyathigerum	Common blue damselfly	2, 5, 6	2 - Common
Ischnura elegans	Blue-tailed damselfly	2, 6, 7, 8, 11	1 – Very common
Sympetrum sanguineum	Ruddy darter	2	5 – Local
Sympetrum striolatum	Common darter	6	1 – Very common

3.5. EVALUATION

3.5.1. The Site supports a well-developed macroinvertebrate community, and although none are afforded legal protection, there were a few species of local conservation interest, suggesting that the pond habitat is likely to be of importance at a 'Local' level.

BICESTER GOLF COURSE
Project No.: 70042711 | Our Ref No.: 70042711-016
Great Wolf Resorts

WSP
April 2019
Page 7 of 12

4. RECOMMENDATIONS

4.1. RETENTION OF POND HABITAT

4.1.1. Any management prescribed for the ponds to be retained should be based on a long-term strategy and consider the following elements:

4.1.2. Vegetation clearance

- Vegetation clearance is generally prescribed for the southern part of a pond; the reason for this is that vegetation casts a shadow over the pond.
- Any clearance works should be limited to habitat immediately adjacent to the pond, up to a distance of 5m from the perimeter of the pond.
- Vegetation clearance should be restricted to scrub, shrub and saplings, and take place between September to February inclusive.

4.1.3. Water Quality

- Reduce inputs of nutrients from golf course management activities such as leaching of herbicides.

4.1.4. Monitoring of pond management

- Follow-up pond surveys to compare the baseline scores from the present study with post management implementation scores.

4.1.5. Ponds utilised by great crested newts should be managed sensitively to ensure that the legislation protecting them and their habitats is not contravened, any management works should be undertaken when great crested newts are least likely to be found in the ponds, typically October to early February.

4.2. LOSS OF POND HABITAT

4.2.1. The loss of ponds should be avoided through the careful and considered design of the Proposed Development. Avoidance of HPI and habitats of ecological value is recommended.

4.2.2. Where losses cannot be avoided, it is likely that compensatory habitat provision will be required, to ensure compliance with legislation.

4.3. PROVISION OF COMPENSATORY POND HABITAT

4.3.1. Important principles for pond creation include:

- Locating new ponds in areas where they are at least risk from pollution.
- Linking new ponds with existing wetland areas.
- Creating pond mosaics and wetland complexes rather than single waterbodies.
- Varying the main factors which influence community type (e.g. depth, size, permanence).

4.3.2. The most environmentally friendly means of successful establishment of new ponds is through natural recolonisation, as they can become species-rich very quickly.

4.3.3. Bare pond edges are particularly susceptible to colonisation by invasive non-native plant species; therefore, it is important to ensure they are removed before they become established as they can outcompete native plants.

WSP
April 2019
Page 8 of 12

BICESTER GOLF COURSE
Project No.: 70042711 | Our Ref No.: 70042711-016
Great Wolf Resorts

4.3.4.   There are reasons for speeding up the establishment process, particularly in amenity locations such as golf courses.

4.3.5.   Vegetation and macroinvertebrate rich sediment can be taken from an existing pond that needs to be filled for development and moved to a new pond. Translocation ensures that native species of local provenance are used rather than imported plants.

4.3.6.   It is important to ensure that invasive non-native species are not present in existing ponds and transferred to any new ponds during translocation activities.

5. CONCLUSIONS

5.1.1. Several ponds contain well-developed macroinvertebrate communities, with a total of 34 families recorded across the seven ponds surveyed.

5.1.2. All ponds were lacking diverse plant assemblages. There were no uncommon species recorded and there was a distinct lack of submerged species, with most ponds dominated by marginal plant species and those associated with eutrophic conditions.

5.1.3. Based upon their physical characteristics, the overall ecological quality of the ponds was limited when compared to nationally expected standards for still waters.

5.1.4. Only Pond 6 qualifies as a HPI based on the results of PSYM.

5.1.5. As summarised in section 3.2.11, several ponds support populations of great crested newt and/or common toad. The presence of these protected species therefore elevates these ponds to HPI in accordance with the requirements of Section 41 of the NERC Act (2006).

5.1.6. To minimise effects upon the pond habitat, a number of management, mitigation and compensatory measures have been recommended within Section 4.

WSP
April 2019
Page 10 of 12

BICESTER GOLF COURSE
Project No.: 70042711 | Our Ref No.: 70042711-016
Great Wolf Resorts

6. REFERENCES

6.1. REPORT REFERENCES

- WSP (2018a) Bicester Golf Course Preliminary Ecological Appraisal.
- WSP (2018b) Bicester Golf Course Invertebrate Habitat Assessment and Hairstreak Butterfly Survey Report.
- WSP (2018c) Bicester Golf Course Great Crested Newt Survey Report.

6.2. TECHNICAL REFERENCES

- CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester.
- HMSO (1981). Wildlife and Countryside Act (as amended by the Countryside and Rights of Way Act 2000). HMSO, Norwich.
- HMSO (2006) Natural Environment and Rural Communities Act. HMSO, Norwich.
- Pond Action. (2002). A guide to monitoring the ecological quality of ponds and canals using PSYM. Pond Conservation Trust, Oxford Brookes University, Oxford and the Environment Agency, West Midlands.

BICESTER GOLF COURSE
Project No.: 70042711 | Our Ref No.: 70042711-016
Great Wolf Resorts

WSP
April 2019
Page 11 of 12

7. FIGURES

Figure 1 - Survey Area

Figure 2 - Location of ponds

WSP
April 2019
Page 12 of 12

BICESTER GOLF COURSE
Project No.: 70042711 | Our Ref No.: 70042711-016
Great Wolf Resorts

Key
Site

0	0.3	0.6	0.9	1.2

km

wsp
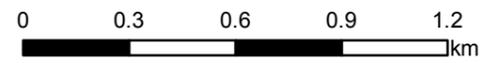
Client:

Great Wolf Resorts

Project:

Bicester

Title

Site Location Plan

Drawing No: Figure 1	Drawn:	BW
Date: February 2019	Checked:	MH
Scale: 20,000 @ A3	Approved:	LR

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Key

- ▭ Site
- ▧ Dry Pond
- ▩ Pond

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
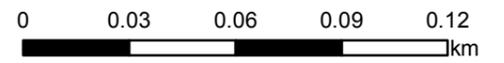
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Project:	Bicester
Title:	Location of ponds

Drawing No: Figure 2	Drawn: BW
Date: February 2019	Checked: MH
Scale: 2,000 @ A3	Approved: LR

Appendix A

PSYM ANALYSIS OUTPUT

Table A-1 - PSYM Analysis metrics and results

Site Name	Pond 2	Pond 5	Pond 6	Pond 7	Pond 8	Pond 11	Pond 13
Survey Date	07/08/18	07/08/18	07/08/18	07/08/18	07/08/18	08/08/18	08/08/18
Grid Reference	SP 54774 21811	SP 54805 21907	SP 54883 21908	SP 54895 21842	SP 54896 21797	SP 55151 21641	SP 55113 21540
Plant Metrics							
No. of submerged + marginal plant species (not including floating leaved)	9	6	10	8	4	9	7
Number of uncommon plant species	0	0	0	0	0	0	0
Trophic Ranking Score (TRS)	8.33	7.7	7.48	7.68	8.6	8.27	7.9
Invertebrates metrics							
ASPT	4.90	4.76	4.67	4.48	4.74	5	4.86
Odonata + Megaloptera (OM) families	4	2	3	2	4	1	0
Coleoptera families	3	3	3	2	3	1	1
Environmental variables							
Altitude (m)	85	85	85	86	85	85	85
Easting	4547	4548	4548	4548	4548	4551	4551
Northing	2218	2219	2219	2218	2217	2216	2215
Shade (%)	15	1	1	10	10	1	5
Inflow (0/1)	0	0	0	0	0	0	0
Grazing (%)	0	0	0	0	0	0	0
pH	7.75	7.74	8.85	8.12	8.2	8.4	8.02
Emergent plant cover (%)	15	5	5	5	5	0	5
Base clay (1-3)	3	3	3	3	3	1	3
Base sand, gravel, cobbles (1-3)	1	1	1	1	1	3	1

Site Name	Pond 2	Pond 5	Pond 6	Pond 7	Pond 8	Pond 11	Pond 13
Base peat (1-3)	1	1	1	1	1	1	1
Base rock (1-3)	1	1	1	1	1	1	1
Area (m2)	2000	1000	500	1100	500	1200	1000
Results							
Submerged + marginal plant species							
Predicted (SM)	23.4	20.7	18.1	21.2	18.4	21.1	20.8
Actual (SM)	9	6	10	8	4	9	7
EQI (SM)	0.38	0.29	0.55	0.38	0.22	0.43	0.34
IBI (SM)	1	1	2	1	0	1	1
Uncommon plant species							
Predicted (U)	4.0	3.4	2.9	3.5	3.0	3.4	3.4
Actual (U)	0	0	0	0	0	0	0
EQI (U)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IBI (U)	0	0	0	0	0	0	0
Trophic Ranking Score (TRS)							
Predicted (TRS)	8.46	8.65	8.74	8.70	8.70	8.57	8.69
Actual (TRS)	8.33	7.7	7.48	7.68	8.6	8.27	7.9
EQI (TRS)	0.98	0.89	0.86	0.88	0.99	0.96	0.91
IBI (TRS)	3	3	3	3	3	3	2
ASPT							
Predicted (ASPT)	5.13	5.03	5.02	5.04	5.03	4.99	5.03
Actual (ASPT)	4.90	4.76	4.67	4.48	4.74	5	4.86
EQI (ASPT)	0.96	0.95	0.93	0.89	0.94	1.00	0.97
IBI (ASPT)	3	3	3	3	3	3	3
Odonata + Megaloptera (OM) families							
Predicted (OM)	3.31	2.90	2.88	2.93	2.91	2.78	2.91
Actual (OM)	4	2	3	2	4	1	0
EQI (OM)	1.21	0.69	1.04	0.68	1.37	0.36	0.00
IBI (OM)	3	2	3	2	3	1	0
Coleoptera (CO) families							

Site Name	Pond 2	Pond 5	Pond 6	Pond 7	Pond 8	Pond 11	Pond 13
Predicted (CO)	3.79	3.69	3.69	3.70	3.69	3.66	3.70
Actual (CO)	3	3	3	2	3	1	1
EQI (CO)	0.79	0.81	0.81	0.54	0.81	0.27	0.27
IBI (CO)	3	3	3	2	3	1	1
Sum of Individual Metrics	13	12	14	11	12	9	7
Index of Biotic Integrity (%)	**72%**	**67%**	**78%**	**61%**	**67%**	**50%**	**39%**
PSYM quality category (IBI >75%=Good, 51-75%= Moderate, 25-50%=Poor, <25%=V Poor)	**Moderate**	**Moderate**	**Good**	**Moderate**	**Moderate**	**Poor**	**Poor**
Is this a Habitat of Principal Importance? (Good quality category)	**No**	**No**	**Yes**	**No**	**No**	**No**	**No**

Appendix B

SITE PHOTOGRAPHS

\\\\sp

Pond	Photograph
2	
5	

6	
7	
8	

9	
10	
11	

12	
13	

wsp

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