

Ravine & Lake Water Quality Monitoring 2008 BSRA-ABCA



Report to: Bluewater Shoreline Residents' Association (BSRA)

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Background

The Bluewater Shoreline Residents' Association (BSRA) is an umbrella organization for many of the lakeshore associations in the Municipality of Bluewater. An important issue that many lakeshore residents have is the state of the water quality in the ravines and Lake Huron. In 2006, the BSRA partnered with the Ausable Bayfield Conservation Authority (ABCA) to undertake water quality monitoring in four ravines (Ridgeway, St. Joseph, Houston Heights and Wildwood) in the Municipality of Bluewater that enter Lake Huron (Veliz and Brock 2006). Prior to 2006, the BSRA conducted water quality testing in some of the ravines along the lakeshore. In 2007 and 2008, the BSRA requested that, in addition to the ravine sampling, the ABCA sample in the lake at the four ravine locations.

Methods

Ravine sampling

In 2008, water samples were collected in four ravines along the Lake Huron shoreline on a weekly basis for a period of 13 weeks, spanning from June 3, 2008 to August 26, 2008. These ravines included, from south to north, Ridgeway, St. Joseph, Houston Heights and Wildwood (Figure 1). Approximate sampling locations for each ravine are shown in Appendix I. All water samples were sent to the ALS Laboratory Group in London, Ontario for analysis of the presence of *Escherichia coli* (*E. coli*).

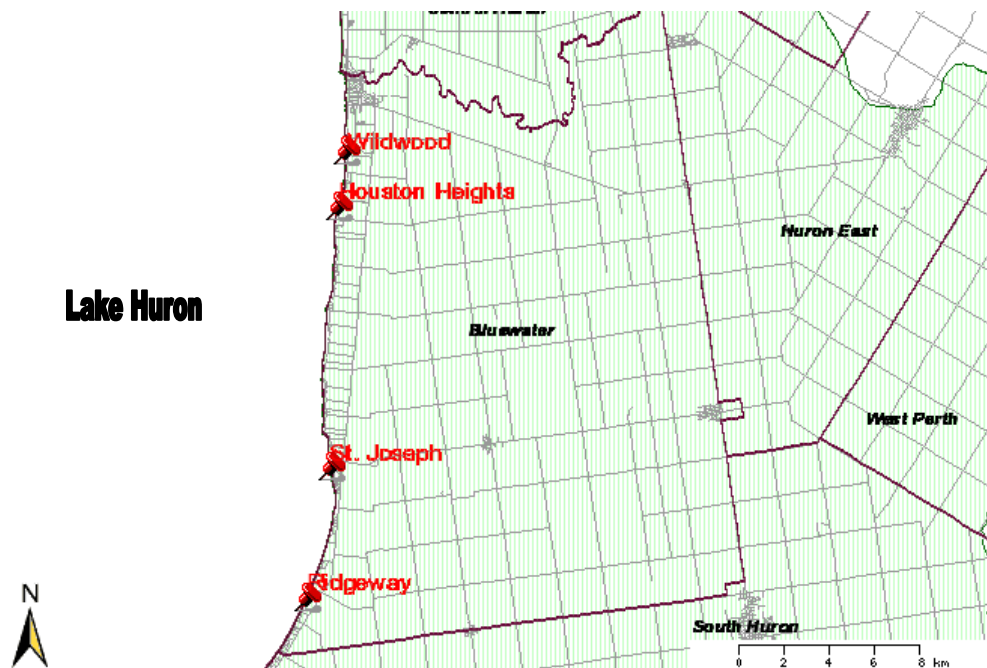


Figure 1: Locations of the four ravines from which water samples were collected.

Lake sampling

Lake samples were collected according to the protocol used in previous years by the Huron County Health Unit (HCHU). This involves the collection of five samples at different locations: one directly out from the mouth of the ravine, two samples north of the mouth (50 paces apart each), and two samples south of the ravine (50 paces apart each) (Figure 2). All samples were collected by wading into the water to waist depth. Using a reaching pole to minimize the collection of any stirred up sediment, each sample was collected approximately a foot under the surface of the water. All water samples were sent to the ALS Laboratory Group in London, Ontario for analysis of the presence of *E. coli*.

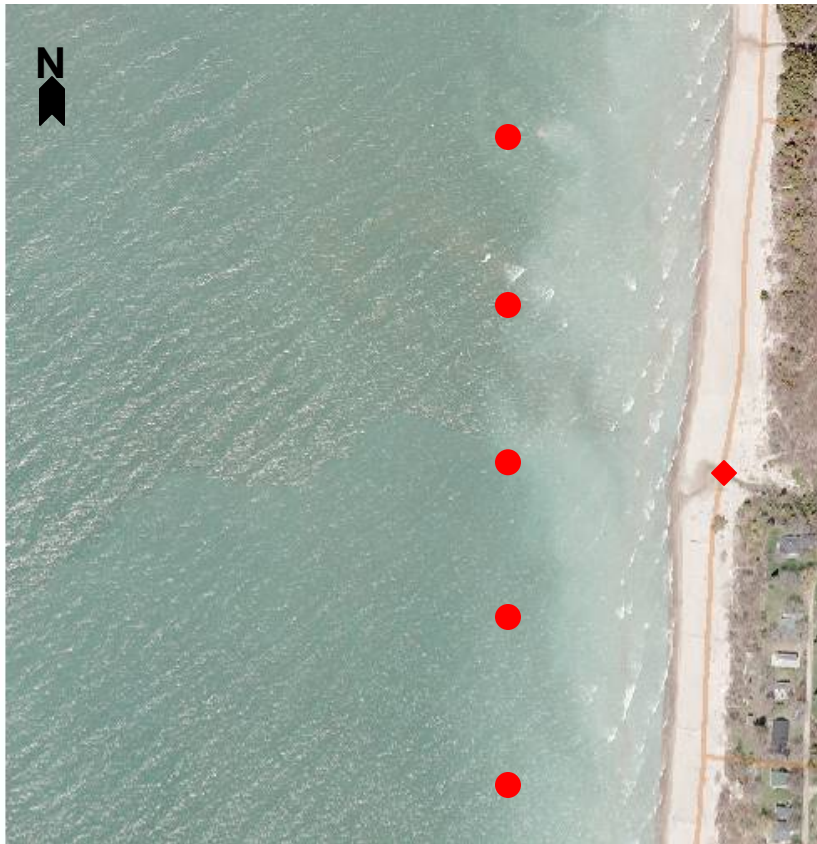


Figure 2: Diagrammatic representation of the five samples collected within the lake (sample locations are 50 paces apart in waist-deep water). Circles represent lake samples; diamond represents ravine sample.

Results and Discussion

The dates and type of sampling events are summarized in Table 1. A rain event was defined as a significant rain the day before or the day of sampling. Daily precipitation levels for the Exeter, Hensall and Varna rain gauge stations are provided for the months of June, July and August in Appendix II. In total, 2008 saw nine rain dates whereas in 2007 there was only one rain event corresponding with sampling.

Table 1: Date and type of sampling event for each sampling run throughout the 13 week sampling period. *Denotes a rain event within 48 hours preceding sampling.

Date	Rain Event
06/03/08	Yes
06/10/08	Yes
06/17/08	Yes
06/24/08	Yes*
07/02/08	No
07/08/08	No
07/15/08	Yes*
07/22/08	Yes*
07/29/08	No
08/05/08	Yes
08/12/08	Yes*
08/19/08	Yes*
08/26/08	No

Ravine water quality

In contrast to 2007 (Veliz and Brock 2007), the ravines, with the exception of Ridgeway, have higher geometric mean E. coli concentrations in 2008. Higher E. coli numbers in the ravines in 2008 can be attributed to the wet year. St. Joseph had the highest geometric mean E. coli concentration, while Houston Heights again had the lowest (Table 2).

Most of the rain events throughout the sampling period occurred on days directly preceding sample collection, which may account for the elevated results for 2008. The rain event on June 10 coincided with sampling. Wildwood, St. Joseph and Houston Heights all have elevated results for this day (Table 3). The result for Ridgeway was only slightly elevated as the sample was collected before the majority of the rain had fallen.

Both Ridgeway and St. Joseph had samples over the recreational guideline of 100cfu/100mL for all thirteen weeks (100%), while Houston Heights had samples over the guideline for 77% of the sampling dates. Wildwood, St. Joseph and Houston Heights each had 23% of their samples reach over 1000cfu/100mL (Tables 2 and 3).

Table 2: Geometric mean E. coli concentrations (cfu/100mL) and the percentage of time samples were over 100 and 1000 cfu/100mL for Wildwood, Houston Heights, St. Joseph and Ridgeway ravines for 2006, 2007 and 2008. 2006 data from Veliz and Brock 2006. 2007 data from Veliz and Brock 2007.

Ravine	Geometric Mean (cfu/100mL)			Percentage of time sample was over 100 cfu/100mL (%)			Percentage of time sample was over 1000 cfu/100mL (%)		
	2006	2007	2008	2006	2007	2008	2006	2007	2008
Wildwood	569	466	548	100	100	92	23	14	23
Houston Heights	567	179	294	85	85	77	38	0	23
St. Joseph	448	182	619	69	62	100	23	8	23
Ridgeway	1509	482	354	100	77	100	54	38	0

Table 3: E. coli concentrations (cfu/100mL) on each sampling day for Wildwood, Houston Heights, St. Joseph and Ridgeway ravines (2008).

Ravine	06/03	06/10	06/17	06/24	07/02	07/08	07/15	07/22	07/29	08/05	08/12	08/19	08/26
Wildwood	1060	14900	540	510	440	350	580	480	60	180	160	2900	430
Houston Heights	160	3800	90	40	280	260	550	370	60	150	2600	1100	150
St. Joseph	680	5500	540	430	390	560	540	1160	330	590	1200	640	110
Ridgeway	430	700	410	160	270	760	300	490	360	160	790	250	200

Over 100cfu/100mL
Over 1000cfu/100mL

In contrast to the past two years (Veliz and Brock 2006 and 2007), the *E. coli* concentrations for Ridgeway fluctuated the least and concentrations of *E. coli* fluctuated more at Wildwood and Houston Heights (Figure 3). Also in contrast to previous years, the highest overall *E. coli* concentrations were found at St. Joseph. Concentrations of *E. coli* were lowest at Ridgeway. Over a limited sampling period from 2006 to 2008, it would seem that most ravines fluctuate more in wet conditions. Ridgeway, however, does not follow this pattern. If *E. coli* concentrations for Wildwood, Houston Heights and St. Joseph remain consistently higher in the coming dry years, further investigation may be required. It would be important to continue to sample these ravines into the future to determine the role rainfall has on *E. coli* concentrations.

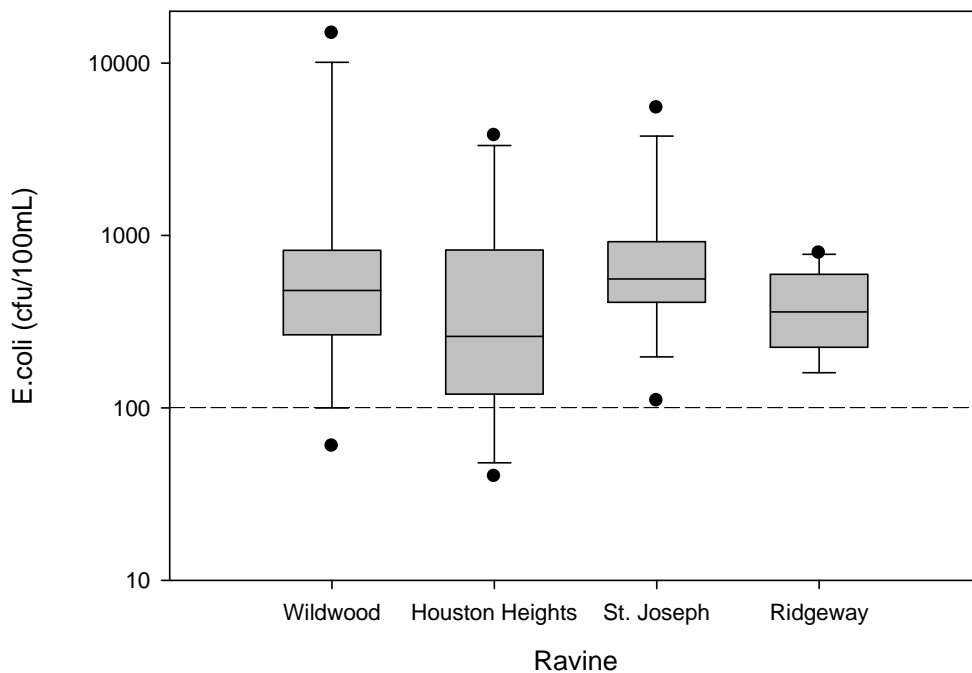


Figure 3: Median *E. coli* concentrations of four ravines along Lake Huron in 2008 (n = 13 for all ravines). Box represents 50% of the concentrations. Circles represent outliers (i.e., observations that are far from the rest of the data) and all outliers are presented. Dashed line represents the Ministry of Health Guideline = 100 cfu/100mL.

Lake water quality

The results from sampling the lake at the four ravine sites display good water quality (Tables 4 and 5). Four sampling dates (i.e., June 10 and 17, July 22 and August 29) show elevated results in one or more of the sampling locations (Table 5). Each of these dates coincides with a rain event or rain 48 hours prior to sampling. However, geometric means calculated from all of the samples for the entire 13 week sampling period are well below the recreational standard of 100cfu/100mL. These results are similar 2007 result. However, in 2007 the three dates with elevated *E. coli* counts did not correspond with rain events.

Table 4: Geometric mean E. coli concentrations (cfu/100mL) and the percentage of time samples were over 100 and 1000 cfu/100mL for Wildwood, Houston Heights, St. Joseph and Ridgeway lake locations. Geometric means are calculated using all samples collected at all five locations over the entire 13 week sampling period.

Lake	Geomean (cfu/100mL)	Percentage of time sample is over 100 cfu/100mL	Percentage of time sample is over 1000 cfu/100mL
Wildwood	27	15	0
Houston Heights	24	8	0
St. Joseph	33	15	0
Ridgeway	29	23	0

Table 5: Geometric mean E. coli concentrations (cfu/100mL) on each sampling day for Wildwood, Houston Heights, St. Joseph and Ridgeway lake locations. Geometric means are calculated using the five samples collected at each location.

Lake	06/03	06/10	06/17	06/24	07/02	07/08	07/15	07/22	07/29	08/05	08/12	08/19	08/26
Wildwood	10	631	313	10	33	14	14	13	11	11	16	88	10
Houston Heights	10	78	87	10	39	26	16	11	10	32	17	113	12
St. Joseph	27	19	353	28	41	10	53	29	17	13	51	134	11
Ridgeway	12	10	149	12	34	11	14	766	10	10	79	104	10

Over 100cfu/100mL

In 2008, corresponding to the results from the ravines, the St. Joseph lake location had the highest geometric mean E. coli concentration (Tables 2 and 4). The results from the ravines may help to explain some of the lake concentrations, as there appears to be a correlation on dates such as June 10 and August 19 (Tables 3 and 5). However, ravine concentrations alone cannot explain all results. Other lake effects such as wind, wave action and currents have the ability to confound any direct relationship between ravine and lake bacterial concentrations.

Next Steps

1. Continue to test water quality at the mouth of the four ravines along Lake Huron.
2. Begin extended water quality testing and stewardship programs in the Ridgeway Ravine.
3. Secure funds for data analysis of the long-term water quality results from the four ravines at the mouth and in the lake.
4. Continue with the Advisory Committee made up of lakeshore and inland stakeholders in 2009 to help direct the next steps for the ravine stewardship initiatives.

References

Veliz, M. and H. Brock, 2006. Water Quality and Wetland Feasibility in the St. Joseph and Adjacent Ravines along Lake Huron. Ausable Bayfield Conservation Authority. Exeter, Ontario. 10pp.

Veliz, M. and H. Brock, 2007. Ravine & Lake Water Quality Monitoring 2007, BSRA-ABCA. Ausable Bayfield Conservation Authority. Exeter, Ontario.

Appendix I



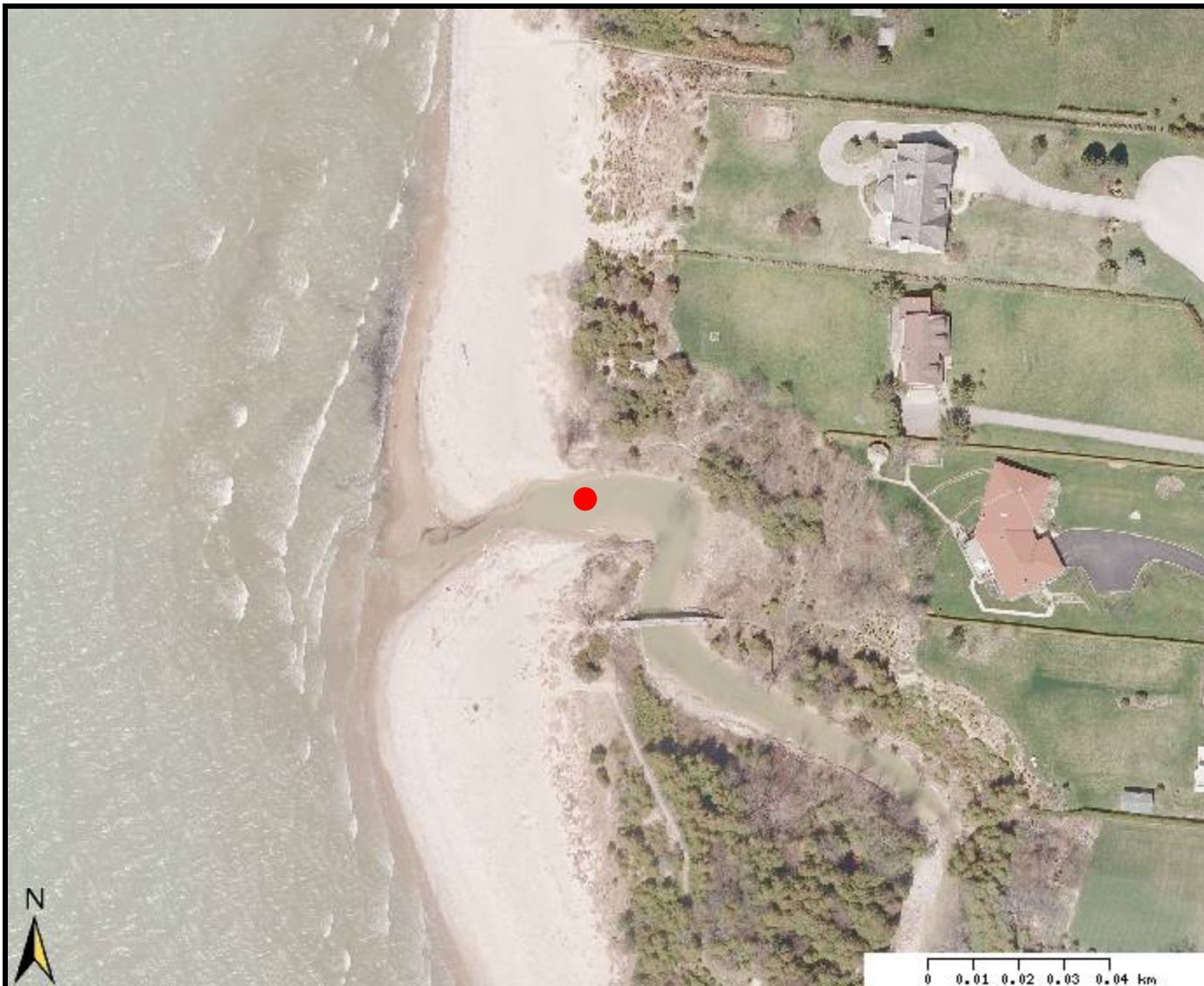
2006 Photo
2006 Photo

Ridgeway

Red circle represents approximate sampling location.



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2006 Photo
2006 Photo

St. Joseph

Red circle represents approximate sampling location.



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	Roads - large scale
	2006 Photo
	2006 Photo

Houston Heights

Red circle represents approximate sampling location.



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2006 Photo
2006 Photo

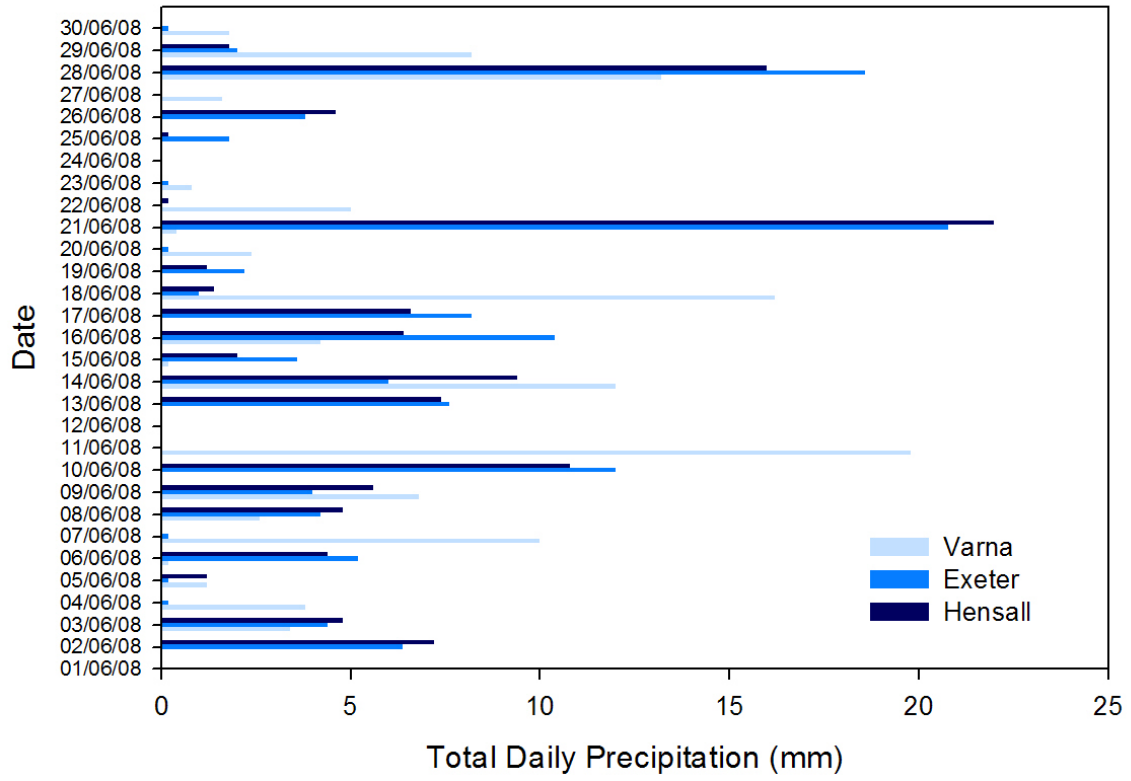
Wildwood

Red circle represents approximate sampling location.

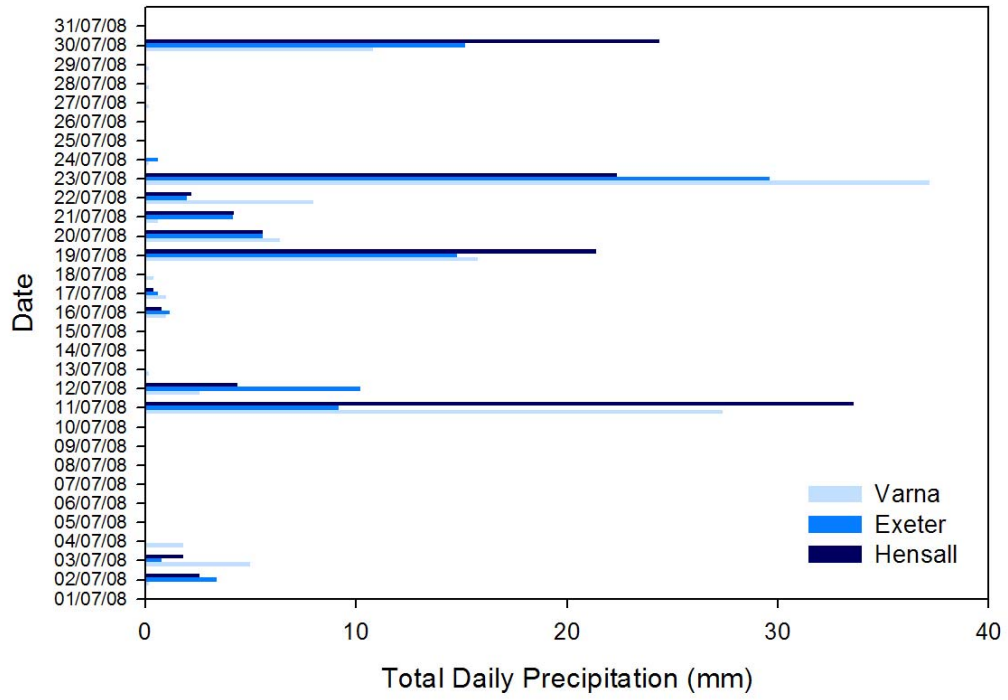
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Appendix II

June 2008



July 2008



August 2008

