

Appendix B

Ministry of the Environment
Water Well Records



Received
Sept 19
1962

34 No 108

UTM Zone 17R 4325010E

127 23
5R 4780545N

The Ontario Water Resources Commission Act

WATER WELL RECORD

Elev. 5R 0630

Basins (2) 2 COMMISSION
County or District Hamilton

Township, Village, Town or City Bascom

Con. 1# Lot 23

Date completed 10 Sept 1962
(day month year)

Address Ledford

Casing and Screen Record

Pumping Test

Inside diameter of casing 27 1/2" - 30"
Total length of casing 30'
Type of screen Traveloch
Length of screen
Depth to top of screen
Diameter of finished hole 27 1/2" - 30"

Static level 12'
Test-pumping rate 2 G.P.M.
Pumping level 28'
Duration of test pumping 1/2 hr.
Water clear or cloudy at end of test cloudy
Recommended pumping rate 1 1/2 G.P.M.
with pump setting of 28' feet below ground surface

Well Log

Water Record

Overburden and Bedrock Record

From ft.

To ft.

Depth(s) at which water(s) found

Kind of water (fresh, salty, sulphur)

Top soil
grey sand
gravel
grey sand
Blue clay

0 1
1 17
17 19
19 20
20 28

17' Fresh

For what purpose(s) is the water to be used?

Livestock

Is well on upland, in valley, or on hillside? Level

Drilling or Boring Firm Armed Well Drilling

Address Elmira

Licence Number 434

Name of Driller or Borer R. L. Frankli

Address Baden Ont.

Date Sept 10/62

(Signature of Licensed Drilling or Boring Contractor)

Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.

Follow hiway #7 from Elginfield to hiway #82, follow Rd into first turn right, follow along rd. to railroad tracks cross over tracks large white farm house on right side of Rd.



UTM 17Z 432500E

CENR 4780542N

Elev 605R 23 0630

The Ontario Water Resources Commission Act

WATER WELL RECORD

WATER RESOURCES
34 DIVISION N: 109
DEC 7 1965
ONTARIO WATER
RESOURCES COMMISSION

Basin 22 Hamilton

Township, Village, Town or City Bosanquet

Con 1 Lot 23

Date completed 27 Jan 1965
(day month year)

Address Theford

Casing and Screen Record

Inside diameter of casing 4
Total length of casing 158, 3 ft above G.L.
Type of screen Johnson slot no 8 and 6
Length of screen 4 ft. Bottom 3 ply top 6 ft 6 of pipe
Depth to top of screen 150 ft. G.L.
Diameter of finished hole 3

Pumping Test

Static level 52 G.L.
Test-pumping rate 4 G.P.M.
Pumping level 72 G.L.
Duration of test pumping 8 hrs.
Water clear or cloudy at end of test Clear
Recommended pumping rate 4 G.P.M.
with pump setting of 100 feet below ground surface

Well Log

Water Record

Overburden and Bedrock Record	From ft.	To ft.	Depth(s) at which water(s) found	Kind of water (fresh, salty, sulphur)
top soil gravel	0	8	158-161	fresh
sand	8	25		
sandy clay	25	40		
blue clay	40	102		
sand with clay streaks	102	150		
sand	150	161		

For what purpose(s) is the water to be used? D & F Stock

Is well on upland, in valley, or on hillside? upland

Drilling or Boring Firm Andrew A Heale

Address Box 264 Watford Ont

Licence Number 1362

Name of Driller or Borer Mervyn Ward

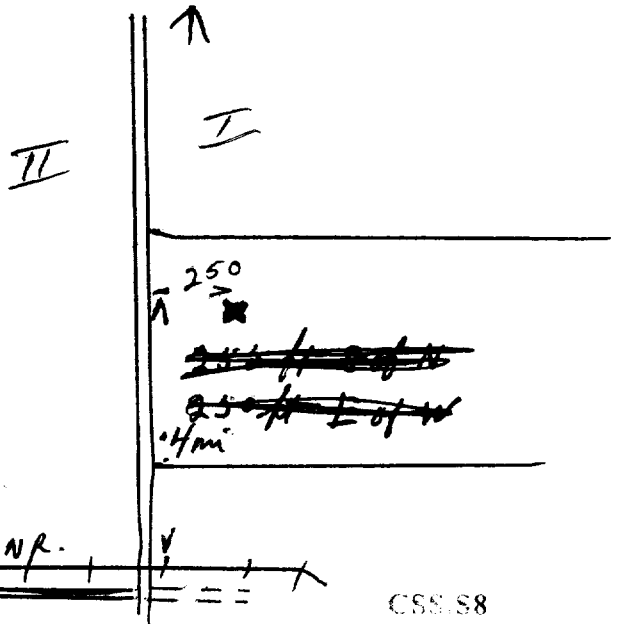
Address R.R. 4 Watford

Date Jan 27 1965

Andrew A Heale
(Signature of Licensed Drilling or Boring Contractor)

Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.





Ontario

WATER WELL RECORD

40P/4W

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK CORRECT BOX WHERE APPLICABLE

11 | 3404835

MUNICIPALITY 34010

CON. ERN | 04

COUNTY OR DISTRICT: West Lambton TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: Warwick CON., BLOCK, TRACT, SURVEY, ETC.: 4 E.Rd. N-026 LOT: 22-27

DATE COMPLETED: 48-53 DAY: 14 MO: 07 YR: 75

DEPTH: 2667.00 RC: 5 ELEVATION: 081.0 RC: 5 BASIN CODE: 22

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET	
				FROM	TO
	Top Soil			0	1
	Brown Sandy Clay			1	20
	Clay Sand			20	70
	Fine Sand			70	96
	Water Sand & Clay			96	113
	Water Sand			113	118

31 | 0001 02 | 002060581 | 0070 0528 | 0096 08 | 0113 2805 | 0118 2891

41 | WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER			
10-13	<input checked="" type="checkbox"/> FRESH	<input type="checkbox"/> SALTY	<input type="checkbox"/> SULPHUR	<input type="checkbox"/> MINERAL
15-18	<input type="checkbox"/> FRESH	<input type="checkbox"/> SALTY	<input type="checkbox"/> SULPHUR	<input type="checkbox"/> MINERAL
20-23	<input type="checkbox"/> FRESH	<input type="checkbox"/> SALTY	<input type="checkbox"/> SULPHUR	<input type="checkbox"/> MINERAL
25-28	<input type="checkbox"/> FRESH	<input type="checkbox"/> SALTY	<input type="checkbox"/> SULPHUR	<input type="checkbox"/> MINERAL
30-33	<input type="checkbox"/> FRESH	<input type="checkbox"/> SALTY	<input type="checkbox"/> SULPHUR	<input type="checkbox"/> MINERAL

51 | CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET	
			FROM	TO
05"	<input checked="" type="checkbox"/> STEEL	188	0	0115
17-18	<input type="checkbox"/> STEEL			20-23
24-25	<input type="checkbox"/> STEEL			27-30

60 | SCREEN RECORD

SIZE(S) OF OPENING (SLOT NO.): 0008 DIAMETER: 05.000 LENGTH: 03

MATERIAL AND TYPE: Stainless steel 0115 DEPTH TO TOP OF SCREEN: 41-44

61 | PLUGGING & SEALING RECORD

DEPTH SET AT - FEET	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
10-13	14-17
18-21	22-25
26-29	30-33

71 | PUMPING TEST

PUMPING TEST METHOD: PUMP BAUER

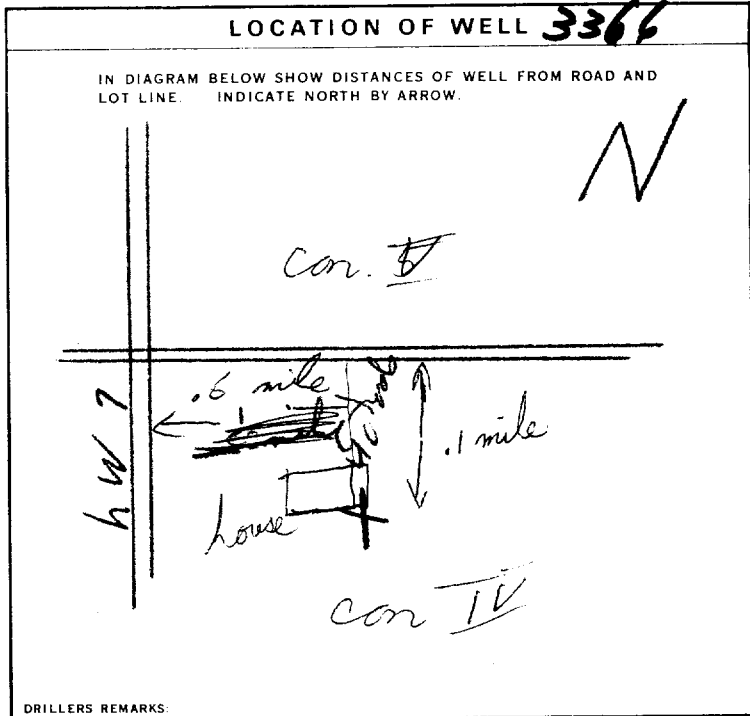
PUMPING RATE: 0008 GPM DURATION OF PUMPING: 02 HOURS 00 MINS

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING					
034	072	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES		
		26-28	29-31	32-34	35-37		

IF FLOWING, GIVE RATE: 100 GPM

RECOMMENDED PUMP TYPE: SHALLOW DEEP

RECOMMENDED PUMP SETTING: 100 FEET



FINAL STATUS OF WELL: 1

WATER USE: 02

METHOD OF DRILLING: 2

CONTRACTOR: Ron Smith LICENCE NUMBER: 4741

ADDRESS: R.R. 3, Beaufield Ont.

NAME OF DRILLER OR BORE: David Berger LICENCE NUMBER:

SIGNATURE OF CONTRACTOR: Ron Smith SUBMISSION DATE: DAY 25 MO. 11 YR. 75

OFFICE USE ONLY

DATA SOURCE: 1 CONTRACTOR: 4741 DATE RECEIVED: 161275

DATE OF INSPECTION: 4/10/76 INSPECTOR: 7

REMARKS: OK

CSS.S8



WATER WELL RECORD

40P/4W

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK CORRECT BOX WHERE APPLICABLE

11 3404836-1 34010 ER N 04

COUNTY OR DISTRICT *Halton* TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE *Wawke* CON., BLOCK, TRACT, SURVEY, ETC. *4 - ~~122~~ F.R.M.N.* LOT 25-27 *026*

DATE COMPLETED 18-53 DAY *18* MO *06* YR. *75*

ELEVATION 66700 5 0810 5 22

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET	
				FROM	TO
	Top soil			0	1
Brown	silty clay	clay		1	20
Grey	silty clay	clay		20	95
	Hard Pan			95	115
	Layered sand			115	125

31 0001 02 002062805 009520584 0115 14 0125 2067

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER			
0115	1 <input checked="" type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	4 <input type="checkbox"/> MINERAL	14
15-18	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	4 <input type="checkbox"/> MINERAL	19
20-23	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	4 <input type="checkbox"/> MINERAL	24
25-28	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	4 <input type="checkbox"/> MINERAL	29
30-33	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	4 <input type="checkbox"/> MINERAL	34-80

51 CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET	
			FROM	TO
05	1 <input checked="" type="checkbox"/> STEEL	188	0	0100
17-18	1 <input type="checkbox"/> STEEL			20-23
24-25	1 <input type="checkbox"/> STEEL			27-30

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER	LENGTH

MATERIAL AND TYPE: *Shovel pack to 100'*

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET		MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
FROM	TO	
10-13	14-17	
18-21	22-25	
26-29	30-33	

71 PUMPING TEST

PUMPING TEST METHOD: *AK* 10 PUMPING RATE: *0001* 11-14 DURATION OF PUMPING: *01* 15-16 HOURS: *00* 17-18 MINS.

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING PUMPING			
		15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
<i>040</i>	<i>099</i>	<i>099</i>			

IF FLOWING, GIVE RATE: *125* GPM. 38-41 PUMP INTAKE SET AT: *125* FEET. 43-45 RECOMMENDED PUMP SETTING: *0001* FEET. 46-49 RECOMMENDED PUMPING RATE: *0001* GPM.

LOCATION OF WELL 3366

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.

2 *1/2* mile *0.6* mile

filled well to casing with gravel.

FINAL STATUS OF WELL

54 1 WATER SUPPLY 5 ABANDONED, INSUFFICIENT SUPPLY
 2 OBSERVATION WELL 6 ABANDONED, POOR QUALITY
 3 TEST HOLE 7 UNFINISHED
 4 RECHARGE WELL

WATER USE

55-56 1 DOMESTIC 5 COMMERCIAL
 2 STOCK 6 MUNICIPAL
 3 IRRIGATION 7 PUBLIC SUPPLY
 4 INDUSTRIAL 8 COOLING OR AIR CONDITIONING
 9 NOT USED

METHOD OF DRILLING

57 1 CABLE TOOL 6 BORING
 2 ROTARY (CONVENTIONAL) 7 DIAMOND
 3 ROTARY (REVERSE) 8 JETTING
 4 ROTARY (AIR) 9 DRIVING
 5 AIR PERCUSSION

CONTRACTOR

NAME OF WELL CONTRACTOR: *Ron Smith* LICENCE NUMBER: *4741*
 ADDRESS: *R.R. 3 Denfield Ont.*
 NAME OF DRILLER OR BORE: *Harold Bender*
 SIGNATURE OF CONTRACTOR: *Ron Smith* SUBMISSION DATE: DAY *25* MO. *11* YR. *75*

OFFICE USE ONLY

DATA SOURCE: *1* 58 CONTRACT NO.: *4741* 59-62 DATE RECEIVED: *161275* 63-68
 DATE OF INSPECTION: *4/10/76* INSPECTOR: *7*
 REMARKS: *properly filled OK* P *1.0* WI *1.0*
 CSS.53



Ontario

WATER WELL RECORD

40P/4W

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK CORRECT BOX WHERE APPLICABLE

11 3404837

MUNICIPALITY 34010

CON. E.R.N. 04

COUNTY OR DISTRICT <i>St. Catharines</i>	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE <i>Warwick</i>	CON., BLOCK, TRACT, SURVEY, ETC. <i>4 E.R.N. 026</i>	LOT <i>026</i>
NAME OF WELL CONTRACTOR <i>R. R. 3 Denfield Cent.</i>		DATE COMPLETED DAY <i>20</i> MO <i>06</i> YR <i>75</i>	
WELL NO. <i>66700</i>	RC <i>5</i>	ELEVATION <i>0810</i>	RC <i>5</i>
BASIN CODE <i>22</i>			

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET	
				FROM	TO
	<i>Top Soil</i>			<i>0</i>	<i>1</i>
<i>Brown</i>	<i>Sand</i>	<i>Clay</i>		<i>1</i>	<i>20</i>
<i>Grey</i>	<i>Silty</i>	<i>Clay</i>		<i>20</i>	<i>95</i>
	<i>Hard Pan</i>			<i>95</i>	<i>115</i>
	<i>Clay & Sand</i>			<i>115</i>	<i>122</i>

31	<i>0001 02</i>	<i>002062805</i>	<i>009520684</i>	<i>0115 114</i>	<i>0122 05108</i>
32					

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER			
10-13	<input type="checkbox"/> FRESH	<input type="checkbox"/> SALTY	<input type="checkbox"/> SULPHUR	<input type="checkbox"/> MINERAL
15-18	<input type="checkbox"/> FRESH	<input type="checkbox"/> SALTY	<input type="checkbox"/> SULPHUR	<input type="checkbox"/> MINERAL
20-23	<input type="checkbox"/> FRESH	<input type="checkbox"/> SALTY	<input type="checkbox"/> SULPHUR	<input type="checkbox"/> MINERAL
25-28	<input type="checkbox"/> FRESH	<input type="checkbox"/> SALTY	<input type="checkbox"/> SULPHUR	<input type="checkbox"/> MINERAL
30-33	<input type="checkbox"/> FRESH	<input type="checkbox"/> SALTY	<input type="checkbox"/> SULPHUR	<input type="checkbox"/> MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET	
			FROM	TO
<i>05</i>	<input checked="" type="checkbox"/> STEEL	<i>1/8</i>	<i>0</i>	<i>0/22</i>
	<input type="checkbox"/> GALVANIZED			
	<input type="checkbox"/> CONCRETE			
	<input type="checkbox"/> OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET
MATERIAL AND TYPE		DEPTH TO TOP OF SCREEN FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)
FROM	TO
<i>10-13</i>	<i>14-17</i>
<i>18-21</i>	<i>22-25</i>
<i>26-29</i>	<i>30-33</i>

71 PUMPING TEST

PUMPING TEST METHOD <input type="checkbox"/> PUMP <input type="checkbox"/> BAILER	PUMPING RATE GPM	DURATION OF PUMPING 15-16 HOURS 17-18 MINS
STATIC LEVEL 19-21 FEET	WATER LEVEL END OF PUMPING 22-24 FEET	WATER LEVELS DURING 15 MINUTES 26-28 FEET 30 MINUTES 29-31 FEET 45 MINUTES 32-34 FEET 60 MINUTES 35-37 FEET
IF FLOWING, GIVE RATE 38-41 GPM	PUMP INTAKE SET AT FEET	WATER AT END OF TEST 1 <input type="checkbox"/> CLEAR 2 <input type="checkbox"/> CLOUDY
RECOMMENDED PUMP TYPE <input type="checkbox"/> SHALLOW <input type="checkbox"/> DEEP	RECOMMENDED PUMP SETTING FEET	RECOMMENDED PUMPING RATE GPM

LOCATION OF WELL 3366

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.

N

76' W

1/2 mile

44 yds.

DRILLERS REMARKS

FINAL STATUS OF WELL 5

<input checked="" type="checkbox"/> WATER SUPPLY	<input type="checkbox"/> ABANDONED, INSUFFICIENT SUPPLY
<input type="checkbox"/> OBSERVATION WELL	<input type="checkbox"/> ABANDONED, POOR QUALITY
<input type="checkbox"/> TEST HOLE	<input type="checkbox"/> UNFINISHED
<input type="checkbox"/> RECHARGE WELL	

WATER USE 55-56

<input checked="" type="checkbox"/> DOMESTIC	<input type="checkbox"/> COMMERCIAL
<input type="checkbox"/> STOCK	<input type="checkbox"/> MUNICIPAL
<input type="checkbox"/> IRRIGATION	<input type="checkbox"/> PUBLIC SUPPLY
<input type="checkbox"/> INDUSTRIAL	<input type="checkbox"/> COOLING OR AIR CONDITIONING
<input type="checkbox"/> OTHER	<input type="checkbox"/> NOT USED

METHOD OF DRILLING 57

<input checked="" type="checkbox"/> CABLE TOOL	<input type="checkbox"/> BORING
<input type="checkbox"/> ROTARY (CONVENTIONAL)	<input type="checkbox"/> DIAMOND
<input type="checkbox"/> ROTARY (REVERSE)	<input type="checkbox"/> JETTING
<input type="checkbox"/> ROTARY (AIR)	<input type="checkbox"/> DRIVING
<input type="checkbox"/> AIR PERCUSSION	

NAME OF WELL CONTRACTOR <i>Don Smith</i>	LICENCE NUMBER <i>4741</i>
ADDRESS <i>R.R. 3 Denfield Cent.</i>	
NAME OF DRILLER OR BORER <i>Harold Bender</i>	LICENCE NUMBER
SIGNATURE OF CONTRACTOR <i>Don Smith</i>	SUBMISSION DATE DAY <i>25</i> MO <i>11</i> YR <i>75</i>

DATA SOURCE <i>1</i>	CONTRACTOR <i>4741</i>	DATE RECEIVED <i>161275</i>
DATE OF INSPECTION <i>4/10/76</i>	INSPECTOR	
REMARKS <i>properly filled</i>		P. <i>0</i> W. <i>0</i>



WATER WELL RECORD

45P/4W

Ontario

PRINT ONLY IN SPACES PROVIDED

11 3406397

MUNICIPALITY 34001

CON. CON

06

COUNTY OR DISTRICT **LAMBTON** TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE **BOSANQUET** CON. BLOCK, TRACT, SURVEY, ETC. **VI** LOT 25-27 **024**

DATE COMPLETED DAY **17** MO. **5** YR. **78**

RC **80950** ELEVATION **5** **0640** BASIN CODE **5** **22**

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET	
				FROM	TO
BROWN	CLAY	BLUE CLAY	PACKED	0	7 1/2
ROCK BOTTOM Water comes out of Top of Rock.					

31 32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER			
7 1/2	1 <input checked="" type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	4 <input type="checkbox"/> MINERAL	14
15-18	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	4 <input type="checkbox"/> MINERAL	19
20-23	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	4 <input type="checkbox"/> MINERAL	24
25-28	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	4 <input type="checkbox"/> MINERAL	29
30-33	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	4 <input type="checkbox"/> MINERAL	34-40

51 CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET	
			FROM	TO
36	CONCRETE	3	0	7 1/2
17-18	STEEL			20-23
24-25	STEEL			27-30

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER	LENGTH
	INCHES	FEET
		DEPTH TO TOP OF SCREEN
		41-44
		FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET	MATERIAL AND TYPE	(CEMENT GROUT) LEAD PACKER, ETC.
10-13		14-17
18-21		22-25
26-29		30-33
		80

71 PUMPING TEST

PUMPING TEST METHOD: PUMP BAILER

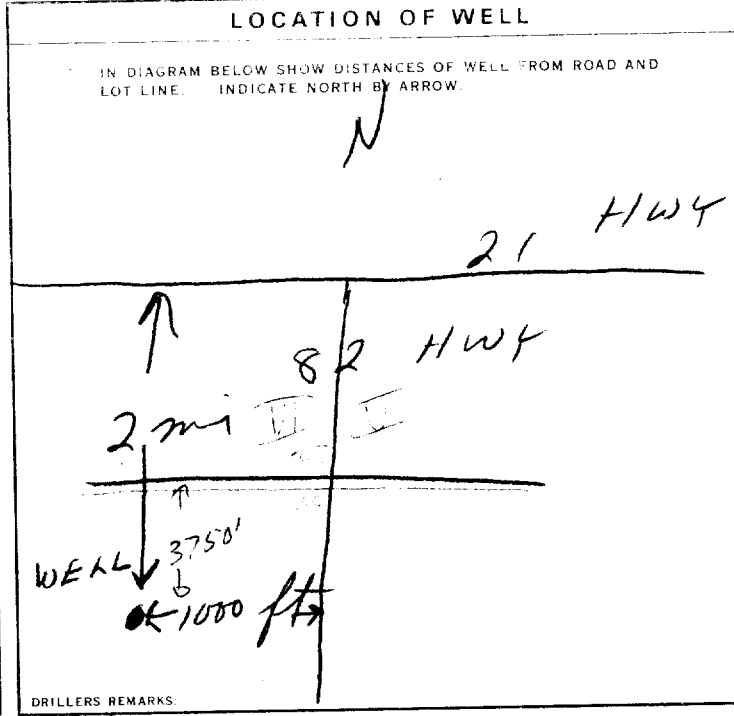
PUMPING RATE: 8 GPM

DURATION OF PUMPING: 15-16 HOURS

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING			
19-21	7 1/2	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
FEET	FEET	FEET	FEET	FEET	FEET

IF FLOWING, GIVE RATE: 7 GPM

RECOMMENDED PUMP TYPE: SHALLOW DEEP



FINAL STATUS OF WELL

1 WATER SUPPLY 5 ABANDONED, INSUFFICIENT SUPPLY
 2 OBSERVATION WELL 6 ABANDONED, POOR QUALITY
 3 TEST HOLE 7 UNFINISHED
 4 RECHARGE WELL

WATER USE

1 DOMESTIC 5 COMMERCIAL
 2 STOCK 6 MUNICIPAL
 3 IRRIGATION 7 PUBLIC SUPPLY
 4 INDUSTRIAL 8 COOLING OR AIR CONDITIONING
 OTHER: **SPRAY NOZ**

METHOD OF DRILLING

1 CABLE TOOL 6 BORING
 2 ROTARY (CONVENTIONAL) 7 DIAMOND
 3 ROTARY (REVERSE) 8 JETTING
 4 ROTARY (AIR) 9 DRIVING
 5 AIR PERCUSSION

CONTRACTOR

NAME OF WELL CONTRACTOR: **CHARLES HAYDEN** LICENCE NUMBER: **2552**

ADDRESS: **RR #2 GPANTON ONT**

NAME OF DRILLER OR BORER: **SAME** LICENCE NUMBER: _____

SIGNATURE OF CONTRACTOR: *Charles Hayden* SUBMISSION DATE: _____

OFFICE USE ONLY

DATA SOURCE: _____ CONTRACTOR: _____ DATE RECEIVED: _____

DATE OF INSPECTION: **24/3/79** INSPECTOR: _____

REMARKS: _____

CSS.S8

Appendix C

Jericho Pre-construction
Dewatering Monitoring Report
(AECOM, 2014)

Jericho Wind, Inc.
Jericho Wind Energy Centre

Jericho Pre-Construction Dewatering Monitoring Report

Report

Jericho Wind, Inc.
Jericho Wind Energy Centre

Jericho Pre-Construction Dewatering Monitoring Report

Prepared by:

AECOM

105 Commerce Valley Drive West, Floor 7
Markham, ON, Canada L3T 7W3
www.aecom.com

905 886 7022 tel
905 886 9494 fax

Project Number:

60301207

Date:

May, 2014

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- may be based on information provided to Consultant which has not been independently verified;
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- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
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AECOM Signatures

Report Prepared By:



Erin Wilson, B.Sc. (Hon.),
Environmental Scientist



Olga Hropach, B.Sc. (Hon.)
Ecologist

Report Reviewed By:



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1. Introduction

Jericho Wind, Inc. (Jericho), a wholly owned subsidiary of NextEra Energy Canada, ULC, (NextEra) is proposing to construct a wind energy project in the Municipality of Lambton Shores and the Township of Warwick, in Lambton County, Ontario and in the Municipality of North Middlesex, in Middlesex County, Ontario. The project is referred to as the Jericho Wind Energy Centre (the “Project”).

AECOM Canada Ltd. (AECOM) was retained by NextEra to prepare an application for the proposed Project in accordance with the requirements of the Renewable Energy Approval (REA) process outlined in Ontario Regulation 359/09 (O. Reg. 359/09) under the *Environmental Protection Act* and the Technical Guide to Renewable Energy Approvals (Ontario Ministry of the Environment, 2011). This application includes the following reports:

- *Jericho Wind Energy Centre Natural Heritage Assessment and Environmental Impact Study Report* (AECOM, 2013a);
- *Jericho Wind Energy Centre Natural Heritage Assessment and Environmental Impact Study Report Addendum* (AECOM, 2012);
- *Jericho Wind Energy Centre Natural Heritage Assessment and Environmental Impact Study Report Second Addendum* (2013b); and
- *Jericho Wind Energy Centre Natural Heritage Assessment and Environmental Impact Study Report Third Addendum* (2013c).

As described in the above reports, commitments were made to monitor impacts of construction dewatering on natural heritage features within the dewatering zones of influence prior to, during and post-construction of the Jericho Wind Energy Centre.

The *Jericho Wind Energy Centre Dewatering Environmental Monitoring Plan* (AECOM, 2013d) was prepared and submitted to the Ministry of Natural Resources (MNR) to fulfill the commitments made in Section 5.3.6 of the *Natural Heritage Assessment and Environmental Impact Study Report* (AECOM, 2013a) with respect to identifying those natural heritage features potentially affected by construction dewatering based on the calculated dewatering zones of influence. Therein, a commitment was made to complete monthly pre-construction dewatering monitoring at a total of two Monitoring Locations (M1 and R1) for a duration of six months from November 2013 to April 2014.

The purpose of this report is to document the results of the pre-construction dewatering monitoring for Monitoring Locations M1 and R1. The methodology by which the pre-construction monitoring was conducted is presented in **Section 2**. The results of the pre-construction monitoring for each monitoring location are described in **Section 3**. Recommendations for dewatering monitoring during the construction phase and post-construction phase are provided in **Section 4**.

2. Methodology

2.1 Natural Heritage Features

Natural heritage features requiring monitoring for potential dewatering effects within the calculated dewatering zones of influence for turbine foundations were identified based on the methodology described in the *Jericho Wind Energy Centre Dewatering Environmental Monitoring Plan* (AECOM, 2013d). Therein, one Significant Turtle Wintering Habitat Feature (TWH-06) located within the dewatering zone of influence for the foundation of Turbine 8 was identified as being potentially affected by construction dewatering and requiring monitoring.

A total of two Monitoring Locations (M1 and R1) were selected to be monitored for potential dewatering effects (refer to **Figures 1 and 2**). Monitoring Location M1 contains the pond identified as Significant Turtle Wintering Habitat Feature TWH-06 located within the dewatering zone of influence for Turbine 8. Monitoring Location R1 contains a pond identified as Significant Turtle Wintering Habitat Feature TWH-05 located outside of any dewatering zones of influence and was selected to be monitored to establish a reference for normal conditions of a Significant Turtle Wintering Habitat Feature with similar characteristics to TWH-06.

Both Monitoring Locations M1 and R1 were monitored monthly for a duration of six months from November 2013 to April 2014. Staff gauges (e.g., metre stick rulers) were secured onto each of the mini-piezometers installed at Monitoring Location M1 and R1 described below in **Section 2.2** to monitor seasonal fluctuations in surface water levels of the ponds. The following information was recorded during each monthly visit at Monitoring Locations M1 and R1:

- Surface water level;
- Soil moisture;
- Description of location habitat conditions and adjacent land use;
- Description of surrounding vegetation health;
- Presence of turtle species observed; and
- Representative photographs.

Detailed field notes are provided in **Appendix A**. Photographic logs depicting the existing conditions of Monitoring Locations M1 and R1 are provided in **Appendix B**.

2.2 Shallow Groundwater

Mini-piezometers (MPs) are used to measure the position of the shallow water table and determine a hydraulic relationship between shallow groundwater and surface water (i.e., determine if a water feature is locally groundwater fed). At each of the two Monitoring Locations (M1 and R1), a single mini-piezometer was installed between November 21, 2013. **Figures 1 and 2** illustrate the location of the two Monitoring Locations. Detailed mini-piezometer field construction notes for each Monitoring Station are provided in **Appendix A**.

Each mini-piezometer consists of a length of 19.1 mm diameter galvanized steel pipe with a 0.235 to 0.285 m long, 12.8 mm diameter slotted and screened drivepoint tip. Soil stratigraphy and geologic conditions were determined at all locations by auguring a pilot hole in close proximity to the proposed MP location to a depth of 1.5 metres below ground surface (mBGS) or to a depth of bedrock refusal. The mini-piezometers were then installed by hand using a post driver to the deepest attainable depth as permitted by subsurface conditions. The surrounding geologic formation was allowed to collapse around the piezometer to seal the annular space around the pipe. Construction details of the mini-piezometers are summarized in **Table 1** below.

The mini-piezometers were monitored monthly for a duration of 6 months for fluctuations in shallow groundwater levels and for changes in the vertical hydraulic gradient. This allows for the assessment of natural variations in shallow groundwater levels and determines baseline thresholds.

Table 1. Mini-Piezometer Construction Summary

Monitor ID	Type of Installation	Total Depth (mBGS)	Screen Length (m)	Stick-Up (m)
MP-M1	Single	1.84	0.235	1.25
MP-R1	Single	1.81	0.285	1.33

3. Results

3.1 Natural Heritage Features

3.1.1 Monitoring Location M1

Monitoring Location M1 includes a dug-out pond identified as Significant Turtle Wintering Habitat Feature TWH-06 (refer to **Figure 1** for location). This pond is located in an agricultural field and has naturalized banks with mature overhanging trees and shrubs. Surrounding vegetation is dominated by Manitoba Maple (*Acer negundo*), Common Buckthorn (*Rhamnus cathartica*), Eastern Cottonwood (*Populus deltoides*) and Red-osier Dogwood (*Cornus sericea*). Pond Duckweed (*Lemna minor*) was observed in the east end of the pond near the installed mini-piezometers. Evaluation of Significance Pre-construction Monitoring surveys conducted in May 2013 reported a Snapping Turtle (*Chelydra serpentina*) basking near this pond as described in the *Jericho Wind Energy Centre Natural Heritage Assessment and Environmental Impact Study Report Third Addendum* (AECOM, 2013c).

Surface water levels, vegetation health and presence of turtle species at Monitoring Location M1 were monitored monthly between November 2013 and April 2014. The results from baseline monitoring are summarized in **Table 2**. The surrounding vegetation appeared to be in good health and going through seasonal change in the fall to a dormant stage in the winter for the monitoring duration. No signs of stress to vegetation health were observed (refer to **Appendix B** for photographic logs). The water surface levels at the edge of the pond were recorded to be fluctuating with the seasons and ranged between 0.48 m to 0.94 m. The pond was frozen between January and March 2014 and as a result it was not possible to record surface water levels at that time. No turtle species were observed during the monitoring period.

Table 2. Summary of Results from Pre-construction Baseline Monitoring at M1

Date	Surface Water Level – Relative to Ground (m)	Surrounding Vegetation Health	Turtle Species Observed
21-Nov-2013	0.48	All vegetation is going through fall seasonal change and in good health. An abundance of Pond Duckweed (<i>Lemna minor</i>) was observed in the east side of the pond, located near the mini-piezometer.	No
18-Dec-2013	0.52	All vegetation is dormant in winter condition.	No
24-Jan-2014	N/A ¹	All vegetation is dormant in winter condition.	No
25-Feb-2014	N/A ¹	All vegetation is dormant in winter condition and covered in snow.	No
25-Mar-2014	N/A ¹	All vegetation is dormant in winter condition and partially covered in snow.	No
28-Apr-2014	0.94	All vegetation is going through seasonal change and in good health.	No

Notes: 1. Water level not calculated due to frozen conditions in mini-piezometer or surface water.

3.1.2 Monitoring Location R1

Monitoring location R1 includes a dug-out pond identified as Significant Turtle Wintering Habitat Feature TWH-05 and was monitored as a reference for normal conditions for Feature TWH-06 at Monitoring Location M1 (refer to **Figure 2** for location). This pond is located in a cultural savannah near a topsoil processing facility. Riparian vegetation is dominated by Red-osier Dogwood, Common Reed (*Phragmites australis*) and Goldenrods (*Solidago* species). Evaluation of Significance Pre-construction Monitoring surveys conducted in May 2013 reported a Snapping Turtle travelling around the gravel pit towards the pond as described the *Jericho Wind Energy Centre Natural Heritage Assessment and Environmental Impact Study Report Third Addendum* (AECOM, 2013c).

Surface water levels, vegetation health and presence of turtle species at Monitoring Location R1 were monitored monthly between November 2013 and April 2014. The results from baseline monitoring are summarized in **Table 3**. The surrounding vegetation appeared to be in good health and going through seasonal change in the fall to a dormant stage in the winter for the monitoring duration. No signs of stress to vegetation health were observed (refer to **Appendix B** for photographic logs). The water surface levels at the edge of the pond were recorded to be fluctuating with the seasons and ranged between 0.22 m to 0.28 m. The pond was frozen between January and March 2014 and as a result it was not possible to record surface water levels at that time. No turtle species were observed during the monitoring period.

Table 3. Summary of Results from Pre-construction Baseline Monitoring at R1

Date	Surface Water Level – Relative to Ground (m)	Surrounding Vegetation Health	Turtle Species Observed
21-Nov-2013	0.48	All vegetation is going through fall seasonal change and in good health.	No
18-Dec-2013	N/A ¹	All vegetation is dormant in winter condition. Coniferous trees appear in good health.	No
24-Jan-2014	N/A ¹	All vegetation is dormant in winter condition.	No
25-Feb-2014	N/A ¹	All vegetation is dormant in winter condition.	No
25-Mar-2014	0.22	All vegetation is dormant in winter condition and partially covered in snow.	No
28-Apr-2014	0.44	All vegetation is going through seasonal change and in good health.	No

Notes: 1. Water level not calculated due to frozen conditions in mini-piezometer or surface water.

3.2 Shallow Groundwater

3.2.1 Monitoring Location M1

One mini-piezometer (MP-M1) was installed in a pond identified as TWH-06 as part of the hydrogeological baseline investigations at Turbine 8. The mini-piezometer is installed approximately 230 m southeast of Turbine 8, within the predicted turbine foundation dewatering zone of influence (**Figure 1**).

Mini-piezometer water levels at MP-M1 were monitored monthly from November 2013 through to April 2014. Water levels are responding to season fluctuations in shallow groundwater levels and precipitation as no construction activities occurred at Turbine 8 during the monitoring period. Based on the data presented in **Table 4** and **Figure 3**, the hydraulic gradients in the pond are variable and change based on seasonal variability in precipitation, snow melt and seasonal fluctuations in groundwater levels. During late fall and early winter (November and December) vertical hydraulic gradients in the pond had downwards hydraulic gradients, indicating groundwater recharge. During the spring (April) MP-M1 had an upward hydraulic gradient, indicating groundwater discharge. This gradient reversal is naturally occurring and is most likely a result of increases in groundwater table elevation as a result of spring snow melt.

Table 4. MP-M1 Summary of Mini-Piezometer Pre-Construction Baseline Monitoring

Date	Water Level – Relative to Ground (m) ¹	Vertical Hydraulic Gradient ²	Comments
21-Nov-2013	-0.73	-0.63	Mini-Piezometer installed.
18-Dec-2013	0.18	-0.47	Pond frozen and snow covered.
24-Jan-2014	N/A ³	N/A ³	Pond frozen and snow covered.
25-Feb-2014	N/A ³	N/A ³	Pond frozen and snow covered.
25-Mar-2014	N/A ³	N/A ³	Pond frozen and snow covered, snow melt prior to monitoring event.
28-Apr-2014	0.53	0.13	Pond free of ice.

Notes: 1. Positive water level indicates flowing artesian condition (i.e., water level above ground surface). Negative water level indicates that water level is below ground surface.
 2. Negative hydraulic gradient indicates a downwards hydraulic gradient (i.e., recharge). Positive hydraulic gradient indicates an upwards hydraulic gradient (i.e., discharge).
 3. Water level and/or hydraulic gradient not calculated due to frozen conditions in mini-piezometer or surface water.

3.2.2 Reference Monitoring Location R1

One mini-piezometer (MP-R1) was installed in a pond identified as TWH-05 in order to provide background monitoring information for Monitoring Location M1. The mini-piezometer is installed approximately 31 m north of Turbine 7, outside any predicted turbine foundation dewatering zone of influence (**Figure 2**).

Mini-piezometer water levels at MP-R1 were monitored monthly from November 2013 through to April 2014. Water levels are responding to season fluctuations in shallow groundwater levels and precipitation as no construction activities occurred at Turbine 7 during the monitoring period. Based on the data presented in **Table 5** and **Figure 4** the hydraulic gradients in the pond are variable and change based on seasonal variability in precipitation, snow melt and seasonal fluctuations in groundwater levels. Upon mini-piezometer installation, vertical hydraulic gradients in the pond had downwards hydraulic gradients, indicating groundwater recharge. This is most likely due to the effects of mini-piezometer installation and the limited recovery time prior to measuring water levels in November. During the winter and spring (February to April) MP-R1 had an upward hydraulic gradient, indicating groundwater discharge.

Table 5. MP-R1 Summary of Mini-Piezometer Pre-Construction Baseline Monitoring

Date	Water Level – Shallow MP - Relative to Ground (m) ¹	Vertical Hydraulic Gradient ²	Comments
21-Nov-2013	-1.12	-0.88	Mini-piezometer installed in sand and gravel in pond.
18-Dec-2013	N/A ³	N/A ³	Pond is frozen and snow covered.
24-Jan-2014	N/A ³	N/A ³	Pond is frozen and snow covered.
25-Feb-2014	0.35	0.11	Pond is frozen and snow covered.
25-Mar-2014	0.21	0.17	Pond is partially frozen and snow covered. Considerable snowmelt since February visit.
28-Apr-2014	0.23	0.03	Beaver/muskrat den observed.

Notes: 1. Positive water level indicates flowing artesian condition (i.e., water level above ground surface). Negative water level indicates that water level is below ground surface.
 2. Negative hydraulic gradient indicates a downwards hydraulic gradient (i.e., recharge). Positive hydraulic gradient indicates an upwards hydraulic gradient (i.e., discharge).
 3. Water level and/or hydraulic gradient not calculated due to frozen conditions in mini-piezometer or surface water.

4. Conclusions and Recommendations

The following conclusions and recommendations are presented based on the results of the pre-construction dewatering monitoring for the Jericho Wind Energy Centre:

- a) Overall health of the surrounding vegetation at Monitoring Locations M1 and R1 was in good condition and undergoing normal seasonal change. Surface water levels were showing seasonal fluctuations. No presence of turtle species was observed at either monitoring location.
- b) Upwards hydraulic gradients, indicating groundwater discharge, were observed at Monitoring Locations M1 and associated reference Monitoring Location R1.
- c) It is recommended that continued monitoring of the Significant Turtle Wintering Habitat Feature TWH-06 at Monitoring Location M1 and the associated reference Monitoring Location R1 for the Significant Turtle Wintering Habitat Feature TWH-05 occur during construction dewatering activities as detailed in **Table 6** below.

Table 6. Construction and Post-Construction Monitoring Plan

Monitoring Location ID	Associated Turbine Dewatering Zone of Influence	Natural Feature or Water Body	Monitoring Activities	Monitoring Frequency and Duration During Construction	Monitoring Frequency and Duration Post-Construction	Early Warning Indicators (EWI)	Contingency Measures
M1	Turbine 8 Monitoring Location	Significant Turtle Wintering Habitat Feature TWH-06	<ul style="list-style-type: none"> • Surface water level (staff gauge) • Vertical hydraulic gradient (mini-piezometer) • Vegetation stress (observation) 	<ul style="list-style-type: none"> • One monitoring event within two weeks prior to dewatering activities at Turbine 8. • Daily monitoring during dewatering activities at Turbine 8. 	<ul style="list-style-type: none"> • Monthly monitoring for up to one year if project-related impacts are observed. 	<ul style="list-style-type: none"> • Decline in surface water levels of 30 cm from seasonal / baseline conditions; or • Decline in surface water levels of 30 cm from previous monitoring event; or • Directional change from upward to downward hydraulic gradient from baseline conditions or from previous monitoring event. 	<ul style="list-style-type: none"> • If EWI detected during turtle wintering timing window (October 1 to April 30): • Direct dewatering discharge to pond after appropriate temperature and water quality controls (e.g., sediment bag, enviro-tank, etc.).
R1	Turbine 8 Reference Location	Significant Turtle Wintering Habitat Feature TWH-05					

5. References

AECOM, 2012:

Jericho Wind Energy Centre Natural Heritage Assessment and Environmental Impact Study Addendum.
Prepared for Jericho Wind, Inc. December 2012.

AECOM, 2013a:

Jericho Wind Energy Centre Natural Heritage Assessment and Environmental Impact Study Report.
Prepared for Jericho Wind, Inc. February 2013.

AECOM, 2013b:

Jericho Wind Energy Centre Natural Heritage Assessment and Environmental Impact Study Report Second Addendum. Prepared for Jericho Wind, Inc. January 2013.

AECOM, 2013c:

Jericho Wind Energy Centre Natural Heritage Assessment and Environmental Impact Study Report Third Addendum. Prepared for Jericho Wind, Inc. October 2013.

AECOM, 2013d:

Jericho Wind Energy Centre Dewatering Environmental Monitoring Plan. Prepared for Jericho Wind, Inc. November 2013.

Figures



Legend

Wind Energy Centre Study Area	Turbine Dewatering Zone of Influence
Transmission Line Study Area	Monitoring Stations
Railway	Natural Heritage Features
Roads	Turtle Wintering Areas
Project Location	Water Body Features
CE Turbine	Moderate Sensitivity REA Watercourse Feature
Transmission Line	Non-REA Watercourse Feature
Collection Line Directionally Drilled	MOE Water Wells (Depth)
Collection Line	< 10 m
Crane Path	> 10 m
Access Road	
Permanent Meteorological Tower	
Substation & Laydown Area	
Disturbance Areas	
120m Area of Investigation	

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UTM Zone 17N, NAD 83

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Jericho Wind Energy Centre
Pre-Construction Dewatering Monitoring Report

Monitoring Location M1

May 2014
Project 60301207

AECOM Figure 1



Legend

Wind Energy Centre Study Area	Turbine Dewatering Zone of Influence
Transmission Line Study Area	Monitoring Stations
Railway	Natural Heritage Features
Roads	Turtle Wintering Areas
Project Location	Water Body Features
CE Turbine	Moderate Sensitivity REA Watercourse Feature
Transmission Line	Non-REA Watercourse Feature
Collection Line Directionally Drilled	MOE Water Wells (Depth)
Collection Line	< 10 m
Crane Path	> 10 m
Access Road	
Permanent Meteorological Tower	
Substation & Laydown Area	
Disturbance Areas	
120m Area of Investigation	

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UTM Zone 17N, NAD 83

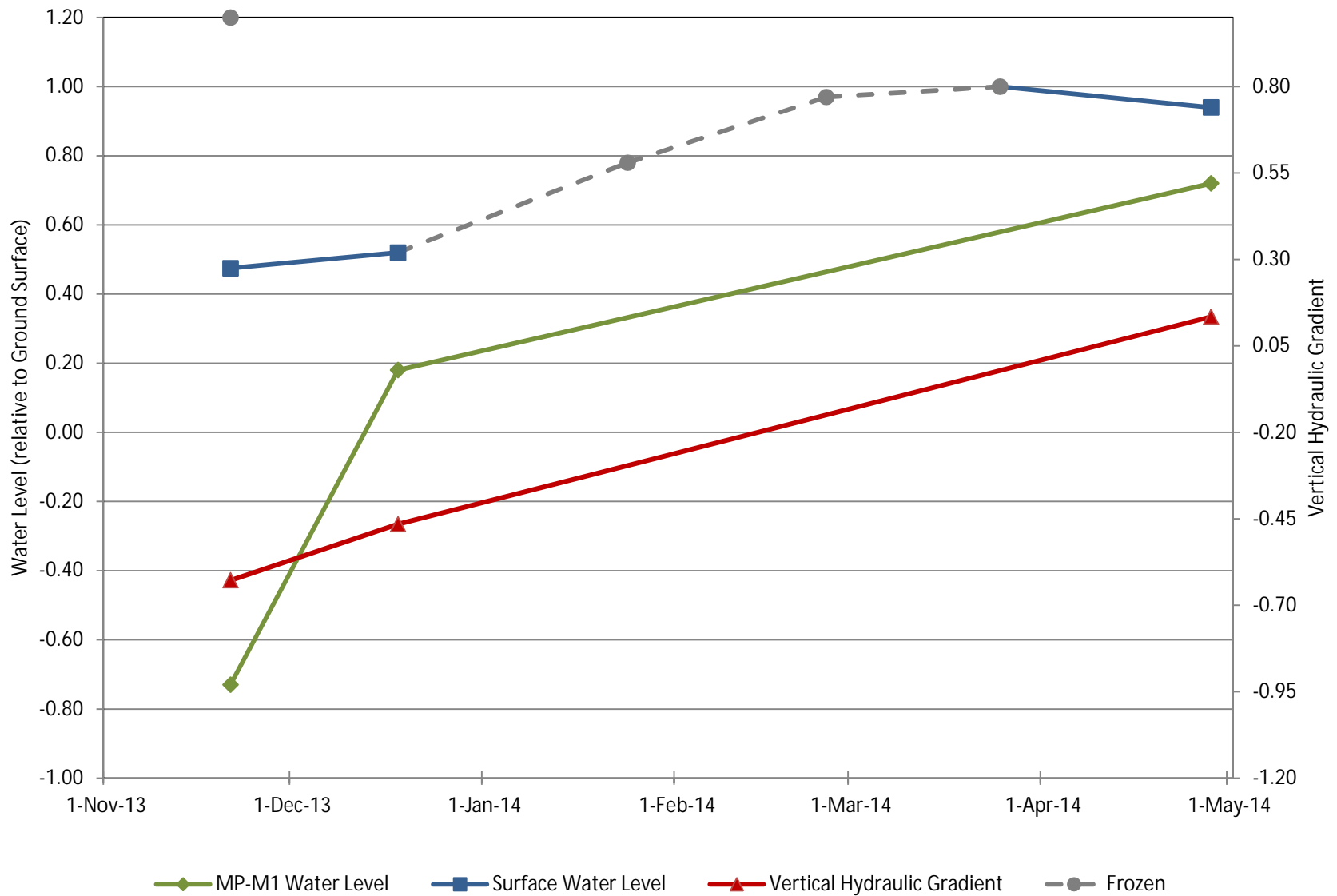
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Jericho Wind Energy Centre
Pre-Construction Dewatering Monitoring Report

Monitoring Location R1

May 2014
Project 60301207

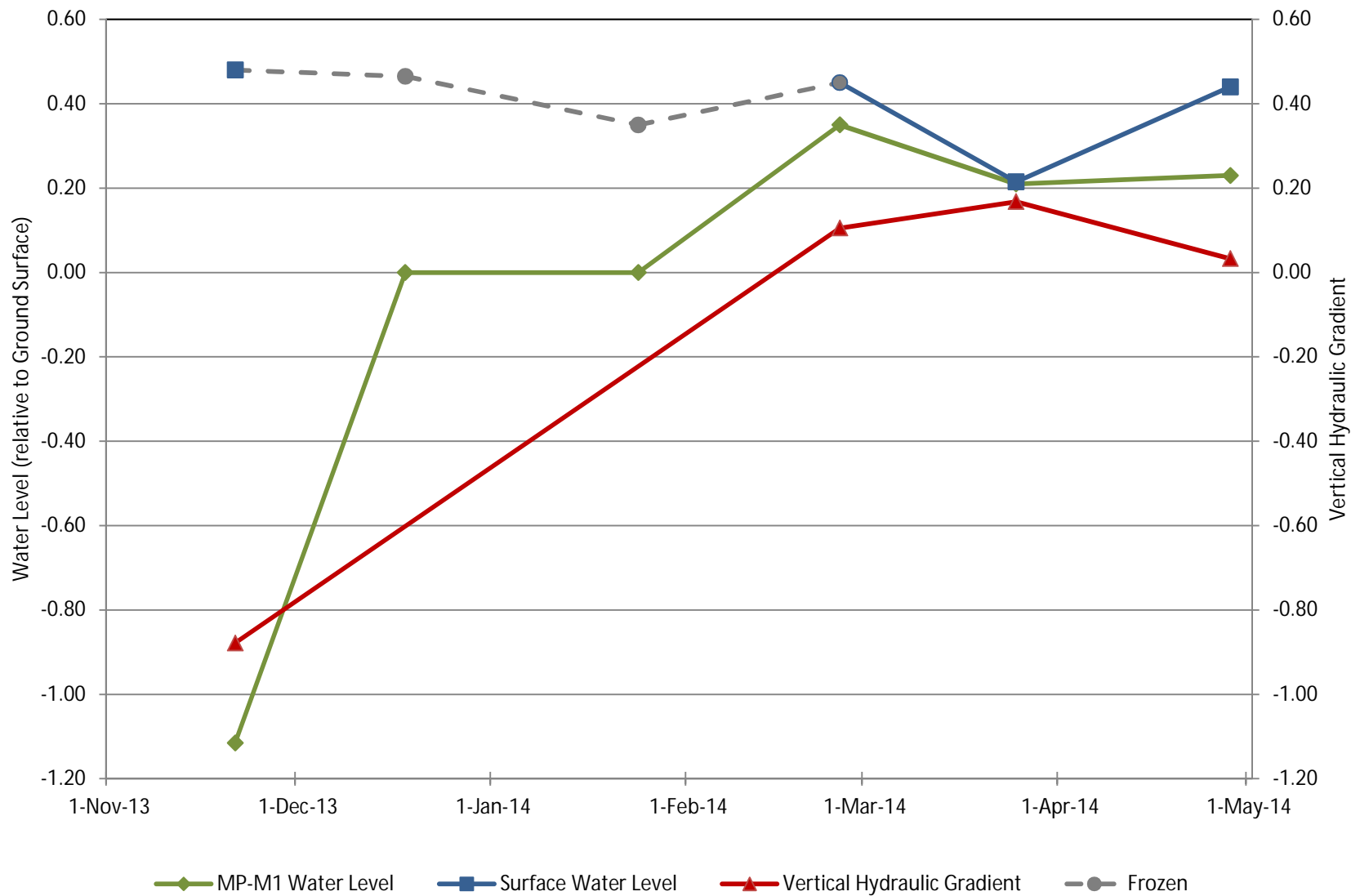
AECOM Figure 2



May 2014

MP-M1 Hydrograph
Jericho Pre-Construction Dewatering Monitoring Report

Figure 3



May 2014

MP-R1 Hydrograph
Jericho Pre-Construction Dewatering Monitoring Report

Figure 4