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Our ref: GCE00234/lpc

T Baker Esq  
Waddeton Park Ltd  
Greendale Court  
Clyst St Mary  
Exeter  
EX5 1AW

28<sup>th</sup> November 2012

Dear Tim

**Re: Tiverton EUE – Soakaway Testing**

**Introduction**

Geo Consulting Engineering Ltd was commissioned by Waddeton Park Limited to undertake soakaway tests in trial pits at the Tiverton EUE site.

**Location**

The site is located immediately west of Tiverton Golf Club. The A361 forms the north boundary and Blundells Road is located to the south. Uplowman Road runs across the north half of the site. A site location plan is included in Figure 1.

**Description**

The site consists of four main fields, labelled clockwise from north. Field 1 is located to the north of Uplowman Road, Field 2 is located south of Uplowman Road and occupies the eastern quarter of the site; Field 3 is located south of Field 2 and Field 4 is located north of Field 3 and west of Field 2. An additional field was accessed by the archaeologists, which is located to the east of Field 1 and located north of Uplowman Road and south of the A361. A site layout plan is presented in Figure 2, which shows Trial Pit Locations.

**Geology**

The site is underlain by the Exeter Group Sandstones, which are predominantly Breccia with subordinate sandstone. Superficial geology is mapped in Fields 2 and 3 and part of Field 4, described as River Terrace Deposits – Sand and Gravel.

### Trial Pitting

Six Trial Pits were excavated for soakaway testing on the 30<sup>th</sup> October 2012 and testing continued until the 2<sup>nd</sup> November 2012. An additional seventh trial pit was excavated into the field to the east of Field 1, following access agreement for the archaeological investigations on the 2<sup>nd</sup> November 2012. The Trial Pit was placed at the north end of their central trench and was used to allow the strata to be recorded. The following table details the location of the trial pits, depths and strata:

Trial Pit	1	2	3	4	5	6	7
Field	3	4	4	2	1	1	5
Topsoil	GL-0.4	GL-0.45	GL-0.2	GL-0.2	GL-0.05	GL-0.3	GL-0.3
Subsoil	-	0.45-0.55	0.2-0.3	0.2-0.35	0.05-0.3	-	0.3-1.1
Made Ground 1	-	-	-	-	0.3-1.4	-	-
Made Ground 2	-	-	-	-	1.4-2.0	-	-
Colluvium	-	0.55-1.4	0.3-1.5	-	2.0-2.1	0.3-1.3	1.1-2.1
Head	-	-	-	0.35-1.1	-	-	-
River Terrace 1	-	-	-	-	-	1.3-2.4	2.1-2.5
River Terrace 2	0.4-0.9	-	-	-	-	-	-
Weathered Breccia	0.9-2.3	1.4-2.1	-	-	2.1-2.4	-	-
Weathered Sandstone	-	-	1.5-2.2	1.1-2.2	-	-	-
Groundwater	NE	NE	NE	NE	NE	NE	NE

The Trial Pit locations are shown on Figure 2.

### Topsoil

The topsoil was typically ploughed except in the area of TP5, which had an established cover of grass.

### Made Ground

Trial Pit 5 encountered two layers of made ground:

- Made Ground 1: Described as stiff red brown very sandy slightly gravelly clay/silt, with gravel of sub rounded to sub angular Culm Sandstone.
- Made Ground 2: Soft to firm red brown very sandy silty slightly gravelly clay. Occasional plastic bag. This may represent a relic topsoil layer.

### Colluvium

This was typically described as firm red brown very gravelly silty sandy clay. This is probably washed down from Terrace Gravel 2 located topographically higher.

### **Head deposits**

These were typically described as soft to firm red brown very sandy slightly gravelly clay with gravel of sub angular Culm Sandstone. Bioturbation was noted within the Head deposits in TP3.

### **River Terrace Deposits**

Two areas of River Terrace Deposits have been identified.

River Terrace 1 was encountered in Trial Pit 6 was described as a very compact sandy gravel located in the valley bottom. This is not shown on the geological mapping within Field 1 but is mapped to the immediate north of the A361 and is likely to be associated with the River Lowman.

River Terrace 2 was encountered in Trial Pit 1 within Field 3 at the topographic high on the site. The deposit was described as compact light brown clayey silty sandy gravel of sub angular to sub rounded Culm Sandstone and quartzite.

### **Exeter Group Sandstone and Breccia**

Weathered Breccia was encountered in Trial Pits 1, 2 and 5. This was described as very stiff red brown very gravelly sandy silty CLAY. The gravel is sub-rounded to sub angular quartzite and Culm Sandstone, with occasional cobble of sandstone.

Weathered Sandstone deposits were encountered in Trial Pits 3 and 4. These were variably described as moderately compact red brown clayey silty SAND. The sand was fine to coarse and rounded.

### **Soakaway Testing**

Six soakaway tests were conducted in general accordance with BRE365. The following table presents the results of the testing:

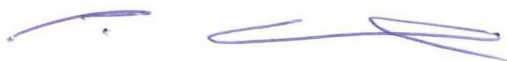
<b>Trial Pit</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
Depth	2.3	2.1	2.2	1.65	2.4	2.4
Stratum	Terrace 2 /Breccia	Breccia	Sandstone	Sandstone	Breccia	Terrace 1
Test 1 (m/s)	75% Effective Depth not reached	22hrs to reach 75% Effective Depth	Collapsed half way through test. Extrapolated result 2.5E-06	2.48E-06	75% Effective Depth not reached 60mm drop in 2.8hrs before side wall collapse.	3.05E-05
Test 2 (m/s)	-	-	1.38E-06	2.02E-06	-	4.62E-05
Test 3 (m/s)	-	-	-	-	-	1.86E-05

The above results confirm that the clayey matrix of Terrace Deposits 2, weathered Breccia and Sandstone limit the soil infiltration characteristics, particularly when CIRIA 156 soakaway factors of safety are taken into consideration.

The relatively clean sandy gravels encountered in Trial Pit 6 provide soil infiltration factors that are considered viable. A similar stratum was observed in TP7 in the field to the east of Field 1. This area is relatively low lying and may be prone to seasonal fluctuations in groundwater levels. It is recommended that groundwater monitoring wells are installed within the lower area to determine depth of unsaturated zone and therefore likely storage potential for soakaways.

Please do not hesitate to call if you have any queries.

Yours sincerely



Philip Curtis – Director  
**for and on behalf of Geo Consulting Engineering Ltd**

Enc. Site Location and Layout Plans, Soakaway Test Results, Trial Pit Records

General data

Title of investigation:	Tiverton EUE
Report number:	GCE00234
Name of client:	Wadderton Park Ltd
Date:	30/10/2012

Samples	Symbol
Soils	
Disturbed small bag	D
Glass Jar disturbed	GJ
Plastic Jar disturbed	PJ
Bulk bag disturbed	B
Undisturbed 100mm	U
Undisturbed Piston 100mm	P
Waters	
Water Glass	WG
Water Plastic	WP
Volatile Vial	WV

Test Results	
Standard Penetration Test split spoon	S
Standard Penetration Test solid cone	C
Field Vane	V

Drilling Records	
Total core recovery %	TCR
Solid core recovery %	SCR
Rock quality designation %	RQD
Fracture spacing mm	If


Title of investigation: Tiverton EUE	Report number: GCE00234	Name of client: Wadderton Park Ltd
Ground Level (mASD):		Trial Pit:1

Sampling		Base Depth	Base Level	Legend	Description
Depth	Type	m	mASD		
		0.4	-0.4		Ploughed soft brown gravelly clayey sandy silt with occasional cobble. (Topsoil)
		0.9	-0.9		Compact light brown clayey silty sandy GRAVEL. Gravel sub-angular to sub-rounded Culm Sandstone and quartzite. (Terrace Deposits)
		2.3	-2.3		Very stiff red brown very gravelly sandy silty CLAY. Gravel sub rounded to sub angular quartzite, Culm Sandstone. Occasional cobble of blocky sandstone. (Exeter Group - Weathered Breccia)

Stability	Generally stable
Groundwater	None encountered
General Remarks	Soakaway test undertaken.
	Pit 2.5m long and 0.6m wide.
Date:	30/10/2012

Title of investigation: Tiverton EUE	Report number: GCE00234	Name of client: Wadderton Park Ltd
Ground Level (mASD):		Trial Pit:2

Sampling		Base Depth	Base Level	Legend	Description
Depth	Type	m	mASD		
		0.45	-0.45		Ploughed soft brown gravelly sandy clayey silt. (Topsoil)
		0.55	-0.55		Firm light brown slightly gravelly clayey silt (Sub-soil)
		1.4	-1.4		firm red brown very gravelly silty sandy CLAY. (Colluvium)
		2.1	-2.1		Firm to Stiff red brown gravelly silty CLAY with partings of fine rounded sand. (Exeter Group- Weathered Breccia)

Stability	Generally stable
Groundwater	None encountered.
General Remarks	Soakaway test undertaken.
	Pit 2.3m long and 0.6m wide.
Date:	30/10/2012

Title of investigation: Tiverton EUE	Report number: GCE00234	Name of client: Wadderton Park Ltd
Ground Level (mASD):		Trial Pit:3

Sampling		Base Depth	Base Level	Legend	Description
Depth	Type	m	mASD		
		0.2	-0.2		Ploughed soft brown gravelly sandy clayey silt. (Topsoil)
		0.3	-0.3		Firm light brown gravelly sandy clayey silt (Sub-soil)
		1.5	-1.5		Soft to firm red brown very sandy slightly gravelly silty CLAY. Gravel sub-angular Culm Sandstone. Vertical Bioturbation burrows evident. (Head)
		2.2	-2.2		Moderately compact red brown clayey silty SAND. Sand fine to coarse rounded within laminations of clay. (Exeter Group - Weathered Sandstone)

Stability	Generally stable
Groundwater	None encountered
General Remarks	Soakaway test undertaken. Trial pit 2.5m long and 0.6m wide.
Date:	30/10/2012



Title of investigation: Tiverton EUE	Report number: GCE00234	Name of client: Wadderton Park Ltd
Ground Level (mASD):		Trial Pit:4

Sampling		Base Depth	Base Level	Legend	Description
Depth	Type	m	mASD		
		0.2	-0.2		Ploughed soft brown gravelly sandy clayey silt. (Topsoil)
		0.35	-0.35		Firm light brown gravelly sandy clayey silt (Sub-soil)
		1.1	-1.1		Moderately compact red brown very clayey silty SAND. Sand fine rounded and gravel fine to medium. (Head)
		2.2	-2.2		Moderately compact red brown slightly clayey very silty SAND. Sand fine to coarse rounded. (Exeter Group Weathered Sandstone)

Stability	Generally stable
Groundwater	None encountered
General Remarks	Soakaway test undertaken.
	Trial pit 2.1m long and 0.6m wide.
Date:	30/10/2012

Title of investigation: Tiverton EUE	Report number: GCE00234	Name of client: Wadderton Park Ltd
Ground Level (mASD):		Trial Pit:5

Sampling		Base Depth	Base Level	Legend	Description
Depth	Type	m	mASD		
		0.05	-0.05		Grass over wet brown gravelly sandy silty clay with rootlets. (Topsoil)
		0.3	-0.3		Firm brown friable gravelly sandy silty clay with occasional rootlets (Sub-soil)
		1.4	-1.4		Made Ground: Stiff red brown very sandy slightly gravelly clay/silt. Gravel sub rounded to sub angular Culm Sandstone.
		2			Made Ground: soft to firm red brown very sandy silty slightly gravelly clay. Occasional plastic bag.
		2.1			Firm to stiff apparent laminations, red brown slightly gravelly silty CLAY with partings of fine rounded sand. Occasional cobble of Culm Sandstone. (Head)
		2.4	-2.4		Stiff red brown apparent laminations slightly gravelly silty clay with partings of sand. Gravel and cobble of sub rounded Culm Sandstone. (Exeter Group - Weathered Breccia)

Stability	Generally stable
Groundwater	None encountered
General Remarks	Soakaway test undertaken. Trial pit 2.2m long and 0.6m wide.
Date:	30/10/2012

Title of investigation: Tiverton EUE	Report number: GCE00234	Name of client: Wadderton Park Ltd
Ground Level (mASD):		Trial Pit:6

Sampling		Base Depth	Base Level	Legend	Description
Depth	Type	m	mASD		
		0.3	-0.3		Ploughed brown friable slightly gravelly slightly sandy clayey silt with mixed rootlets. (Topsoil)
		0.8	-0.8		Compact brown clayey sandy GRAVEL of sub angular and sub rounded Culm Sandstone. (Colluvium)
		1.3	-1.3		Firm to stiff red brown mottled orange brown fissured slightly sandy silty slightly gravelly CLAY with gravel size lenses of fine rounded sand. (Colluvium)
		1.8	-1.8		Compact light brown and red brown silty very gravelly SAND. Gravel sub angular to sub rounded blocky Culm Sandstone. (River Terrace - Sand)
		2.4	-2.4		Very compact brown 'wet' slightly clayey very sandy GRAVEL. Occasional cobble of sub rounded sub angular Culm Sandstone. (River Terrace - Gravel)

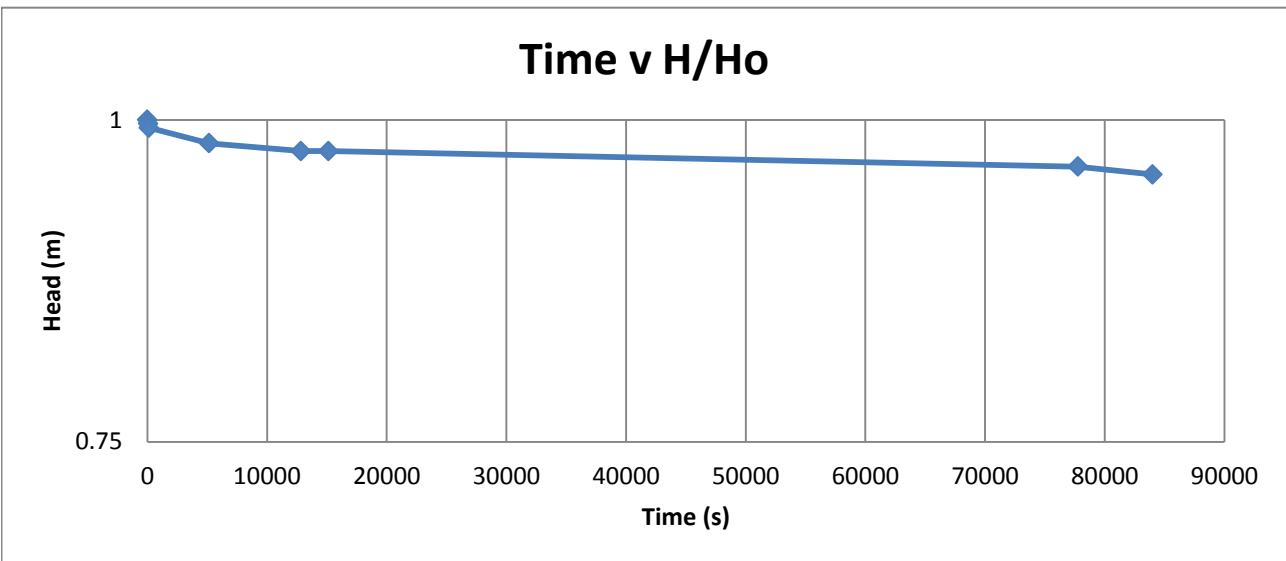
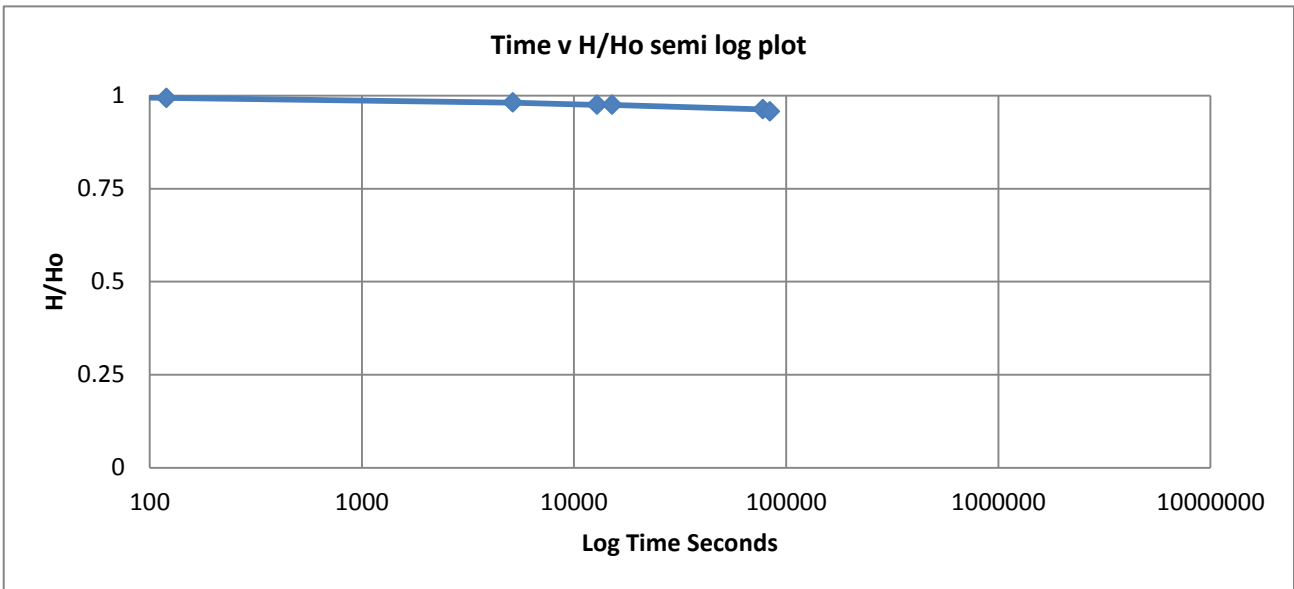
Stability	Generally stable
Groundwater	None encountered
General Remarks	Soakaway test undertaken.
	Trial pit 2.2m long and 0.6m wide.
Date:	30/10/2012

Title of investigation: Tiverton EUE	Report number: GCE00234	Name of client: Wadderton Park Ltd
Ground Level (mASD):		Trial Pit:7

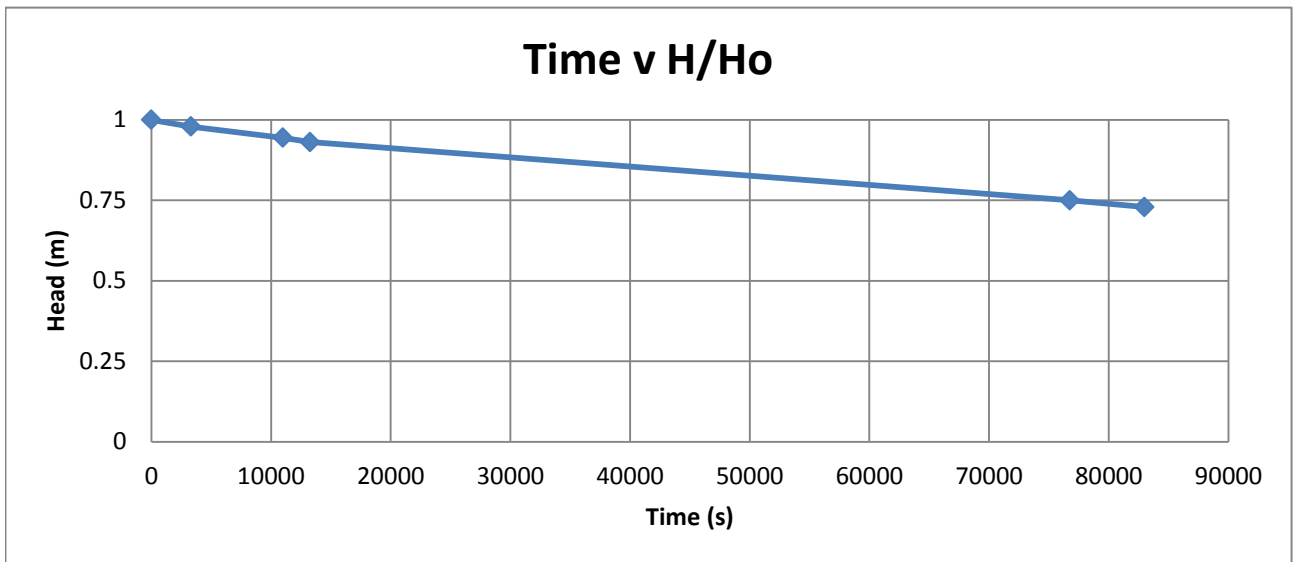
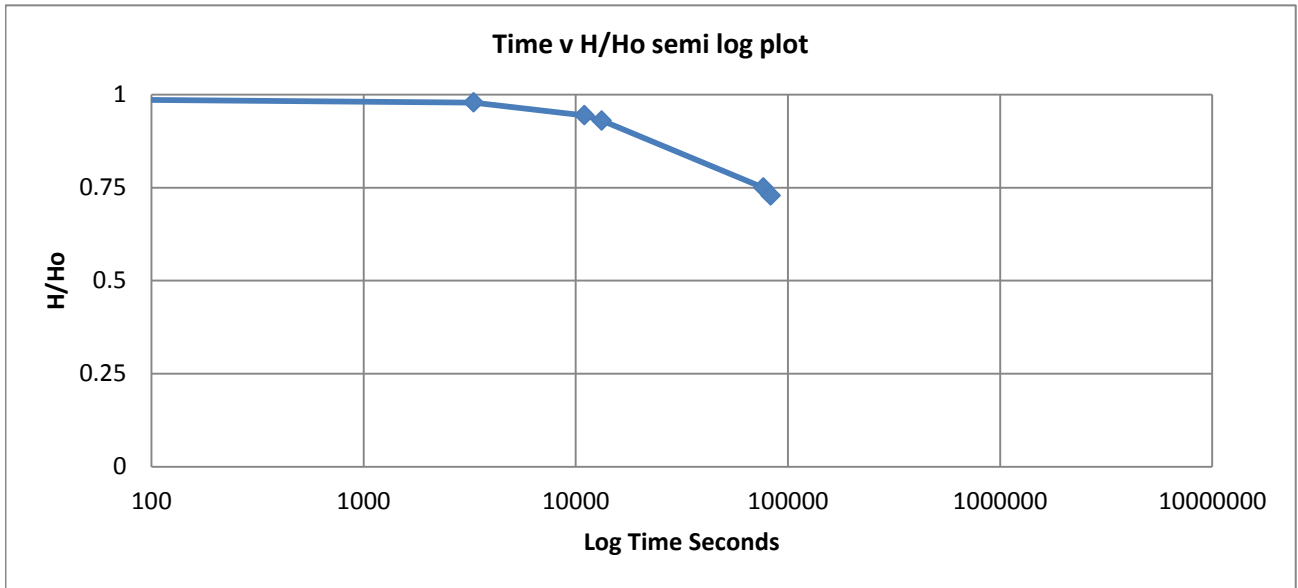
Sampling		Base Depth	Base Level	Legend	Description
Depth	Type	m	mASD		
		0.3	-0.3		Ploughed brown friable slightly gravelly slightly sandy clayey silt with mixed rootlets. (Topsoil)
		1.1	-1.1		Firm light brown slightly gravelly slightly sandy silty CLAY. (Head
		2.1	-2.1		Firm to stiff red brown mottled orange brown fissured slightly sandy silty slightly gravelly CLAY with gravel size lenses of fine rounded sand. (Colluvium)
		2.5	-2.5		Very compact brown 'wet' slightly clayey very sandy GRAVEL. Occasional cobble of sub rounded sub angular Culm Sandstone. (River Terrace - Gravel)

Stability	Generally stable
Groundwater	None encountered
General Remarks	Excavated at north end of archaeological excavation mid way along field.
Date:	02/11/2012



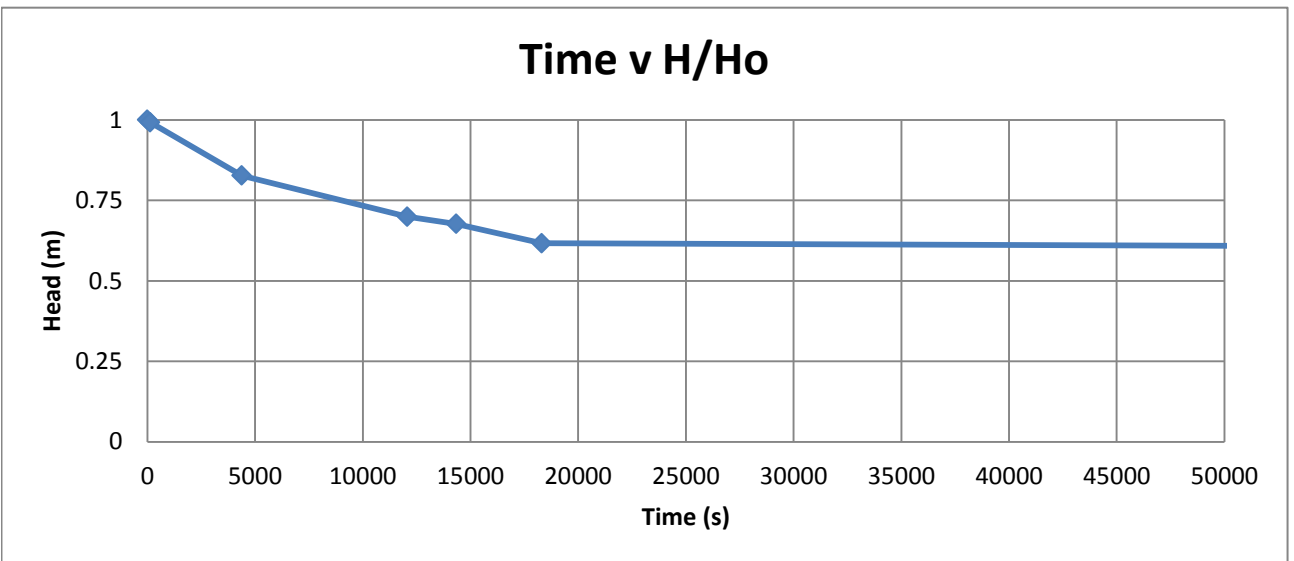
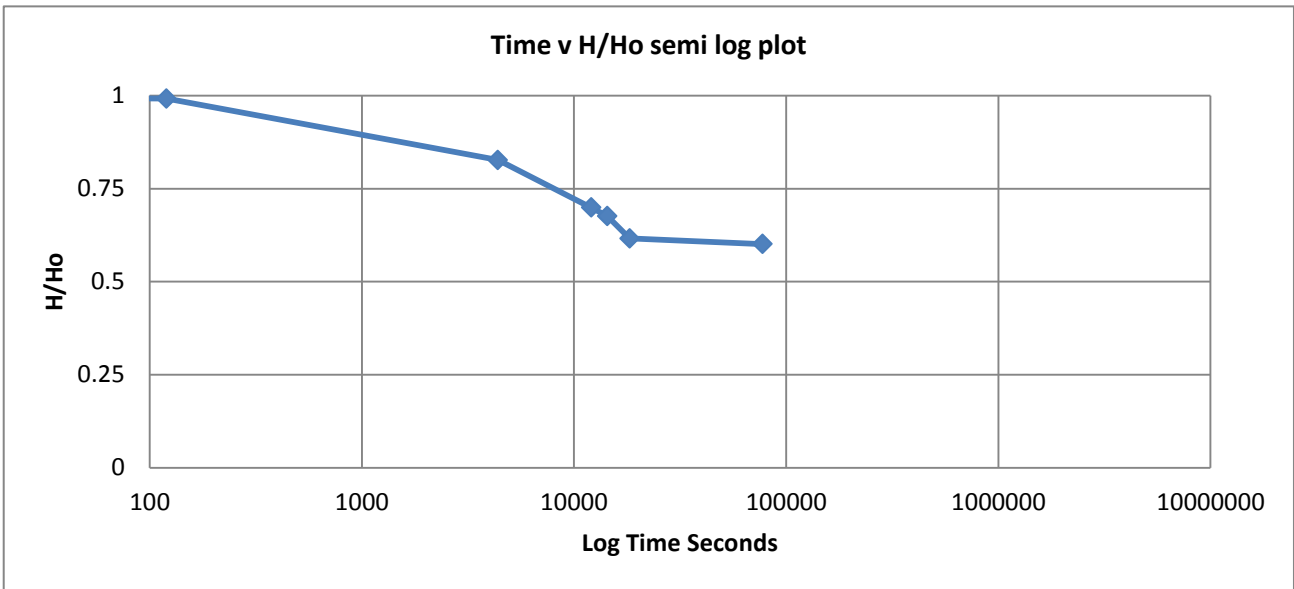




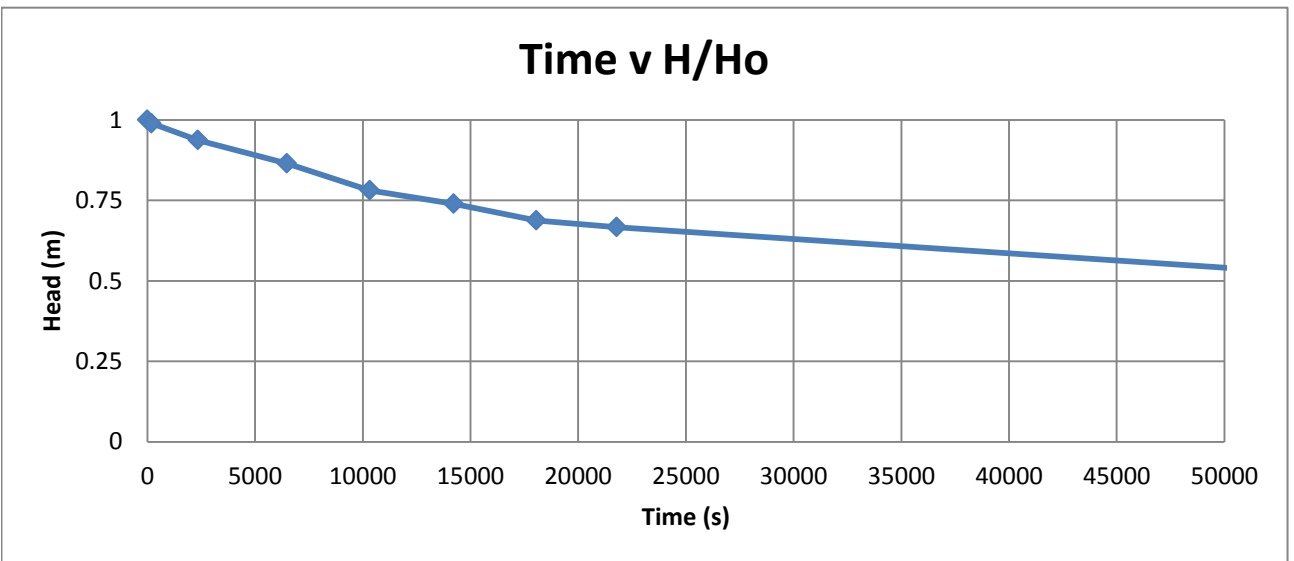
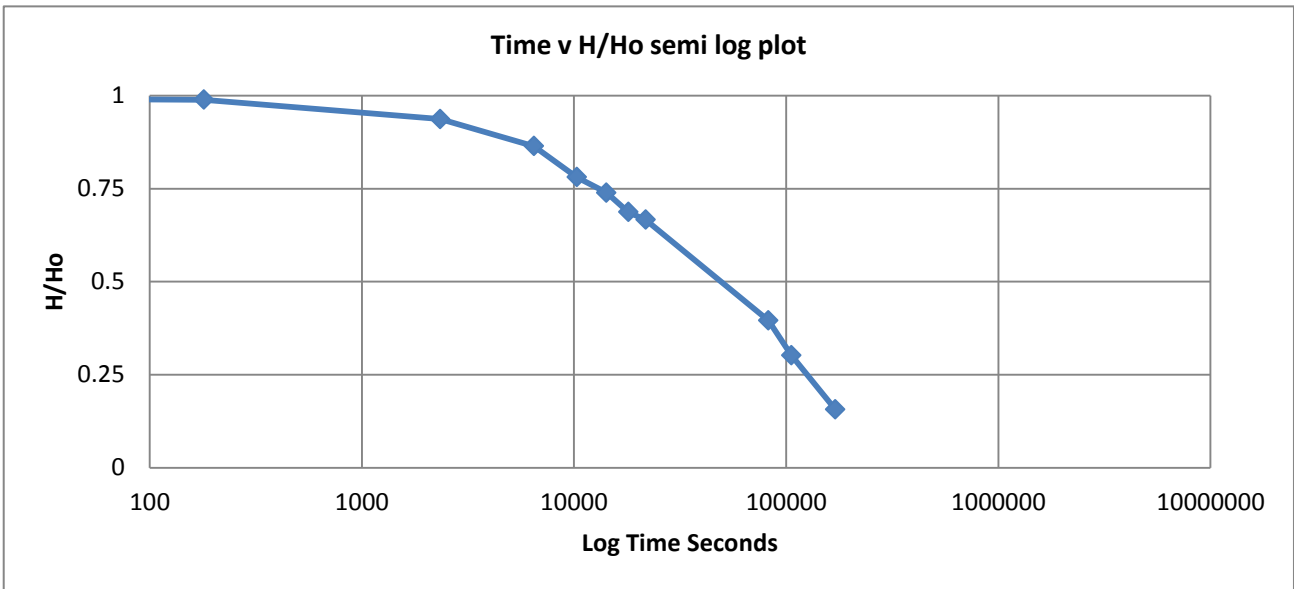




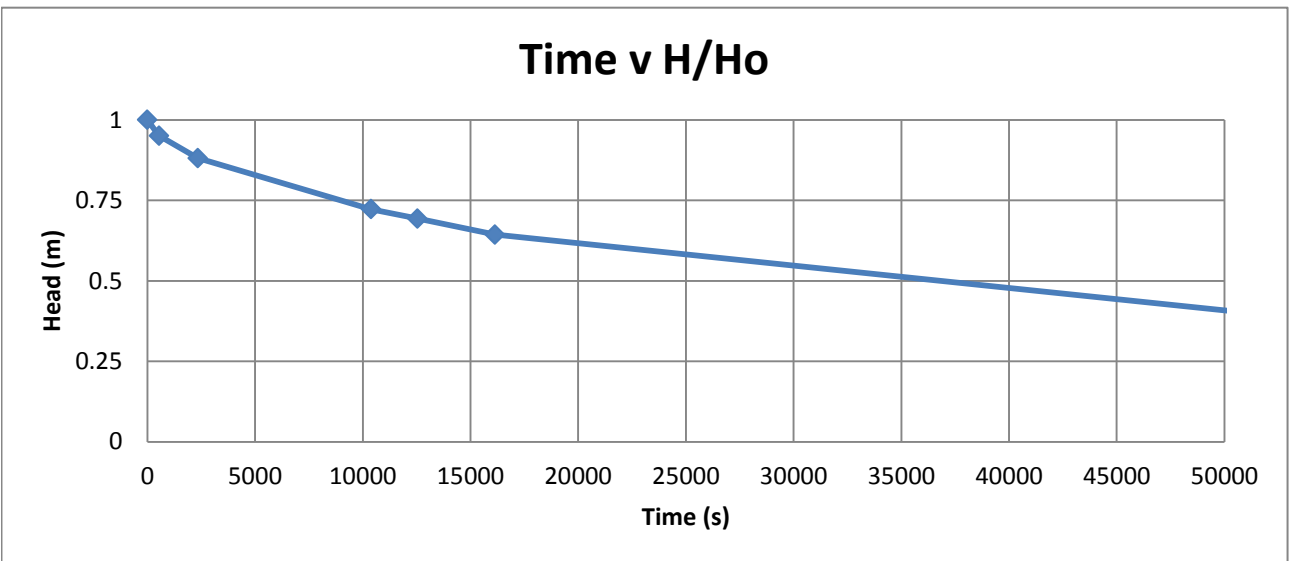
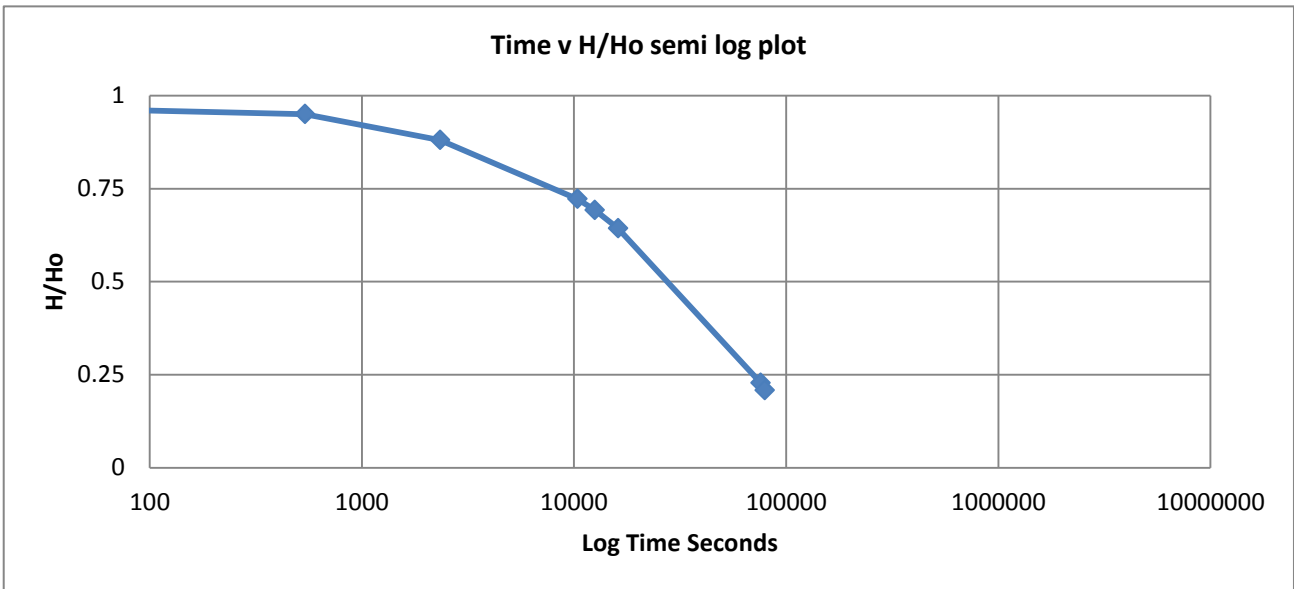




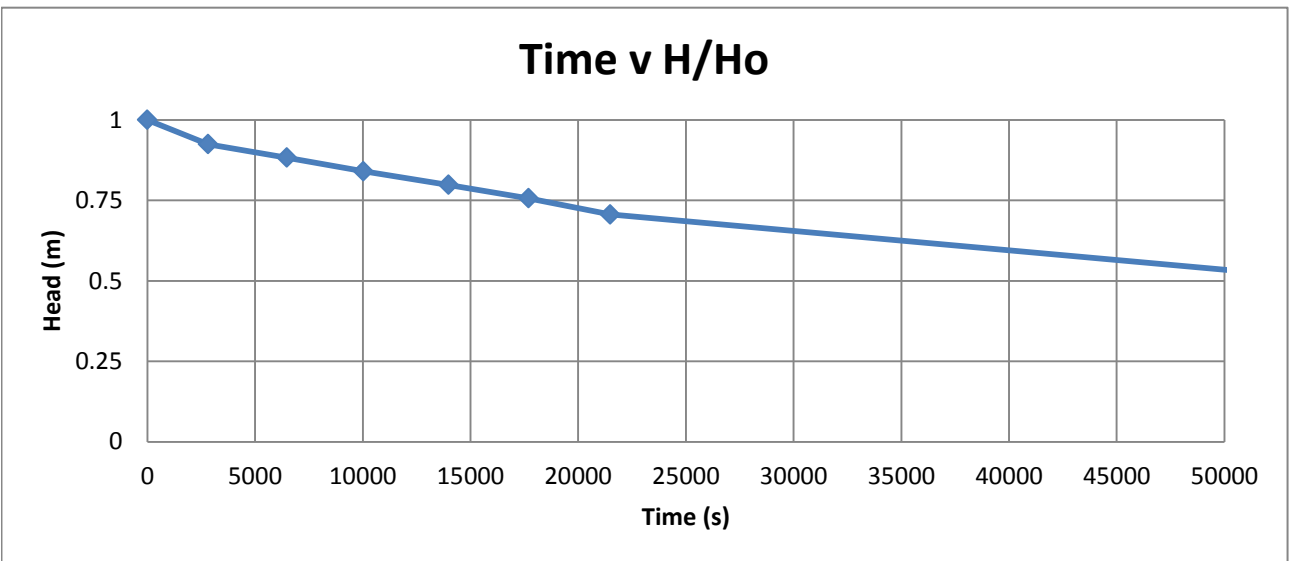
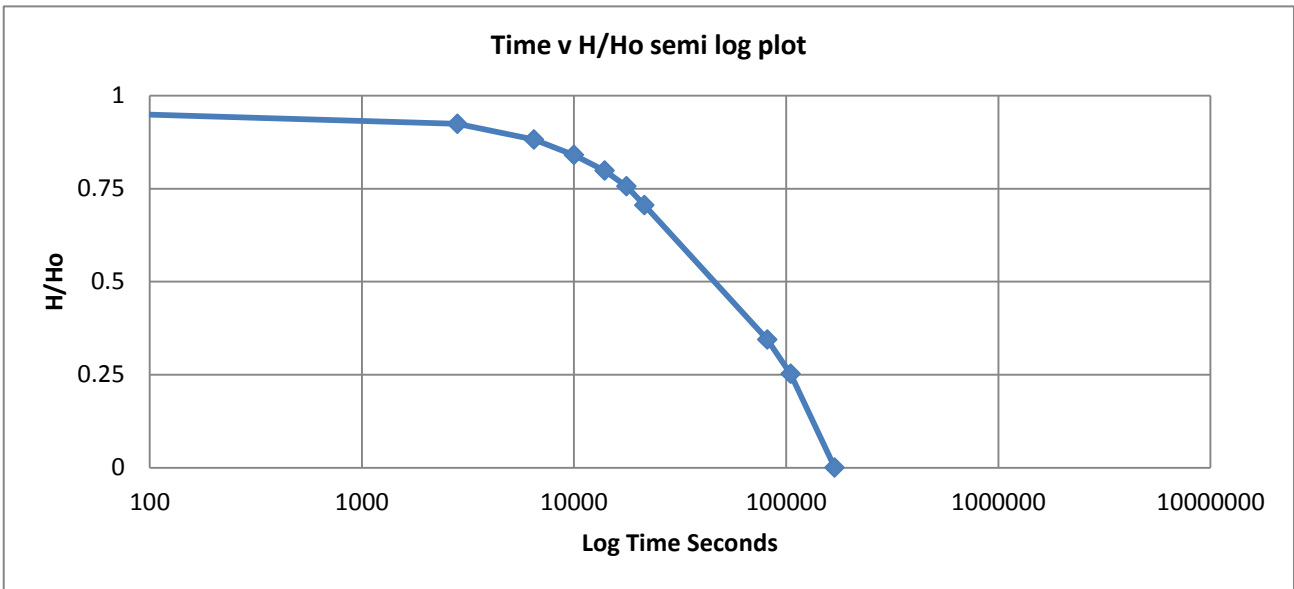






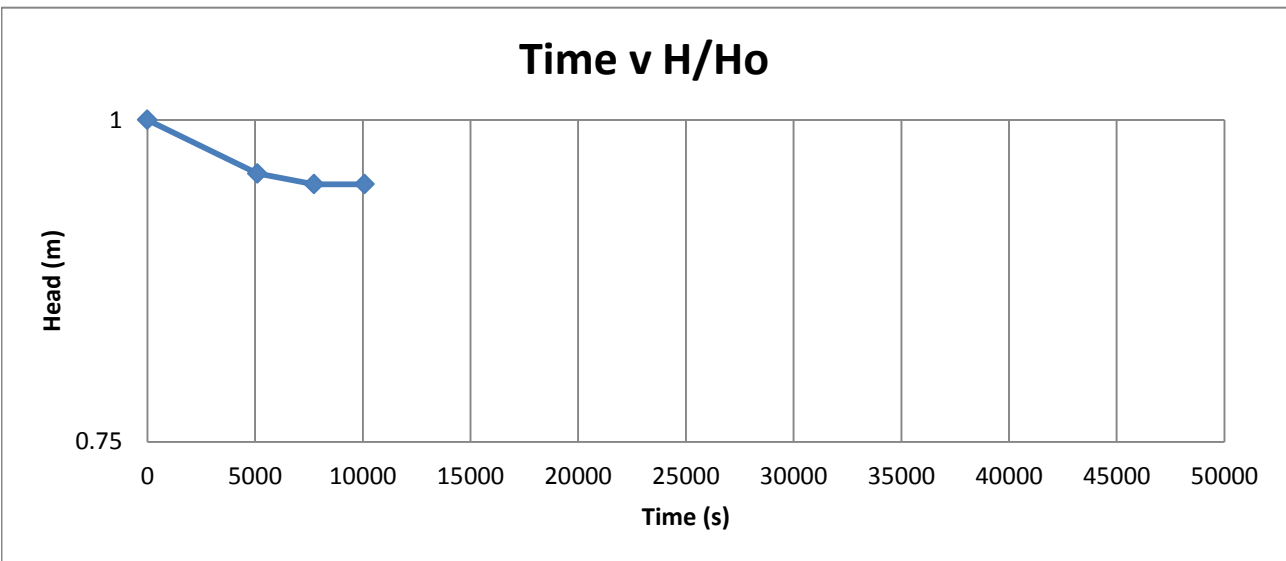
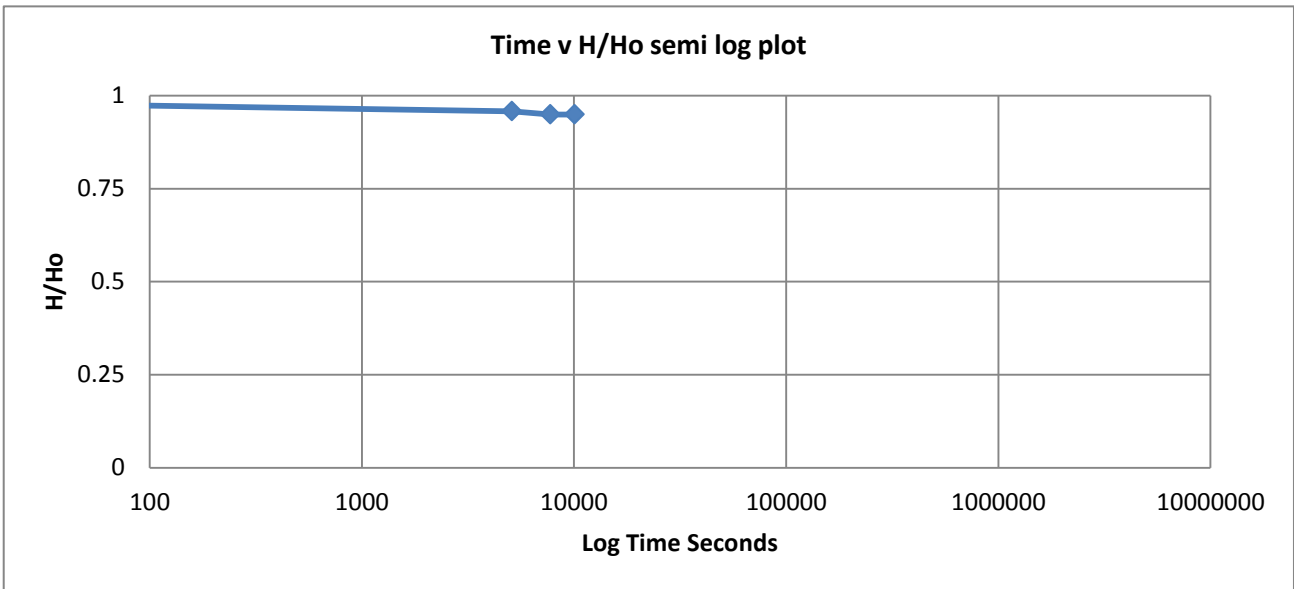












Soakaway Test:

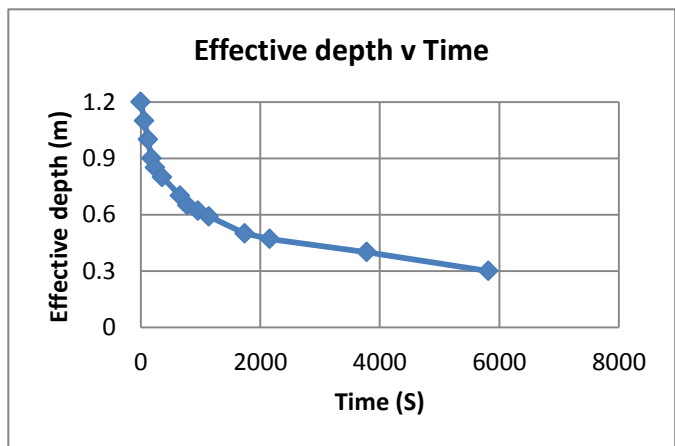
Trial Pit.	6
Test No.	1

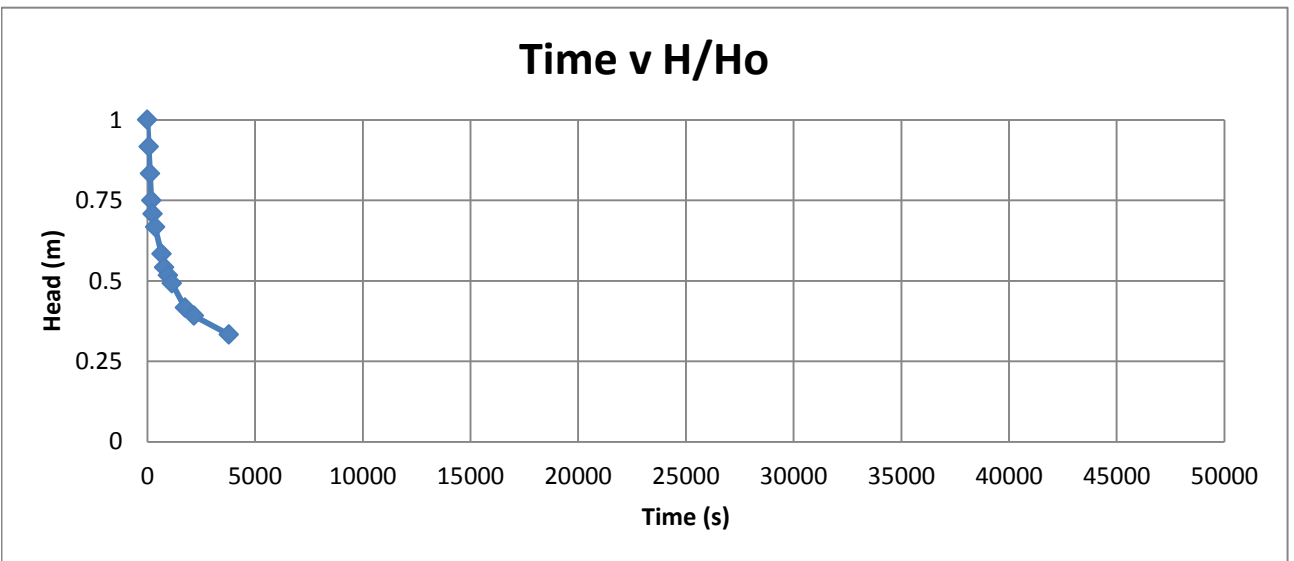
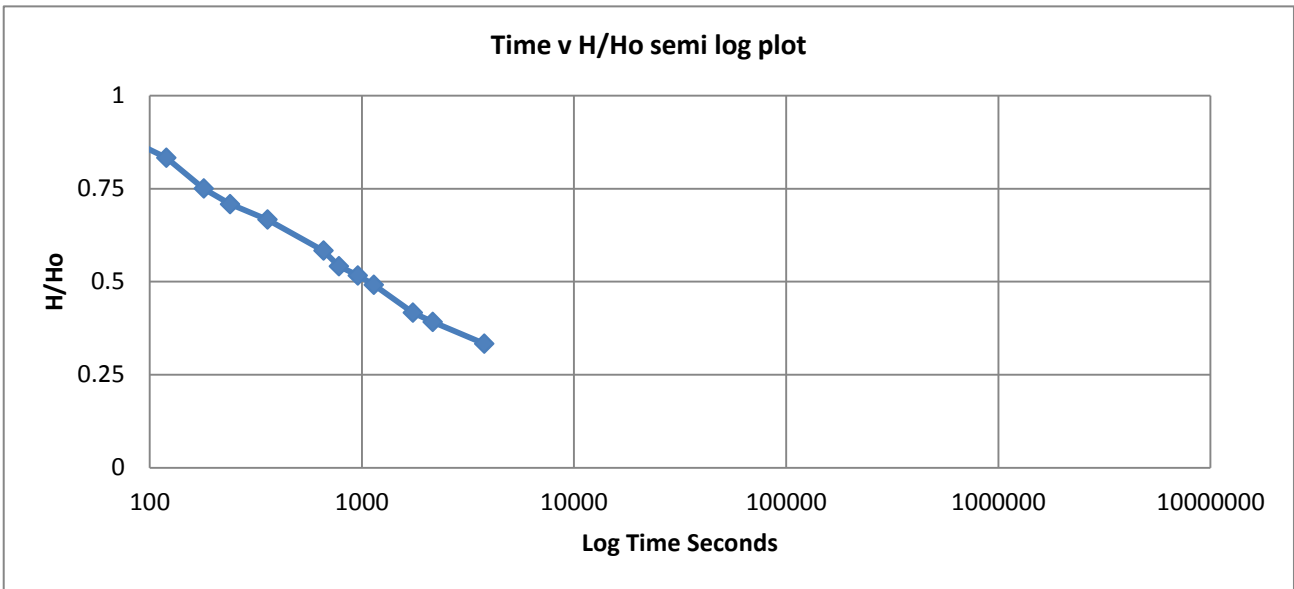
Dimensions:

Length	2.5	m
Width	0.6	m
Depth	2.4	m
Start water depth	1.2	m
Effective Depth	1.2	m

			Depth	Effect	Head		
Time	Time	Seconds	m	Depth		Seconds	H/Ho
13:11:00	0.549	0	1.2	1.2	1.2	0.1	1
13:12:00	0.550	60	1.3	1.1	1.1	60	0.916667
13:13:00	0.551	120	1.4	1	1	120	0.833333
13:14:00	0.551	180	1.5	0.9	0.9	180	0.75
13:15:00	0.552	240	1.55	0.85	0.85	240	0.708333
13:17:00	0.553	360	1.6	0.8	0.8	360	0.666667
13:22:00	0.557	660	1.7	0.7	0.7	660	0.583333
13:24:00	0.558	780	1.75	0.65	0.65	780	0.541667
13:27:00	0.560	960	1.78	0.62	0.62	960	0.516667
13:30:00	0.563	1140	1.81	0.59	0.59	1140	0.491667
13:40:00	0.569	1740	1.9	0.5	0.5	1740	0.416667
13:47:00	0.574	2160	1.93	0.47	0.47	2160	0.391667
14:14:00	0.593	3780	2	0.4	0.4	3780	0.333333
14:48:00	0.617	5820	2.1	0.3	0.3	5820	0.25

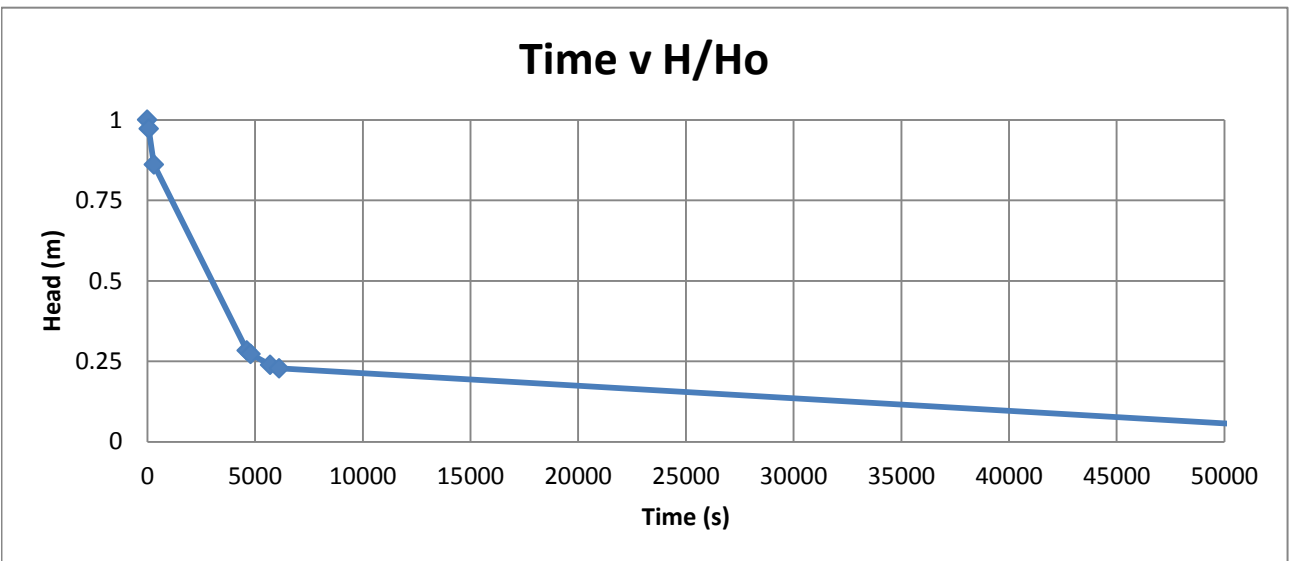
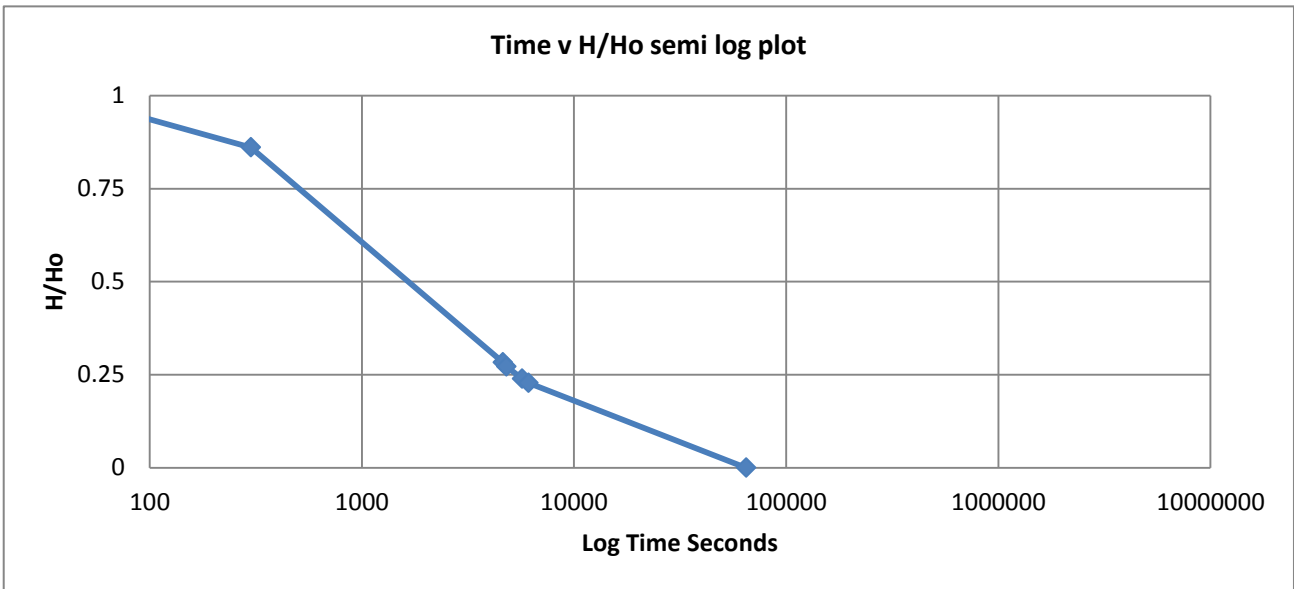
	Depth	Time
Effective Depth %	m	Seconds
75	0.9	180
25	0.3	5820
	Vp75-25	tp75-25
Sum	0.9	5640
Base	1.5	m <sup>2</sup>
Side long	1.5	m
Side short	0.36	m
ap50	5.22	m <sup>2</sup>
<b>Soil Infiltration Rate</b>	<b>3.057E-05</b>	<b>m/s</b>





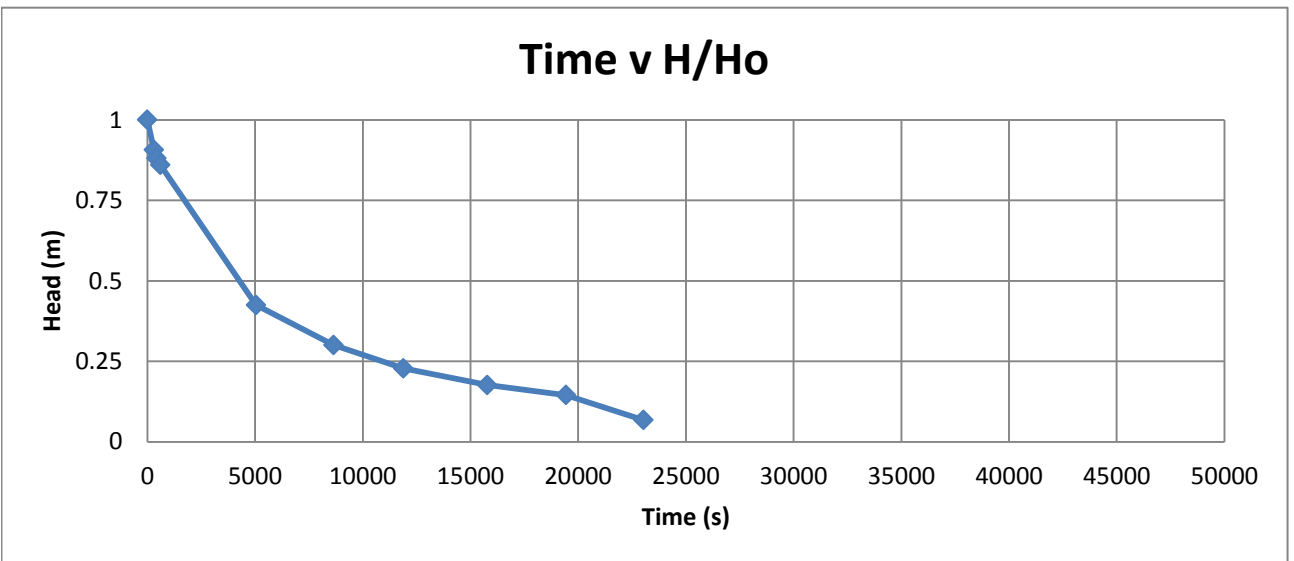
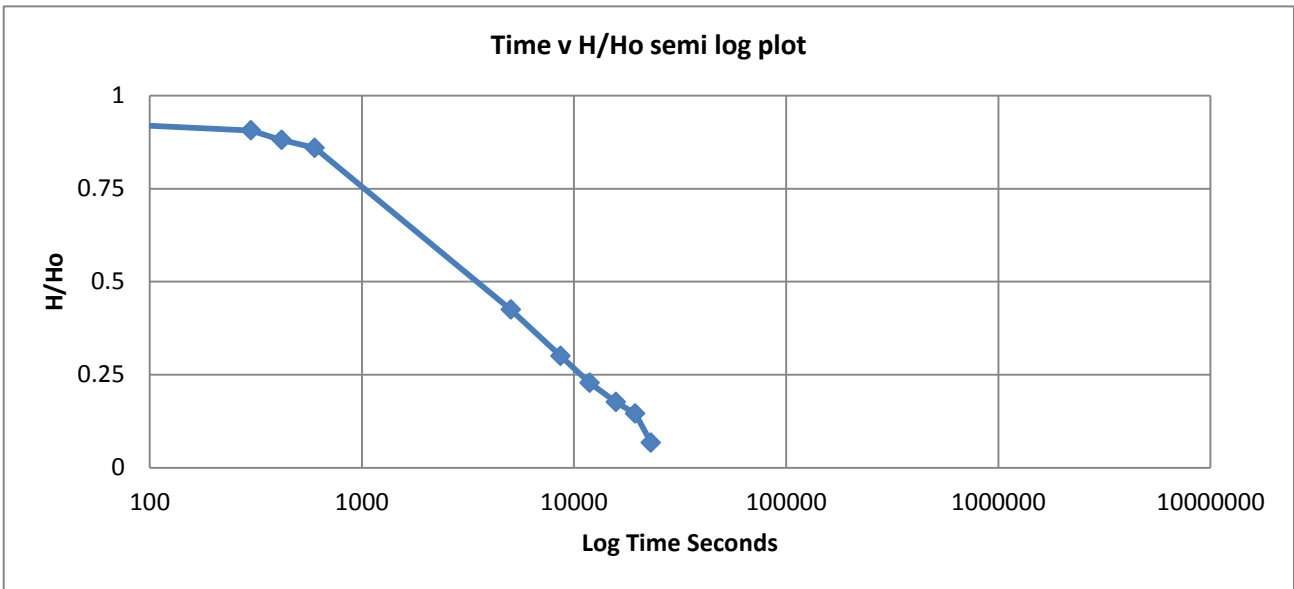


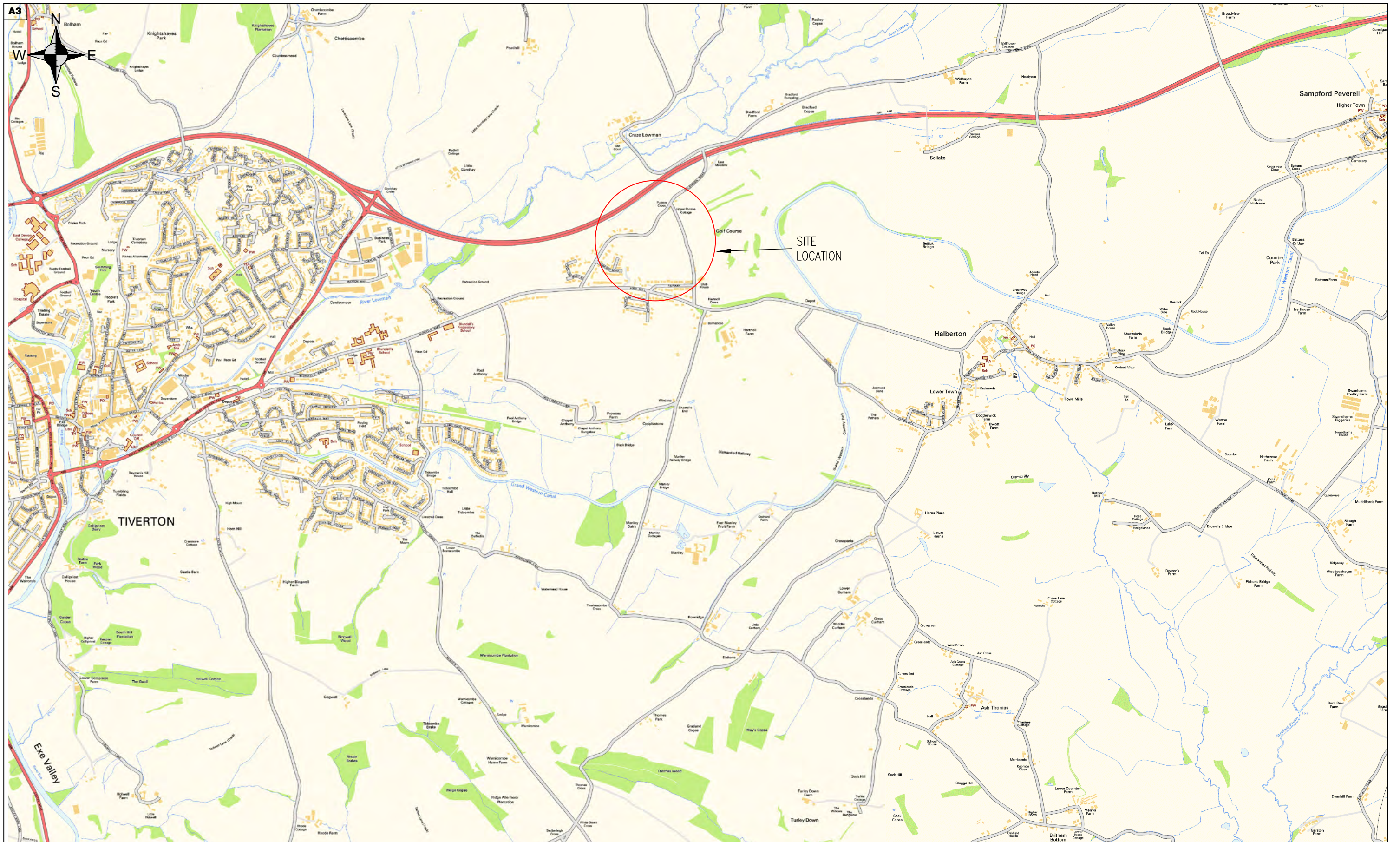












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Job Title:  
**Tiverton EUE  
 Tiverton**

Client:  
**Waddeton Park Ltd**

Dwg Title:  
**Site  
 Location Plan**

Drawing Status  
**For Information**

Scale ..... 1:20000 @ A3 Drawn ..... PC  
 Date ..... Nov. 2012 ..... Checked ..... DLJ

Drawing no:  
**GCE00234-Fig1** Rev -



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Job Title:  
**Tiverton EUE  
 Tiverton**

Client:  
**Waddeton Park Ltd**

Dwg Title:  
**Trial Pit  
 Location Plan**

Drawing Status  
**For Information**

Scale ..... 1:2000 @ A3 ..... Drawn ..... PC .....  
 Date ..... Nov. 2012 ..... Checked ..... DLJ .....

Drawing no:  
**GCE00234-Fig2**      Rev -