SELECT	cells that are highlighted blue contain a dropdown menu click to select one option from the list
guidance document link	cells that contain underlined text click to access relevant guidance documents for this section
Table heading *	table headings followed by a symbol have an associated footnote or instructions
Cells with red indicator in top right corner	cells that have a red indicator in the top right corner contain a comment box with further instructions or clarification

Please note an interpretation of results is still required. This should be entered in the additional information/comments boxes within the templates. Please size these boxes appropriately to fit your interpretation, if additional space is required please include an appendix to the AER template and merge it as part of the AER PDF document. The excel template should have all cells sized appropriately so that all text is readable before it is converted to PDF document.

Facility Information Summary	
AER Reporting Year	2014
Licence Register Number	W0041-01
Name of site	Enva Ireland Ltd
Site Location	Smithstown Industrial Estate, Shannon, Co. Clare
NACE Code	E38
Class/Classes of Activity	Class 6: Biological treatment not referred to elsewhere in this Schedule which results in final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1 to 10 of this schedule. Class 7: Physico-chemical treatment not referred to elsewhere in this Schedule (including evaporation, drying and calcination) which results in final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1 to 10 of this Schedule. Class 11: Blending or mixture prior to submission to any activity referred to in a preceding paragraph of this Schedule. Class 12: Repackaging prior to submission to any activity referred to in a preceding paragraph of this Schedule. Class 13: Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced. Licensed waste recovery activities, in accordance with the Fourth Schedule of the Waste Management Act, 1996 Class 2: Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes). Class 3: Recycling or reclamation of metals and metal compounds. Class 4: Recycling or reclamation of other inorganic materials. Class 8: Oil re-refining or other re-uses of oil.
National Grid Reference (6E, 6 N)	140778.83E, 163241.64N

A description of the activities/processes at the site for the reporting year. This should include information such as production increases or decreases on site, any infrastructural changes, environmental performance which was measured during the reporting year **and an overview of compliance with your licence** listing all exceedances of licence limits (where applicable) and what they relate to e.g. air, water, noise.

Site Performance: The company continues to demonstrate its commitment towards HSE management standards - ISO14001 re-certification achieved in 2014, with no non-conformances raised. **Infrastructure / EMP progress:** In 2014 a system was installed for storage and reuse of reject mains water from deionisation units. This water is used on site in the preparation of lime slurry for use in physical chemical treatment processing. Yard integrity improvement works have continued throughout the year, and focused primarily on the rear yard area, further works focusing on the lower yard area are scheduled for 2015. CCTV cameras have been installed in bulk storage areas, providing remote access to monitor the area during out of hours. All licence required testing continues to be carried out by accredited laboratories. **Environmental Performance:** A non-conformance was issued in November for over 6 months stock on site. This stock is primarily made up of old legacy waste and requires specialised projects to dispose of. Stock levels on site continue to be analysed and monitored closely, performance continues to be reported monthly to the Agency, and two full-scale stock audits are carried out per year. There were 3 incidents in 2014 which were reported to the EPA in timely fashion and corrective and preventative actions implemented to address the incidents.

Declaration:

All the data and information presented in this report has been checked and certified as being accurate. The quality of the information is assured to meet licence requirements.

_____	_____
Signature Group/Facility manager (or nominated, suitably qualified and experienced deputy)	Date

AIR-summary template	Lic No:	W0041-01	Year	2014

Answer all questions and complete all tables where relevant

			Additional information
1	Does your site have licensed air emissions? If yes please complete table A1 and A2 below for the current reporting year and answer further questions. If **you do not have** licenced emissions and **do not complete a solvent management plan** (table A4 and A5) you do not need to complete the tables	Yes	Air monitoring is completed quaterly to demonstrate compliance with a set of emission limit values as specified in our site licence.

Periodic/Non-Continuous Monitoring

2	Are there any results in breach of licence requirements? If yes please provide brief details in the comment section of TableA1 below	No	
3	Was all monitoring carried out in accordance with EPA guidance note AG2 and using the basic air monitoring checklist? Basic air monitoring checklist AGN2	Yes	

Table A1: Licensed Mass Emissions/Ambient data-periodic monitoring (non-continuous)

Emission reference no:	Parameter/ Substance	Frequency of Monitoring	ELV in licence or any revision therof	Licence Compliance criteria	Measured value	Unit of measurement	Compliant with licence limit	Method of analysis	Annual mass load (kg)	Comments - reason for change in % mass load from previous year if applicable
	Hydrogen Chloride	Monthly	10	100 % of values < ELV		mg/Nm3	yes	EN 1911-1 to 3:2003	2.1	
	Sulphur oxides (SOx/SO2)	Quaterly	300 mg/m3	100 % of values < ELV		mg/Nm3	yes	TGN 21	24.9	
	Nitrogen oxides (NOx/NO2)	Quaterly	300 mg/m3	100 % of values < ELV		mg/Nm3	yes	EN 14792:2005	0.5	
	Ammonia (NH3)	Monthly	30 mg/m3	100 % of values < ELV		mg/Nm3	yes	EN 14791:2005	2.1	
	Volumetric Flow	Monthly	4000	100 % of values < ELV		Nm3/hour	yes	EN 13284 - 1:2002	12,265	
	TA Luft organic substances class 3	Monthly	50 mg/m3	100 % of values < ELV		mg/Nm3	yes	EN 13649:2001	29.9	

Note 1: Volumetric flow shall be included as a reportable parameter

AIR-summary template	Lic No:	W0041-01	Year	2014

Continuous Monitoring

4	Does your site carry out continuous air emissions monitoring?	No	
	If yes please review your continuous monitoring data and report the required fields below in Table A2 and compare it to its relevant Emission Limit Value (ELV)		
5	Did continuous monitoring equipment experience downtime? If yes please record downtime in table A2 below	No	
6	Do you have a proactive service agreement for each piece of continuous monitoring equipment?	No	
7	Did your site experience any abatement system bypasses? If yes please detail them in table A3 below	No	

Table A2: Summary of average emissions -continuous monitoring

Emission reference no:	Parameter/ Substance	ELV in licence or any revision therof	Averaging Period	Compliance Criteria	Units of measurement	Annual Emission	Annual maximum	Monitoring Equipment downtime (hours)	Number of ELV exceedences in current reporting year	Comments
	SELECT			SELECT	SELECT					
	SELECT				SELECT					
	SELECT				SELECT					
	SELECT				SELECT					
	SELECT				SELECT					

note 1: Volumetric flow shall be included as a reportable parameter.

Table A3: Abatement system bypass reporting table

Bypass protocol

Date*	Duration** (hours)	Location	Reason for bypass	Impact magnitude	Corrective action

* this should include all dates that an abatement system bypass occurred

** an accurate record of time bypass beginning and end should be logged on site and maintained for future Agency inspections please refer to bypass protocol link

AIR-summary template	Lic No:	W0041-01	Year	2014

Solvent use and management on site

8 Do you have a total Emission Limit Value of direct and fugitive emissions on site? if yes please fill out tables A4 and A5

SELECT

Table A4: Solvent Management Plan Summary
Total VOC Emission limit value

Solvent regulations — Please refer to linked solvent regulations to complete table 5 and 6

Reporting year	Total solvent input on site (kg)	Total VOC emissions to Air from entire site (direct and fugitive)	Total VOC emissions as %of solvent input	Total Emission Limit Value (ELV) in licence or any revision therof	Compliance
					SELECT
					SELECT

Table A5: Solvent Mass Balance summary

	(I) Inputs (kg)	(O) Outputs (kg)						
Solvent	(I) Inputs (kg)	Organic solvent emission in waste	Solvents lost in water (kg)	Collected waste solvent (kg)	Fugitive Organic Solvent (kg)	Solvent released in other ways e.g. by-	Solvents destroyed onsite through	Total emission of Solvent to air (kg)
							Total	

AER Monitoring returns summary template-WATER/WASTEWATER(SEWER) Lic No: W0041-01 Year 2014

			Additional information
1	Does your site have licensed emissions direct to surface water or direct to sewer? If yes please complete table W2 and W3 below for the current reporting year and answer further questions. If **you do not have** licenced emissions you only need to complete table W1 and or W2 for storm water analysis and visual inspections	Yes	Condition 7.4 of the Waste Licence requires quarterly monitoring of stormwater discharges. As the majority of stormwater is collected in underground storage tanks and treated on site, stormwater has not been tested historically. There is only small percentage of stormwater released from the site this originates from rainwater run-off from the car-park area and from guttering on some buildings on site.
2	Was it a requirement of your licence to carry out visual inspections on any surface water discharges or watercourses on or near your site? If yes please complete table W2 below summarising only any evidence of contamination noted during visual inspections	No	

Table W1 Storm water monitoring

Location reference	Location relative to site activities	PRTR Parameter	Licenced Parameter	Monitoring date	ELV or trigger level in licence or any revision thereof*	Licence Compliance criteria	Measured value	Unit of measurement	Compliant with licence	Comments
	SELECT	SELECT	SELECT			SELECT		SELECT	SELECT	
	SELECT	SELECT	SELECT			SELECT		SELECT	SELECT	

*trigger values may be agreed by the Agency outside of licence conditions

Table W2 Visual inspections-Please only enter details where contamination was observed.

Location Reference	Date of inspection	Description of contamination	Source of contamination	Corrective action	Comments
			SELECT		
			SELECT		

Licensed Emissions to water and /or wastewater(sewer)-periodic monitoring (non-continuous)

3	Was there any result in breach of licence requirements? If yes please provide brief details in the comment section of Table W3 below		Yes	See complaints-incidents section.
4	Was all monitoring carried out in accordance with EPA guidance and checklists for Quality of Aqueous Monitoring Data Reported to the EPA? If no please detail what areas require improvement in additional information box	External /Internal Lab Quality checklist / Assessment of results checklist	Yes	

Table W3: Licensed Emissions to water and /or wastewater (sewer)-periodic monitoring (non-continuous)

Emission reference no:	Emission released to	Parameter/ SubstanceNote 1	Type of sample	Frequency of monitoring	Averaging period	ELV or trigger values in licence or any revision therof[Note 2]	Licence Compliance criteria	Measured value	Unit of measurement	Compliant with licence	Method of analysis	Procedural reference source	Procedural reference standard number	Annual mass load (kg)	Comments
W1	Wastewater/Sewe	SELECT	SELECT		SELECT		SELECT		SELECT	SELECT	SELECT	SELECT			
	Wastewater/Sewe	volumetric flow	composite	Daily		250m3	No flow value shall exceed the specific limit.		m3/day	yes	Flow meter			65527	
	Wastewater/Sewe	COD	composite	Daily		3000mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	Spectrophotometry (Colorimetry)			67075.2	
	Wastewater/Sewe	BOD	composite	Monthly		2000mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	Titration			9983.65	
	Wastewater/Sewe	Suspended Solids	composite	3/Week		400mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	Gravimetric analysis			5391.197	
	Wastewater/Sewe	Sulphate	composite	Monthly		1500mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	Spectrophotometry (Colorimetry)			10695.6	
	Wastewater/Sewe	Sulphides	composite	Monthly		10mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	Spectrophotometry (Colorimetry)			8.22196	
	Wastewater/Sewe	Detergents (as MBAS)	composite	Monthly		80mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	Spectrophotometry (Colorimetry)			21.5146	
	Wastewater/Sewe	Phenols (as total C)	composite	Monthly		3mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	HPLC			2.78488	
	Wastewater/Sewe	Phosphorous	composite	3/Week		50mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	Spectrophotometry (Colorimetry)			243.721999	
	Wastewater/Sewe	Ammonia (as N)	composite	3/Week		250mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	Spectrophotometry (Colorimetry)			7641.87	
	Wastewater/Sewe	Nitrate (as N)	composite	Monthly		100mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	Spectrophotometry (Colorimetry)			55.4028	
	Wastewater/Sewe	Silver	composite	Monthly		2mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	AAS (Atomic Absorption Spectroscopy)			2.73246	

AER Monitoring returns summary template-WATER/WASTEWATER(SEWER)					Lic No:	W0041-01		Year	2014					
Wastewater/Sewe	Aluminium	composite	Monthly		10mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	ICP / ICPMS (Inductively Coupled Plasma - Mass Spectrometry)			3.122645	
Wastewater/Sewe	Cobalt	composite	Monthly		10mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	AAS (Atomic Absorption Spectroscopy)			3.22278	
Wastewater/Sewe	Cadmium and compounds (as Cd)	composite	Monthly		0.5mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	AAS (Atomic Absorption Spectroscopy)			0.36695	
Wastewater/Sewe	Chromium and compounds (as Cr)	composite	Monthly		1mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	AAS (Atomic Absorption Spectroscopy)			3.649018106	
Wastewater/Sewe	Copper and compounds (as Cu)	composite	Monthly		10mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	AAS (Atomic Absorption Spectroscopy)			8.81826	
Wastewater/Sewe	Iron	composite	Monthly		20mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	AAS (Atomic Absorption Spectroscopy)			94.007	

AER Monitoring returns summary template-WATER/WASTEWATER(SEWER)						Lic No:	W0041-01		Year	2014					
	Wastewater/Sewe	Mercury and compounds (as Hg)	composite	Monthly		.05mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	AFS			0.71794984	
5	Wastewater/Sewe	Nickel and compounds (as Ni)	composite	Monthly		20mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	AAS (Atomic Absorption Spectroscopy)			52.354	
	Wastewater/Sewe	Lead and compounds (as Pb)	composite	Monthly		.5mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	AAS (Atomic Absorption Spectroscopy)			4.52318	
6	Wastewater/Sewe	Tin	composite	Monthly		2mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	ICP / ICPMS (Inductively Coupled Plasma - Mass Spectrometry)			2.39679	
7	Wastewater/Sewe	Zinc and compounds (as Zn)	composite	Monthly		20mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	AAS (Atomic Absorption Spectroscopy)			105.4	
8	Wastewater/Sewe	Arsenic and compounds (as As)	composite	Monthly		1mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	ICP / ICPMS (Inductively Coupled Plasma - Mass Spectrometry)			0.56085	
	Wastewater/Sewe	Cyanides (as total CN)	composite	Monthly		0.5mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	Spectrophotometry (Colorimetry)			3.27634	
	Wastewater/Sewe	Chlorides (as Cl)	composite	Monthly		3000mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	Spectrophotometry (Colorimetry)			24212.7	
	Wastewater/Sewe	Fluorides (as total F)	composite	Monthly		10mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	Spectrophotometry (Colorimetry)			56.8593	
	Wastewater/Sewe	Halogenated organic compounds (as AOX)	composite	Weekly		50mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	GCMS (Gas Chromatography Mass Spectroscopy)			1.931165459	
	Wastewater/Sewe	Fats, Oils and Greases	composite	Monthly		.15mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	IR			467.7787296	
	Wastewater/Sewe	Chromium III	composite	Monthly		10mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	Spectrophotometry (Colorimetry)			3.649018106	
	Wastewater/Sewe	Chromium VI	composite	Monthly		0.5mg/l	All results < 1.2 times ELV, plus 8 from ten results must be < ELV		mg/L	yes	Spectrophotometry (Colorimetry)			1.965801	

Table W5: Abatement system bypass reporting table

Date	Duration (hours)	Location	Resultant emissions	Reason for bypass	Corrective action*	Was a report submitted to the EPA?	When was this report submitted?
						SELECT	

*Measures taken or proposed to reduce or limit bypass frequency

Bund/Pipeline testing template

Lic No: W0041-01 Year 2014

Bund testing — dropdown menu click to see options

			Additional information
1	Are you required by your licence to undertake integrity testing on bunds and containment structures ? if yes please fill out table B1 below listing all **new bunds and containment structures** on site, in addition to **all bunds which failed** the integrity test-**all bunding structures which failed including mobile bunds must be listed in the table below, please include all bunds outside the licenced testing period** (mobile bunds and chemstore included)	Yes	
2	Please provide integrity testing frequency period	3 years	
3	Does the site maintain a register of bunds, underground pipelines (including stormwater and foul), Tanks, sumps and containers? (containers refers to "Chemstore" type units and mobile bunds)	Yes	
4	How many bunds are on site?	30	
5	How many of these bunds have been tested within the required test schedule?	10	Completed in 2014
6	How many mobile bunds are on site?	27	
7	Are the mobile bunds included in the bund test schedule?	Yes	
8	How many of these mobile bunds have been tested within the required test schedule?	0	Completed in 2014
9	How many sumps on site are included in the integrity test schedule?	6	
10	How many of these sumps are integrity tested within the test schedule?	0	
	Please list any sump integrity failures in table B1		
11	Do all sumps and chambers have high level liquid alarms?	No	
12	If yes to Q11 are these failsafe systems included in a maintenance and testing programme?	N/A	
13	Is the Fire Water Retention Pond included in your integrity test programme?	N/A	

Table B1: Summary details of bund /containment structure integrity test

Bund/Containment structure ID	Type	Specify Other type	Product containment	Actual capacity	Capacity required*	Type of integrity test	Other test type	Test date	Integrity reports maintained on site?	Results of test	Integrity test failure explanation <50 words	Corrective action taken	Scheduled date for retest	Results of retest(if in current reporting year)
AQ	reinforced concrete		Localised bunding of mixed plastic IBC/Containers containing liquid and solid waste substances (Additional remote bunding provided on site)	5.627 m3	1.1 m3 (110% largest vess	Other (please specify)	Visual and hydrostatic test	08/08/2014	Yes	Fail	Failed hydrostatic test	Other (please describe)	17/03/2015. Retest complete.	Awaiting report.
	SELECT					SELECT			SELECT	SELECT		SELECT		

* Capacity required should comply with 25% or 110% containment rule as detailed in your licence

			Commentary
15	Has integrity testing been carried out in accordance with licence requirements and are all structures tested in line with BS8007/EPA Guidance? bunding and storage guidelines	Yes	
16	Are channels/transfer systems to remote containment systems tested?	Yes	
17	Are channels/transfer systems compliant in both integrity and available volume?	Yes	

Pipeline/underground structure testing

1	Are you required by your licence to undertake integrity testing* on underground structures e.g. pipelines or sumps etc ? if yes please fill out table 2 below listing all underground structures and pipelines on site **which failed the integrity test and all which have not been tested withing the integrity test period as specified**	Yes	
2	Please provide integrity testing frequency period	Other (please specify)	Every 5 years

*please note integrity testing means water tightness testing for process and foul pipelines (as required under your licence)

Table B2: Summary details of pipeline/underground structures integrity test

Structure ID	Type system	Material of construction:	Does this structure have Secondary containment?	Type of secondary containment	Type integrity testing	Integrity reports maintained on site?	Results of test	Integrity test failure explanation <50 words	Corrective action taken	Scheduled date for retest	Results of retest(if in current reporting year)
	SELECT	SELECT	SELECT	SELECT	SELECT	SELECT	SELECT				SELECT

Please use commentary for additional details not answered by tables/ questions above

Groundwater/Soil monitoring template	Lic No:	W0041-01	Year	2014

			Comments	
1	Are you required to carry out groundwater monitoring as part of your licence requirements?	yes		Please provide an interpretation of groundwater monitoring data in the interpretation box below or if you require additional space please include a groundwater/contaminated land monitoring results interpretaion as an additional section in this AER
2	Are you required to carry out soil monitoring as part of your licence requirements?	no		
3	Do you extract groundwater for use on site? If yes please specify use in comment section	yes	For use in treatment process and flushing	
4	Do monitoring results show that groundwater generic assessment criteria such as GTVs or IGVs are exceeded or is there an upward trend in results for a substance? If yes, please complete the Groundwater Monitoring Guideline Template Report (link in cell G8) and submit separately through ALDER as a licensee return AND answer questions 5-12 below. Groundwater monitoring template	no		Based on the fourth round of quaterly groundwater monitoring, the key VOC concentrations continue to decline across the site. VOC concentrations were broadly low throughout 2014 from MW 3. The four quaterly monitoring results for total VOC concentrations are the lowest reported since monitoring began. Hydrocarbons also continue to decline since 2013.
5	Is the contamination related to operations at the facility (either current and/or historic)	no		
6	Have actions been taken to address contamination issues?If yes please summarise remediation strategies proposed/undertaken for the site	yes	Groundwater extracted 24/7 and filtered through	
7	Please specify the proposed time frame for the remediation strategy	N/A		
8	Is there a licence condition to carry out/update ELRA for the site?	yes		
9	Has any type of risk assesment been carried out for the site?	yes		
10	Has a Conceptual Site Model been developed for the site?	no		
11	Have potential receptors been identified on and off site?	yes		
12	Is there evidence that contamination is migrating offsite?	no		

Table 1: Upgradient Groundwater monitoring results

Date of sampling	Sample location reference	Parameter/ Substance	Methodology	Monitoring frequency	Maximum Concentration++	Average Concentration+	unit	GTV's*	SELECT**	Upward trend in pollutant concentration over last 5 years of monitoring data
10/12/2014	mw5	VOC's		Quarterly	204	109.66	ug/l			no
							SELECT			SELECT

.+ where average indicates arithmetic mean

.++ maximum concentration indicates the maximum measured concentration from all monitoring results produced during the reporting year

Table 2: Downgradient Groundwater monitoring results

Date of sampling	Sample location reference	Parameter/ Substance	Methodology	Monitoring frequency	Maximum Concentration	Average Concentration	unit	GTV's*	SELECT**	Upward trend in yearly average pollutant concentration over last 5 years of monitoring data
10/12/2014	mw6	VOC's		Quarterly	5411	4011	ug/l			no
							SELECT			SELECT

Groundwater/Soil monitoring template	Lic No:	W0041-01	Year	2014

*please note exceedance of generic assessment criteria (GAC) such as a Groundwater Threshold Value (GTV) or an Interim Guideline Value (IGV) or an upward trend in results for a substance indicates that further interpretation of monitoring results is required. In addition to completing the above table, please complete the Groundwater Monitoring Guideline Template Report at the link provided and submit separately through ALDER as a licensee return or as otherwise instructed by the EPA.	Groundwater monitoring template
More information on the use of soil and groundwater standards/ generic assessment criteria (GAC) and risk assessment tools is available in the EPA published guidance (see the link in G31)	Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites (EPA 2013).

**Depending on location of the site and proximity to other sensitive receptors alternative Receptor based Water Quality standards should be used in addition to the GTV e.g. if the site is close to surface water compare to Surface Water Environmental Quality Standards (SWEQS), If the site is close to a drinking water supply compare results to the Drinking Water Standards (DWS)	Surface water EQS	Groundwater regulations GTV's	Drinking water (private supply) standards	Drinking water (public supply) standards	Interim Guideline Values (IGV)

Groundwater/Soil monitoring template Lic No: W0041-01 Year 2014

Table 3: Soil results

Date of sampling	Sample location reference	Parameter/ Substance	Methodology	Monitoring frequency	Maximum Concentration	Average Concentration	unit
							SELECT
							SELECT

Where additional detail is required please enter it here in 200 words or less

URS

Enva Ireland Limited

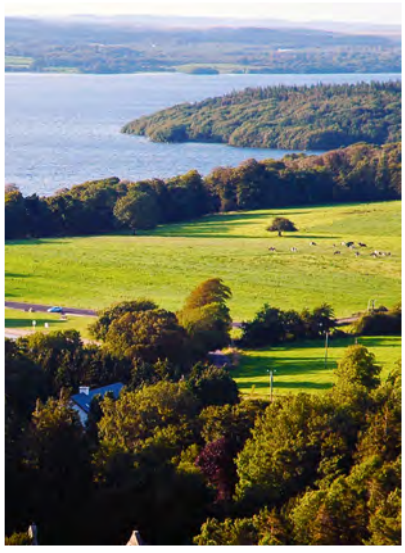
Shannon Hydrogeological Review and Assessment

22 May 2014

47092526
CKRP0006

Prepared for:
Enva Ireland Limited

IRELAND



Issue	Date	Details	Prepared by	Checked by	Approved by
1	22 May2014	Draft Issue for Client Review	Fergus O'Regan Environmental Scientist	Kevin Forde Principal Hydrogeologist	Kevin Forde Principal Hydrogeologist

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Limitations

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The conclusions and recommendations contained in this Report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by URS has not been independently verified by URS, unless otherwise stated in the Report.

The methodology adopted and the sources of information used by URS in providing its services are outlined in this Report. The work described in this Report was undertaken on 17 December 2013 and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

Where assessments of works or costs identified in this Report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

URS disclaim any undertaking or obligation to advise any person of any change in any matter affecting the Report, which may come or be brought to URS' attention after the date of the Report.

Certain statements made in the Report that are not historical facts may constitute estimates, projections or other forward-looking statements and even though they are based on reasonable assumptions as of the date of the Report, such forward-looking statements by their nature involve risks and uncertainties that could cause actual results to differ materially from the results predicted. URS specifically does not guarantee or warrant any estimate or projections contained in this Report.

Unless otherwise stated in this Report, the assessments made assume that the sites and facilities will continue to be used for their current purpose without significant changes.

Where field investigations are carried out, these have been restricted to a level of detail required to meet the stated objectives of the services. The results of any measurements taken may vary spatially or with time and further confirmatory measurements should be made after any significant delay in issuing this Report.

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1. INTRODUCTION

URS Ireland Limited (URS) is pleased to present this report to Enva Ireland Limited (Enva) detailing a hydrogeological review and assessment for the Enva site in Shannon, Co. Clare. This report has been prepared in accordance with URS proposal reference 3134294, dated 22 November 2013; and authorised by Enva under purchase order number 13145.

1.1 Background

Enva provide waste management and environmental solutions covering areas such as treatment and disposal of oil, contaminated soil and hazardous waste, as well as water and effluent treatment. Enva's facility in Shannon is the leading integrated waste chemical treatment and recovery facility in Ireland.

The site operates under a Waste licence (W0041-1) issued by the Environmental Protection Agency (EPA) in 2000.

Licensed waste disposal activities, in accordance with the Third Schedule of the Waste Management Act, 1996 are as follows:

- Class 6: Biological treatment not referred to elsewhere in Schedule 3 which results in final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1 to 10 of Schedule 3
- Class 7: Physico-chemical treatment not referred to elsewhere in Schedule 3 (including evaporation, drying and calcination) which results in final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1 to 10 of Schedule 3
- Class 11: Blending or mixture prior to submission to any activity referred to in a preceding paragraph of Schedule 3
- Class 12: Repackaging prior to submission to any activity referred to in a preceding paragraph of Schedule 3
- Class 13: Storage prior to submission to any activity referred to in a preceding paragraph of Schedule 3, other than temporary storage, pending collection, on the premises where the waste concerned is produced

Licensed waste recovery activities, in accordance with the Fourth Schedule of the Waste Management Act, 1996 are:

- Class 2: Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes)
- Class 3: Recycling or reclamation of metals and metal compounds
- Class 4: Recycling or reclamation of other inorganic materials
- Class 8: Oil re-refining or other re-uses of oil
- Class 13: Storage of waste intended for submission to any activity referred to in a preceding paragraph of Schedule 4, other than temporary storage, pending collection, on the premises where such waste is produced

On 14 January 2013, Technical Amendment E was issued to the site's waste licence and requires Enva to conduct a review of hydrogeological data for the site:

> ***Condition 9.12*** *- Within eighteen months of the date of this technical amendment, the licensee shall, in line with the criteria set out in the Guidance on the Authorisation of Discharges to Groundwater, published by the Environmental Protection Agency, review the most relevant hydrogeological assessment report for the installation or where relevant, arrange for an assessment of the installation, by an appropriately qualified consultant / professional, to demonstrate compliance with the European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended. A report on the review or assessment report with recommendations shall be included in the next AER. Further to the hydrological review or assessment, any actions (including the setting of groundwater compliance values, if appropriate) required to demonstrate compliance with the European Communities Environmental Objectives (Groundwater) Regulations 201 0, as amended shall be implemented before 22nd December 2015.*

1.2 Objective

The objective of this hydrogeological review and assessment is to comply with Condition 9.12 of waste licence 41-1.

1.3 Scope of Work

The following tasks have been completed to address requirements of Condition 9.12:

- Task 1 – review of publically available hydrogeological data pertinent to the Enva Shannon site and environs
- Task 2 – review of available site specific hydrogeological data for the Enva Shannon site
- Task 3 – assessment of groundwater monitoring data for the Enva Shannon site in the context of S.I. No. 9 of 2010

2. REVIEW OF PUBLIC DATA

2.1 Data Sources

This section presents information collated from the following sources:

- Ordnance Survey of Ireland (OSI), www.osi.ie
- Geological Survey of Ireland (GSI), www.gsi.ie
- EPA, http://gis.epa.ie/Envision
- Water Maps, http://watermaps.wfdireland.ie/
- National Parks and Wildlife Services, http://webgis.npws.ie/npwsviewer/
- Shannon Town and Environs - Local Area Plan 2012–2018, Written Statement

2.2 Site Location and Setting

The site is situated in the Smithstown Industrial Estate, Shannon, Co. Clare, approximately 1 km north of Shannon town centre and 3 km north-east of Shannon airport. The site is located at national grid reference (NGR) R 409 633.

The site can be accessed via a small access road from either the N18 road to the east of the site or from the N19 road to the west.

Land use in the immediate area of the site is a light industrial estate, with agricultural land surrounding the estate to the west and north, with scattered residential properties.

The site is bounded to the north by industrial units including Cleanwell (a distributor of cleaning materials and equipment), Smithstown Light Engineering and Modular Automation. Galvotech (International) Limited, an Industrial Emissions (IE) licensed site (P0292-01) is also located north of the site. Further north are agricultural fields and the M18, which links Shannon to Gort.

Directly south of the site are industrial units occupied by Tammdek Tooling and Shannon Christian Church. Land between the access road and the R471 is predominantly used for agricultural purposes. South of the R471 road is Shannon town, a residential and commercial area. Shannon town is County Clare's second largest town. Much of the town was built in the 1960s as part of the development of the regional economy.

Enva is located at the western boundary of the Smithstown Industrial Estate. Industries located in the estate to the east of the site include Hassett Precision Engineering, Four JS Development Tools and the Beech Park logistics centre. The N18 road is located 1,250 m west of the site, with agricultural land and residential properties beyond the N18 road.

Chemifloc (who manufacture and supply water treatment products) bound the site to the west. Chemifloc operate under IE licence (P0076-01) granted by the EPA. The N19 road is located 200 m west of Chemifloc, with agricultural land and dispersed residential properties beyond.

Shannon Industrial Estate is located 2 km southwest of the Enva site. There are eight EPA licensed facilities in and around the industrial estate and Shannon Airport, which is situated 3 km southwest of Enva. The Shannon Estuary bounds the airport to the south.

A site location plan is presented in Figure 1.

2.3 Topography

The site is at an elevation of approximately 10 m above Ordnance Datum (aOD) (Malin). The area slopes very gently to the south and southeast, to the Shannon Estuary, approximately 3 km from the site. The topography rises to between 20 and 30 m aOD within 500 m north of the site.

2.4 Historic Landuse

Information pertaining to the history of the site and surrounding area was obtained following a review of available historical maps and aerial photographs from the OSI. The following maps and aerial photographs were available for review:

- 6 inch mapping series (1:10,560) colour 1829-1841
- 25 inch mapping series (1:2,500) greyscale 1897-1913
- Aerial photography for the years 1995, 2000 and 2005

2.4.1 *1829-1841*

The site and area surrounding appear to be predominantly undeveloped and in agricultural use.

The existing access roads to the south and east of the site are shown on the map. Smithstown House is located 950 m north of the site. Smithstown Castle (in ruins) is present 350 m east of the existing eastern site boundary. Knockaun House is located 750 m west of the site.

There are no other developments of significance mapped within a 1 km radius of the site.

2.4.2 *1897 - 1913*

Little appears to have changed from the previous map. The site still appears to have been in agricultural use.

Smithstown House and Knockaun House are still in existence and there appears to have been some additional development around Knockaun House, including the development of a gravel pit. Smithstown Castle (in ruins) is still shown to be present.

2.4.3 *1995*

Significant development of the Shannon area is shown on the 1995 aerial photograph. Large numbers of residential properties were developed in Shannon in the 1960's.

The Smithstown Industrial Estate was originally developed by Shannon Development as a location for subcontract and service activities supporting companies located within the Shannon Free Zone[1]. Smithstown Industrial Estate currently comprises around 150 firms across a diverse range of sectors. Practically all of the estate is developed, with a building

[1] Shannon Free Zone (SFZ) is a 243 hectare industrial area with more than 7,000 people working in over 100 companies

footprint of approximately 75,000 m^2 – 90% of which is owned by the private sector and the other 10% by Shannon Development.

Smithstown House and Knockaun House are still present but it is difficult to determine what condition they are in. The land around Smithstown Castle has been developed on and now incorporates the Smithstown Industrial Estate.

2.4.4 *2000*

The Smithstown Industrial Estate expanded significantly between 1995 and 2000. Substantial development is noted to the north and east of the Enva site.

One of the main developments between 1995 and 2000 in the area is the construction of the Beech Park Logistics centre east of the Enva site.

2.4.5 *2005*

Very few changes appear to have taken place at the site between 2000 and 2005. There appears to have been only minor alterations to the layout of the Enva site. The N19 road to the west of the site was constructed between 2000 and 2005. The N19 links the N18/M18 at Ballycasey Beg to Shannon Airport.

2.5 Geology

2.5.1 *Subsoils*

The subsoils mapped across the Smithstown Industrial Estate by the GSI are identified as 'made ground'. A zone of limestone till is mapped in all directions surrounding the estate. The tills are generally thin (1 to 5 m thick) and clayey in the area around Shannon. No sand or gravel deposits have been mapped in the Shannon area.

Since the end of glaciation (approximately 10,000 years ago) extensive estuarine muds have been deposited along the Shannon Estuary coast.

2.5.2 *Bedrock*

The GSI website indicates (Bedrock Geology of Ireland, 1:100,000 scale) that the bedrock geology beneath the site consists of Dinantian Lower Limestone Shale, close to the contact with the older, underlying Old Red Sandstone Group of Devonian age. The Old Red Sandstone rocks in the area are typically white, yellow or pale brown, coarse grained sandstones, pebbly sandstones and conglomerates.

The Lower Limestone Shales are composed of low permeability rocks which have been folded into major east-west trending open folds with associated pervasive fracturing and shearing of the strata. No major fault structures are mapped within 5 km of the site.

The Lower Limestone Shales form part of an inlier of older rock, approximately 2.5 km in diameter, surrounded by the younger Ballymartin and Ballysteen Formation of fossiliferous, dark grey, muddy limestones and calcareous shales.

2.6 Hydrology

2.6.1 *Surface Water Features*

The nearest surface water body to the site is a small stream, which rises 1 km north of the Smithstown Industrial Estate and flows southwards. It is diverted around the industrial estate in a man-made drainage ditch along the eastern boundary of Smithstown Industrial Estate, approximately 200 m east of the site. It then flows south-eastwards towards Shannon town and becomes culverted at the N19, approximately 500 m southeast of the site. It discharges to the River Shannon Estuary at Ballycasey Creek, 2.5 km south of the Enva site.

Two other streams exist within a 1 km radius of the Smithstown Industrial Estate, one 750 m to the east near Ballycasey Cross and the other 750 m to the west near Ballymurtagh. Both flow in a generally southerly direction and terminate at or south of the N19 road, presumably entering the drainage network below Shannon town.

Glonloghan River is the nearest river, located approximately 750 m south west of the site. The river flows in a southerly direction and enters the Shannon Estuary at Drumgeely Creek.

The most significant surface water feature in the wider area is the Shannon Estuary, which flows from east to west and is located 3 km south of the site.

2.6.2 *Surface Water Quality*

Estuarine water quality in Upper Shannon Estuary, a transitional waterbody, is classified as *'Unpolluted'* by the EPA.

Due to their small size, the water quality in the three unnamed streams, within 1 km of the site has not been classified.

2.7 Hydrogeology

According to GSI online maps, the Lower Limestone Shale bedrock aquifer in the region is classified as a *Locally Important Aquifer,* which is Moderately Productive only in Local Zones. Groundwater vulnerability in the Smithstown area is assessed as *Extreme* by the GSI, due to the generally thin overlying soils (<3 m clayey soil).

There is little groundwater abstraction for private or industrial use as the area is supplied by Council mains water, which is abstracted from a lake near Sixmilebridge. None of the other industrial units in Smithstown Industrial Estate abstract groundwater and there are no known private wells in the immediate vicinity of the site. According to the GSI website, there are no groundwater wells located within 1 km of the site. The nearest known industrial abstraction is for cooling water at the UCB Manufacturing Ireland facility (formerly SIFA), over 1.5 km to the west of Enva site.

It should be noted that there is no permitting system to govern well drilling or any requirement to register wells in Ireland. Therefore, publically available well records in Ireland are not complete; wells used for domestic and other purposes are often not recorded by the owners or authorities.

Based on the general topography, the regional groundwater flow is likely to be towards the Shannon Estuary to the south and south-east. The gentle topographic gradient suggests low hydraulic gradients and therefore slow overall groundwater movement. Groundwater may move more rapidly in fracture zones.

Groundwater beneath the Enva site is present within 2 to 4 m of the surface and may discharge either to local watercourses or may flow beneath Shannon town to the Shannon Estuary.

2.8 Water Framework Directive

2.8.1 *Protected Areas*

Groundwater beneath Enva site as a whole is classed as a *Protected Area* under the WFD in terms of *Groundwater for Drinking Water* use.

The Lower River Shannon (Shannon Estuary) (located approximately 3 km south of the site) is designated as a *Proposed Natural Heritage Area* (site code 002048), a Special Protected Area (site code 004077) and a *Special Area of Conservation* (SAC No. 002165).

The Lower River Shannon has been classified as a SAC on the basis that the site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive.

2.8.2 *Status and Objectives*

Groundwater beneath the site is part of the TullaNewmarket_2 Groundwater Body (IE_SH_G_231) whose overall status is classified as *Good*, with the objective of *Protect*.

The closest classified River Waterbody under the WFD is Clenagh River Waterbody, Tributary of Shannon Estuary North (IE_SH_27_1147). This River Waterbody is classed as *High*, with the overall objective of *Protect*.

Status of the Upper Shannon Estuary, a transitional waterbody (IE_SH_060_0800) is classified as *Good*, with the overall objective of *Protect*.

3. REVIEW OF SITE DATA

3.1 Site History and Description

The Enva site occupies approximately 3 acres (1.1 ha) in area and comprises a waste management facility, with associated administration buildings, laboratory, stores and car parking.

The Enva site was developed as a hazardous waste processing and transfer facility in 1986. Prior to 1986 the eastern half of the site was a bus depot for tour buses (Jackson's Coaches). The site was purchased by Chemifloc in 1985 and was acquired from them by Shannon Environmental Services (SES) in 1986. In January 2003, Enva acquired SES.

3.2 Site Investigations

There have been several phases of site assessment and investigation conducted with regard to assessing soil and groundwater quality beneath the site. As part of this assessment, the following reports have been reviewed for the site:

- URS, 2002, Final Report On Soil and Groundwater Remediation Programme for Shannon Environmental Services, Shannon, Co. Clare, URS/Dames and Moore Ref. 49802\001\Report\Final
- URS, 2002, Soil Gas Monitoring Results for Shannon Environmental Services and Adjacent Areas, July/August 2002, URS Ref: 49802/001/447
- URS, 2005, February 2005 MNA and Waste Licence Monitoring, URS Ref. 45078332/0205
- URS, 2008, Groundwater Monitoring and Monitored Natural Attenuation Review, URS Ref. 49341578/CKRP0002

Discussion in the following sections draws on data from the above reports, routine groundwater monitoring events and site experience.

3.3 Wells, Boreholes and Groundwater Monitoring Network

Enva has a network of nine on-site groundwater monitoring wells and three off-site wells. The off-site wells are located to the southeast in a parking area. Enva also has access to two wells located on an adjacent site (Chemifloc) to the west.

Under the terms of the site's Waste licence (W0041-01), Enva are required to monitor the quality of groundwater in monitoring wells MW3, MW4S and MW5 at quarterly intervals for a range of organic and inorganic parameters.

Wells are screened at various depths but all within the limestone bedrock. A site layout map illustrating well locations is presented as Figure 2.

There has been three previous significant groundwater or ground contamination investigations carried out at the site. These were a hydrogeological investigation conducted in 1998 as part of the application to the EPA for a waste licence, and a subsequent soil investigation in the area of well MW4S in the first half of 2001. Both investigations were performed by K.T. Cullen & Co. Limited, (KTC, 1998 and KTC, 2001b). URS/Dames and Moore completed the third significant investigation, a soil and groundwater remediation assessment in 2001/2002.

MW3, MW4 and MW5 were drilled and installed on the Enva site, during the 1998 K.T.C site investigation. MW1 and MW2 were installed on the adjacent Chemifloc site during the same investigation. The boreholes were installed as 50 mm internal diameter groundwater monitoring wells.

Boreholes MW4D to MW10 were drilled using the air rotary drilling method in July and August 2001. Boreholes MW11 to MW13 were drilled using the air rotary drilling method in December 2001.

MW6, MW7 and MW8, were drilled at 150 mm diameter and installed with 50 mm uPVC standpipes. These boreholes were drilled to between 12 and 16 m bgl.

MW9 and MW10 were drilled at 200 mm diameter with a 100 mm uPVC standpipe installed. These boreholes were drilled to 18 and 20 m bgl respectively.

MW4D, was considered to be close to the source area for volatile organic contamination (VOC) and was “double drilled” to prevent contamination from the vicinity of MW4S migrating deeper into the bedrock aquifer via the borehole itself. MW4D was targeted at the lower part of the aquifer (i.e. deeper than MW4S) in order to get information on the vertical extent of contamination in the aquifer.

The three off-site boreholes (MW11 to MW13) were drilled at 150 mm diameter with 50 mm diameter HDPE standpipe installed. Each of the off-site boreholes was drilled to approximately 13 m bgl.

In all of the boreholes drilled under the supervision of Dames & Moore/URS, the bottom 5 m of each standpipe was screened with a 50 mm internal diameter slotted screen to allow water entry.

The Enva site is supplied with process water from a production well located in the centre of the site. The well is 80 m deep and can sustain pumping rates of up at 120 m^3/d, which is an uncharacteristically high yield for wells in the Lower Limestone Shales. This suggests that the well intersects a fracture zone in the shales or the underlying Old Red Sandstone (if intersected). Well drilling logs and installation details are not available for this well.

Anecdotal evidence (from SES/Enva staff) report that when the production well was initially developed there were hydrogen sulphide odours from the water and the water had a high iron content. The water was also brackish. All of these conditions are consistent with the reported groundwater quality issues in the general Shannon area. The water was deemed unsuitable for potable use and the site is supplied with drinking water from the Council mains supply.

A brief summary of drilling and monitoring well installation is provided in the table below, with a more detailed description, and available logs, provided in Appendix A.

Table 1: Monitoring Well Summary

Location	Year	Monitoring Well	Screened Unit	Comments
MW1	1998	Yes	Limestone	Present, on Chemifloc site
MW2	1998	Yes	Limestone	Present, on Chemifloc site
MW3	1998	Yes	Limestone	Present, routinely sampled
MW4S	1998	Yes	Limestone	Present, routinely sampled
MW4D	2001	Yes	Limestone	Present, last sampled in December 2007
MW5	1998	Yes	Limestone	Present, routinely sampled
MW6	2001	Yes	Limestone	Present, last sampled in December 2007
MW7	2001	Yes	Limestone	Present, last sampled in December 2007
MW8	2001	Yes	Limestone	Present, last sampled in December 2007
MW9	2001	Yes	Limestone	Present, last sampled in May 2013
MW10	2001	Yes	Limestone	Present, last sampled in May 2013
MW11	2001	Yes	Limestone	Present, last sampled in December 2007
MW12	2001	Yes	Limestone	Present, last sampled in December 2007
MW13	2001	Yes	Limestone	Present, last sampled in December 2007
Enva Production Well	Pre 2002	No, production well	Limestone	Production well, sampled annually, usually in Round 2
WS-101	2002	No, soil vapour point	Sand	Present, last sampled in October 2003
WS-102	2002	No, soil vapour point	Sand	Present, last sampled in April 2004
WS-103	2002	No, soil vapour point	Fill	Present, last sampled in May 2006
WS-104	2002	No, soil vapour point	Clay	Present, last sampled in November 2006
WS-105	2002	No, soil vapour point	Clay	Present, last sampled in January 2008

Location	Year	Monitoring Well	Screened Unit	Comments
WS-106	2002	No, soil vapour point	Clay	Present, last sampled in January 2008

3.4 Site Geology

Depth to bedrock varies only slightly across site. Drilling logs indicted that limestone bedrock was encountered at between 1.3 (MW4D) and 4.5 m (MW6) bgl in all boreholes. The overburden sediments above the bedrock consisted of soft to firm, brown gravelly clay with cobbles, which is inferred to be a stony glacial till. The moisture content of the clay ranged from dry to damp.

3.5 Site Hydrogeology

The site is underlain by a fractured limestone aquifer with relatively low permeability, although groundwater flow through fracture zones can be more rapid. All boreholes were drilled into predominantly low permeability argillaceous limestone. The overburden is considered dry, with groundwater residing in the limestone bedrock aquifer beneath the site.

During the 2001 site investigation, a series of falling/rising head tests were undertaken across the site.

The hydraulic conductivity was found to vary by two orders of magnitude between monitoring wells, confirming the heterogeneity in the bedrock aquifer.

The lowest permeability was recorded from well MW7 (4.28×10^{-3} m/d), while the highest permeability's were recorded in wells MW8 and MW4D (3.97 and 7.56×10^{-1} m/d, respectively). A linear fracture zone was interpreted to exist running from north-west to south-east through the Enva production well and wells MW8 and MW4D/S.

The direction of groundwater flow under natural gradient conditions is considered to follow the topographic gradient of the area and be toward the south and south-east, eventually discharging to the Shannon Estuary. However, abstraction from Enva's Production Well modifies the natural gradient.

In January 2005 Chemifloc began abstracting groundwater from a new production well located next to their monitoring well MW2. This resulted in a change in groundwater flow across the two sites, creating a groundwater divide close to Enva's western site boundary when the Chemifloc well is pumping.

Enva's Production Well continues to draw groundwater from the north, south and east (depending on the pumping regime), but its influence to the west was lessened by the influence of the Chemifloc Production Well. Enva's Production well was pumped at a moderately low rate throughout 2013, with an average abstraction rate of 3 m^3/day.

Figures 3 and 4 illustrate groundwater flow at the Enva site under March and September 2013 conditions.

3.6 Groundwater Monitoring Data

URS groundwater monitoring data are available dating back to 2001. Waste licence requirements include monitoring of groundwater on a quarterly basis across the site from selected wells.

Quarterly groundwater monitoring is required from the following three on-site groundwater monitoring wells:

- MW3
- MW4S
- MW5

The suite of parameters analysed in each monitoring round generally includes:

- Volatile organic compounds (VOCs) (including chlorinated hydrocarbons)
- Semi volatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs)
- Total petroleum hydrocarbons including diesel and petrol range organics
- Major ions (chloride, sodium, sulphate, potassium, ammoniacal nitrogen)
- Total oxidised nitrogen (TON)
- Total organic carbon (TOC)
- Cyclohexane extractable matter (CEM/SEM)

The following suite of parameters are analysed on an annual basis as part of the Waste licence monitoring:

- Phosphate
- Total alkalinity
- Total dissolved solids
- Total cyanide
- Total phenols
- Dissolved heavy metals (arsenic, cadmium, chromium, copper, mercury, nickel, lead, iron, manganese, calcium and magnesium)

A five-year monitored natural attenuation (MNA) remediation program was completed between 2002 and 2007 which demonstrated that VOC concentrations in groundwater underlying the Enva site are declining and that there are no sensitive receptors located in the vicinity of the site. Given the long timescales involved for the degradation of chlorinated solvents, it was recommended that MNA remediation program be undertaken on a reduced scope following the completion of the five-year MNA program.

As such, the EPA also requires that Enva monitor groundwater quality in five on-site wells (MW4S, MW8, MW9, MW10 and the on-site Production Well) for VOCs and a range of redox indicator compounds on an annual basis.

The following suite of parameters are analysed on an annual basis as part of the MNA monitoring:

- VOCs
- Redox indicators (chloride, sulphate, manganese, total alkalinity, nitrate, nitrite)

During the most recent monitoring round (December 2013), additional parameters specified in S.I. No. 9 of 2010 were included in the analytical suite, specifically:

- Major ions: molybdate reactive phosphorus, nitrate and nitrite
- Dissolved heavy metals: aluminium and boron
- Pesticides

Historic results, where available for selected parameters, are presented in Appendices B to F, with all results from December 2013 in Appendix G.

3.6.1 *Field Measurements*

Field measurements of pH and electrical conductivity (EC) have been routinely measured in groundwater at the Enva site and are specified in the site's Waste licence.

Tabulated field measurements and trend graphs of pH and EC from 2008 to 2013 are presented in Appendix B.

pH

Groundwater pH across the site is generally slightly alkaline, which is typical of a limestone aquifer and within the normal range for groundwater in Ireland (6.0 to 8.0). There is no apparent trend in pH measurements over time. There is no GTV defined for pH.

Electrical Conductivity

With the exception of well MW4S, EC readings in groundwater from wells beneath the site fall within a relatively narrow range of values, from ~500 µS/cm to ~2,500 µS/cm. Generally, groundwater EC readings are close to 1,000 µS/cm. The lower GTV for EC is 800 µS/cm and is usually exceeded in groundwater from the licensed monitoring wells. The higher GTV for EC is 1,875 µS/cm, which is consistently exceeded at well MW4S (average EC value of 4,020 µS/cm). The consistently elevated EC readings from well MW4S are interpreted to indicate the presence of organic contamination in the well.

3.6.2 *Major Ions*

Selected major ion results from 2008 to 2013 have been tabulated and graphed in Appendix C.

- The highest concentrations of sodium and chloride are detected in groundwater from well MW4S. Average concentrations for well MW4S are: 665 mg/L sodium and 1,120 mg/L chloride. Higher major ion concentrations for well MW4S correspond to elevated EC

readings in groundwater from this well. Sulphate concentrations are also elevated in groundwater from well MW4S (average of 544 mg/L)

- Sodium and chloride concentrations are generally low in groundwater from wells MW3 (<75 mg/L and <115 mg/L, respectively), MW5 (<35 mg/L and <75 mg/L, respectively), and the Enva Production Well (both <40 mg/L). Sodium is consistently below the GTV of 150 mg/L; while chloride concentrations are generally close to the Upper GTV of 187.5 mg/L

- Sulphate concentrations are generally below the GTV of 187.5 mg/L in groundwater from wells MW3 and MW5

- Nitrate has not been regularly monitored for in groundwater at the site. When analysed, nitrate concentrations are low in the three licensed site wells, with the highest average concentration recorded at well MW3 (16 mg/L). Well MW3 has also had some of the highest dissolved oxygen concentrations, suggesting more aerobic groundwater conditions in the north of the site. Nitrate would not be typically detected in reducing groundwater conditions. The GTV for nitrate is 37.5 mg/L

- Between 2008 and 2013, nitrite has only been analysed for on six occasions in groundwater from the licensed wells. Nitrite has not been detected above the laboratory method detection limit (MDL) during any of the monitoring rounds. The GTV for nitrite is 0.375 mg/L

- Ammoniacal nitrogen concentrations in groundwater from MW5 are generally below the lower GTV of 0.065 mg/L. Concentrations of ammoniacal nitrogen have increased throughout 2013 in groundwater from well MW3 to a maximum of 2 mg/L in December 2013, exceeding the Upper GTV of 0.175 mg/L. Ammoniacal nitrogen concentrations in groundwater from well MW4S have fluctuated between 2008 and 2013, up to a maximum of 31 mg/L in May 2010. Ammoniacal nitrogen concentrations at well MW4S are normally greater than the Upper GTV

- Ortho phosphate as P was analysed for in groundwater from the three licensed wells on an annual basis between August 2008 and August 2012. Ortho phosphate was detected above the MDL in groundwater from wells MW3 (0.04 mg/L) and MW5 (0.03 mg/L) only in August 2010. Molybdate reactive phosphorus (as PO_4) was analysed for in December 2013 and was not detected above the MDL in any of the three groundwater samples

- Cyanide has been analysed for in groundwater from the three licensed wells on an annual basis between August 2008 and September 2013. Cyanide had not been detected above the MDL in groundwater from the three licensed onsite wells. The GTV for cyanide is 0.0375 mg/L

3.6.3 *Dissolved Heavy Metals*

Between 2008 and 2013 dissolved heavy metals have been routinely monitored on an annual basis at the Enva site. Tabulated metal results for the three licensed wells, from September 2008 to September 2013, for which there are GTVs, are presented in Appendix D.

The majority of metals are generally either present at low concentrations or are below MDLs.

Lead, mercury, cadmium, chromium and copper have not been detected above their respective GTVs in any of the groundwater monitoring rounds.

Arsenic is commonly detected above the MDL in groundwater from well MW4S, but has not been detected at concentrations greater that the GTV (7.5 µg/L) since September 2009 (29 µg/L). Arsenic was detected marginally above the GTV in groundwater from well MW3 on a single occasion (September 2013, 8.2 µg/L). Between 2008 and 2013, arsenic has only been detected above the MDL in groundwater from well MW5 on a single occasion (September 2009, 1 µg/L).

Chromium was detected above the GTV (37.5 µg/L) on a single occasion, in September 2010, in groundwater from well GW06 (59 µg/L). All other chromium concentrations, when detected, are <20 µg/L.

Aluminium has previously been detected at elevated concentrations and above the GTV (150 µg/L) in groundwater from wells GW04 (up to 240 µg/L), GW05 (up to 360 µg/L) and GW08 (up to 367 µg/L). Since September 2010, aluminium concentrations have remained low (<35 µg/L) in groundwater from the three licensed wells.

Arsenic was detected in groundwater from well MW3 on three occasions, and was marginally above the GTV (7.5 µg/L) on two occasions. Arsenic was detected at concentrations of 9.2 µg/L and 9.5 µg/L in November 2011 and February 2012, respectively. In 2013, arsenic concentrations were below the MDL in groundwater from all three wells sampled.

Nickel is detected at elevated concentrations in groundwater from well MW4S (up to 1,540 µg/L) and to a lesser extent MW3 (up to 55 µg/L) and MW5 (up to 40 µg/L). The GTV for nickel is 15 µg/L, which is consistently exceeded in groundwater from the three monitoring wells. The presence of elevated concentrations of nickel in wells MW3 and MW5 suggest a naturally occurring source. Elevated nickel concentrations of between 22 mg/kg to 30 mg/kg have been mapped in the Shannon area and are associated with the impure limestone geology[2]. Elevated concentrations of nickel in groundwater from well MW4s may be related either to site processes or be associated with an upgradient source in the industrial estate.

Aluminium and boron were analysed in December 2013 only. Aluminium was not detected above the MDL in any of the three samples analysed. Boron was detected above the MDL in the three groundwater samples in December 2013, at concentrations of between 19 µg/L (MW5) and 272 µg/L (MW4S), all results are significantly below the GTV (750 µg/L).

3.6.4 *Polycyclic Aromatic Hydrocarbons*

PAHs are analysed as part of a larger SVOC suite and selected PAH results are tabulated and presented in Appendix E.

Between 2008 and 2013, benzo(a)pyrene, benzo(bk)fluoranthene, benzo(ghi)perylene and indeno(1,2,3-cd)pyrene have not been detected above MDLs in groundwater from the three licensed wells on the Enva site.

3.6.5 *Volatile Organic Compounds*

A wide variety of VOCs are detected in groundwater at the Enva site. The VOCs detected can be broken down into the following categories:

[2] Teagasc and the Environmental Protection Agency, 2007, Soil Geochemical Atlas of Ireland

Typical chlorinated ethenes detected in groundwater at the Enva site are:

- Tetrachloroethene (PCE)
- Trichloroethene (TCE)
- Dichloroethene (DCE)
- Vinyl Chloride (VC)

Typical chlorinated ethanes detected in groundwater at the Enva site are:

- Trichloroethane (TCA)
- Dichloroethane (DCA)
- Chloroethane (CA)

Typical chlorinated methanes detected in groundwater at the Enva site are:

- Tetrachloromethane (TCM)
- Trichloromethane, or chloroform (CFM)
- Dichloromethane (DCM)
- Chloromethane (CM)

Other non-chlorinated VOCs: including BTEX hydrocarbons (benzene, toluene, ethyl benzene and xylene), trimethylbenzenes and various other VOCs.

A summary of total VOC concentrations trend data is presented in Appendix F for monitoring wells MW3, MW4S, MW5 and the Enva Production Well.

Between 1998 and 2013, an overall decreasing trend in total VOC concentrations is generally observed in the wells sampled.

MW3

MW3 is located on the up-gradient northern site boundary. Since January 2001, total VOC concentrations are relatively low in groundwater from this well, typically fluctuating between 200 and 600 µg/L (see Appendix F1). In general, the detected compounds are dominated by chlorinated ethanes.

Concentrations of VOCs were broadly similar during Q1, Q2 and Q3 2013 (<300 µg/L), with higher total concentrations being detected in Q4 (~600 µg/L). The most noted increase in VOC concentrations during 2013 was for DCM from <MDL in Q1, Q2 and Q3 to 496 µg/L in Q4 2013.

MW4S

MW4S is located in the southern part of the site near the processing and storage areas. Since 2000, total VOC concentrations in MW4S have generally decreased from 40,000 µg/L to approximately 10,000 µg/L (or lower).

More recently, a decrease in total VOC concentrations at well MW4S is noted between May 2012 (10,785 µg/L) and the most recent monitoring round completed in December 2013 (6,683 µg/L) was reported.

Groundwater samples collected from this well have both the highest total VOC concentrations and the greatest variety of organic compounds detected. During 2013, an overall slight increasing trend in VOC concentrations is apparent, with increases noted for VC, cDCE and 1,1,1-TCA. In 2013, the highest concentrations of VOCs were reported in Q4 (December).

MW5

MW5 is located next to Enva's western site boundary with Chemifloc. The lowest total VOC concentrations are reported in groundwater samples collected at this well, usually less than 10 µg/L, but the highest was 206 µg/L in February 1998, as such, an overall decreasing trend is apparent.

In 2013, VOCs were not detected in groundwater from well MW5 above MDLs.

Production Well

The Enva Production Well is located in the middle of the site. Between August 2001 and May 2006, total VOC concentrations fluctuated between 2,000 µg/L and 3,000 µg/L. However, since November 2006 the total VOC concentrations remained relatively stable at approximately 2,000 µg/L. More recently a significant decrease in total VOC concentrations was noted between May 2011 (2,230 µg/L) and May 2012 (403 µg/L). However, an increase in total VOCs is observed between May 2012 and June 2013 (924 µg/L) at this location. The most notable increase is in concentrations of cDCE reported, increasing from 113 µg/L (May 2012) and 535 µg/L (June 2013).

3.7 Conceptual Site Model (CSM)

A schematic representation of the CSM is presented in Figure 5.

Depth to bedrock across the site ranges from ~1.5 m to 4.5 m bgl, with overburden consisting of limestone till. The overburden is generally dry with groundwater residing in the bedrock aquifer beneath the site. The bedrock aquifer is fractured limestone.

At the Enva site it is expected that the direction of groundwater flow under natural gradient conditions is to the south and south east. However, groundwater flow is influenced by the pumping of both the Enva and Chemifloc Production Wells.

The main contaminants of concern are chlorinated solvents primarily in groundwater from well MW4S.

The site investigation undertaken by URS and reported in 2002 identified three sources of chlorinated solvents:

1. One up-gradient to the north of the site; consisting predominantly of chloroethanes
2. One historic source in the centre of the site, immediately up-gradient of the on-site production well; consisting predominantly of chloroethenes
3. One historic source close to, and possibly up-gradient of, the southern site boundary, and consisting of a varied suite of chlorinated solvents including chloroethenes, chloroethanes and chloromethanes

It has been shown (via redox potential and dissolved oxygen measurements and iron and manganese analytical results) that groundwater conditions across the site are reducing (anaerobic) and facilitate the in-situ, natural breakdown of chlorinated solvents through reductive dechlorination. Through reductive dechlorination heavily chlorinated solvents are broken-down sequentially into less chlorinated solvents and finally into non-chlorinated gases.

When the well is pumped at a sufficient rate, all three plumes are hydraulically contained by the Enva Production Well. Groundwater from the Enva Production Well is used for production purposes only and is not used for potable supply. There are no identified potential off-site groundwater receptors.

4. ASSESSMENT OF GROUNDWATER STATUS

4.1 Introduction

The following documents have been reviewed in completing this section:

- 2010, S.I. No. 9 of 2010, *European Communities Environmental Objectives (Groundwater) Regulations*
- 2010, EPA, *Methodology for Establishing Groundwater Threshold Values and the Assessment of Chemical and Quantitative Status of Groundwater, Including and Assessment of Pollutant Trends and Trend Reversal*
- 2011, EPA, *Guidance on the Authorisation of Discharges to Groundwater*
- 2011, EPA, Groundwater Status Report May 2011 Appendix 1 (*GW_1_Status_May2011_Appendix1.xls,* downloaded from www.epa.ie on 20 February 2014)

S.I. No. 9 of 2010 established a strengthened regime for the protection of groundwater in Ireland. This regime is in line with the requirements of the WFD (2000/60/EC) and the Groundwater Directive (2006/118/EC).

S.I. No. 9 of 2010 identifies the conditions for assessing the status of a groundwater body. Tests are defined relating to the quantitative status of the groundwater body and to the qualitative (or chemical) status of the groundwater body. Each test is applied independently and the overall groundwater body status is the worst result from all tests.

The GTVs presented in S.I. No. 9 of 2010 are to be used as triggers to assist with determining whether conditions for good qualitative status have been met. Exceedance of a GTV triggers further investigation of whether the impact is localised or sufficient to prevent the groundwater body as a whole achieving good status. It is noted that this report considers only groundwater beneath the Enva site and does not consider the TullaNewmarket_2 Groundwater Body as a whole.

4.2 Quantitative Status Assessment

4.2.1 *Test 1 – Saline or Other Intrusions Test*

The Saline (or Other) Intrusions Test is intended to identify groundwater bodies where there is intrusion of poor quality water as a result of groundwater abstraction. Trends in EC and other indicators (such as chloride) are assessed to identify whether an intrusion of poor quality water into the groundwater body is occurring due to groundwater abstraction. The 'poor quality intrusion' could be from either saline water (if in a coastal setting); or the drawing-in of poor quality water from a deeper water body, or an adjacent water body.

The GTVs for EC and chloride in this instance are 800 µS/cm and 24 mg/L, respectively.

Where EC and chloride concentrations are above natural background levels and there is either a significant upward trend in concentration of that parameter, or there is already an impact on a point of abstraction (e.g. where a water supply has been decommissioned due to saline intrusion), then the groundwater body will be at *Poor* status. Otherwise it will be at *Good* status.

EC concentrations above the GTV of 800 µS/cm are frequently recorded in groundwater beneath the site. Long term average EC concentrations exceed the Lower GTV of 800 µS/cm in groundwater from all three licensed wells.

The highest long-term average EC concentration is recorded in groundwater from well MW4S (4,019 µS/cm). Elevated EC concentrations in groundwater from well MW4S are attributed to elevated concentrations of organic contaminants in the well.

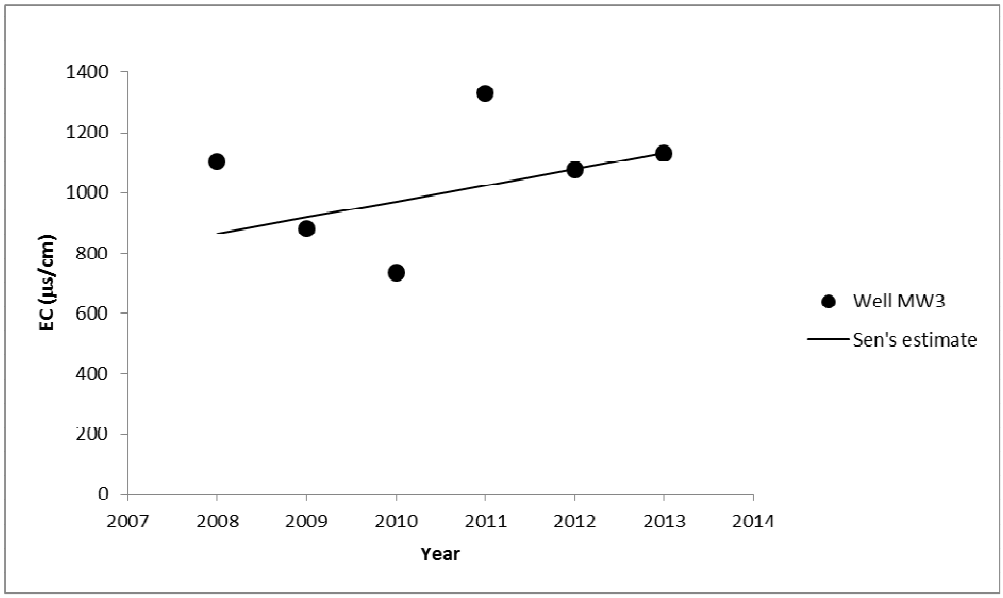
Long term average chloride concentrations exceed the Lower GTV of 24 mg/L in groundwater from all three licensed wells. The highest long-term average chloride concentration is recorded in groundwater from well MW4S (1,167 mg/L).

Assessment of Status

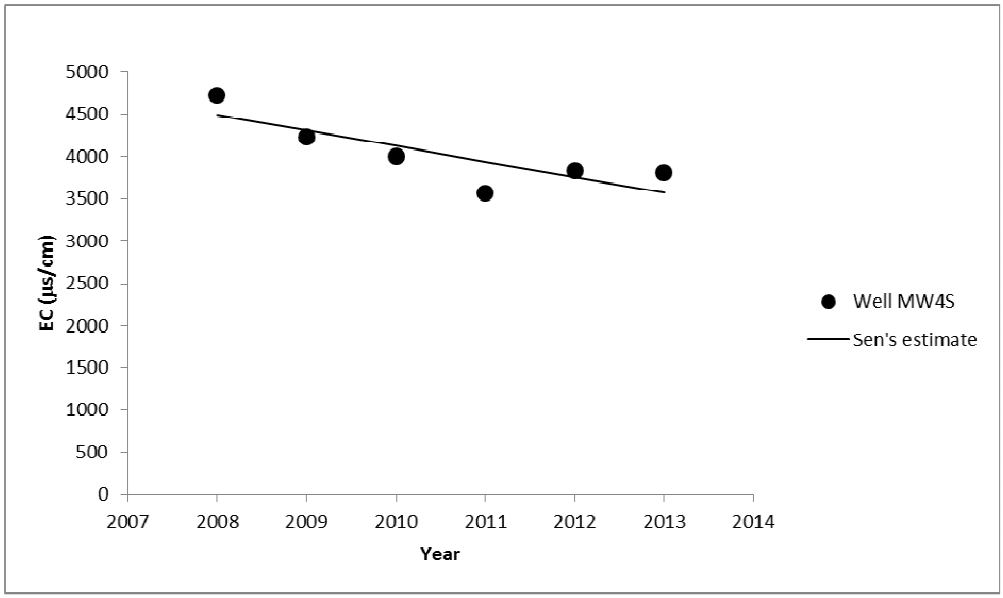
In assessing the impact of saline intrusion on groundwater, the presence of a statistically significant upward trend in both chloride and EC at any individual monitoring point results in the groundwater body status being classified as *Poor*. Monitoring locations with significant upward trends in chloride, but not in EC or vice versa, remain at *Good* status, but are at risk of failing to meet WFD objectives in the future.

Annual concentration trends for both EC and chloride in groundwater from the three licensed wells from 2008 to 2013 have been assessed using MAKESENS (Mann-Kendall test for trend and Sen's slope estimates) as recommended by the Agency. As the number of values for both time series is equal to 9, the Mann-Kendall test is performed using the S statistics and the confidence interval for the Sen's slope estimate is not determined.

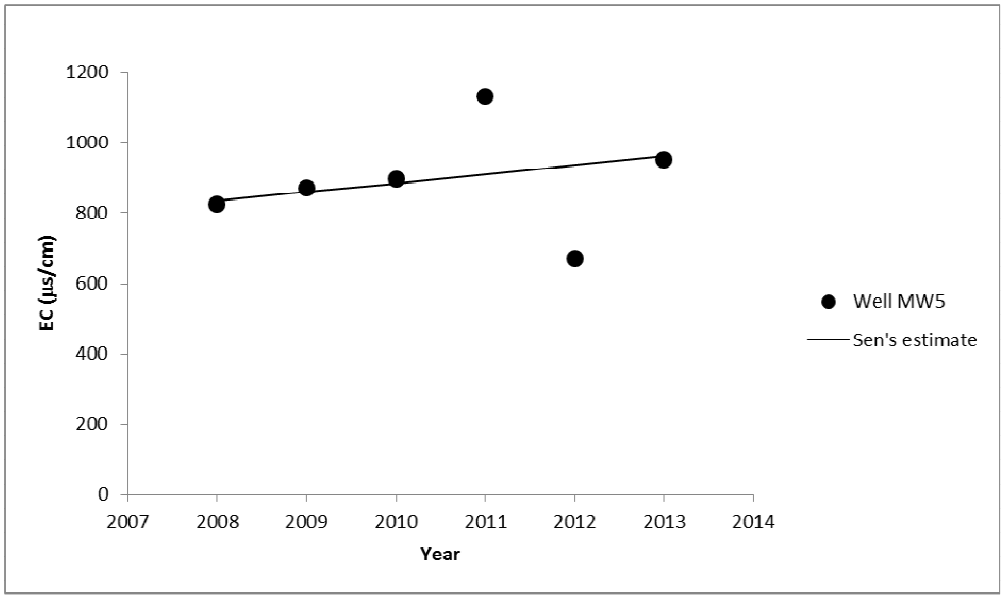
Graph 1: EC Trend Analysis for Well MW3



Graph 2: EC Trend Analysis for Well MW4S



Graph 3: EC Trend Analysis for Well MW5



There are no statistically significant upward trends in EC in the three licensed wells. Therefore the groundwater status in relation to the test is classified as *Good*.

The WFD indicates that confidence in the status assessment must also be reported. The overall assessment approach is outlined in the following table. For the Enva site, as there are exceedances of the GTVs for EC and chloride, however there are no sustained rising trends. The status is described as *Good* with low confidence.

Table 2: Summary of Criteria to Determine Status and Confidence

Status	Confidence	Example Criteria
Good	High	No exceedance of the TV levels, OR Exceedance of TV levels not caused by abstraction
	Low	Exceedance of TV levels but further investigation has determined there are no sustained rising trends OR Possible risk identified but no monitoring available
Poor	Low	Exceedance of TV levels caused by abstraction with sustained rising trends OR Exceedance of TV levels caused by abstraction AND impacted abstraction
	High	Exceedance of TV levels with sustained rising trends caused by abstraction AND The Intrusions have caused a significant impact on abstraction(s)

Test 1: Passed

Status: Good, Low Confidence

4.2.2 *Test 2 – Impact of Groundwater on Surface Water Ecology*

This test is required to assess whether the ecology of a surface water body is damaged due to groundwater abstraction impacting groundwater flow from the groundwater body to the surface water receptor.

This test is only required where the surface water body is classified as less than *Good* status due to a failure of surface water body flow standards, which are caused by abstraction.

There are no significant rivers or streams in close proximity down-gradient of the site. The nearest surface water body is Upper Shannon Estuary (IE_SH_060_800). The Upper Shannon Estuary is a transitional waterbody whose status is classified as *Good*.

Test 2: Not Applicable

4.2.3 *Test 3 – Groundwater Dependent Terrestrial Ecosystems*

This test is required to assess whether groundwater abstractions are reducing the contribution from groundwater to groundwater-dependent terrestrial ecosystems. Groundwater dependent terrestrial ecosystems (GWDTE) are wetlands which critically depend on groundwater flows and/or chemistries.

This test is only applied to wetlands that have been formally identified as protected areas under Regulation 8 of S.I. No. 722 of 2003. Groundwater from the site could possibly discharge to the Shannon Estuary (~3 km south of the site). The Lower River Shannon has been identified as a SAC (No. 002165).

The ecological status of Upper Shannon Estuary (IE_SH_060_800) is classified as *Good*. Given the distance from site to the Lower River Shannon (~3 km), it is considered unlikely that localised abstraction on the Enva site, would impact on the hydrological conditions of the Estuary.

Status	Confidence	Example Criteria
Good	High	No ecological damage to GWDTE OR Ecology of GWDTE damaged, but no associated significant groundwater abstractions in the GWB
	Low	Ecology of GWDTE damaged, but further investigation indicates groundwater abstractions not impacting on the wetland
Poor	Low	Ecology of GWDTE damaged, and further investigation indicates groundwater abstractions are impacting on the wetland
	High	Ecology of GWDTE damaged, and further investigation indicates groundwater abstractions are impacting on the wetland AND Detailed site-specific studies identify and quantify direct connection between groundwater and GWDTE.

Test 3: Passed

Status: Good, High Confidence

4.2.4 *Test 4 – Water Balance Test*

This test is conducted at the Groundwater Body scale and assesses whether groundwater abstraction over the body as a whole is resulting in insufficient water being left to support surface water ecologies or groundwater-dependent terrestrial ecosystems, or if it is resulting in declining groundwater elevations.

As this assessment considers the TullaNewmarket_2 Groundwater Body only in so far as it is present beneath the Enva site, this Groundwater Body scale test is beyond the scope of this assessment.

Test 4: Not Applicable

4.2.5 *Quantitative Status Assessment Summary*

Quantitative classification of groundwater bodies is split into the above four tests. The tests are designed to assess whether the objectives of the WFD are being met. The worst case is reported for a groundwater body, so "failure" of one or more of the tests causes a groundwater body to be at *Poor* status.

Only two of quantitative status assessment tests (Test 1 and Test 3) are applicable to groundwater in the TullaNewmarket_2 Groundwater Body, in so far as it is present beneath the Enva site. As groundwater data for the site passes Test 1 and Test 3 of the Quantitative Assessment, the overall quantitative status is considered *Good.*

Overall Quantitative Status: Good

4.3 Qualitative Status Assessment

Monitoring data from the three licensed monitoring wells located across the Enva site are considered in the qualitative status assessment.

4.3.1 *Test 1 – Saline or Other Intrusions Test*

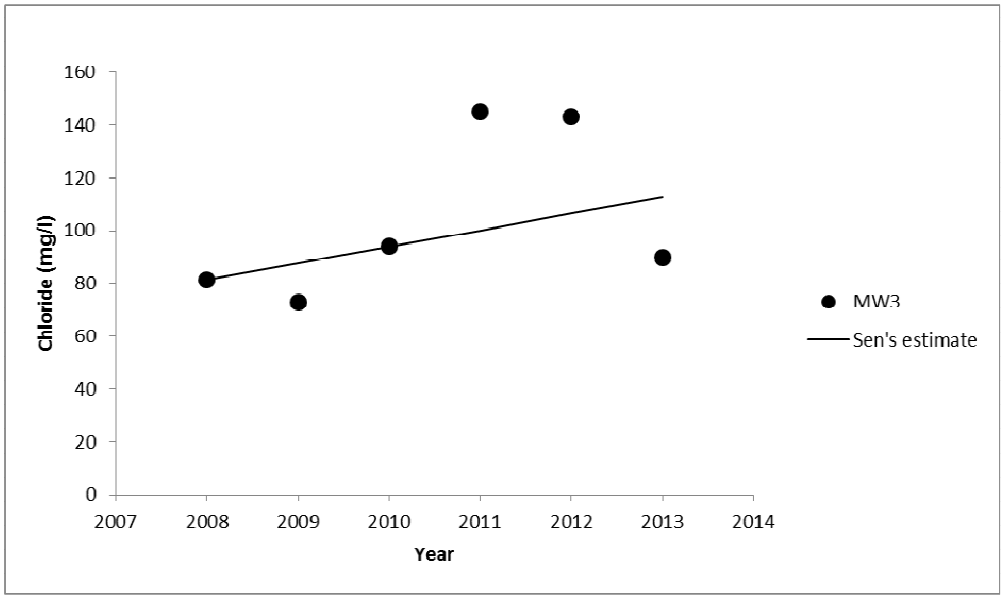
This test mirrors Quantitative Status Test 1.

In assessing the impact of saline intrusion on groundwater, the presence of a statistically significant upward trend in both EC and chloride at any individual monitoring point, as a result of abstraction, results in the groundwater body status being classified as *Poor*.

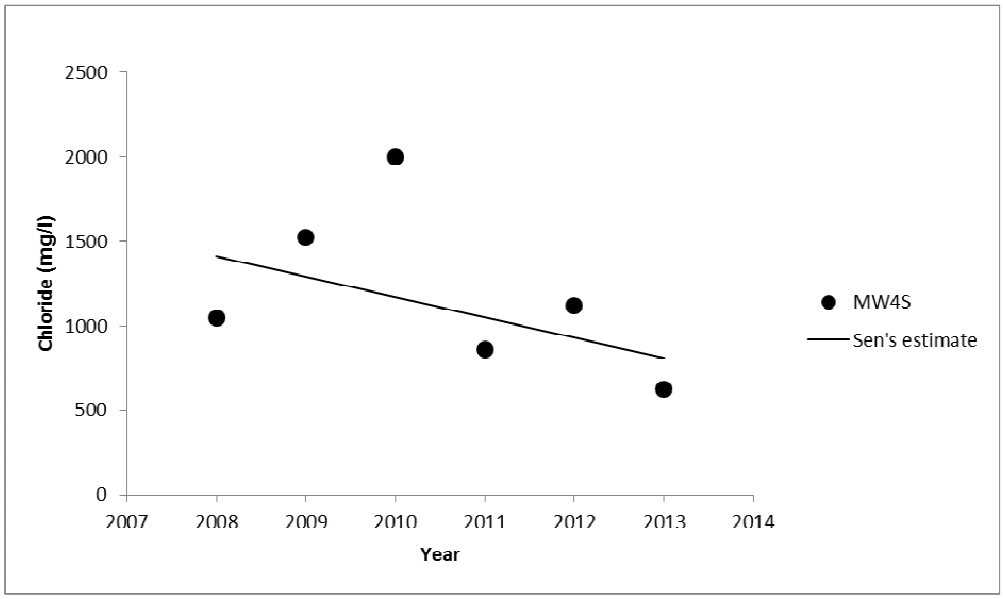
Monitoring locations with significant upward trends in chloride, but not in EC or vice versa, remain at *Good* status, but are at risk of failing to meet WFD objectives in the future.

There are no statistically significant upward trends in chloride in groundwater from the three licensed wells.

Graph 4: Chloride Trend Analysis for Well MW3



Graph 5: Chloride Trend Analysis for Well MW4S



Graph 6: Chloride Trend Analysis for Well MW5

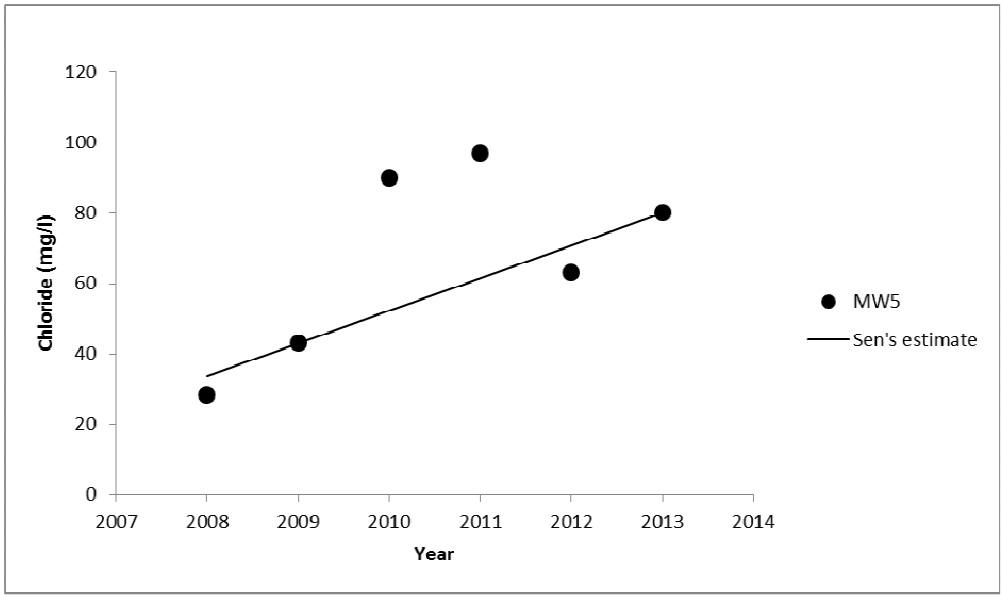


Table 3: Summary of Criteria to Determine Status and Confidence

Risk assessment					Status & Confidence
Abstraction in GWB	Abstraction <20km from the coast	Concentration at Monitoring Point >TV	Elevated Concentration Caused by Abstraction	Upward Trend in Concentration	
No	-	-	-	-	Good-HC
Yes	No	-	-	-	Good-HC
Yes	Yes	No	-	-	Good-HC
Yes	Yes	Yes	No	-	Good-LC
Yes	Yes	Yes	Yes	No	Good-LC
Yes	Yes	Yes	Yes	Yes	Poor-LC
Yes	Yes	Yes	Yes	Yes	Poor-HC*

*Evidence of impacts of saline intrusion on nearby receptors

As discussed in Section 4.2.1, there are exceedances of the GTVs for EC and chloride in groundwater from the licensed wells. However, there are no sustained upward trends. Therefore, the groundwater status is *Good* with low confidence.

Test 1: Passed

Status: Good, Low Confidence

4.3.2 *Test 2 - Impact of Groundwater on Associated Surface Water Bodies*

This test is required to assess whether the ecology of an associated surface water body is damaged due to the quality of groundwater discharging to it.

It is possible that groundwater from the site to discharges to the Upper Shannon Estuary (IE_SH_060_800), albeit at a considerable distance from the site (3 km); therefore, this test is considered somewhat applicable to the Enva site.

As per the EPA 2010 guidance document, two parameters are considered in this test:

- Ammonium (as nitrogen), with a GTV of 0.065 mg/L
- Molybdate reactive phosphorous (MRP), with a GTV of 0.035 mg/L

The overall status of the Upper Shannon Estuary is classified as *Good,* with the classification related to MRP as *High*; no surface water EQS is defined for ammonium as nitrogen in a *transitional water body.*

The overall assessment approach is outlined in the following table. As the status of Upper Shannon Estuary with regard to MRP is *High*, the groundwater status is *Good* with high confidence.

Table 4: Summary of Criteria to Determine Status and Confidence

Status	Confidence	Example Criteria
Good	High	No surface water body at less than Good Status OR Surface water body at less than Good Status, but groundwater concentrations < 50% of EQS and therefore Groundwater unable to contribute > 50% of the load to surface water.
	Low	Surface water body at less than Good Status, but further investigation indicates groundwater loading < 50% of loading required to breach EQS OR Elevated pollution concentrations in groundwater unlikely to impact on the associated surface water body, e.g. where MRP is likely to be bound or attenuated by the overlying subsoil
Poor	Low	Surface water body at less than Good Status, and further investigation indicates groundwater loading > 50% of loading required to breach EQS
	High	Surface water body at less than Good Status, and further investigation indicates groundwater loading > 50% of loading required to breach EQS AND Detailed site specific studies (e.g. groundwater tracing) identify and quantify direct connection between groundwater and surface water.

Test 2: Passed

Status: Good, High Confidence

4.3.3 *Test 3 - Groundwater Dependent Terrestrial Ecosystems*

This test is required to assess whether groundwater quality is damaging the ecology of groundwater dependent terrestrial ecosystems. This test is only applied to wetlands that have been formally identified as protected areas under Regulation 8 of S.I. No. 722 of 2003.

As discussed in Section 4.2.3, groundwater from the site could potentially discharge to the Shannon Estuary. The Lower River Shannon has been identified as a Special Area of Conservation (SAC – 002165).

The ecological status of the Upper Shannon Estuary (Lower River Shannon) is classified under the WFD as *Good*. Given the distance from the site to the Lower River Shannon (~3 km), it is considered unlikely that localised contamination in groundwater beneath the Enva site would impact on the ecological status of the Estuary.

Status	Confidence	Example Criteria
Good	High	No ecological damage to GWDTE OR Ecology of GWDTE damaged, but groundwater concentrations < wetland trigger action value/concentration
	Low	Ecology of GWDTE damaged, but further investigation indicates groundwater loading < loading required to breach wetland trigger action value/concentration
Poor	Low	Ecology of GWDTE damaged, and further investigation indicates groundwater loading > loading required to breach wetland trigger action value/concentration
	High	Ecology of GWDTE damaged, and further investigation indicates groundwater loading > loading required to breach wetland trigger action value/concentration AND Detailed site-specific studies identify and quantify direct connection between groundwater and GWDTE.

Test 3: Passed

Status: Good, High Confidence

4.3.4 *Test 4: Drinking Water Protected Area*

To minimise the requirement for purification treatment, groundwater intended for human consumption at the point of abstraction should be of *Good* qualitative status. The guidance specifically states that this test is applicable "at a representative selection of drinking water abstractions". While groundwater from beneath the Enva site is not currently abstracted for human consumption, this test is applicable as a "Protected Area" under the WFD in terms of Groundwater for Drinking Water use.

The following parameters are considered in this test:

- Boron, with a GTV of 750 µg/L
- Individual pesticides, with individual GTVs of 0.075 µg/L
- Total pesticides, with a GTV of 0.375 µg/L
- Nitrate (as NO_3), with a GTV of 37.5 mg/L
- Nitrite (as NO2), with a GTV of 0.375 mg/L
- Electrical conductivity, with a GTV of 1,875 µS/cm
- Chloride, with a GTV of 187.5 mg/L
- Sulphate, with a GTV of 187.5 mg/L
- Sodium, with a GTV of 150 mg/L
- Ammonium (as N), with a GTV of 0.175 mg/L[3]

Many of these parameters are included in routine groundwater monitoring analysis, with some additional analyses included in December 2013.

[3] GTV is given as 0.175 mg/L for ammonium as nitrogen, which is equivalent to 0.225 mg/L of ammoniacal Nitrogen as NH_4

The following table outlines the rationale in determining the status of the groundwater for this test.

Statistically significant trend in data	Mean concentration currently below TV	Mean concentration currently above TV
Down	Good (also not at risk)	Good (at risk)
No trend	Good (also not at risk)	Good (at risk)
Up	Good (at risk where predicted concentration in 2021 > TV, otherwise not at risk)	Poor (at risk)

Boron

Boron concentrations in December 2013 were low and less than half the Drinking Water Standard of 1 mg/L (DWS, S.I. No. 278 of 2007). No individual boron result exceeded the GTV. Therefore, groundwater status in relation to boron is considered *Good (also not at risk).*

Pesticides

Pesticides were all below MDLs in groundwater from the three licensed monitoring wells in December 2013. Groundwater status in relation to pesticides is considered *Good (also not at risk).*

Nitrate and Nitrite

Long term average concentrations for nitrate and nitrite in groundwater from all three wells are less than half the relevant DWS. Therefore, groundwater status in relation to nitrate and nitrite is considered *Good (also not as risk).*

EC

The long term annual average EC concentration in groundwater from well MW4S is above the GTV of 1,875 µS/cm. However, there is a no statistically significant trend (see Graph 2). Therefore, groundwater status in relation to EC is considered *Good* (also not at risk).

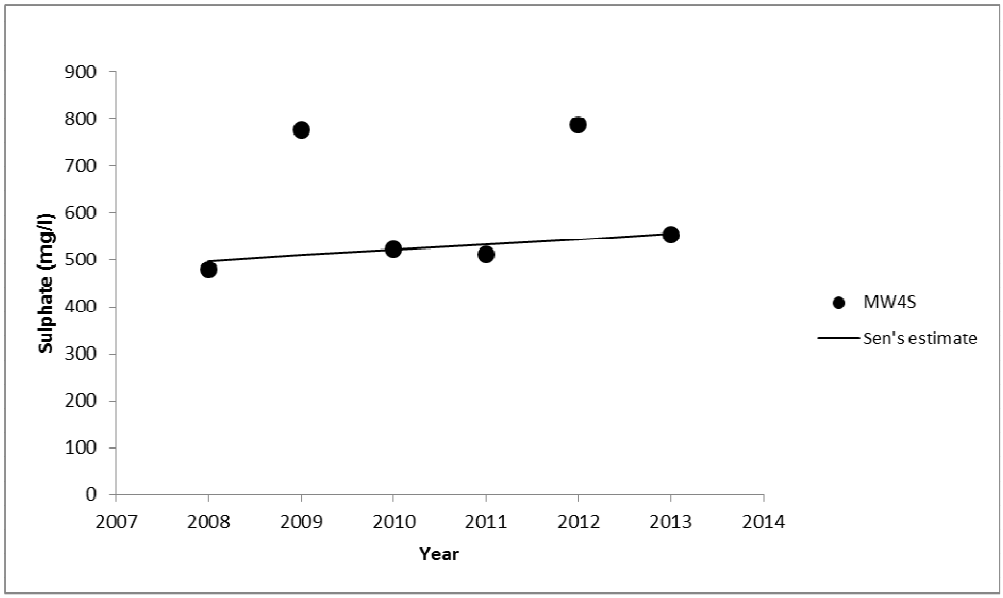
Chloride

The long term annual average chloride concentration in groundwater from well MW4S is above the GTV of 187.5 mg/L. However, there is no statistically significant trend (see Graph 5). Therefore, groundwater status in relation to chloride is considered *Good* (also not at risk).

Sulphate

The long term annual average sulphate concentration in groundwater from well MW4S is above the GTV of 187.5 mg/L. However, as there is no statistically significant trend, the groundwater status in relation to sulphate is considered *Good* (also not at risk).

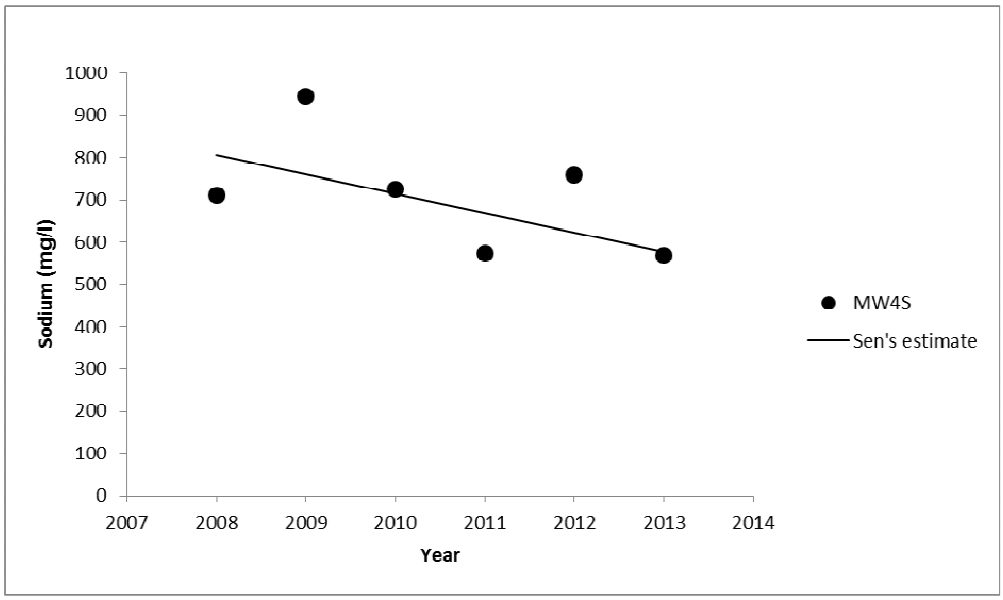
Graph 7: Sulphate Trend Analysis for Well MW4S



Sodium

The long term annual average sodium concentration in groundwater from well MW4S is above the GTV of 187.5 mg/L. However, as there is no statistically significant trend; the groundwater status in relation to sodium is considered *Good* (also not at risk).

Graph 8: Sulphate Trend Analysis for Well MW4S

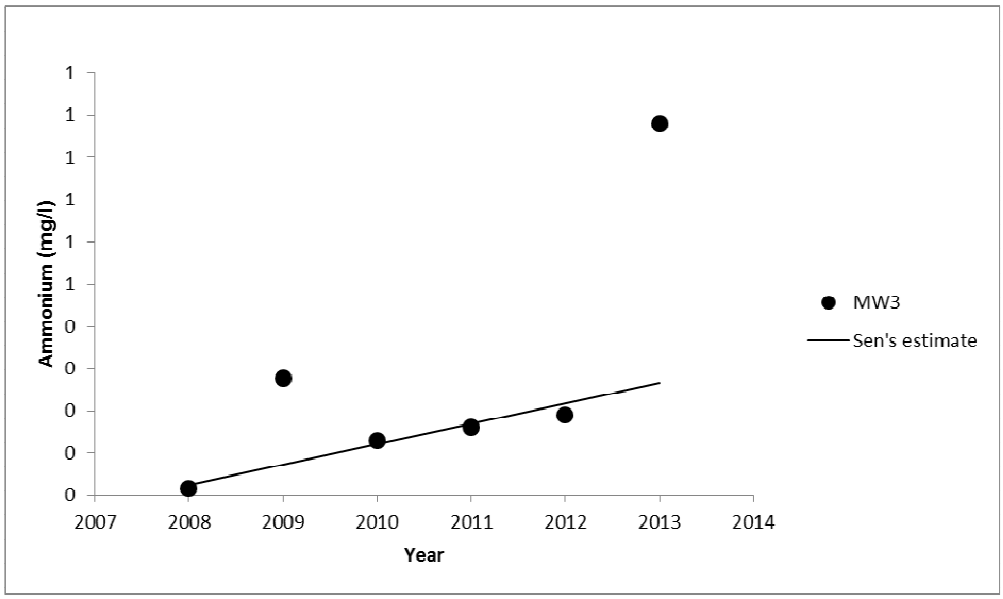


Ammonium

Long term average ammoniacal nitrogen concentrations in groundwater from wells MW3 and MW4S exceed the GTV (0.175 mg/L).

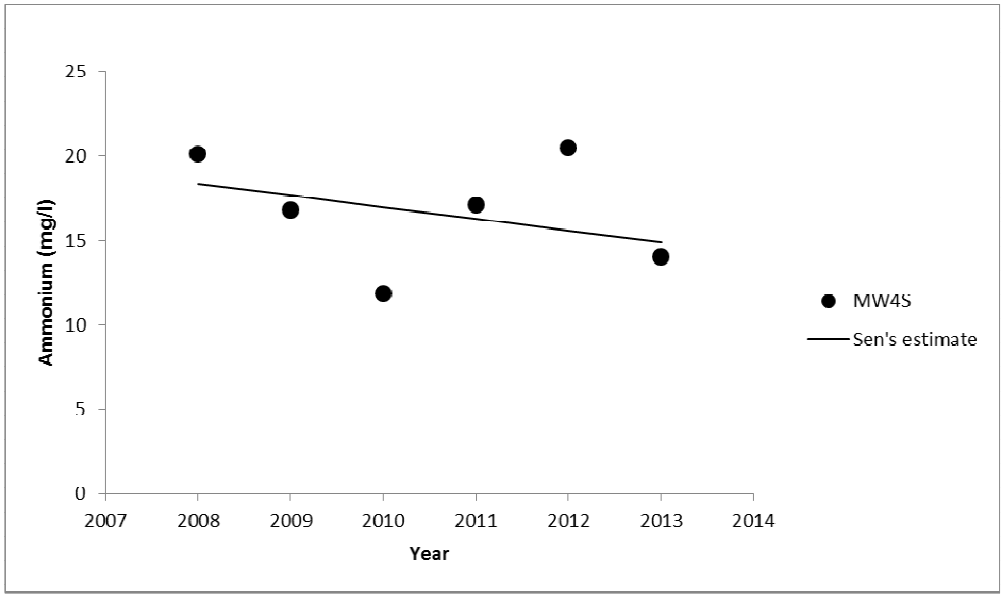
For well MW3, there is no statistically significant trend for ammoniacal nitrogen; therefore, groundwater status in relation to ammoniacal nitrogen is considered *Good* (also not at risk).

Graph 9: Ammonium Trend Analysis for Well MW3



Concentrations of ammoniacal nitrogen are highest in groundwater from well MW4S and are consistently in excess of the GTV. However, there is no statistically significant trend for ammoniacal nitrogen; therefore, groundwater status in relation to ammoniacal nitrogen is considered Good (also not at risk).

Graph 10: Ammonium Trend Analysis for Well MW3



Test 4: Passed

Status: Good (also not at risk)

4.3.5 *Test 5 – General Chemical Assessment*

This test identifies whether there is "deterioration in groundwater quality at a scale which will compromise its future use for existing or planned human consumption and/or other potential purposes" (EPA, 2010, Section 3.5.2).

The EPA guidance specifically states that "the test is not intended to identify local pollution impacts", therefore this test is intended to assess the groundwater body as a whole, although it further states that "significant point sources, e.g. mining activities and contaminated land" are to be included. While this test is not strictly applicable at the scale of the Enva site, it is being undertaken to assess the general groundwater quality in the TullaNewmarket_2 Groundwater Body (IE_SH_G_231) in so far as it is present beneath the Enva site.

The following parameters are considered in this test:

- Nitrate (as NO_3), with a GTV of 37.5 mg/L
- Ammonium as nitrogen, with a GTV of 0.175 mg/L
- EC, with a GTV of 1,875 µS/cm
- Nitrite (as NO_2), with a GTV of 0.375 mg/L
- Chloride, with a GTV of 187.5 mg/L
- Sulphate, with a GTV of 187.5 mg/L
- Sodium, with a GTV of 150 mg/L
- Individual pesticides, with individual GTVs of 0.075 µg/L
- Total pesticides, with a GTV of 0.375 µg/L
- Boron, with a GTV of 750 µg/L
- Chromium, with a GTV of 37.5 µg/L
- Arsenic, with a GTV of 7.5 µg/L
- Lead, with a GTV of 18.75 µg/L
- Nickel, with a GTV of 15 µg/L
- Mercury, with a GTV of 0.75 µg/L
- Cadmium, with a GTV of 3.75 µg/L
- Copper, with a GTV of 1,500 µg/L
- Aluminium, with a GTV of 150 µg/L

- Cyanide, with a GTV of 37.5 µg/L
- 1,2-Dichloroethane, with a GTV of 2.25 µg/L
- Vinyl Chloride, with a GTV of 0.375 µg/L
- Tetrachloroethene and Trichloroethene, with a GTV of 7.5 µg/L
- Benzene, with a GTV of 0.75 µg/L
- Benzo(a)pyrene, with a GTV of 0.0075 µg/L
- Total PAHs[4], with a GTV of 0.075 µg/L
- Total Trihalomethanes, with a GTV of 75 µg/L

Most of these parameters are included in routine groundwater monitoring analysis. Pesticides, aluminium, boron were added to the analytical suite in the December 2013 monitoring round. Results for these parameters in December 2013 were below their respective GTVs. While the long term average for these parameters can't be calculated the groundwater status in relation to them is considered *Good*, albeit based on a single round of data.

Where six years' of monitoring data (2008-2013) were available from Enva's three licensed wells, the long term average parameter concentrations were calculated. The aggregated long term average concentrations of the following parameters did not exceed the GTVs in groundwater from any groundwater monitoring well:

- Nitrate
- Nitrite
- Pesticides
- Chromium
- Lead
- Mercury
- Cadmium
- Copper
- Cyanide
- 1,2-Dichloroethane
- Total Trihalomethanes

Therefore, groundwater status in relation to these parameters is considered *Good.*

[4] Total PAHs is taken as the sum of benzo(ghi)perylene, benzo(b,k)flouranthene and indeno(1,2,3-cd)pyrene

Ammonium as Nitrogen

The long term average concentration for ammoniacal nitrogen in groundwater from wells MW3 and MW4S between 2008 and 2013 is 0.39 mg/L and 16.74 mg/L respectively. Both long term averages exceed the GTV for ammoniacal nitrogen of 0.175 mg/L. The long term average concentration for ammonium (0.14 mg/L) in groundwater from well MW5 is below the GTV.

The aggregated long term average for ammoniacal nitrogen for the three licensed wells is 5.76 mg/L, which is above the GTV. A weighting factor has been applied to the aggregated long term average to determine whether monitoring data are representative of groundwater quality across the site.

> *Area-Weighted Average Concentration = ((Polluted area x Estimated average concentration in polluted area) + (Area of the remainder of the GWB x Estimated average concentration in this area)) / Total GWB area*

As this test is being conducted for the TullaNewmarket_2 Groundwater Body only in so far as it is present beneath the Enva site, the site area has been used in the calculation rather than the area of the TullaNewmarket_2 Groundwater Body as a whole.

The weighted average concentration is 0.60 mg/L and is above the GTV (0.175 mg/L). Therefore, site-wide groundwater status in relation to ammoniacal nitrogen is considered *Poor.*

EC

The long term average concentration for EC in groundwater from well MW4S between 2008 and 2013 is 4,019 µs/cm and exceeds the GTV of 1, 875 µs/cm. The long term average concentrations for EC in groundwater from the other two licensed wells are less than the GTV (1,044 µs/cm and 891 µs/cm, respectively).

The aggregated long term average for the three licensed wells is 1,984 µs/cm, which is marginally above the GTV. A weighting factor, as outlined above (for ammonium) has been applied to the aggregated long term EC average to determine whether monitoring data are representative of groundwater quality across the site.

The weighted average EC concentration is 1,164 µs/cm and is below the GTV for EC (1,875 µs/cm). Therefore, site-wide groundwater status in relation to EC is considered *Good.*

Chloride

The long term average concentration for chloride in groundwater from well MW4S between 2008 and 2013 is 1,167 mg/L, which exceeds the GTV of 187.5 mg/L. The long term average concentration for chloride in groundwater from the other two licensed monitoring wells is less than the GTV (106 mg/L and 68 mg/L). The aggregated long term average for chloride for the three licensed wells is 447 mg/L, which is above the GTV.

The weighted average chloride concentration is 162 mg/L and is below the GTV (187.5 mg/L). Therefore, site-wide groundwater status in relation to chloride is considered *Good.*

Sulphate

The long term average concentration for sulphate in groundwater from well MW4S between 2008 and 2013 is 599 mg/L and exceeds the GTV of 187.5 mg/L. The long term average concentrations for sulphate in groundwater from wells MW3 and MW4 are less than the GTV

(156 mg/L and 137 mg/L respectively). The aggregated long term average for sulphate for the three licensed wells is 297 mg/L, which is above the GTV.

The weighted average concentration is 177 mg/L and is below the GTV (187.5 mg/L). Therefore, site-wide groundwater status in relation to sulphate is considered Good.

Sodium

The long term average concentration for sodium in groundwater from well MW4S between 2008 and 2013 is 704 mg/L and exceeds the GTV of 150 mg/L. The long term average concentrations for sodium in groundwater from wells MW3 and MW5 are less than the GTV (74 mg/L and 31 mg/L respectively). The aggregated long term average for sodium for the three licensed wells is 269 mg/L, which is above the GTV.

The weighted average concentration is 101 mg/L and is below the GTV (150 mg/L). Therefore, site-wide groundwater status in relation to sodium is considered Good.

Arsenic

The long term average concentration for arsenic in groundwater from well MW4S between 2008 and 2013 is 9 µg/L and marginally exceeds the GTV of 7.5 µg/L. The long term average concentrations for arsenic in groundwater from the other two licensed wells MW3 and MW5 are less than the GTV (2 µg/L and 1 µg/L respectively). The aggregated long term average for arsenic for the three licensed wells is 4 µg/L, which is below the GTV. Therefore, site-wide groundwater status in relation to arsenic is considered Good.

Nickel

The long term average nickel concentration in groundwater from well MW4S between 2008 and 2013 is 1,041 µg/L and significantly exceeds the GTV of 15 µg/L. The long term average concentrations for nickel in groundwater from wells MW3 and MW5 are also greater than the GTV (39 µg/L and 22 µg/L respectively). The aggregated long term average for nickel for the three licensed wells is 367 µg/L.

Elevated nickel concentrations of between 22 mg/kg to 30 mg/kg have been mapped in the Shannon area and are associated with the impure limestone geology. Arsenic concentrations in groundwater are considered to reflect background conditions. Therefore, groundwater status in relation to nickel is considered *Good.*

Vinyl Chloride

The long term average concentrations for VC in groundwater from wells MW3 and MW4S between 2008 and 2013 are 9 µg/L and 606 µg/L respectively. Both long term averages exceed the GTV of 7.5 µg/L. VC has not been detected above MDLs in groundwater from well MW05 and as such is below the GTV. The aggregated long term average for the three licensed wells for VC is 205 µg/L, which is above the GTV.

The weighted average concentration is 78 µg/L and is above the GTV (7.5 µg/L). Therefore, site-wide groundwater status in relation to VC is considered *Poor.*

Trichloroethene and Tetrachloroethene

Long term average TCE and PCE concentrations in groundwater samples collected from monitoring wells MW3 and MW4S between 2008 and 2013 exceeded the combined GTV of

7.5 µg/L. The long term average combined concentrations of TCE and PCE in groundwater monitoring well MW5 is less than the GTV.

The aggregated long term average for TCE and PCE for the three licensed wells is 21 µg/L, which is above the GTV. A weighting factor has been applied to the aggregated long term average to determine whether monitoring data are representative of groundwater quality across the site.

The weighted average concentration for TCE is 150 µg/L and is above the GTV.

The weighted average concentration for PCE is 70 µg/L and is above the GTV.

Therefore, site-wide groundwater status in relation to TCE and PCE is considered *Poor.*

Benzo(a)pyrene

It is not possible to assess groundwater status in relation to benzo(a)pyrene, as the GTV is 0.0075 µg/L and the detection limit ranges between 1 µg/L and 10 µg/L.

Total PAHs

It is not possible to assess groundwater status in relation to total polycyclic aromatic hydrocarbon (sum of benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene and indeno (1,2,3-cd)pyrene), as the GTV 0.075 µg/L is below the individual MDLs for these substances.

Summary

The chemical status of groundwater beneath the Enva is considered to be Poor with low confidence, as outlined in the table below.

Status	Confidence	Example Criteria
Good	High	No individual site concentrations higher than TV(s)
	Low	Aggregated pollutant concentration < TV(s), but individual site concentrations higher than TV(s) OR Aggregated pollutant concentration > TV(s), but aggregated pollutant concentrations lower than Natural Background concentrations OR Evidence of remediation causing a significant reduction in pollutant concentrations
Poor	Low	Aggregated pollutant concentration > TV(s)
	High	Aggregated pollutant concentration > TV(s) and individual sample concentrations greater than Drinking Water Standard OR Aggregated pollutant concentration > TV(s) and evidence of impact on drinking water abstractions, surface watercourses or wetlands

Test: Failed (for ammonium, vinyl chloride and TCE/PCE)

Status: Poor, Low Confidence

4.3.6 *Qualitative Status Assessment Summary*

The qualitative status assessment from Test 1 (Saline or Other Intrusions Test) is *Good.*

The qualitative status assessment from Test 2 (Impact of Groundwater on Surface Water Ecological/Chemical Status Test) is not applicable to the site and consequently the status defaults to *Good*.

Test 3 (Groundwater Dependent Terrestrial Ecosystems – Chemical Assessment Test) is *Good*.

The groundwater status in relation to Test 4 (Drinking Water Protected Area) is *Poor*.

The qualitative status assessment from Test 5 (General Chemical Assessment Test) is *Poor* in relation to ammonium, VC and TCE/PCE. However, Test 5 is strictly only applicable to widespread groundwater issues affecting entire water bodies (i.e. the entire TullaNewmarket_2 Groundwater Body) and therefore not appropriate to a site-scale assessment.

Overall Qualitative Status: *Poor*

4.4 Assessment of Groundwater Status Summary

The overall groundwater status is *Poor*, as summarised in the table below.

	Test	Applicable	Status	Overall Status	Groundwater Body Status
Quantitative	1	Yes	*Good*	*Good*	***Poor***
	2	No	*Defaults to Good*		
	3	Yes	*Good*		
	4	No	*Defaults to Good*		
Qualitative	1	Yes	*Good*	Poor	
	2	No	*Defaults to Good*		
	3	Yes	*Good*		
	4	Yes	*Good*		
	5	Yes	*Poor* (for ammonium, VC, TCE and PCE) Test 5 not strictly applicable.		

5. SUMMARY AND CONCLUSIONS

The Enva facility occupies approximately 1 ha in area and is situated in the Smithstown Industrial Estate; 1 km north of Shannon town centre. The site operates as a licensed waste facility. Land use surrounding the site is zoned for industrial use.

Depth to bedrock across the site ranges from approximately 1 m to 4.5 m bgl. The overburden consists of soft to firm, brown gravelly clay with cobbles, which is inferred to be a stony glacial till. The overburden is considered dry with groundwater residing in the limestone bedrock aquifer beneath the site.

The limestone bedrock aquifer in the region is classified as a Locally Important Aquifer, which is Moderately Productive only in Local Zones. Groundwater vulnerability in the Smithstown area is assessed as *Extreme.*

The aquifer beneath the site is fractured argillaceous limestone with relatively low permeability, although groundwater flow through fracture zones can be more rapid. Groundwater flow direction beneath the site, under natural gradient conditions, is expected to be to the south and south-west. The aquifer is part of the TullaNewmarket_2 Groundwater Body.

The main contaminants of concern are chlorinated solvents primarily in groundwater from well MW4S. Total VOC concentrations have declined significantly in groundwater from well MW4S (from up to 48,000 µg/L) in recent years, generally 5,000 µg/L throughout 2013.

Review of groundwater data indicates that there are no sustained elevated concentrations of organic contaminants. Major ion and dissolved metal concentrations in groundwater are generally low (especially in groundwater from wells MW3 and MW4) and below the relevant GTVs.

An assessment of groundwater status beneath the site, in line with requirements of S.I. No. 9 of 2010, and only in so far as the TullaNewmarket_2 Groundwater Body is present beneath the site, was completed. The assessment considers both quantitative and qualitative status.

Only two of quantitative status assessment tests (Test 1 and Test 3) are applicable to groundwater in the TullaNewmarket_2 Groundwater Body, in so far as it is present beneath the Enva site. As groundwater data for the site passes Test 1 and Test 3 of the Quantitative Assessment, the overall quantitative status is considered *Good.*

Four of the five qualitative tests were applicable to groundwater beneath the Enva site. The qualitative status assessment from Test 5 is *Poor* in relation to ammonium, VC and TCE and PCE However, Test 5 is strictly only applicable to widespread groundwater issues affecting entire water bodies (i.e. the TullaNewmarket_2 Groundwater Body) and, therefore, not appropriate to a site-scale assessment. The overall status of the groundwater beneath the site is *Poor.*

This finding does not concur with that of the 2011 EPA Groundwater Status report for the entire TullaNewmarket_2 Groundwater Body (IE_SH_G_231), which was assigned *Good* status. However, it should be borne in mind that the tests are applied to the TullaNewmarket_2 Groundwater Body only in so far as it is present beneath the Enva site and the tests presented in this report, especially Qualitative Test 5, do not consider the status of the groundwater body as a whole.

Consequently, there are no specific actions or recommendations (other than continuing the current routine groundwater monitoring programme) proposed or recommended to achieve

compliance with the European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended.

FIGURES

North

N
W
E
S

Approximate Scale

0 km 0.25 km 0.5 km

CLIENT

ENVA IRELAND LIMITED

PROJECT LOCATION

SMITHSTOWN INDUSTRIAL ESTATE, SHANNON

DRAWING TITLE

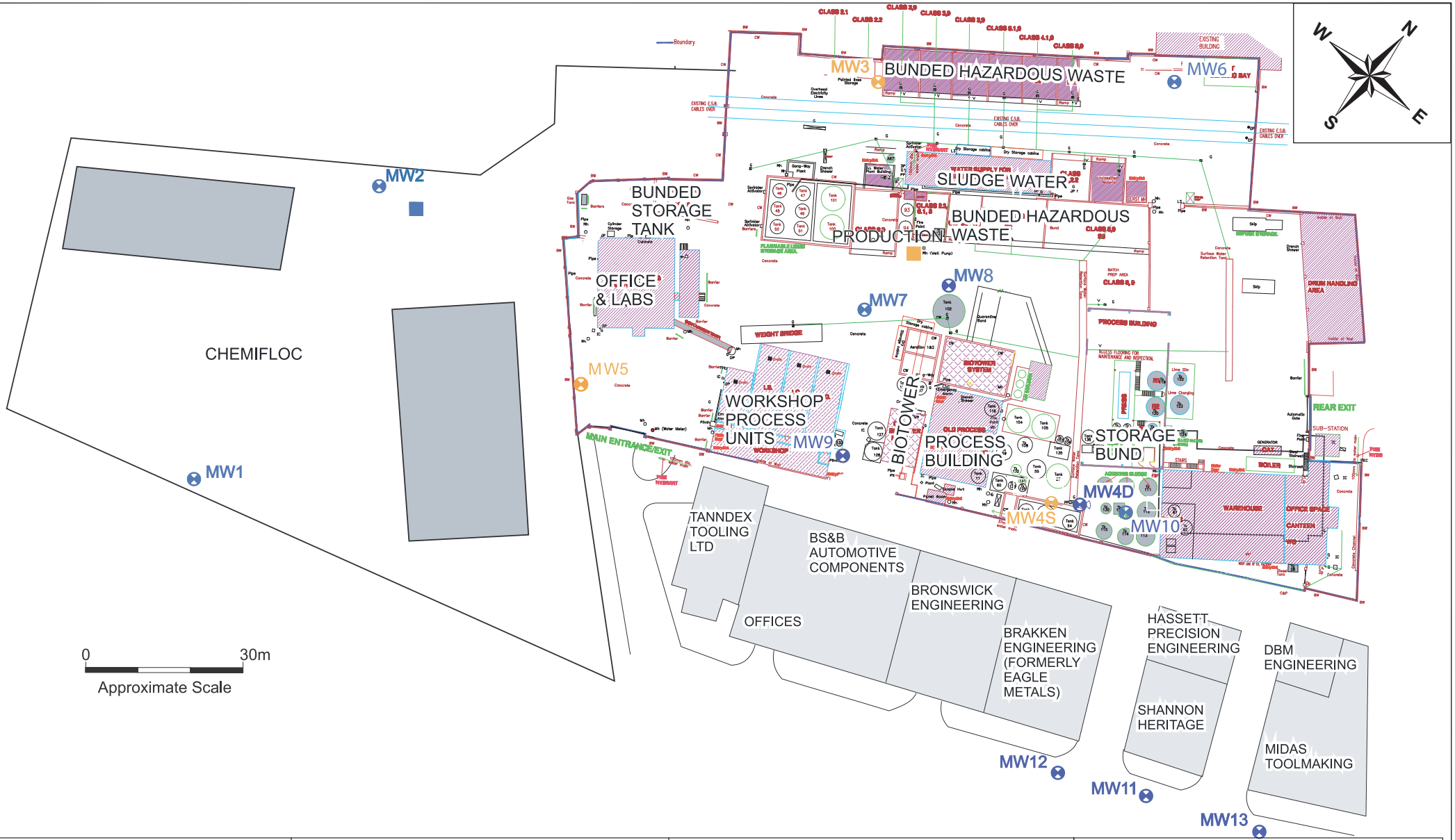
FIGURE 1 - SITE LOCATION PLAN

ENVIRONMENTAL CONSULTANTS

URS

ACORN BUSINESS CAMPUS, MAHON IND PK, CORK
TEL +353 21 4536 136/7 FAX +353 21 4530 666

DRAWN	TRACED	CHECKED	APPROVED	DATE
FO'R		FO'R	KF/COR	MAR 2014
SCALE	Job No.			
AS SHOWN	47092526			A



CLIENT
ENVA IRELAND LIMITED

PROJECT LOCATION
SMITHSTOWN INDUSTRIAL ESTATE, SHANNON, CO. CLARE

DRAWING TITLE
FIGURE 2
SITE LAYOUT PLAN SHOWING BOREHOLE LOCATIONS

DRAWN	TRACED	CHECKED	APPROVED	DATE
FO'R		KF	KF/CORK	MAR 2014
SCALE N.T.S	Job No. 47092526			REV. A

Key

- ENVA SITE BOUNDARY
- MW 4S — WASTE LICENCE MONITORING WELL
- MW10 — NON LICENSED MONITORING WELL
- SITE PRODUCTION WELL
- CHEMIFLOC PRODUCTION WELL

ENVIRONMENTAL CONSULTANTS

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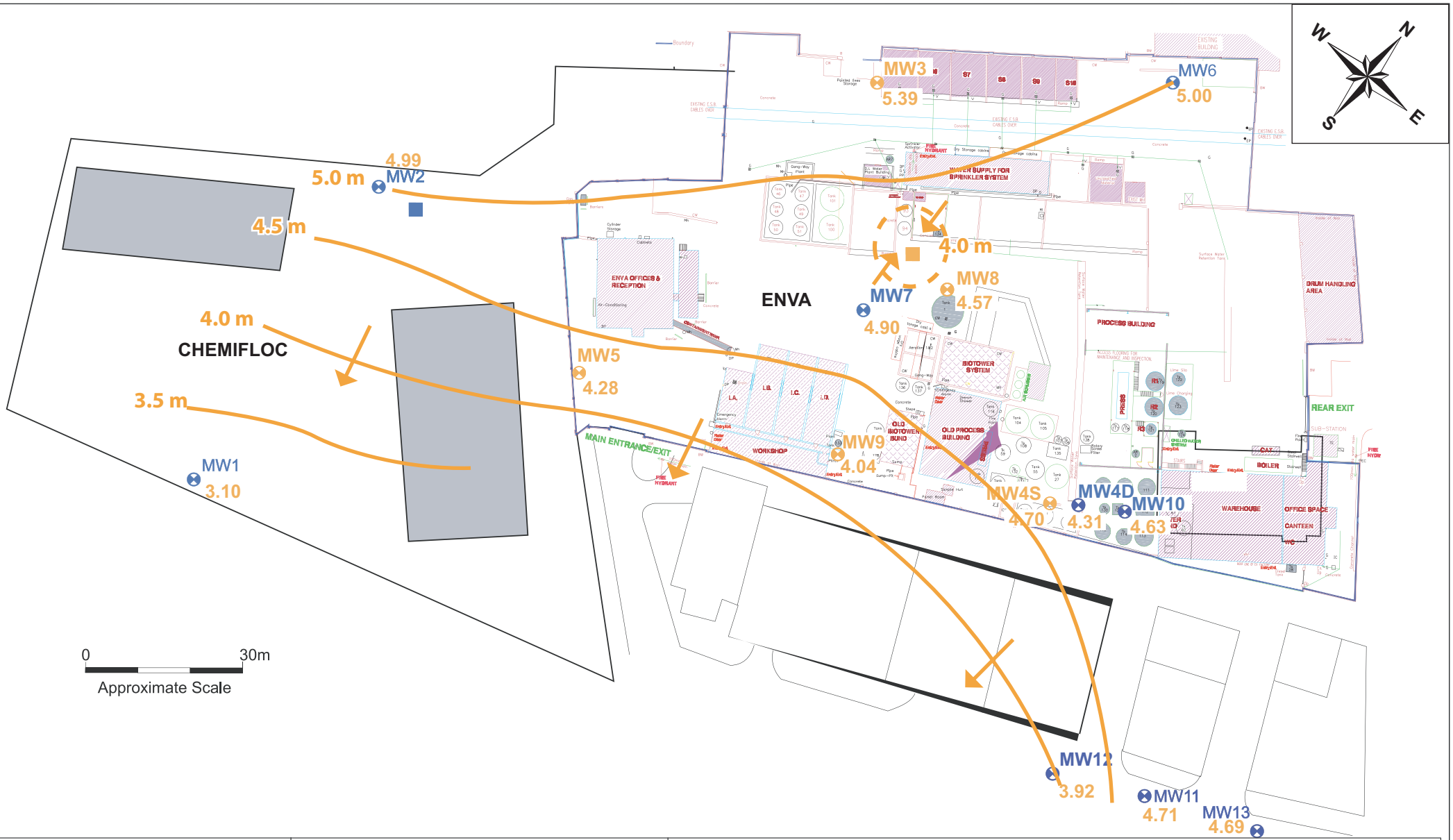

CLIENT	ENVA IRELAND LIMITED
PROJECT LOCATION	SMITHSTOWN INDUSTRIAL ESTATE, SHANNON, CO. CLARE
DRAWING TITLE	FIGURE 3 - GROUNDWATER CONTOUR PLAN 05 JUNE 2013

DRAWN	TRACED	CHECKED	APPROVED	DATE
SML		FO'R	KF/COR	MAR 2014

SCALE	Job No.	REV.
N.T.S	47092526	A

Key

- ENVA SITE BOUNDARY
- MW3 / MW1 — MONITORING WELL SAMPLED / MONITORING WELL DIPPED
- SITE PRODUCTION WELL
- CHEMIFLOC PRODUCTION WELL
- 5.35 — GROUNDWATER ELEVATION (m Above Site Datum)
- GROUNDWATER CONTOUR
- GROUNDWATER FLOW DIRECTION

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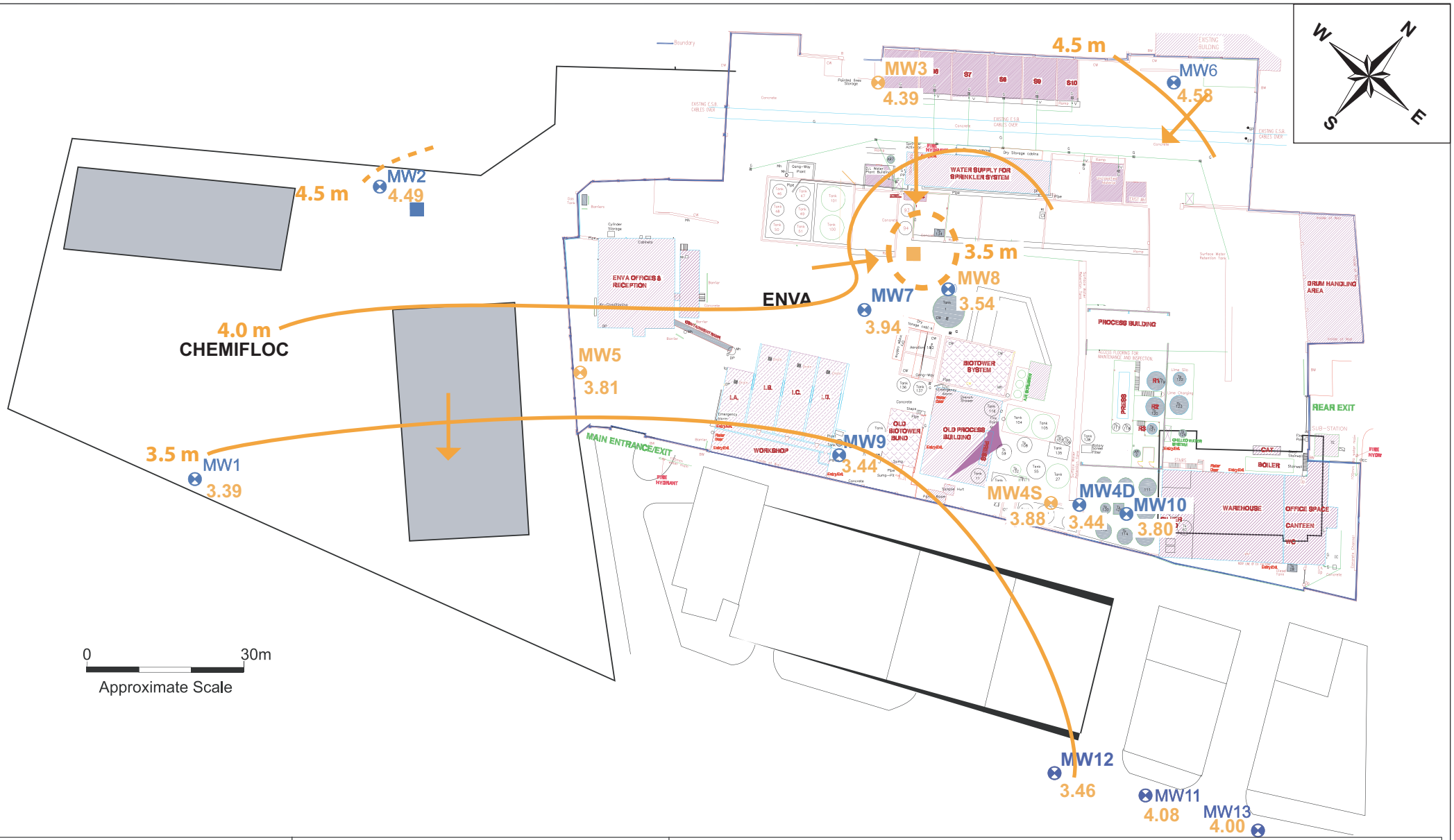

CLIENT	ENVA IRELAND LIMITED
PROJECT LOCATION	SMITHSTOWN INDUSTRIAL ESTATE, SHANNON, CO. CLARE
DRAWING TITLE	FIGURE 4 - GROUNDWATER CONTOUR PLAN 30 SEPTEMBER 2013

DRAWN	TRACED	CHECKED	APPROVED	DATE
FO'R		EOH	DM/DUB	MAR 2014
SCALE	Job No.			REV.
N.T.S	47092526			A

Key

- ENVA SITE BOUNDARY
- MW3 — MONITORING WELL SAMPLED
- MW1 — MONITORING WELL DIPPED
- SITE PRODUCTION WELL
- CHEMIFLOC PRODUCTION WELL
- 5.35 — GROUNDWATER ELEVATION (m Above Site Datum)
- GROUNDWATER CONTOUR
- GROUNDWATER FLOW DIRECTION

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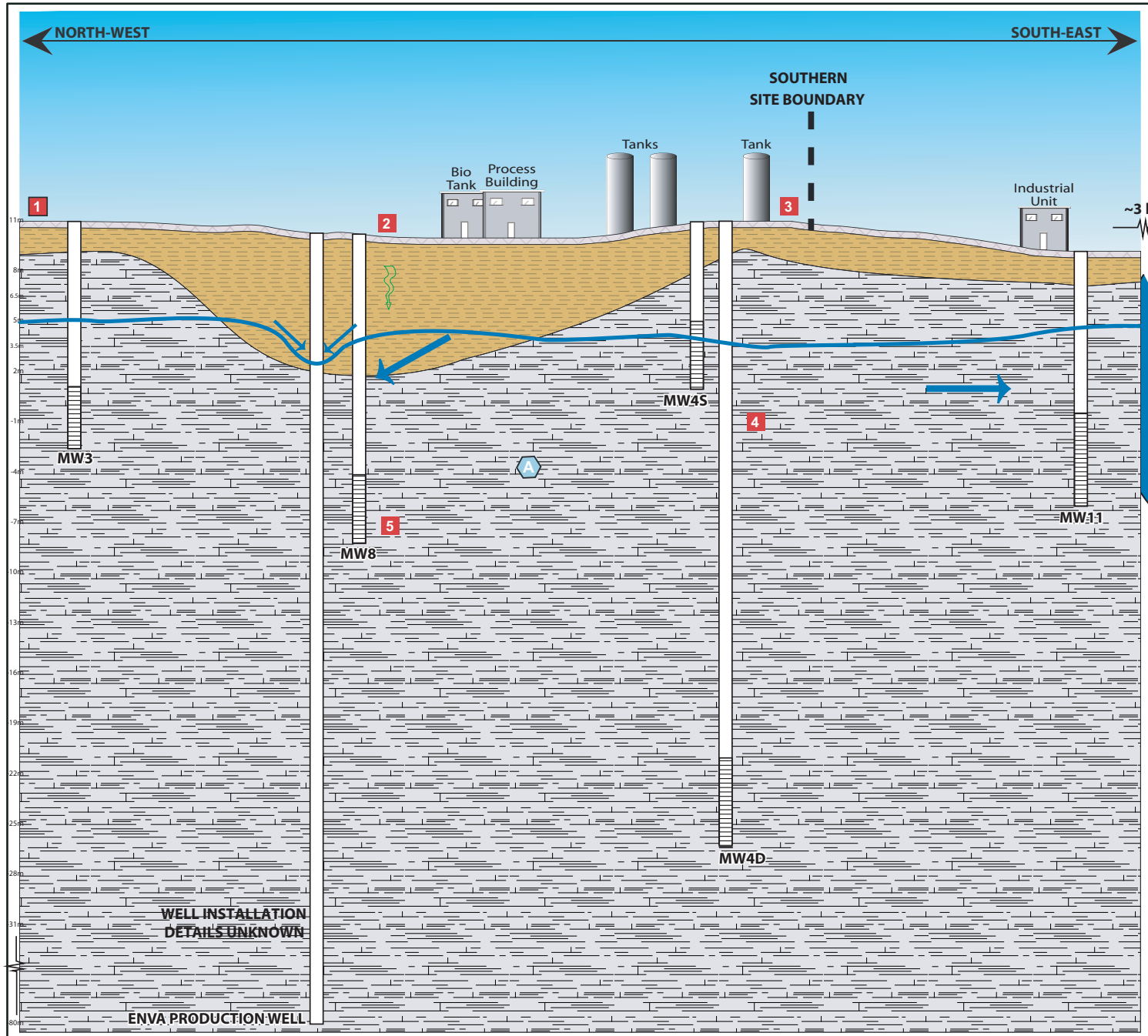

POTENTIAL SOURCES

1 UPGRADIENT OF MW3 - CHLOROETHANES

IDENTIFIED SOURCES

2 CENTRE OF THE SITE - CHLOROETHENES

3 SOUTHERN SITE BOUNDARY - VARIED SUITE OF CHLORINATED SOLVENTS

4 IN GROUNDWATER - VARIED SUITE OF CHLORINATED SOLVENTS

5 IN GROUNDWATER - CHLOROETHANES

PATHWAYS

1 GROUNDWATER FLOW

KNOWN RECEPTOR

A GROUNDWATER

POTENTIAL RECEPTOR

B RIVER SHANNON ESTUARY

LEGEND

MADE GROUND

GRAVELLY CLAY / SILT - LIMESTONE TILL

LIMESTONE BEDROCK

GROUNDWATER LEVEL

URS

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CLIENT: ENVA IRELAND LIMITED

PROJECT: ENVA HYDROGEOLOGICAL ASSESSMENT 2014

DRAWING TITLE: **FIGURE 5 CONCEPTUAL SITE MODEL CROSS SECTION NORTH-WEST-SOUTH-EAST**

DRAWN	TRACED	CHECKED	APPROVED	DATE
SML		FO'R	KF/COR	APRIL 2014

SCALE	JOB NO.	REV
AS SHOWN	47092726	

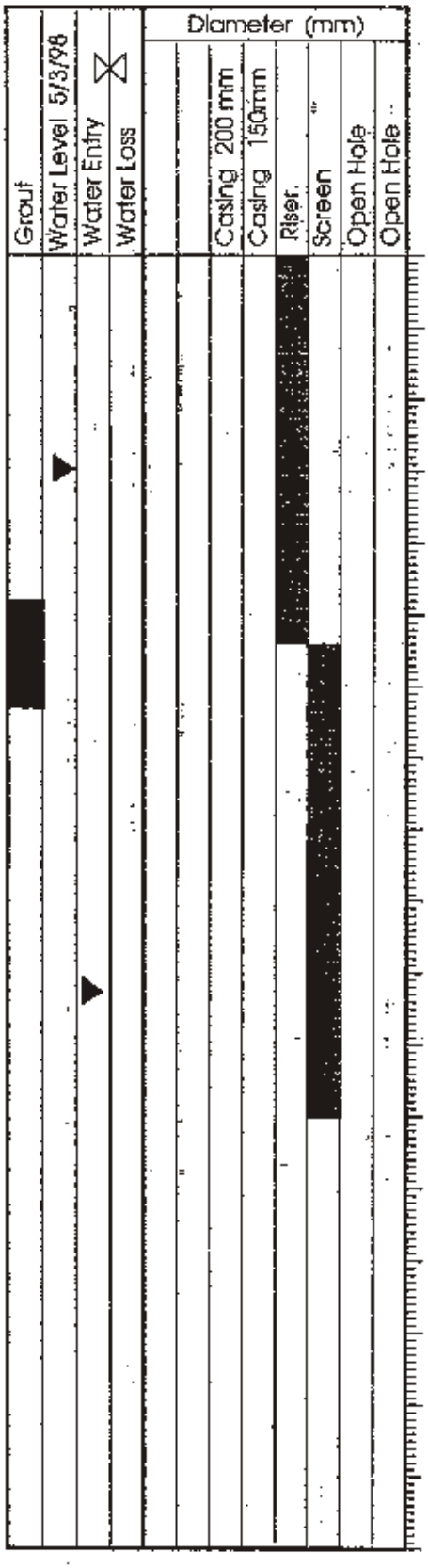
APPENDIX A ENVA BOREHOLE DRILLING SUMMARY

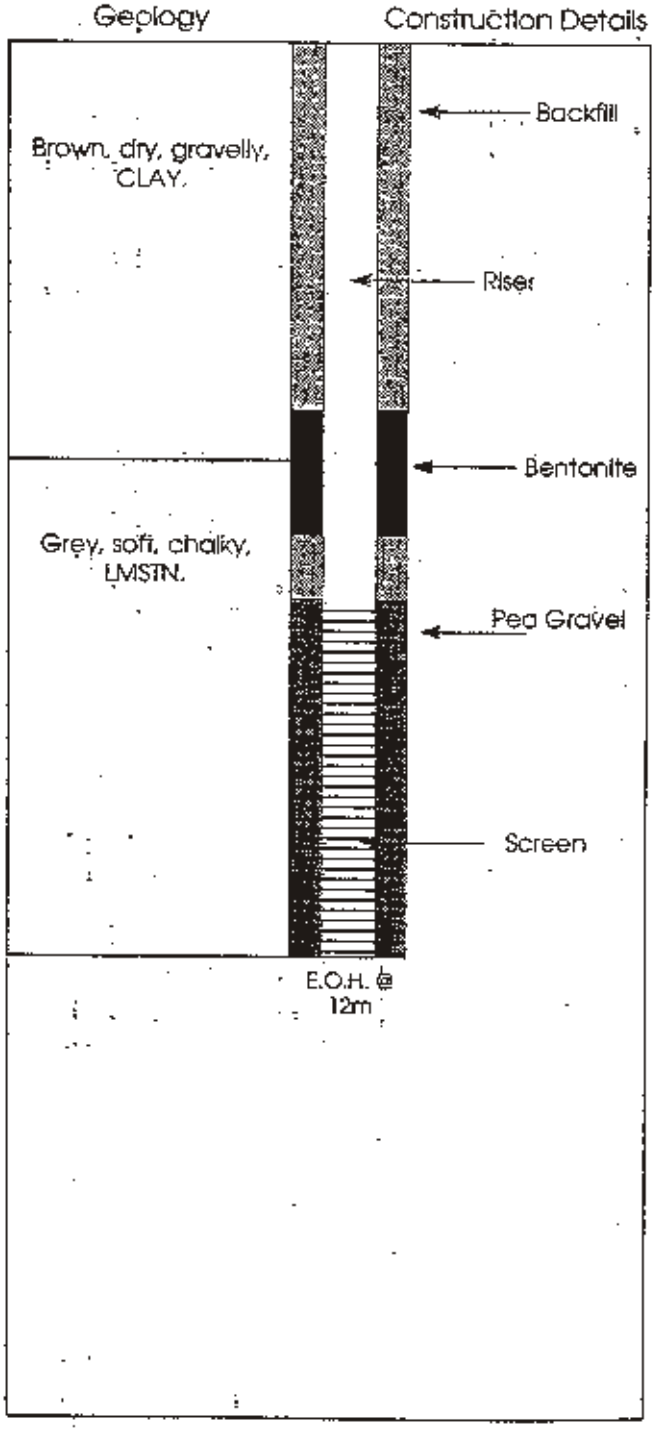
Completed Well Design

BH No.-1

Client : Shannon Environment
Project : Groundwater Investigation.
Location : Smithstown Industrial Estate
County : Clare
Date : 25/2/98
Driller : T.J. Cross & Co.
Aquifer : Carboniferous Limestone.
Output : N.A.
Elevation (mOD):
Water Level (mOD)

Remarks





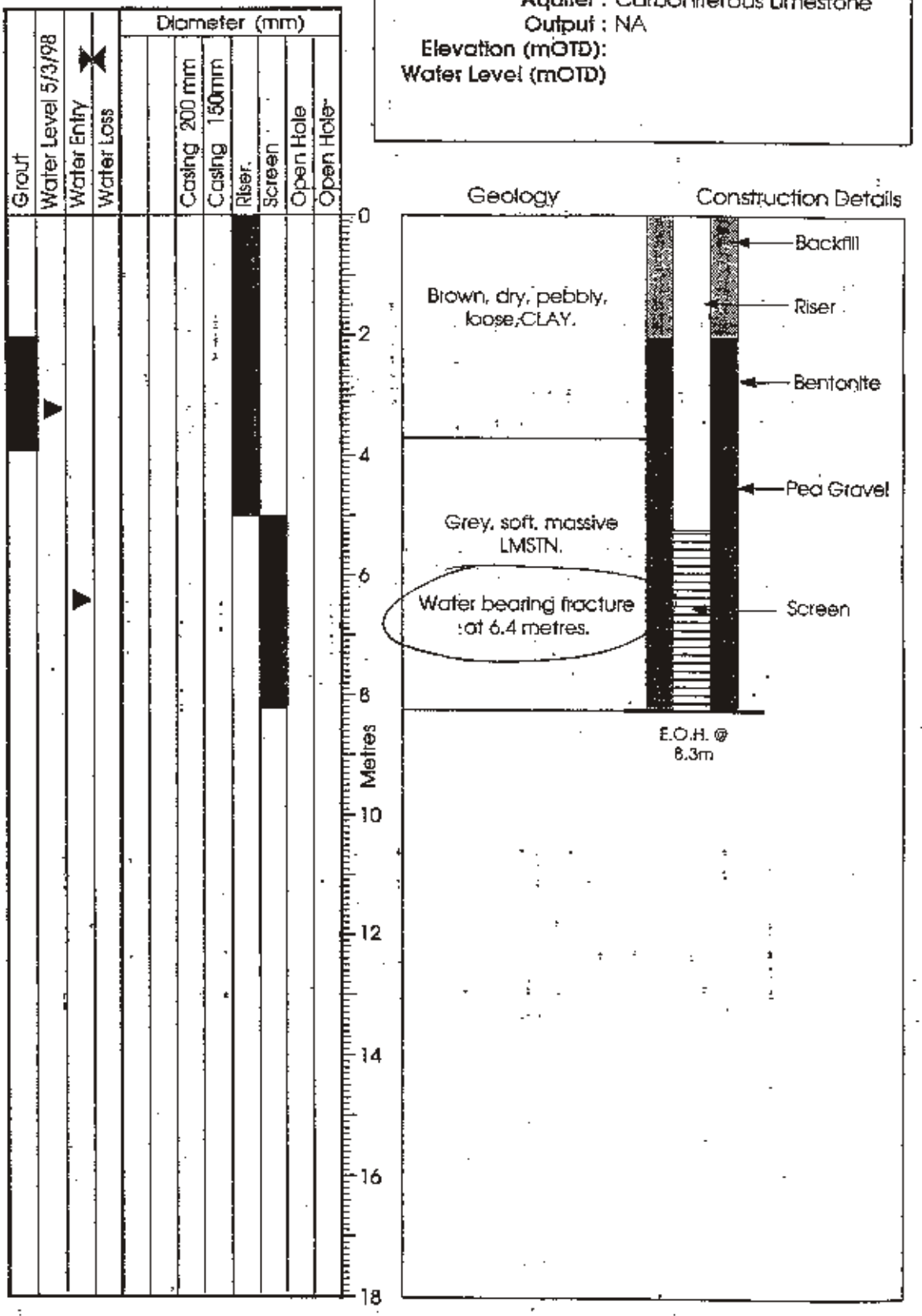
K.T.Cullen & Co. Ltd.
Hydrogeological & Environmental Consultants

Completed Well Design

BH No. 2

Client : Shannon Environment
Project : Groundwater Investigation
Location : Smithstown Industrial Estate
County : Clare
Date : 25/2/98
Driller : T. Cross
Aquifer : Carboniferous Limestone
Output : NA
Elevation (mOTD):
Water Level (mOTD)

Remarks



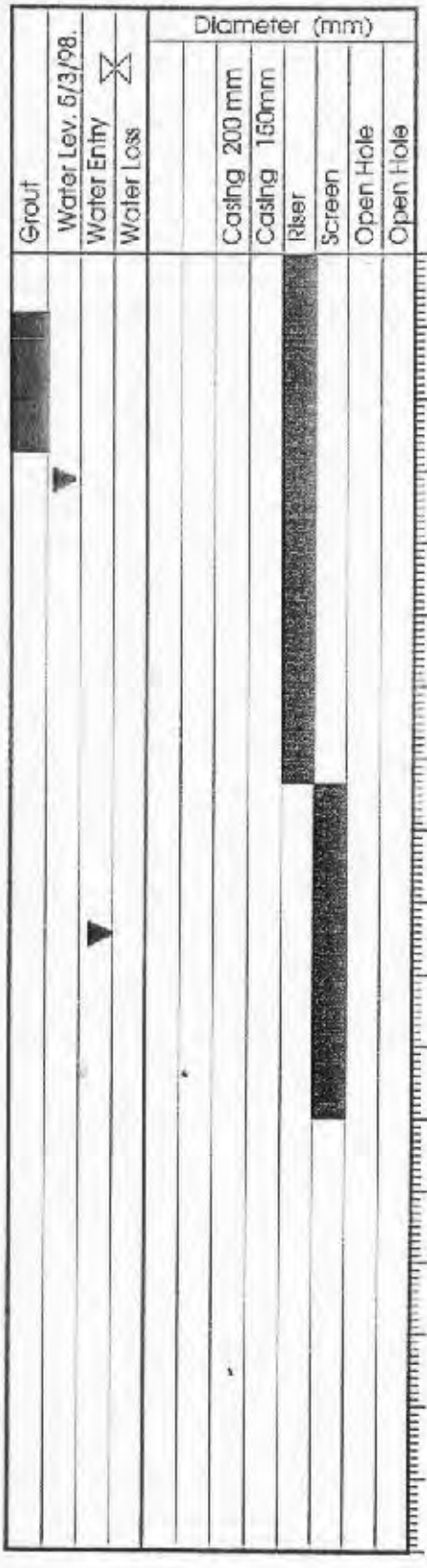
K.T.Cullen & Co. Ltd.
Hydrogeological & Environmental Consultants

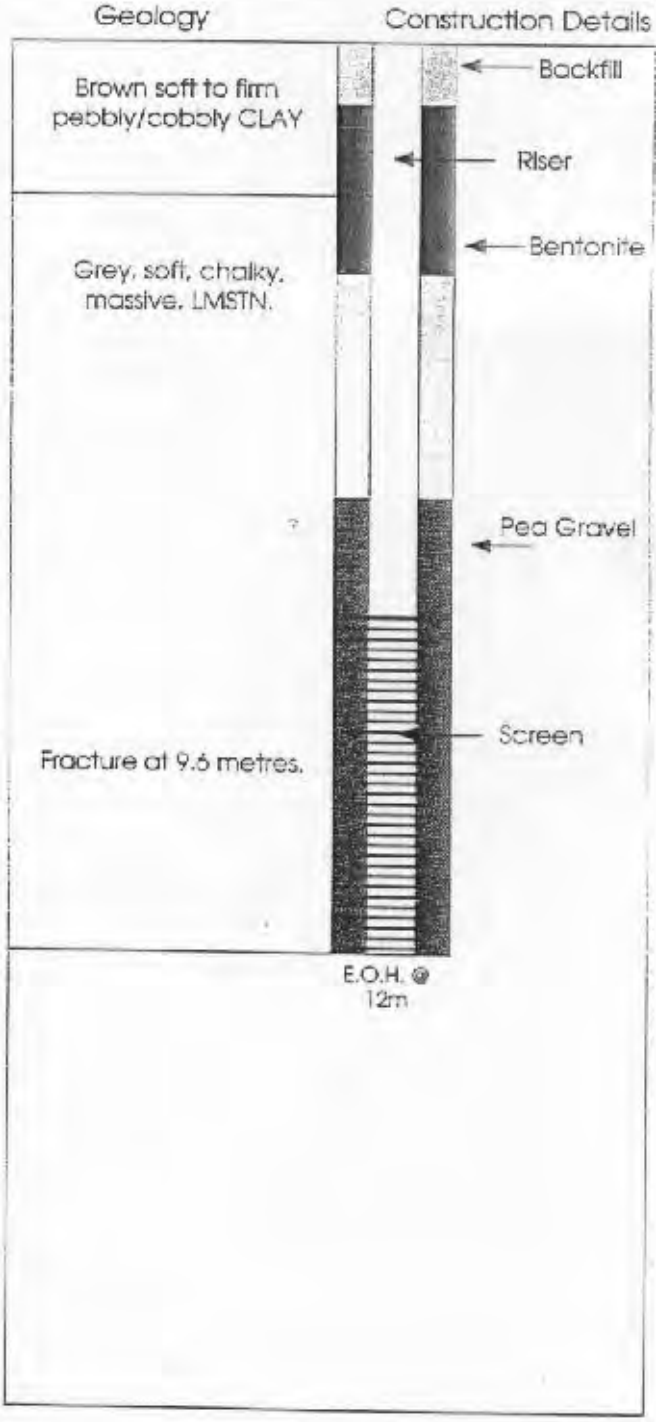
Completed Well Design

BH No. 3

Client : Shannon Environment
Project : Groundwater Investigation
Location : Smithstown Industrial Estate
County : Clare
Date : 25/2/98
Driller : T. Cross
Aquifer : Carboniferous Limestone
Output : NA
Elevation (mOTD):
Water Level (mOTD)

Remarks





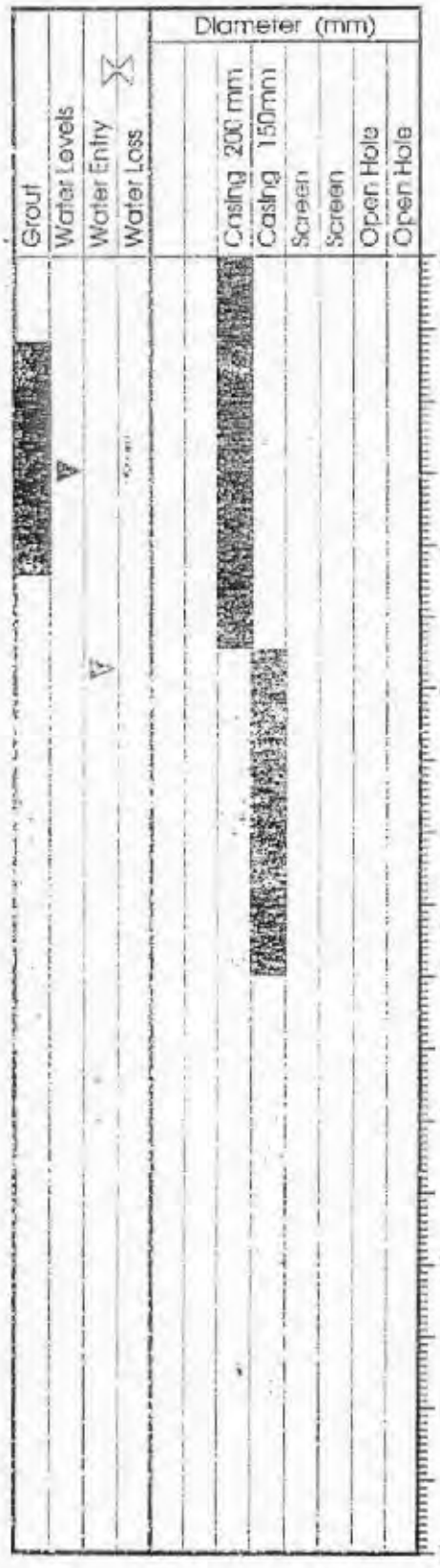
K.T.Cullen & Co. Ltd.
Hydrogeological & Environmental Consultants

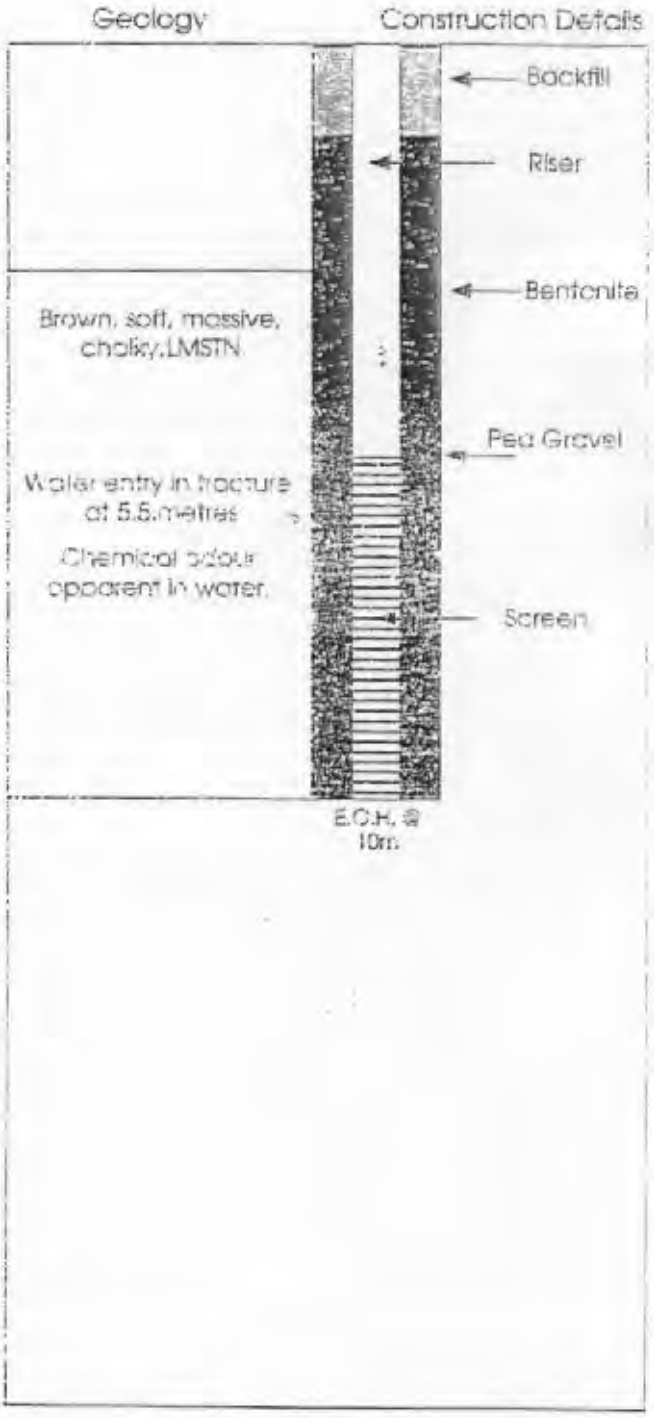
Completed Well Design

BH No. 4

Client : Shannon Environment
Project : Groundwater Investigation
Location : Smithstown Industrial Estate
County : Clare
Date : 25/2/98
Driller : T. Cross
Aquifer : Carboniferous Limestone.
Output : NA
Elevation (mOTD):
Water Level (mOTD)

Remarks





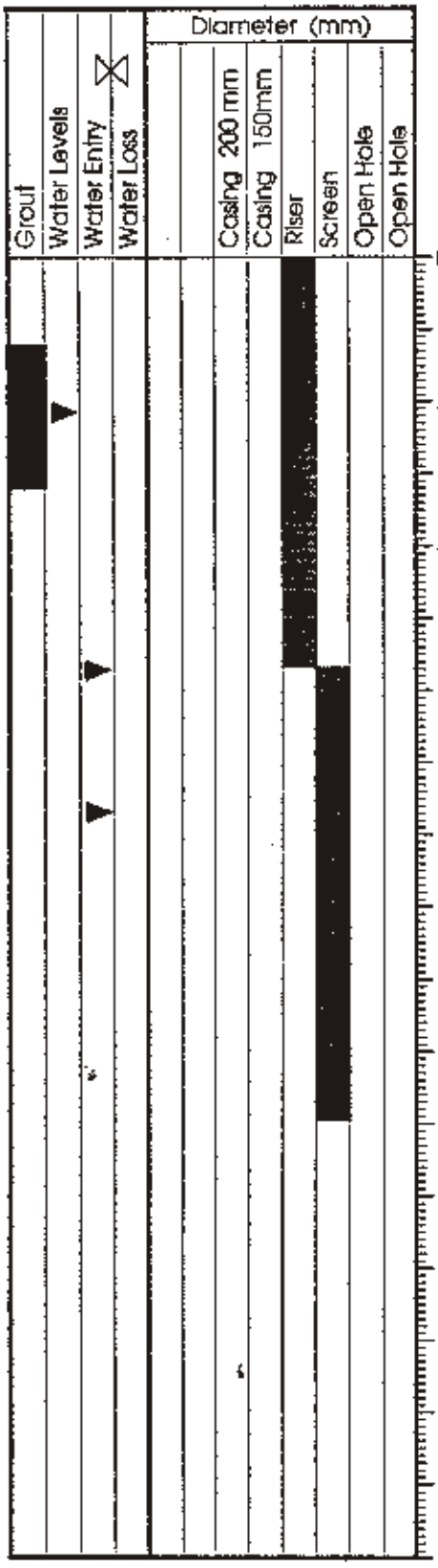
K.T.Cullen & Co. Ltd.
Hydrogeological & Environmental Consultants

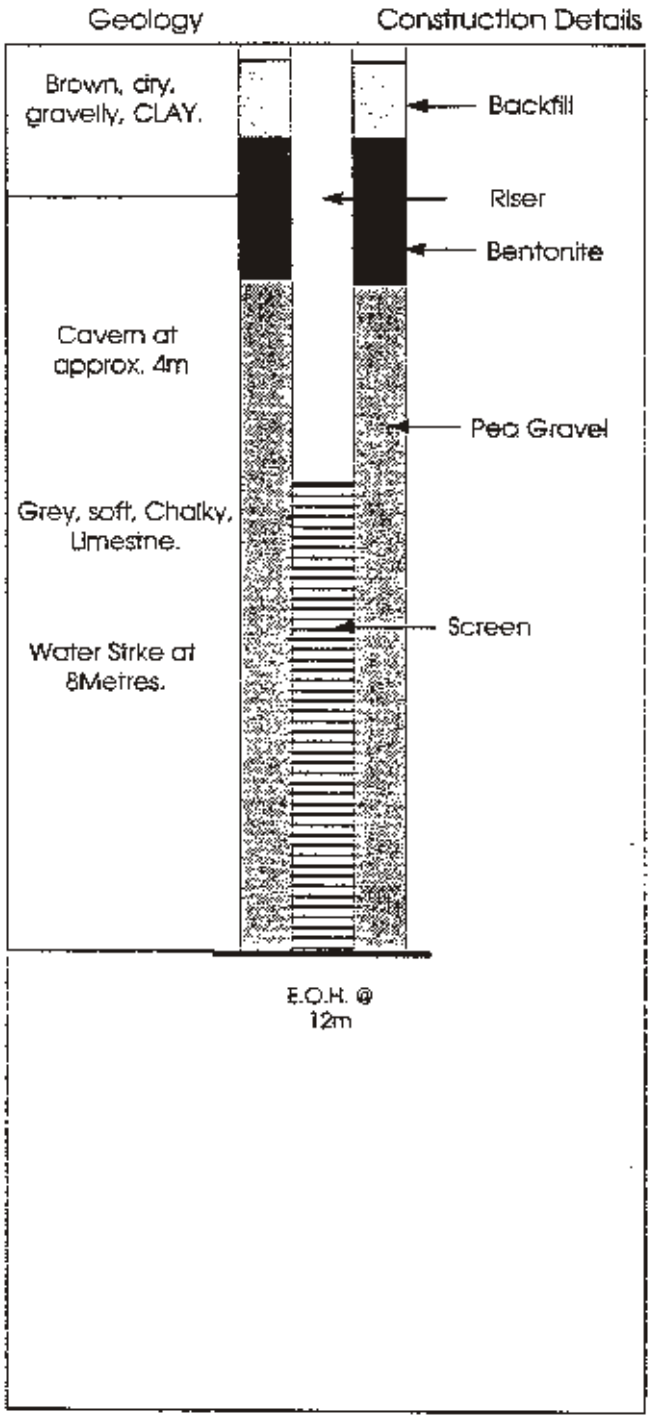
Completed Well Design

BH No. 5

Client : Shannon Environment
Project : Groundwater Investigation
Location : Smithstown Industrial Estate
County : Clare
Date : 25/2/98
Driller : T. Cross
Aquifer : Carboniferous Limestone.
Output : NA
Elevation (mOTD):
Water Level (mOTD)

Remarks





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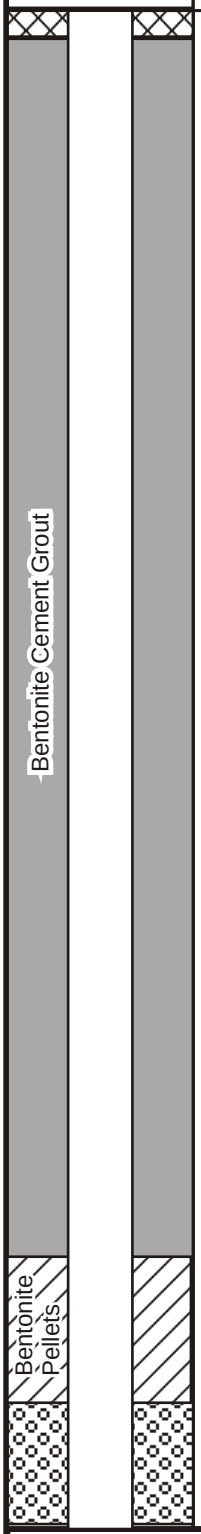
Hydrogeological & Environmental Consultants

BOREHOLE NUMBER: MW 4D			PAGE 1 of 2
DRILLING DATES: 31 July & 1 August 01		DRILLING METHOD:	AIR ROTARY
DRILLER: Glovers Site Investigation		BOREHOLE DIAMETER:	200mm
LOGGED BY: Antonia Newlands		SCREEN TYPE & DIAMETER:	PVC + 50mm
CHECKED BY:		SCREEN SLOT SIZE:	1mm



SAMPLE NUMBER	SAMPLE TYPE	PID Reading in air (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	DESCRIPTION	COMMENTS
				0		MADE GROUND of concrete	
				1		Dry soft to firm brown CLAY with some fine to coarse grained gravel of mixed lithology	
				2			
				3		Hard dry light grey LIMESTONE	
				4			
				5			
		*0		6		Possible damp area but water being used whilst drilling.	
				7		Returns become slightly darker in colour then revert to light grey.	
				8			
				9			
				10		Colour changes to dark grey.	
			▽	11		Light grey LIMESTONE with softer weathered areas	
		*0		12			Water airlifted in morning had slight sheen, but could be existing sheen from ground surface
				13		Dark grey LIMESTONE with some wet brown mud	
				14			
				15			
				16		Drilling stopped overnight to allow grout in the annulus to harden. Drilling recommenced next morning.	Drilled at 140mm diameter below 16m
				17		Dry light grey weathered LIMESTONE. (Colour change at 17 m to brown and then back to light grey again)	Hard rock, not much returns
		*0		18			
				19			
				20			

LOCATION / NOTES:

Located 3m to the east of MW4S

PID readings represent monitoring inside borehole cavity when drilling rods were changed. Continual air monitoring by PID was carried out and did not rise above 0 ppm.

Wet mud noted at 11.5m

LEGEND

- Disturbed Sample
- Undisturbed Sample
- * Headspace Analysis
- † Down Borehole Analysis
- ▼ Groundwater Table
- ▽ Perched Water Table

BOREHOLE LOG

Job Title	**Phase II Groundwater Investigation**
Location	**SHANNON, CO CLARE**
Client	**SHANNON ENVIRONMENTAL SERVICES**
TI App'd	
Ref.	
Date	AUGUST 2001
Job No.	49802-001

URS
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BOREHOLE NUMBER: MW 4D		PAGE 2 of 2
DRILLING DATES: 31 July & 1 August 01	DRILLING METHOD:	AIR ROTARY
DRILLER: Glovers Site Investigation	BOREHOLE DIAMETER:	150mm
LOGGED BY: Antonia Newlands	SCREEN TYPE & DIAMETER:	PVC + 50mm
CHECKED BY:	SCREEN SLOT SIZE:	1mm

BOREHOLE CONSTRUCTION	SAMPLE NUMBER	SAMPLE TYPE	PID Reading in air (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	DESCRIPTION	COMMENTS
Filter Pack / Screen			*0	▼	20–24		Soft dry light grey LIMESTONE	Brown muddy water
					25		Borehole terminated at 25m	

LOCATION / NOTES:

Water ingressing at 21.5m during drilling..

At 24m, PID * 0 but LEL *2

LEGEND

- Disturbed Sample
- Undisturbed Sample
- * Headspace Analysis
- † Down Borehole Analysis
- ▼ Groundwater Table
- ▽ Perched Water Table

BOREHOLE LOG

Job Title	Phase II Groundwater Investigation
Location	SHANNON, CO CLARE
Client	SHANNON ENVIRONMENTAL SERVICES
TI App'd	
Ref.	
Date	AUGUST 2001
Job No.	49802-001

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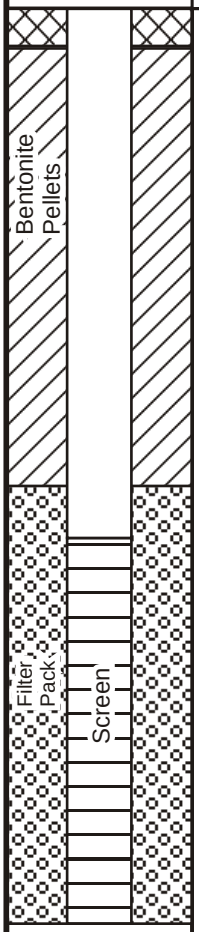
BOREHOLE NUMBER: MW 6		PAGE 1 of 1
DRILLING DATES: 31 July 01	DRILLING METHOD: AIR ROTARY	
DRILLER: Glovers Site Investigation	BOREHOLE DIAMETER: 150mm	
LOGGED BY: Antonia Newlands	SCREEN TYPE & DIAMETER: PVC + 50mm	
CHECKED BY:	SCREEN SLOT SIZE: 1mm	



SAMPLE NUMBER	SAMPLE TYPE	PID Reading in air (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	DESCRIPTION	COMMENTS
				0		MADE GROUND of concrete	
						MADE GROUND of red brown clay and a little fine to coarse grained gravel of mixed lithology	
				2		Brown CLAY with much fine to coarse grained gravel of mixed lithology	
		*0		4		Hard light brown LIMESTONE and a little coarse grained sand.	
		*0		6		Light grey LIMESTONE with a little firm dry red brown clay	
			▼	8		Light grey LIMESTONE (sometimes dark grey in colour)	
				10		Colour changes to blue grey limestone and back to light grey	
						Colour changes to light brown and back to light grey	
		*0		12		Borehole terminated at 12m	
				14			
				16			
				18			
				20			

LOCATION / NOTES:

Located to the west of the export area.

PID readings represent monitoring inside borehole cavity when drilling rods were changed. Continual air monitoring by PID was carried out and always read 0 ppm.

Chalky water at 7m after well left to settle for 1 hour after installation.

LEGEND

- Disturbed Sample
- Undisturbed Sample
- Headspace Analysis
- Down Borehole Analysis
- Groundwater Table
- Perched Water Table

BOREHOLE LOG

Job Title	Phase II Groundwater Investigation
Location	SHANNON, CO CLARE
Client	SHANNON ENVIRONMENTAL SERVICES
TI App'd	
Ref.	
Date	AUGUST 2001
Job No.	49802-001

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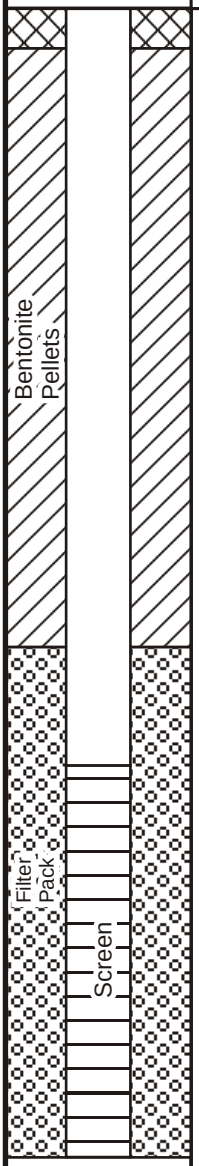
BOREHOLE NUMBER: MW 7		PAGE 1 of 1
DRILLING DATES: 31 July 01	DRILLING METHOD:	AIR ROTARY
DRILLER: Glovers Site Investigation	BOREHOLE DIAMETER:	150mm
LOGGED BY: Antonia Newlands	SCREEN TYPE & DIAMETER:	PVC + 50mm
CHECKED BY:	SCREEN SLOT SIZE:	1mm



SAMPLE NUMBER	SAMPLE TYPE	PID Reading in air (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	DESCRIPTION	COMMENTS
				0		MADE GROUND of concrete	
						MADE GROUND of dark grey medium to coarse grained subangular gravel	
				2		Dry soft to firm brown CLAY and much fine to medium grained gravel.	
				4		Light grey LIMESTONE	
		*0		6			
				8			
				10		Very soft, pale grey white LIMESTONE	
		*0		12			
				14			
		*0		16		Borehole terminated at 15m	
				18			
				20			

LOCATION / NOTES:

Located to the north east of the quarantine area.

PID readings represent monitoring inside borehole cavity when drilling rods were changed. Continual air monitoring by PID was carried out and always read 0 ppm.

No water detected during drilling or installation.

LEGEND

- Disturbed Sample
- Undisturbed Sample
- Headspace Analysis
- Down Borehole Analysis
- Groundwater Table
- Perched Water Table

BOREHOLE LOG

Job Title	**Phase II Groundwater Investigation**
Location	**SHANNON, CO CLARE**
Client	**SHANNON ENVIRONMENTAL SERVICES**
TI App'd	
Ref.	
Date	AUGUST 2001
Job No.	49802-001

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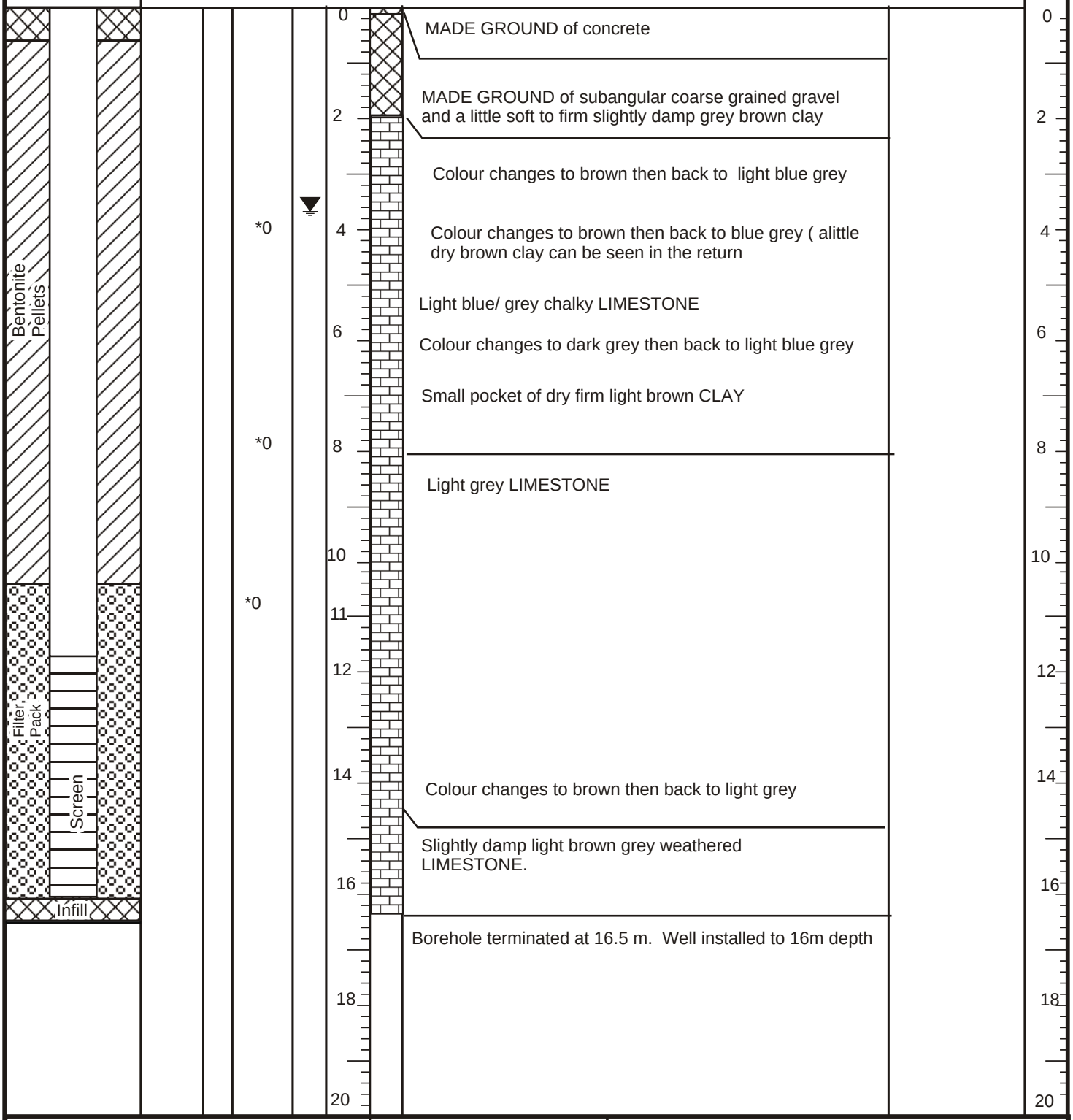
BOREHOLE NUMBER: **MW 8**			PAGE 1 of 1
DRILLING DATES: 31 July 01		DRILLING METHOD:	AIR ROTARY
DRILLER: Glovers Site Investigation		BOREHOLE DIAMETER:	150mm
LOGGED BY: Antonia Newlands		SCREEN TYPE & DIAMETER:	PVC + 50mm
CHECKED BY:		SCREEN SLOT SIZE:	1mm



LOCATION / NOTES:

PID readings represent monitoring inside borehole cavity when drilling rods were changed. Continual air monitoring by PID was carried out and always read 0 ppm.

At 14:10 water level = 7.82m after drilling
At 15:30 water level = 3.7m after drilling

LEGEND

- Disturbed Sample
- Undisturbed Sample
- Headspace Analysis
- Down Borehole Analysis
- Groundwater Table
- Perched Water Table

BOREHOLE LOG

Job Title	**Phase II Groundwater Investigation**
Location	**SHANNON, CO CLARE**
Client	**SHANNON ENVIRONMENTAL SERVICES**
TI App'd	
Ref.	
Date	
Job No.	

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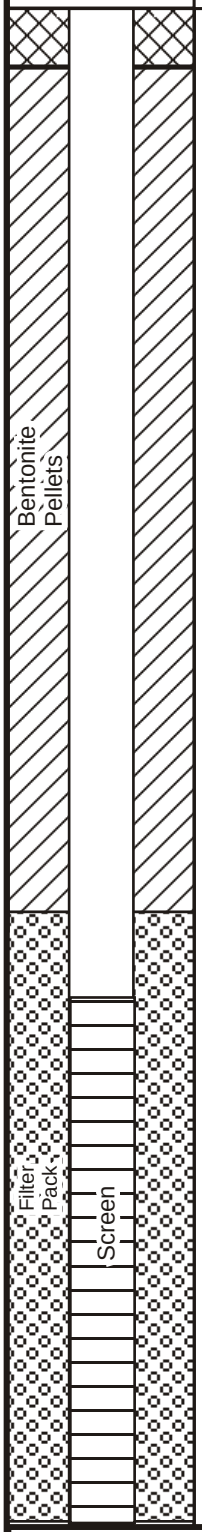
BOREHOLE NUMBER: MW 9		PAGE 1 of 2
DRILLING DATES: 1 August 01	DRILLING METHOD: AIR ROTARY	
DRILLER: Glovers Site Investigation	BOREHOLE DIAMETER: 200 mm	
LOGGED BY: Antonia Newlands	SCREEN TYPE & DIAMETER: PVC + 100mm	
CHECKED BY:	SCREEN SLOT SIZE: 1mm	



SAMPLE NUMBER	SAMPLE TYPE	PID Reading in air (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	DESCRIPTION	COMMENTS
				0		MADE GROUND of concrete	
						MADE GROUND of coarse grained subangular gravel	
				2		Brown CLAY with some fine to coarse grained gravel of mixed lithology	
		*0		4		Light grey LIMESTONE	
		*0		8			
		*0		10			
		*0		12		Dark grey LIMESTONE and a little light brown clay	
		*0		16			
		*0		18			
				20			

LOCATION / NOTES:

PID readings represent monitoring inside borehole cavity when drilling rods were changed. Continual air monitoring by PID was carried out and always read 0 ppm.

No water detected during drilling or installation.

LEGEND

- Disturbed Sample
- Undisturbed Sample
- Headspace Analysis
- Down Borehole Analysis
- Groundwater Table
- Perched Water Table

BOREHOLE LOG

Job Title	**Phase II Groundwater Investigation**
Location	**SHANNON, CO CLARE**
Client	**SHANNON ENVIRONMENTAL SERVICES**
TI App'd	
Ref.	
Date	AUGUST 2001
Job No.	49802-001

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BOREHOLE CONSTRUCTION	SAMPLE NUMBER	SAMPLE TYPE	PID Reading in air (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	DESCRIPTION	COMMENTS
					20			
							Dark grey LIMESTONE and a little light brown clay	
					22		Borehole terminated at 22m	
					24			
					26			
					28			
					30			
					32			
					34			
					36			
					38			
					40			

BOREHOLE NUMBER: MW 9 **PAGE** 2 of 2

DRILLING DATES: 1 August 01 **DRILLING METHOD:** AIR ROTARY

DRILLER: Glovers Site Investigation **BOREHOLE DIAMETER:** 200mm

LOGGED BY: Antonia Newlands **SCREEN TYPE & DIAMETER:** PVC + 50mm

CHECKED BY: **SCREEN SLOT SIZE:** 1mm

LOCATION / NOTES:

LEGEND

- Disturbed Sample
- Undisturbed Sample
- Headspace Analysis
- Down Borehole Analysis
- Groundwater Table
- Perched Water Table

BOREHOLE LOG

Job Title	**Phase II Groundwater Investigation**
Location	**SHANNON, CO CLARE**
Client	**SHANNON ENVIRONMENTAL SERVICES**
TI App'd	
Ref.	
Date	AUGUST 2001
Job No.	49802-001

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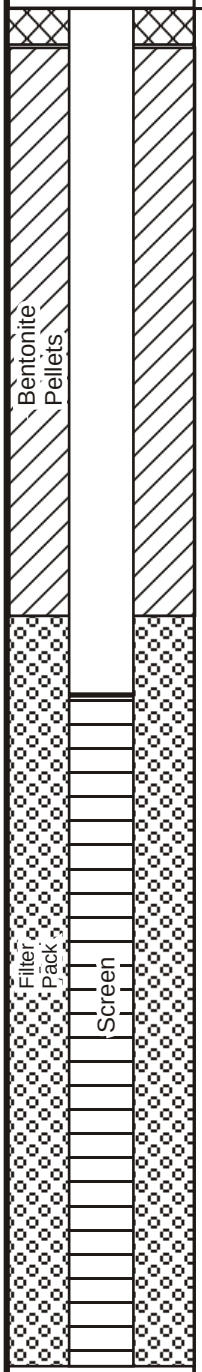
BOREHOLE NUMBER: MW 10	PAGE 1 of 1
DRILLING DATES: 1 August 01	DRILLING METHOD: AIR ROTARY
DRILLER: Glovers Site Investigation	BOREHOLE DIAMETER: 200mm
LOGGED BY: Antonia Newlands	SCREEN TYPE & DIAMETER: PVC + 100mm
CHECKED BY:	SCREEN SLOT SIZE: 1 mm



SAMPLE NUMBER	SAMPLE TYPE	PID Reading in air (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	DESCRIPTION	COMMENTS
				0		MADE GROUND of concrete	
						MADE GROUND of coarse grained subangular gravel	
				2		Brown CLAY with a little fine to coarse grained subangular gravel	
						Dark grey LIMESTONE	
				4		Soft white LIMESTONE	
		*0		6		Harder white grey LIMESTONE	
						Soft white LIMESTONE	
				8			
				10		Grey hard LIMESTONE	
		*0		12		Light brown white LIMESTONE	
				14			
				16		Colour changes to light grey then back to light brown	
						Colour changes to dark grey	
		*0		18		Borehole terminated at 18 m	
				20			

LOCATION / NOTES:

PID readings represent monitoring inside borehole cavity when drilling rods were changed. Continual air monitoring by PID was carried out and always read 0 ppm.

No water detected during drilling or installation.

LEGEND

- Disturbed Sample
- Undisturbed Sample
- Headspace Analysis
- Down Borehole Analysis
- Groundwater Table
- Perched Water Table

BOREHOLE LOG

Job Title	**Phase II Groundwater Investigation**
Location	**SHANNON, CO CLARE**
Client	**SHANNON ENVIRONMENTAL SERVICES**
TI App'd	
Ref.	
Date	AUGUST 2001
Job No.	49802-001

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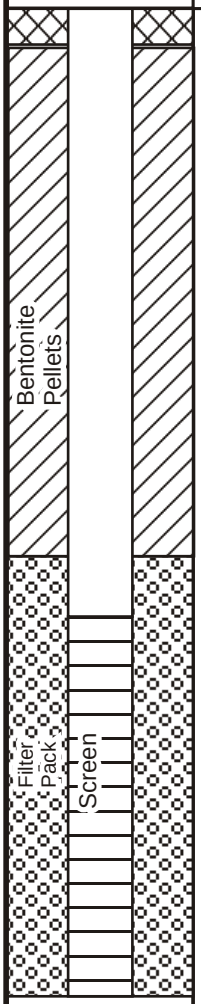
BOREHOLE CONSTRUCTION	SAMPLE NUMBER	SAMPLE TYPE	PID Reading in air (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: **MW 11**		PAGE 1 of 1
							DRILLING DATES: 1st December 01	DRILLING METHOD: AIR ROTARY	
							DRILLER: Hilliard Ltd.	BOREHOLE DIAMETER: 200 + 150mm	
							LOGGED BY: Edel O'Hannelly	SCREEN TYPE & DIAMETER: HDPE 50 mm	
							CHECKED BY:	SCREEN SLOT SIZE: 1.5 mm & SOCK	



DESCRIPTION	COMMENTS
MADE GROUND of tarmac.	
MADE GROUND of brown/grey sand and gravel fill becoming pale grey gravel.	Dry to damp.
Light brown very gravelly silt and clay. Limestone boulder at 1m.	
Hard LIMESTONE bedrock creamy/grey chippings and dust return. At 3 m some finer black material.	Wet.
Pale and dark grey, almost black, finely crystalline limestone Some rusty bands visible in rock chippings.	H_2S odour at 3.5m
Yellow, grey/brown limestone.	
At 5.6 m colour changes to grey/dark blue, returning to a lighter creamy grey/brown by 5.8 m.	
Dark grey limestone.	
Pale grey limestone.	Slight H_2S odour
Dark grey limestone.	No H_2S odour
Creamy grey limestone with a slight orange hue. Becomes dark grey at 9.3 m, possible cavity - drill stopped momentarily, returns to creamey grey colour at 9.4 m.	
Band of dark grey limestone at 11.6 m.	
Borehole completed at 13 m.	

PID readings: *0 (2 m), *0 (4 m), †0 (4 m), *0 (12 m)

0 2 4 6 8 10 12 14 16 18 20

LOCATION / NOTES:

PID readings represent monitoring inside borehole cavity when drilling rods were changed. Continual air monitoring by PID was carried out and did not rise above 0 ppm.

Air lifted and surged for 30 mins prior to installation.

LEGEND

- Disturbed Sample
- Undisturbed Sample
- * Headspace Analysis
- † Down Borehole Analysis
- Groundwater Table
- Perched Water Table

BOREHOLE LOG

Job Title	**Phase II Groundwater Investigation**
Location	**SHANNON, CO CLARE**
Client	**SHANNON ENVIRONMENTAL SERVICES**
TI App'd	
Ref.	
Date	DECEMBER 2001
Job No.	49802-001

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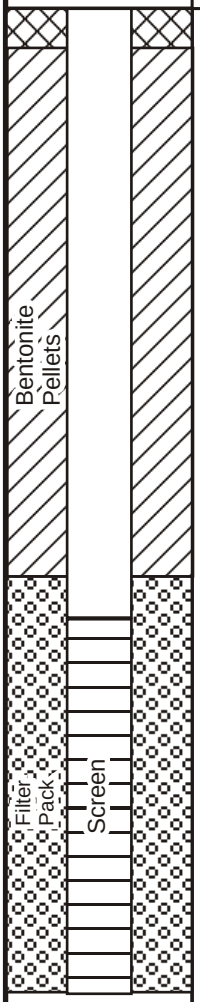
BOREHOLE NUMBER: MW 12	PAGE 1 of 1
DRILLING DATES: 1st + 2nd Dec '01	DRILLING METHOD: AIR ROTARY
DRILLER: Hilliard Ltd.	BOREHOLE DIAMETER: 200 + 150mm
LOGGED BY: Edel O'Hannelly	SCREEN TYPE & DIAMETER: HDPE 50mm
CHECKED BY:	SCREEN SLOT SIZE: 1.5 mm & SOCK



SAMPLE NUMBER	SAMPLE TYPE	PID Reading in air (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	DESCRIPTION	COMMENTS
				0		Tarmac on grey/brown sand and gravel FILL.	
						Orange brown boulder clay, a lot of small and medium sub-angular gravel, SILT and CLAY with some sand.	Damp, no odour
		*0		2		BEDROCK, white/grey, limestone chippings and dust. Pale grey limestone at 2 m, slightly yellower in colour.	Dry
				4		Yellow/grey/beige limestone.	Wet.
						Grey returns.	No sheen, no odour.
		*0		6		Some fine black particles in the returns at 6 m.	No sheen, no odour.
						Paler grey returns alternating with darker grey returns, no more black particles.	
				8		Creamy grey returns.	
				10		No returns twice between 10 and 11 m, possible cavities.	
		*0		12			
				14		Borehole completed at 13 m.	
				16			
				18			
				20			

LOCATION / NOTES:

PID readings represent monitoring inside borehole cavity when drilling rods were changed. Continual air monitoring by PID was carried out and did not rise above 0 ppm.

Air lifted and surged for 30 mins prior to installation.

LEGEND

- Disturbed Sample
- Undisturbed Sample
- * Headspace Analysis
- † Down Borehole Analysis
- Groundwater Table
- Perched Water Table

BOREHOLE LOG

Job Title	**Phase II Groundwater Investigation**
Location	**SHANNON, CO CLARE**
Client	**SHANNON ENVIRONMENTAL SERVICES**
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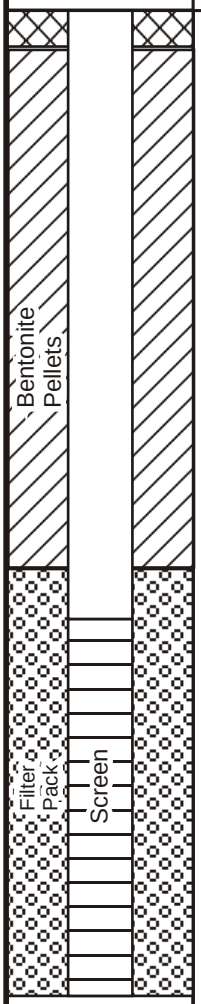
BOREHOLE NUMBER: MW 13		PAGE 1 of 1
DRILLING DATES: 2nd + 3rd Dec '01	DRILLING METHOD: AIR ROTARY	
DRILLER: Hilliard Ltd.	BOREHOLE DIAMETER: 200 + 145mm	
LOGGED BY: Edel O'Hannelly	SCREEN TYPE & DIAMETER: HDPE 50mm	
CHECKED BY:	SCREEN SLOT SIZE: 1.5 mm & SOCK	



SAMPLE NUMBER	SAMPLE TYPE	PID Reading in air (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	DESCRIPTION	COMMENTS
				0		Tarmac on yellow/orange/brown gravel FILL with some clay.	
						Brown CLAY with a little fine to coarse grained subangular gravel	Damp no odour.
				2		Bedrock, pale grey LIMESTONE chippings	Dry
						Returns become slightly darker grey at 2.8 m. Yellow grey returns at 3 m. Reverts to dark grey, with less dust at 3.4 m.	
				4			Wet at 4 m.
		*0		6		Creamy/grey/beige returns, not so many colour changes as in MW11 and Mw12.	
				8			Returns are only damp below 6 m
				10			
		*0		12			
				14		Borehole completed at 13 m	
				16			
				18			
				20			

LOCATION / NOTES:

PID readings represent monitoring inside borehole cavity when drilling rods were changed. Continual air monitoring by PID was carried out and always read 0 ppm.

Air lifted and surged for 30 mins prior to installation.

LEGEND

- Disturbed Sample
- Undisturbed Sample
- * Headspace Analysis
- † Down Borehole Analysis
- Groundwater Table
- Perched Water Table

BOREHOLE LOG

Job Title	**Phase II Groundwater Investigation**
Location	**SHANNON, CO CLARE**
Client	**SHANNON ENVIRONMENTAL SERVICES**
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Ref.	
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APPENDIX B PH AND EC TREND DATA

Appendix B - pH Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Apr-2008	Jun-2008	Aug-2008	Nov-2008	Apr-2009	Jun-2009	Sep-2009	Dec-2009	Feb-2010	May-2010	Aug-2010	Nov-2010	Feb-2011	May-2011	Aug-2011	Nov-2011	Feb-2012	May-2012	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	7.27	6.90	7.06	6.11	7.49	7.40	7.11	7.09	6.73	8.01	7.74	7.63	7.30	7.24	7.27	7.79	7.51	6.55	7.33	7.17	7.20	7.26	7.87	7.21	7.47
MW4S	7.06	7.61	7.47	6.21	7.33	7.30	7.07	6.30	5.76	6.60	6.92	7.46	6.80	6.53	7.97	7.90	6.80	6.94	7.00	7.36	6.66	7.04	7.84	7.46	7.03
MW5	7.29	6.79	7.28	6.55	7.61	7.70	7.20	7.20	7.25	7.80	7.01	7.34	7.60	7.22	6.94	7.50	7.91	6.81	7.24	7.41	7.80	7.23	7.70	7.05	6.78
P.W	7.63	ns	ns	ns	ns	ns	ns	7.30	ns	ns	7.85	ns	ns	ns	7.73	ns	7.73	ns	7.33	ns	ns	ns	7.85	ns	ns

Notes:

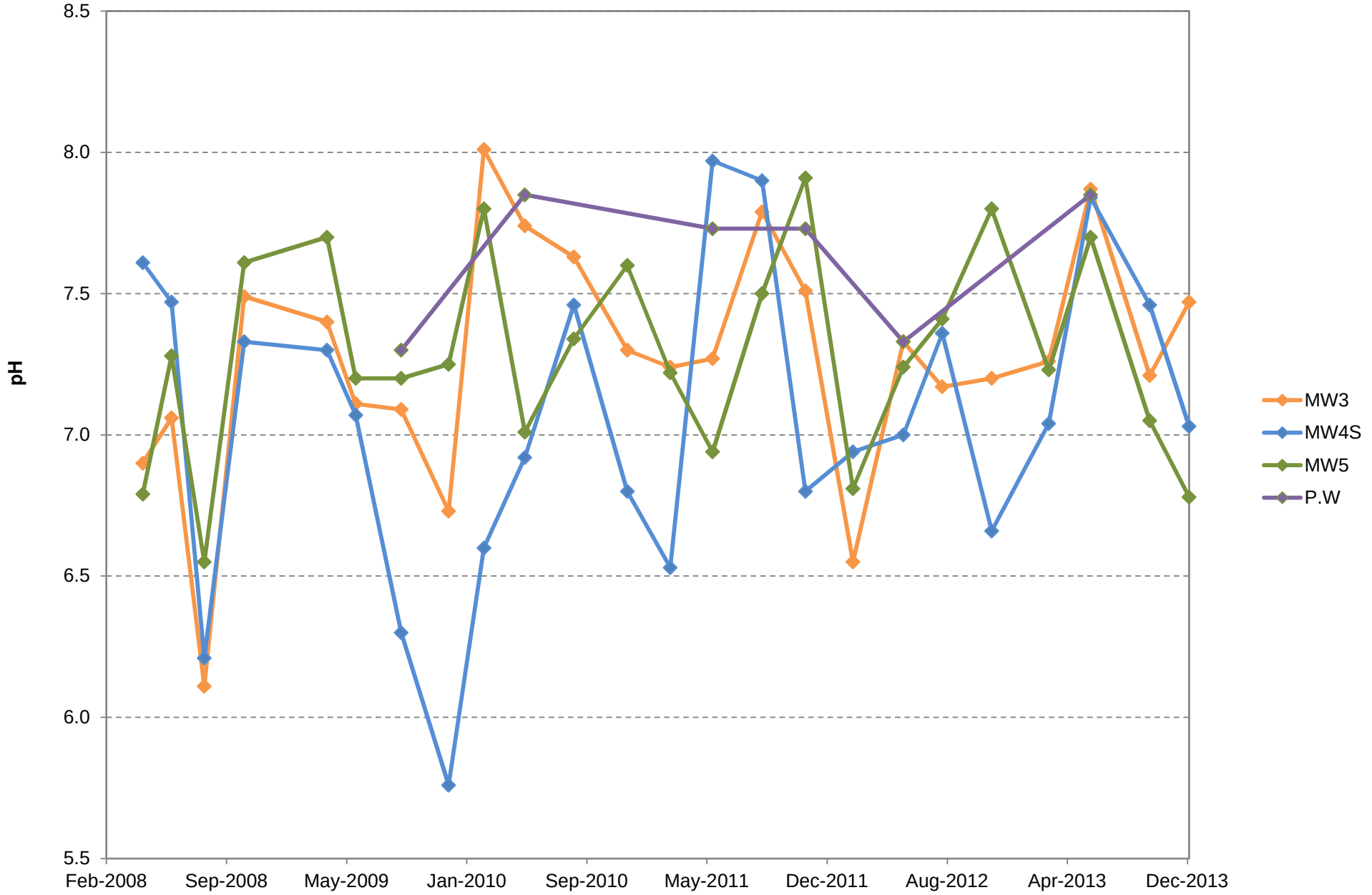
ns: Indicates well not sampled
na: Indicates sample not analysed
P.W: Production Well

GTV: None
Draft IGV: >6.5 and <9.5

Underline indicates results above IGV

Prepared by: FO'R
Checked by: EO'H

Appendix B - pH Trends - Enva Shannon



Appendix B - EC Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Apr-2008	Jun-2008	Aug-2008	Nov-2008	Mar-2009	Jun-2009	Sep-2009	Dec-2009	Feb-2010	May-2010	Aug-2010	Nov-2010	Feb-2011	May-2011	Aug-2011	Nov-2011	Feb-2012	May-2012	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	**1,044**	**1,117**	**1,037**	**1,141**	**1,123**	**963**	**983**	**866**	711	**990**	590	**846**	520	675	**1,214**	**2,510**	**926**	**1,271**	**950**	**1,120**	**969**	**1,383**	**1,006**	**1,091**	**1,042**
MW4S	**4,019**	**5,524**	**4,560**	**4,000**	**4,806**	**4,704**	nm	**>4000**	**>4000**	**875**	**4,580**	**3,338**	**7,210**	**4,882**	**2,075**	**3,928**	**3,382**	**6,455**	**2,400**	**3,333**	**3,136**	**5,916**	**3,357**	**2,870**	**3,102**
MW5	**891**	**926**	**1,094**	599	677	**878**	**928**	**960**	715	**990**	775	**1,114**	710	**998**	**967**	**1,970**	590	706	708	681	587	**992**	**932**	**888**	**993**
P.W	762	ns	ns	ns	ns	ns	ns	697	ns	ns	514	ns	ns	ns	714	ns	ns	ns	**1,100**	ns	ns	ns	785	ns	ns

Notes:

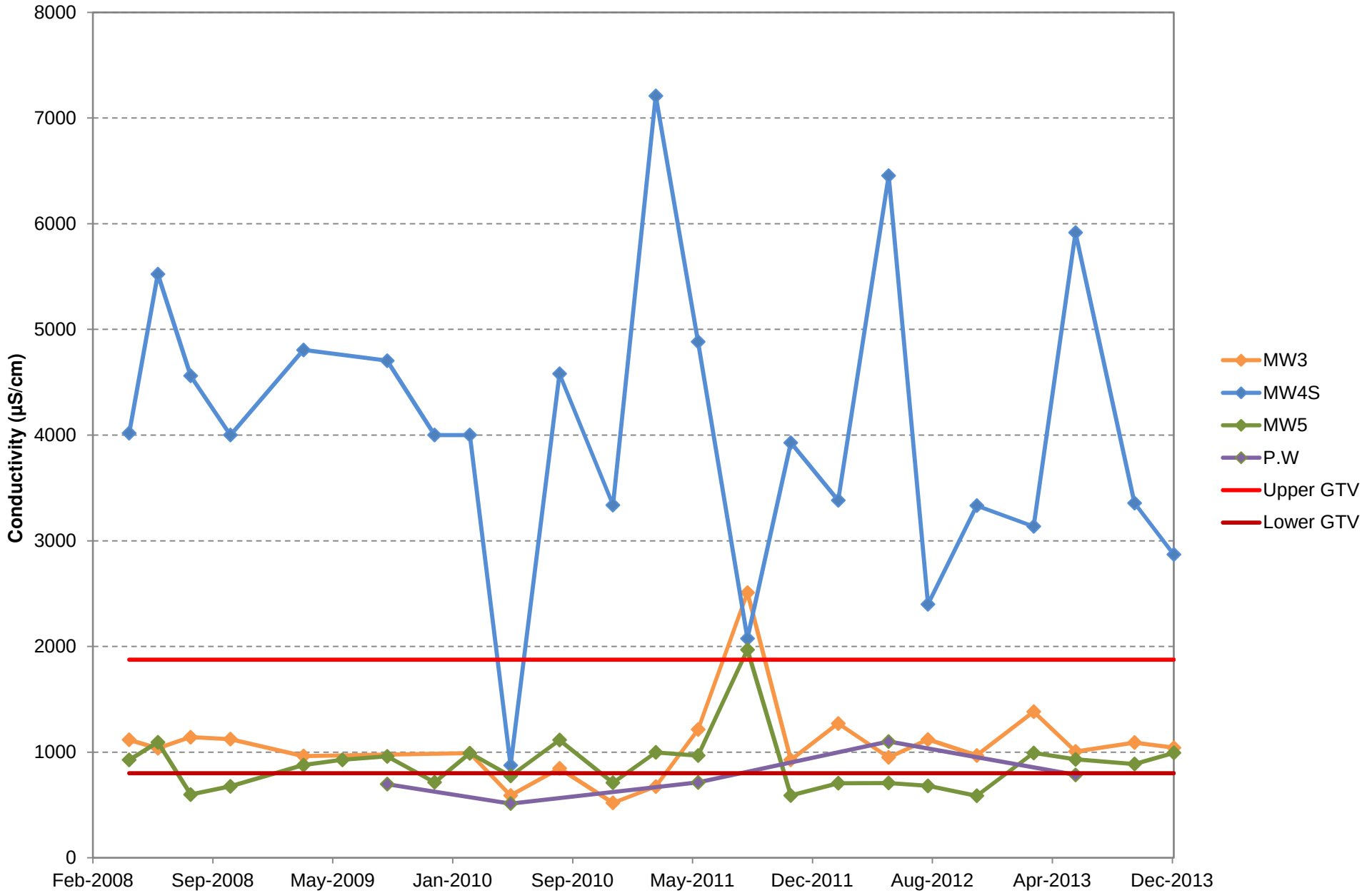
ns: Indicates well not sampled
na: Indicates sample not analysed
nm: Indicates not measured accurately
P.W: Production Well

GTV: 800 - 1,875 µS/cm
Draft IGV: 1,000 µS/cm

Bold Indicates results above GTV
Underline Indicates results above Draft IGV

Prepared by: FO'R
Checked by: EO'H

Appendix B - EC (µs/cm) Trends - Enva Shannon



APPENDIX C MAJOR IONS TREND DATA

Appendix C - Sodium (mg/L) Monitoring Data (2008 to 2013) - Enva Shannon

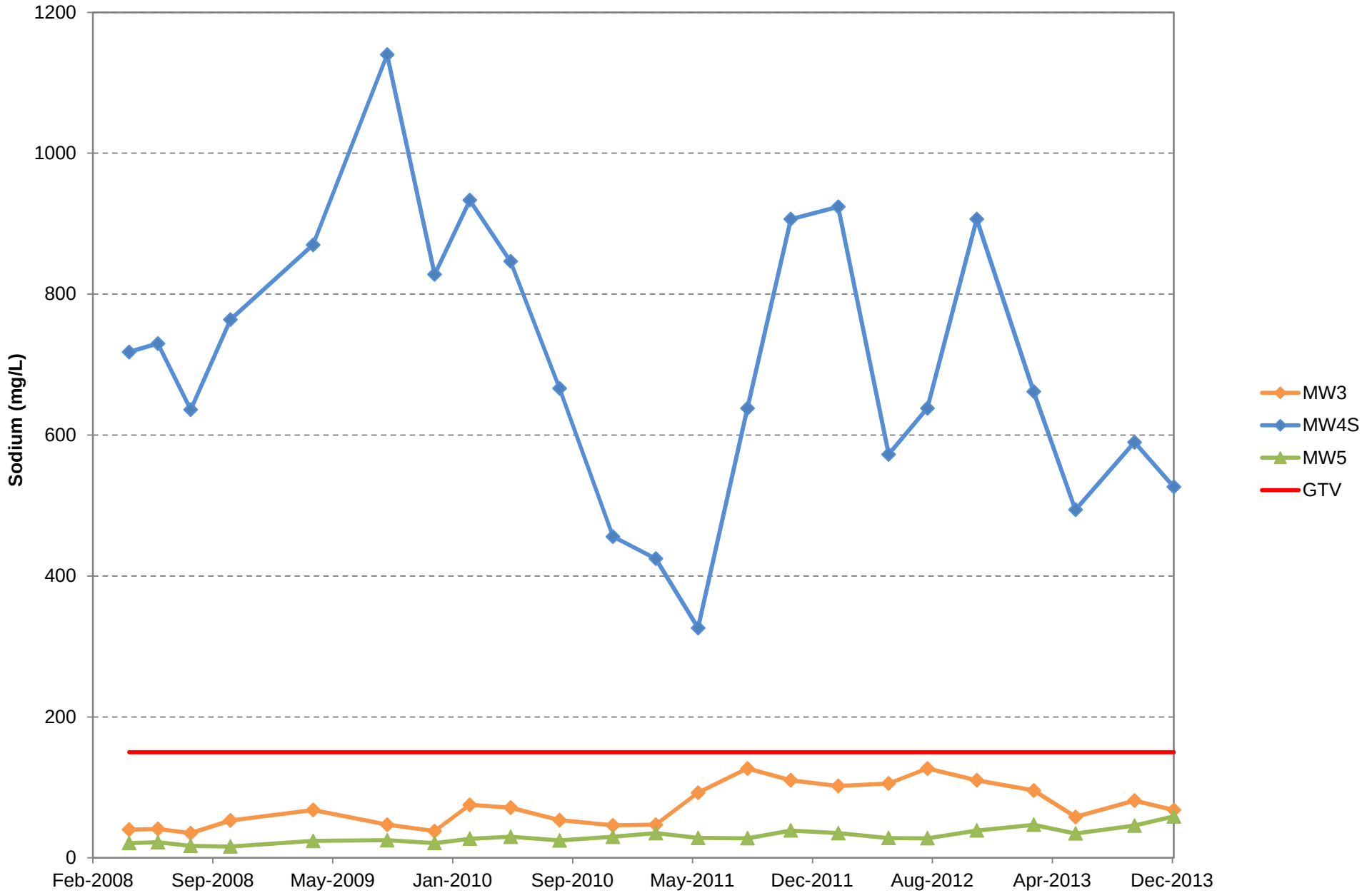
Monitoring Well	Average	Apr-2008	Jun-2008	Aug-2008	Nov-2008	Apr-2009	Jun-2009	Sep-2009	Dec-2009	Feb-2010	May-2010	Aug-2010	Nov-2010	Feb-2011	May-2011	Aug-2011	Nov-2011	Feb-2012	May-2012	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	74	40	41	35	53	68	na	47	38	75	71	54	46	47	93	127	110	102	106	127	110	96	58	81	68
MW4S	**704**	**718**	**730**	**636**	**764**	**870**	na	**1,140**	**828**	**933**	**847**	**666**	**456**	**425**	**326**	**638**	**907**	**924**	**573**	**638**	**907**	**662**	**494**	**590**	**526**
MW5	31	21	22	17	16	24	na	25	21	27	30	25	30	35	28	28	39	35	28	28	39	47	35	46	59
P.W	36	ns	ns	ns	ns	ns	ns	na	ns	ns	na	ns	ns	ns	36	ns	na	ns	na	ns	ns	ns	na	ns	ns

Notes:
ns: Indicates well not sampled
na: Indicates sample not analysed

GTV: 150 mg/L
Draft IGV: 150 mg/L
DWS: 200 mg/L

Bold Indicates results above GTV
Underline Indicates results above Draft IGV

Appendix C - Sodium (mg/L) Trends - Enva Shannon



Appendix C - Chloride (mg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Apr-2008	Jun-2008	Aug-2008	Nov-2008	Apr-2009	Jun-2009	Sep-2009	Dec-2009	Feb-2010	May-2010	Aug-2010	Nov-2010	Feb-2011	May-2011	Aug-2011	Nov-2011	Feb-2012	May-2012	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	**106**	**85**	**86**	**71**	**84**	**80**	na	**73**	**66**	**123**	**102**	**80**	**72**	**94**	**165**	**189**	**132**	**166**	**116**	**160**	**132**	**110**	**76**	**109**	**65**
MW4S	**1,167**	**1,040**	**721**	**1,330**	**1,090**	**1,000**	na	**2,050**	na	**2,941**	**1,642**	**814**	**2,615**	**1,322**	**461**	**510**	**1,162**	**1,639**	**465**	**1,209**	**1,162**	**1,146**	**454**	**419**	**474**
MW5	**68**	**30**	**33**	22	**28**	**38**	na	**44**	**46**	**76**	**97**	**90**	**97**	**120**	**100**	**95**	**75**	**52**	**84**	**41**	**75**	**72**	**77**	**81**	**92**
P.W	**40**	ns	ns	ns	ns	ns	ns	**42**	ns	ns	**39**	ns	ns	ns	**36**	ns	ns	ns	**42**	ns	ns	ns	**41**	ns	ns

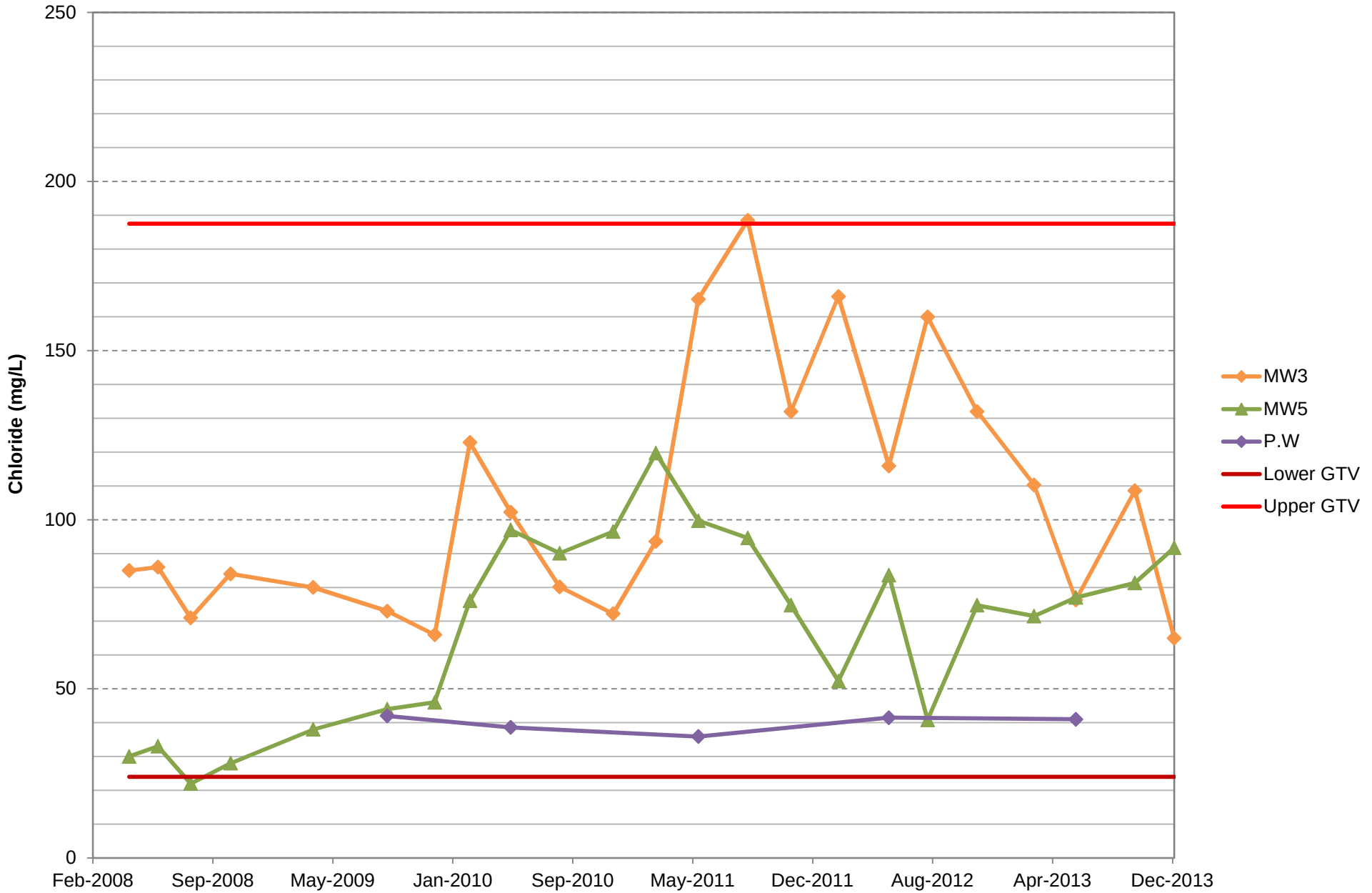
Notes:

ns: Indicates well not sampled
na: Indicates sample not analysed

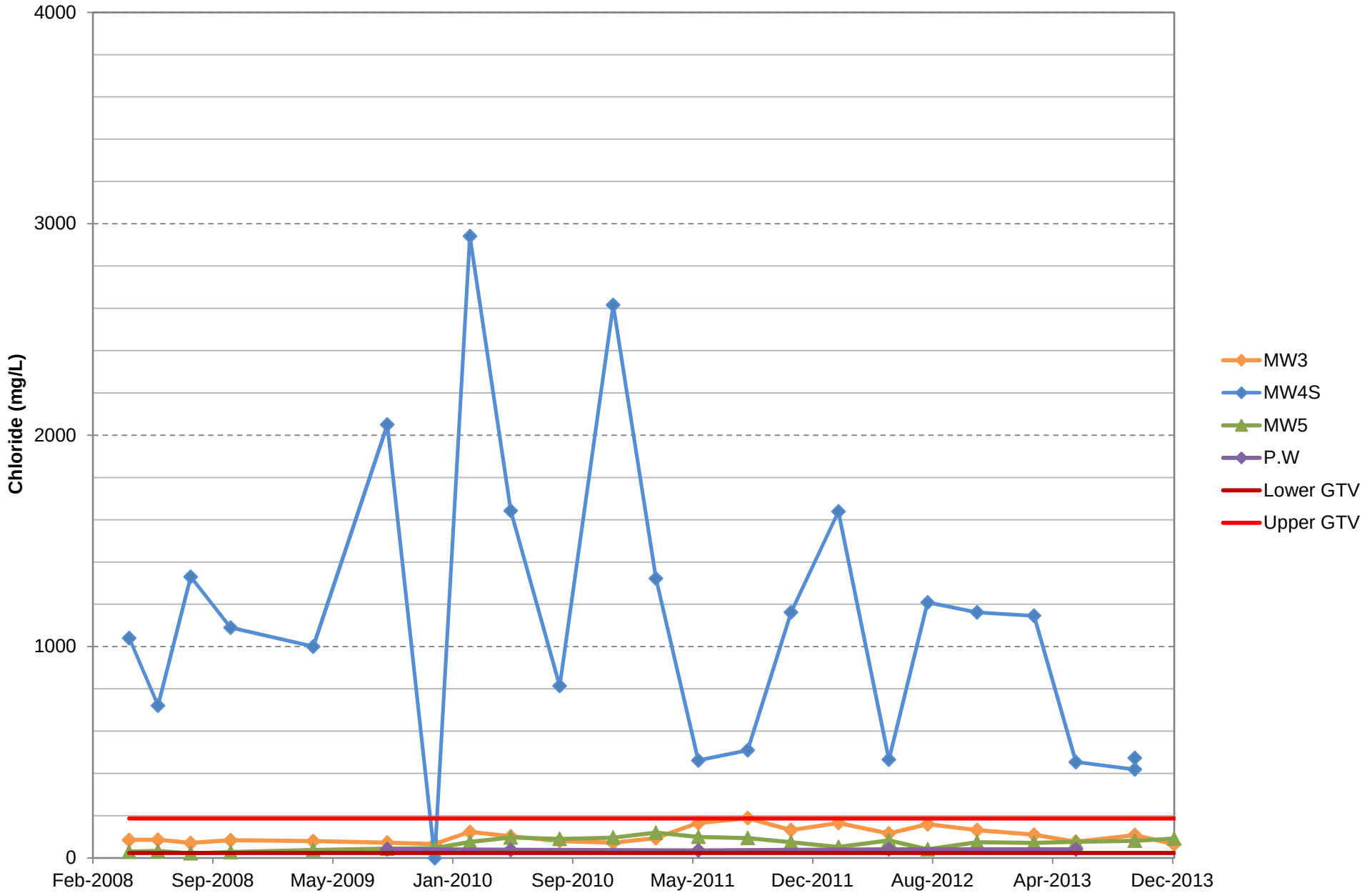
GTV: 24 - 187.5 mg/L
Draft IGV: 30 mg/L
DWS: 250 mg/L

Bold Indicates results above GTV
Underline Indicates results above Draft IGV

Appendix C - Chloride (mg/L) Low Concentration Trends - Enva Shannon



Appendix C - Chloride (mg/L) high Concentration Trends - Enva Shannon



Appendix C - Sulphate (mg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Apr-2008	Jun-2008	Aug-2008	Nov-2008	Apr-2009	Jun-2009	Sep-2009	Dec-2009	Feb-2010	May-2010	Aug-2010	Nov-2010	Feb-2011	May-2011	Aug-2011	Nov-2011	Feb-2012	May-2012	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	156	150	149	150	173	165	na	154	160	156	16	134	**192**	139	141	**221**	**208**	**209**	180	185	**208**	182	126	99	96
MW4S	**599**	**396**	**574**	**495**	**450**	**702**	na	**921**	**712**	**671**	**581**	**460**	**382**	**255**	**203**	**629**	**969**	**1016**	**670**	**495**	**969**	**535**	**583**	**556**	**543**
MW5	137	**190**	**323**	55	66	**253**	na	**270**	**215**	**218**	184	**201**	144	171	87	111	62	55	88	64	62	63	89	86	89
P.W	82	ns	ns	ns	ns	ns	ns	84		ns	77	ns	ns	ns	72	ns	na	ns	89	ns	ns	ns	90	ns	ns

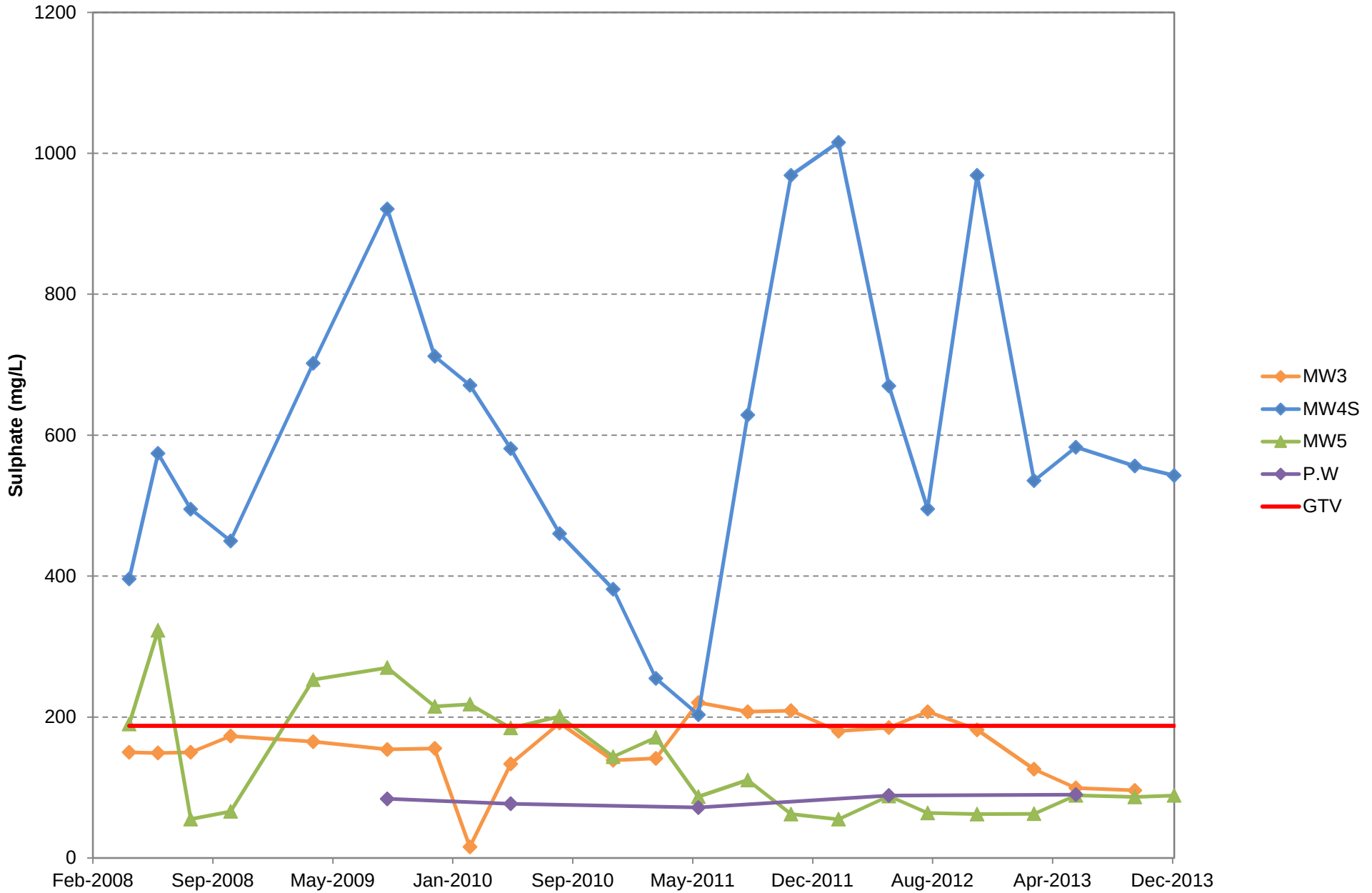
Notes:

ns: Indicates well not sampled
na: Indicates sample not analysed

GTV: 187.5 mg/L
Draft IGV: 200 mg/L
DWS: 250 mg/L

Bold Indicates results above GTV
Underline Indicates results above Draft IGV

Appendix C - Sulphate (mg/L) Trends - Enva Shannon



Appendix C - Nitrate as NO_3 (mg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Apr-2008	Jun-2008	Aug-2008	Nov-2008	Apr-2009	Jun-2009	Sep-2009	Dec-2009	Feb-2010	May-2010	Aug-2010	Nov-2010	Feb-2011	May-2011	Aug-2011	Nov-2011	Feb-2012	May-2012	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	10.93	na	na	na	na	30	na	3	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	-
MW4S	0.26	na	na	na	na	-	na	-	na	na	-	na	na	na	-	na	na	na	0.3	na	na	na	1	na	-
MW5	3.97	na	na	na	na	-	na	3	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	9
P.W	0.56	ns	ns	ns	ns	ns	ns	-	ns	ns	-	ns	ns	ns	-	ns	ns	ns	1.5	ns	ns	ns	1	ns	ns

Notes:

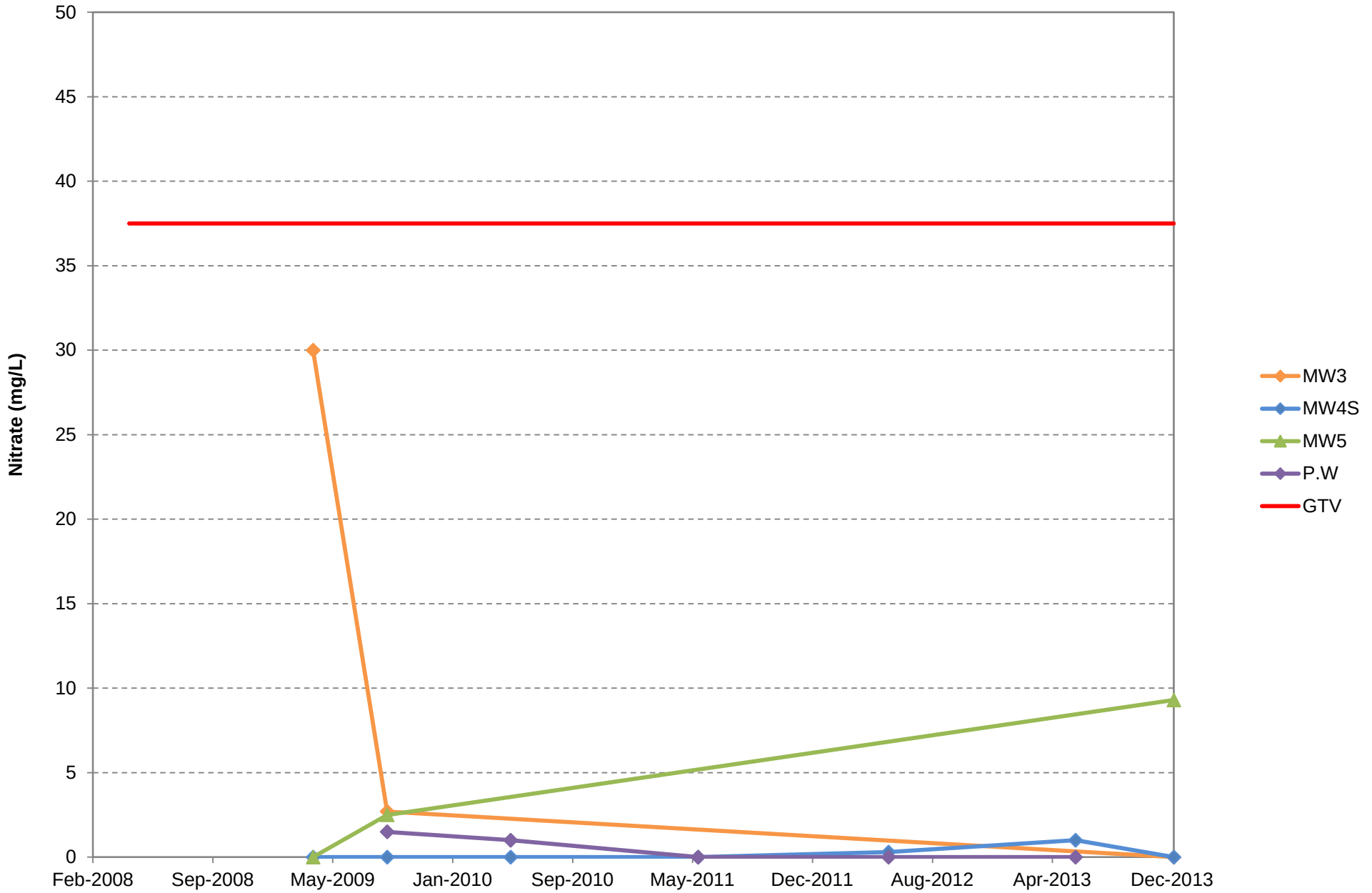
Notes:
ns: Indicates well not sampled
na: Indicates sample not analysed
-: indicates result is <method detection limit

GTV: 37.5 mg/L
Draft IGV: 25 mg/L
DWS: 50 mg/L

Bold Indicates results above GTV
Underline Indicates results above Draft IGV

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in December 2013, 0.2 mg/L

Appendix C - Nitrate (mg/L) Trends - Enva Shannon



Appendix C - Ammoniacal Nitrogen (mg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Apr-2008	Jun-2008	Aug-2008	Nov-2008	Apr-2009	Jun-2009	Sep-2009	Dec-2009	Feb-2010	May-2010	Aug-2010	Nov-2010	Feb-2011	May-2011	Aug-2011	Nov-2011	Feb-2012	May-2012	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	**0.27**	-	-	-	-	-	na	-	**0.80**	**0.22**	**0.15**	-	**0.14**	0.05	**0.13**	**0.22**	**0.22**	**0.23**	**0.19**	**0.17**	**0.15**	**0.12**	**0.28**	**1.16**	**1.96**
MW4S	**16.74**	**18.50**	**9.95**	**25.10**	**27.00**	**17.20**	na	**29.70**	**3.60**	**0.14**	**31.31**	**15.52**	**0.39**	**25.03**	**14.19**	**8.48**	**20.76**	**28.52**	**10.46**	**25.09**	**17.89**	**25.70**	**11.56**	**8.70**	**10.25**
MW5	0.05	**0.60**	-	-	-	-	na	-	-	0.03	**0.13**	0.06	-	**0.09**	0.03	-	-	-	-	-	-	-	-	0.04	-
P.W	0.02	ns	ns	ns	ns	ns	ns	-	ns	ns	na	ns	ns	ns	na	ns	na	ns	na	ns	ns	ns	na	ns	ns

Notes:

ns: Indicates well not sampled
na: Indicates sample not analysed
-: indicates result is <MDL

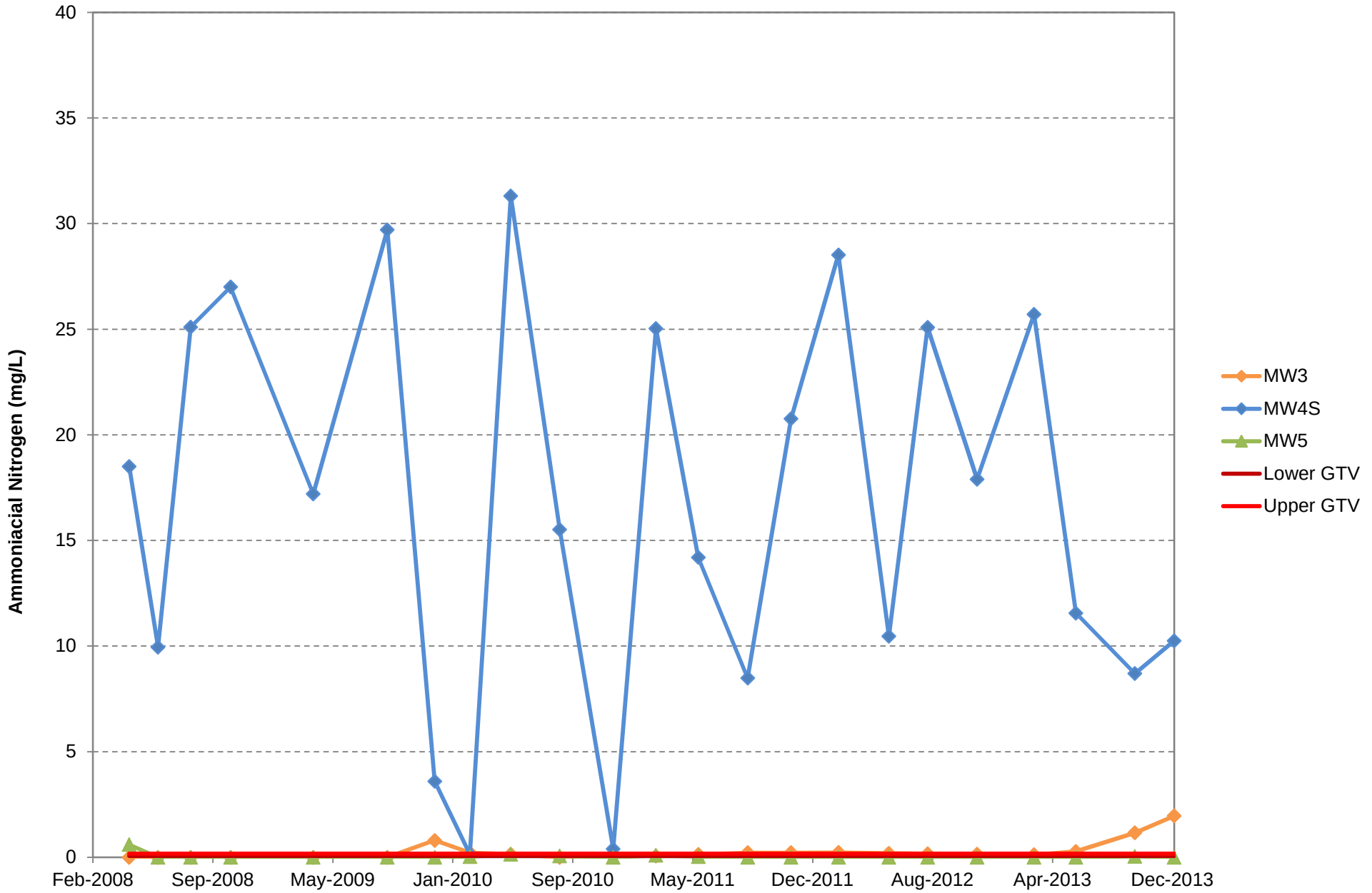
GTV: 0.065 - 0.175 mg/L
Draft IGV: 0.12 mg/L
DWS: 0.25 mg/L

Bold Indicates results above GTV
Underline Indicates results above Draft IGV

Draft IGV given as mg/L NH_4, converted to equivalent mg/L N
Drinking Water Standard for ammonium as NH_4 = 0.30 mg/L, this converts to an equivalent of 0.23 mg/L as N

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in December 2013, 0.03 mg/L

Appendix C - Ammoniacal Nitrogen as N (mg/L) Trends - Enva Shannon



Appendix C - Nitrite as NO_2 (mg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Apr-2008	Jun-2008	Aug-2008	Nov-2008	Apr-2009	Jun-2009	Sep-2009	Dec-2009	Feb-2010	May-2010	Aug-2010	Nov-2010	Feb-2011	May-2011	Aug-2011	Nov-2011	Feb-2012	May-2012	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	**1.34**	na	na	na	na	na	na	-	**4**	na	na	na	na	na	na	na	na	na	na	na	na	na	na	-
MW4S	0.01	na	na	na	na	na	na	-	-	na	-	na	na	na	-	na	na	na	-	na	na	na	-	na	-
MW5	**1.01**	na	na	na	na	na	na	-	**3**	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	-
P.W	0.01	ns	ns	ns	ns	ns	ns	-	ns	ns	-	ns	ns	ns	-	ns	ns	ns	-	ns	ns	ns	-	ns	ns

Notes:

Notes:

ns: Indicates well not sampled
na: Indicates sample not analysed
-: indicates result is <MDL

GTV: 0.375 mg/L
Draft IGV: 0.1 mg/L
DWS: 0.5 mg/L

Bold Indicates results above GTV
Underline Indicates results above Draft IGV

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in December 2013, 0.02 mg/L

Appendix C - Ortho Phosphate as P (mg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Aug-2008	Sep-2009	Aug-2010	Aug-2011	Aug-2012	Sep-2013
MW3	0.015	-	-	**0.04**	-	-	-
MW4S	0.010	-	-	-	-	-	-
MW5	0.013	-	-	0.03	-	-	-
P.W	-	ns	ns	ns	ns	ns	ns

Notes:

ns: Indicates well not sampled

na: Indicates sample not analysed

Bold Indicates results above GTV

Underline Indicates results above IGV

GTV: 0.035 mg/L

Draft IGV: 0.01 mg/L

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in September 2013, 0.06 mg/L PO_4 equivalent to 0.02 mg/L as P

IGV is given as 0.03 mg/L for orthophosphate as PO_4, which is equivalent to 0.01 mg/L of orthophosphate as P

Appendix C - Cyanide (mg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Aug-2008	Sep-2009	Aug-2010	Aug-2011	Aug-2012	Sep-2013
MW3	0.005	-	-	-	-	-	-
MW4S	0.005	-	-	-	-	-	-
MW5	0.005	-	-	-	-	-	-
P.W	-	ns	ns	ns	ns	ns	ns

Notes:

ns: Indicates well not sampled

na: Indicates sample not analysed

Bold Indicates results above GTV

Underline Indicates results above IGV

GTV: 0.0375 mg/L

Draft IGV: 0.01 mg/L

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in September 2013, 0.01 mg/L

APPENDIX D DISSOLVED HEAVY METALS TREND DATA

Appendix D - Arsenic (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Aug-2008	Sep-2009	Aug-2010	Aug-2011	Aug-2012	Sep-2013
MW3	2	1	-	-	-	-	**8**
MW4S	**9**	**15**	**29**	7	-	-	3
MW5	1	-	1	-	-	-	-
P.W	-	ns	ns	ns	ns	ns	ns

Notes:

ns: Indicates well not sampled

na: Indicates sample not analysed

Bold Indicates results above GTV

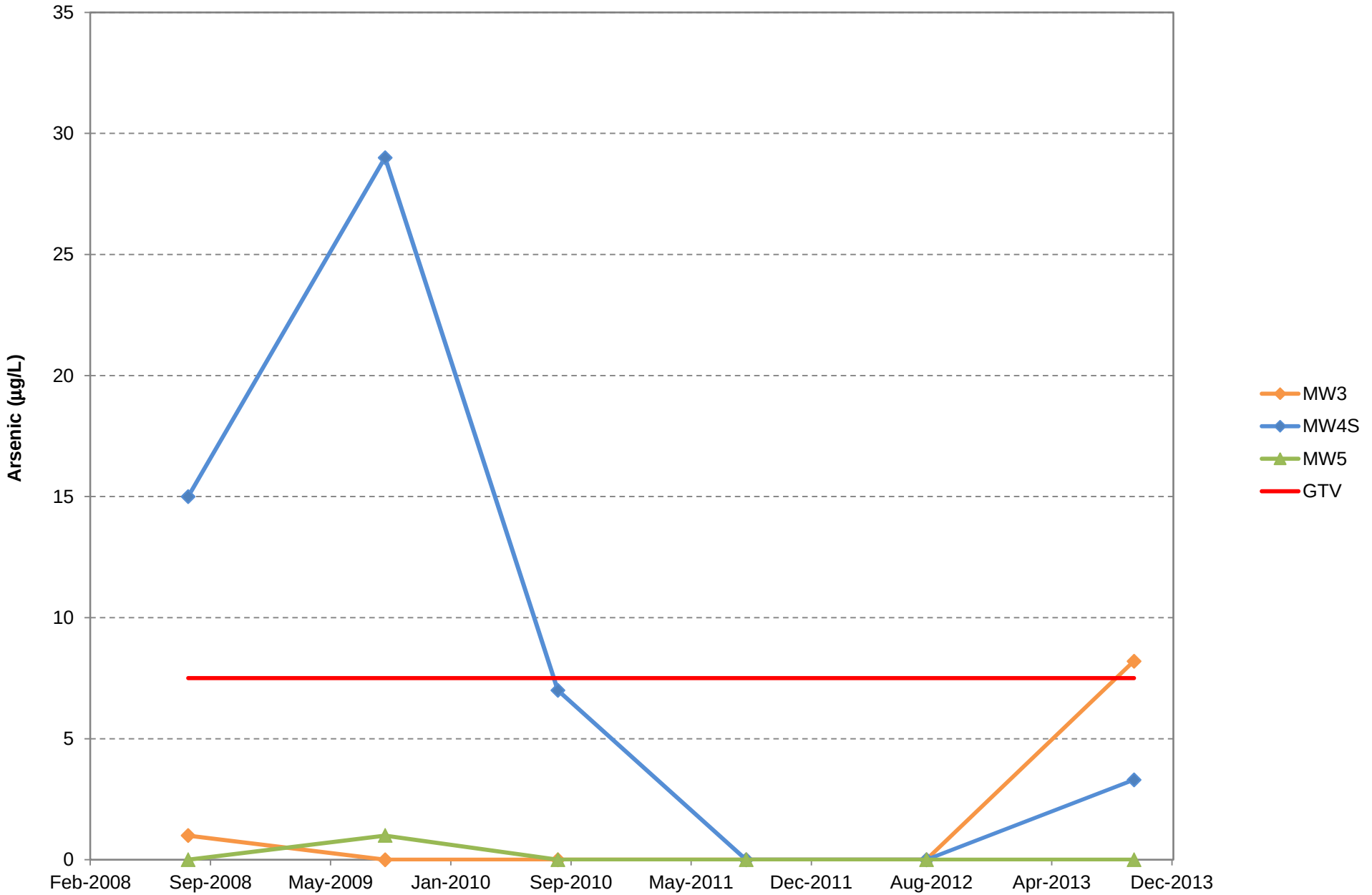
Underline Indicates results above Draft IGV

GTV:	7.5	µg/L
Draft IGV:	10	µg/L

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in September 2013, 2.5 µg/L

Prepared by: FO'R
Checked by: EO'H

Appendix D - Arsenic (µg/L) Trends - Enva Shannon



Appendix D - Lead (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Aug-2008	Sep-2009	Aug-2010	Aug-2011	Aug-2012	Sep-2013
MW3	2.5	-	-	-	-	-	-
MW4S	3.4	-	8	-	-	-	-
MW5	2.5	-	-	-	-	-	-
P.W	-	ns	ns	ns	ns	ns	ns

Notes:

ns: Indicates well not sampled
na: Indicates sample not analysed

Bold Indicates results above GTV
Underline Indicates results above Draft IGV

GTV:	18.75	µg/L
Draft IGV:	10	µg/L

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in September 2013, 5 µg/L

Appendix D - Nickel (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Aug-2008	Sep-2009	Aug-2010	Aug-2011	Aug-2012	Sep-2013
MW3	**39**	**48**	**33**	**25**	**32**	**40**	**55**
MW4S	**1,041**	**1,360**	**1,540**	**927**	**993**	**667**	**759**
MW5	**22**	12	**40**	**30**	**18**	3	**27**
P.W	-	ns	ns	ns	ns	ns	ns

Notes:

ns: Indicates well not sampled

na: Indicates sample not analysed

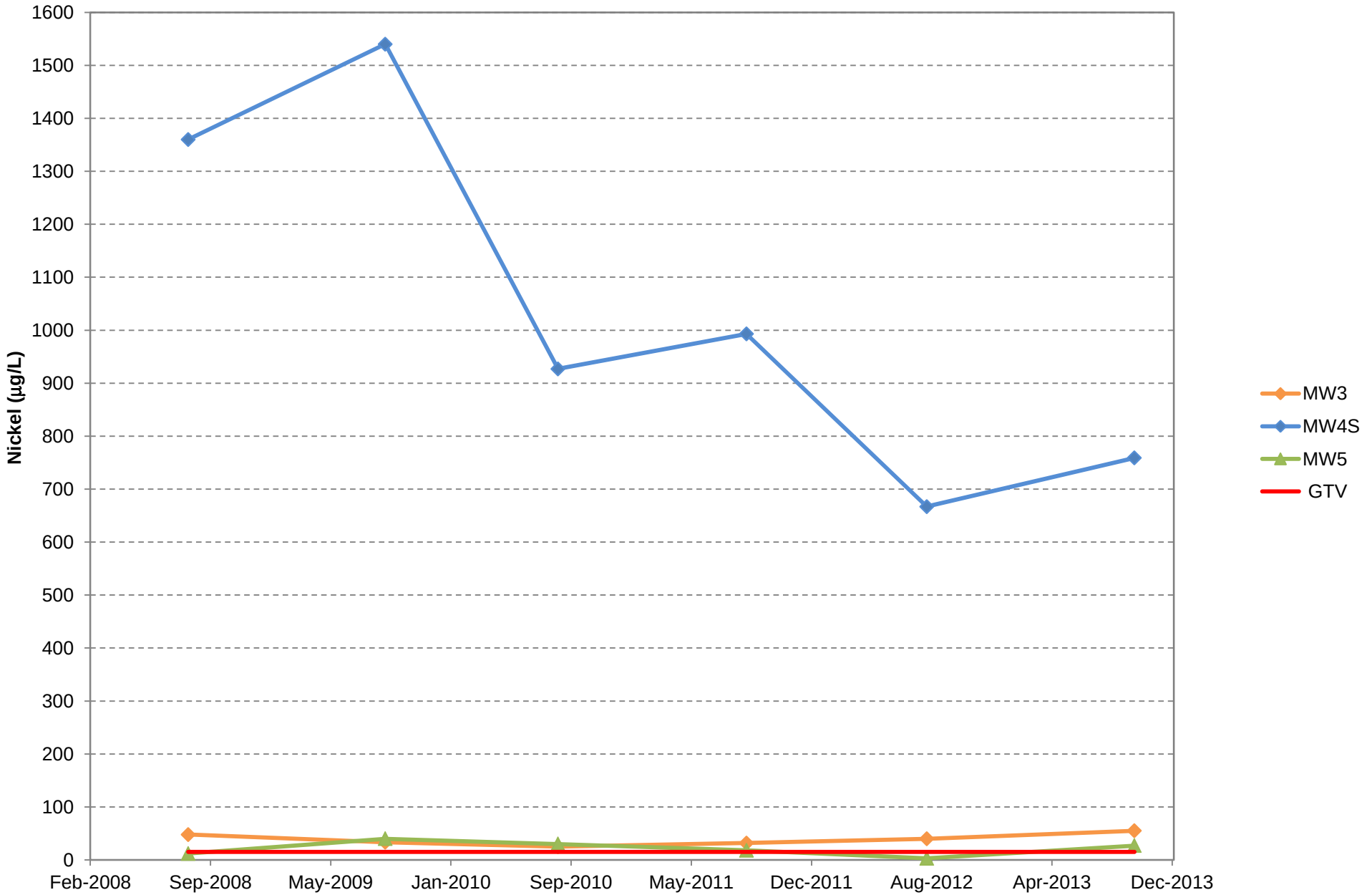
Bold Indicates results above GTV

GTV: 15 µg/L

Draft IGV: None µg/L

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in September 2013, 2 µg/L

Appendix D - Nickel (µg/L) Trends - Enva Shannon



Appendix D - Mercury (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Aug-2008	Sep-2009	Aug-2010	Aug-2011	Aug-2012	Sep-2013
MW3	0.52	-	0.6	-	-	-	-
MW4S	0.50	-	-	-	-	-	-
MW5	0.50	-	-	-	-	-	-
P.W	-	ns	ns	ns	ns	ns	ns

Notes:

ns: Indicates well not sampled

na: Indicates sample not analysed

Bold Indicates results above GTV

Underline Indicates results above Draft IGV

GTV:	0.75	µg/L
Draft IGV:	1	µg/L

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in September 2013, 1 µg/L

Appendix D - Chromium (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Aug-2008	Sep-2009	Aug-2010	Aug-2011	Aug-2012	Sep-2013
MW3	0.8	-	-	-	-	-	-
MW4S	4.8	-	2	5	2	17	3
MW5	0.8	-	-	-	-	-	-
P.W	-	ns	ns	ns	ns	ns	ns

Notes:

ns: Indicates well not sampled
na: Indicates sample not analysed

Bold Indicates results above GTV
Underline Indicates results above Draft IGV

GTV:	1500	µg/L
Draft IGV:	30	µg/L

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in September 2013, 1.5 µg/L

Appendix D - Cadmium (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Aug-2008	Sep-2009	Aug-2010	Aug-2011	Aug-2012	Sep-2013
MW3	0.25	-	-	-	-	-	-
MW4S	0.53	-	-	-	-	1.9	-
MW5	0.25	-	-	-	-	-	-
P.W	-	ns	ns	ns	ns	ns	ns

Notes:

ns: Indicates well not sampled
na: Indicates sample not analysed

Bold Indicates results above GTV
Underline Indicates results above Draft IGV

GTV: 3.75 µg/L
Draft IGV: 5 µg/L

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in September 2013, 0.5 µg/L

Appendix D - Copper (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Aug-2008	Sep-2009	Aug-2010	Aug-2011	Aug-2012	Sep-2013
MW3	18	20	27	9	24	26	-
MW4S	4	-	-	-	-	-	-
MW5	4	-	6	-	-	-	-
P.W	-	ns	ns	ns	ns	ns	ns

Notes:

ns: Indicates well not sampled
na: Indicates sample not analysed

Bold Indicates results above GTV
Underline Indicates results above Draft IGV

GTV: 1500 µg/L
Draft IGV: 30 µg/L

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in September 2013, 7 µg/L

APPENDIX E POLYCYCLIC AROMATIC HYDROCARBONS TREND DATA

Appendix E - Benzo(a)pyrene (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Aug-2008	Aug-2010	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	**5**	-	-	-	-	-	-	-	-
MW4S	**5**	-	-	-	-	-	-	-	-
MW5	**5**	-	-	-	-	-	-	-	-
P.W	-	ns	ns	ns	ns	ns	ns	ns	ns

Notes:

ns: Indicates well not sampled
na: Indicates sample not analysed

GTV: 0.0075 µg/L
Draft IGV: 0.01 µg/L

Bold Indicates results above GTV
Underline Indicates results above Draft IGV

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in September 2013, 10 µg/L

Appendix E - Benzo(ghi)perylene (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Aug-2008	Aug-2010	Aug-2011	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	**5**	-	-	-	-	-	-	-	-	-
MW4S	**5**	-	-	-	-	-	-	-	-	-
MW5	**5**	-	-	-	-	-	-	-	-	-
P.W	-	ns	ns	ns	ns	ns	ns	ns	ns	ns

Notes:
ns: Indicates well not sampled
na: Indicates sample not analysed

GTV*: 0.075 µg/L
Draft IGV: 0.05 µg/L

Bold Indicates results above GTV
Underline Indicates results above Draft IGV

* GTV is for the sum of benzo(ghi)perylene, benzo(b) and benzo(k)fluoranthene and indeno(123cd)pyrene

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in December 2013, 10 µg/L

Appendix E - Benzo(bk)fluoranthene (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Aug-2008	Aug-2010	Aug-2011	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	**5**	-	-	-	-	-	-	-	-	-
MW4S	**5**	-	-	-	-	-	-	-	-	-
MW5	**5**	-	-	-	-	-	-	-	-	-
P.W	-	ns	ns	ns	ns	ns	ns	ns	ns	ns

Notes:
ns: Indicates well not sampled
na: Indicates sample not analysed

GTV*: 0.075 µg/L

Draft IGV: 0.05 µg/L benzo(k)fluoranthene
0.5 µg/L benzo(b)fluoranthene

Bold Indicates results above GTV
Underline Indicates results above Draft IGV

* GTV is for the sum of benzo(ghi)perylene, benzo(b) and benzo(k)fluoranthene and indeno(123cd)pyrene
Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in December 2013, 10 µg/L

Appendix E - Indeno(123)pyrene (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Aug-2008	Aug-2010	Aug-2011	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	**5**	-	-	-	-	-	-	-	-	-
MW4S	**5**	-	-	-	-	-	-	-	-	-
MW5	**5**	-	-	-	-	-	-	-	-	-
P.W	-	ns	ns	ns	ns	ns	ns	ns	ns	ns

Notes:
ns: Indicates well not sampled
na: Indicates sample not analysed

GTV*: 0.075 µg/L
Draft IGV: 0.05 µg/L

Bold Indicates results above GTV
Underline Indicates results above Draft IGV

* GTV is for the sum of benzo(ghi)perylene, benzo(b) and benzo(k)fluoranthene and indeno(123cd)pyrene

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in December 2013, 10 µg/L

APPENDIX F VOLATILE ORGANIC COMPOUNDS TREND DATA

Appendix F - 1,2 Dichloroethane (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Apr-2008	Jun-2008	Aug-2008	Nov-2008	Apr-2009	Jun-2009	Sep-2009	Dec-2009	Feb-2010	May-2010	Aug-2010	Nov-2010	Feb-2011	May-2011	Aug-2011	Nov-2011	Feb-2012	May-2012	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW4S	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P.W	1	ns	ns	ns	ns	ns	ns	ns	ns	ns	-	ns	ns	ns	-	ns	ns	ns	ns	ns	ns	ns	535	ns	ns

Notes:

ns: Indicates well not sampled
na: Indicates sample not analysed

GTV: 2.25 µg/L **Bold** Indicates results above GTV
Draft IGV: 3 µg/L Underline Indicates results above IGV

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in December 2013, 2 µg/L

Appendix F - Vinyl Chloride (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Apr-2008	Jun-2008	Aug-2008	Nov-2008	Apr-2009	Jun-2009	Sep-2009	Dec-2009	Feb-2010	May-2010	Aug-2010	Nov-2010	Feb-2011	May-2011	Aug-2011	Nov-2011	Feb-2012	May-2012	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	**9**	**25**	**27**	**18**	**10**	-	**6**	-	5	**4**	-	**6**	-	**11**	**7**	-	**4**	**61**	**7**	**3**	-	**3**	**7**	**13**	**6**
MW4S	**606**	**496**	**535**	**346**	**669**	-	**2**	**433**	273	**502**	**1,461**	**278**	**424**	nr	**324**	**530**	**619**	**2,198**	**908**	**298**	**1,177**	**389**	**658**	**811**	**722**
MW5	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P.W	**12**	ns	ns	ns	ns	ns	ns	-	ns	ns	**15**	ns	ns	ns	**14**	ns	ns	ns	**20**	ns	ns	ns	14	ns	ns

Notes:

ns: Indicates well not sampled
na: Indicates sample not analysed
nr: Indicates February 2011 ommited due to possible lab error

GTV: 0.375 µg/L
Draft IGV: none

Bold Indicates results above GTV

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in December 2013, 0.1 µg/L

Appendix F - Trichloroethene (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Apr-2008	Jun-2008	Aug-2008	Nov-2008	Apr-2009	Jun-2009	Sep-2009	Dec-2009	Feb-2010	May-2010	Aug-2010	Nov-2010	Feb-2011	May-2011	Aug-2011	Nov-2011	Feb-2012	May-2012	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	**17**	**27**	**17**	**25**	**33**	**26**	**21**	**22**	**24**	**12**	**21**	**27**	**30**	**22**	7	**8**	**10**	**22**	**19**	**17**	**24**	**15**	6	-	-
MW4S	**23**	-	**91**	**45**	**30**	-	-	-	27	**26**	**59**	**21**	7	nr	5	**24**	**39**	**49**	**48**	**30**	**12**	**13**	6	**10**	**19**
MW5	2	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P.W	**349**	ns	ns	ns	ns	ns	ns	**662**	ns	ns	**431**	ns	ns	ns	**477**	ns	ns	ns	**80**	ns	ns	ns	**97**	ns	ns

Notes:

ns: Indicates well not sampled
na: Indicates sample not analysed
nr: Indicates February 2011 ommited due to possible lab error

GTV: 7.5 µg/L
Draft IGV: 10 & 40* µg/L

Bold Indicates results above GTV
Underline Indicates results above IGV
* Two draft IGVs are defined for Trichloroethene

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in December 2013, 3 µg/L

Appendix F - Tetrachloroethene (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Apr-2008	Jun-2008	Aug-2008	Nov-2008	Apr-2009	Jun-2009	Sep-2009	Dec-2009	Feb-2010	May-2010	Aug-2010	Nov-2010	Feb-2011	May-2011	Aug-2011	Nov-2011	Feb-2012	May-2012	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	**11**	2	2	2	**10**	**16**	**27**	**21**	**22**	**20**	**18**	**13**	**18**	**15**	**9**	-	**8**	**10**	**10**	-	**12**	**9**	**8**	-	-
MW4S	7	-	-	**20**	-	-	-	-	-	**11**	**14**	7	-	-	4	-	**10**	**11**	**43**	-	**9**	7	6	**9**	**9**
MW5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P.W	**693**	ns	ns	ns	ns	ns	ns	**835**	ns	ns	**1,054**	ns	ns	ns	**1,186**	ns	ns	ns	**173**	ns	ns	ns	**217**	ns	ns

Notes:

ns: Indicates well not sampled
na: Indicates sample not analysed
nr: Indicates February 2011 ommited due to possible lab error

GTV: 7.5 µg/L
Draft IGV: 10 & 40* µg/L

Bold Indicates results above GTV
Underline Indicates results above IGV

* Two draft IGVs are defined for Tetrachloroethene

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in December 2013, 3 µg/L

Appendix F - Benzene (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Apr-2008	Jun-2008	Aug-2008	Nov-2008	Apr-2009	Jun-2009	Sep-2009	Dec-2009	Feb-2010	May-2010	Aug-2010	Nov-2010	Feb-2011	May-2011	Aug-2011	Nov-2011	Feb-2012	May-2012	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	0.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2**	-	-	-
MW4S	**10**	-	-	**24**	**24**	-	-	-	-	**17**	**16**	**12**	**10**	nr	**3**	**9**	**17**	**14**	**18**	**10**	**12**	**13**	**10**	**12**	**13**
MW5	0.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P.W	0.25	ns	ns	ns	ns	ns	ns	-	ns	ns	-	ns	ns	ns	-	ns	ns	ns	-	ns	ns	ns	-	ns	ns

Notes:

ns: Indicates well not sampled
na: Indicates sample not analysed
nr: Indicates February 2011 ommited due to possible lab error

GTV: 0.75 µg/L
Draft IGV: 1 µg/L

Bold Indicates results above GTV
Underline Indicates results above IGV

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in December 2013, 0.5 µg/L

Appendix F - Chloroform (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Apr-2008	Jun-2008	Aug-2008	Nov-2008	Apr-2009	Jun-2009	Sep-2009	Dec-2009	Feb-2010	May-2010	Aug-2010	Nov-2010	Feb-2011	May-2011	Aug-2011	Nov-2011	Feb-2012	May-2012	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	1	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-
MW4S	58	-	**129**	**92**	**83**	-	5	-	72	**95**	**78**	58	31	nr	18	40	**99**	**96**	**108**	49	**80**	50	40	51	-
MW5	3	2	-	3	3	-	1	-	-	-	-	-	-	-	-	-	20	10	-	21	-	-	-	-	-
P.W	1	ns	ns	ns	ns	ns	ns	-	ns	ns	-	ns	ns	ns	-	ns	ns	ns	-	ns	ns	ns	-	ns	ns

Notes:

ns: Indicates well not sampled
na: Indicates sample not analysed
nr: Indicates February 2011 ommited due to possible lab error

GTV: 75* µg/L
Draft IGV: 12 µg/L

Bold Indicates results above GTV
Underline Indicates results above IGV

* Guideline Threshold Value is for the sum of trihalomethanes

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in December 2013, 2 µg/L

Appendix F - Bromodichloromethane (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Apr-2008	Jun-2008	Aug-2008	Nov-2008	Apr-2009	Jun-2009	Sep-2009	Dec-2009	Feb-2010	May-2010	Aug-2010	Nov-2010	Feb-2011	May-2011	Aug-2011	Nov-2011	Feb-2012	May-2012	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW4S	0.5	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW5	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P.W	0.5	ns	ns	ns	ns	ns	ns	-	ns	ns	-	ns	ns	ns	-	ns	ns	ns	-	ns	ns	ns	-	ns	ns

Notes:

ns: Indicates well not sampled
na: Indicates sample not analysed

GTV: 75* µg/L **Bold** Indicates results above GTV
Draft IGV: None

* Guideline Threshold Value is for the sum of trihalomethanes

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in December 2013, 1 µg/L

Appendix F - Dibromochloromethane (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Apr-2008	Jun-2008	Aug-2008	Nov-2008	Apr-2009	Jun-2009	Sep-2009	Dec-2009	Feb-2010	May-2010	Aug-2010	Nov-2010	Feb-2011	May-2011	Aug-2011	Nov-2011	Feb-2012	May-2012	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW4S	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW5	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P.W	0.5	ns	ns	ns	ns	ns	ns	-	ns	ns	-	ns	ns	ns	-	ns	ns	ns	-	ns	ns	ns	-	ns	ns

Notes:

ns: Indicates well not sampled
na: Indicates sample not analysed

GTV: 75* µg/L
Draft IGV: None

Bold Indicates results above GTV

* Guideline Threshold Value is for the sum of trihalomethanes

Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in December 2013, 1 µg/L

Appendix F - Bromoform (µg/L) Monitoring Data (2008 to 2013) - Enva Shannon

Monitoring Well	Average	Apr-2008	Jun-2008	Aug-2008	Nov-2008	Apr-2009	Jun-2009	Sep-2009	Dec-2009	Feb-2010	May-2010	Aug-2010	Nov-2010	Feb-2011	May-2011	Aug-2011	Nov-2011	Feb-2012	May-2012	Aug-2012	Nov-2012	Mar-2013	Jun-2013	Sep-2013	Dec-2013
MW3	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW4S	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW5	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P.W	0.5	ns	ns	ns	ns	ns	ns	-	ns	ns	-	ns	ns	ns	-	ns	ns	ns	-	ns	ns	ns	-	ns	ns

Notes:
ns: Indicates well not sampled
na: Indicates sample not analysed

GTV: 75* mg/L **Bold** Indicates results above GTV
Draft IGV: None
* Guideline Threshold Value is for the sum of trihalomethanes

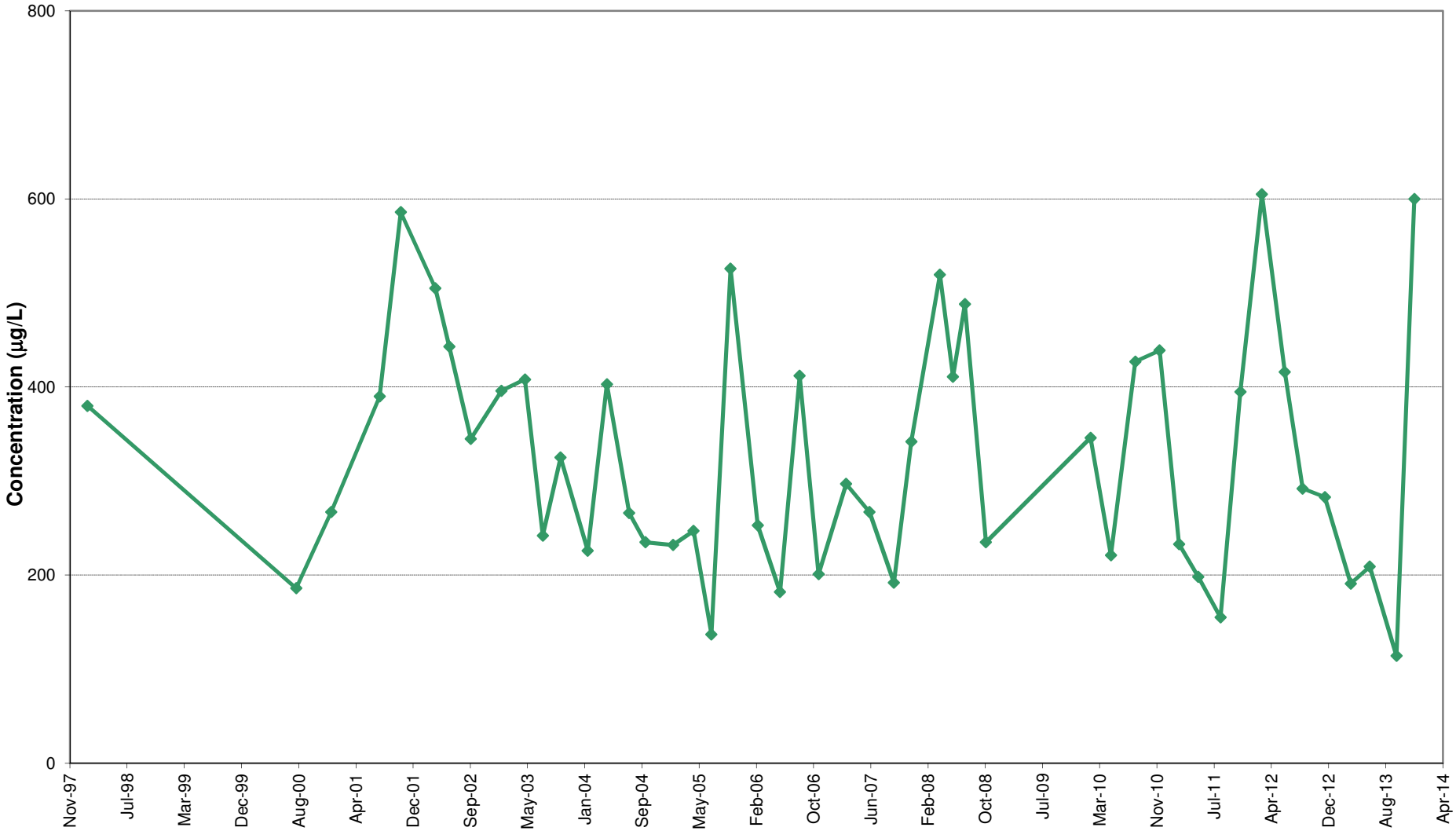
Where detections are below the MDL, the average has been calculated using a concentration equal to half the MDL in December 2013, 1 µg/L

1 mdl

0.5
0.5
0.5

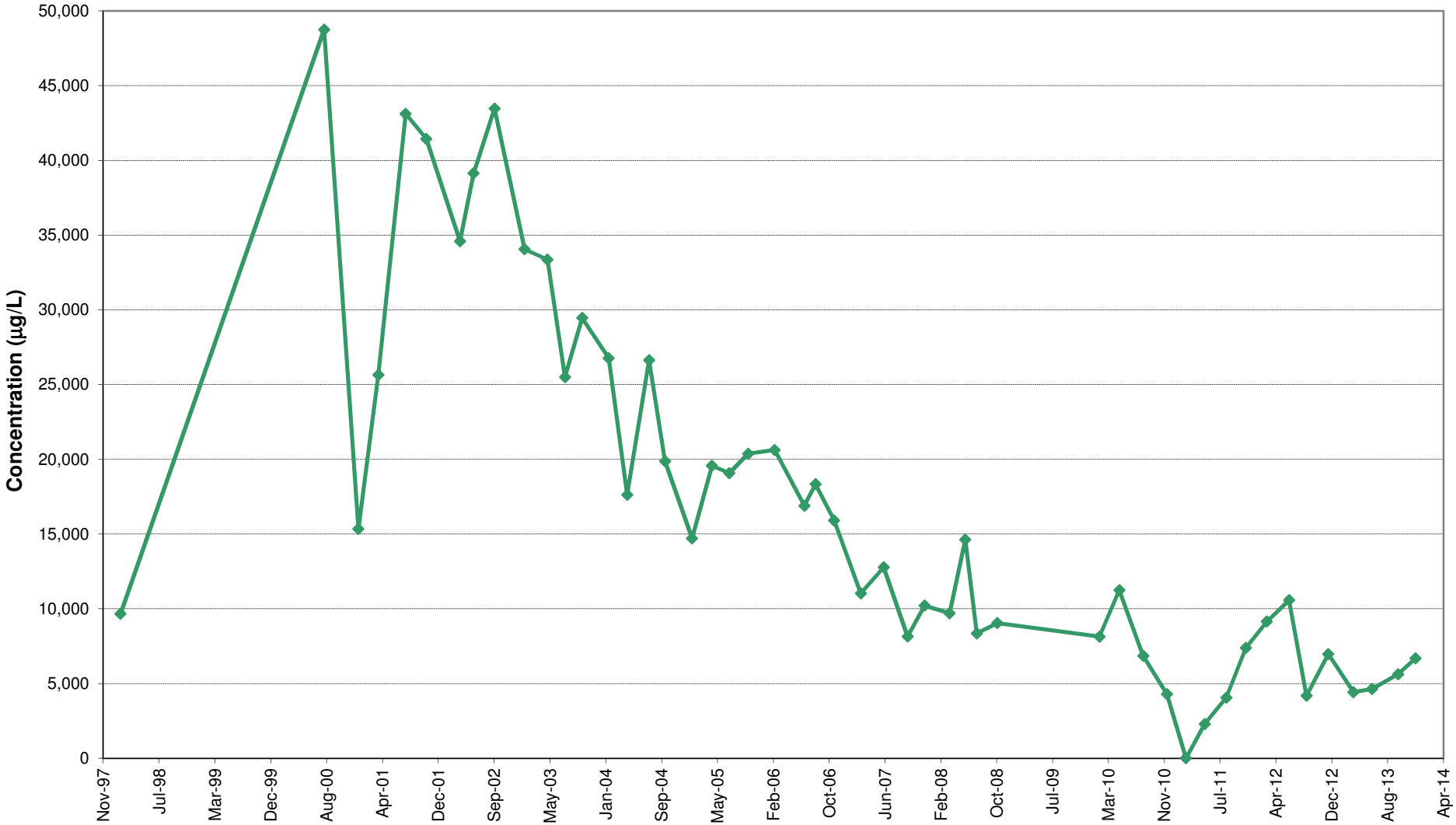
Appendix F1: Enva Shannon, Groundwater Monitoring Data February 1998 to December 2013

Total VOC Concentration - MW3
(Maximum Total VOC Concentration = 605 µg/L in February 2012)

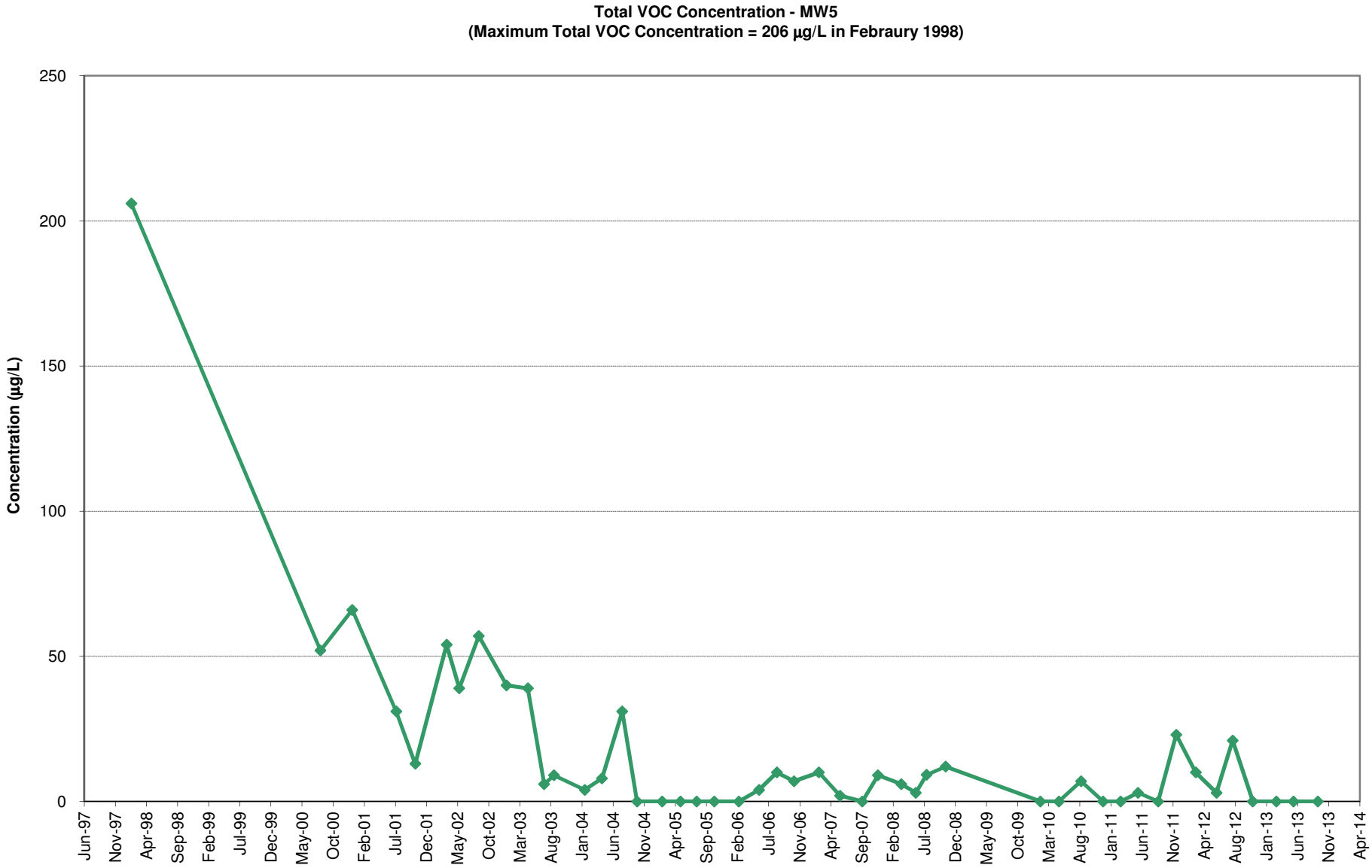


Appendix F2: Enva Shannon, Groundwater Monitoring Data February 1998 to December 2013

Total VOC Concentration - MW4S
(Maximum Total VOC Concentration = 48,749 µg/L in August 2000)



Appendix F3: Enva Shannon, Groundwater Monitoring Data February 1998 to December 2013



APPENDIX G DECEMBER 2013 GROUNDWATER MONITORING DATA

Compiled by: FO'R
Checked by: KF

Appendix G - Table 6: Miscellaneous Parameter Results (mg/L) - Enva Shannon, December 2013

Compound	Groundwater Regs 2010	EPA Draft Interim Guideline Value (IGV)	Monitoring Well		
			MW3	MW4S	MW5
Ammoniacal Nitrogen as N	0.065 - 0.175	0.12*	***1.96***	***10.25***	<0.03
Total Oxidised Nitrogen as N	nv	No abnormal change	<0.2	<0.2	2.1
Total Organic Carbon	nv	No abnormal change	3	21	<2
Chloride	187.5	250	65	***474***	92
Sodium	150	150	68	***526***	59
Sulphate	187.5	200	96	***543***	89
Potassium	nv	5	*9*	*10*	3
Cyclohexane Extractable Matter	nv	nv	*11*	*<1*	<1
Nitrate as NO_3	25	37.5	<0.2	<0.2	9.3
Nitrite as NO_2	0.10	0.375	<0.02	<0.02	<0.02
MRP as PO_4	0.03	0.035	<0.06	<0.06	<0.06
Aluminium	0.20	0.150	<20	<20	<20
Boron	1	1	144	272	19

Notes:

BOLD	Exceeds GTV
Italics	Exceeds Draft IGV
nv	no value
*	IGV given as mg/L NH_4, converted to equivalent mg/L N

Appendix G - Table 7: Pesticide Results (mg/L) - Enva Shannon, December 2013

Pesticide	MDL (µg/L)	GTV (µg/L)	Monitoring Well		
			MW3	MW4S	MW5
Atrazine	0.05	0.075	-	-	-
Simazine	0.05	0.075	-	-	-
MCPA	0.05	0.075	-	-	-
Lindane	0.05	0.075	-	-	-
4,4-DDT	0.05	0.075	-	-	-
Diuron	0.05	0.075	-	-	-
Dieldrin	0.05	0.075	-	-	-
Cypermethrin	0.05	0.075	-	-	-
Glyphosate	2*	0.075	-	-	-
Chlortoluron	0.05	0.075	-	-	-
Bentazone	0.05	0.075	-	-	-
Mecoprop	0.05	0.075	-	-	-
Isoproturon	0.05	0.075	-	-	-
2,4 Dichlorophen-oxyacetic acid	0.05	0.075	-	-	-

APPENDIX H FULL REPORT FOR TULLANEWMARKET_2 GROUNDWATER BODY

water matters
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Full Report for Waterbody TullaNewmarket_2

River Basin Management Plans (RBMPs) have been published for all River Basin Districts in Ireland in accordance with the requirements of the Water Framework Directive. The WaterMaps viewer is an integral part of the River Basin Management Plan and provides access to information at individual waterbody level and at Water Management Unit level for all the River Basin Districts in Ireland.

The following report provides summary plan information about the selected waterbody (indicated by the pin in the map above) relating to its status, risks, objectives, and measures proposed to retain status where this is adequate, or improve it where necessary. Waterbodies can relate to surface waters (these include rivers, lakes, estuaries [transitional waters], and coastal waters), or to groundwaters. Other relevant information not included in this report can be viewed using the WaterMaps viewer, including areas listed in the Register of Protected Areas.

You will find brief notes at the bottom of some of the individual report sheets that will help you in interpreting the information presented. More detailed information can be obtained in relation to all aspects of the RBMPs at www.wfdireland.ie.

Date Reported to Europe:July 2010

Date Report Created 11/03/2014

water matters
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Summary Information:

Water Management Unit:	N/A
WaterBody Category:	Groundwater Waterbody
WaterBody Name:	TullaNewmarket_2
WaterBody Code:	IE_SH_G_231
Overall Status:	Good
Overall Objective:	Protect
Overall Risk:	2a Probably Not At Risk
Heavily Modified:	No

shannon river basin district

Report data based upon final RBMP, 2009-2015.

The information provided above is a summary of the principal findings related to the selected waterbody. Further details and explanation of individual elements of the report are outlined in the following pages.

Date Reported to Europe:July 2010

Date Report Created 11/03/2014

water matters
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Chemical and Quantitative Status Report

Water Management Unit: N/A

WaterBody Category: Groundwater Waterbody

WaterBody Name: TullaNewmarket_2

WaterBody Code: IE_SH_G_231

Overall Status Result: Good

Heavily Modified: No

shannon river basin district

	Status Element Description	Result
	Status information	
INS	Status associated with saline intrusion into groundwater	GS-HC
DWS	Status associated with exceedances of water quality above specific standards	GS-HC
DS	Chemical status of groundwater due to pressure from diffuse sources of pollution	GS-HC
CLS	Chemical status of groundwater due to pressure from contaminated soil or land.	GS-HC
MS	Chemical status of groundwater due to pressure from mine sites (active or closed).	GS-HC
UAS	Chemical status of groundwater due to pressures from urban areas	GS-HC
GWS	General groundwater quality status	GS-HC
RPS	Status associated with MRP loading to rivers	GS-HC
TNS	Status associated with nitrate loading to transitional and coastal waters	GS-HC
SWS	Overall status associated with nutrient loadings to rivers and transitional and coastal waters	GS-HC
SQS	Status associated with dependant surface water quantitative status	GS-HC
GDS	Groundwater dependant terrestrial ecosystems status	GS-HC
QSO	Quantitative status overall	GS-HC
CSO	Chemical status overall	GS-HC
OS	Overall status	Good

GS -HC : Good status High Confidence
GS- LC : Good status Low Confidence
n/a - not assessed

Status
By 'Status' we mean the condition of the water in the waterbody. It is defined by its chemical status and quantitative status, whichever is worse. Groundwaters are ranked in one of 2 status classes: Good or Poor.

You can read more about status and how it is measured in our RBMP Document Library at www.wfdireland.ie (Directory 15 Status).

Date Reported to Europe:July 2010

Date Report Created 11/03/2014

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Risk Report

Water Management Unit: N/A

WaterBody Category: Groundwater Waterbody

WaterBody Name: TullaNewmarket_2

WaterBody Code: IE_SH_G_231

Overall Risk Result: 2a Probably Not At Risk

Heavily Modified: No

shannon river basin district

	Risk Test Description	Risk
	Groundwater Dependent Terrestrial Ecosystems	
TE	GWDTE Risk	N/A
	Groundwater Quality	
DIF	Diffuse Elements (General) Risk	N/A
DW	Drinking Waters Risk	N/A
INT	Intrusions Risk	N/A
WB	Water Balance Risk	N/A
	Groundwater Quality (General)	
GQ	General Groundwater Quality Risk	N/A
	Groundwater Quality (Point Risk)	
CL	Contaminated Land Risk	N/A
LF	Landfill Risk	N/A
MI	Mine Risk	N/A
QY	Quarry Risk	N/A
UR	Urban Risk	N/A
UW	UWWT Risk	N/A
	GW Diffuse Risk Sources	
WB3	Mobile Nutrients (NO3)	N/A
WB4	Mobile Chemicals	N/A
WB5	Clustered OSWTSs and leaking urban sewerage systems	N/A
	GW Hydrology	
WB1	Water balance - Abstraction	N/A
WB2	Abstraction - Intrusion	N/A

Date Reported to Europe:July 2010

Date Report Created 11/03/2014

	GW Point Risk Sources		
WB10	Risk from Point sources of pollution - Contaminated Land		N/A
WB11	Risk from Point sources of pollution - Trade Effluent Discharges		N/A
WB12	Risk from Point sources of pollution - Urban Wastewater Discharges		N/A
WB6	Risk from Point sources of pollution - Mines		N/A
WB7	Risk from Point sources of pollution - Quarries		N/A
WB8	Risk from Point sources of pollution - Landfills		N/A
WB9	Risk from Point sources of pollution - Oil Industry Infrastructure		N/A
	Overall Risk		
RA	Groundwater Overall - Worst Case		N/A
	Risk information		
CLR	Contaminated land risk	2b	Not At Risk
DR	Risk of groundwater due to pressure from diffuse sources of pollution	2a	Probably Not At Risk
DWR	Risk associated with exceedances of water quality above specific standards	2b	Not At Risk
GDR	Groundwater dependant terrestrial ecosystems risk	2b	Not At Risk
GWR	General groundwater quality risk	2a	Probably Not At Risk
INR	Risk associated with saline intrusion into groundwater	2b	Not At Risk
LR	Risk due to landfills sites/old closed dump sites	2b	Not At Risk
MR	Mines risk	2b	Not At Risk
NULL	Diffuse nitrates from agriculture risk		N/A
QR	Risk due to quarries	2b	Not At Risk
RA	Revised risk assessment	2a	Probably Not At Risk
RPR	Risk associated with MRP loading to rivers	2b	Not At Risk
SQR	Risk associated with dependant surface water quantitative status	2b	Not At Risk
SWR	Overall risk associated with nutrient loadings to rivers and transitional and coastal waters	2b	Not At Risk
TNR	Risk associated with nitrate loading to transitional and coastal waters	2b	Not At Risk
UAR	Risk of groundwater due to pressures from urban areas	2b	Not At Risk
UWR	Risk due to direct discharges of urban wastewater	2b	Not At Risk

Risk
By 'risk' we mean the risk that a waterbody will not achieve good ecological or good chemical status/potential at least by 2015. To examine risk the various pressures acting on the waterbody were identified along with any evidence of impact on water status. Depending on the extent of the pressure and its potential for impact, and the amount of information available, the risk to the water body was placed in one of four categories: 1a at risk; 1b probably at risk; 2a probably not at risk; 2b not at risk. Note that '2008' after the risk category means that the risk assessment was revised in 2008. All other risks were determined as part of an earlier risk assessment in 2005.

You can read more about risk assessment in our 'WFD Risk Assessment Update' document in the RBMP document library, and other documents at www.wfdireland.ie (Directory 31 Risk Assessments).

Date Reported to Europe:July 2010

Date Report Created 11/03/2014

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Objectives Report

Water Management Unit: N/A

WaterBody Category: Groundwater Waterbody

WaterBody Name: TullaNewmarket_2

WaterBody Code: IE_SH_G_231

Overall Objective: Protect

Heavily Modified: No

shannon river basin district

	Objectives Description	Result
	Extended timescale information	
E1	Extended deadlines due to agricultural P	No Status
E2	Extended deadlines due to agricultural N	No Status
E3	Extended deadlines due to mines	No Status
E4	Extended deadlines due to urban areas	No Status
E5	Extended deadlines due to contaminated lands	No Status
EO	Extended deadlines - overall	No Status
	Objectives information	
OB1	Prevent deterioration objective	Protect
OB2	Restore at least good status objective	No Status
OB3	Reduce chemical pollution objective	No Status
OB4	Protected areas objective	No Status
OBO	Overall objectives - objective	Protect

Extended timescales
Extended timescales have been set for certain waters due to technical, economic, environmental or recovery constraints. Extended timescales are usually of one planning cycle (6 years, to 2021) but in some cases are two planning cycles (to 2027).

Objectives
In general, we are required to ensure that our waters achieve at least good status/potential by 2015, and that their status does not deteriorate. Having identified the status of waters (this is given earlier in this report), the next stage is to set objectives for waters. Objectives consider waters that require protection from deterioration as well as waters that require restoration and the timescales needed for recovery. Four default objectives have been set initially:-

Prevent Deterioration
Restore Good Status
Reduce Chemical Pollution
Achieve Protected Areas Objectives

These objectives have been refined based on the measures available to achieve them, the latter's likely effectiveness, and consideration of cost-effective combinations of measures. Where it is considered necessary extended deadlines have been set for achieving objectives in 2021 or 2027.

Date Reported to Europe:July 2010

Date Report Created 11/03/2014

water matters
'our Plan'

Measures Report

Water Management Unit: N/A

WaterBody Category: Groundwater Waterbody

WaterBody Name: TullaNewmarket_2

WaterBody Code: IE_SH_G_231

Heavily Modified: No

shannon river basin district

	Measures Description	Applicable
BC	Total number of basic measures which apply to this waterbody	24
BW	Directive - Bathing Waters Directive	No
BIR	Directive - Birds Directive	No
HAB	Directive - Habitats Directive	No
DW	Directive - Drinking Waters Directive	Yes
MAE	Directive - Major Accidents and Emergencies Directive	Yes
EIA	Directive - Environmental Impact Assessment Directive	Yes
SS	Directive - Sewage Sludge Directive	Yes
UWT	Directive - Urban Waste Water Treatment Directive	Yes
PPP	Directive - Plant Protection Products Directive	Yes
NIT	Directive - Nitrates Directive	Yes
IPC	Directive - Integrated Pollution Prevention Control Directive	Yes
CR	Other Stipulated Measure - Cost recovery for water use	Yes
SUS	Other Stipulated Measure - Promotion of efficient and sustainable water use	Yes
DWS	Other Stipulated Measure - Protection of drinking water sources	Yes
ABS	Other Stipulated Measure - Control of abstraction and impoundment	Yes
POI	Other Stipulated Measure - Control of point source discharges	Yes
DIF	Other Stipulated Measure - Control of diffuse source discharges	Yes
GW	Other Stipulated Measure - Authorisation of discharges to groundwaters	Yes
PS	Other Stipulated Measure - Control of priority substances	Yes
MOD	Other Stipulated Measure - Controls on physical modifications to surface waters	Yes
OA	Other Stipulated Measure - Controls on other activities impacting on water status	Yes
AP	Other Stipulated Measure - Prevention or reduction of the impact of accidental pollution incidents	Yes
OTS	On-site waste water treatment systems	Yes
FPM	Freshwater Pearl Mussel sub-basin plan	No
SHE	Shellfish Pollution Reduction Plan	No
IPR	IPPC licences requiring review	Yes
WPR	Water Pollution Act licences requiring review	Yes
FOR	Forestry guidelines and regulations	Yes

Date Reported to Europe:July 2010

Date Report Created 11/03/2014

HQW	Protect high quality waters	Yes

Measures
Measures are necessary to ensure that we meet the objectives set out in the previous page of this report. Many measures are already provided for in national legislation and must be implemented. Other measures have been recently introduced or are under preparation. A range of additional potential measures are also being considered but require further development. Any agreed additional measures can be introduced through the update of Water Management Unit Action Plans during the implementation process.

You can read more about Basic Measures in 'River Basin Planning Guidance' and in other documents in our RBMP Document Library at www.wfdireland.ie.

Date Reported to Europe:July 2010

Date Report Created 11/03/2014

Environmental Liabilities template	Lic No:	W0041-01	Year	2014

Click here to access EPA guidance on Environmental Liabilities and Financial provision

			Commentary
1	ELRA initial agreement status	Submitted and agreed by EPA	
2	ELRA review status	Review required and completed	Currently under review
3	Amount of Financial Provision cover required as determined by the latest ELRA	€426,875	
4	Financial Provision for ELRA status	Submitted and agreed by EPA	
5	Financial Provision for ELRA - amount of cover	€426,875	
6	Financial Provision for ELRA - type	bond	
7	Financial provision for ELRA expiry date	Continuous gurantee	
8	Closure plan initial agreement status	Closure plan submitted and agreed by EPA	
9	Closure plan review status	Review required and not completed	Currently under review
10	Financial Provision for Closure status	Submitted and agreed by EPA	
11	Financial Provision for Closure - amount of cover	56,500	
12	Financial Provision for Closure - type	bond	
13	Financial provision for Closure expiry date	Continuous gurantee	

Environmental Management Programme/Continuous Improvement Programme template

Lic No: W0041-01 Year 2014

Highlighted cells contain dropdown menu click to view

			Additional Information
1	Do you maintain an Environmental Mangement System (EMS) for the site. If yes, please detail in additional information	Yes	
2	Does the EMS reference the most significant environmental aspects and associated impacts on-site	Yes	
3	Does the EMS maintain an Environmental Management Programme (EMP) as required in accordance with the licence requirements	Yes	
4	Do you maintain an environmental documentation/communication system to inform the public on environmental performance of the facility, as required by the licence	Yes	

Environmental Management Programme (EMP) report

Objective Category	Target	Status (% completed)	How target was progressed	Responsibility	Intermediate outcomes
Additional improvements	Consider additional roofing remaining chemical storage bunds (front yard) if appropriate.	50	No additional roofing installed in the reporting year.	Section Head	Improved Environmental Management Practices
Additional improvements	Provide local bunding for bulk waste storage tanks (i.e tank farm bund).	0	Pending financial approval.	Section Head	Installation of infrastructure
Additional improvements	Install pH probe in underground tank.	50	Works ongoing. To be included in Pat Twomey site upgrade. Monitored in site initiatives.	Individual	Increased compliance with licence conditions
Materials Handling/Storage/Bunding	Improve yard integrity in areas for loading and unloading of waste	90	Cracks have been sealed in the export yard.	Individual	Improved Environmental Management Practices
Energy Efficiency/Utility conservation	Install system for storage and reuse of DIW reject water, for use in lime slurry batches	100	This is completed	Section Head	Improved Environmental Management Practices
Additional improvements	Continue to implement the agreed plan with a view to eliminating all pre-acquistion waste	90	Performance continues to be reported monthly to the Agency, and two full-scale stock audits are carried out per year. Specialised projects are underway to eliminate those wastes which are proving more difficult to deal with.	Section Head	Increased compliance with licence conditions

Environmental Management Programme/Continuous Improvement Programme template			Lic No:	W0041-01	Year 2014
Groundwater protection	Review the Agency's guidance document and implement additional groundwater monitoring studies if required	95	Hyrogeological review assessment carried out in May 2014 and No further action deemed necessary. Pending agreement with agency	Section Head	Increased compliance with licence conditions
SELECT		SELECT		SELECT	SELECT

Noise monitoring summary report	Lic No:	W0041-01	Year	2014

1	Was noise monitoring a licence requirement for the AER period? If yes please fill in table N1 noise summary below	Yes
2	Was noise monitoring carried out using the EPA Guidance note, including completion of the "Checklist for noise measurement report" included in the guidance note as table 6? (Noise Guidance note NG4)	Yes
3	Does your site have a noise reduction plan	No
4	When was the noise reduction plan last updated?	N/A
5	Have there been changes relevant to site noise emissions (e.g. plant or operational changes) since the last noise survey?	No

Table N1: Noise monitoring summary

Date of monitoring	Time period	Noise location (on site)	Noise sensitive location -NSL (if applicable)	LA_{eq}	LA_{90}	LA_{10}	LA_{max}	Tonal or Impulsive noise* (Y/N)	If tonal /impulsive noise was identified was 5dB penalty applied?	Comments (ex. main noise sources on site, & extraneous noise ex. road traffic)	Is site compliant with noise limits (day/evening/night)?
05/12/2014	30 MINS	N1		63.4	58.6		87.7	No	No	Main source of noise from construction activities off site.	Yes
05/12/2014	30 MINS	N4		63.1	52.6		77.7	No	No	Main source of noise from a pump operating in the ADVOX building	Yes
05/12/2014	30 MINS	N5		62.3	50.6		91.6	Yes	No	Main source of noise was from forklifts and pumps operating on site	Yes
05/12/2014	30 MINS	N6		58	50.6		87.6	No	No	Main source of noise from traffic entering and exiting the site- HGCs etc. Unloading operations also were taking place at the time of the suvey. Traffic in the industrial estate, neighbouring facilities and on the M18. Aircrafts overhead.	Yes
05/12/2014	30 MINS	N8		64.3	56.5		81.7	No	No	No significant noise at the time of the survey.	Yes

*Please ensure that a tonal analysis has been carried out as per guidance note NG4. These records must be maintained onsite for future inspection

If noise limits exceeded as a result of noise attributed to site activities, please choose the corrective action from the following options?

SELECT

** please explain the reason for not taking action/resolution of noise issues?
Any additional comments? (less than 200 words)

Resource Usage/Energy efficiency summary	Lic No:	W0041-01	Year	2014

			Additional information
1	When did the site carry out the most recent energy efficiency audit? Please list the recommendations in table 3 below	Enter date of audit	
2	Is the site a member of any accredited programmes for reducing energy usage/water conservation such as the SEAI programme linked to the right? If yes please list them in additional information	No	
3	Where Fuel Oil is used in boilers on site is the sulphur content compliant with licence conditions? Please state percentage in additional information	No	

SEAI - Large Industry Energy Network (LIEN)

Table R1 Energy usage on site

Energy Use	Previous year	Current year	Production +/- % compared to previous reporting year**	Energy Consumption +/- % vs overall site production*
Total Energy Used (MWHrs)				
Total Energy Generated (MWHrs)				
Total Renewable Energy Generated (MWHrs)				
Electricity Consumption (MWHrs)	503.154	610.113		
Fossil Fuels Consumption:				
Heavy Fuel Oil (m3)		9.285		
Light Fuel Oil (m3)				
Natural gas (m3)		2.244		
Coal/Solid fuel (metric tonnes)				
Peat (metric tonnes)				
Renewable Biomass				
Renewable energy generated on site				

* where consumption of energy can be compared to overall site production please enter this information as percentage increase or decrease compared to the previous reporting year.

** where site production information is available please enter percentage increase or decrease compared to previous year

Table R2 Water usage on site

					Water Emissions	Water Consumption	
Water use	Water extracted Previous year m3/yr.	Water extracted Current year m3/yr.	Production +/- % compared to previous reporting year**	Energy Consumption +/- % vs overall site production*	Volume Discharged back to environment(m^3yr):	Volume used i.e not discharged to environment e.g. released as steam m3/yr	Unaccounted for Water:
Groundwater							
Surface water							
Public supply	11,371	12,121			12,121		
Recycled water							
Total							

* where consumption of water can be compared to overall site production please enter this information as percentage increase or decrease compared to the previous reporting year.

** where site production information is available please enter percentage increase or decrease compared to previous year

Table R3 Waste Stream Summary

	Total	Landfill	Incineration	Recycled	Other
Hazardous (Tonnes)					
Non-Hazardous (Tonnes)		1860.8		91.14	

Resource Usage/Energy efficiency summary

Lic No: W0041-01 Year 2014

Table R4: Energy Audit finding recommendations

Date of audit	Recommendations	Description of Measures proposed	Origin of measures	Predicted energy savings %	Implementation date	Responsibility	Completion date	Status and comments
			SELECT					
			SELECT					
			SELECT					

Table R5: Power Generation: Where power is generated onsite (e.g. power generation facilities/food and drink industry)please complete the following information

	Unit ID	Unit ID	Unit ID	Unit ID	Station Total
Technology					
Primary Fuel					
Thermal Efficiency					
Unit Date of Commission					
Total Starts for year					
Total Running Time					
Total Electricity Generated (GWH)					
House Load (GWH)					
KWH per Litre of Process Water					
KWH per Litre of Total Water used on Site					

Complaints and Incidents summary template Lic No: W0041-01 Year 2014

Complaints

Have you received any environmental complaints in the current reporting year? If yes please complete summary details of complaints received on site in table 1 below	No	Additional information

Table 1 Complaints summary

Date	Category	Other type (please specify)	Brief description of complaint (Free txt <20 words)	Corrective action< 20 words	Resolution status	Resolution date	Further information
	SELECT				SELECT		
	SELECT				SELECT		
	SELECT				SELECT		
	SELECT				SELECT		
	SELECT				SELECT		

Total complaints open at start of reporting year	
Total new complaints received during reporting year	
Total complaints closed during reporting year	
Balance of complaints end of reporting year	

Incidents

Have any incidents occurred on site in the current reporting year? Please list all incidents for current reporting year in Table 2 below	Yes	Additional information

*For information on how to report and what constitutes an incident	What is an incident

Table 2 Incidents summary

Date of occurrence	Incident nature	Location of occurrence	Incident category*please refer to guidance	Receptor	Cause of incident	Other cause(please specify)	Activity in progress at time of incident	Communication	Occurrence	Corrective action<20 words	Preventative action <20 words	Resolution status	Resolution date	Likelihood of reoccurence
20/01/2014	Monitoring equipment offline	Licenced discharge point (ty	1. Minor	Sewer	Plant or equipment issues		Normal activities	EPA	New	Replaced PH and temp probes and PH & temperature checked in the lab daily	Regular maintenance on PH probes-monthly PH checks	Complete	21/01/2014	Low
15/05/2014	Breach of ELV	Licenced discharge point (ty	1. Minor	Sewer	Plant or equipment issues		Normal activities	EPA	New	Regular cleaning of the v point and metal plate point around the v point.	Regular cleaning of the v point and metal plate point around the v point	Complete	16/05/2014	Low
01/12/2014	Monitoring equipment offline	Licenced discharge point (ty	1. Minor	Sewer	Plant or equipment issues		Normal activities	EPA	New	Scada can only now be manually switched off in lab office	Scada can only now be manually switched off in lab office	Complete	08/12/2014	Low

Complaints and Incidents summary template		Lic No:	W0041-01	Year	2014

Total number of incidents current year	3
Total number of incidents previous year	2
% reduction/ increase	50% increase

WASTE SUMMARY Lic No: W0041-01 Year 2014

SECTION A-PRTR ON SITE WASTE TREATMENT AND WASTE TRANSFERS TAB- TO BE COMPLETED BY ALL IPPC AND WASTE FACILITIES PRTR facility logon. dropdown list click to see options

SECTION B- WASTE ACCEPTED ONTO SITE-TO BE COMPLETED BY ALL IPPC AND WASTE FACILITIES

			Additional Information
1	Were any wastes accepted onto your site for recovery or disposal or treatment prior to recovery or disposal within the boundaries of your facility ?; (waste generated within your boundaries is to be captured through PRTR reporting) If yes please enter details in table 1 below	Yes	All waste accepted on site for recovery, disposal or treatment etc is included in the PRTR and the National waste report.
2	Did your site have any rejected consignments of waste in the current reporting year? If yes please give a brief explanation in the additional information	No	
3	Was waste accepted onto your site that was generated outside the Republic of Ireland? If yes please state the quantity in tonnes in additional information	No	

Table 1 Details of waste accepted onto your site for recovery, disposal or treatment (do not include wastes generated at your site, as these will have been reported in your PRTR workbook)

Licenced annual tonnage limit for your site (total tonnes/annum)	EWC code European Waste Catalogue EWC codes	Source of waste accepted	Description of waste accepted **Please enter an accurate and detailed description - which applies to relevant EWC code** European Waste Catalogue EWC codes	Quantity of waste accepted in current reporting year (tonnes)	Quantity of waste accepted in previous reporting year (tonnes)	Reduction/ Increase over previous year +/ - %	Reason for reduction/ increase from previous reporting year	Packaging Content (%)- only applies if the waste has a packaging component	Disposal/Recovery or treatment operation carried out at your site and the description of this operation	Quantity of waste remaining on site at the end of reporting year (tonnes)	Comments -

SECTION C-TO BE COMPLETED BY ALL WASTE FACILITIES (waste transfer stations, Composters, Material recovery facilities etc) EXCEPT LANDFILL SITES

4	Is all waste processing infrastructure as required by your licence and approved by the Agency in place? If no please list waste processing infrastructure required onsite	Yes	
5	Is all waste storage infrastructure as required by your licence and approved by the Agency in place? If no please list waste storage infrastructure required on site	Yes	
6	Does your facility have relevant nuisance controls in place?	Yes	
7	Do you have an odour management system in place for your facility? If no why?	Yes	
8	Do you maintain a sludge register on site?	No	

SECTION D-TO BE COMPLETED BY LANDFILL SITES ONLY

Table 2 Waste type and tonnage-landfill only

Waste types permitted for disposal	Authorised/licenced annual intake for disposal (tpa)	Actual intake for disposal in reporting year (tpa)	Remaining licensed capacity at end of reporting year (m3)	Comments

Table 3 General information-Landfill only

Area ID	Date landfilling commenced	Date landfilling ceased	Currently landfilling	Private or Public Operated	Inert or non-hazardous	Predicted date to cease landfilling	Licence permits asbestos	Is there a separate cell for asbestos?	Accepted asbestos in reporting year	Total disposal area occupied by waste SELECT UNIT	Lined disposal area occupied by waste SELECT UNIT	Unlined area SELECT UNIT	Comments on liner type
Cell 8													

WASTE SUMMARY Lic No: W0041-01 Year 2014

Table 4 Environmental monitoring-landfill only

Landfill Manual-Monitoring Standards

Was meterological monitoring in compliance with Landfill Directive (LD) standard in reporting year +	Was leachate monitored in compliance with LD standard in reporting year	Was Landfill Gas monitored in compliance with LD standard in reporting year	Was SW monitored in compliance with LD standard in reporting year	Have GW trigger levels been established	Were emission limit values agreed with the Agency (ELVs)	Was topography of the site surveyed in reporting year	Has the statement under S53(A)(5) of WMA been submitted in reporting year	Comments

.+ please refer to Landfill Manual linked above for relevant Landfill Directive monitoring standards

Table 5 Capping-Landfill only

Area uncapped*	Area with temporary cap	Area with final cap to LD Standard m2 ha, a	Area capped other	Area with waste that should be permanently capped to date under licence	What materials are used in the cap	Comments
SELECT UNIT	SELECT UNIT					

*please note this includes daily cover area

Table 6 Leachate-Landfill only

9	Is leachate from your site treated in a Waste Water Treatment Plant?	SELECT
10	Is leachate released to surface water? If yes please complete leachate mass load information below	SELECT

Volume of leachate in reporting year(m3)	Leachate (BOD) mass load (kg/annum)	Leachate (COD) mass load (kg/annum)	Leachate (NH4) mass load (kg/annum)	Leachate (Chloride) mass load kg/annum	Leachate treatment on-site	Specify type of leachate treatment	Comments

Please ensure that all information reported in the landfill gas section is consistent with the Landfill Gas Survey submitted in conjunction with PRTR returns

Table 7 Landfill Gas-Landfill only

Gas Captured&Treated by LFG System m3	Power generated (MW / KWh)	Used on-site or to national grid	Was surface emissions monitoring performed during the reporting year?	Comments
			SELECT	