Facility Information Summary		
AER Reporting Year	2015	
×	W0184-	
Licence Register Number	01	
Name of site	Enva Ireland Limited	5
Site Location	Clonminan Industrial Estate, Portlaoise, Co. Loias	2
NACE Code	3832	
Class/Classes of Activity	Fourth Schedule - Class 6, Class 7, Class 12, Class 13.	
Vational Grid Reference (6E, 6 N)	2461 E, 1978 N	
	Site Performance: The processing activities onsite include waste oil re-p contaminated soil, repacking of oily contaminated wastes, and paint was in packages (barrels, ASPs, IBCs, etc.) prior to transfer off site for recover	l re-pi it was cover
	continues to demonstrate its commitment towards HSE management sta	nt sta

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

and renaired as remittined. The FMP has been undated to include programme of works devised for EMP progress: The site is currently undergoing a licence review. Yard integrity is monitored regularly maintenance to the standard. environmental and safety aspect. There were no issues raised during the reporting period regarding ISO14001 and OHSAS 18001. This ensures a standard approach is taking to managing activities from an ry or disposal. The company andards - the site maintains stes. The site also stores wastes rocessing, treatment of Infrastructure /

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.

accepted onsite was subject to availability from customers rather than an intentional increase/decrease correspondance uploaded to EDEN and as set out in the EMP attached. Fluctuations in waste quantities Environmental Performance: There were 28 complaints received by Enva during the reporting period. Compliance מוומ ורלמוורה מז ורלמוורתי זוור דומו זומז אררו מלממורת וז זוומומתר לו לומווווור כו מכוניז מרמורות וכו Investigation (CI001037) remains open. Control measures have been implemented as per in waste volumes. The licence review process is currently on-going. reductionin odour generation from the site.

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.

31.03.16	Date	18	a. ??	81
Donal Conroy	Signature	Group/Facility manager	(or nominated, suitably qualified and	experienced deputy)

202	DP1	g	9	DP1	g	9	DP1	g	2	DP1	P	Ą	P	P.	a	1	ω c	2 A		4 5
3	P1	DP3	DP2	P1	DP3	DP2	P1	DP3	DP2	91	A-01	A-01	A-01	A-01	Emission reference no:	able A1: Lice	Vas all monitor note AG2 a	re there any re	Period	eporting year: solv
INCENTED	LICENCED	Combustion Efficiency	Sulphur oxides (SOx/SO2)	Nitrogen oxides (NOx/NO2)	Carbon monoxide (CO)	Parameter/ Substance	nsed Mass Emissions	Was all monitoring carried out in accordance with EPA guidance note AG2 and using the basic air monitoring checklist?	sults in breach of licence rea	Periodic/Non-Continuous Monitoring	year and answer further questions. If you do not have licenced emissions and do not t solvent management plan (table A4 and A5) you <u>do not</u> need to complete the tables									
	Quarter 4	Quarter 3	Quarter 3	Quarter 3	Quarter 2	Quarter 2	Quarter 2	Quarter 1	Quarter 1	Quarter 1	Annually	Annually	Annually	Annually	Frequency of Monitoring	s/Ambient data-	ce with EPA guidance toring checklist?	quirements? If yes ple TableA1 below	Nonitoring	ions. If you do not able A4 and A5) you
	Yes - 350 mg/m2	N/A	N/A	N/A	N/A	ELV in licence or any revision therof	periodic monito	Basic air monitoring checklist	ease provide brief de N	SALE AND A	have licenced emis 1 <u>do not</u> need to co									
Monitoring to occur 4 times a	Monitoring to occur 4 times a year	No 30min mean can exceed the ELV	No 30min mean can exceed the ELV	No 30min mean can exceed the ELV	No 30min mean can exceed the ELV	Licence Compliance criteria	Table A1: Licensed Mass Emissions/Ambient data-periodic monitoring (non-continuous)	AGN2	Are there any results in breach of licence requirements? If yes please provide brief details in the comment section of TableA1 below		reporting year and answer further questions. It you do not have licenced emissions and do not complete a solvent management plan (table A4 and A5) you <u>do not</u> need to complete the tables									
27.5	8.49	17.8	41.4	73.7	12.19	35.98	31.34	89.96	60.94	92.86	92.36	6.1	164,4	1.7			Yes	No		Yes
ale Maria a	mg/m2/day	%	mg/Nm3	mg/Nm3	mg/Nm3	Unit of measurement				STRAF PART	Dust monitoring however they are									
	yes	SELECT	SELECT	SELECT	yes	Compliant with licence limit	-				Dust monitoring results are detailed on however they are not emission points.									
Sume Dispetion 14	Standard Method	OTH	ОТН	EN 14792:2005	EN 15058:2004	Method of analysis	-				on the table below 5.									
	N/A	N/A	19.55 N/A	526.77 N/A	5.45 N/A	Annual mass load (kg)	-	L	1											
	N/A	N/A	N/A	N/A	N/A	Comments - reason for change in % mass load from previous year if applicable				1241.23										

-

AIR-summary template Answer all questions and complete all tables where relevant

Lic No:

W0184-01

Year

2015

Additional information

AIR-summa	ary template			A State of the second	Lic No:	W0184-01		Year	2015	Self-Lags
	A STATE AND A STATE OF	sole -	Mon	itoring to occur 4 times a	17	.19				
DP3	LICENCED	Quareter 4	Yes - 350 mg/m2 year			mg/m2/day	Ves	Standard Method	N/A	N/A

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

it to its relevant Emission Limit Value (ELV)

S Did continuous monitoring equipment experience downtime? If yes please record downtime in table A2 below

Do you have a proactive service agreement for each piece of continuous monitoring equipment?

Did your site experience any abatement system bypasses? If yes please detail them in table A3 below Table A2: Summary of average emissions -continuous monitoring

7 6



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

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

Table A3: Abatement system bypass reporting table

Table A3: Ab	Table A3: Abatement system bypass reporting table	ass 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

Year 2015			-						stroyed Total emission of ugh Solvent to air (kg)		
W0184-01		SELECT							Solvent released in Solvents destroyed Total emission of other ways e.g. by-onsite through Solvent to air (kg)		
Lic No: W		AS	vent regulations to e 5 and 6	Compliance	SELECT	SELECT		(O) Outputs (kg)	Fugitive Organic Solvent (kg)		
		Do you have a total Emission Limit Value of direct and fugitive emissions on site? If yes please fill out tables A4 and A5	Please refer to linked solvent regulations to complete table 5 and 6	Total Emission Limit Value (ELV) in licence or any revision therof					Collected waste solvent (kg)		
States and the		ssions on site? if yes	<u>Solvent</u> regulations	as %of ut					Solvents lost in water (kg)		
	t on site	ect and fugitive emis	n Summary	Total VOC emissions to Air from entire site (direct and fugitive)			e summary		Organic solvent emission in waste		
emplate	Solvent use and management on site	Emission Limit Value of dir	Table A4: Solvent Management Plan Summary Total VOC Emission limit value	Total solvent input on Total VOC emissions Total VOC site (kg) to Air from entire emissions a site diffrom entire fugitive) fugitive)			Table A5: Solvent Mass Balance summary	(I) Inputs (kg)	(I) Inputs (kg)		
AlR-summary template	Solvent i	8 Do you have a total i	Table A4: Solvent Management Total VOC Emission limit value	Reporting year			Table A5: 5		Solvent		1

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Integrity test failure explanation <50 words		Test date	
n Corrective action taken		Integrity reports maintained on site? SELECT	
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Results of retest(If in current reporting year) SELECT		Integrity test failure explanation <50 words	
		Corrective action taken SELECT	
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Please use commentary for additional details not answered by tables/ questions above

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Financial provision for Closure expiry date	Financial Provision for Closure - type	Financial Provision for Closure - amount of cover	Financial Provision for Closure status	Closure plan review status	Closure plan initial agreement status	Financial provision for ELRA expiry date	Financial Provision for ELRA - type	Financial Provision for ELRA - amount of cover	Financial Provision for ELRA status	Amount of Financial Provision cover required as determined by the latest ELRA	ELRA review status	ELRA initial agreement status		provision	Click here to access EPA guidance on Environmental Liabilities and Financial
01/05/2019	bond	2,255,641.34	Submitted and agreed by EPA	Review required and completed	Closure plan submitted and agreed by EPA	Insurance (11.10.17) & Bond (11.10.19)	Other please specify	4,133,343	Submitted and agreed by EPA	4,133,343	Review required and completed	Submitted and agreed by EPA			
							Insurance and Bond						Commentary		

Year

licence conditions Increased compliance with	Operations	Complete tank air tight testing.	NEM		
licence conditions Increased compliance with	Operations	abatement chemical during soil operations.	Complete		
licence conditions Increased compliance with	Operations	levels from the soil operation. Implementation of odour abatement mobile unit with odour	509		
increased compliance with		cladding with two roller doors. This will also reduce noise and dust			
100 A. 14		off. The front of the soil bay will be enclosed with panels and			
		Cladding of soil bay to reduce fugitive emissions from the site. The back (adjacent to CIE) and side (adjacent to Rockview) are closed			
licence conditions	35H	while improvement programmes are being implemented.	Complete		
Increased compliance with		mination in place since lanuary 16. This is an interim			
		The engagement of external consultants to carry out odour			
licence conditions	Operations	will be checked continuously.	Complete		
Increased compliance with		electrostatic filter did not prove to be as effective as a carbon filter. This carbon filter is now in place. This action is complete however			
		removing odour. Treatment options were reviewed, the			
		remove oil fume present from the extracted airstream therefore			
		Centrifuge room. The existing extraction system will be redeployed. The extraction system employs an electrostatic precipitation filter to			
		An odour statement system to be installed in the Oil Filter and			
suojųpuos esuesij	Operations	completed.	Complete	from site	annue go i a nonnochu noce c
increased compliance with	- Operations	system through a scrubber system and carbon filter has also been	atalamoj	Reduce odour emissions	Odour Reduction Programme
		effluen with Hydrogen Peroxide. The installation of an extraction			
		facilitate a more controlled dosing of odour abatement chemical. This system has been upgraded to include the continuous dosing of			
		separator will also see the recommissioning of the existing pump to			
		farm with improved model with sealed lids. The replacement			
		transfered to the effluent treatment area is over 20 years old and becoming past its serviceable life. Replace the separator in tank			
		Bried fio area of base area is the team teat the off of besetteest bre blo area of parts is care toomteast travilly off of besetteest			
licence conditions licence conditions	32H	Viisb stramszesze subob beseestori	gnīng-nO		
licence conditions	Operations	abatement litters	Complete		
Increased compliance with		and ducting the vents from the tanks to ground level odour			
	5	Reduce potential odours arising from the tank larm by sealing lids			
increased compliance with licence conditions	Reations & Operations	Cease Air Spaesging on drying tanks until suitable odour abatement equipment is installed	Complete		
MAL (M) (A (A					
licence conditions	snoitenego & 32H	of the RTO system epected to be completed April 2018	Pending licence review		
Increased compliance with		ooperations for oil processing have ceased until the implementation			
		Review and determine suitable odour abatement equipment for drying tanks and submit for approval to the Agency. Drying			
Management Practices	anoitenego & 32H	facility, replacements will occur as they come to end of life.	anioa-nO	energy consumption.	ergy Efficiency/Utility conservation
lstnemnorivn3 bevorgmt		have been installed in areas/rooms where deemed safe to do so. This is an ongoing project as there are numerous lights in the		motion sensors can be installed in order to reduce	
		Low wattage LED lights both inside and outside. Motion sensors		order to determine where	
		fit which have come to their end of life have been replaced with		ni əsizno gnistigil wəivəß	
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205	achi a Operations	.810S ni nisse aud. 210S ni test in 810S. Due again in 810S	Complete	reporting requirements.	expansion gap assessments.
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			%06	yearly bund integrity assessment. Review the assessment of bunds to meet standard	id expansion gap assessments. Iprove tank, pipeline, bund integrity, yard
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19]	bench marken version automotion version automotion train version versi	٥N	85	CS.	57	25	٥N	EN RYEI	91.1

SELECT

fanotice interested as a result of noise activities, please choose the corrective action from the following options?

freuzzi eston to nottuloren/notze gnišez zon vol nozen ert niektra essetd **

e DDS niedz zzel) Sztnemmoz lenoizibbe ynA.

Lic No: W0184-01
100

Additional information

ч When did the site carry out the most recent energy efficiency audit? Please list the recommendations in table 3 below

N 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 Where Fuel Oil is used in boilers on site is the sulphur content compliant with licence conditions? Please state percentage in additional information

ω

<u>SEAI - Large</u> Industry Energy Network (LIEN) Yes No Jan-07

Table K1 Energy usage on site	e on site			
Energy Use	Previous year	Current year	Production +/- % Energy compared to Consumption previous reporting vs overall site year** production*	Energy Consumption +/- % vs overall site production*
Total Energy Used (MWHrs)	6117.914	3903.408	-36.19707632	
Total Energy Generated (MWHrs)				
Total Renewable Energy Generated (MWHrs)	MWHrs)			
Electricity Consumption (MWHrs)	477.312	368.569	-22.78237296	
Fossil Fuels Consumption:				
Heavy Fuel Oil (m3)				
Light Fuel Oil (m3)	41	0		
Natural gas (m3)	471955.3	334843.046	-29.05195767	
Coal/Solid fuel (metric tonnes)				
Peat (metric tonnes)			3	
Renewable Biomass				
Renewable energy generated on site				

write consumption or 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 increase on cite

The square state of the state					AND CHINSPICES	water consumption	
Water use Pri	Water extracted Previous year m3/yr.	Produc compa Water extracted previor Current year m3/yr. year**	tion +/- % red to us reporting	Energy Consumption +/- % Volume Discharged vs overall site back to production environment/m ³ vr):	11	Volume used i.e not discharged to environment e.g. released as steam m3/xr	Inaccounted for Water
Groundwater							
Surface water							
Public supply	15458	16185	4.703066373				
Recycled water							
Total							

** 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)				

Resource Usage/Energy efficiency summary	ummary	Part NUN NOV	Lie	Lic No:	W0184-01		Year	2015
Table R4: Energy	Table R4: Energy Audit finding recommend	dations						_
Date of audit	Recommendations	Description of Measures proposed	Description of Predicted e Measures proposed Origin of measures savings %	Predicted energy savings %	Implementation date Responsibility	Responsibility	Completion date	Status and comments
			and the second					
			「日本は、日本の日本					
								-
			and the second s					

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

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details of complaints received on site in table 1 below Yes

Table	Table 1 Complaints summary		Brief description of				
Date	Category	Other type (please specify)	Brief description of complaint (Free txt <20 words)	2.225	Corrective action < 20 words	Corrective action < 20 words Resolution status	
07.01.15 to	Odegr		Odour complaints received.		The Agency opened Compliance Investigation CIOD137 In relation to odours emitting from Enva indentified odour sources on site and have implemented controls to miligate odour nuisances. Information in nuisances. Information in nuisances actions have been uploaded to EDEN	2 5 5 6	2 ⁵ 3 6 Ong Solar R
09,12,16	Odour		received.		under Cl001037	under Cl001037 Ongoing	Ongoing
	SELECT						SELECT
	SELECT					SELECT	SELECT
	SELECT					SELECT	SELECT
*	SELECT					SELECT	SELECT
Total complaints open at start of							
reporting year	47						
Total new							
complaints							
received during							
reporting year	28						
Total complaints							
closed during	All complaints remain open as						
reporting year	part of CI001037						
Balance of							
complaints end of	All complaints remain open as						
reporting year	part of CI001037						

Have any incidents occurred on site in the current reporting year? Please list all incidents for current reporting	g year? Please list all incide	ints for current reporting		Additional information For details on Non conformances please		
year in Table 2 below	below	_	No	refer to Eden.		
*For information on how to report and what	What is an incident	1			,	
Table 2 Incidents summary						
					Other	Activity in
		Incident category nlease			caucalplanca	caucal anca

n Likeliho reoccur	Resolution status date	Preventative action <20 words	Corrective action<20 words	Occurrence	Communication	Activity in progress at time of incident	Otner cause(please specify)	Cause of incident	Receptor	Incident category*please refer to guidance	Location of occurrence	Incident nature	Date of occurrence

Complaints and	Complaints and Incidents summary template	iry template	A SALES AND SALES	- Diversity of the second	Lic No:	W0184-01	Year	2015		
	SELECT	SELECT	SELECT	SELECT	SELECT	SELE	CT SELECT	select	SELECT	SELECT
	SELECT	SELECT	SELECT	SELECT	SELECT	SELECT		SELECT	SELECT	SELECT
Total number of										
incidents current										
year		æ								
Total number of										
incidents previous										
year		æ								
% reduction/										
Increase		C								

	1 10,000 tons	tonnage limit for your site (total tonnes/annum)	SECTION B- W Were any wastes; 1 to be captured th If yes please enter If yes please enter 2 Did your site have 3 Table 1 Det	SECTION A-PRTR ON
13 07 02	13 02 08	your m) <u>European Waste Catalogue FWC codes</u>	STE ACCEPTED (g) PRTR.reporting) (g) PRTR.reporting) table in table 1 belo table in table 1 belo table accepted consignm of waste accepted consignments	SECTION A-PRTR ON SITE WASTE TREATMENT AND WASTE TRANSFERS TAB- TO BE COMPLETED BY ALL IPPC AND WASTE FACILITIES
13- OIL WASTES AND WASTES OF LIQUID FUES (except edible oils, and those in chapters 05, and 130	13-OIL WASTES AND WASTES OF LIQUID FUELS (except ediable outs, and those in chapters 05, 12 and 19	Source of waste accepted	OMPLETED BY ALL IPPC A or treatment prior to recovery or ent reporting year? If yes please g enerated outside the Republic of I site for recovery, disp	D WASTE TRANSFERS TAB
Diesel and Fuel al	Waste oil	Description of waste accepted Please enter an accurate and detailed description - which applies to relevant EWC code <u>European Waste</u> <u>Catalogue EWC codes</u>	ND WASTE FACILITIE disposal within the bound ive a brief explanation in the ireland? If yes please state ocal or treatment	- TO BE COMPLETED
214	14269.867	Quantity of waste accepted in current reporting year (tonnes)	S aries of your facility 7; (was he additional information the quantity in tonnes in ac (do not include wa	BY ALL IPPC AND W
72.124	17852.46	Quantity of waste accepted in previous reporting year (tonnes)	te generated within your boundaries iditional Information astes generated at your si	ASTE FACILITIES
196,6637347	-2006778338	Reduction/ Increase over previous year +/- %	K Ves	PRTR facility logon
Increase/decrease in the tonnages of waste accepted in 2015, compared to 2014, was subject to	Increase/decrease in the tonnages of 2015 compared to 2014, was subject	Reason for reduction/ increase from previous reporting year	Additional Information	
	NA .	Packaging Content (%)- only applies if the waste has a packaging component	ported in your PR	Year dropdown ll
B3-Oil re-sefinition or other reverses of sit	R9-Oll re-refining or other reuses	Disposel/Recovery or treatment operation carried out at your site and the description of this operation	TR workbook)	2015 dropdown list click to see options
	8	Quantity of waste remaining on site at the end of reporting year (tonnes)		
Enva Ireland does not currently record the packaging content of waste	Envo Ireland does Envo Ireland does not currently packooping packooping canterin gi varite canterin gi varite canterin gi varite	Comments -		

Tank of Aller	Erva Iteland does not currently record the content of wase content of wase	ate Enva treland does Enva treland does root currently packaging content of woste siste anives on-	Erva Ireland docs Erva Ireland docs not currently pockogine pockogine sti arrives on- teckiste
2015		AS-Uniterendiming or conterretuses AS-Oniterendiming or other retuses AS-Oniterendiming or other retuses	Enva treland does Enva treland does not currently record the packaging content of worke BS-Recycling/redamation or other inorganic material ste
Year	<u> </u>	en en Ma ed to WA	ein http://www.com/ ed/ M/A
1	Increase/decrease in the tomnages of the tomnages of a subject to 2014, was subject to 2014, was subject to wate mude a vallable to Erwa in some instances were wates were wates were were not a scopped in previous years.	 Increase/decrease in the comage of the comage	Increase/decrease in the tomages of wata accepted in 2015 compared to 2014, was subject to the quantity of wata mule instances some instances some instances some excepted ondie har in previous years. 2339/76554
W0184-01		234.52 234.52 234.52 1.23	€ 62 8.985 8.885
Lic No:			
	335.05	434.70	258.08
		Interceptor studges of the emulsions Other emulsions	
	13- OIL WASTES AND WASTES OF LUCUID FUELS (except edible oils, and those in	Grapters Co, 14 and 19 13- Oli WASTES AND WASTES OF LIQUID FUELS (except edible of and 190 chopters 65, and 190	13- OIL WASTES AND WASTES OF LIQUID FUELS (except addle old, and those in chapters 52 and 19
		50 00 00 EE	70 50 EE
WASIE SUMMARY			

			WASTE SUMMARY
80 SO ET	Ef 10 EF	66 80 ET	University in Social Procession
13- OL WASTES AND WASTES OF LIQUID FUELS (except editionals, and these in obspires 05, 21 and 19)	13- OIL WASTES AND WASTES OF LUUID FUES leavent edible oils, and these in chapters DS, 12 and 19	13- OIL WASTES AND WASTES OF LOUID FUELS (except edible oils, and those in chapters 05, 12 and 19)	Contraction and Contraction Contraction
Mixtures of waste from Mixtures of waste from gait chambers and al / water separatos	other hydraulis olls	Waste not oherwise specified	A CONTRACTOR OF
279,03	0.00	1327	ないできるのです。
16 32	5 438	11.259	Lic No:
267 5026637		7 17.57903011	W0184-01
Increase/decrease in the tonnages of waste accepted in 2015, compared to 2014, was subject to	Increase/decrease in the tonnages of waste accepted in 2015, was subject to the quarkity of waste made available to Enva Ireland. In some Instances some Instances some excepted onsite that waste were excepted onsite that were not accepted in previous years.	Increase/decrease in the tonnages of waste accepted in 2015, compared to 2014, was subject to the quantity of waste made instances some instances some instances some instances were excepted onsite that were not accepted in previous years.	
		M/A	Year
	R9-Ol re-telfning or other reuses of ol	Environment of the operation site	2015
Enve Ireland does not currently record the content of waste content of waste	Envo ireland does not currently record the pockaging content of waste os it arrives on-	Enva ireland does not currently record the packaging content of waste as it arrives on-	国政部に訪ったい

WASTE SUMMARY		22 51 102 02 102 50			Lic No:	W0184-01	Year	The second second second	2015	
	50 20 ET	13- OIL WASTES AND WASTES OF LIQUID FUELS (except edible (i), and those in charters (s. 1, and 19)	Mineral based non- chanding dealer and libricetina dis, geor	0		10/AG#	Increase/decrease in Increase/decrease in waste accepted in 2015 compared to 2015, was subject to 2014, was subject to waste made in some Instances some Instances some instances onsile that were not accepted in previous years.	19- Oll re-reliana or other reuses of ol	the returns of oil	Ewo heland does not currently record the pockaging content of woste si it arrives on-
	ET 10 80	DB- WASTES FORM THE MANNUTACTURE, FORMULATION, SUPPLY AND USE (MASTU) OF COATINGS (PAINTS, VARNISHES AND VATINGS, SEALUNGS ADHESIVES, SEALUNGS AND PRINTING IMAS	Sludges from paint or variable containing organic solvents or substances	14.66	2 2121		Increase/decrease in the tomages of wasta accordented in wasta accompared to 2015, was subject to the quantity of waster made waster made instances some instances some instances some were not accepted in previous years. MA	R13-Storage of waite E	Ervo Ervo Rect Rect Rect Rect Rect Rect Rect Rect	Erva ireland does Erva ireland does record three packaging packaging sate arrives on- site
	51 70 80	08- WASTES FORM THE 08- WASTES FORM THE MANUVEACTURE, FORMULATION, SUPPLY AND USE (MARES, AND VITTEOUS ENLANTS AND ADHESING AND PANTING MASS	Aqueous studges controlling othersive or controlling organic solveris or other ordsrous substorous	0		to/voi 0	Increase/decrease in the tonnages of waste accepted in waste accepted in 2015, was subject to the quantity of waste made available to Enva avaita were instances some instances donsite that were not accepted in previous years.	R13-Storage of waste	Envo Envo Anti Anti Anti Anti Anti Anti Anti Anti	Ewa heland does not currently record the peddaging content of woste site on-

			WA
			WASTE SUMMARY
			SPECIAL SPEC
17 05 03	<u>160107</u>	20 01 21	
17- CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOL FROM CONTAINANTED STED)	16- WASTES NOT OTHERWISE SPECIFIED IN THE LIST	20-MUNICIPAL WASTES HOUSENDE WASTE ANNERCAL INDUSTRIAL AND INCLUENCE SEAVATELY INCLUENCE SEAVATELY COLLECTED FRACTIONS	Sector sector
		5. CMC	00000
soil and stone containing domenous substances	Of filters	Fluorescent tubes	S. S
4,076.70	169.769	2 685	1000 1000 1000 1000 1000
57426.003	69682	215	Lic No:
25:10265:006-2-	12	12 6. 547 6 19048	W0184-01
Increase/decrease in the tonnages of waste accepted in 2015, compared to 2014, was subject to the quantity of waster made available to Enva irreland, in some instances some excepted onsile that were not accepted in previous years.	Increase/decrease in the tonnages of waste accepted in 2015, compared in 2015, compared in 2014, was subject to the quantity of waste made available to Enva Ireland. In some Instances some Instances some excepted onsite that were not accepted in previous years.	Increase/decrease in the tonnages of waste accepted in 2015, compared to 2014, was subject to the quantity of wastes made available to Enva instances some instances some excepted onsite that were not accepted in previous years.	100 P.
M/A	M/A	MA	Year
R5-Recyclina/restanation or othe	R13-Storage of weste pending on	R13-Storage of weste pending on	2015
Enva Ireland does nat currently record the packaging content of waste	Envo Ireland does not currently record the packaging content of waste da it arrives on-	Envo Ireland does nac currently record the peckaging content of weste cost arrives on-	
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	Envo ireland does hos currently nos currently pociading content of waste stie at arrives on-	Erve ireland does not currently record the procording content of waste content of waste site arrives on-	Evo Ireland does not trend does record to wate pockaging conter of waste
	36.05		
2015	113-Storoge of waste pending an	113-Storoge of waste pending an	Enve Enve pool
Year	WA	ew	
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10-5810M	962962,577,8	724016625.0	
10 100:	666.75 666.75	6/T/3	
	728.41	437.618	
	Lead batteries	Absorbents, filter materials (including oil filters on chrenvise protective ciothing protective ciothing contaminete by	
	16. WASTES NOT OTHERWISE SPECIFIED IN THE LIST	15- WASTE PACKGING; 15- WASTE PACKGING; ABSOPBENTS, WIPNG COTHS, FILTER MATERALS AND PODTECTOTHING NOT	de. WASTES KOT OTHERWISE
	10 90 J	20 20 ST	

			WA
			WASTE SUMMARY
20 LD ET	13 07 03	16 10 31	
13 - DIL WASTES AND WASTES OF LIQUID FUES (except edible oils, and those in disperse 16.5 and 190	13-OIL WASTES AND WASTES OF LIQUUS FUES (avept edible oils, and those in chapters 05, 12 and 19	J6- WASTES NOT OTHERWISE SPECIFIED IN THE LIST	Particular and the second second
Petrod	Other fuels (including mixtures)	Brake fluids	Subscription of the
10.22	233.66	0.00	NY SUPERVICE
19.68	127.501	8 907	Lic No:
-4.8.6.0059400059		. a.779611541	W0184-01
Increase/decrease in the tonnages of waste accepted in 2015, compared to 2014, was subject to the quantity of waste made available to Enva Ireland. In some Instances some Instances some excepted onsite that were not accepted in previous years.	Increase/decrease in the tonnages of waste accepted in 2014, was subject to the quantity of waste made unstances some Instances some Instances some Instances some excepted onsite that were not accepted in previous years.	Increase/decrease in the tonnages of waste accepted in 2014, was subject to the quantity of waste made available to Enva Ireland. In some Intances some instances some excepted onsite that were not accepted in previous years.	A CONSTRUCTION OF
M/A		MA	Year
R13-Storage of waste pending on	A13-Storage of waite pending on	A13-Storage of waste pending any of the operation:	2015
Enva Ireland does nat currently peccord the peccord in content of waste d sta it arrives on-	Enva Ireland does not currently not currently content of waste cantent of waste stat curives on-	Enva ireland does Enva ireland does not currently packaging content of waste as it arrives on-	ののないないです。

 ending on 28	to a othe 150.7	
R13-Storage of waste pending an	R5-Recycling/reclamation or othe	
 474 10 10 10 10 10 10 10 10 10 10 10 10 10 1	u o u	E 9 #
Increase/decrease in the tonmages of waste accepted in 2015 compared to 2014, was subject to the quantly of available to Enva are finded. In some wastes were wastes were wastes were wastes were wastes were wastes were were not accepted in previous years.	Increase/decrease in weste accepted in weste accepted in 2015 compared to 2015, was subject to the quantity of waste mede instances some instances some were not accepted in previous year.	Increase/decrease in the tennages of the tennages of a subject to 2015. compared to 2015. compared to 2015. vois subject to the quantity of wate mode instances some instances some instances some instances or a cocopted in previous year.
18 14 15 138 138	35 52.99748417	
 31,118	SE8.723	
44 25 2	1,008.47	8.44
Gases in pressure containes finctualing containes fonctualing dangerous substances	Wate puint and varnish containing organic solversi ar other solvers substances	
Je. WASTES NOT OTHERWISE SPECIFIED IN THE LIST	08- WASTES FORM THE NANUJSATURE, FORMULATION, SUPPLY AND USE (MARIES) VATREOUS ENAMELS, PRIMTING, NUS	
16 05 04	11 JO 80	

			WASTE SUMMARY
88 04 09	2001 27	10 10	
08- WASTES FORM THE MANUFACTURE, FORMULATION, SUPPLY AND USE (MISSU) OF COATINGS (PANTS, VARIANTS AND VITIEOUS ENAMELS,) ADHESIVES, LEAANTS AND PRINTING INIS	20- MUNICIPAL WASTES INDUSENDUD WASTE AND SIMULAR COMMERCIAL INDUSTRIAL AND INSTITUTIONAL WASTES INCLUDING SEMANTELY INCLUDING SEMANTELY COLLECTED FRACTIONS	15- WASTE PACKAGING: ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED	
Waste adhesives and seafants contoining anter dangerous substances	Point, inks, adhesives and resins containing dengerous subcontes	Pockeging containing residues of a containing dangerous substances	Contract Services
0.21	18.42	182.87	1
661.0	20 353	128 679	Lic No:
5.527638191	-9.4777 18272	41.95789523	W0184-01
Increase/decrease in the tonnages of waste accepted in 2015 compared to 2015 compared to 2015 compared to 2015 compared to the quantity of waster made manuality of waster made instances some instances some instances one instances one instan	Increase/decrease in the tonnages of waste accepted in 2015, compared to 2015, compared to 2014, was subject to the quantity of waste made available to Enva incland. In some instances some wastes were excepted onsite that were not accepted in previous years.	Increase/decrease in the tonnages of waste accepted in 2015 compared to 2014, was subject to the quantity of waste made available to Enva Ireland. In some wastes were wastes were	たいたちないのない
N/A	N/A	NA.	Year
Enva Enva R13-Storage of waste pending any of the operation: site state	R13-Storage of watte pending an	R13-Storage of waste pending an	2015
Erwa treland does Erwa treland does not currently record the packaging content of waste as it arrives on-	Eriva Ireland does not currently record the parkeging content of waste as it arrives on-	Enva Ireland does not currently record the packaging content of wate as it arrives on- 43 site	

				LIC No:	W0184-01	Year		2015	-	
90 SO 91	16- WASTES NOT OTHERWISE SPECIFIED IN THE LIST	Laboratory chemicals, constanty ging constanting dangerous substances, including mixtures of dangerous	21.96	21811	60959167,58 85,79165609	Increase/decrease in the formages of available of the 2015 compared to 2015 compared to 2015 compared to 2015 compared to 2015 compared to 2015 compared to 2015 compared to available to Erva attendard in some market were available to Erva in the quantity of the quantity are previous years. MAA	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	113-Storoge of waste pending an	6.5 5.5 6.5 5.5 5.5 5.5 5.5 5.5 5.5 5.5	Ervo ireland does not currently record the pediaging content of worle sit arrives on-
16 OS OB	16- WASTES NOT OTHERWISE SPECIFIED IN THE LIST	Discarded organic chemicals consisting of chemicals consisting of substances	10.22	2262	7445/382,8,45	Increase/decrease in the tomages of waste accepted in waste accepted in 2014, was subject to the quantity of wastermade wastermade instances some waster were waster were waster were waster were waster wore were provided onsite that were not accepted in previous years.		113-Storage of waste pending an	्यु २ ३ <u>३</u> ४ ७	Erva ireland does erva ireland does record the pedeaping content of woste content of woste
2002	17- CONSTRUCTION AND DEMOLTION VASTES CONSTRUCTION AND Glass, plastic and woo DEMOLTION WASTES CONTRUMENTES CONTINUATES CONTINUATED	Glass, plastic and wood containing or containing et with	c			Increase/decrease in the tomages of waste accepted in waste accepted in 2014, was subject to the quantity of the quantity of waste wate waster waster waster wate waster wate waster wate waster wate waster wate waster wate waster wate waster wate waster wate wate wate waster wate		Enve Enve national and the second of the control of the control of the Starter and worth a second on on of the control of start	nd the constraints	Erve Ireland does into currently record the pologoing content of weste stie a cirves on-

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			WASTE SUMMARY
51 TO 02	06 02 04	0 80 21 21	
20- MUNICIPAL WASTES HOUSEHOLD WASTE AND SIMILAR COMMERCIAL INDUSTRUL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLETICS FRANTLEY	OG- WASTES FROM INORGANIC CHEMICAL PROCESSES hydroxide	OB- WASTES FORM THE MANUFACTURE FORMULATION, SUPPLY AND USE (MASU) OF COATINGS (PANTS, WARNISHES AND VITREOUS EMANTELS) ADHERIVES, SELANTS AND PRINTING INKS	Second and Meridian and Annual Second
Periódes	Sodum and potassium hydraute	Waste ink containing dangerous substances	A REPORT OF A REPORT OF A
D 914	0	16.595	Lic No:
073	0 66	17.924	ło:
25,20547945	-100	-7 414639589	W0184-01
Increase/decrease in the tomnages of waste accepted in 2015 compared to 2015, was subject to the quantity of the quantity of waste made available to Enva Irreland. In some instances some instances were excepted onsite that were not accepted in previous years.	Increase/decrease in Increase/decrease in waste accepted in 2015, compared to 2014, was subject to the quantify of waste made available to Enva instances some Instances some instances some escepted onsite that were not accepted in previous years.	Increase/decrease in Increase/decrease in Waste accepted in 2015, was subject to 2014, was subject to the quantity of waste made available to Enva Ireland. In some wastes some wastes were excepted onsite that were not accepted in previous years.	10347 1045 - AV
\$	WA	N)	Year
Environment of the population of the convertion direction of the convertion of the conve	D15-Storage pending any of the operations number	R13-Storage of waite pending any of the operation	2015
Enva ireland does Enva ireland does neoord the packaging content of waste as it arrives an-	Erva Ireland does Erva Ireland does not currently packaging content of waste as it arrives on-	not currently packaging content of waste content of waste saft arrives on-	State of South

WAS IE SUIMIMART	A DEAL OF A DEAL				Lic No:	W0184-01		Year	2015	-
							Increase/decrease in the tommages of wasta accepted in wasta accepted in 2014, was subject to the quantity of waste mode waster were waster were were not accepted in previour years.			Erva reland does not currently record the packaging
	10 01 04	10- WASTES FROM THERMAL PROCESSES	Oil fly ash and boiler dust	0	26,0	7 -100		N/A	as it R5-Recycling/reclamation or other inorganic materil site	as it arrives on- naterissite
							Increase/decrease in the tonnages of the tonnages of 2015, compared to 2014, was subject to waste made available to Enva instances some wastes were wastes were instances some wastes were wastes were instances tone to the the available to the the available to the available to the wastes were wastes were instances to the previous vears.			Erve Iteland dees nos currenty record the pactogin
	06 03 15	06- WASTES FROM INORGANIC Metal oxides containing CHEMICAL PROCESSES heavy metal	Metal axides containing heavy metal	0		#DIV/01		N/A	as it R13-Storage of waste pending any of the operation-site	as it arrives on- ation; site
		35			S	×	Increase/decrease in the teamages of waste accepted in waste accepted in 2013, was subject to 2014, was subject to waste made available to Erwa Instances some wastes were wastes were wastes were were not accepted only that were not accepted only that wer			Ervo retand does Ervo retand does not currently record the packaging content of waste content of waste

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		ä	WASTE SUMMARY
50 IT 61	10 10	F 1002	The second s
19- WASTES FROM WASTE MANAGEMENT FACUTIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER ONSUMPTION AND WATER FOR INDUSTINAL USE	13- OIL WASTES AND WASTES OF LULIUD FUELS (except edible oils, and those in chapters 05, 21 and 19)	20- MUNICIPAL WASTES INCUSTINAL WASTES SIMULAR COMMERCIAL INSULTINAL WASTES INSULTINAL WASTES INSULTINAL WASTES	Contraction in the second
Sludges from onsite effluent treatment containing dangerous substances	Mineral based non- bhiaria te dhydraulic olis	Acida	all and a second second second
0	6.28	0	Lic No:
			0.
o attraction of the second sec	2.75	s. 6 <u>61</u>	W0184-01
Increase/decrease in the tonmages of waste accepted in 2015, wasse accepted in 2014, was subject to the quantity of waste made Ireland. In some Instances some instances some excepted antite that were not accepted In previous years.	Increase/decrease in the tonnages of wasta accepted in 2015, compared in 2015, was subject to the quantity of wasta made usata made instances some instances some instances some instances were excepted onsite that were not accepted in previous years.	Increase/decrease in the tonnages of waste accepted in 2015 compared to 2014, was subject to the quantity of waste made available to Enva Ireland. In some instances some wastes were excepted onsile that were not accepted in previous years.	
			Year
Enva net action files fi	R9:-Oil re-refining or other reuses of oil	A13-Storage of waste pending any of the operation	2015
Enva Ireland does not currently not currently packaging content of waste oal it arrives on-	Enva Leland does nat currently nat currently packaging content of waste cost enrives on- site	Enva treland does not currently not currently parteging content of waste as it arrives on-	Contraction of the

WASTE SUMMARY				2 10 10 10 10 10 10 10 10 10 10 10 10 10	Lic No:	W0184-01		Year	2015	
	66 0313	OB- WASTES FORM THE DANUFACTURE, NANUFACTURE, FORMULLTON, SUPPLY AND USE (MASU) OF COATWOS PARINES AND UTREOUS EMANTES AND ADESURE, SELANTR AND PRATTING INS	Wost hk other than those mentioned in 08 03-12	19.36		13.529 13.529	Increase/decrease in wasta accepted in wasta accepted in 2015 compared to 2015 compared to 2015 and waste acce waste made instances some instances some were not accepted in previous years.	WA	Enva Enva Mot 1 Proce proce proce of weste pending any of the operation size it at it	Erva ireland does Erva ireland does not currently record the pactograg content of worte
	80 ED 80	06. WASTES FORM THE MANUFACTURE, NANUFACTURE, FORMULATION, SUPPLY AND USE (MASU) OF COATINGS (PANTS, VARNISHS AND VITEOUS EMANTES AND ADHSIVE SAUANES, ANDESSES SEMANTES AND PRIVITING IMAS	Aqueous liquid weste conteining Juk	19.57		1,369 72.15234409	Increase/decrease in the tommages of 2015 compared to 2014, was subject to 2014, was subject to waste made waste made instances some were not accepted in previous years.	VM	Била Била по ст лесс реск лесто ле ле ле ле ле лесто ле ле ле ле ле ле ле ле ле ле ле ле ле	Erva ireland does Erva ireland does record the packeging content of woste content of woste
		16- WASTES NOT OTHERWISE	Brake pads other than those mentioned in				Increase/decrease in the tomages of the tomages of 2015 compared to 2015, compared to 2014, was aubject to waste made available to Erwa available to Erwa wastes were wastes were wastes were evere not accepted in previous years.		Evv E	Erva Iteland does Erva Iteland does nos currently record the pockapia

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		WASTE SUMMARY
08 01 12	20 01 25	TANK THE PARTY OF
08- WASTES FORM THE MANUFACTURE FORMULATION, SUPPLY AND USE (MASU) OF COATINGS (PANTS, VANDERS AND VITREOUS ENAMELS) ADHESIYES, SEALANTS AND PRINTING INKS	20-MUNICIPAL WASTES BIOLISENGLI WASTE AND SIMULAB COMMERCIAL INDUSTRIAL AND INCLUDING SEAMARTELY COLLECTED FRACTIONS COLLECTED FRACTIONS COLLECTED FRACTIONS SPECIFIED IN THE LIST mentioned in 16 10 01	THE REPORT OF THE PARTY OF
wate point and varnish other than those membaned in OB OI 11	edible oil and fat edible oil and fat aqueous liquid wastes after than those mentioned in 16 10 01	
12.41	13,786 27,14	Production of the Production
2063	62 077	Lic No:
r - 39.82549685	5 5 5 5 5 5 5 5 5 5 5 5 5 5	W0184-01
Increase/decrease in the tonnages of waste accepted in 2015, compared to 2015, compared to 2014, was subject to the quantity of the quantity of wastes made mistances some instances some	Increase/decrease in the tonnages of waste accepted in 2015, compared to 2014, was subject to the quantity of waste made instances some excepted onsite that were not accepted in previous years. 2014, was subject to the quantity of waste ancepted in 2015 compared in 2015 compared to 2014, was subject to the quantity of wastes made ureland. In some instances some instances some instances some instances some	075-54 Part - 50
		Year
	A13-Storage of waste pending any of the operation.	2015
Envo Ireland does not currently roct currently rockgling content of waste content of waste	Erva Ireland does nat currently packaging content of waste content of waste site arrives on- site fava Ireland does nat currently nat currently nat currently actaging content of waste content of waste	A Sub-

				lic No:	W0184-01		Year	2015	
51 to 31	16- WASTES NOT OTHERWISE SPECIFICD IN THE LIST	ontifreese fluids other them these mentioned in	185.08	342.881	266,252,297 266,257,297	Increase/decrease in the tomages of waste accepted in 2015 compared to 2014, was subject to the quantity of the quantity of waste made available to Ema Instances some Instances some excepted onsite that were not accepted in previous years.	NA NA	Envo Envo And t Proco proco All 3-Storage of waste pending any of the operation size at f	Erva ireland does Erva ireland does not currently packaging content of waste carives on- usite
50 50 9T	ISE		•		10///10# 0	Increase/decrease in the tomages of the tomages of 2015 compared to 2014, was subject to waste made available to Enva instances some instances some excepted onlie that were not accepted in previous years.		Envo Envo Envo Resc R13.Storage of waste pending onv of the operation size as it	Erva iteland does Erva iteland does nat carrently packaging content of waste as it arrives on- nable
16 GG CS	'ISE	other batteries and accumulators	1		0.425 0.425	Increase/decrease in the transpers of the transpers of 2015 compared to 2014, was subject to waste made waste made available to Enva instances some instances some excepted onlier that were not accepted in previous years.	VA	Elvio Elvio Rest Proto P	Ervo ireland does Ervo ireland does nat currently packaging content of waste s it arrives on-

17 05 04	20 01 40	J6 05 09
17- CONSTRUCTION AND 17- CONSTRUCTION MAND IDEMOSITION WASTE INCLUDING EXCAVATED SITES FROM CONTAMINATED SITES	20- MUNICIPAL WASTES INIULAR COLUMERCIA INIULAR COMERCIA INICULTINA ANTO INSTITUTIONAL WASTED INCLUDING SEMANTELY COLLECTED FRACTIONS	16- WASTES NOT OTHERWISE SPECIFIED IN THE LIST
sail and stones other ban those mentioned in 1 1705 03	Metols	discarded chemicals other than those mentioned in 16 05 06, 16 05 07 or 16 05 08
63.94	157,622	<u>6</u>
<u>0</u>	161.823	0.04
Increase/decrease in the tomages of waste accepted 2015 compared to 2015 compared to 2014, was subject to the quantity of waste made available to fina Ireland. In some instances some excepted onsite that were not accepted in provious years.	Increase/decrease in the tonnages of 2015 compared to 2015 compared to 2014, was subject to the quanty of the quan	Increase/decrease in the tomages of waste accepted in 2015, compared to 2014, was subject to the quantity of waste made available to Enva Irreland. In some Instance some wastes were excepted onsite that were not accepted in previous years.
ease In d fi f et to f et to f et to pried ars.	an.	ease in of d din d din d din d din t din d
Env R5-Recycling/reclamation or other inarganic materia site state R5-Recycling/reclamation or other inarganic materia site sate sate sate sate sate sate	R13-Storoge of waste pending an	R13-Storage of weste pending any of the operation
Enva Ireland does Enva Ireland does not currently record the packaging content of waste content of waste	Enva Ireland does Enva Ireland does not currently record the packaging content of waste as it arrives on- 321 site	Erva Ireland does not currently recard the packaging content of waste as it arrives on:

		Enva treland does not currently	record the record the	packaging content of waste as it arrives on-	perations site	Erva Ireland does Erva Ireland does Fecord the peckaging content of waste at it arrives on-	Envo ireland does Envo ireland does record threnity pactaging content of weste site arrives on- site
					R13-Storage of waste pending any of the operation:	13.51xxxge of waste pending any of the operation	R9-Oil re-refining or other reuses of oil
					N/A	WA	VN
Increase/decrease in the tonnages of waste accepted in	2015 compared to 2014, was subject to the quantity of waste made available to Enva	Ireland. In some instances some wastes were	excepted onsite that were not accepted	in previous years.		Increase/decrease in the tonnages of waste accepted in 2015 compared to 2014 was subject to the quantity of waste made available to Enva available to Enva arrances are vecested on noile that were not accepted in previous years.	Increase/decrease in the tomages of avera secopted in 2015 compared to 2015 compared to 2014 wast a work and 2014 wast and wast and in the average wastes were ware and accepted in previous year.
					29.54545455		IO/AU
					0.22	25.28	0
					0.285	97 DI	•
				components not	otherwise specified	spent octivated carbon	other insulating and heat transmission oils
				16- WASTES NOT OTHERWISE		13- WASTES FROM WASTE MANAEBKIET FACILITIES OFF-SITE WASTE WATER PREATING VENTER MITENDED FOR HUMAN CONSUMMATEN AND WATER FOR MOUSTENT USE	 OIL WASTES AND WASTES OIL UNASTES AND WASTES OF LUDIO FUELS Gravepti edible oils, and those in chapters ofs, 12 and 19 in
					16 01 22	50 SS 51	OT EDET
							1

			WASTE SUMMARY
70 ED EL	79 50 EL	59 6C	
13- OIL WASTES AND WASTES OF LUDIO FUELS (except edible oils, and those chapters 05, 32 and 159	13- OL WASTES AND WASTES OF LIQUID FUELS (except edible oils, on those in chapters US, 12 and 19)	13- OIL WASTES AND WASTES OF LIQUE PIELS ACCOUNT editie offs and set disperse 15, 12 and 19	
mineral-based non- chlorinated insulating and heat transmission off	oly water from adjwater separators	sludges from eil/water separatos	
49.401.4	506.0733	24 86	LIE No:
2.04	805	22.36	0
23	1012046.6	5 11.180673939	W0184-01
Increase/decrease in the tonnages of waste accepted in 2015, was subject to the quantity of wastes made instances some instances some instances some instances some instances some instances no accepted onsile that were not accepted in previous years.	Increase/decrease in the tonnages of waste accepted in 2015, was subject to the quantity of waste made available to Enva Irreland. In some Instances some wastes were excepted onsite that were not accepted in previous years.	Increase/decrease in the consigns of waste accepted in 2014, was subject to the quantity of wasta made available to Enva Ireland. In some Instances some Instances some wastes were excepted onite that were not accepted in previous years.	Same and the second sec
MA	MA.	WA .	Year
	RS-Oil re-refining or other reuses of oil	Envi not. RS-Recycling/reciamation or other incorganic moteril as it status	2015
Enva Ireland does Enva Ireland does nat currantly prochaging context of waste context of waste	Enva Ireland does not currently not currently record the packaging content of waste as it aurives on- stie	Enva iteland does not currently packaping packaping as it arives an- site	

11 70 61	13- OIL WASTES AND WASTES OF LIQUID FIELS (except calles of 1, 1 and 1900 en 10 charaers 05, 1, 2 and 190	svirtibet i frividro ilife olis	556 0	278 278	10 10 10 10 10 10 10 10 10 10 10 10 10 1	Increase/decrease in the comages of wast e accepted in source accepted in 2014, was subject to waste made waste made. In some unstances some wastes were wastes were were not accepted in previous years.	87	813-Storone of waste perialize any of the coercition	Enva Ireland does Enva Ireland does nat currently record the pedeaptin contant of waste contant of waste
<u>21 10 80</u>	DB. WASTES FORM THE MANUFACTURE MANUFACTURE FORMULATON, SUPPLY AND USE (MISSU) OF COATWICS (PAINTS, VARNISHES AND ATHERVES, SEALAND ATHERVES, SEALANDS ATTING INIS ARMITING INIS	waste from point or varnish removal contraind organic solvenss or orbr dangerous substances	0	1.45		Increase/decrease in the tommges of 2015, compared in 2015, compared in 2014, was subject to the quantity of wate medie the quantity of wate were instances some instances some were not accepted in previous years. A	WA	Envo Envo conce pock pock product pending ony of the operation, site	Enva Iteland does Enva Iteland does nat currently record the pockoping pockoping sortent of waste sort framines on-
11 507.0	07-WASTES FROM ORGANIC	studges from onsite effluerit treetment containing dangerous	•	9 6 7		Increase/decrease in the tomages of 2015 compared to 2015 compared to 2014, was subject to the quantity of waste made. In some instances some instances some instances some instances vere excepted onsite that were not accepted in previous years.	20	Envo Envo Envo Envo Rest Contr R13-Storeces of woste evending onv of the operation sist is	Enva ireland does Enva ireland does not currently poctoging content of waste at errives on-

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2001 26	18 01 09	16 05 04	
20- MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMULA NOUSEROLL AND INSTITUTIONAL MASTES) INCLUMING SEPARATELY COLLECTOR SEPARATELY	Ja: WASTES FROM HUMAN OR ANIMAL HEALTH CARE ANID/OR RELATED RESSARCH (except kitchen ond restauront wates not actisung from limmediate RESEARCH (except kitchen ond restauront wastes not axising from immediate not axising from immediate health care)	16- WASTES NOT OTHERWISE SPECIFIED IN THE LIST	
paint, inks, adhesives and resins other than those mentioned in 20 01 27	medicines other than those mentioned in 18 01 08	alkoline batteries (except 16 06 03)	
9	0.342	0.294	
2	S 4	a.	
Incr 201 201 Incr Incr Incr Incr Incr Incr Incr Incr	Increase and the second s	194 Inc week week week week week week week wee	to torot
Increase/decrease in the tonnages of wasta accepted in 2015 compared to 2014, was subject to the quantity of waste made available to Enva treiand. In some instand. In some instand, in some instand, content that wastes were excepted onsite that were not a accepted in previous years.	Increase/decrease in the tonnages of waste accepted in 2015 compared to 2014, was subject to the quantity of waste made available to Enva Ireland. In some instances some waste were excepted onsite that were not accepted in previous years.	Increase/decrease in the connages of waste accepted in 2015 compared to 2014, was subject to the quantity of waste made available to Enva Ireland. In some wastes were excepted onlite that were not accepted in previous years.	A DESCRIPTION OF A
5	NA.	N/A	TEaT
Enve tott cont cont cont cont cont cont cont	All 3 Strange of waite pending ony of the operation	R13-Storage of watte pending any of the operations site	etor
Envo Ireland does not currently record the poetsopilo control of woste as it arrives on-	Erva Ireland does Erva Ireland does not currenty packaging content of waste as it arrives on-	Enva treland does ans currently precord the packaging content of waste content of waste content of waste as it enrives on-	and a standard and a standard

				DC NO:				
						Increase/decrease in		
						the tonnages of		
						Waste accepted in		
						2014, was subject to		
						the quantity of		
						waste made		14
						available to Enva		
						ireianu, in some Inctantas some		
	20- MUNICIPAL WASTES					wastes were		Enva ireland does
	(HOUSEHOLD WASTE AND					excepted onsite that		not currently
	SIMILAR COMMERCIAL,					were not accepted		record the
	INDUS INIAL AND					In previous years.		pockeging
	INCLUDENCE SEPARATELY							as it arrives on-
		Streat cleaning residues	0	15.14	4 -100	N/A	R5-Recyclina/reclamation or other inorganic materia site	erisite
	Γ					Increase/decrease in		1
						the tonnages of		
	02-WASTES FROM					waste accepted in		Enva treiand does
	AGRICULIURE,					2015 compared to		not currently
	HORTICULTURE,					2014, was subject to		record the
	AQUACULTURE, FORESTRY,					the quantity of		packaging
	000					waste made		content of waste
	9	Agrochemical containing				available to Enva		as it arrives on-
02 01 08	PROCESSING	dangerous substanuces	0.04	3		Ireland. In some	waste penalty of waste penalty and all the operations	2012 5115
						the tonnages of		
						waste accepted in		Enva Ireland does
						2015 compared to		not currently
						2014, was subject to		record the
	_					the quantity of		packaging
						waste made	-	content of waste
	07- WASTES FROM ORGANIC					available to Enva		as it arrives on-
07 02 01	CHEMICAL PROCESSES	Aqueous washing liquids	0.8		0 #DIV/01	Ireland. In some	R13-Storage of waste pending any of the operation site	on site
						Increase/decrease In		
								Enva Ireland does
								not currently
						2014 uns subject to		record the
						LUIH, Was subject to		packaalna
						the quantity of		contant of works
						waste made		content of waste
	07- WASTES FROM ORGANIC	Waste not other wise			internation of	available to Enva	ada holdanana adda anda anda adami ka anana 2.20	un citra
65 c0 /0	CHEMICAE PROCESSES	specified	0.04		10//10#	ireiana. In some Increase/decrease in	and and a fundamental stend in affinite of	
						the transmer of		
	_					the tomages of		Enva Ireland does
_	_					2015 rombared to		not currently
	03- WASTES FROM WOOD					2014. was subject to		record the
	PROCESSING AND THE					the quantity of		packaging
	PRODUCTION OF PANELS AND					waste made		content of waste
	FURNITURE, PULP, PAPER AND Woste from cooling	Waste from cooling				available to Enva	1) SD	as it arrives on-
10.01.26	CANDOADA	And an and a second sec	•		INIVIAN D			

							8 8	5	4																				Π	ĺ
	Arm ID	Table 3 General Int		Waste types permitted for disposal	Table 2 Waste type	SECTION D-TO BE (6 Does your facility have relevant nuisance (7 Do you have an odour management syste 8 Do you maintain a sludge register on site?	Is all waste storage infra	is all waste processing in	SECTION C-TO BE C																			WASTE SUMMARY	
	Date landfilling commenced	Table 3 General Information-Landfill only		Authorised/licenced annual intake for disponal (tpa)	Table 2 Waste type and tonnage-landfill only	SECTION D-TO BE COMPLETED BY LANDFILL SITES ONLY	Does your facility have nelevant nuisance controls in place? Do you have an odour management system in place for your facility? If no why? Do you maintain a sludge register on site?	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	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	SECTION C-TO BE COMPLETED BY ALL WASTE FACILITIES (waste transfer stations, Composters, Material recovery facilities etc) EXCEPT LANDFILL SITES	20 60 61					19 08 05				15 01 06					13 04 03					
「「「「「「「」」」」	Date landfilling ceased			Actual intake for disposal in reporting year (tpa)		ONLY	y? If no why?	pproved by the Agency in place?	id approved by the Agency in plac	LITIES (waste transfer stat	CONSUMPTION AND WATER FOR INDUSTRIAL USE	PREPARATION OF WATER	OFF-SITE WASTE WATER	19- WASTES FROM WASTE MANAGEMENT FACILITIES,		FOR INDUSTRIAL USE	PREPARATION OF WATER	OFF-SITE WASTE WATER TREATMENT PLANTS AND THE	19- WASTES FROM WASTE MANAGEMENT FACILITIES,	OTHERWISE SPECIFIED	ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND	15- WASTE PACKAGING;			edible oils, and those in chapters 05, 12 and 19)	13- OIL WASTES AND WASTES OF LIQUID FUELS (except				
	Currently landfilling			Remaining licensed espacity at end of reporting year (m3)				lf no please list waste storag	e? If no please list waste pr	ions, Composters, Mi	Sludges from treatmet of urban wastewater					Sludges from treatmet of urban wastewater				Mixed Packaging					Bilge oil					
「「日本のない」	Private or Public Operated			Comments				ge infrastructure required o	ocessing infrastructure requ	aterial recovery facili	16.08					6.2				0.935					3858.531					
	Ineri or non-hazardous							n site	ired onsite	ties etc) EXCEPT LANDFILLS																			Lic No:	
and a second	Predicted date to cease landfilling	-					Yes No	Yes	Yes	ITES	0 #DIV/01	0415				0 #0IV/0I				a #DIV/01					0 #DIV/01				W0184-01	
	Licence permits asbestos										wastes were	available to Enva Ireland. In some	waste made	2015 compared to 2014, was subject to	the tonnages of waste accepted in	available to Enva	the quantity of waste made	2015 compared to 2014, was subject to	Increase/decrease in the tonnages of waste accepted in	available to Enva Ireland. In some	the quantity of waste made	2014, was subject to	waste accepted in	Increase/decrease in the tonnages of	available to Enva Ireland. In some	the quantity of waste made	2015 compared to 2014, was subject to	the tonnages of waste accepted in		
	Is there a separate cell for asbestos?																					~~							Year	
SEL	Accepted arbeston in reporting waste										R13-Storage of waste pending any of the operations site					R13-Storage of waste pending an				R13-Storage of waste pending any of the operation					R9-Oil re-refining or other reuses of oil				2015	
SELECT UNIT SELECT UNIT	Total disposal Lined disposal area occupied by area occupied by waste waste										as it arrives on- the operations site	packaging content of waste	not currently	Enva Ireland does		as it arrives on- 5 site	packaging content of waste	not currently record the	Enva treland does		packaging content of waste	record the	Enva Ireland does			packaging content of waste	not currently record the	Enva Ireland does		

Unlined area

SELECT UNIT

	MUIB4-UI	Year	2015
Cells			

Ironmental monitoring-landfill only Landfill Manual-Monitoring Standards Leat
venue and the second se
.+ please refer to Landfill Manual linked above for relevant Landfill Directive monitoring standards Table 5 Capping-Landfill only
Area with temporary cap about the permanently
SELECT UNIT Area with final cap to LD Standard m2 ha, a Area capped other

raurie 5 Leachate-Landfill only 9 is leachate from your site treated in a Waste Water Treatment Plant? 10 is leachate released to surface water? If you name and a community of the second second second second second

Smelfy type of	Leachate (COD) mass load Leachate (NH4) mass	sachate (ROD) mass load (ke/annum	Volume of leachate in renorting year(m3)
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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

of rat of observations in the second of the barrier	Gas Captured&Treated	
1) Over off-site of to instantial Birds		
CELETT Juni 1	Was surface emissions monitoring performed during the reporting	
Comments	1	

Appendix 1



| PRTR# W0184 | Facility Name Enva Ireland Limited (Portlaoise) | Filename . Copy of W0184_2016.xts | Return Year : 2016 |

Guidance to completing the PRTR workbook

PRTR Returns Workbook

Environmental Protection Agency

Version 1.1 19

REFERENCE YEAR 2016

1. FACILITY IDENTIFICATION

Parent Company Name	Enva Ireland Limited
Facility Name	Enva Ireland Limited (Portlaoise)
PRTR Identification Number	W0184
Licence Number	W0184-01

Classes of Activity

No. class_name - Refer to PRTR class activities below

	Clonminam Industrial Estate
Address 2	Portlaoise
Address 3	
Address 4	
	Laois
Country	
Coordinates of Location	
River Basin District	IESE
NACE Code	3832
Main Economic Activity	Recovery of sorted materials
AER Returns Contact Name	Kevin Coll
AER Returns Contact Email Address	kevin.coll@enva.com
AER Returns Contact Position	HSE Coordinator
AER Returns Contact Telephone Number	0578678617
AER Returns Contact Mobile Phone Number	0860280038
AER Returns Contact Fax Number	0578678699
Production Volume	0.0
Production Volume Units	
Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	90
User Feedback/Comments	
Web Address	

2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name
5(a)	Installations for the recovery or disposal of hazardous waste
5(c)	Installations for the disposal of non-hazardous waste
50.1	General
3. SOLVENTS REGULATIONS (S.I. No. 543 of 20	02)
Is it applicable?	
Have you been granted an exemption ?	
If applicable which activity class applies (as per	
Schedule 2 of the regulations) ?	
Is the reduction scheme compliance route being	
used ?	

| PRTR# : W0184 | Facility Name : Enva Ireland Limited (Portlaoise) | Filename : Copy of W0184_2016.xls | Return Year : 2016 | Page 1 of 2

4. WASTE IMPORTED/ACCEPTED ONTO SITE

Guidance on waste imported/accepted onto site

Do you import/accept waste onto your site for on-	
site treatment (either recovery or disposal	
activities) ?	

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Link to previous years emissions data 4.1 RELEASES TO AIR

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

	POLLUTANT		METHOD			CUANTITY	
			Method Used		1		111
No. Annex II	Name	M/C/E Method Code	de Designation or Description	Emission Point 1	Emission Point 1 T (Total) KG/Year	A (Accidental) KG/Year F (Fugitive) KG/Year	F (Fuaitive) KG/Ye
	Carbon monoxide (CO)	C EN 15058:2004	2004 Non Dispersive Infra Red	5.45	5.45		0.0
			Chemiluminescence NDIR				
	Nitrogen oxides (NOx/NO2)	C EN 14792:2005	2005 AG2 Non Dispersive	526.77			0.0
	Sulphur oxides (SOx/SO2)	C OTH	Infra Red	19.55	5 19.55	6 0.0	
	 Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button 						

Emission Point 1 T (Total) KG/Year 0.0 METHOD Method Used [Designation or Description M/C/E Method Code Name POLLUTANT No. Annex II

RELEASES TO AIR

A (Accidental) KG/Year F (Fugitive) KG/Year 0.0

QUANTITY

Please enter all quantities in this section in KGs

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION C : REMAINING POLLUTANT EMISSIONS (As required in your Licence)

	RELEASES ID AIR		14 15 - 614 412 11 15 25 21 16 - 21 16 23	lease enter all quantitie	as in this section in KGS	S	
	POLLUTANT	ME	ETHOD			QUANTITY	
「「「「「「」」」」」」「「「「」」」」」」」」」」」」」」」」」」」」			Method Used				
Pollutant No.	Name	M/C/E Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Ye	Ir F (Fugitive) KG/Year
				0	0,0	0.0	0.0 0.0
	 Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button 						

click the B) then ing on the l Select a row by do

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For the purposes of the National Inventory on Greenhouse Gases, landfill operators are requested to provide summary data on landfill gas (Nethane) flared or utilised on their facilities to accompany the figures for total methane generated. Operators should only report their Net methane (CH4) emission to the environment under T(total) KGyr for Section A: Sector specific PRTR pollutants above. Please complete the table below:

Enva Ireland Limited (Portlaoise)

Landfill: Please enter summary data on the

qui

12	city		0.0 (Total Flaring Capacity)	0.0 (Total Utilising Capacity)	
	Facility Total Capacity m3 per hour	NIA			N/A
Method Used	Designation or Description				
Met	Method Coe				
	MICIE				
	T (Total) kg/Year	0.0	38	0.0	0.0
quantities of methane flared and / or utilised		Total estimated methane generation (as per site model)	Methane flared	Methane utilised in engine/s	Net methane emission (as reported in Section A above)

Sheet : Releases to Wastewater or Sewer

AER Returns Workbook

4.3 RELEASES TO WASTEWATER OR SEWER

Link to previous years emissions data

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MCE Method Code 2005/19 <th< th=""><th>II XIII</th><th>I OLLOIMNI</th><th>100 10000 100</th><th>AND I CARACTER A</th><th></th><th>A Contract Contraction</th><th></th><th></th><th>Valia Sulta S</th><th>No. It</th></th<>	II XIII	I OLLOIMNI	100 10000 100	AND I CARACTER A		A Contract Contraction			Valia Sulta S	No. It
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Amona (N-3)		Name	M/C/E	Method Code	Designation or Description	mission Point 1	T (Total) KG/Year	A (Accidental) KG/Yea	ar F (Fug	tive) KG/Ye
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Select a row by double-clicking on the Polytant Name (Column B) then click the delete button		Lead and compounds (as Pb)	0	OTH	200.8	0			00	2 2
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SECTION D : REMAINING	SECTION D : NEWAINING FOLLOTANI EMISSIONA (AR FOLDER) TO STATUED FOR MASTE MATER TREAT OR SERVER	AENT OD S	IEMED		Please other all cumulifies in this section in KGs	ac in this costion in MCs		
	OI SILE INANSIEN OF COLORING DESTINED FOR WASTE-WATEN INCATIM				Licese clifel all dualitie	SOV III IIONDAS SIIIN III SO		
の日本のないのないのであるのである	POLLUTANT	No. of Survey	MET	METHOD	The second and second	THEN SAME AND ADDRESS	QUANTITY	014603-10100-001-001-00
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				carbon banding within the				
314	Fats, Oils and Greases	0	OTH	range C8-C40 GC-FID.	28,984		28.984 0.0	0.0
なからいいのでいいでいたい				APHA /AWWA Standard				
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いたいに うちいけ ちちょうちょう				APHA /AWWA Standard				
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				APHA /AWWA Standard				
306	COD	o	OTH	Methods	23727.13	13 23727.13	.13 0.0	0.0
	 Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button 							

Link to previous years emissions data

Waste	
Transfers of	
Treatment	
Sheet :	

AER Returns Workbook

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE (PERIPE WORd, Faulty functor famous frame and theoretic of the date of the set frame frame frame and the set of the

40	Actual Address of Final Destination 1.6. Final Receivery 10 possial Ste Had XaRTON IIS WAATE ONI YO		Mullingar business park,Mullingar,.,Westmeath,I reland	Rue de Courriere 49 Zoning Industrial de Feluy	,Belgium	Krombacher Strasse 42-46 Kreutzal,D57223 ,Germany		Krombacher Strasse 42-46 Kreutzal,D57223 ,Germany	Caulside Drive, Greystone Road, Antrim, Antrim, United	Ninguorin JFK Road Naas Road,.,Dublin,Dublin 12 Ireland	Raiffeisenstraße 38 D- 47865 Sonsbeck ,Germany	Rue de Courriere 49 Zoning Industrial de Feluy ,B 7181 Seneffe	,Belgium Louis-Krages-Strabe Bremen., D-28237 Germany	Krombacher Strasse 42-46 Kreutzal,D57223 ,Germany	Noning Inustrial d'Ehein,B- 4480 EngisBelgium	Centrum Zuid 3017 ,3530,Belgium.
	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE		Soltec Ltd,W0041-01	ang gr		Lindenschmidt , 04 714 . 98089		Lindenschmidt , 04 714 98089, Krombacher Strasse 42-46 ,, Kreutzal, D57223 Germany Me	Ilans, P0187/07A/V1, Caul a Drive, Greystone ad, Antrim, Antrim, United	Enva;W0196-01,JFK Road J Naas Road, Dublin, Dublin F 12 Ireland	ing ,12 150 MS		7181 Senerite , Beiglum Nehlsen GmbH & Co.kg, A- 4187 HH,Louis-Krages- Strabe,Bremen, D-28237 , Germany	hmidt,04 714 ombacher Strasse Kreutzal,D57223	ED/200 Jstrial	rv recycling (Jovam approved,Centrum Zuid 3017,3530,Belgium,
	D <u>Haz Waste</u> : Address of Next Next Maste : Address of Next Non Haz Waste, Addres of Recover/Dispose	1	Mullingar business park,Mullingar,Westmeath,I reland	Rue de Courriere 49 Zoning Industrial de Feluy B 7181 Semetre	, Belgium	S.A.,3200/61080/RGPED/20 Noning Industriel d'Ehein,B- 06/2/AP-PU 4480 Engls,,Belgium	Recytuel S.A.,3200/61080/RGPED/20 Noning Industriel d'Ehein,B- 08/2/AP-PU 4480 Englis,Belgium	Smithstown Industrial estate ,,,Shannon ,Co. Clare,Ireland	Caulside Drive, Greystone Road, Newpark Industrial	JFK Road Naas Road, Dublin, Dublin 12. Ireland	Raiffeisenstraße 38, D- 47665 Sonsbeck ,Germany Rue de Courriere 49	Zoning Industrial de Feluy 	.38.152/BP , Beigum Recyfuel S.A.,3200/81080/RGPED/20 Noning Industriel d'Ehein,B- 08/2/AP-PU 4480 Engls,Beiglum	Smithstown Industrial estate Shannon ,Co. Clare,Ireland	Recyfuel S.A.,3200/61080/RGPED/20 Noning Industriel d'Ehein,B- 08/2/AP-PU	Centrum Zuid 3017 ,3530,Belgium. Raiffeisenstraße 38 D- 47665 Sonsbeck ,Germany
	Haz Waste : Name and Licence/Permit No of Next Destination Facility Haz Waste, Name and Licence/Permit No of Recover/Dispose	83	Offsite in Ireland Soltec Ltd, W0041-01	Geocycle	,38.152/BP Recrétial	S.A., 3200/61080/RGPED/2 08/2/AP-PU	Recyluel S.A., 3200/61080/RGPED/2/ 08/2/AP-PU	Enva ,W041-1	Mc Outlines D0187/07A			Geocycle	.38.132/BP Recyfuel S.A.,3200/61080/RGPED/2(08/2/AP-PU	Enva , W041-1	Recyfuel S.A.,3200/61080/RGPED/2/ 08/2/AP-PU	RD Recycling ,Ovarn approved KS Recycling ,12 150 13984/01TMS
		Location of Treatment	Offsite in Ireland		Abroad	Abroad	Abroad	Abroad	hende	Offsite in Ireland	Abroad		Abroad	Abroad	Abroad	Abroad Abroad
	Method Used	Method Used	Weighed		Weighed	Weighed	Weighed	Weighed	Mainhard	Weighed	Weighed		weighed Weighed	Weighed	Weighed	Weighed Weighed
	×	M/C/E	> W		> W	×	>	>	2				> > 2 2	×	s v	> > > >
		Waste Treatment Operation														
		> Ĕ Q	.2	anic	s R1	anic s R1	е R1	õ	010	6	8	1	5 E	by R13	by R1	R12 R3
Please enter all quantities on this sheet in Tonnes		Description of Waste	waste paint and vamish containing organic 6.92 solvents or other dangerous substances	waste peint and varmish containing organic	85.42 solvents or other dangerous substances	waste paint and vamish containing organic 280.07 solvents or other dangerous substances	waste paint and varnish other than those 168.14 mentioned in 08 01 11	0.55 fixed solutions	other wastes containing dangerous 699.44 substances	6.58 olly water from oil/water separators	102.36 other fuels (including mixtures)		11.05 outer ruers (including mixtures) packaging containing residues of or 137.26 contaminated by dangerous substances	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances	absorbents, filter materials (including oil filters not othenwise specified), wiping cloths, protective clothing contaminated by dangerous substances	697.36 oil filters antifreeze fluids other than those 262.58 mentioned in 16 01 14
ease enter :	Quantity (Tonnes per Year)		6.92		85.42	280.07	168.14	0.55	699 44	6.58	102.36		137.26	0.07	234.49	697.36 262.58
Id	E	Hazardous	Yes		Yes	Yes	N	Yes	Yes	Yes	Yes	ļ	sa - 54	Yes	Yes	Yes No
		European Waste Code	08 01 11		08 01 11	08 01 11	08 01 12	09 01 04	19 02 11	13 05 07	13 07 03		15 01 10	15 02 02	15 02 02	16 01 07 16 01 15
		Transfer Destination	Within the Country 00		To Other Countries 08	To Other Countries 06	To Other Countries 06	To Other Countries 09	To Other Countries 19		To Other Countries 13			To Other Countries 15	To Other Countries 16	To Other Countries 16 To Other Countries 16

| PRTR#: W0184 | Facility Name : Enva Ireland Limited (Portlaoise) | Filename : Copy of W0184_2016.xts | Return Year : 2016 |

Actual Address of Final Destination I.e., Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)		Austrabe 5D74238 Krautheim,Germany	Normaduler Suasse 42-40 Kreutzal, D57223 ,Germany	Krombacher Strasse 42-46 Kreutzal,D57223 ,Germany	Niljverheidsstraat 2 Belgium,B- 2340 Beerse ,Belgium		Rue de Courriere 49 Zoning Industrial de Feluy ,B 181 Seneffe Belgium Straboe	, Portlaoise ,Co Laois ,Ireland	Rue de Courriere 49 Zoning Industrial de Feluy Balgium	Krombacher Strasse 42-46 Kreutzal, D57223 ,Germany	Noning Industriel d'Ehein, B- 4480 Engis,, Belgium	Graftstr. 25,47475 Kamp-Lintfort ,Germany Krombacher Strasse 42-46	Kreutzal,D57223 ,Germany
Name and License / Permit No. and Address of Final Recoverier / Disposer (HAZARDOUS WASTE ONLY)		SBH,121296753,Austrabe 5,…,D74238 Krautheim,Germany	Lindenschmidt , 04 714 98089	Contraction of the second	Campire, ovain Approved, Niljverheidsstraat 2 Belgium,B- 2340 Beerse ,Belgium		Geocycle ,38.152/BP, Rue de Courriere 49. Zoning Industrial de Feluy,,B 7181 Seneffe ,Belgium	Hinch Plant hire ,WFP-LS-09-0002-01	Geocycle, 38.152/BP, Rue de Courriere 49. Zoning Industrial de Feluy, B 7181 Seneffe, Belgium	Lindenschmidt , 04 714 98089,Krombacher Strasse 42-46 ,,Kreutzal,D57223 ,Germany ,Germany	S.A.,3200/61080/RGPED/20 08/2/AP-PU	KWA,E17012100	Lindenschmidt , 04 714 98089
Haz Waste : Address of Next Destination Facilty Non Haz Waste Address of RecorenDisposer	9	Austrabe 5,D74238 Krautheim, Germany contractor active	Clare, Ireland	Smithstown Industrial estate ,.,Shannon ,Co. Clare,Ireland	Niijverheidsstraat 2 Belgium,,B- 2340 Beerse ,Belgium Cappincur Industrial Estate	,Daingean Road,Tullamore,Co. Offaly,Ireland Rue de Courriere 49 Zoning Industrial de Feluy	, B 7181 Seneffe , B 7181 Seneffe , Belgium Straboe	, Portlaoise , Co Laois , Ireland Rue de Courriere 49 Rue de Courriere 49	, B 7181 Seneffe , Belgium	Recyfuel S.A.,3200/61080/RGPED/20 Noning Industriel d'Ehein,B- S.A.,3200/6701 S.A.PPU 4480 Englis,Belgium	Noning Industriel d'Ehein,B- 4480 Engis,,Belgium	Graftstr, 25 ,,47475 Kamp-Lintfort ,Germany Krombacher Strasse 42-46	,Kreutzal,D57223 ,Germany
Haz Weste Name and Licence/Permit No of Next Destination Facily Haz Waste. Name and Licence/Permit No of Recover/Disposer		SBH ,121296753	Enva ,W041-1	Enva ,W041-1	Campine, Ovam Approved	KNK Metals Recycling Limited,W0113-04	Geocycle ,38.152/BP	Hinch Plant hire ,WFP-LS-09-0002-01	Geocycle ,38.152/BP	Recyfuel S.A.,3200/61080/RGPED/20 08/2/A-PU Boordroid	S.A.,3200/61080/RGPED/20 08/2/AP-PU	KWA,E17012100	Lindenschmidt , 04 714 98089
	Location of Treatment	Abroad	Abroad	Abroad	Abroad	Offsite in Ireland	Abroad	Offsite in Ireland	Abroad	Abroad	Abroad	Abroad	Abroad
Method Used	Method Used	Weighed	Weighed	Weighed	Weighed	Weighed	Weighed	Weighed	Weighed	Weighed	Weighed	Weighed	Weighed
	ant Ion M/C/E	Σ	Σ	Σ	×	×	Σ	×	Σ	Σ	Σ	Σ	Σ
	Waste Treatment Operation	R4	60	R13	R4	R13	R	I R5	R1	R	5	D10	R1
~	Description of Waste	gases in pressure containers (including 40.26 halons) containing dangerous substances	5.585 including mixtures of laboratory chemicals	discarded organic chemicals consisting of 2.0 or containing dangerous substances	720.02 lead batteries	2.313 alkaline batteries (except 16 06 03)	25.8 wastes containing oil	soil and stones other than those mentioned 1327.44 in 17 05 03	sludges from physicorchemical treatment	liquid combustible wastes containing 264.12 dangerous substances	solid combustible wastes containing 279.14 dangerous substances	utter wastes (including includes or materials) from mechanical treatment of 176.58 wastes containing dangerous substances other wastes (including mixtures of	materials) from mechanical treatment of 259.25 waste containing dangerous substances
Quantity (Tonnes per Year)	ŝ	40.26	5.585	2.0	720.02	2.313	25.6	1327.44	262.156	264.12	279.14	176.51	259.2
	Hazardous	Yes	Yes	Yes	Yes	°N N	Yes	No	Yes	Yes	Yes	Yes	Yes
	European Waste Code	16 05 04	16 05 06	16 05 08	16 06 01	16 06 04	16 07 08	17 05 04	19 02 05	19 02 08	19 02 09	19 12 11	19 12 11
	Transfer Destination	To Other Countries	To Other Countries	To Other Countries 16 05 08	To Other Countries 16 06 01	Within the Country	To Other Countries 16 07 08	Within the Country	To Other Countries	To Other Countries	To Other Countries	To Other Countries	To Other Countries

AER Returns Workbook

Sheet : Treatment Transfers of Waste

Actual Address of Final Destination Le Final Recovery / Despara She (HAZARDOUS WASTE ONLY)		Rue de Courriere 49 Zoning Industrial de Feluy B 7181 Seneffe ,Belgium	Woodstock Industrial Estate ,Athy ,Co. Kildare, ,Ireland		Krombacher Strasse 42-46 ,Kreutzal,D57223 ,Germany			JFK Road Naas Road,Dublin,Dublin 12,Ireland	Vlasweg 12,4762 PW Moerdijk,Holland,Holland,Ne therlands		Unit 1A,Allied Industrial Estate,Kylemore Road,Ballyfermot ,Ireland	Krombacher Strasse 42-46 ,Kreutzal,D57223 ,Germany	Rue de Courriere 49 Zoning Industrial de Feluy ,B 7181 Seneffe ,Belgium	Krombacher Strasse 42-46 Kreutzal,D57223 ,Germany
Name and License / Permit No. and Address of Final Rocoverer / Disposer (HJZARDOUS WASTE ONLY)		Geocycle ,38.152/BP, Rue de Courriere 49 Zoning Industrial de FeluyB 7181 Seneffe ,Belgium	Irish Lamp Recycling ,WFP- Woodstock Industrial Estate KE-08-0348-01 ,,Athy ,Co. Kildare, ,Ireland		Lindenschmidt, 04 714 98089			Enva, w0196-01, JFK Road Naas Road, ., Dublin, Dublin 12, Ireland	Arvatsionten Terminal Moerdijk, NB501809XXHB, VI assweg 12,4782 PW Moerdijk, Holland, Ne therlands		SRCL Eco Safe Systems, W0154-02, Unit 1A, Ailled Industrial Estate, Kylemore Road, Ballyfermot, Ireland	Lindenschmidt , 04 714 98089,Krombacher Strasse 42-46 ,.,Kreutzal,D57223 ,Germany	Geocycle ,38.152/BP, Rue de Courriere 49 Zoning Industrial de Feluy,B 7181 Seneffe ,Belgium	Lindenschmidt , 04 714 98089;Krombacher Strasse 42-46 ,.,Kreutzal,D57223 ,Germany
1 <u>Haz Waste</u> : Address of Next Destination Facility Noth Haz Wastle, Address of Recover/Disposer		Rue de Courriere 49 Zoning Industrial de Feluy . B 7181 Seneffe , Belgium	hish Lamp Recycling ,WFP- Woodstock Industrial Estate I fish Lamp Rec KE-08-0348-01 ,Aithy ,Co. Kildare, Ireland KE-08-0348-01	bailymount Drive Ballymount Industrial Estate, Unit J1 , Dublin, Dublin 12, Ireland	recytuel S.A.,3200/61080/RGPED/20 Noning Industriel d'Ehein,B- 08/2/AP-PU 4480 Engls,Belgium	Noning Industriel d'Ehein,B- 4480 EngisBelgium	- Annagh., Birr,Co. Tipperary, Ireland	JFK Koaq,Naas Road,Dublin,Dublin12,Irelan d	Vlasweg 12,4782 PW Moerdijk, , ,Netherlands	Unit 1A ,Allied Industrial Estate Kylemore Road ,Ballyfermot,Dublin 10,Ireland	Unit 1A ,Allied Industrial Estate Kylemore Road ,Ballyfermot,Dublin 10,ireland	Smithstown Industrial estate Shannon ,Co. Clare,Ireland Rue de Courriere 49	Zoning Industrial de Feluy ,Belgium	Krombacher Strasse 42-46 ,Kreutzal,D57223 ,Germary
Haz Wester Name and LicencePermit No of Next Destination Facility Haz Wester Name and LeoncePermit No of Recover/Disposer		Geocycle ,38,152/BP			Recyruel S.A.,3200/61080/RGPED/2(08/2/AP-PU	Recytuel S.A.,3200/61080/RGPED/20 08/2/AP-PU	MSM Recycling, WEP-TN-11- Annagh., Birr, Co. 0003-02 Tipperary, Ireland	Enva Dublin, W0196-01	Afvalstoffen Terminal Moerdijk BV,NB501809XXHB	SRCI Eco Safe Systems Limted,W054-02		Offsite in Ireland Enva ,W041-1	Geocycle ,38.152/BP	Lindenschmidt , 04 714 98089
	Location of Treatment	Abroad	Offsite in Ireland	Offsite in Ireland	Abroad	Abroad	Offsite in Ireland	Offsite in Ireland	Abroad	Offsite in Ireland	Offsite in Ireland	Offsite in Ireland	Abroad	Abroad
Method Used	Method Used	Weighed	Weighed	Weighed	Weighed	Weighed	Weighed	Weighed	Weighed	Weighed	Weighed	Weighed	Weighed	Weighed
	n M/C/E	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ	Σ	×	Σ	×
Waste	Treatment	R1	R4	R3	R13	R1	R4	60	RS	60	60	R13	R1	R1
	Description of Waste	other wastes (including mixtures of materials) from mechanical treatment of 58.304 waste containing dangerous substances	fluorescent tubes and other mercury- 1.24 containing waste	0.555 edible oil and fat	paint, inks, adhesives and resins 21.62 containing dangerous substances	paint, inks, adhesives and resins other 4.35 than those mentioned in 20 01 27	239.1 metals	water-based offset plate developer 0.824 solutions	soil and stones containing dangerous 3530.66 substances	medicines other than those mentioned in 0.64 18 01 08	wastes whose collection and disposal is subject to special requirements in order to 7.327 prevent infection	sludges from on-site efficient treatment 3.7 containing dangerous substances	absorbents, fitter materials (including oil fitters not otherwise specified), wiping cloths, protective clothing contaminated by 300.0 dangerous substances	solid combustible wastes containing 127.25 dangerous substances
Quantity (Tonnes per Year)		58.304	1.24	0.595	21.62	4.35	239.1	0.824	3530.66	0.64	7.327	3.7	300.0	127.25
	Hazardous	Yes	Yes	Ŋ	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes
	European Waste Code		20 01 21	20 01 25	20 01 27	20 01 28	20 01 40	09 01 02		18 01 09	18 02 02	07 05 11		
	Transfer Destination	To Other Countries 1912 11	Within the Country	Within the Country	To Other Countries	To Other Countries	Within the Country	Within the Country	To Other Countries 17 05 03	Within the Country	Within the Country	Within the Country	To Other Countries 15 02 02	To Other Countries 19 02 09

| PRTR#: W0184 | Facility Name : Enva Ireland Limited (Portlaoise) | Filename : Copy of W0184_2016.xls | Return Year : 2016 |

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			Quantity (Tonnes per Year)		- 	Met	Method Used		Haz Waste Name and Licence/Permit No of Next Destination Facility Haz Waste Name and Licence/Permit No of Recover/Disposer	<u>Haz Waste</u> - Address of Next Destination Facitity <u>Non Haz Waste</u> Address of RecoverDisposer	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination 1. Efinal Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
	European Waste		2		Waste Treatment			Location of	8			
Transfer Destination	n Code	Hazardous		Description of Waste	Operation M/C/E Method Used	A/C/E Me	thod Used	Treatment				
To Other Countries 08 03 12	08 03 12	Yes 'Sadact a row i	12.05 by double-clicking	es 5-4 ct a row by double-doking the Description of William dangerous substances A	R1	W	Veighed	Abroad	Recyfuel S.A.,320061080/RGPED/20 08/2/AP-PU	Recyfuel Recyfuel 82,320061080/ 82,320061080/RGPED/20 Noning Industriel d'Ehein,B- 42Hon 08/2/AP-PU Engis,Belgium Engis,Belgium	RGPED/200 19 Inustrial	Noning Inustrial d'Ehein,B- 4480 Engis,Belgium

Appendix 2



CONFIDENTIAL REPORT

Client Enva Ireland Ltd Clonminam Industrial Estate Portlaoise Co. Laois Attn. Mr. Kevin Coll

Title

Annual Environmental Noise Survey 2016 Enva Ireland Ltd. – Portlaoise EPA Waste Licence Reg. No. 184-1

Report Ref:	1659	Survey and Report by:	Frances Wright Trances Wand
Date recd:		Approved by:	Paddy Wright Paddy Ung St. BSc, PgDip ChemEng, CertOH
Copies to:		Date:	26 th January 2017

CONTENTS PAGE

1.	INTRODUCTION	3
2.	SUMMARY	4

3. MONITORING RESULTS AND DISCUSSION

APPENDIX I

Methodology

APPENDIX II

Instrumentation and External Calibration Details

APPENDIX III

Site Plan showing Noise Monitoring Positions

1. INTRODUCTION:

Enva Ireland Ltd. (Enva) operate a waste recovery facility at Clonminam Industrial Estate, Portlaoise which is licensed under the EPA Waste Licence (Reg. No. 184-1). Schedule D of the company's licence requires an annual Environmental Noise Survey to be undertaken.

At the request of Mr. Kevin Coll of Enva Ireland Ltd., Wright Environmental Services carried out this Noise Survey on the 24th November 2016.

This report presents and interprets the results of the survey with reference to the company's Waste Licence noise criteria. The methodology used for the survey is described in Appendix I. Instrumentation and calibration is described in Appendix II. Monitoring locations are shown in the site map in Appendix III.

2. SUMMARY

Enva are required by their EPA Waste Licence (Reg. No. 184-1) to have an annual Environmental Noise Survey undertaken. Wright Environmental Services carried out this survey on the 24th November 2016. Table 1 outlines the monitoring plan. Table 2 summarises the noise levels measured at each location and exams the results in relation to the noise criteria set the company's EPA Waste Licence.

The results for each sampling location passed the licence criteria. It is therefore concluded that Enva Ireland Ltd. are in compliance with the noise criteria set out in their EPA Waste Licence (Reg. No. 184-1).

Table 1

	N1 boundary location	N2 boundary location	N3 boundary location	N4 noise sensitive location	N5 abandoned noise sensitive location
Day Time Survey	3 sampling periods	3 sampling periods	3 sampling periods	3 sampling periods	3 sampling periods
Night Time Survey	2 sampling periods	2 sampling periods	2 sampling periods	2 sampling periods	2 sampling periods

Location	Leq Range	Leq Range	Dominant Noise Sources	Pass/Fail	Rational
	Day	Night			Licence criteria: 57dB(A) Daytime and 47dB(A) at Noise Sensitive Locations (NSL)
N1	52-55	43-44	Distant traffic, vehicle movement onsite (day)	Pass	Below the criteria noise levels
N2	54-56	48-49	Distant traffic, fan noise from neighbouring facility (night), vehicle movement onsite (day) and from neighbouring facility (day), onsite boiler (day)	Pass	Noise levels were below the criteria levels during the day. Examining the night levels, noise levels were above 47dB(A). However this limit is set for NSL (nearest NSL >250m). Using the inverse square law, noise levels (if attributable to onsite activity) would be reduced well below the limit over this distance. There was no noise audible from Enva at this point during the night survey.
N3	50-52	40-41	vehicle maintenance in train yard (day), distant traffic	Pass	Below the criteria noise levels
N4	50-54	39-40	Passing and distant traffic, industrial noise	Pass	Below the criteria noise levels. Enva not audible at this location
N5	52-54	42-43	Distant traffic, vehicle movement onsite (day)	Pass	Below the criteria noise levels

3. MONITORING RESULTS AND DISCUSSION:

Wright Environmental Services carried out the day and night Environmental Noise Survey. The monitoring locations are described below and are shown in the site map in Appendix III.

Location **N1**:Along the mid western site boundary.

Location N2: In the corner of the site, along the south eastern boundary
Location N3: In the corner of the site, along the north eastern boundary.
Location N4: Nearby residential area, east/south east of Enva, on the corner of Knockmay
Road and Marian Avenue. The railway yard is the main land use between Enva in this monitoring location.

Location N5:North west of Enva site, on the corner with access road for Rowan halting site (currently deserted). Note access to this point is now restricted, therefore monitoring was carried out at the barrier, blocking access to this point (see map in Appendix III).

The following "A-Weighted" data was determined for each discrete sampling period.

L eq	:	The equivalent continuous noise level for the measurement period.
		(This is defined as the sound level of a steady sound having the same energy
		as a fluctuating sound over the specified measuring period).
\mathbf{L}_{1}	:	The noise level exceeded for 1% of the measurement period.
		(This parameter gives a good indication of typical maximum levels.)
L 10	:	The noise level exceeded for 10% of the measurement period.
L 90	:	The noise level exceeded for 90% of the measurement period.
		(This is taken to represent the background noise level).

Detailed results are presented in the Tables below along with appropriate comments regarding noise in the monitoring environment.

Start Time t = 30mins	Leq (dBA)	L1 (dBA)	L10 (dBA)	L90 (dBA)	Comments	
17.05	55	61	57	49	Dominant Noise: distant traffic (particularly from the S/SW), vehicle movement onsite and in/out Enva	
17.05	55	01	57	49	Onsite Noise: forklift, 2 HGV in/out vehicle movement, low hum Offsite Noise: 3 trains and 3 cars pass nearby, distant traffic noise	
					Dominant Noise: distant traffic (particularly from the S/SW), vehicle movement onsite	
17.35	54	62	55	48	Onsite Noise: forklift, low hum	DAY
					Offsite Noise: 2 trains and 2 cars pass nearby, distant traffic noise	
					Dominant Noise: distant traffic (particularly from the S/SW)	
18.05	52	59	54	48	Onsite Noise: forklift, low hum	
					Offsite Noise: 2 trains and 2 cars pass nearby, distant traffic noise	
					Dominant Noise: distant traffic (particularly from the S/SW)	
23:26	43	49	44	40	Onsite Noise: occasional hum from the compressor near cardboard compactor	
					Offsite Noise: 1 train passes (slowly)	NIGHT
					Dominant Noise: distant traffic (particularly from the S/SW)	1,10111
23:56	44	51	46	41	Onsite Noise: occasional hum from the compressor near cardboard compactor	
					Offsite Noise: 1 train passes, HGV on idle beyond Emo Oil (approx. 5 mins)	

N1 - Monitoring Location

Start Time t = 30mins	Leq (dBA)	L ₁ (dBA)	L10 (dBA)	L19 (dBA)	Comments	
12:56	56	64	58	52	Dominant Noise: vehicle movement onsite and from neighbouring facility, onsite boiler Onsite Noise: forklift, vehicle movement, boiler	
					Offsite Noise: vehicle movement next door, distant traffic noise, construction noise from neighbours (west)	
					Dominant Noise: vehicle movement onsite and from neighbouring facility, onsite boiler	
13:29	55	63	58	51	Onsite Noise: forklift, vehicle movement, boiler	DAY
					Offsite Noise: vehicle movement next door, distant traffic noise, construction noise from neighbours (west)	
					Dominant Noise: vehicle movement onsite and from neighbouring facility, onsite boiler	
14:05	54	61	57	51	Onsite Noise: forklift, vehicle movement, boiler	
					Offsite Noise: vehicle movement next door, distant traffic noise, construction noise from neighbours (west)	
					Dominant Noise: fan noise in neighbouring facility, distant traffic	
22:00	49	53	51	47	Onsite Noise: No noise audible from Enva	
					Offsite Noise: fan noise in neighbouring facility, distant traffic	NIGHT
					Dominant Noise: fan noise in neighbouring facility, distant traffic	monn
22:30	48	52	50	47	Onsite Noise: No noise audible from Enva	
					Offsite Noise: fan noise in neighbouring facility, distant traffic, distant train	

N2 - Monitoring Location

Start Time t = 30mins	Leq (dBA)	L1 (dBA)	L10 (dBA)	L90 (dBA)	Comments	
13:12	52	59	54	46	Dominant Noise: vehicle maintenance in train yard (engine noise)	
15.12	54	39	54	40	Onsite Noise: forklift, vehicle movement (distant) Offsite Noise: vehicle maintenance in train yard (engine noise), 2 trains pass, distant traffic	
					Dominant Noise: vehicle maintenance in train yard (engine noise)	
13:42	52	58	53	45	Onsite Noise: forklift, vehicle movement (distant), talking/people movement	DAY
					Offsite Noise: vehicle maintenance in train yard (engine noise), 1 trains pass, distant traffic, plane passes overhead	
					Dominant Noise: vehicle maintenance in train yard (engine noise)	
14:14	50	58	53	44	Onsite Noise: forklift, vehicle movement (distant)	
					Offsite Noise: vehicle maintenance in train yard (engine noise), distant traffic	
					Dominant noise: Distant traffic noise.	
22:10	41	47	44	38	Onsite Noise: no noise audible from Enva.	
					Offsite Noise: Distant traffic noise	NIGHT
					Dominant noise: Distant traffic noise.	niom
22:40	40	44	42	37	Onsite Noise: no noise audible from Enva.	
					Offsite Noise: Distant traffic noise	

N3 - Monitoring Location

Start Time t = 30mins	L _{eq} (dBA)	L1 (dBA)	L10 (dBA)	L90 (dBA)	Comments							
18:51	54	63	57	46	Dominant Noise: passing traffic and distant traffic							
					Onsite Noise: No noise audible from Enva							
												Offsite Noise: approximately 35 cars pass, distant traffic
19:21	53	62	56	44	Dominant Noise: passing traffic and distant traffic							
					Onsite Noise: No noise audible from Enva	DAY						
					Offsite Noise: approximately 30 cars pass, distant traffic							
								Dominant Noise: passing traffic and distant traffic				
19:51	50	60	54	42	Onsite Noise: No noise audible from Enva							
					Offsite Noise: approximately 28 cars pass, distant traffic							
00:40	40	44	41	36	Dominant Noise: industrial noise to south and distant traffic							
					Onsite Noise: No noise audible from Enva							
					Offsite Noise: approximately 4 cars pass, distant traffic	NIGHT						
01:10	39	44	40	35	Dominant Noise: industrial noise to south and distant traffic	NIGITI						
					Onsite Noise: No noise audible from Enva							

N4 - Monitoring Location

Start Time t = 30mins	L _{eq} (dBA)	L ₁ (dBA)	L10 (dBA)	L90 (dBA)	Comments	
17.05		<i>c</i> 0		17	Dominant Noise: distant traffic (particularly from the S/SW), vehicle movement onsite and in/out Enva	
17.05	54	60	56	47	Onsite Noise: forklift, 2 HGV in/out vehicle movement, low hum	
					Offsite Noise: 3 trains and 3 cars pass nearby, distant traffic noise	
					Dominant Noise: distant traffic (particularly from the S/SW), vehicle movement onsite	
17.35	53	60	56	46	Onsite Noise: forklift, low hum	DAY
					Offsite Noise: 2 trains and 2 cars pass nearby, distant traffic noise	
					Dominant Noise: distant traffic (particularly from the S/SW)	
18.05	52	59	54	46	Onsite Noise: occationa	
					Offsite Noise: 2 trains and 2 cars pass nearby, distant traffic noise	
					Dominant Noise: distant traffic (particularly from the S/SW)	
23:26	42	48	43	40	Onsite Noise: occasional hum from the compressor near cardboard compactor	
					Offsite Noise: 1 train passes (slowly)	NIGHT
					Dominant Noise: distant traffic (particularly from the S/SW)	
23:56	43	49	45	40	Onsite Noise: occasional hum from the compressor near cardboard compactor	
					Offsite Noise: 1 train passes, HGV on idle beyond Emo Oil (approx. 5 mins)	

N5 - Monitoring Location

In accordance with their waste licence, Enva are required to comply with maximum noise limit values. Criterion noise levels are set for day and night time, for noise measured at Noise Sensitive Locations (NSLs). The criterion noise levels are presented in Schedule C of the licence as follows:

Day55dB(A) LAeq(30 minutes)Night45dB(A) LAeq(30 minutes)

Section 7.7.1 states that noise from the facility should not exceed this level by more than 2dB(A).

7.1.1 Noise from the activity shall not give rise to sound pressure levels (LAeq 30min) measured at noise sensitive locations which exceed the limit value(s) by more than 2dB(A).

Noise levels were below the limit values at N1,N3,N4 and N5. Noise levels were above the 47dB(A) during the night time survey at N4. This limit is set for noise sensitive location, the nearest of which is greater than 250m. Using the inverse square law (see Appendix I), noise levels (if attributable to onsite activity) would be reduced well below the limit over this distance. However there was no noise audible from Enva at this location during the night time survey. Therefor it is concluded that that noise levels measured at this location are in compliance with licence criteria.

Section 6.7 of the company's licence states that

"There shall be no clearly audible tonal component or impulsive component in the noise emissions from the activity at the noise sensitive locations."

The noise was examined at each of the monitoring locations to investigate the presence of tones. No tones were identified from Enva.

It is therefore concluded that Enva Ireland Ltd. are in compliance with the noise criteria set out in their EPA Waste Licence (Reg. No. 184-1).

APPENDIX I Methodology

METHODOLOGY

The methodology of the survey was based upon procedures set out in the International Standard, ISO 1996-2:2007 (Acoustics – description, measurement and assessment of environmental noise Part 2: Determination of Environmental Noise Levels.). The survey was carried out in accordance with EPA published document (*NG4*) Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities.

Environmental noise levels were determined by using a Pulsar Model 33, Type 1 Real Time Sound Level Meter, with half inch condenser microphone and B&K Type 2250 Light, Type 1 Real Time Sound Level Meter, with half inch condenser microphone. The instrumentation was calibrated directly before and after the noise measurements. Details of the instrumentation and external calibration are presented in Appendix II of this report.

Results reported were determined using the fast response, A-Weighting (ref. 20 μ Pa) and are rounded off to the nearest whole decibel. Monitoring was conducted in relatively calm, dry weather conditions during the day (08:00 – 22:00) and night (22:00 – 08:00). Throughout the monitoring, the microphone was situated 1.5 m above ground level, away from any reflective surfaces. The monitoring equipment was manned throughout the sampling intervals and comments were recorded in order to aid the interpretation of the results.

During the survey air temperature and humidity measurements were undertaken using a Delta Ohm Hygrometer HD 8501 H. Wind speed measurements were taken using a TSI VelociCalc and the wind direction was noted using a compass. Details of the weather conditions are presented in the Table below.

Date/Time	Air Temperature °C	Relative Humidity %	Wind Direction	Wind Speed m/s	General Conditions
24 th November 2017 15:00	8	63	NE	4.2	Dry – no precipitation.
24 th November 2017 23:30	6	76	ENE	4.1	Dry – no precipitation.

Summary of Weather Conditions

The Inverse Square Law can be used to calculate the expected reduction in noise levels as one moves away from a given noise source, which is assumed to radiate uniformly in all directions. The Inverse Square Law states that as one doubles the distance from a source, a reduction of 6 dB is achieved as follows:

$$L_{p2} = L_{p1} - 20 \text{ Log} (^{R2}/_{R1})$$

where:

- L_{p1} is the measured reference Sound Pressure Level (SPL) at a distance of R1 metres from the source.
- L_{p2} is the calculated SPL at a distance of R2 metres from the source.

APPENDIX II

Instrumentation and External Calibration Details

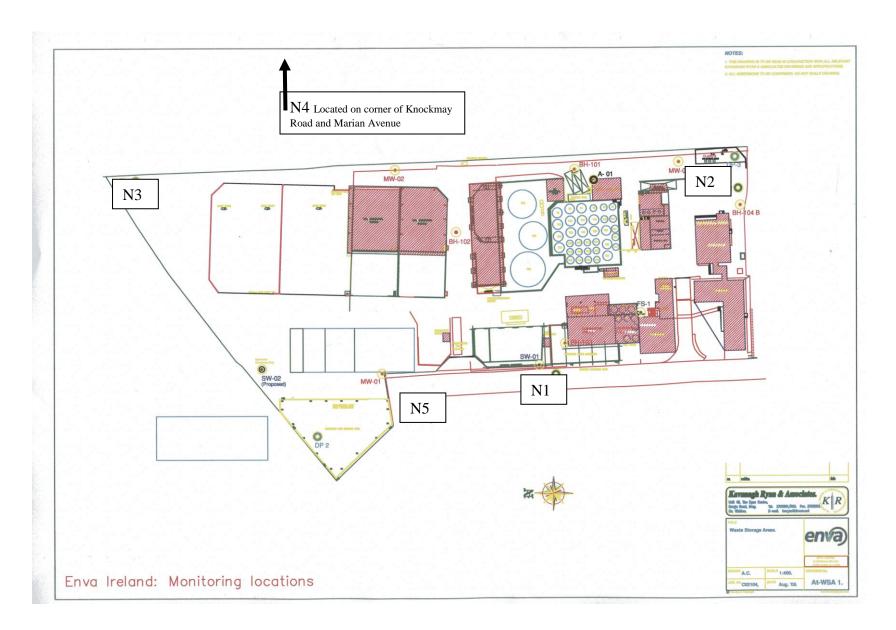
and the second		Equipment Det	aile		
Instrument Manufactu	uper Pulsar Instruments	and the second	ans		
Instrument Type	Model 100B	1			
Description	Acoustic Calibrat	or			
Serial Number	42171				
manual. The procedure – Sound Calibrators II applicable The calibr	r detailed above has b es and techniques used C 60942:2003, IEC 6 ator's main output is 9	d to follow the recor 0942:1997, BS EN 94.00 dB (1 Pa) and	published da mendations 50942:1998 a this was set w	ata as described in the op of the IEC standard Elec and BS EN 60942:2003 ithin the 0.01 dB resolu the paragraph in IEC 60	troacoustics where tion of the
	vas calibrated against		atory standar	ds held by Cirrus Resea	rch plc.
These are traceable to Microphone Type		Is {A.0.6}. The stand Serial Number	lards are: 19207921	Calibration Ref.	S6450
Pistonphone Type		Serial Number	613843	Calibration Ref.	S6388
Static Pressure Ambient Noise Level	{B.3.: {B.3.:		d band 85 kP mitted level (
		Measurement R	esults		
The figures below are than those permitted in		atory test limits for i	his model ca	librator and have a sma	ller toleranc
94 dB Output	94.02 dB	Permitted band		93.95 to 94.05dB	
104 dB Output	103.98 dB	Permitted band		103.80 to 104.30dB	
Frequency	995.1 Hz	Permitted band		990 to 1010Hz	
	m :	Uncertainty			
	efficient of $k=2$, i.e. a $\pm 0.13 \text{ dB}$	95% confidence le 104 dB		tainty of each measure $\pm 0.14 \text{ d}$	
94 dB Output	±0.13 dB	Level S		$\pm 0.14 d$ $\pm 0.04 d$	
Frequency	±0.1 HZ	Levers		± 0.04 0	
Calibrated by		1	M.B	ERRY	
Calibration Date		10	February 20	15	
Calibration Certificate			5813		

Pistonphone Type B&K 4220 Serial Number 613843 Calibration Re Calibrated by M. BERAY Calibration Date 10 February 2015 Calibration Certificate Number 225812 This Calibration Certificate is valid for 24 months from the date above. Pulsar Instruments plc, The Evron Centre, John Street, Filey, North Yorkshire, YOU				
Description Sound Level Meter Serial Number T223417 Calibration Procedure The instrument detailed above has been calibrated to the publish test and calibration data as de instrument hand book, using the techniques recommended in the latest revisions of the Internate IEC 61672-1:2002, IEC 60651:1979, IEC 60804:2001, IEC 61260:1995, IEC 60942:1997, IEC ANSI S1.4-1983, ANSI S1.11-1986 and ANSI S1.43-1997 where applicable. Sound Level Meters: All Calibration procedures were carried out by substituting the micropho suitable electrical signal, apart from the final acoustic calibration. Calibration Traceability The equipment detailed above was calibrated against the calibration laboratory standards held to plc. These are traceable to International Standards {A.0.6}. The standards are: Microphone Type B&K 4192 Serial Number 19207921 Calibration Re Pistonphone Type B&K 4220 Serial Number 19207921 Calibration Re Calibration Date 10 February 2015 225812 This Calibration Certificate is valid for 24 months from the date above. Pulsar Instruments plc, The Evron Centre, John Street, Filey, North Yorkshire, YOU		plc	urer Pulsar Instrument	Instrument Manufact
Serial Number T223417 Calibration Procedure The instrument detailed above has been calibrated to the publish test and calibration data as de instrument hand book, using the techniques recommended in the latest revisions of the Internate EC 61672-1:2002, IEC 60651:1979, IEC 60804:2001, IEC 61260:1995, IEC 60942:1997, IEC ANSI S1 A-1983, ANSI S1 A-1986 and ANSI S1 A-3-1997 where applicable. Sound Level Meters: All Calibration procedures were carried out by substituting the micropho suitable electrical signal, apart from the final acoustic calibration. Calibration Traceability The equipment detailed above was calibrated against the calibration laboratory standards held to be. These are traceable to International Standards {A.0.6}. The standards are: Microphone Type B&K 4192 Serial Number 19207921 Calibration Re Pistonphone Type B&K 4220 Serial Number 19207921 Calibration Re Calibrated by In February 2015 225812 Calibration Date 10 February 2015 Calibration Certificate Number 225812 This Calibration Certificate is valid for 24 months from the date above. Pulsar Instruments plc, The Evron Centre, John Street, Filey, North Yorkshire, YOU			Model 33	instrument Type
Calibration Procedure Calibration Procedure Che instrument detailed above has been calibrated to the publish test and calibration data as de nstrument hand book, using the techniques recommended in the latest revisions of the Internate EC 61672-1:2002, IEC 60651:1979, IEC 60804:2001, IEC 61260:1995, IEC 60942:1997, IEC ANSI S1 4-1983, ANSI S1 1.1-1986 and ANSI S1 4.3-1997 where applicable. Sound Level Meters: All Calibration procedures were carried out by substituting the micropho suitable electrical signal, apart from the final acoustic calibration. Calibration procedures were carried out by substituting the micropho suitable electrical signal, apart from the final acoustic calibration. Calibration procedures were carried out by substituting the micropho suitable electrical signal, apart from the final acoustic calibration. Calibration Proceedures Microphone Type B&K 4192 Serial Number 19207921 Calibration Re Pistonphone Type B&K 4220 Serial Number 613843 Calibration Re Calibrated by I0 February 2015 225812 Calibration Certificate Number 225812 This Calibration Certificate is valid for 24 months from the date above. Pulsar Instruments plc, The Evron Centre, John Street, Filey, North Yorkshire, YOU			Sound Level Met	Description
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blc. These are traceable to International Standards {A.0.6}. The standards are: Microphone Type B&K 4192 Serial Number 19207921 Calibration Re Pistonphone Type B&K 4220 Serial Number 613843 Calibration Re Calibrated by M. BERAY Calibration Date 10 February 2015 Calibration Certificate Number 225812 This Calibration Certificate is valid for 24 months from the date above. Pulsar Instruments plc, The Evron Centre, John Street, Filey. North Yorkshire YOL	<i>c</i> : n 1			m · · · · ·
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Pulsar Instruments plc, The Evron Centre, John Street, Filey, North Yorkshire, YOL			te Number	Calibration Certifica
Pulsar Instruments plc, The Evron Centre, John Street, Filey, North Yorkshire, YO14		cate is valid for 24 months from the date above.	This Calibration Cert	
Email: sales@pulsarinstruments.com	4 9DW	0) 1723 518011 Fax: +44 (0) 1723 518043	Telephone: +44	Pulsar In:

Brüel & Kjæ The Calibration Laboratory Skodsborgvej 307, DK-2850 Nærun		No: CDK1331010	CAL Reg Nr. 307 Page 1 of 10
Sound Level Meter:	Brüel & Kjær Type 2250 Lig	ght No: 30	01350 Id: -
Microphone:	Brüel & Kjær Type 4950	No: 27	78447
Preamplifier:	Brüel & Kjær Type ZC-0032	No: 16	741
Supplied Calibrator:	None		
Software version:	BZ7130 Version 3.5.1	Pattern Approval:	PENDING
Instruction manual:	BE-1774-14	- The second sec	
CUSTOMER			
	Enfonic Ltd Tecpro House, IDA Business & Technolog Clonshaugh Dublin 17 Ireland	y Park, Clonshaugh	
CALIBRATION CO Preconditioning: Environment conditions: SPECIFICATIONS	4 hours at 23°C ± 3°C See actual values in Environmental condition		
IEC61672-1:2002 class 1.1	iel & Kjær Type 2250 Light has been calibrat procedures from IEC 61672-3:2006 were used in international units system S1.	ed in accordance with the requ to perform the periodic tests.	irements as specified in The accreditation
	en performed with the assistance of Brüel & k 763 (version 4.9 - DB: 4.90) by using procedu		ration System 3630 with
RESULTS			
The reported expanded unc of confidence of approxima	tion after repair/adjustment. ertainty is based on the standard uncertainty n tely 95 %. The uncertainty evaluation has bee he standards, calibration method, effect of en- ration.	n carried out in accordance wi	th EA-4/02 from
Date of calibration	: 2014-10-10	Date of issue: 2014-10	0-10
	önder kail Önder	Jonas Joha	nnessen
	tion Technician	Approved S	
Reproduction of the complete certifi	cate is allowed. Parts of the certificate may only be repro	duced after written permission	

APPENDIX III

Site Plan showing Noise Monitoring Positions



Appendix 3



Unit 5 Caherdavin Business Centre, Ennis Road, Limerick.

Enva (Ireland) Limited Clonminam Industrial Estate, Portlaoise, County Laois, Laois.

Bund Integrity Report 2015

Waste Licence Number: W0184-01

Report Reference Number: Version: Date of Issue: **Report Compiled by:**

3520-15-01 2 03-09-2015 Mark McGarry

1.0 Introduction

Enva (Ireland) Limited, Clonminam Industrial Estate, Portlaoise, Co. Laois are required as part of Waste Licence number W0184-01, Condition 3.13.5 and Schedule E to have their bunds tested for the protection of ground and surface water.

The bunds were tested in accordance with BS 8007: Design of Concrete Structures for Retaining Aqueous Liquids and documented guidance from the EPA entitled Storage and Transfer of Materials for Scheduled Activities.

The test was carried out in two stages, firstly to inspect the bund visually for cracks, weak spots or if the bund required any remedial work. The integrity of the bund was then tested for water tightness over a 72 hour period. The reduced timeframe from the BS 8007 standard for testing was applied as the bunds were in use and were required for the operation of the site.

2.0 Licence Conditions

The following conditions have been taken from the current licence applicable to this site:

- 3.12.5 The drainage system, bunds, silt traps and oil separators shall be inspected weekly, desludged as necessary and properly maintained at all times. All sludge and drainage from these operations shall be collected for safe disposal. A written record shall be kept of the inspections, desludging, cleaning, disposal of associated waste products, maintenance and performance of the interceptors, bunds and drains.
- 3.13.2 All tank and drum storage areas shall, as a minimum, be bunded, either locally or remotely, to a volume not less than the greater of the following:
 - a) 110% of the capacity of the largest tank or drum within the bunded area; orb) 25% of the total volume of substance which could be stored within the bunded area
- 3.13.5 The integrity and water tightness of all the bunds and their resistance to penetration by water or other materials stored therein shall be confirmed by the licensee and shall be reported to the Agency within 12 months of the date of grant of this licence. This confirmation shall be repeated at least once every three years thereafter and reported to the Agency on each occasion

3.0 Summary of Methodology

A visual inspection was carried out on the bund to determine if there were any cracks, fissures or unacceptable surface continuity between the bund walls.

The hydrostatic test was completed by filling the bund to a fill level using clean water, in line with the procedure outlined in BS8007:1987. Liquid levels were allowed to stabilise for 24 hours. After stabilisation a depth reading was recorded and marked at a preset suitable location. The water level was re-recorded after remaining in the bund for 72 hours.

A water level meter was placed in situ to determine the impact of rainfall and evaporation in the bund. When this statistic was accounted for the bund was verified as passed or failed in line with the criteria set out in the standard.

4.0 Summary of Results

Bund Identity	Pass / Fail	Comments
Bund 1 Section A	Pass	This storage area is too large to complete a hydrostatic test. The building was split into 3 sections to allow for movement of material in order to complete visual assessments thoroughly. The bund was deemed to pass the visual inspection.
Bund 2		This bund passed the Hydrostatic Integrity test and had sufficient storage volume to meet the licence requirements
Bund 5 Section 1		This bund passed the Hydrostatic Integrity test and had sufficient storage volume to meet the licence requirements
Bund 6		This bund passed the Hydrostatic Integrity test and had sufficient storage volume to meet the licence requirements
Bund 8		This bund passed the Hydrostatic Integrity test and had sufficient storage volume to meet the licence requirements

Project Manager	KQ. LOCary	Date of Report	07-07-2015
Client	Enva Ireland Limited	Contact	Kevin Coll

Bund Number 5 Section 1

Company	ENVA Ireland	Waste Reference No	W0184-01
Site	Clonminam Industrial Estate Portlaoise	Waste Category	Hazardous Waste Facility
Bund Reference No	Bund 5 (Section 1)	Bund Type: Local/ Remote / Combined	Local
Bund Location	Storage Area	Bund Risk Classification: 0, 1, 2, 3	2
Bund Dimensions	4210 x 8280 x 220mm	Primary Vessel Material	Steel Tanks
Bund Materials of Construction	Reinforced Concrete	Primary Vessel Storage Volume	c. 13m ³ full
Bund Lining materials	N.a	Primary Vessel 110% Largest Vessel	14.3 m ³
Bund Retention Volume (local/ Remote)	76 m ³ (Local)	Primary Vessel 25% Total Volume	-
Practical to Conduct Hydrostatic Test	Yes	Date of Visual Inspection	11-06-2015
Visual Description:			

Visual inspection was carried out on the walls, joints and floor both internally and externally. The walls and floors were deemed acceptable and therefore the bund passed through to the hydrostatic test. Water was filled to a height of 125mm from the floor of the bund – this bund could not be filled much higher due to the risk of damage to in line equipment and damage to the storage vessel controls. A visual inspection was completed on the remainder of the bund walls which has not been submerged for the test. There were no cracks, fissures or weak spots identified above the water line with the exception of a pipe connected through the wall. The seals around the pipe are finished and deemed appropriate to retain water. This pipe is above the level of water in the tank and therefore did not form part of the hydrostatic test but has been deemed to pass the visual inspection.

Date Bunds Filled	11-06-2015	Date of Hydrostatic Test	12 to 15-06-15
Start Time	10:00	End Time	11:00
Start Level of Water	125 mm	End of Test Level of Water	124 mm
Status & Recommendations:			

• Bund Passes Hydrostatic Test to the level of water filled.

• Hydrostatic retest required in 2018 unless bund is damaged or repaired in the meantime.

Notes:

Signed: 10.00mg	Date: 07-07-2015	Title: Project Manager
Signed: Noel Harrington	Date: 07-07-2015	Title: Chartered Engineer

Bund Number 6

Company	ENVA Ireland	Waste Refe	erence No	W0184-01	
Site	Clonminam Industrial Estate Portlaoise	Waste Cate	egory	Hazardous Waste Facility	
Bund Reference No	Bund 6	Bund Type Local/ Ren	: note / Combined	Local	
Bund Location	Effluent Discharge Tank	Bund Risk 0, 1, 2, 3	Classification:	1	
Bund Dimensions	1200 x 410 x 144mm	Primary Ve	essel Material	Steel Tanks	
Bund Materials of Construction	Reinforced Concrete	Primary Ve Volume	essel Storage	c. 130 m ³ full	
Bund Lining materials	N.a	Primary Ve Largest Ve		55 m ³	
Bund Retention Volume (local/ Remote)	71 m ³ (Local)	Primary Ve Volume	essel 25% Total	32.5 m ³	
Practical to Conduct Hydrostatic Test	Yes	Date of Vis	ual Inspection	11-06-2015	
Visual Description:					
Visual inspection was carried out on were deemed acceptable and there 92 mm from the floor of the bund – t	ore the bund passed through t	o the hydrost	atic test. Water was	filled to a height of	
A visual inspection was completed There were no cracks, fissures or v through the wall. The seals around t level of water in the tank and therefor inspection.	veak spots identified above the he pipe are finished and deeme	e water line v ed appropriate	with the exception of e to retain water. Thi	a pipe connected s pipe is above the	
The bund is fitted with a screw cork	to allow for emptying purpose -	- this connect	ion was included in th	ne hydrostatic test.	
Date Bunds Filled	11-06-2015 D a	ate of Hydros	static Test	12 to 15-06-15	
Start Time	10:35 Er	nd Time		11:05	
Start Level of Water	92 mm Er	nd of Test Le	vel of Water	91 mm	
Status & Recommendations:					
 Bund Passes Hydrostatic Test to the level of water filled. Hydrostatic retest required in 2018 unless bund is damaged or repaired in the meantime. 					
Notes:					
Low Risk - WGK 0 or 1 High Risk – WGK 2 or 3 R45, R46, I	R50, R51, R52, R53, R54, R55,	, R56, R58, R	61, R63		
Signed: Alectory	Date: 07-07-201	15	Title: Proje	ct Manager	
Signed: Noel Harrington	Date: 07-07-201	15	Title: Charte	red Engineer	

Bund Number 1 Section 1 of 3

Note: This store was sectioned into 3 parts for this visual inspection. The reason for only completing 1/3rd of the building was to allow for stored materials to be moved into the other sections leaving one completely free for visual observation. There were no materials in this section for the visual observation therefore allowing a complete and comprehensive assessment of the section. This store is far too large of floor area to be deemed suitable for a hydrostatic test.

Company	ENVA Ireland	Waste Refe	erence No	W0184-01		
Site	Clonminam Industrial Estate Portlaoise	Waste Cate	egory	Hazardous Waste Facility		
Bund Reference No	Bund 1 Section 1	Bund Type Local/ Rem	: note / Combined	Local		
Bund Location	Export Storage	Bund Risk 0, 1, 2, 3	Classification:	2		
Bund Dimensions	c. 322 m ² for Section 1		ssel Material	IBC's, Plastic and Metal Barrells		
Bund Materials of Construction	Reinforced Concrete	Primary Ve Volume	ssel Storage	Variable – max 100 m ³		
Bund Lining materials	N.a	Primary Ve Largest Ve		1.1 m ³		
Bund Retention Volume (local/ Remote)	Total c. 57 m ³ (Local)	Primary Ve Volume	ssel 25% Total	25 m ³		
Practical to Conduct Hydrostatic Test	No	Date of Vis	ual Inspection	11-06-2015		
Visual Description:						
Visual inspection was carried out of with this section would be 22mm. volume of this export store was calco	Above this level liquid would					
A visual inspection was completed on section 1 of the store floor, joints and walls. There were no significant cracks, fissures or weak spots identified. There was evidence of weak surface concrete in places however this did not constitute a failure of visual inspection as they were very minor.						
Date Bunds Filled	N/a Da	te of Hydros	tatic Test	N/a		
Start Time	N/a En	nd Time		N/a		
Start Level of Water	N/a En	d of Test Le	vel of Water	N/a		
Status & Recommendations:						
 Bund Section 1 passed the visual inspection. This should be inspected every three years or in the event of damage caused as per the licence requirement. 						
Notes:						
Low Risk - WGK 0 or 1 High Risk – WGK 2 or 3 R45, R46, F	R50, R51, R52, R53, R54, R55,	R56, R58, R	61, R63			
Signed: Actor	Date: 07-07-201	5	Title: Proje	ct Manager		
Signed: Noel Harrington	Date: 07-07-201	5	Title: Charter	red Engineer		

Bund Number 2

Company	ENVA Ireland	Waste Reference No	W0184-01			
Site	Clonminam Industrial Estate Portlaoise	Waste Category	Hazardous Waste Facility			
Bund Reference No	Bund 2	Bund Type: Local/ Remote / Combined	Local & Remote			
Bund Location	Mixed Fuels Bay	Bund Risk Classification: 0, 1, 2, 3	3			
Bund Dimensions	8680 x 8260 x avg 220mm	Primary Vessel Material	IBC, Plastic and Steel Barrels			
Bund Materials of Construction	Reinforced Concrete	Primary Vessel Storage Volume	Variable max 50 m³ full			
Bund Lining materials	N.a	Primary Vessel 110% Largest Vessel	1.1 m ³			
Bund Retention Volume (local/ Remote)	15 m ³ (Local)	Primary Vessel 25% Total Volume	12 m ³			
Practical to Conduct Hydrostatic Test	Yes	Date of Visual Inspection	11-06-2015			
Visual Description:						
	Visual inspection was carried out on the walls and floor both internally and externally of the bund. The walls, joints and floors were deemed acceptable and therefore the bund passed through to the hydrostatic test. Water was filled to a					

A visual inspection was completed on the remainder of the bund walls which has not been submerged for the test. There were no cracks, fissures or weak spots identified above the water line with the exception of a bung connected through the wall to another bund. This bung was below the level of water in the bund and therefore did form part of the hydrostatic test.

Date Bunds Filled	11-06-2015	Date of Hydrostatic Test	12 to 15-06-15
Start Time	10:55	End Time	11:10
Start Level of Water	161 mm	End of Test Level of Water	159 mm

Status & Recommendations:

height of 161 mm from the floor of the bund.

- Bund Passes Hydrostatic Test to the level of water filled.
- Hydrostatic retest required in 2018 unless bund is damaged or repaired in the meantime.

Notes:

Signed: 10.00mg	Date: 07-07-2015	Title: Project Manager
Signed: Noel Harrington	Date: 07-07-2015	Title: Chartered Engineer

Bund Number 8

Company	ENVA Ireland	Waste Reference No	W0184-01
Site	Clonminam Industrial Estate Portlaoise	Waste Category	Hazardous Waste Facility
Bund Reference No	Bund 8	Bund Type: Local/ Remote / Combined	Local
Bund Location	Chemical Dosing Area	Bund Risk Classification: 0, 1, 2, 3	2
Bund Dimensions	6260 x 5190 x 1020mm	Primary Vessel Material	Steel Tanks
Bund Materials of Construction	Reinforced Concrete	Primary Vessel Storage Volume	20 m ³ full
Bund Lining materials	N.a	Primary Vessel 110% Largest Vessel	11 m ³
Bund Retention Volume (local/ Remote)	33 m ³ (Local)	Primary Vessel 25% Total Volume	5 m ³
Practical to Conduct Hydrostatic Test	Yes	Date of Visual Inspection	11-06-2015
Visual Description:			

Visual inspection was carried out on the walls, joints and floor both internally and externally of the bund. The walls, joints and floors were deemed acceptable and therefore the bund passed through to the hydrostatic test. Water was filled to a height of 64 mm from the floor of the bund. There was electrical equipment in the bund restricting the height of the hydrostatic test to this level.

A visual inspection was completed on the reminder or the wall which was not submerged. There were no cracks, fissures or weak spots identified above the water line. The hydrostatic test was completed and passed.

Date Bunds Filled	11-06-2015	Date of Hydrostatic Test	12 to 15-06-15
Start Time	11:20	End Time	11:20
Start Level of Water	64 mm	End of Test Level of Water	64 mm

Status & Recommendations:

- Bund Passes Hydrostatic Test to the level of water filled.
- Hydrostatic retest required in 2018 unless bund is damaged or repaired in the meantime.

Notes:

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Low Risk - WGK 0 or 1
High Risk – WGK 2 or 3 R45, R46, R50, R51, R52, R53, R54, R55, R56, R58, R61, R63
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Signed: 10.00mg	Date: 07-07-2015	Title: Project Manager
Signed: Noel Harrington	Date: 07-07-2015	Title: Chartered Engineer



Unit 5 Caherdavin Business Centre, Ennis Road, Limerick.

Enva (Ireland) Limited Clonminam Industrial Estate, Portlaoise, County Laois, Laois.

Bund Integrity Report 2015

Waste Licence Number: W0184-01

Report Reference Number: Version: Date of Issue: **Report Compiled by:**

3520-15-02 4 03-09-2015 Mark McGarry

1.0 Introduction

Enva (Ireland) Limited, Clonminam Industrial Estate, Portlaoise, Co. Laois are required as part of Waste Licence number W0184-01, Condition 3.13.5 and Schedule E to have their bunds tested for the protection of ground and surface water.

The bunds were tested in accordance with BS 8007: Design of Concrete Structures for Retaining Aqueous Liquids and documented guidance from the EPA entitled Storage and Transfer of Materials for Scheduled Activities.

The test was carried out in two stages, firstly to inspect the bund visually for cracks, weak spots or if the bund required any remedial work. The integrity of the bund was then tested for water tightness over a 24 hour period. The reduced timeframe from the BS 8007 standard for testing was applied as the bunds were in use and were required for the operation of the site.

2.0 Licence Conditions

The following conditions have been taken from the current licence applicable to this site:

- 3.12.5 The drainage system, bunds, silt traps and oil separators shall be inspected weekly, desludged as necessary and properly maintained at all times. All sludge and drainage from these operations shall be collected for safe disposal. A written record shall be kept of the inspections, desludging, cleaning, disposal of associated waste products, maintenance and performance of the interceptors, bunds and drains.
- 3.13.2 All tank and drum storage areas shall, as a minimum, be bunded, either locally or remotely, to a volume not less than the greater of the following:
 - a) 110% of the capacity of the largest tank or drum within the bunded area; orb) 25% of the total volume of substance which could be stored within the bunded area
- 3.13.5 The integrity and water tightness of all the bunds and their resistance to penetration by water or other materials stored therein shall be confirmed by the licensee and shall be reported to the Agency within 12 months of the date of grant of this licence. This confirmation shall be repeated at least once every three years thereafter and reported to the Agency on each occasion

3.0 Summary of Methodology

A visual inspection was carried out on the bund to determine if there were any cracks, fissures or unacceptable surface continuity between the bund walls.

The hydrostatic test was completed by filling the bund to a fill level using clean water, in line with the procedure outlined in BS8007:1987. Liquid levels were allowed to stabilise for 24 hours. After stabilisation a depth reading was recorded and marked at a preset suitable location. The water level was re-recorded after remaining in the bund for 24 hours.

A water level meter was placed in situ to determine the impact of rainfall and evaporation in the bund. When this statistic was accounted for the bund was verified as passed or failed in line with the criteria set out in the standard.

4.0 Summary of Results

Bund Identity	Pass / Fail	Comments
Area 7 – Water Treatment	Pass	This bund passed the Hydrostatic Integrity test and had sufficient storage volume to meet the licence requirements
Bund 4 Sump	Pass	This sump passed the Hydrostatic Integrity test.
Bund 4	Pass	This bund passed the visual inspection. It was not deemed practical to complete a hydrostatic test in this bund due to the size of floor area that needed to be covered and large volumes of water required.

Project Manager	KQ. LOCary	Date of Report	12-08-2015
Client	Enva Ireland Limited	Contact	Kevin Coll

Water Treatment Area 7

Company	ENVA Ireland	Waste Reference No	W0184-01	
Site	Clonminam Industrial Estate Portlaoise	Waste Category	Hazardous Waste Facility	
Bund Reference No	Area 7	Bund Type: Local/ Remote / Combined	Local	
Bund Location	Wastewater treatment area	Bund Risk Classification: 0, 1, 2, 3	2	
Bund Dimensions	1112 x 1153 x 220mm	Primary Vessel Material	Steel Tanks	
Bund Materials of Construction	Reinforced Concrete	Primary Vessel Storage Volume	c. 20m ³ full	
Bund Lining materials	N.a	Primary Vessel 110% Largest Vessel	22 m ³	
Bund Retention Volume (local/ Remote)	28 m ³ (Local)	Primary Vessel 25% Total Volume	5 m ³	
Practical to Conduct Hydrostatic Test	Yes	Date of Visual Inspection	20-07-2015	
Visual Description:				
Visual inspection was carried out on the walls, joints and floor both internally and externally. The walls and floors were deemed acceptable and therefore the bund passed through to the hydrostatic test. Water was filled to a height of 99mm from the floor of the bund – this bund could not be filled much higher due to the risk of damage to in line equipment and damage to the storage vessel controls. A visual inspection was completed on the remainder of the bund floor and walls which has not been submerged for the test. There were no cracks, fissures or weak spots identified above the water line with the exception of a pipe connected through the wall. The seals around the pipe are finished and deemed appropriate to retain water. This pipe is above the level of water in the tank and therefore did not form part of the hydrostatic test but has been deemed to pass the visual inspection. The bund floor is sloped and raised in the middle – numerous measurements were made across the bund to get an overview of the entire structure.				
Date Bunds Filled	17-07-2015 D	ate of Hydrostatic Test	20 - 21-07-15	
Start Time	10:30 E	nd Time	11:00	
Start Level of Water	Side 1 99 mm E Side 2 104 mm	nd of Test Level of Water	Side 1 98 mm Side 2 104 mm	
Status & Recommendations:				
		ostatic Test to the level of water fill equired in 2018 unless bund is dar		
Notes:				
Low Dick WCK 0 or 1				

Low Risk - WGK 0 or 1 High Risk – WGK 2 or 3 R45, R46, R50), R51, R52, R53, R54, R55, R56, R58, R	.61, R63
Signed: And Chang	Date: 12-08-2015	Title: Project Manager
Signed: Noel Harrington	Date: 12-08-2015	Title: Chartered Engineer

Signed: 10.200	Date: 12-08-20	15	Title: Proje	ect Manager
Notes: Low Risk - WGK 0 or 1 High Risk – WGK 2 or 3 R45, R46, R50, R51, R52, R53, R54, R55, R56, R58, R61, R63				
 Sump Passes Hydrostatic Test to the level of water filled. Hydrostatic retest required in 2018 unless bund is damaged or repaired in the meantime. 				
Status & Recommendations:				
Start Level of Water	1570 mm E	570 mm End of Test Level of Wa		1569 mm
Start Time	10:00 E	b:00 End Time		11:10
Date Bunds Filled	17-07-2015 E	ate of Hydros	static Test	20 - 21-07-15
Visual Description: Visual inspection was carried out of limited visual inspection that could a height of 1570 mm from the floor of	be carried out. The sump pass			
Practical to Conduct Hydrostatic Test	Yes	Date of Vis	ual Inspection	20-07-2015
Bund Retention Volume (local/ Remote)	20 m ³ (Local)	Primary Ve Volume	essel 25% Total	-
Bund Lining materials	N.a	Primary Ve Largest Ve		-
Bund Materials of Construction	Reinforced Concrete	Primary Ve Volume	essel Storage	-
Bund Dimensions	1840 x 6060 x 1790mm	Primary Ve	essel Material	Filter Press
Bund Location	Filter Press	Bund Risk 0, 1, 2, 3	Classification:	1
Bund Reference No	Bund 4 – Sump under Filter Press	Bund Type Local/ Ren	: note / Combined	Local
Site	Clonminam Industrial Estate Portlaoise	Waste Cate	egory	Hazardous Waste Facility
Company	ENVA Ireland	Waste Refe	erence No	W0184-01

Bund Number 4 – Sump under Filter Press

Bund Number 4 – Filter Press

with this section would be 250mn 155m ²) that is was not deemed pra means of emptying and disposal of put out of commission while the tes A visual inspection was completed	 Above this level liquid would actical to conduct a hydrostatic t this liquid afterwards and the si 	Bund Risk 0, 1, 2, 3 Primary Ve Volume Primary Ve Largest Ve Primary Ve Volume Date of Vis	egory : note / Combined Classification: essel Material essel Storage essel 110% essel essel 25% Total eual Inspection ernally. The maxim bund lip. The bun evolumes of water r	id was so large (c. required, the limited
Bund Reference No Bund Location Bund Dimensions Bund Dimensions Bund Materials of Construction Bund Lining materials Bund Retention Volume (local/ Remote) Practical to Conduct Hydrostatic Test Visual Description: Visual inspection was carried out of with this section would be 250mm 155m ²) that is was not deemed pra means of emptying and disposal of put out of commission while the test	Portlaoise Bund 4 – Bund Surrounding Filter Press Filter Press 18180 x 8540 x 250mm Reinforced Concrete N.a 38.8 m ³ (Local) No on the walls and floor both inter Above this level liquid would rotical to conduct a hydrostatic t this liquid afterwards and the si	Bund Type Local/ Rem Bund Risk 0, 1, 2, 3 Primary Ve Volume Primary Ve Largest Ve Primary Ve Volume Date of Vis	c Iassification: Classification: essel Material essel Storage essel 110% essel 25% Total eual Inspection ernally. The maxim bund lip. The bun evolumes of water r	Waste Facility Local 2 Filter Press - - 20-07-2015 um retention height d was so large (c. equired, the limited
Bund Location Bund Dimensions Bund Materials of Construction Bund Lining materials Bund Lining materials Bund Retention Volume (local/ Remote) Practical to Conduct Hydrostatic Test Visual Description: Visual inspection was carried out of with this section would be 250mm 155m ²) that is was not deemed pra- means of emptying and disposal of put out of commission while the test A visual inspection was completed	Filter Press Filter Press 18180 x 8540 x 250mm Reinforced Concrete N.a 38.8 m ³ (Local) No on the walls and floor both inter h. Above this level liquid would totical to conduct a hydrostatic t this liquid afterwards and the si	Local/ Rem Bund Risk 0, 1, 2, 3 Primary Ve Primary Ve Volume Primary Ve Largest Ve Primary Ve Volume Date of Vis	note / Combined Classification: essel Material essel Storage essel 110% essel essel 25% Total eual Inspection ernally. The maxim e bund lip. The bun e volumes of water r	2 Filter Press - - - 20-07-2015 um retention height id was so large (c. equired, the limited
Bund Dimensions Bund Materials of Construction Bund Lining materials Bund Retention Volume (local/ Remote) Practical to Conduct Hydrostatic Test Visual Description: Visual inspection was carried out of with this section would be 250mm 155m ²) that is was not deemed pra means of emptying and disposal of put out of commission while the test A visual inspection was completed	18180 x 8540 x 250mm Reinforced Concrete N.a 38.8 m ³ (Local) No on the walls and floor both inter b. Above this level liquid would retical to conduct a hydrostatic t this liquid afterwards and the si	0, 1, 2, 3 Primary Ve Volume Primary Ve Largest Ve Primary Ve Volume Date of Vis	essel Material essel Storage essel 110% essel essel 25% Total eual Inspection ernally. The maxim bund lip. The bun evolumes of water r	Filter Press 20-07-2015 um retention height d was so large (c. equired, the limited
Bund Materials of Construction Bund Lining materials Bund Retention Volume (local/ Remote) Practical to Conduct Hydrostatic Test Visual Description: Visual inspection was carried out of with this section would be 250mm 155m ²) that is was not deemed pra means of emptying and disposal of put out of commission while the test A visual inspection was completed	Reinforced Concrete N.a 38.8 m ³ (Local) No on the walls and floor both inter Above this level liquid would critical to conduct a hydrostatic t this liquid afterwards and the si	Primary Ve Volume Primary Ve Largest Ve Primary Ve Volume Date of Vis	essel Storage essel 110% ssel essel 25% Total eual Inspection ernally. The maxim bund lip. The bun e volumes of water r	- - 20-07-2015 um retention height id was so large (c. required, the limited
Bund Lining materials Bund Retention Volume (local/ Remote) Practical to Conduct Hydrostatic Test Visual Description: Visual inspection was carried out of with this section would be 250mm 155m ²) that is was not deemed pra means of emptying and disposal of put out of commission while the test A visual inspection was completed	N.a 38.8 m ³ (Local) No on the walls and floor both inter n. Above this level liquid would actical to conduct a hydrostatic t this liquid afterwards and the si	Volume Primary Ve Largest Ve Primary Ve Volume Date of Vis mally and ext	essel 110% ssel essel 25% Total ual Inspection ernally. The maxim bund lip. The bun e volumes of water r	um retention height d was so large (c. equired, the limited
Bund Retention Volume (local/ Remote) Practical to Conduct Hydrostatic Test Visual Description: Visual inspection was carried out of with this section would be 250mm 155m ²) that is was not deemed pra means of emptying and disposal of put out of commission while the test A visual inspection was completed	38.8 m ³ (Local) No on the walls and floor both inter n. Above this level liquid would actical to conduct a hydrostatic t this liquid afterwards and the si	Largest Ve Primary Ve Volume Date of Vis mally and ext d overflow the est due to the	ssel essel 25% Total cual Inspection ernally. The maxim bund lip. The bun e volumes of water r	um retention height id was so large (c. required, the limited
Remote) Practical to Conduct Hydrostatic Test Visual Description: Visual inspection was carried out of with this section would be 250mm 155m ²) that is was not deemed pra- means of emptying and disposal of put out of commission while the tess A visual inspection was completed	No on the walls and floor both inter n. Above this level liquid would actical to conduct a hydrostatic t this liquid afterwards and the si	Volume Date of Vis mally and ext d overflow the est due to the	ernally. The maxim bund lip. The bund ovolumes of water r	um retention height id was so large (c. required, the limited
Hydrostatic Test Visual Description: Visual inspection was carried out of with this section would be 250mm 155m ²) that is was not deemed pra means of emptying and disposal of put out of commission while the test A visual inspection was completed	on the walls and floor both inter a. Above this level liquid would actical to conduct a hydrostatic t this liquid afterwards and the si	rnally and ext d overflow the rest due to the	ernally. The maxim bund lip. The bun volumes of water r	um retention height d was so large (c. equired, the limited
Visual inspection was carried out with this section would be 250mn 155m ²) that is was not deemed pra means of emptying and disposal of put out of commission while the test A visual inspection was completed	 Above this level liquid would actical to conduct a hydrostatic t this liquid afterwards and the si 	d overflow the est due to the	e bund lip. The bun e volumes of water r	d was so large (c. equired, the limited
with this section would be 250mn 155m ²) that is was not deemed pra means of emptying and disposal of put out of commission while the tes A visual inspection was completed	 Above this level liquid would actical to conduct a hydrostatic t this liquid afterwards and the si 	d overflow the est due to the	e bund lip. The bun e volumes of water r	d was so large (c. equired, the limited
	Visual inspection was carried out on the walls and floor both internally and externally. The maximum retention height with this section would be 250mm. Above this level liquid would overflow the bund lip. The bund was so large (c. 155m ²) that is was not deemed practical to conduct a hydrostatic test due to the volumes of water required, the limited means of emptying and disposal of this liquid afterwards and the size of floor space that would need to be covered and put out of commission while the test was underway.			
A visual inspection was completed on of the bund floor, joints and walls. There were no significant cracks, fissures or weak spots identified. There was a hole in one wall which was plugged and deemed watertight.				
Date Bunds Filled	- Da	ate of Hydros	static Test	-
Start Time	- Er	End Time -		-
Start Level of Water	- Er	End of Test Level of Water		-
Status & Recommendations:				
Notes:	 Bund passed the vis This should be inspective caused as per the lie 	ected every th	nree years or in the e	event of damage
Low Risk - WGK 0 or 1 High Risk – WGK 2 or 3 R45, R46, R50, R51, R52, R53, R54, R55, R56, R58, R61, R63				
Signed: AQ. Quary	Date: 12-08-201	15	Title: Proje	ect Manager
Signed: Noel Harrington		Date: 12-08-2015 Title: Chartered Engine		



Unit 5 Caherdavin Business Centre, Ennis Road, Limerick.

Enva (Ireland) Limited Clonminam Industrial Estate, Portlaoise, County Laois, Laois.

Bund Integrity Report 2015

Waste Licence Number: W0184-01

Report Reference Number: Version: Date of Issue: **Report Compiled by:**

3520-15-03 1 02-10-2015 Mark McGarry

1.0 Introduction

Enva (Ireland) Limited, Clonminam Industrial Estate, Portlaoise, Co. Laois are required as part of Waste Licence number W0184-01, Condition 3.13.5 and Schedule E to have their bunds tested for the protection of ground and surface water.

The bunds were tested in accordance with BS 8007: Design of Concrete Structures for Retaining Aqueous Liquids and documented guidance from the EPA entitled Storage and Transfer of Materials for Scheduled Activities.

The test was carried out in two stages, firstly to inspect the bund visually for cracks, weak spots or if the bund required any remedial work. The integrity of the bund was then tested for water tightness over a 24 hour period. The reduced timeframe from the BS 8007 standard for testing was applied as the bunds were in use and were required for the operation of the site.

Bunds which could not be tested hydrostatically were visually inspected.

2.0 Licence Conditions

The following conditions have been taken from the current licence applicable to this site:

- 3.12.5 The drainage system, bunds, silt traps and oil separators shall be inspected weekly, desludged as necessary and properly maintained at all times. All sludge and drainage from these operations shall be collected for safe disposal. A written record shall be kept of the inspections, desludging, cleaning, disposal of associated waste products, maintenance and performance of the interceptors, bunds and drains.
- 3.13.2 All tank and drum storage areas shall, as a minimum, be bunded, either locally or remotely, to a volume not less than the greater of the following:

a) 110% of the capacity of the largest tank or drum within the bunded area; orb) 25% of the total volume of substance which could be stored within the bunded area

3.13.5 The integrity and water tightness of all the bunds and their resistance to penetration by water or other materials stored therein shall be confirmed by the licensee and shall be reported to the Agency within 12 months of the date of grant of this licence. This confirmation shall be repeated at least once every three years thereafter and reported to the Agency on each occasion

3.0 Summary of Methodology

A visual inspection was carried out on the bund to determine if there were any cracks, fissures or unacceptable surface continuity between the bund walls.

Where applicable the hydrostatic test was completed by filling the bund to a fill level using clean water, in line with the procedure outlined in BS8007:1987. Liquid levels were allowed to stabilise for 24 hours. After stabilisation a depth reading was recorded and marked at a preset suitable location. The water level was re-recorded after remaining in the bund for 24 hours.

A water level meter was placed in situ to determine the impact of rainfall and evaporation in the bund. When this statistic was accounted for the bund was verified as passed or failed in line with the criteria set out in the standard.

4.0 Summary of Results

Bund Identity	Pass / Fail	Comments
Stores Area Section 2 (Bund No 5)	Pass	This bund passed the visual inspection. This bund also passed the Hydrostatic Integrity test and had sufficient storage volume to meet the licence requirements
Export Section 2 (Bund No 1)	Pass	This bund passed the visual inspection. It was not deemed practical to complete a hydrostatic test in this bund due to the size of floor area that needed to be covered and large volumes of water required.
Export Section 3 (Bund No 1)	Pass	This bund passed the visual inspection. It was not deemed practical to complete a hydrostatic test in this bund due to the size of floor area that needed to be covered and large volumes of water required.
Main Tank Farm (Bund No 3)	Pass	This bund passed the visual inspection. It was not deemed practical to complete a hydrostatic test in this bund due to the size of floor area that needed to be covered and large volumes of water required.

Project Manager	KQ. LOCary	Date of Report	02-10-2015
Client	Enva Ireland Limited	Contact	Kevin Coll

Stores Area Section 2 – Bund No. 5

Company	ENVA Ireland	Waste Reference No	W0184-01	
Site	Clonminam Industrial Estate Portlaoise	Waste Category	Hazardous Waste Facility	
Bund Reference No	Bund No 5	Bund Type: Local/ Remote / Combined	Local	
Bund Location	Stores Area	Bund Risk Classification: 0, 1, 2, 3	2	
Bund Dimensions	1600 x 700 x 170mm	Primary Vessel Material	IBC / 200 L steel barrels	
Bund Materials of Construction	Reinforced Concrete walls, concrete floor	Primary Vessel Storage Volume	Total storage c. 64m ³	
Bund Lining materials	N.a	Primary Vessel 110% Largest Vessel	1.1 m ³ IBC's	
Bund Retention Volume (local/ Remote)	19 m ³ (Local)	25% Total Volume	c. 12 m ³	
Practical to Conduct Hydrostatic Test	Yes	Date of Visual Inspection	20-09-2015	
Visual Description:				
Visual inspection was carried out on the walls, joints and floor both internally and externally. The walls and floors were deemed acceptable and therefore the bund passed through to the hydrostatic test. Water was filled to a height of 35 and 47mm from the floor of the bund at 2 separate locations – this bund could not be filled much higher due to the room being used by employees for access to the stores. A visual inspection was completed on the remainder of the bund				

deemed acceptable and therefore the bund passed through to the hydrostatic test. Water was filled to a height of 35 and 47mm from the floor of the bund at 2 separate locations – this bund could not be filled much higher due to the room being used by employees for access to the stores. A visual inspection was completed on the remainder of the bund floor and walls which had not been submerged for the test. There were no cracks, fissures or weak spots identified above the water line. The bund floor is sloped and raised in the middle – numerous measurements were made across the bund to get an overview of the entire structure.

Date Bunds Filled	20-09-2015	Date of Hydrostatic Test	21/22-09-2015
Start Time	14:20	End Time	15:00
Start Level of Water	Side 1 35 mm Side 2 47 mm	End of Test Level of Water	Side 1 35 mm Side 2 47 mm

Status & Recommendations:

- Bund Passes Hydrostatic Test to the level of water filled.
- Hydrostatic retest required in 2018 unless bund is damaged or repaired in the meantime.

Notes:

Signed: Alacelland	Date: 02-10-2015	Title: Project Manager
Signed: Noel Harrington	Date: 02-10-2015	Title: Chartered Engineer

Export Storage – Bund No. 1 Section 2

Note: This store was sectioned into 3 parts for this visual inspection. The reason for only completing 1/3rd of the building was to allow for stored materials to be moved into the other sections leaving one completely free for visual observation. There were no materials in this section for the visual observation therefore allowing a complete and comprehensive assessment of the section. This store is far too large of floor area to be deemed suitable for a hydrostatic test.

Company	ENVA Ireland	Waste Reference No	W0184-01
Site	Clonminam Industrial Estate Portlaoise	Waste Category	Hazardous Waste Facility
Bund Reference No	Bund 1 Section 2	Bund Type: Local/ Remote / Combined	Local
Bund Location	Export Storage	Bund Risk Classification: 0, 1, 2, 3	2
Bund Dimensions	c. 320 m ² for Section 2	Primary Vessel Material	IBC's, Plastic and Metal Barrels
Bund Materials of Construction	Reinforced Concrete walls and concrete floors	Primary Vessel Storage Volume	1.0 m ³ IBC
Bund Lining materials	N.a	Primary Vessel 110% Largest Vessel	1.1 m ³
Bund Retention Volume (local/ Remote)	Total c. 57 m ³ (Local)	25% Total Volume	25 m ³
Practical to Conduct Hydrostatic Test	No	Date of Visual Inspection	21-09-2015
Visual Description:			
Visual inspection was carried out on the walls and floor both internally and externally. The maximum retention height with this section would be 22mm. Above this level liquid would overflow the bund lip. Therefore the total retention			

A visual inspection was completed on section 2 of the store floor, joints and walls. There were no significant cracks, fissures or weak spots identified. There was evidence of weak surface concrete in places however this did not constitute a failure of visual inspection as they were very minor. There were 2 sumps in this bay which have been

previously tested and passed hydrostatically by Kavanagh Ryan & Associates.

Date Bunds Filled	N/a	Date of Hydrostatic Test	N/a
Start Time	N/a	End Time	N/a
Start Level of Water	N/a	End of Test Level of Water	N/a

Status & Recommendations:

volume of this export store was calculated at c. 57 m³.

• Bund Section 2 passed the visual inspection.

• This should be inspected every three years or in the event of damage caused as per the licence requirement.

Notes:

Signed: A. C. Comp.	Date: 02-10-2015	Title: Project Manager
Signed: Noel Harrington	Date: 02-10-2015	Title: Chartered Engineer

Export Storage – Bund No. 1 Section 3

Note: This store was sectioned into 3 parts for this visual inspection. The reason for only completing 1/3rd of the building was to allow for stored materials to be moved into the other sections leaving one completely free for visual observation. There were no materials in this section for the visual observation therefore allowing a complete and comprehensive assessment of the section. This store is far too large of floor area to be deemed suitable for a hydrostatic test.

Company	ENVA Ireland	Waste Reference No	W0184-01
Site	Clonminam Industrial Estate Portlaoise	Waste Category	Hazardous Waste Facility
Bund Reference No	Bund 1 Section 3	Bund Type: Local/ Remote / Combined	Local
Bund Location	Export Storage	Bund Risk Classification: 0, 1, 2, 3	2
Bund Dimensions	c. 280 m ² for Section 3	Primary Vessel Material	IBC's, Plastic and Metal Barrels
Bund Materials of Construction	Reinforced Concrete walls and concrete floors	Primary Vessel Storage Volume	1.0 m ³
Bund Lining materials	N.a	Primary Vessel 110% Largest Vessel	1.1 m ³
Bund Retention Volume (local/ Remote)	Total c. 57 m ³ (Local)	25% Total Volume	25 m ³
Practical to Conduct Hydrostatic Test	No	Date of Visual Inspection	02-10-2015
Visual Description:			
Visual inspection was carried out	on the walls and floor both into	really and externally. The maxim	um rotantian height

Visual inspection was carried out on the walls and floor both internally and externally. The maximum retention height with this section would be 22mm. Above this level liquid would overflow the bund lip. Therefore the total retention volume of this export store was calculated at c. 57 m³.

A visual inspection was completed on section 3 of the store floor, joints and walls. There were no significant cracks, fissures or weak spots identified. There was evidence of weak surface concrete in places however this did not constitute a failure of visual inspection as they were very minor. There was 1 sump in this bay which have been previously tested and passed hydrostatically by Kavanagh Ryan & Associates.

Date Bunds Filled	N/a	Date of Hydrostatic Test	N/a
Start Time	N/a	End Time	N/a
Start Level of Water	N/a	End of Test Level of Water	N/a

Status & Recommendations:

• Bund Section 3 passed the visual inspection.

• This should be inspected every three years or in the event of damage caused as per the licence requirement.

Notes:

Signed: A. C. Comp.	Date: 02-10-2015	Title: Project Manager
Signed: Noel Harrington	Date: 02-10-2015	Title: Chartered Engineer

Tank Farm – Bund No. 3

Company	ENVA Ireland	Waste Reference No	W0184-01	
Site	Clonminam Industrial Estate Portlaoise	Waste Category	Hazardous Waste Facility	
Bund Reference No	Bund 3	Bund Type: Local/ Remote / Combined	Local	
Bund Location	Tank Farm	Bund Risk Classification: 0, 1, 2, 3	2	
Bund Dimensions	c. 1880 m ² x 2 m high	Primary Vessel Material	Large Steel Tanks	
Bund Materials of Construction	Reinforced Concrete walls and concrete floors	Primary Vessel Storage Volume	180 m ³	
Bund Lining materials	N.a	Primary Vessel 110% Largest Vessel	200 m ³	
Bund Retention Volume (local/ Remote)	Total c. 4066 m ³ (Local)	25% Total Volume	1,850 m ³	
Practical to Conduct Hydrostatic Test	No	Date of Visual Inspection	21-09-2015	
Visual Description:				
Visual inspection was carried out on the walls and floor both internally and externally. The maximum retention height with this section would be 2000mm. Above this level liquid would overflow the bund at its lowest point. A visual inspection was completed on floor, joints and walls. There were no significant cracks, fissures or weak spots identified. There was evidence of weak surface concrete in places however this did not constitute a failure of visual inspection as they were very minor. The bund consists of 45 tanks totalling 7,400 m ³ . Boiler condensate is discharged into the bund through permanent pipes which could not be ceased without shutting down production. This fact rendered a hydrostatic				

test impractical to complete on top of the excessive volumes of water that would be required to cover the base of the bund.

Date Bunds Filled	N/a	Date of Hydrostatic Test	N/a
Start Time	N/a	End Time	N/a
Start Level of Water	N/a	End of Test Level of Water	N/a

Status & Recommendations:

- Bund 3 passed the visual inspection.
- This should be inspected every three years or in the event of damage caused as per the licence requirement.

Notes:

Signed: ACA4CQuert	Date: 02-10-2015	Title: Project Manager
Signed: Noel Harrington	Date: 02-10-2015	Title: Chartered Engineer

W0184-1	Ref Number:	Clonminham Industrial Estate, Portlaoise, Co. Laois.	Site: C
Waste	Category:	Company: Enva Ireland limited.	Company: E
10.03.14	Date of Test:	Sump Exfiltration Test.	UNWIS PLAN
K. Ryan	By:	Tel: 01-2765661 E-mail: <u>kmryan@eircom.net</u> web site: <u>www.kavanaghryan.com</u>	AG. DE
C14022	Job No.:	KAVANAGH RYAN & ASSOCIATES LIMITED.	SIGN & CONSTRUCT

Sump	Ref.	80	9	10	7	6
Sump Dimensions	(mm)	650 x 1470 x 875(Dp)	640 x 1500 x 735(Dp)	900 x 2700 x 1040(Dp)	670 x 1430 x 555(Dp)	760 x 1880 x 680(Dp)
Initia	Height (mm)	875	735	1040	555	680
Initial Dip	Time	10.04	10.06	10.15	10.18	10.20
Secol	Height (mm)	875	735	1040	555	680
Second Dip	Time	10.42	10.43	10.46	10.50	10.52
Diff	Height (mm)	0	0	0	0	0
Difference	Time (mins)	38	37	31	32	32
Comments/Recommendations		Passed	Passed	Passed	Passed	Passed

Signed:-Kevin Ryan BEnd MIEI APEA

Note: shall be underside of cover level. The chamber shall be filled with clean water and allowed to stand for an absorption period, topping up as necessary. The absorption period shall be determined by Exfiltration Test based on recommended methodology given in EPA Guidance Note on storage and transfer of materials for scheduled activities section 2.3.5.2. This test involves filling the chamber with clean water to the required test level. The test level for shallow (less than 1.5m depth) manholes and inspection chambers

period and if the drop is less than 5mm, the chamber shall be deemed to have passed the leak tightness test. the supervising engineer and will depend on the condition of the manhole. After the absorption period, the drop in water level shall be measured over a 30 minute

KAVANAGH RYAN & ASSOCIATES LIMITED. Job No.: C14013	Unit 48, The Egan Centre, Dargle Road, Bray, Co. Wicklow. Tel: 01-2765661 E-mail: kmryan@eircom.net_web site: www.knyanghryan.com	Test. Date of Test: 10.02.14	Calegory: Waste	nois. Ref Number: W0184-1	Difference Comments/Recommendations	e Height Time (mm) (mins)	5 -5 58 Passed	5 -5 58 Passed	5 0 32 Passed	5 0 32 Passed	8 0 47 Passed	0 0 45 Passed	
CIATES	oad, Bray, C	tion		e, Co. La	Second Dip	Time	11.25	11.25	11.15	11.15	11.18	11.20	
& ASSO	e, Dargle R	filtra		ortlaoise	Sec	Height (mm)	1135	1165	1710	1820	725	440	
H RYAN	e Egan Centr E-mail: kmrva	Sump Exfiltration Test.		Estate, P	I Dip	Time	10.27	10.27	10.43	10.43	10.31	10.35	
AVANAG	Unit 48, Th 01-2765661	Sum	mited.	dustrial	Initial Dip	Height (mm)	1140	1170	1710	1820	725	440	
		SULANTS	9: Enva Ireland limited.	Clonminham Industrial Estate, Portlaoise, Co. Laois.	Sump Dimensions	(mm)	1060 x 1400 x 1440(Dp)	1050 x 1400 x 1410(Dp)	1290 x 1270 x 1710(Dp)	1300 x 1270 x 1820(Dp)	4900 x 1200 x 830(Dp)	660 x 660 x 460(Dp)	
OF SCONSTRUCT	G. DES	Alland	Company:	Site:	Sump	Ref.	1	2	3	4	5	11	

Signed:

Kevin Ryan BEng MIEI APEA

Exfiltration Test based on recommended methodology given in EPA Guidance Note on storage and transfer of materials for scheduled activities section 2.3.5.2. This test involves filling the chamber with clean water to the required test level. The test level for shallow (less than 1.5m depth) manholes and inspection chambers shall be underside of cover level. Note:

The chamber shall be filled with clean water and allowed to stand for an absorption period, topping up as necessary. The absorption period shall be determined by the supervising engineer and will depend on the condition of the manhole. After the absorption period, the drop in water level shall be measured over a 30 minute period and if the drop is less than 5mm, the chamber shall be deemed to have passed the leak tightness test.

Appendix 4



Enva Portlaoise

2016 Groundwater Compliance Monitoring Quarter 1 (Jan – Mar 2016)

Document Control Sheet

Client:	Enva Ireland Ltd.							
Project Title:	Enva Portlaoise 2016 Groundwater Compliance Monitoring							
Document Title:	Quarter 1 (Jan – Mar 2016)							
Document No:	MDE0973Rp0027							
Text Pages:	35	Appendices:	-					

Rev.	Status	Date	Author(s)			Reviewed By	ļ	Approved By
A01	Client Approval	27 th June 2016	DC	Doulahur	CR	Cabron Rally	CR	Cabron Rally
F01	Final	27 th June 2016	DC	Doulahor	CR	Catron Rally	CR	Cabron Relly

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TABLE OF CONTENTS

1		INTRODUCTION	1
	1.1	BACKGROUND	1
	1.2	OBJECTIVES & SCOPE OF WORK	1
2		REVIEW OF PREVIOUS DATA	2
	2.1	INFORMATION SOURCES	2
	2.2	SITE SETTING	2
	2.3	REGIONAL SETTING	4
		2.3.1 Geology	4
		2.3.2 Hydrogeology	4
	2.4	SITE GROUND CONDITIONS	4
		2.4.1 Licence Conditions	5
3		METHODOLOGY	6
	3.1	LABORATORY ANALYSIS	6
	3.2	PRESENTATION & INTERPRETATION OF RESULTS	8
4		QUARTER 1 RESULTS FEBRUARY 2016	9
5		DISCUSSION OF QUARTER 1 RESULTS	0
5	5.1	DISCUSSION OF QUARTER 1 RESULTS	
5			0
5	5.2	FIELD PARAMETERS	0
5	5.2 5.3	FIELD PARAMETERS	0 0 1
5	5.2 5.3 5.4	FIELD PARAMETERS 20 RESULTS OF BTEX & MTBE 20 RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS) 21	0 0 1 1
5	5.2 5.3 5.4 5.5	FIELD PARAMETERS 20 RESULTS OF BTEX & MTBE 20 RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS) 21 RESULTS OF SPECIATED PHENOLS 21	0 0 1 1
5	5.2 5.3 5.4 5.5 5.6	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS21	0 1 1 2
5	5.2 5.3 5.4 5.5 5.6	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS21RESULTS OF VOLATILE ORGANIC COMPOUNDS21RESULTS OF VOLATILE ORGANIC COMPOUNDS21	0 0 1 1 2 2
	5.2 5.3 5.4 5.5 5.6 5.7	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS21RESULTS OF VOLATILE ORGANIC COMPOUNDS21RESULTS OF TOTAL PETROLEUM HYDROCARBONS21RESULTS OF TOTAL PETROLEUM HYDROCARBONS21	0 1 1 2 4
	5.2 5.3 5.4 5.5 5.6 5.7 6.1	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS21RESULTS OF VOLATILE ORGANIC COMPOUNDS21RESULTS OF TOTAL PETROLEUM HYDROCARBONS21HISTORICAL RESULTS & TRENDS24	0 1 1 2 2 4
	5.2 5.3 5.4 5.5 5.6 5.7 6.1	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)22RESULTS OF SPECIATED PHENOLS22RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS22RESULTS OF VOLATILE ORGANIC COMPOUNDS22RESULTS OF VOLATILE ORGANIC COMPOUNDS22RESULTS OF TOTAL PETROLEUM HYDROCARBONS22HISTORICAL RESULTS & TRENDS24GROUNDWATER LEVELS OVER TIME24	0 1 1 2 4 6
	5.2 5.3 5.4 5.5 5.6 5.7 6.1	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS22RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS22RESULTS OF VOLATILE ORGANIC COMPOUNDS22RESULTS OF TOTAL PETROLEUM HYDROCARBONS22HISTORICAL RESULTS & TRENDS24GROUNDWATER LEVELS OVER TIME24GROUNDWATER CONCENTRATIONS OVER TIME24	0 1 1 2 4 6 7
	5.2 5.3 5.4 5.5 5.6 5.7 6.1	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS22RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS21RESULTS OF VOLATILE ORGANIC COMPOUNDS22RESULTS OF VOLATILE ORGANIC COMPOUNDS22RESULTS OF TOTAL PETROLEUM HYDROCARBONS22RESULTS OF TOTAL PETROLEUM HYDROCARBONS24GROUNDWATER LEVELS OVER TIME24GROUNDWATER CONCENTRATIONS OVER TIME246.2.1 Phenols21	0 1 1 2 4 6 7 7

LIST OF FIGURES

Figure 2.1 – Site Location	3
Figure 3.1 – Site Layout Plan with Groundwater Monitoring Locations	7
Figure 6.1 – Ground Elevation (mAOD) in all Monitoring Wells	24
Figure 6.2 – Ground Elevation (mAOD) in Shallow Groundwater Monitoring Wells	25
Figure 6.3 – Ground Elevation (mAOD) in Deep Groundwater Monitoring Wells	25
Figure 6.4 – Phenol Concentrations in all Monitoring Wells	27
Figure 6.5 – PAH (Total) Concentrations in all Monitoring Wells	28
Figure 6.6 – Fluoroanthene Concentrations in all Monitoring Wells	29
Figure 6.7 – Naphthalene Concentrations in all Monitoring Wells	29
Figure 6.8 – Benzo (g,h,i) perylene Concentrations	30
Figure 6.9 – Benzo (g,h,i) perylene in Monitoring Wells BH104B & MW03	31
Figure 6.10 – Benzo (a) pyrene Concentrations in all Monitoring Wells	32
Figure 6.11 – TPH (Carbon Range C5-C44) in all Monitoring Wells	32

LIST OF TABLES

Table 3.1 – Analytical Methodologies – ALS Environmental6Table 4.1 – Groundwater Levels (Quarter 1, 2016)10Table 4.2 – Results of Field Parameters Measured at each Groundwater Monitoring Well (Quarter 1, 2016)11Table 4.3 – Results of BTEX and MTBE12Table 4.4 – Results of Speciated PAHs12Table 4.5 – Results of Speciated Phenols14Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)15Table 4.7 – Results of Volatile Organic Compounds (VOCs)17Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow26	Table 2.2 – Licence Parameters5Table 3.1 – Analytical Methodologies – ALS Environmental6Table 4.1 – Groundwater Levels (Quarter 1, 2016)10Table 4.2 – Results of Field Parameters Measured at each Groundwater Monitoring Well (Quarter 1, 2016)11Table 4.3 – Results of BTEX and MTBE12Table 4.4 – Results of Speciated PAHs12Table 4.5 – Results of Speciated Phenols14Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)15Table 4.7 – Results of Volatile Organic Compounds (VOCs)17Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.3 – Monthly Rainfall Data for Year 2014 for Oak Park, Carlow26Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow26Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow26Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow26	Table 2.1 – Ground Conditions	5
Table 4.1 – Groundwater Levels (Quarter 1, 2016)10Table 4.2 – Results of Field Parameters Measured at each Groundwater Monitoring Well (Quarter 1,2016)11Table 4.3 – Results of BTEX and MTBE12Table 4.4 – Results of Speciated PAHs12Table 4.5 – Results of Speciated Phenols14Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)15Table 4.7 – Results of Volatile Organic Compounds (VOCs)17Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow26	Table 4.1 – Groundwater Levels (Quarter 1, 2016)10Table 4.2 – Results of Field Parameters Measured at each Groundwater Monitoring Well (Quarter 1,2016)11Table 4.3 – Results of BTEX and MTBE.12Table 4.4 – Results of Speciated PAHs12Table 4.5 – Results of Speciated Phenols.14Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)15Table 4.7 – Results of Volatile Organic Compounds (VOCs)17Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 – Monthly Rainfall Data for Year 2014 for Oak Park, Carlow26Table 6.3 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow26	Table 2.2 – Licence Parameters	5
Table 4.2 – Results of Field Parameters Measured at each Groundwater Monitoring Well (Quarter 1,2016)11Table 4.3 – Results of BTEX and MTBE12Table 4.4 – Results of Speciated PAHs12Table 4.5 – Results of Speciated Phenols14Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)15Table 4.7 – Results of Volatile Organic Compounds (VOCs)17Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow26	Table 4.2 - Results of Field Parameters Measured at each Groundwater Monitoring Well (Quarter 1,2016)11Table 4.3 - Results of BTEX and MTBE12Table 4.4 - Results of Speciated PAHs12Table 4.5 - Results of Speciated Phenols14Table 4.6 - Results of Speciated Phenols14Table 4.7 - Results of Semi-Volatile Organic Compounds (SVOCs)15Table 4.8 - Results of Volatile Organic Compounds (VOCs)17Table 4.8 - Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 - Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 - Monthly Rainfall Data for Year 2014 for Oak Park, Carlow26Table 6.3 - Monthly Rainfall Data for Year 2015 for Oak Park, Carlow26	Table 3.1 – Analytical Methodologies – ALS Environmental	6
2016)11Table 4.3 – Results of BTEX and MTBE.12Table 4.4 – Results of Speciated PAHs12Table 4.5 – Results of Speciated Phenols.14Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)15Table 4.7 – Results of Volatile Organic Compounds (VOCs)17Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow26	2016)11Table 4.3 – Results of BTEX and MTBE.12Table 4.4 – Results of Speciated PAHs12Table 4.5 – Results of Speciated Phenols.14Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)15Table 4.7 – Results of Volatile Organic Compounds (VOCs)17Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 – Monthly Rainfall Data for Year 2014 for Oak Park, Carlow26Table 6.3 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow26	Table 4.1 – Groundwater Levels (Quarter 1, 2016)	10
Table 4.3 – Results of BTEX and MTBE.12Table 4.4 – Results of Speciated PAHs12Table 4.5 – Results of Speciated Phenols14Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)15Table 4.7 – Results of Volatile Organic Compounds (VOCs)17Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow26	Table 4.3 – Results of BTEX and MTBE.12Table 4.4 – Results of Speciated PAHs12Table 4.5 – Results of Speciated Phenols14Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)15Table 4.7 – Results of Volatile Organic Compounds (VOCs)17Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow26Table 6.3 – Monthly Rainfall Data for Year 2014 for Oak Park, Carlow26Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow26	Table 4.2 – Results of Field Parameters Measured at each Groundwater Monitoring Well (Qua	arter 1,
Table 4.4 – Results of Speciated PAHs12Table 4.5 – Results of Speciated Phenols14Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)15Table 4.7 – Results of Volatile Organic Compounds (VOCs)17Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow26	Table 4.4 - Results of Speciated PAHs12Table 4.5 - Results of Speciated Phenols14Table 4.6 - Results of Semi-Volatile Organic Compounds (SVOCs)15Table 4.7 - Results of Volatile Organic Compounds (VOCs)17Table 4.8 - Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 - Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 - Monthly Rainfall Data for Year 2013 for Oak Park, Carlow26Table 6.3 - Monthly Rainfall Data for Year 2014 for Oak Park, Carlow26Table 6.4 - Monthly Rainfall Data for Year 2015 for Oak Park, Carlow26	2016)	11
Table 4.5 – Results of Speciated Phenols.14Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)15Table 4.7 – Results of Volatile Organic Compounds (VOCs)17Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow26	Table 4.5 – Results of Speciated Phenols.14Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)15Table 4.7 – Results of Volatile Organic Compounds (VOCs)17Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow26Table 6.3 – Monthly Rainfall Data for Year 2014 for Oak Park, Carlow26Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow26	Table 4.3 – Results of BTEX and MTBE	12
Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)15Table 4.7 – Results of Volatile Organic Compounds (VOCs)17Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow26	Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)15Table 4.7 – Results of Volatile Organic Compounds (VOCs)17Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow26Table 6.3 – Monthly Rainfall Data for Year 2014 for Oak Park, Carlow26Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow26		
Table 4.7 – Results of Volatile Organic Compounds (VOCs)17Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow26	Table 4.7 – Results of Volatile Organic Compounds (VOCs)17Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow26Table 6.3 – Monthly Rainfall Data for Year 2014 for Oak Park, Carlow26Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow26	Table 4.5 – Results of Speciated Phenols	14
Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow	Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)19Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow26Table 6.3 – Monthly Rainfall Data for Year 2014 for Oak Park, Carlow26Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow26	Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)	15
Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow	Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow26Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow26Table 6.3 – Monthly Rainfall Data for Year 2014 for Oak Park, Carlow26Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow26	Table 4.7 – Results of Volatile Organic Compounds (VOCs)	17
Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow 26	Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow26Table 6.3 – Monthly Rainfall Data for Year 2014 for Oak Park, Carlow26Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow26	Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)	19
	Table 6.3 – Monthly Rainfall Data for Year 2014 for Oak Park, Carlow26Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow26	Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow	26
Table 6.3 – Monthly Bainfall Data for Year 2014 for Oak Park, Carlow 26	Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow	Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow	26
		Table 6.3 – Monthly Rainfall Data for Year 2014 for Oak Park, Carlow	26
Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow	Table C.F. Manthly Deinfall Data fan Vaan 2010 fan Oaly Dank, Canlaur	Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow	26
	Table 6.5 – Monthly Raintali Data for Year 2016 for Oak Park, Carlow	Table 6.5 – Monthly Rainfall Data for Year 2016 for Oak Park, Carlow	26

1 INTRODUCTION

1.1 BACKGROUND

RPS has been commissioned by Enva Ireland Ltd (Enva) to carry out groundwater quality monitoring for environmental compliance, at their facility in the Clonminam Industrial Estate, Portlaoise, Co Laois. Groundwater monitoring has being carried out in strict accordance with criteria set out in Schedule 4(ii) of the site's Industrial Emissions Licence, Register No. W0184-01.

Enva Ireland has been operating under Waste Licence Register No. W0184-01 since January 2004. The licence was amended by the Environmental Protection Agency in December 2013 to conform to the provisions and requirements of the Council Directive 2010/75/EU (Industrial Emissions Directive) and as such is deemed an Industrial Emissions Licence. Enva is required to submit a report to the EPA on a quarterly basis, outlining the existing groundwater quality underlying the site.

A suitably qualified environmental consultant from RPS, collected groundwater samples from a series of 8 monitoring wells (BH101, BH102, BH103, BH104B, MW01, MW02, MW03, MW04) within the site boundary on the 24th of February 2016. The samples underwent laboratory analysis for the suite of parameters specified in Schedule 4(ii) of Industrial Emissions Licence W0184-01. This report outlines the results of the Quarter 1 monitoring for 2016 and reviews historical data recorded at the site.

1.2 OBJECTIVES & SCOPE OF WORK

The specific objectives and scope of work are as follows:

- Review of previous data as provided by Enva Portlaoise;
- Graphical presentation of key compounds and trends; and
- Discussion of results for Quarter 1 2016 within the context of previous results and available guideline concentrations.

2 REVIEW OF PREVIOUS DATA

2.1 INFORMATION SOURCES

The following documents were reviewed as part of this project:

- Industrial Emissions Licence W0184-01 and any available EPA documents from the EPA website;
- Quarterly Groundwater Monitoring Reports (Quarter 1 2004 to Quarter 4 2005), URS;
- Quarterly Groundwater Monitoring Reports (Quarter 1 2006 to Quarter 4 2015), RPS;
- Summary Report on Trend of Contaminant Levels at Enva Ireland Ltd since 2005, Ref: MDE0647RP0001, RPS (2007);
- Groundwater Risk Assessment, Ref: MDE0788Rp0001, RPS (2008);
- Hydrogeological Review and Assessment Report, Ref MDE0973Rp0017F01, RPS (2014); and
- Baseline Environment Report, Ref: MDE0973Rp0104.

2.2 SITE SETTING

The site is located to the southwest of the town of Portlaoise immediately to the south of the Dublin to Cork railway line. The general area is gently undulating. The site slopes gently to the southwest but to the east of the site the ground slopes gently towards the River Triogue, which is located approximately 1.5 km to the east. The site occupies an area of approximately 1.5 hectares and comprises of an operational waste oil and contaminated soil treatment plant.

The site is located on the outskirts of Portlaoise in an area of agricultural and light industrial development. The site is bounded to the north and east by land belonging to Irish rail, comprising sidings and general storage areas. To the south is a vehicle repair garage, which is elevated above the level of the site by approximately 1.5 m. To the west the site is adjoined by further industrial land, as well as residential land. The site location is presented on **Figure 2.1**.

The site has been in operation since 1978, and the layout has remained relatively consistent. The site layout is presented on **Figure 3.1**. The site is largely covered in hardstanding with some open areas in the far north and northeast of the site. All oil and soil storage areas are suitably bunded and the general standard of housekeeping is good.

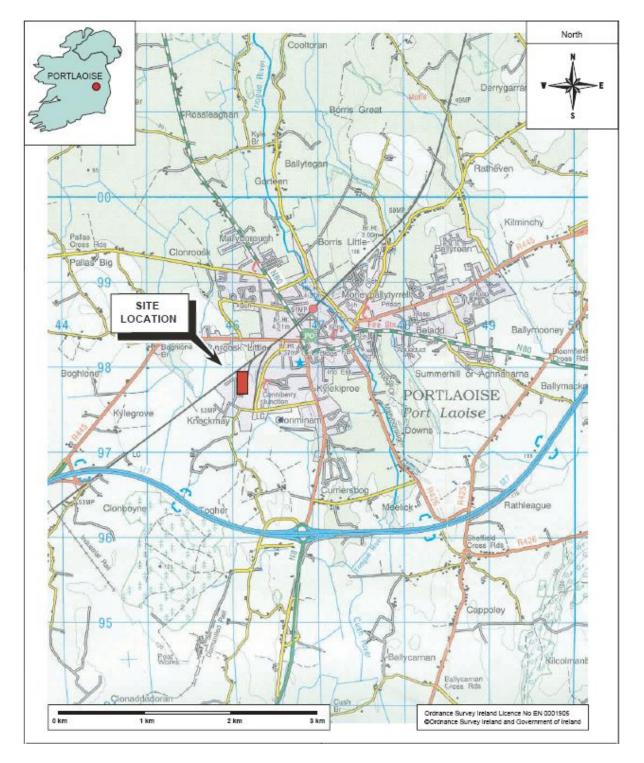


Figure 2.1 – Site Location



2.3 REGIONAL SETTING

2.3.1 Geology

The Geological Survey of Ireland indicates that the regional geology of Portlaoise is typified by Carboniferous Limestone. In the vicinity of the site itself the solid geology comprises the Ballysteen Formation, a micaceous-bioclastic limestone. This well-bedded limestone, with interbeds of shale, is extensively folded, with axes trending north-east to south-west, and becomes increasingly muddy towards the top of the formation. North-east to south-west trending faults are found in the region, with one located approximately 500m to the east of the site. The subsoils in the region comprise mainly Made Ground, around the industrial area, and Limestone Till in the surrounding regions.

2.3.2 Hydrogeology

The limestone is classified by the Geological Survey of Ireland (GSI) as a Locally Important Karstified Aquifer (LI). Porosity is predominantly in the form of fractures, in this aquifer, however the muddy nature of this formation greatly reduces permeability. Vulnerability of this aquifer beneath the site is classified as high, with moderate vulnerability to the east of the site.

The public water supply for Portlaoise is derived from groundwater, utilising three groundwater abstraction well fields comprising of two abstraction wells in each well field. This supply currently comes from the Straboe area, approximately 5.5 km to the north-east of the site. The source protection zone for this water supply extends to within 3.2 km of the Enva site but does not encompass the Enva site.

The GSI record a number of other dug wells and boreholes within the Portlaoise area, including the boreholes installed on the site. The accuracy of the locations of these wells varies. One well, which was drilled in 1899 is recorded as being located immediately to the south of the Enva site. The use of this well is not known and its location is only accurate to 1 km. A second borehole, drilled in 1973 is recorded 1.5 km to the north of the site at Clonroosk; the accuracy of this location is also 1 km so it could be closer or further from the site. The use of this well is not known but its yield is recorded as being poor. There are no other wells recorded within 1 km of the site.

Enva is not aware of any abstraction boreholes within the immediate vicinity of their site.

2.4 SITE GROUND CONDITIONS

A total of eight boreholes have been drilled at the site and the general sequence of ground conditions is presented in **Table 2.1**.

Strata	Extent	Thickness	Description
Made Ground	BH104	0-3.5 m	Predominantly concrete, with hardcore fill, and clay.
Boulder Clay	All boreholes	<8.5 m	Includes fine to medium, well rounded gravels.
Sand and Gravel	Confined to south east corner of site (BH101, BH104 and MW03)	0-2 m	In general the transition from boulder clay to sand is gradual with changes from gravel, to sandy gravel, to sand.
Limestone Bedrock	Encountered in MW01, MW02 and MW03	Top of limestone ranges from 7.7m to 9m below ground level.	Pale grey, fine-grained bedrock, differentiated from boulders by its un- weathered nature.

Table 2.1 – Ground Conditions

The logs for each of the boreholes were previously presented as Appendix B in the RPS Groundwater Risk Assessment Report (Ref: MDE0788Rp0001).

2.4.1 Licence Conditions

The Industrial Emissions Licence requires the regular monitoring and sampling of boreholes BH101, BH102, BH103, BH104B, MW01, MW02, MW03 and MW04. The parameters requiring measurement or analysis are presented in **Table 2.2**.

Table 2.2 – Licence Parameters

Group	Parameters requiring Quarterly Measurement	Parameters requiring Annual Measurement				
	Groundwater Level	Groundwater Level				
	рН	рН				
Field Parameters	Temperature	Temperature				
Field Parameters	Dissolved Oxygen	Dissolved Oxygen				
	Electrical Conductivity	Electrical Conductivity				
	Visual Inspection	Visual Inspection				
	Mineral Oil	Mineral Oil				
	BTEX & MTBE	BTEX & MTBE				
Organies	PAHs	PAHs				
Organics	Phenols	Phenols				
	VOCs	VOCs				
	SVOCs	SVOCs				
Inorganics	-	Total Alkalinity, Calcium, Manganese, Sulphate, Cyanide (Total), Chloride, Sodium,				

3 METHODOLOGY

Groundwater samples were collected from 8 no. on-site groundwater monitoring wells (BH101, BH102, BH103, BH104B, MW01, MW02, MW03, MW04), (Figure 3.1) using dedicated Waterra tubing, in accordance with RPS's standard sampling protocol. A non-return foot valve was fixed to the bottom of the tubing and inserted into the well, close to the base of the borehole. Separate tubing and foot valves were used at each monitoring well to eliminate the possibility of cross contamination.

Groundwater in the well casing is not considered representative of the groundwater quality at a given location. For this reason, three well volumes were purged from each well prior to collection of the groundwater sample. By the time purging was complete all field test water parameters (namely pH, Temperature, Electrical Conductivity and Dissolved Oxygen) were within 10% variance in three consecutive measurements. This ensured that the groundwater sample extracted from the monitoring borehole was representative of the water held in the subsurface strata and not water held stagnant in the borehole casing. The purged volumes were calculated on-site from the measured static water levels and total well depths using an electronic dip meter.

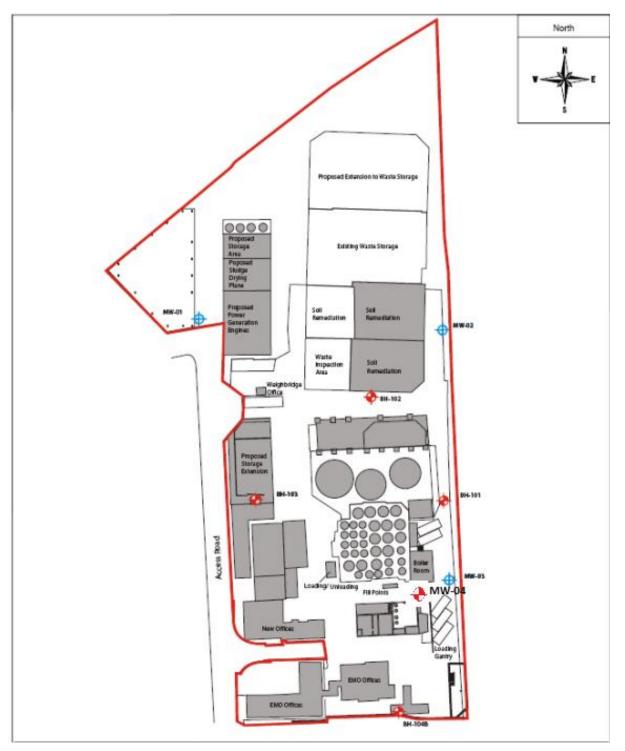
Groundwater samples were collected in laboratory supplied containers and stored in chilled cool boxes following sampling and during transit to the laboratory. A rigorous chain of custody procedure was used during the sample round.

3.1 LABORATORY ANALYSIS

All groundwater samples were analysed at a UKAS accredited laboratory, ALS Environmental for the suite of analyses listed in **Table 3.1**. **Table 3.1** also indicates the analytical techniques used by the laboratory.

Table 3.1 – Analytical Methodologies – ALS Environmental

Parameter	Analytical Methodology
Phenols	GC-MS
Speciated PAHs	GC-MS
BTEX & MTBE	Headspace GC-MS
Petroleum Hydrocarbons	Headspace GC-MS
Volatile Organic compounds & Tentatively Identified Organic Compounds (VOCs & TICs)	Headspace GC-MS
Semi-Volatile Organic compounds & Tentatively Identified Organic Compounds (SVOCs & TICs)	GC-MS





Shallow Monitoring Well locations Deep Monitoring Well locations

Source: URS Environmental Consultants (Ref: 45078497 Issue No. 1)

3.2 PRESENTATION & INTERPRETATION OF RESULTS

The Quarter 1 2016 results are tabulated in **Section 4** and discussed with respect to previous results in **Section 5**. Results are compared against Groundwater Threshold Values (GTVs) outlined in the European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. No 9 of 2010), where available. Where GTVs are not available for parameters, results are compared against the Interim Guideline Values (IGVs) set out in the Environmental Protection Agency interim report, 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland'.

Previous monitoring reports (as listed in **Section 2.1**) provide details of contaminant concentrations since 2004. The data available within these reports has been reviewed and time series plots of key parameters have been compiled. Trends for chlorinated solvents, petroleum hydrocarbons and phenol parameters have been plotted.

Time series plots are presented in **Section 6** and include the results of this Quarter 1 2016 monitoring round. As the monitoring continues in accordance with the Industrial Emissions licence requirements, the plots will be updated with the results of subsequent rounds used to illustrate the results.

Time series plots are also provided for manual water levels where available from previous reports.

4 QUARTER 1 RESULTS FEBRUARY 2016

The results of all field measurements and laboratory analysis are presented in this section. This resulted in a lack of field measurements. Results are primarily compared against Groundwater Threshold Values (GTVs) outlined in the European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. No 9 of 2010), where available. Where GTVs are not available for parameters, results are compared against the Interim Guideline Values (IGVs) set out in the Environmental Protection Agency interim report, 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland'.

The results are discussed in relation to appropriate guideline values in **Section 5**. Results that are shown to be above the relevant threshold or guideline values are highlighted in bold and shaded. Results that are shown to be above the relevant laboratory detection limits are highlighted in italics.

Site-specific field parameter measurements were collected during the site visit as per RPS Water sampling protocol.

Table 4.1 – Groundwater Levels	(Quarter 1, 2016)
--------------------------------	-------------------

Monitoring Well	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04
Depth (mbgl)	6.64	6.41	4.45	4.72	22.12	30.88	14.64	6.46
Static Water Level (mbgl)	3.98	2.50	1.62	0.41	2.21	3.48	3.89	3.69
Ground Level (mAOD)	103.06	102.55	101.16	101.52	102.10	103.12	102.77	-
Water Level (mAOD)	99.08	100.05	99.54	101.11	99.89	99.64	98.88	-
Free Phase Oil (mm)	No detection							

mbgl = metres below ground level

Monitoring Well	рН (рН Units)	Temperature (°C)	Conductivity (μS/cm)	Dissolved O ₂ (ppm)	Observations
BH101	7.71	11.3	1137	2.44	Light cloudy colour, some suspended solids, little sediment
BH102	8.56	10.4	731	3.12	Clear/yellow colour on purging, very little suspended solids, slight H_2S odour
BH103	8.44	9.9	863	2.89	Slightly cloudy on purging with a very minor H ₂ S odour, little sediment
BH104B	7.30	7.6	595	1.76	Slightly brown colour, clearer after 10L, slight H ₂ S odour, very little suspended solids or sediment
MW01	7.73	9.7	638	3.37	Cloudy grey on purging, no odour, some sediment and very little suspended solids
MW02	8.21	11.9	746	2.22	Grey on purging, clear after 10L, very slight H ₂ S odour, very little sediment or suspended solids
MW03	7.41	12.5	1568	3.78	Dark grey colour on purging, H ₂ S odour, some suspended solids, slight oil sheen
MW04	7.59	11.0	1571	1.59	Light cloudy brown in colour, high amount of suspended solids
Groundwater Threshold Value	-	-	1875	-	-
Interim EPA Guideline Values (Units as indicated)	>6.5 & <9.5	25°C	1000	No abnormal change	-

Table 4.2 – Results of Field Parameters Measured at each Groundwater Monitoring Well (Quarter 1, 2016)

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the GTV are highlighted in bold and shaded.

Table 4.3 – Results of BTEX and MTBE

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Benzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.75	1.0
Toluene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
Ethylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
p & m-xylene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	-	10 ^{Note 1}
o-xylene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10 Note 1
MTBE (Methyl Tertiary Butyl Ether)	µg/I	1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	2.2	2.1	-	30

Note: No specific IGV for parameter. IGV for Total Xylenes is used as guideline.

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

Table 4.4 – Results of Speciated PAHs

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Naphthalene	μg/l	0.01	<0.10	<0.01	<0.12	0.034	<0.01	<0.01	<0.01	0.153	-	1.0
Acenaphthylene	μg/l	0.01	<0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	-	-
Acenaphthene	μg/l	0.01	<0.10	<0.01	0.087	0.034	<0.01	<0.01	<0.01	<0.10	-	-
Fluorene	μg/l	0.01	<0.10	<0.01	0.025	0.051	<0.01	<0.01	<0.01	<0.10	-	-
Phenanthrene	μg/l	0.01	<0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	-	-
Anthracene	μg/l	0.01	<0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	-	10,000
Fluoranthene	μg/l	0.01	<0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	-	1.0
Pyrene	μg/l	0.01	<0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	-	-
Benzo(a)anthracene	μg/l	0.01	<0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	-	-
Chrysene	µg/l	0.01	<0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	-	-
Benzo(b)fluoranthene	μg/l	0.01	<0.10	<0.01	0.011	<0.01	<0.01	<0.01	<0.01	<0.10	-	0.5

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Benzo(k)fluoranthene	µg/l	0.01	<0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	-	0.05
Benzo(a)pyrene	µg/l	0.01	<0.10	<0.01	<0.04	<0.01	<0.01	<0.01	<0.01	<0.10	-	0.01
Indeno(1,2,3-cd)pyrene	μg/l	0.01	<0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	-	0.05
Dibenz(a,h)anthracene	μg/l	0.01	<0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	-	-
Benzo(g,h,i)perylene	μg/l	0.01	<0.10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	-	0.05
Total EPA-16 PAHs	μg/l	0.1	<0.10	<0.01	0.123	0.159	<0.01	<0.01	<0.01	0.153	0.075	0.1

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the GTV are highlighted in bold and shaded.

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

Table 4.5 – Results of Speciated Phenols

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Phenol	µg/l	5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	-	0.5
2,4,6-Trichlorophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	200
2,4-Dichlorophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2,4-Dimethylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Chlorophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	200
2-Methylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Nitrophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
4-Chloro-3-methylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
4-Methylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Phenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.5
2-Chlorophenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	200
Bis(2-chloroethyl)ether	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,3-Dichlorobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2-Dichlorobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
1,4-Dichlorobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bis(2-chloroisopropyl)ether	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Methylphenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Hexachloroethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Nitrobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
4-Methylphenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Isophorone	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Nitrophenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2,4-Dimethylphenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bis(2-chloroethoxy)methane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2,4-trichlorobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.40
Naphthalene	µg/l	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	1.0
2,4-Dichlorophenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Hexachlorobutadiene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.10
4-Chloro-3-methylphenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2,4,6-Trichlorophenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	200
2,4,5-Trichlorophenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Methylnaphthalene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Chloronaphthalene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Dimethylphthalate	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
2,6-Dinitrotoluene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Acenaphthylene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Acenaphthene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2,4-Dinitrotoluene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Dibenzofuran	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
4-Chlorophenyl phenyl ether	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Diethyl phthalate	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Fluorene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bromophenyl phenyl ether	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Hexachlorobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.03
Phenanthrene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Anthracene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10,000
Pyrene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Butyl benzyl phthalate	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzo(a)anthracene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Chrysene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzo(b)fluoranthene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.5
Benzo(k)fluoranthene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.05
Benzo(a)pyrene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.01
Indeno(1,2,3-cd)pyrene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.05
Dibenz(a,h)anthracene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzo(g,h,i)perylene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	

Note: Results above the relevant IGV are highlighted in bold. Note: Results above the GTV are highlighted in bold and shaded.

Table 4.7 – Results of Volatile Organic Compounds (VOCs)

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Chloromethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Chloroethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bromomethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Vinyl Chloride	μg/l	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	0.375	-
Trichlorofluoromethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,1-dichloroethene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	30
1,1,2-Trichloro 1,2,2- Trifluoroethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Cis-1,2-dichloroethene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	30
2,2-Dichloropropane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Trichloromethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	12
1,1,1-Trichloroethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	500
1,2-dichloroethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.25	-
1,1-Dichloropropene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Trans-1,2-dichloroethene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	1.0
1,2-dichloropropane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Trichloroethene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	70
Dibromomethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bromodichloromethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Cis-1,3-dichloropropene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Trans-1,3-dichloropropene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Toluene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
1,1,2-Trichloroethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,3-Dichloropropane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Dibromochloromethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Tetrachloroethene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	40
1,2-Dibromoethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Chlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	1.0
1,1,1,2-Tetrachloroethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Ethylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
p & m-xylene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	-	10
Styrene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Tribromomethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
o-xylene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
Isopropylbenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bromobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
N-Propylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Chlorotoluene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
4-Chlorotoluene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,3,5-Trimethylbenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Tert-Butylbenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2,4-Trimethylbenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	-	-
Sec-Butylbenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,3-dichlorobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
P-Isopropyltoluene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2-dichlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
1,4-dichlorobenzene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Butylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
1,2-Dibromo-3-chloropropane	μg/l	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	-
1,2,4-Trichlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.40
Hexachlorobutadiene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.10
1,2,3-Trichlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the GTV are highlighted in bold and shaded.

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Aliphatic > C10-C12	μg/l	10	<10	<10	<40	<200	<10	<10	<10	<10	-	-
Aliphatic > C12-C16	μg/l	10	<10	<10	<40	<200	<10	<10	<10	<10	-	-
Aliphatic > C16-C35	μg/l	10	<10	<10	132	<200	<10	<10	<10	<10	-	-
Aliphatic > C35-C44	µg/l	10	<10	<10	<40	<200	<10	<10	<10	<10	-	-
Aliphatic > C10-C44	µg/l	10	<10	<10	132	<200	<10	<10	<10	<10	-	10
Aromatic > C10-C12	µg/l	10	<10	<10	<40	<200	<10	<10	<10	<10	-	-
Aromatic > C12-C16	µg/l	10	<10	<10	<40	<200	<10	<10	<10	15	-	-
Aromatic > C16-C21	µg/l	10	<10	<10	<40	<200	<10	<10	<10	<10	-	-
Aromatic > C21-C35	µg/l	10	<10	<10	<40	<200	<10	<10	<10	<10	-	-
Aromatic > C35-C44	µg/l	10	<10	<10	<40	<200	<10	<10	<10	<10	-	-
Aromatic > C10-C44	µg/l	10	<10	<10	<40	<200	<10	<10	<10	15	-	10

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the GTV are highlighted in bold and shaded.

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

5 DISCUSSION OF QUARTER 1 RESULTS

The results of the Quarter 1 monitoring event for 2016 are presented in **Table 4.1** to **4.8** of this report. For the purpose of this report, the results are compared against the Groundwater Threshold Values (GTVs) outlined in the European Communities Environmental Objectives (Groundwater) Regulations (S.I. No. 9 of 2010) where available. Where GTVs are not available results are compared against the EPA Interim Guideline Values (IGV) as set out in the Interim Report *'Towards Setting Guideline Values for the Protection of Groundwater in Ireland' 2004.* A discussion of the results and their significance is included below.

5.1 FIELD PARAMETERS

The results of the field parameters measured at each groundwater monitoring well are presented in **Table 4.2**. Groundwater samples recorded pH levels ranging between 7.30 and 8.56, all within the EPA Interim guideline range of \geq 6.5 to \leq 9.5. Temperature measurements ranged from 7.6°C to 12.5°C and were below the EPA IGV of 25°C.

Field measurements of Electrical Conductivity levels ranged between 595 μ S/cm and 1571 μ S/cm. Three measurements of Electrical Conductivity were above the IGV of 1000 μ S/cm at BH101 (1137 μ S/cm), MW03 (1568 μ S/cm) and MW04 (1571 μ S/cm), but all however were below the GTV limit of 1875 μ S/cm.

Dissolved oxygen levels ranged between 1.59 and 3.78 ppm. Factors such as climate, nutrients in the water, suspended solids; organic wastes and groundwater inflow can all influence the dissolved oxygen values.

Observations relating to colour and odour varied from well to well as detailed in Table 4.2.

5.2 RESULTS OF BTEX & MTBE

The results of the **BTEX** and **MTBE** analysis are presented in **Table 4.3**. BTEX concentrations are below the associated GTVs and IGVs at all locations. BTEX concentrations are also below the laboratory of limit of detection at all locations, with the exception of p & m-xylene at MW03 (1.1 μ g/l). MTBE was detected at BH103 (1.4 μ g/l), MW03 (2.2 μ g/l) and MW04 (2.1 μ g/l), however these are all below the IGV of 30 μ g/l. MTBE was also below the laboratory limit of detection and IGV at all other locations.

The previous detection of MTBE was in the Quarter 3 monitoring event of 2015 and recorded a concentration above the laboratory limit of detection of $3.1 \,\mu$ g/l at BH103. This is still well below the IGV limit. Prior to this there was a detection of MTBE at BH104B in the Quarter 1 monitoring event of 2012 with a recorded concentration of 280 μ g/l which is above the laboratory limit of detection. This was the only recorded exceedance in Quarter 1 2012.

Monitoring during Quarter 1 and Quarter 2 of 2010 detected exceedances of MTBE at BH103 at a concentration of 16 μ g/l. Subsequent monitoring in 2010 recorded concentrations below the laboratory limit of detection. Prior to these 2010 monitoring events, concentrations of MTBE at BH103 were recorded at 63 μ g/l in December 2009.

5.3 **RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)**

The results of the Speciated PAH analysis during this monitoring period are presented in **Table 4.4.**

The laboratory limit of detection for Total EPA-16 PAHs is 0.1 μ g/l and has been lowered for comparison with the EPA IGV of 0.1 μ g/l; however this is not accredited. This laboratory limit of detection is above the EPA GTV of 0.075 μ g/l. To identify the compounds, which attributed to these concentrations, speciated PAH analysis was carried out, which reduces the limit of detection for individual parameters to 0.01 μ g/l.

Total Polyaromatic Hydrocarbons were above the IGV limit of 0.1 μ g/l at BH103 (0.123 μ g/l), BH104B (0.159 μ g/l) and MW04 (0.153 μ g/l). Total PAHs were below the IGV of 0.1 μ g/l and the GTV of 0.075 μ g/l at all other locations. Total PAHs were also above the IGV at BH103 (0.21 μ g/l) and MW03 (0.986 μ g/l) during the previous Quarter 4 2015 monitoring event.

The results of the speciated polycyclic aromatic hydrocarbon analysis detected a number of different compounds in BH103, BH104B and MW04 above the laboratory limit of detection. However none of these compounds were above their respective IGV limits at any location.

5.4 **RESULTS OF SPECIATED PHENOLS**

During previous quarterly monitoring events and sample analysis, total monohydric phenol was determined and historically has been below the laboratory limit of detection of 10 μ g/l since December 2008. It should be noted that the laboratory limit of detection was however above the IGV of 0.5 μ g/l for phenols.

For this reason, samples were analysed for phenols to include chlorophenols. The results of the speciated phenols analysis are presented in **Table 4.5**. The speciated phenol analysis reduces the laboratory limit of detection to $1.0 \,\mu$ g/l for individual parameters.

The results of the current Quarter 1 2016 speciated phenol analysis confirm concentrations of phenols were below the laboratory limit of detection of 1.0 μ g/l at all locations.

4-Chloro-3-methylphenol was detected at BH104B (1.37 μ g/l) above the laboratory limit of detection during the Quarter 1 2015 analysis. With the exception of this, all other results are consistent with results since the 2012 quarterly monitoring events.

5.5 RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS

The results of the Semi-Volatile Organic Compound analysis are presented in Table 4.6.

There are no GTVs for individual SVOC parameters. No SVOCs were detected above the relevant IGVs during this monitoring period, consistent with the results from the 2015 and 2014 monitoring periods.

The Quarter 3 2013 monitoring event detected two SVOC compounds, Acenaphthene (1.1 μ g/l) and Fluorene (1.5 μ g/l) in MW03. Prior to this detection the Quarter 2 monitoring event of 2012 detected concentrations of Naphthalene and Acenaphthylene in MW03 at concentrations of 2.4 μ g/l and 0.12 μ /l respectively.

5.6 **RESULTS OF VOLATILE ORGANIC COMPOUNDS**

The results of the Volatile Organic Compound analysis are presented in **Table 4.7**. The results of the current Quarter 1 2016 monitoring event indicate that Vinyl Chloride was detected above the GTV of 0.375 μ g/l at MW04 (1.1 μ g/l). 1,2,4-Trimethylbenzene (1.1 μ g/l) and p & m-xylene (1.1 μ g/l) were also detected in monitoring well MW03. However, the results are below the IGV for p & m-xylene (10 μ g/l) and there is no GTV or IGV limit for 1,2,4-Trimethylbenzene. All other compounds were below their respective laboratory limits of detection.

Historic groundwater monitoring events detected some parameters above the laboratory limit of detection in November 2009, corresponding to Quarter 4 of 2009. 1,1-Dichloroethane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, MTBE, n-butylbenzene, n-propylbenzene, o-xylene, p-isopropyltoluene, sec-butylbenzene and tert-butylbenzene were detected above the laboratory limits of detection. No VOCs were detected above the relevant GTVs or IGVs.

The results of the Quarter 3 and Quarter 4 monitoring events of 2009 and all subsequent monitoring events indicate that there were no exceedances of the GTVs or IGVs for specific parameters.

5.7 RESULTS OF TOTAL PETROLEUM HYDROCARBONS

In order to provide a more accurate profile of TPH within the groundwater, speciated hydrocarbon analysis using the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) method was carried out on samples taken at all boreholes. The results of the TPH analysis are presented in **Table 4.8**.

The EPA IGV of 10 μ g/l for the Total Hydrocarbons is deemed comparable with the results for Total Petroleum Hydrocarbons. Some detections of TPH in both the aliphatic and aromatic range were observed during the current Quarter 1 2016 monitoring event. Detections in samples from the well BH103 were in the aliphatic range C16-C35 (132 μ g/l) and from well MW04 in the aromatic range C12-C16 (15 μ g/l).

The previous Quarter 4 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 (879 μ g/l), C16-C21 (1380 μ g/l) and C21-C35 (694 μ g/l) at BH104B, C21-C35 at BH103 (60 μ g/l) and C10-C12 (13 μ g/l) and C12-C16 (21 μ g/l) at MW04. TPH concentrations were detected in the aliphatic ranges C10-C12 (495 μ g/l), C12-C16 (3080 μ g/l) and C16-C35 (3360 μ g/l) at BH104B and C16-C35 (231 μ g/l) and C35-C44 (14 μ g/l).

The Quarter 3 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 (39 μ g/l), C16-C21 (37 μ g/l) and C21-C35 (28 μ g/l) at BH104B, C21-C35 at BH103 (17 μ g/l) and C10-C12 (18 μ g/l) and C12-C16 (29 μ g/l) at MW04. TPH concentrations were detected in the aliphatic ranges C10-C12 (13 μ g/l), C12-C16 (40 μ g/l) and C16-C35 (62 μ g/l) at BH104B and C16-C35 at BH103 (72 μ g/l) and MW03 (14 μ g/l).



The Quarter 2 monitoring event of 2015 detected TPH in the aromatic range C21-C35 at BH03 (509 μ g/l). TPH concentrations were detected in the aliphatic ranges C16-C35 at BH103 (1760 μ g/l) and BH104B (337 μ g/l), and C12-C16 at BH104B (225 μ g/l).

The Quarter 1 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 at wells MW03 (14 μ g/l), MW04 (15 μ g/l) and BH104B (27 μ g/l), C16-C21 at BH104B (15 μ g/l), and C21-C35 (14 μ g/l) at BH103. TPH concentrations were detected in the aliphatic ranges C16-C35 and C35-C44 at MW03 (46 μ g/l and 12 μ g/l respectively), BH103 (54 μ g/l) and BH104B (11 μ g/l.

No detections of TPH in the aliphatic or aromatic range were observed in any shallow or deep monitoring well locations during the Quarter 4 monitoring event of 2014.

The Quarter 3 monitoring event of 2014 detected TPH concentrations in the aliphatic range at the shallow groundwater well BH104B. The TPH concentration detected was 410 μ g/l. The speciated TPH ranges that contributed to the value of 410 μ g/l were C12-C16 (150 μ g/l), C16-C21 (250 μ g/l) and C31-C35 (10 μ g/l).

The Quarter 3, 2013 monitoring event detected TPH in the aliphatic range in one deep groundwater well, MW03. TPH of the range C10-C12 and C12-C16 were detected at concentrations of 200 μ g/l and 190 μ g/l respectively.

The Quarter 1, 2013 monitoring event detected aliphatic TPH of the range C12-C16, C16-C21 and C21-C35. TPH in the mid to high aromatic ranges were detected in BH103, BH104B and MW04 during the previous Quarter 1 2013 monitoring event. Aromatic TPH of the ranges C12-C16, C16-C21 and C21-C35 were detected in BH103, the ranges C10-C12, C12-C16 and C16-C21 were detected in BH104B and aromatic TPH of the ranges C10-C12 and C12-C16 were detected in MW04.

The Quarter 2 monitoring event of 2012 detected elevated TPH of the aliphatic range C12-C16, C16-C21 and C21-C25 in BH103. Hydrocarbons have been detected in borehole MW03 during Quarter 1 2010, in borehole BH104B during the Quarter 2 2010 monitoring event and in borehole BH104B and MW03 during the Quarter 3 2010 monitoring events. Hydrocarbons have also been detected in BH103, BH104B and MW03 in the Quarter 2 2011 monitoring event and in MW03 in the Quarter 3 and Quarter 4 2011. These detections are discussed further in **Section 6.2.3**.

6 HISTORICAL RESULTS & TRENDS

Time series plots are presented in this section and include the results of the Quarter 1 2016 monitoring round. As the monitoring continues in accordance with the Industrial Emissions Licence requirements, the plots will be updated with the results of subsequent rounds and used to illustrate the results.

6.1 GROUNDWATER LEVELS OVER TIME

Figure 6.1 to **Figure 6.3** below illustrates the manually recorded water levels using an electronic probe. The graphs show that groundwater levels can vary considerably between monitoring rounds.

Figure 6.2 illustrates groundwater elevations (mAOD) in shallow groundwater wells (BH101 to BH104B) ranging between approximately 98 mAOD and 102 mAOD.

Figure 6.3 illustrates groundwater elevation (mAOD) in the deeper groundwater wells (MW01 to MW03). The groundwater elevation (mAOD) for these deeper groundwater wells ranges from approximately 97.5 mAOD to approximately 100 mAOD.

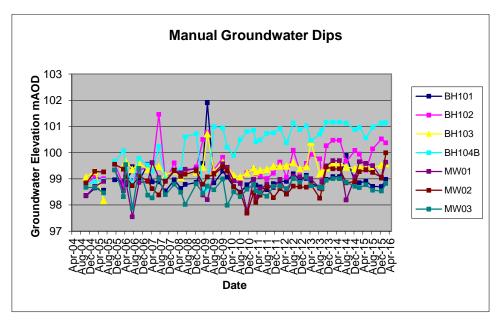


Figure 6.1 – Ground Elevation (mAOD) in all Monitoring Wells



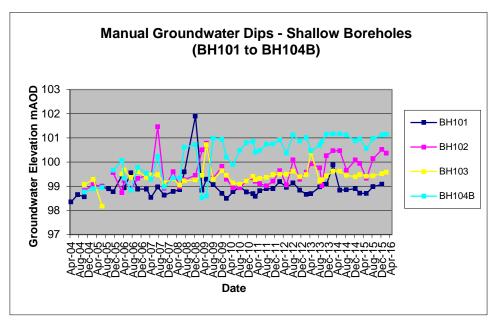
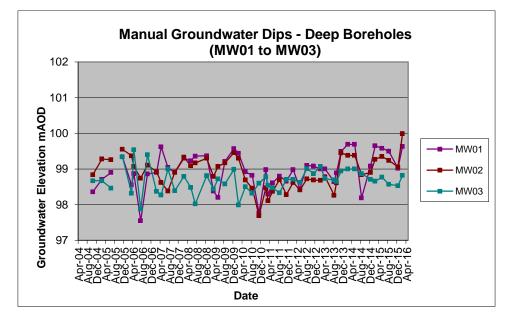


Figure 6.3 – Ground Elevation (mAOD) in Deep Groundwater Monitoring Wells



The groundwater levels generally show a similar pattern of fluctuation over time indicating a degree of connection between boreholes. The graphs demonstrate that groundwater levels can vary considerably between monitoring rounds; the general direction of flow in the shallow and deeper groundwater bearing unit is in an easterly or north easterly direction however there have been some occasional historic cases of groundwater flowing in a south-easterly direction.

In addition, monthly rainfall data for Oak Park, Carlow have been tabulated from Met Éireann to examine the relationship between compounds and rainfall events. The data from Oak Park was chosen as the weather station at Birr, Co. Offaly closed in October 2009. A summary of the rainfall data is in **Tables 6.1** to **6.5**.

Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Rainfall (mm)	70.8	24.5	18.0	56.3	50.2	155.8	76.2	127.7	37.9	63.4	80.9	68.1

Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Rainfall (mm)	76.2	35.8	57.6	44.4	35.6	37.5	32.3	85.6	24.4	170.0	27.7	136.6

Table 6.3 – Monthly Rainfall Data for Year 2014 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Rainfall (mm)	147.2	176.7	65.0	52.6	78.6	61.9	24.6	122.1	18.2	138.2	165.6	47.7

Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	66.0	36.3	53.5	26.3	89.4	29.7	79.4	83.0	17.9	56.8	110.0	270.9

Table 6.5 – Monthly Rainfall Data for Year 2016 for Oak Park, Carlow

Month	Jan	Feb	Mar
Rainfall (mm)	110.9	95.7	40.6

6.2 GROUNDWATER CONCENTRATIONS OVER TIME

Groundwater quality trends have previously been examined in two reports (URS 2005 and RPS 2007). In addition, RPS carried out a groundwater risk assessment (Ref: MDE0788RP0001, dated November 2008) in which the general trend of contaminant concentrations over time was observed to be erratic with compounds rarely being detected in the same borehole on two consecutive monitoring rounds.

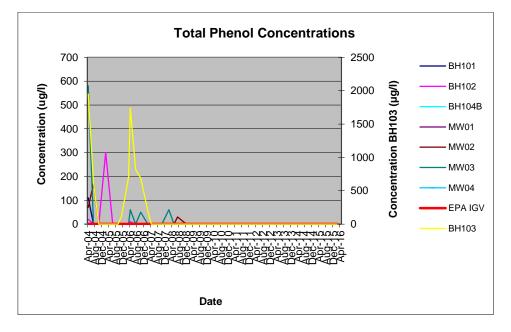
The data available within these reports has been reviewed and time series plots of key parameters have been compiled based on notable trends. Trends for phenols, petroleum hydrocarbons and chlorinated solvents have been plotted as outlined in the following sections.

6.2.1 Phenols

Phenols have been detected historically in all boreholes with the highest concentrations recorded in BH103. However concentrations in BH103 have declined since April 2007. Phenol concentrations have since been recorded below the IGV of 0.5 μ g/l in all monitoring wells since December 2008 indicating natural attenuating conditions within the groundwater.

2,4-Dimethylphenol was detected at a concentration of 0.12 μ g/l during the Quarter 1, 2010 monitoring event. There is no recommended IGV for this parameter. Subsequent to the Quarter 1 2010 monitoring event no detections of phenols have been noted at any monitoring location up to and including the current Quarter 1 2016 monitoring event.





6.2.2 Polyclyclic Aromatic Hydrocarbons

Figure 6.5 below illustrates that PAHs (Polycyclic Aromatic Hydrocarbons) have previously been detected within all monitoring wells above the recommended EPA IGV of 0.1 μ g/l. Historically the highest concentrations have been detected within MW03 and BH104B, with the highest concentration detected in March 2006 (107 μ g/l) and in October 2007 (19.72 μ g/l) respectively. In addition, a range of PAHs including Benzo(a)pyrene, Benzo(g,h,i)perylene, Indeno(1,2,3)cd pyrene, Fluoranthene and Naphthalene have previously been detected in MW03 with **Figures 6.6** to **6.10** illustrating some of the PAH compounds which were detected above their respective IGVs.

Since 2007 concentrations of PAH have shown a marked decrease and since 2010 detections of PAH have been confined to MW03, MW02 and BH104B. Concentrations of Total PAH above the IGV in 2010 were detected during the Quarter 1 monitoring event in MW03 (0.3 μ g/l), Quarter 2 monitoring event in BH104B (1.2 μ g/l) and Quarter 3 monitoring event in MW02 (2.0 μ gl) and BH104B (0.2 μ gl). There were no elevated concentrations of Total PAH during the Quarter 4 2010 monitoring event.

No Total PAH detections were recorded throughout 2011 and in Q1 of 2012. Total PAH was detected above the IGV in MW03 in the Q2 2012 monitoring event. No Total PAH exceedances were detected from Quarter 3 2012 to Quarter 4 2013 inclusive. Total PAHs were detected at a concentration of 2.62 μ g/l in MW03 during the Q3 2013 monitoring event however; no detections above the laboratory limit were noted during the subsequent monitoring events up to and including the Quarter 2 2015 monitoring event. Total PAHs were also above the GTV at BH103 (0.093 μ g/l), BH104B (0.159 μ g/l) and MW03 (0.586 μ g/l) during the Quarter 3 2015 monitoring event, as well as at BH103 (0.21 μ g/l), MW03 (0.986 μ g/l) and MW04 (0.079 μ g/l) during previous Quarter 4 2015 monitoring event. Similarly, during the current Quarter 1 2016 monitoring event Total Polyaromatic Hydrocarbons were above the IGV limit of 0.1 μ g/l at BH103 (0.123 μ g/l), BH104B (0.159 μ g/l) and MW04 (0.153 μ g/l).

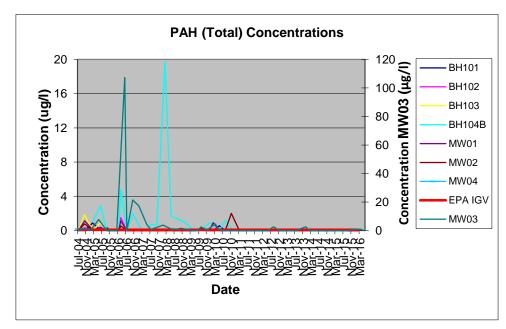


Figure 6.5 – PAH (Total) Concentrations in all Monitoring Wells



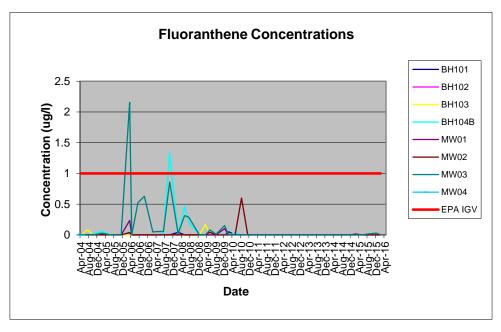


Figure 6.6 illustrates that **Fluoranthene** was previously detected above the IGV of 1.0 μ g/l in groundwater monitoring wells BH104B (October 2007, 1.33 μ g/l) and MW03 (March 2006, 2.158 μ g/l) only. The remaining monitoring wells recorded concentrations below the IGV of 1.0 μ g/l.

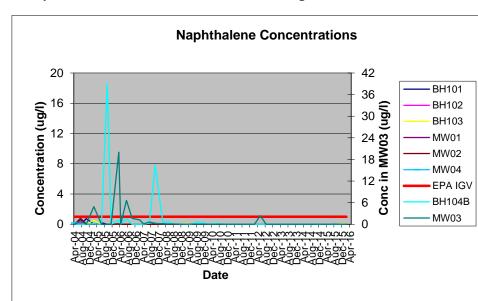
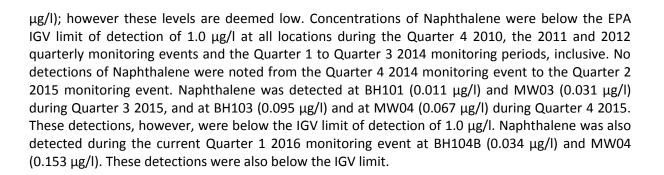


Figure 6.7 – Naphthalene Concentrations in all Monitoring Wells

A similar trend to Fluoroanthene has been noted in **Figure 6.7**, with concentrations of **Naphthalene** recorded above the IGV of 1.0 μ g/l in BH104B and MW03 only. 4 no. exceedances of the IGV were noted in BH104B in September 2005 (39 μ g/l), March 2006 (1.069 μ g/l), July 2006 (1.594 μ g/l) and October 2007 (16.31 μ g/l). Since October 2007, the concentrations in BH104B have decreased below the IGV. There have been 6 exceedances of the IGV of 1.0 μ g/l in MW03, with the highest concentration detected in March 2006 (19.986 μ g/l) and the most recent being the detected in the Quarter 2 2012 monitoring event (2.4 μ g/l). The concentrations detected in August 2010 were slightly above the laboratory limit of detection of 0.01 μ g/l at BH104B (0.08 μ g/l) and MW03 (0.05



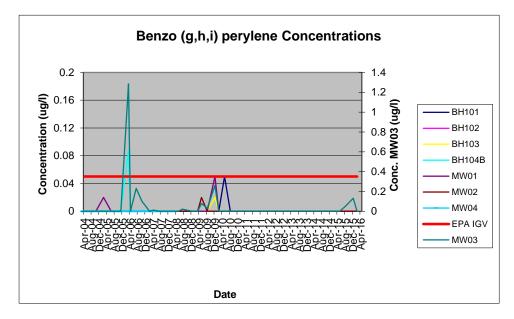


Figure 6.8 – Benzo (g,h,i) perylene Concentrations

Figure 6.8 illustrates the concentrations of **Benzo(g,h,i)perylene** in all monitoring wells over time. Elevated concentrations above the IGV were recorded at BH104B (0.087 μ g/l) on one occasion in March 2006.

Figure 6.9 illustrates elevated concentrations above the IGV recorded at MW03 on 6 no. occasions with the most recent elevated concentration recorded during the Quarter 4 2015 monitoring event (0.053 μ g/l). The previous elevated concentration detected was in Quarter 3 2015 (0.053 μ g/l). The results of all monitoring events from 2010 to the Quarter 2 2015 monitoring event recorded concentrations below the laboratory limit of detection of 0.01 μ g/l at all locations. Concentrations were also below the laboratory limit of detection at all locations during the current Quarter 1 2016 monitoring event.

RPS

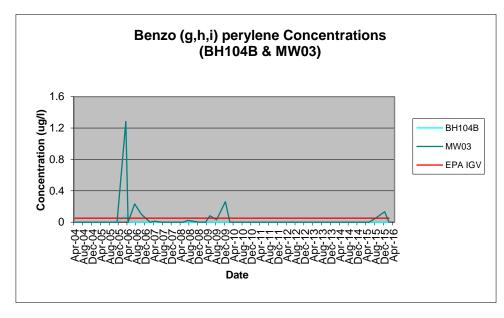


Figure 6.9 – Benzo (g,h,i) perylene in Monitoring Wells BH104B & MW03

Figure 6.10 illustrates the concentrations of **Benzo(a)pyrene** in all groundwater monitoring wells and indicates that Benzo(a)pyrene has been detected historically in all boreholes above the IGV of 0.01 μ g/l. Similarly with the above mentioned trends, the highest concentrations have been detected in MW03 and BH104B. Concentrations have markedly decreased since March 2006 when an elevated concentration of 2.751 μ g/l was detected in MW03, however there have been a number of detections above the IGV, with the most recent elevated level detected in December 2009. Elevated concentrations above the IGV were recorded in BH101, BH103 and MW01 during this same period.

The slightly higher concentrations of Benzo(g,h,i)perylene and Benzo(a)pyrene detected in Quarter 4, 2009 may be attributed to heavy rainfall, which occurred in November of 2009 and as a result possibly mobilized traces of these compounds from the soil. The static water levels for December 2009 ranged between 0.58 and 3.78 mbgl. Since December 2009, concentrations of compounds have notably decreased to below the IGVs.

Benzo(a)pyrene was detected above the IGV limit of 0.01 μ g/l at MW03 (0.108 μ g/l) during the previous Quarter 4 2015 monitoring event. Benzo(a)pyrene was also detected above the IGV at MW03 (0.052 μ g/l) during the Quarter 3 2015 monitoring event. All other results of all monitoring events from 2010 to the current Quarter 1 2016 monitoring event did not detect other concentrations above the IGV.

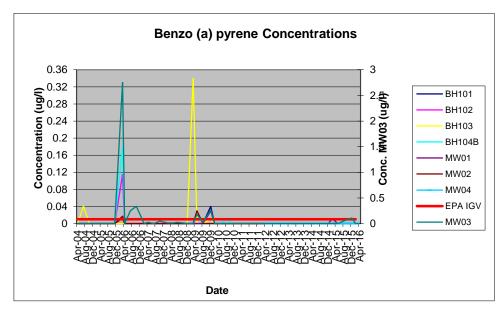


Figure 6.10 – Benzo (a) pyrene Concentrations in all Monitoring Wells

6.2.3 Petroleum Hydrocarbons (TPH)

Historically **Total Petroleum Hydrocarbons (TPH)** including mineral oil, petrol range organics (PRO) and diesel range organics (DRO) have been detected within BH103, BH104B and MW03. Since 2009, speciated hydrocarbon analysis using the Total Hydrocarbon Criteria Working Group (TPHCWG) method has been carried out on all samples to obtain a more accurate profile of TPH within groundwater.

The results of the TPHCWG analysis has indicated that the predominant hydrocarbons detected are in the heavier chain carbon fractions, most notably in the carbon range C12 – C16, C16 – C21 and C21 – C35. **Figure 6.11** illustrates the TPH analysis for the total TPH analysis from C5 – C44 in all monitoring wells since 2009. The highest concentrations detected historically are at monitoring wells MW03, BH104B and BH103 respectively.

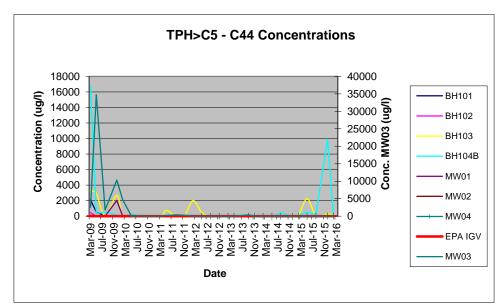


Figure 6.11 – TPH (Carbon Range C5-C44) in all Monitoring Wells



Previous quarterly monitoring reports have outlined the hydrocarbon trends recorded in each well since 2010. This report outlines the trends from 2012 up to and including the current monitoring report.

During the Quarter 1, 2012 monitoring event, hydrocarbons were detected in borehole BH103 only. The predominant aliphatic carbon range comprised C10-C12 (13 μ g/l), C12-C16 (270 μ g/l), C16-C21 (690 μ g/l) and C21-C35 (980 μ g/l). The predominant aromatic carbon range comprised of C16-C21 (250 μ g/l) and C21-C25 (680 μ g/l).

During the Quarter 2, 2012 monitoring event, hydrocarbons were detected in BH103 only. The detected aliphatic carbon range comprised C12-C16 (98 μ g/l), C16-C21 (230 μ g/l) and C21-C25 (170 μ g/l). No detections of aromatic carbons were measured during the Quarter 2 2012 monitoring event.

No hydrocarbons were detected at any location during the Quarter 3 and Quarter 4, 2012 monitoring events.

During the Quarter 1, 2013 monitoring event aromatic hydrocarbons were detected in BH103, BH104B and MW04. The predominant aromatic carbon range comprised C12-C16 ($30 \mu g/I$), C16-C21 (280 $\mu g/I$) and C21-C35 ($100 \mu g/I$) in BH103, C10-C12 ($30 \mu g/I$), C12-C16 ($110 \mu g/I$) and C16-C21 ($80 \mu g/I$) in BH104B and C10-C12 ($20 \mu g/I$) and C12-C16 ($80 \mu g/I$) in MW04. Aliphatic hydrocarbons were detected in BH103 in the ranges C12-C16 ($70 \mu g/I$), C16-C21 ($100 \mu g/I$) and C21-C35 ($90 \mu g/I$).

During the Quarter 2, 2013 monitoring event no aliphatic or aromatic hydrocarbons were detected at any location.

During the Quarter 3, 2013 monitoring event, hydrocarbons of the aliphatic range were detected in MW03 only. The detected aliphatic carbon range comprised C10-C16 (290 μ g/l) and C12-C16 (190 μ g/l). No detections of aromatic carbons were measured during the Quarter 3 2013 monitoring event.

Total Petroleum Hydrocarbons were not detected at any monitoring location during the Quarter 4, 2014 monitoring event. During the monitoring event for Quarter 3 2014 following ranges of the aliphatic hydrocarbons were recorded for BH104B; C12-C16 (150 μ g/l), C16-C21 (250 μ g/l) and C21-C35 (10 μ g/l).

During the Quarter 1 2015 monitoring event, hydrocarbons were detected in MW03, MW04, BH103 and BH104B. The predominant aromatic carbon range comprised C21-C35 (14 μ g/l) in BH103, C12-C16 (27 μ g/l) and C16-C21 (15 μ g/l) in BH104B, C12-C16 (14 μ g/l) in MW03 and C12-C16 (15 μ g/l) in MW04. Aliphatic hydrocarbons were detected in the ranges C16-C35 (54 μ g/l) in BH103, C16-C35 (11 μ g/l) in BH104B and C16-C35 (46 μ g/l) and C35-C44 (12 μ g/l) in MW03.

During the Quarter 2 2015 monitoring event, the TPH concentration in the aromatic C21-C35 range was detected at one shallow groundwater wells BH103 (509 μ g/l). The TPH concentration in the aliphatic range was detected at C16-C35 (1760 μ g/l) in BH103 and C12-C16 (225 μ g/l) and C16-C35 (11 μ g/l) in BH104B.

The Quarter 3 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 (39 μ g/l), C16-C21 (37 μ g/l) and C21-C35 (28 μ g/l) at BH104B, C21-C35 at BH103 (17 μ g/l) and C10-C12 (18 μ g/l) and C12-C16 (29 μ g/l) at MW04. TPH concentrations were detected in the aliphatic ranges C10-C12 (13 μ g/l), C12-C16 (40 μ g/l) and C16-C35 (62 μ g/l) at BH104B and C16-C35 at BH103 (72 μ g/l) and MW03 (14 μ g/l).

The previous Quarter 4 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 (879 μ g/I), C16-C21 (1380 μ g/I) and C21-C35 (694 μ g/I) at BH104B, C21-C35 at BH103 (60 μ g/I) and C10-C12 (13 μ g/I) and C12-C16 (21 μ g/I) at MW04. TPH concentrations were detected in the aliphatic ranges C10-C12 (495 μ g/I), C12-C16 (3080 μ g/I) and C16-C35 (3360 μ g/I) at BH104B and C16-C35 (231 μ g/I) and C35-C44 (14 μ g/I) at BH103.

For the current Quarter 1 2016 monitoring event, detections in samples from the well BH103 were in the aliphatic range C16-C35 (132 μ g/l) and from well MW04 in the aromatic range C12-C16 (15 μ g/l).

7 CONCLUSIONS

- In accordance with the criteria set out in Schedule 4(ii) of the site's Industrial Emissions Licence Register No. W0184-01, groundwater monitoring was carried out at the ENVA Ireland site on the 24th February 2016 corresponding to Quarter 1 of 2016. Samples were collected at 8 groundwater monitoring wells during this event.
- The results presented have been referenced against Groundwater Threshold Values (GTVs) outlined in the European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. no 9 of 2010), where available. Where GTVs are not available for parameters, results are compared against the Interim Guideline Values (IGVs) set out in the Environmental Protection Agency interim report, 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland'.
- Results of the BTEX and MTBE demonstrate that the levels of Toluene, Ethylbenzene and Xylene, Benzene and MTBE were all below the recommended EPA IGVs.
- The Quarter 1 2016 results of the speciated polycyclic aromatic hydrocarbons indicate that Total PAHs were below the EPA IGV of 0.1 µg/l at all monitoring wells with the exception of BH103 (0.123 µg/l), BH104B (0.159 µg/l) and MW04 (0.153 µg/l).
- Vinyl Chloride was detected above the GTV of 0.375 μg/l at MW04 (1.1 μg/l). 1,2,4-Trimethylbenzene (1.1 μg/l) and p & m-xylene (1.1 μg/l) were also detected in monitoring well MW03. However, the results are below their respective limits. All other VOCs and SVOCs were below their respective laboratory limits of detection
- Samples were analysed for speciated phenols to include chlorophenols and the results indicate that there were no detections above the laboratory limits of detection.
- For the current Quarter 1 2016 monitoring event, TPH detections in samples from the well BH103 were in the aliphatic range C16-C35 (132 μg/l) and from well MW04 in the aromatic range C12-C16 (15 μg/l).
- Hydrocarbons in the aliphatic range C16-C35 (132 µg/l) at BH103 and the aromatic range C12-C16 (15 µg/l) at MW04 were observed during the current Quarter 1 2016 monitoring event. Concentrations in the aliphatic ranges C10-C12 (495 µg/l), C12-C16 (3080 µg/l) and C16-C35 (3360 µg/l) as well as in the aromatic ranges C12-C16 (879 µg/l), C16-C21 (1380 µg/l) and C21-C35 (694 µg/l) were detected at BH104B during the previous Quarter 4 2015 monitoring event. Also in Quarter 4 2015, TPH concentrations were recorded in the aliphatic ranges C16-C35 (231 µg/l) and C35-C44 (14 µg/l) at BH103 and aromatic ranges C21-C35 (60 µg/l) at BH103 and C10-C12 (13 µg/l) and C12-C16 (21 µg/l) at MW04. During Quarter 3 2015, TPH concentrations were also recorded in the aromatic ranges at BH103, BH104B and MW04, as well as in the aliphatic ranges at BH103, BH104B and MW03. Hydrocarbons were detected at BH104B in the aliphatic range and BH103 in both the aromatic and aliphatic ranges during the Quarter 2 2015 monitoring event, as well as MW04 in the aromatic range and BH103, BH104B and MW03 in both the aromatic ranges during Quarter 1 2015. Hydrocarbons were not detected in any monitoring location during the Quarter 4 2014 monitoring event.
- The general trend of contaminant concentrations over time continues to be somewhat variable with compounds not being continually detected in the same borehole on two or three consecutive monitoring rounds. In general, the contaminant levels detected at the Enva facility appear to indicate reducing contaminant concentrations over time with infrequent elevations in some parameters. Further monitoring is recommended to confirm these reductions.



Enva Portlaoise

2016 Groundwater Compliance Monitoring Quarter 2 (Apr – Jun 2016)

Document Control Sheet

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TABLE OF CONTENTS

1		INTRODUCTION1
	1.1	BACKGROUND
	1.2	OBJECTIVES & SCOPE OF WORK
2		REVIEW OF PREVIOUS DATA
	2.1	INFORMATION SOURCES
	2.2	SITE SETTING
	2.3	REGIONAL SETTING
		2.3.1 Geology
		2.3.2 Hydrogeology
	2.4	SITE GROUND CONDITIONS
		2.4.1 Licence Conditions
3		METHODOLOGY
	3.1	LABORATORY ANALYSIS
	3.2	PRESENTATION & INTERPRETATION OF RESULTS
4		QUARTER 2 RESULTS MAY 2016
5		DISCUSSION OF QUARTER 1 RESULTS
5	5.1	DISCUSSION OF QUARTER 1 RESULTS 20 FIELD PARAMETERS 20
5		
5		FIELD PARAMETERS
5	5.2 5.3	FIELD PARAMETERS
5	5.2 5.3 5.4	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21
5	5.2 5.3 5.4	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21
5	 5.2 5.3 5.4 5.5 5.6 	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS21
5	 5.2 5.3 5.4 5.5 5.6 	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS21RESULTS OF VOLATILE ORGANIC COMPOUNDS22
	5.2 5.3 5.4 5.5 5.6 5.7	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS21RESULTS OF VOLATILE ORGANIC COMPOUNDS22RESULTS OF TOTAL PETROLEUM HYDROCARBONS22
	 5.2 5.3 5.4 5.5 5.6 5.7 6.1 	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS21RESULTS OF VOLATILE ORGANIC COMPOUNDS22RESULTS OF TOTAL PETROLEUM HYDROCARBONS22HISTORICAL RESULTS & TRENDS24
	 5.2 5.3 5.4 5.5 5.6 5.7 6.1 	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS21RESULTS OF VOLATILE ORGANIC COMPOUNDS22RESULTS OF TOTAL PETROLEUM HYDROCARBONS22HISTORICAL RESULTS & TRENDS24GROUNDWATER LEVELS OVER TIME24
	 5.2 5.3 5.4 5.5 5.6 5.7 6.1 	FIELD PARAMETERS.20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS21RESULTS OF VOLATILE ORGANIC COMPOUNDS22RESULTS OF TOTAL PETROLEUM HYDROCARBONS22HISTORICAL RESULTS & TRENDS24GROUNDWATER LEVELS OVER TIME24GROUNDWATER CONCENTRATIONS OVER TIME26
	 5.2 5.3 5.4 5.5 5.6 5.7 6.1 	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS21RESULTS OF VOLATILE ORGANIC COMPOUNDS22RESULTS OF TOTAL PETROLEUM HYDROCARBONS22HISTORICAL RESULTS & TRENDS24GROUNDWATER LEVELS OVER TIME24GROUNDWATER CONCENTRATIONS OVER TIME266.2.1 Phenols27

LIST OF FIGURES

Figure 2.1 – Site Location	3
Figure 3.1 – Site Layout Plan with Groundwater Monitoring Locations	7
Figure 6.1 – Ground Elevation (mAOD) in all Monitoring Wells	24
Figure 6.2 – Ground Elevation (mAOD) in Shallow Groundwater Monitoring Wells	25
Figure 6.3 – Ground Elevation (mAOD) in Deep Groundwater Monitoring Wells	25
Figure 6.4 – Phenol Concentrations in all Monitoring Wells	27
Figure 6.5 – PAH (Total) Concentrations in all Monitoring Wells	28
Figure 6.6 – Fluoroanthene Concentrations in all Monitoring Wells	29
Figure 6.7 – Naphthalene Concentrations in all Monitoring Wells	29
Figure 6.8 – Benzo (g,h,i) perylene Concentrations	30
Figure 6.9 – Benzo (g,h,i) perylene in Monitoring Wells BH104B & MW03	31
Figure 6.10 – Benzo (a) pyrene Concentrations in all Monitoring Wells	32
Figure 6.11 – TPH (Carbon Range C5-C44) in all Monitoring Wells	32

LIST OF TABLES

1 INTRODUCTION

1.1 BACKGROUND

RPS has been commissioned by Enva Ireland Ltd (Enva) to carry out groundwater quality monitoring for environmental compliance, at their facility in the Clonminam Industrial Estate, Portlaoise, Co Laois. Groundwater monitoring has being carried out in strict accordance with criteria set out in Schedule 4(ii) of the site's Industrial Emissions Licence, Register No. W0184-01.

Enva Ireland has been operating under Waste Licence Register No. W0184-01 since January 2004. The licence was amended by the Environmental Protection Agency in December 2013 to conform to the provisions and requirements of the Council Directive 2010/75/EU (Industrial Emissions Directive) and as such is deemed an Industrial Emissions Licence. Enva is required to submit a report to the EPA on a quarterly basis, outlining the existing groundwater quality underlying the site.

A suitably qualified environmental consultant from RPS, collected groundwater samples from a series of 8 monitoring wells (BH101, BH102, BH103, BH104B, MW01, MW02, MW03, MW04) within the site boundary on the 25th of May 2016. The samples underwent laboratory analysis for the suite of parameters specified in Schedule 4(ii) of Industrial Emissions Licence W0184-01. This report outlines the results of the Quarter 2 monitoring for 2016 and reviews historical data recorded at the site.

1.2 OBJECTIVES & SCOPE OF WORK

The specific objectives and scope of work are as follows:

- Review of previous data as provided by Enva Portlaoise;
- Graphical presentation of key compounds and trends; and
- Discussion of results for Quarter 2 2016 within the context of previous results and available guideline concentrations.

2 REVIEW OF PREVIOUS DATA

2.1 INFORMATION SOURCES

The following documents were reviewed as part of this project:

- Industrial Emissions Licence W0184-01 and any available EPA documents from the EPA website;
- Quarterly Groundwater Monitoring Reports (Quarter 1 2004 to Quarter 4 2005), URS;
- Quarterly Groundwater Monitoring Reports (Quarter 1 2006 to Quarter 4 2015), RPS;
- Summary Report on Trend of Contaminant Levels at Enva Ireland Ltd since 2005, Ref: MDE0647RP0001, RPS (2007);
- Groundwater Risk Assessment, Ref: MDE0788Rp0001, RPS (2008);
- Hydrogeological Review and Assessment Report, Ref MDE0973Rp0017F01, RPS (2014);
- Baseline Environment Report, Ref: MDE0973Rp0104; and
- Quarter 1 Groundwater Monitoring Report, RPS (2016).

2.2 SITE SETTING

The site is located to the southwest of the town of Portlaoise immediately to the south of the Dublin to Cork railway line. The general area is gently undulating. The site slopes gently to the southwest but to the east of the site the ground slopes gently towards the River Triogue, which is located approximately 1.5 km to the east. The site occupies an area of approximately 1.5 hectares and comprises of an operational waste oil and contaminated soil treatment plant.

The site is located on the outskirts of Portlaoise in an area of agricultural and light industrial development. The site is bounded to the north and east by land belonging to Irish rail, comprising sidings and general storage areas. To the south is a vehicle repair garage, which is elevated above the level of the site by approximately 1.5 m. To the west the site is adjoined by further industrial land, as well as residential land. The site location is presented on **Figure 2.1**.

The site has been in operation since 1978, and the layout has remained relatively consistent. The site layout is presented on **Figure 3.1**. The site is largely covered in hardstanding with some open areas in the far north and northeast of the site. All oil and soil storage areas are suitably bunded and the general standard of housekeeping is good.

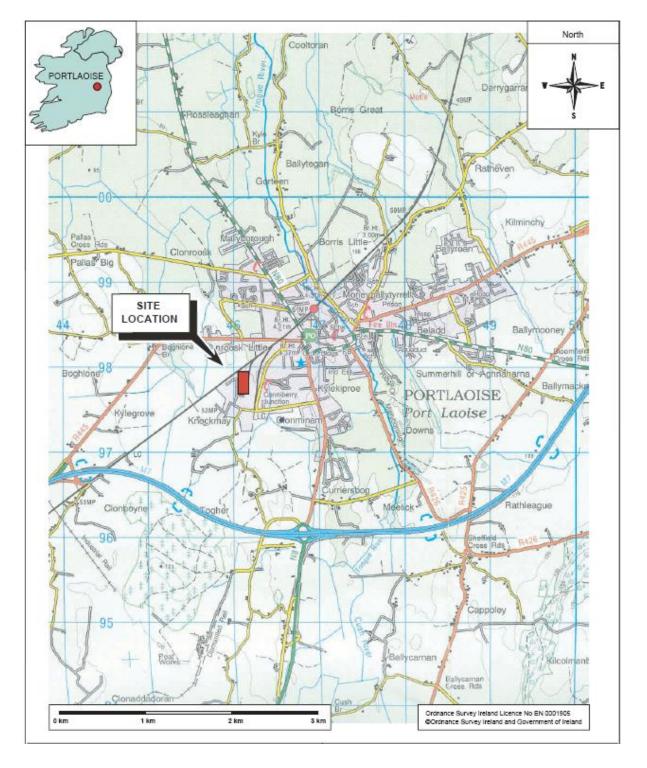


Figure 2.1 – Site Location



2.3 REGIONAL SETTING

2.3.1 Geology

The Geological Survey of Ireland indicates that the regional geology of Portlaoise is typified by Carboniferous Limestone. In the vicinity of the site itself the solid geology comprises the Ballysteen Formation, a micaceous-bioclastic limestone. This well-bedded limestone, with interbeds of shale, is extensively folded, with axes trending north-east to south-west, and becomes increasingly muddy towards the top of the formation. North-east to south-west trending faults are found in the region, with one located approximately 500m to the east of the site. The subsoils in the region comprise mainly Made Ground, around the industrial area, and Limestone Till in the surrounding regions.

2.3.2 Hydrogeology

The limestone is classified by the Geological Survey of Ireland (GSI) as a Locally Important Karstified Aquifer (LI). Porosity is predominantly in the form of fractures, in this aquifer, however the muddy nature of this formation greatly reduces permeability. Vulnerability of this aquifer beneath the site is classified as high, with moderate vulnerability to the east of the site.

The public water supply for Portlaoise is derived from groundwater, utilising three groundwater abstraction well fields comprising of two abstraction wells in each well field. This supply currently comes from the Straboe area, approximately 5.5 km to the north-east of the site. The source protection zone for this water supply extends to within 3.2 km of the Enva site but does not encompass the Enva site.

The GSI record a number of other dug wells and boreholes within the Portlaoise area, including the boreholes installed on the site. The accuracy of the locations of these wells varies. One well, which was drilled in 1899 is recorded as being located immediately to the south of the Enva site. The use of this well is not known and its location is only accurate to 1 km. A second borehole, drilled in 1973 is recorded 1.5 km to the north of the site at Clonroosk; the accuracy of this location is also 1 km so it could be closer or further from the site. The use of this well is not known but its yield is recorded as being poor. There are no other wells recorded within 1 km of the site.

Enva is not aware of any abstraction boreholes within the immediate vicinity of their site.

2.4 SITE GROUND CONDITIONS

A total of eight boreholes have been drilled at the site and the general sequence of ground conditions is presented in **Table 2.1**.

Strata	Extent	Thickness	Description
Made Ground	BH104	0-3.5 m	Predominantly concrete, with hardcore fill, and clay.
Boulder Clay	All boreholes	<8.5 m	Includes fine to medium, well rounded gravels.
Sand and Gravel	Confined to south east corner of site (BH101, BH104 and MW03)	0-2 m	In general the transition from boulder clay to sand is gradual with changes from gravel, to sandy gravel, to sand.
Limestone Bedrock	Encountered in MW01, MW02 and MW03	Top of limestone ranges from 7.7m to 9m below ground level.	Pale grey, fine-grained bedrock, differentiated from boulders by its un- weathered nature.

Table 2.1 – Ground Conditions

The logs for each of the boreholes were previously presented as Appendix B in the RPS Groundwater Risk Assessment Report (Ref: MDE0788Rp0001).

2.4.1 Licence Conditions

The Industrial Emissions Licence requires the regular monitoring and sampling of boreholes BH101, BH102, BH103, BH104B, MW01, MW02, MW03 and MW04. The parameters requiring measurement or analysis are presented in **Table 2.2**.

Table 2.2 – Licence Parameters

Group	Parameters requiring Quarterly Measurement	Parameters requiring Annual Measurement			
	Groundwater Level	Groundwater Level			
Field Parameters	рН	рН			
	Temperature	Temperature			
	Dissolved Oxygen	Dissolved Oxygen			
	Electrical Conductivity	Electrical Conductivity			
	Visual Inspection	Visual Inspection			
	Mineral Oil	Mineral Oil			
	BTEX & MTBE	BTEX & MTBE			
Organies	PAHs	PAHs			
Organics	Phenols	Phenols			
	VOCs	VOCs			
	SVOCs	SVOCs			
Inorganics	-	Total Alkalinity, Calcium, Manganese, Sulphate, Cyanide (Total), Chloride, Sodium,			

3 METHODOLOGY

Groundwater samples were collected from 8 no. on-site groundwater monitoring wells (BH101, BH102, BH103, BH104B, MW01, MW02, MW03, MW04) (Figure 3.1) using dedicated Waterra tubing, in accordance with RPS's standard sampling protocol. A non-return foot valve was fixed to the bottom of the tubing and inserted into the well, close to the base of the borehole. Separate tubing and foot valves were used at each monitoring well to eliminate the possibility of cross contamination.

Groundwater in the well casing is not considered representative of the groundwater quality at a given location. For this reason, three well volumes were purged from each well prior to collection of the groundwater sample. By the time purging was complete all field test water parameters (namely pH, Temperature, Electrical Conductivity and Dissolved Oxygen) were within 10% variance in three consecutive measurements. This ensured that the groundwater sample extracted from the monitoring borehole was representative of the water held in the subsurface strata and not water held stagnant in the borehole casing. The purged volumes were calculated on-site from the measured static water levels and total well depths using an electronic dip meter.

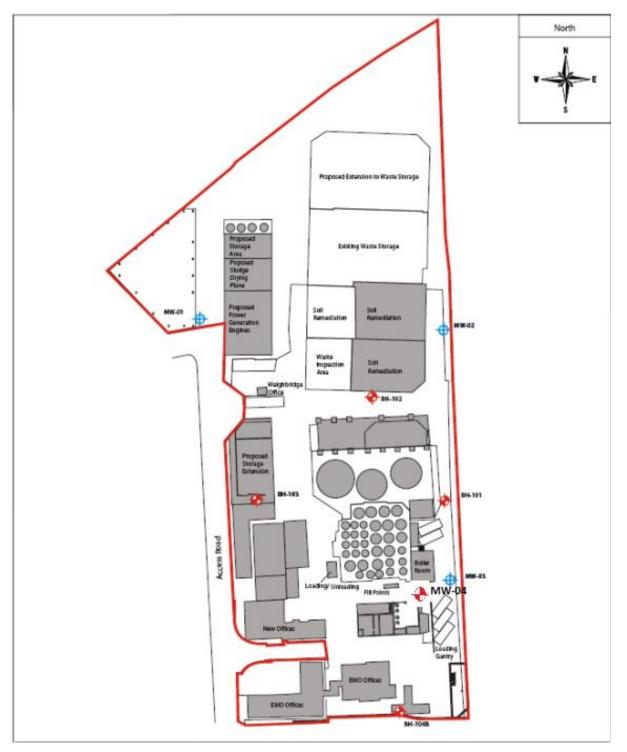
Groundwater samples were collected in laboratory supplied containers and stored in chilled cool boxes following sampling and during transit to the laboratory. A rigorous chain of custody procedure was used during the sample round.

3.1 LABORATORY ANALYSIS

All groundwater samples were analysed at a UKAS accredited laboratory, ALS Environmental for the suite of analyses listed in **Table 3.1**. **Table 3.1** also indicates the analytical techniques used by the laboratory.

Table 3.1 – Analytical Methodologies – ALS Environmental

Parameter	Analytical Methodology
Phenols	GC-MS
Speciated PAHs	GC-MS
BTEX & MTBE	Headspace GC-MS
Petroleum Hydrocarbons	Headspace GC-MS
Volatile Organic compounds & Tentatively Identified Organic Compounds (VOCs & TICs)	Headspace GC-MS
Semi-Volatile Organic compounds & Tentatively Identified Organic Compounds (SVOCs & TICs)	GC-MS





Shallow Monitoring Well locations Deep Monitoring Well locations

Source: URS Environmental Consultants (Ref: 45078497 Issue No. 1)

3.2 PRESENTATION & INTERPRETATION OF RESULTS

The Quarter 2 2016 results are tabulated in **Section 4** and discussed with respect to previous results in **Section 5**. Results are compared against Groundwater Threshold Values (GTVs) outlined in the European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. No 9 of 2010), where available. Where GTVs are not available for parameters, results are compared against the Interim Guideline Values (IGVs) set out in the Environmental Protection Agency interim report, 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland'.

Previous monitoring reports (as listed in **Section 2.1**) provide details of contaminant concentrations since 2004. The data available within these reports has been reviewed and time series plots of key parameters have been compiled. Trends for chlorinated solvents, petroleum hydrocarbons and phenol parameters have been plotted.

Time series plots are presented in **Section 6** and include the results of this Quarter 2 2016 monitoring round. As the monitoring continues in accordance with the Industrial Emissions licence requirements, the plots will be updated with the results of subsequent rounds used to illustrate the results.

Time series plots are also provided for manual water levels where available from previous reports.

4 QUARTER 2 RESULTS MAY 2016

The results of all field measurements and laboratory analysis are presented in this section. This resulted in a lack of field measurements. Results are primarily compared against Groundwater Threshold Values (GTVs) outlined in the European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. No 9 of 2010), where available. Where GTVs are not available for parameters, results are compared against the Interim Guideline Values (IGVs) set out in the Environmental Protection Agency interim report, 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland'.

The results are discussed in relation to appropriate guideline values in **Section 5**. Results that are shown to be above the relevant threshold or guideline values are highlighted in bold and shaded. Results that are shown to be above the relevant laboratory detection limits are highlighted in italics.

Site-specific field parameter measurements were collected during the site visit as per RPS Water sampling protocol.

Table 4.1 – Groundwater Levels	(Quarter 2, 2016)
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Monitoring Well	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	
Depth (mbgl)	6.78	6.40	4.39	4.72	21.98	30.88	14.17	6.48	
Static Water Level (mbgl)	4.22	3.21	1.73	0.54	2.44 3.87		4.11	3.94	
Ground Level (mAOD)	103.06	102.55	101.16	101.52	102.10 103.12		102.77	-	
Water Level (mAOD)	98.84	99.34	99.43	100.98	99.66	99.25	98.66	-	
Free Phase Oil (mm)	No detection	No detection	No detection	No detection					

mbgl = metres below ground level

Monitoring Well	pH (pH Units)	Temperature (°C)	Conductivity (μS/cm)	Dissolved O ₂ (ppm)	Observations
BH101	8.23	11.9	1147	2.78	Light cloudy colour, some sediment
BH102	7.91	11.0	653	3.55	Clear on purging, very little suspended solids
BH103	8.07	11.2	866	2.91	Slightly white cloudy colour, little sediment
BH104B	8.08	10.3	547	1.63	Slightly brown colour, slight H ₂ S odour, very little suspended solids or sediment
MW01	7.85	13.3	757	3.69	Slightly cloudy, very little sediment and suspended solids
MW02	8.60	12.2	712	2.48	Dark grey colour, slight odour, very little sediment
MW03	7.29	14.7	1588	3.90	Cloudy colour on purging, very little sediment & suspended solids, very slight oil sheen
MW04	7.11	14.3	1538	1.85	Light cloudy colour, some suspended solids, very little sediment, very faint $\rm H_2S$ odour
Groundwater Threshold Value	-	-	1875	-	-
Interim EPA Guideline Values (Units as indicated)	>6.5 & <9.5	25°C	1000	No abnormal change	-

Table 4.2 – Results of Field Parameters Measured at each Groundwater Monitoring Well (Quarter 2, 2016)

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the GTV are highlighted in bold and shaded.

Table 4.3 – Results of BTEX and MTBE

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Benzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.75	1.0
Toluene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
Ethylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
p & m-xylene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10 ^{Note 1}
o-xylene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10 ^{Note 1}
MTBE (Methyl Tertiary Butyl Ether)	µg/I	1.0	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	1.8	1.7	-	30

Note: No specific IGV for parameter. IGV for Total Xylenes is used as guideline.

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

Table 4.4 – Results of Speciated PAHs

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Naphthalene	μg/l	0.01	<0.01	<0.01	<0.12	<0.10	<0.01	<0.01	<0.01	<0.16	-	1.0
Acenaphthylene	μg/l	0.01	<0.01	<0.01	<0.01	<0.10	<0.01	<0.01	<0.10	<0.01	-	-
Acenaphthene	μg/l	0.01	<0.01	<0.01	0.073	<0.10	<0.01	<0.01	<0.10	0.01	-	-
Fluorene	μg/l	0.01	<0.01	<0.01	0.027	<0.10	<0.01	<0.01	<0.10	0.013	-	-
Phenanthrene	μg/l	0.01	<0.01	<0.01	0.011	<0.10	<0.01	0.01	<0.10	<0.01	-	-
Anthracene	μg/l	0.01	<0.01	<0.01	<0.01	<0.10	<0.01	<0.01	<0.10	<0.01	-	10,000
Fluoranthene	μg/l	0.01	<0.01	<0.01	<0.01	<0.10	<0.01	0.012	<0.10	<0.01	-	1.0
Pyrene	μg/l	0.01	<0.01	<0.01	<0.01	<0.10	0.011	<0.01	<0.10	<0.01	-	-
Benzo(a)anthracene	μg/l	0.01	<0.01	<0.01	<0.01	<0.10	<0.01	<0.01	<0.10	<0.01	-	-
Chrysene	µg/l	0.01	<0.01	<0.01	<0.01	<0.10	<0.01	<0.01	<0.10	<0.01	-	-
Benzo(b)fluoranthene	μg/l	0.01	<0.01	<0.01	0.011	<0.10	<0.01	0.01	<0.10	<0.01	-	0.5

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Benzo(k)fluoranthene	μg/l	0.01	<0.01	<0.01	<0.01	<0.10	<0.01	<0.01	<0.10	<0.01	-	0.05
Benzo(a)pyrene	μg/l	0.01	<0.01	<0.01	<0.05	<0.10	<0.01	0.01	<0.10	<0.01	-	0.01
Indeno(1,2,3-cd)pyrene	μg/l	0.01	<0.01	<0.01	<0.01	<0.10	<0.01	<0.01	<0.10	<0.01	-	0.05
Dibenz(a,h)anthracene	μg/l	0.01	<0.01	<0.01	<0.01	<0.10	<0.01	<0.01	<0.10	<0.01	-	-
Benzo(g,h,i)perylene	μg/l	0.01	<0.01	<0.01	<0.01	<0.10	<0.01	0.011	<0.10	<0.01	-	0.05
Total EPA-16 PAHs	μg/l	0.1	<0.01	<0.01	0.111	<0.10	0.011	0.069	<0.10	0.023	0.075	0.1

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the GTV are highlighted in bold and shaded.

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

Table 4.5 – Results of Speciated Phenols

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Phenol	µg/l	5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	-	0.5
2,4,6-Trichlorophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	200
2,4-Dichlorophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2,4-Dimethylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Chlorophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	200
2-Methylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Nitrophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
4-Chloro-3-methylphenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
4-Methylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Phenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.5
2-Chlorophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	200
Bis(2-chloroethyl)ether	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,3-Dichlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2-Dichlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
1,4-Dichlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bis(2-chloroisopropyl)ether	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Methylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Hexachloroethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Nitrobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
4-Methylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Isophorone	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Nitrophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2,4-Dimethylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bis(2-chloroethoxy)methane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2,4-trichlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.40
Naphthalene	μg/l	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	1.0
2,4-Dichlorophenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Hexachlorobutadiene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.10
4-Chloro-3-methylphenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2,4,6-Trichlorophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	200
2,4,5-Trichlorophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Methylnaphthalene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Chloronaphthalene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Dimethylphthalate	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
2,6-Dinitrotoluene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Acenaphthylene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Acenaphthene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2,4-Dinitrotoluene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Dibenzofuran	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
4-Chlorophenyl phenyl ether	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Diethyl phthalate	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Fluorene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bromophenyl phenyl ether	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Hexachlorobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.03
Phenanthrene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Anthracene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10,000
Pyrene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Butyl benzyl phthalate	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzo(a)anthracene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Chrysene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzo(b)fluoranthene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.5
Benzo(k)fluoranthene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.05
Benzo(a)pyrene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.01
Indeno(1,2,3-cd)pyrene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.05
Dibenz(a,h)anthracene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzo(g,h,i)perylene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the GTV are highlighted in bold and shaded.

Table 4.7 – Results of Volatile Organic Compounds (VOCs)

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Chloromethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Chloroethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	1.4	9.2	-	-
Bromomethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Vinyl Chloride	µg/l	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.9	0.375	-
Trichlorofluoromethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,1-dichloroethene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.7	3.6	-	30
1,1,2-Trichloro 1,2,2- Trifluoroethane	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Cis-1,2-dichloroethene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/I	1.0	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	1.8	1.7	-	30
2,2-Dichloropropane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Trichloromethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	12
1,1,1-Trichloroethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	500
1,2-dichloroethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.25	-
1,1-Dichloropropene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Trans-1,2-dichloroethene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	1.0
1,2-dichloropropane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Trichloroethene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	70
Dibromomethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bromodichloromethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Cis-1,3-dichloropropene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Trans-1,3-dichloropropene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Toluene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
1,1,2-Trichloroethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,3-Dichloropropane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Dibromochloromethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Tetrachloroethene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	40
1,2-Dibromoethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Chlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	1.0
1,1,1,2-Tetrachloroethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Ethylbenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
p & m-xylene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
Styrene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Tribromomethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
o-xylene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
Isopropylbenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bromobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
N-Propylbenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Chlorotoluene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
4-Chlorotoluene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,3,5-Trimethylbenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Tert-Butylbenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2,4-Trimethylbenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Sec-Butylbenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,3-dichlorobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
P-Isopropyltoluene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2-dichlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
1,4-dichlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Butylbenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
1,2-Dibromo-3-chloropropane	μg/l	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	-
1,2,4-Trichlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.40
Hexachlorobutadiene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.10
1,2,3-Trichlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the GTV are highlighted in bold and shaded.

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Aliphatic > C10-C12	µg/l	10	<10	<10	<10	<10	<10	<10	<10	<10	-	-
Aliphatic > C12-C16	µg/l	10	<10	<10	<10	<10	<10	<10	<10	<10	-	-
Aliphatic > C16-C35	µg/l	10	<10	<10	150	<10	<10	<10	<10	<10	-	-
Aliphatic > C35-C44	µg/l	10	<10	<10	<10	<10	<10	<10	<10	<10	-	-
Aliphatic > C10-C44	µg/l	10	<10	<10	150	<10	<10	<10	<10	<10	-	10
Aromatic > C10-C12	µg/l	10	<10	<10	<10	<10	<10	<10	<10	<10	-	-
Aromatic > C12-C16	µg/l	10	<10	<10	<10	<10	<10	<10	<10	20	-	-
Aromatic > C16-C21	µg/l	10	<10	<10	<10	<10	<10	<10	<10	<10	-	-
Aromatic > C21-C35	µg/l	10	<10	<10	57	<10	<10	<10	<10	<10	-	-
Aromatic > C35-C44	µg/I	10	<10	<10	<10	<10	<10	<10	<10	<10	-	-
Aromatic > C10-C44	μg/l	10	<10	<10	57	<10	<10	<10	<10	20	-	10

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

5 DISCUSSION OF QUARTER 1 RESULTS

The results of the Quarter 2 monitoring event for 2016 are presented in **Table 4.1** to **4.8** of this report. For the purpose of this report, the results are compared against the Groundwater Threshold Values (GTVs) outlined in the European Communities Environmental Objectives (Groundwater) Regulations (S.I. No. 9 of 2010) where available. Where GTVs are not available results are compared against the EPA Interim Guideline Values (IGV) as set out in the Interim Report *'Towards Setting Guideline Values for the Protection of Groundwater in Ireland' 2004.* A discussion of the results and their significance is included below.

5.1 FIELD PARAMETERS

The results of the field parameters measured at each groundwater monitoring well are presented in **Table 4.2**. Groundwater samples recorded pH levels ranging between 7.11 and 8.60, all within the EPA Interim guideline range of \geq 6.5 to \leq 9.5. Temperature measurements ranged from 10.3°C to 14.7°C and were below the EPA IGV of 25°C.

Field measurements of Electrical Conductivity levels ranged between 547 μ S/cm and 1588 μ S/cm. Three measurements of Electrical Conductivity were above the IGV of 1000 μ S/cm at BH101 (1147 μ S/cm), MW03 (1588 μ S/cm) and MW04 (1538 μ S/cm), but all however were below the GTV limit of 1875 μ S/cm.

Dissolved oxygen levels ranged between 1.63 and 3.90 ppm. Factors such as climate, nutrients in the water, suspended solids; organic wastes and groundwater inflow can all influence the dissolved oxygen values.

Observations relating to colour and odour varied from well to well as detailed in Table 4.2.

5.2 RESULTS OF BTEX & MTBE

The results of the **BTEX** and **MTBE** analysis are presented in **Table 4.3**. BTEX concentrations are below the associated GTVs and IGVs at all locations. BTEX concentrations are also below the laboratory of limit of detection at all locations. MTBE was detected at BH103 (1.2 μ g/l), MW03 (1.8 μ g/l) and MW04 (1.7 μ g/l), however these are all below the IGV of 30 μ g/l. MTBE was also below the laboratory limit of detection and IGV at all other locations.

The previous detection of MTBE was in the Quarter 1 monitoring event of 2016 and recorded concentrations above the laboratory limit of detection at BH103 (1.4 μ g/l), MW03 (2.2 μ g/l) and MW04 (2.1 μ g/l). These detections are still below the IGV limit however. Prior to this there was a detection of MTBE at BH104B in the Quarter 1 monitoring event of 2012 with a recorded concentration of 280 μ g/l which is above the laboratory limit of detection. This was the only recorded exceedance in Quarter 1 2012.

Monitoring during Quarter 1 and Quarter 2 of 2010 detected exceedances of MTBE at BH103 at a concentration of 16 μ g/l. Subsequent monitoring in 2010 recorded concentrations below the laboratory limit of detection. Prior to these 2010 monitoring events, concentrations of MTBE at BH103 were recorded at 63 μ g/l in December 2009.

5.3 **RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)**

The results of the Speciated PAH analysis during this monitoring period are presented in **Table 4.4**.

The laboratory limit of detection for Total EPA-16 PAHs is 0.1 μ g/l and has been lowered for comparison with the EPA IGV of 0.1 μ g/l; however this is not accredited. This laboratory limit of detection is above the EPA GTV of 0.075 μ g/l. To identify the compounds, which attributed to these concentrations, speciated PAH analysis was carried out, which reduces the limit of detection for individual parameters to 0.01 μ g/l.

Total Polyaromatic Hydrocarbons were above the IGV limit of 0.1 μ g/l at BH103 (0.111 μ g/l). Total PAHs were below the IGV of 0.1 μ g/l and the GTV of 0.075 μ g/l at all other locations. Total PAHs were also above the IGV BH103 (0.123 μ g/l), BH104B (0.159 μ g/l) and MW04 (0.153 μ g/l) during the previous Quarter 1 2016 monitoring event.

The results of the speciated polycyclic aromatic hydrocarbon analysis detected a number of different compounds in BH103, MW01, MW) and MW04 above the laboratory limit of detection. However none of these compounds were above their respective IGV limits at any location.

5.4 **RESULTS OF SPECIATED PHENOLS**

During previous quarterly monitoring events and sample analysis, total monohydric phenol was determined and historically has been below the laboratory limit of detection of 10 μ g/l since December 2008. It should be noted that the laboratory limit of detection was however above the IGV of 0.5 μ g/l for phenols.

For this reason, samples were analysed for phenols to include chlorophenols. The results of the speciated phenols analysis are presented in **Table 4.5**. The speciated phenol analysis reduces the laboratory limit of detection to $1.0 \mu g/l$ for individual parameters.

The results of the current Quarter 1 2016 speciated phenol analysis confirm concentrations of phenols were below the laboratory limit of detection of 1.0 μ g/l at all locations.

4-Chloro-3-methylphenol was detected at BH104B (1.37 μ g/l) above the laboratory limit of detection during the Quarter 1 2015 analysis. With the exception of this, all other results are consistent with results since the 2012 quarterly monitoring events.

5.5 RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS

The results of the Semi-Volatile Organic Compound analysis are presented in Table 4.6.

There are no GTVs for individual SVOC parameters. No SVOCs were detected above the relevant IGVs during this monitoring period, consistent with the results from the 2015 and 2014 monitoring periods.

The Quarter 3 2013 monitoring event detected two SVOC compounds, Acenaphthene (1.1 μ g/l) and Fluorene (1.5 μ g/l) in MW03. Prior to this detection the Quarter 2 monitoring event of 2012 detected concentrations of Naphthalene and Acenaphthylene in MW03 at concentrations of 2.4 μ g/l and 0.12 μ /l respectively.

5.6 **RESULTS OF VOLATILE ORGANIC COMPOUNDS**

The results of the Volatile Organic Compound analysis are presented in **Table 4.7**. The results of the current Quarter 2 2016 monitoring event indicate that Vinyl Chloride was detected above the GTV of 0.375 μ g/l at MW03 (0.6 μ g/l) and MW04 (0.9 μ g/l). Chloroethane in MW01 (1.1 μ g/l) and 1,1-dichloroethene in MW03 (1.7 μ g/l) and MW04 (3.6 μ g/l) were also detected. However, the results are below the IGV for 1,1-dichloroethene (30 μ g/l) and there is no GTV or IGV limit for Chloroethane. All other compounds were below their respective laboratory limits of detection.

Historic groundwater monitoring events detected some parameters above the laboratory limit of detection in November 2009, corresponding to Quarter 4 of 2009. Historically 1,1-Dichloroethane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, MTBE, n-butylbenzene, n-propylbenzene, o-xylene, p-isopropyltoluene, sec-butylbenzene and tert-butylbenzene were detected above the laboratory limits of detection.

The results of the Quarter 3 and Quarter 4 monitoring events of 2009 and all subsequent monitoring events indicate that there were no exceedances of the GTVs or IGVs for specific parameters.

5.7 RESULTS OF TOTAL PETROLEUM HYDROCARBONS

In order to provide a more accurate profile of TPH within the groundwater, speciated hydrocarbon analysis using the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) method was carried out on samples taken at all boreholes. The results of the TPH analysis are presented in **Table 4.8**.

The EPA IGV of 10 μ g/l for the Total Hydrocarbons is deemed comparable with the results for Total Petroleum Hydrocarbons. Some detections of TPH in both the aliphatic and aromatic range were observed during the current Quarter 2 2016 monitoring event. Detections in samples from the well BH103 were in the aliphatic range C16-C35 (150 μ g/l) and in the aromatic range C21-C35 (57 μ g/l) and from well MW04 in the aromatic range C12-C16 (20 μ g/l).

The previous Quarter 1 monitoring event of 2016 detected TPH in the aliphatic range C16-C35 (132 μ g/l) at BH103 and in the aliphatic range C12-C16 (15 μ g/l) at MW04.

The Quarter 4 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 (879 μ g/l), C16-C21 (1380 μ g/l) and C21-C35 (694 μ g/l) at BH104B, C21-C35 at BH103 (60 μ g/l) and C10-C12 (13 μ g/l) and C12-C16 (21 μ g/l) at MW04. TPH concentrations were detected in the aliphatic ranges C10-C12 (495 μ g/l), C12-C16 (3080 μ g/l) and C16-C35 (3360 μ g/l) at BH104B and C16-C35 (231 μ g/l) and C35-C44 (14 μ g/l).

The Quarter 3 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 (39 μ g/l), C16-C21 (37 μ g/l) and C21-C35 (28 μ g/l) at BH104B, C21-C35 at BH103 (17 μ g/l) and C10-C12 (18 μ g/l) and C12-C16 (29 μ g/l) at MW04. TPH concentrations were detected in the aliphatic ranges C10-C12



(13 $\mu g/l)$, C12-C16 (40 $\mu g/l)$ and C16-C35 (62 $\mu g/l)$ at BH104B and C16-C35 at BH103 (72 $\mu g/l)$ and MW03 (14 $\mu g/l).$

The Quarter 2 monitoring event of 2015 detected TPH in the aromatic range C21-C35 at BH03 (509 μ g/l). TPH concentrations were detected in the aliphatic ranges C16-C35 at BH103 (1760 μ g/l) and BH104B (337 μ g/l), and C12-C16 at BH104B (225 μ g/l).

The Quarter 1 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 at wells MW03 (14 μ g/l), MW04 (15 μ g/l) and BH104B (27 μ g/l), C16-C21 at BH104B (15 μ g/l), and C21-C35 (14 μ g/l) at BH103. TPH concentrations were detected in the aliphatic ranges C16-C35 and C35-C44 at MW03 (46 μ g/l and 12 μ g/l respectively), BH103 (54 μ g/l) and BH104B (11 μ g/l.

No detections of TPH in the aliphatic or aromatic range were observed in any shallow or deep monitoring well locations during the Quarter 4 monitoring event of 2014.

The Quarter 3 monitoring event of 2014 detected TPH concentrations in the aliphatic range at the shallow groundwater well BH104B. The TPH concentration detected was 410 μ g/l. The speciated TPH ranges that contributed to the value of 410 μ g/l were C12-C16 (150 μ g/l), C16-C21 (250 μ g/l) and C31-C35 (10 μ g/l).

The Quarter 3, 2013 monitoring event detected TPH in the aliphatic range in one deep groundwater well, MW03. TPH of the range C10-C12 and C12-C16 were detected at concentrations of 200 μ g/l and 190 μ g/l respectively.

The Quarter 1, 2013 monitoring event detected aliphatic TPH of the range C12-C16, C16-C21 and C21-C35. TPH in the mid to high aromatic ranges were detected in BH103, BH104B and MW04 during the previous Quarter 1 2013 monitoring event. Aromatic TPH of the ranges C12-C16, C16-C21 and C21-C35 were detected in BH103, the ranges C10-C12, C12-C16 and C16-C21 were detected in BH104B and aromatic TPH of the ranges C10-C12 and C12-C16 were detected in MW04.

The Quarter 2 monitoring event of 2012 detected elevated TPH of the aliphatic range C12-C16, C16-C21 and C21-C25 in BH103. Hydrocarbons have been detected in borehole MW03 during Quarter 1 2010, in borehole BH104B during the Quarter 2 2010 monitoring event and in borehole BH104B and MW03 during the Quarter 3 2010 monitoring events. Hydrocarbons have also been detected in BH103, BH104B and MW03 in the Quarter 2 2011 monitoring event and in MW03 in the Quarter 3 and Quarter 4 2011. These detections are discussed further in **Section 6.2.3**.

6 HISTORICAL RESULTS & TRENDS

Time series plots are presented in this section and include the results of the Quarter 2 2016 monitoring round. As the monitoring continues in accordance with the Industrial Emissions Licence requirements, the plots will be updated with the results of subsequent rounds and used to illustrate the results.

6.1 GROUNDWATER LEVELS OVER TIME

Figure 6.1 to **Figure 6.3** below illustrates the manually recorded water levels using an electronic probe. The graphs show that groundwater levels can vary considerably between monitoring rounds.

Figure 6.2 illustrates groundwater elevations (mAOD) in shallow groundwater wells (BH101 to BH104B) ranging between approximately 98 mAOD and 102 mAOD.

Figure 6.3 illustrates groundwater elevation (mAOD) in the deeper groundwater wells (MW01 to MW03). The groundwater elevation (mAOD) for these deeper groundwater wells ranges from approximately 97.5 mAOD to approximately 100 mAOD.

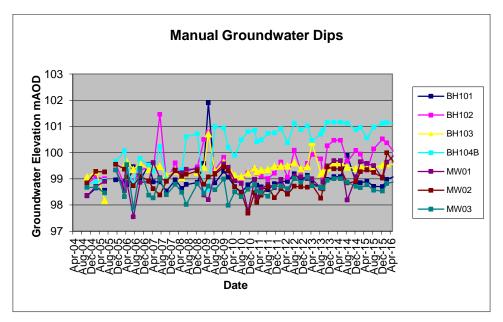


Figure 6.1 – Ground Elevation (mAOD) in all Monitoring Wells



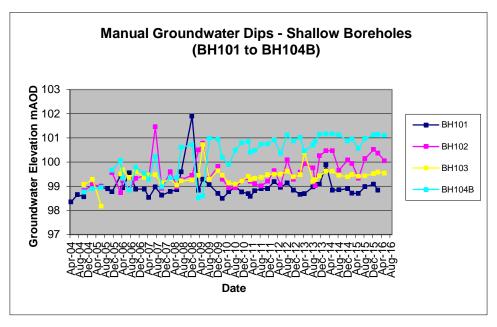
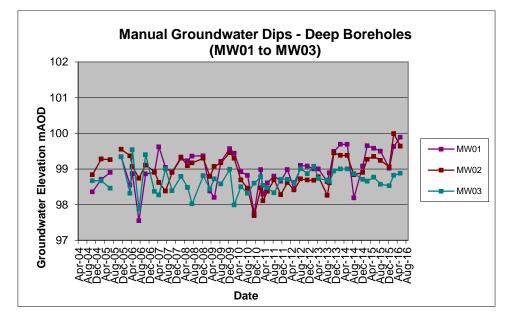


Figure 6.3 – Ground Elevation (mAOD) in Deep Groundwater Monitoring Wells



The groundwater levels generally show a similar pattern of fluctuation over time indicating a degree of connection between boreholes. The graphs demonstrate that groundwater levels can vary considerably between monitoring rounds; the general direction of flow in the shallow and deeper groundwater bearing unit is in an easterly or north easterly direction however there have been some occasional historic cases of groundwater flowing in a south-easterly direction.

In addition, monthly rainfall data for Oak Park, Carlow have been tabulated from Met Éireann to examine the relationship between compounds and rainfall events. The data from Oak Park was chosen as the weather station at Birr, Co. Offaly closed in October 2009. A summary of the rainfall data is in **Tables 6.1** to **6.5**.

Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Rainfall (mm)	70.8	24.5	18.0	56.3	50.2	155.8	76.2	127.7	37.9	63.4	80.9	68.1

Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Rainfall (mm)	76.2	35.8	57.6	44.4	35.6	37.5	32.3	85.6	24.4	170.0	27.7	136.6

Table 6.3 – Monthly Rainfall Data for Year 2014 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Rainfall (mm)	147.2	176.7	65.0	52.6	78.6	61.9	24.6	122.1	18.2	138.2	165.6	47.7

Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	66.0	36.3	53.5	26.3	89.4	29.7	79.4	83.0	17.9	56.8	110.0	270.9

Table 6.5 – Monthly Rainfall Data for Year 2016 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	Jun
Rainfall (mm)	110.9	95.7	40.6	64.3	61.6	61.7

6.2 GROUNDWATER CONCENTRATIONS OVER TIME

Groundwater quality trends have previously been examined in two reports (URS 2005 and RPS 2007). In addition, RPS carried out a groundwater risk assessment (Ref: MDE0788RP0001, dated November 2008) in which the general trend of contaminant concentrations over time was observed to be erratic with compounds rarely being detected in the same borehole on two consecutive monitoring rounds.

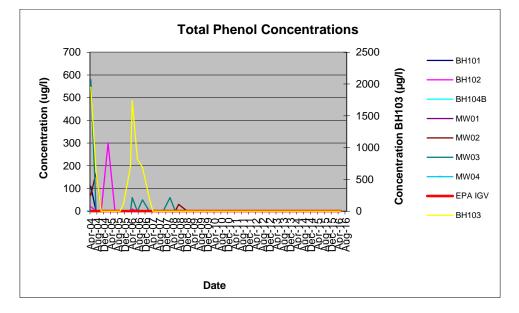
The data available within these reports has been reviewed and time series plots of key parameters have been compiled based on notable trends. Trends for phenols, petroleum hydrocarbons and chlorinated solvents have been plotted as outlined in the following sections.

6.2.1 Phenols

Phenols have been detected historically in all boreholes with the highest concentrations recorded in BH103. However concentrations in BH103 have declined since April 2007. Phenol concentrations have since been recorded below the IGV of 0.5 μ g/l in all monitoring wells since December 2008 indicating natural attenuating conditions within the groundwater.

2,4-Dimethylphenol was detected at a concentration of 0.12 μ g/l during the Quarter 1, 2010 monitoring event. There is no recommended IGV for this parameter. Subsequent to the Quarter 1 2010 monitoring event no detections of phenols have been noted at any monitoring location up to and including the current Quarter 1 2016 monitoring event.





6.2.2 Polyclyclic Aromatic Hydrocarbons

Figure 6.5 below illustrates that PAHs (Polycyclic Aromatic Hydrocarbons) have previously been detected within all monitoring wells above the recommended EPA IGV of 0.1 μ g/l. Historically the highest concentrations have been detected within MW03 and BH104B, with the highest concentration detected in March 2006 (107 μ g/l) and in October 2007 (19.72 μ g/l) respectively. In addition, a range of PAHs including Benzo(a)pyrene, Benzo(g,h,i)perylene, Indeno(1,2,3)cd pyrene, Fluoranthene and Naphthalene have previously been detected in MW03 with **Figures 6.6** to **6.10** illustrating some of the PAH compounds which were detected above their respective IGVs.

Since 2007 concentrations of PAH have shown a marked decrease and since 2010 detections of PAH have been confined to MW03, MW02 and BH104B. Concentrations of Total PAH above the IGV in 2010 were detected during the Quarter 1 monitoring event in MW03 (0.3 μ g/l), Quarter 2 monitoring event in BH104B (1.2 μ g/l) and Quarter 3 monitoring event in MW02 (2.0 μ gl) and BH104B (0.2 μ gl). There were no elevated concentrations of Total PAH during the Quarter 4 2010 monitoring event.

No Total PAH detections were recorded throughout 2011 and in Q1 of 2012. Total PAH was detected above the IGV in MW03 in the Q2 2012 monitoring event. No Total PAH exceedances were detected from Quarter 3 2012 to Quarter 4 2013 inclusive. Total PAHs were detected at a concentration of 2.62 μ g/l in MW03 during the Q3 2013 monitoring event however; no detections above the laboratory limit were noted during the subsequent monitoring events up to and including the Quarter 2 2015 monitoring event. Total PAHs were also above the GTV at BH103 (0.093 μ g/l), BH104B (0.159 μ g/l) and MW03 (0.586 μ g/l) during Quarter 3 2015, at BH103 (0.21 μ g/l), MW03 (0.986 μ g/l) and MW04 (0.079 μ g/l) during Quarter 4 2015, and at BH103 (0.123 μ g/l), BH104B (0.159 μ g/l) and MW04 (0.153 μ g/l) during the previous Quarter 1 2016 monitoring event. Similarly during the Quarter 2 2016 monitoring event, Total Polyaromatic Hydrocarbons were above the IGV limit of 0.1 μ g/l at BH103 (0.111 μ g/l).

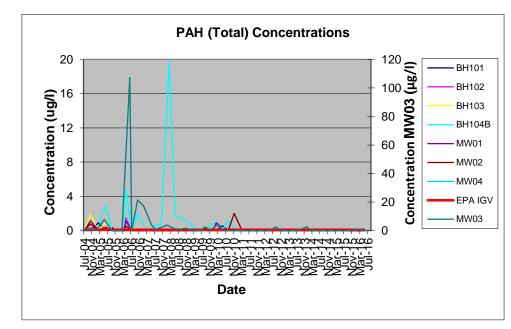


Figure 6.5 – PAH (Total) Concentrations in all Monitoring Wells



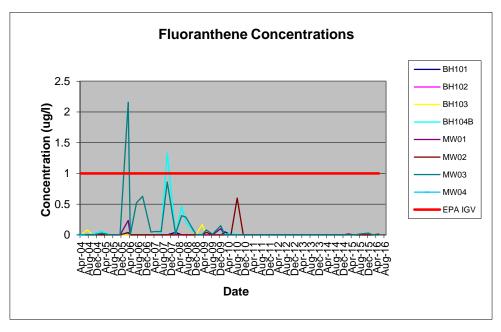


Figure 6.6 illustrates that **Fluoranthene** was previously detected above the IGV of 1.0 μ g/l in groundwater monitoring wells BH104B (October 2007, 1.33 μ g/l) and MW03 (March 2006, 2.158 μ g/l) only. The remaining monitoring wells recorded concentrations below the IGV of 1.0 μ g/l.

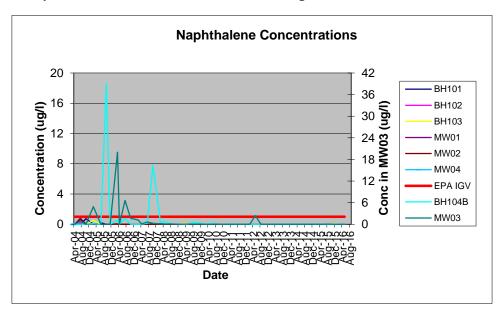


Figure 6.7 – Naphthalene Concentrations in all Monitoring Wells

A similar trend to Fluoroanthene has been noted in **Figure 6.7**, with concentrations of **Naphthalene** recorded above the IGV of 1.0 μ g/l in BH104B and MW03 only. 4 no. exceedances of the IGV were noted in BH104B in September 2005 (39 μ g/l), March 2006 (1.069 μ g/l), July 2006 (1.594 μ g/l) and October 2007 (16.31 μ g/l). Since October 2007, the concentrations in BH104B have decreased below the IGV. There have been 6 exceedances of the IGV of 1.0 μ g/l in MW03, with the highest concentration detected in March 2006 (19.986 μ g/l) and the most recent being the detected in the Quarter 2 2012 monitoring event (2.4 μ g/l). The concentrations detected in August 2010 were slightly above the laboratory limit of detection of 0.01 μ g/l at BH104B (0.08 μ g/l) and MW03 (0.05



 μ g/l); however these levels are deemed low. Concentrations of Naphthalene were below the EPA IGV limit of detection of 1.0 μ g/l at all locations during the Quarter 4 2010, the 2011 and 2012 quarterly monitoring events and the Quarter 1 to Quarter 3 2014 monitoring periods, inclusive. No detections of Naphthalene were noted from the Quarter 4 2014 monitoring event to the Quarter 2 2015 monitoring event. Naphthalene was detected at BH101 (0.011 μ g/l) and MW03 (0.031 μ g/l) during Quarter 3 2015, and at BH103 (0.095 μ g/l) and at MW04 (0.067 μ g/l) during Quarter 4 2015. Naphthalene was also detected during the previous Quarter 1 2016 monitoring event at BH104B (0.034 μ g/l) and MW04 (0.153 μ g/l). These detections, however, were all below the IGV limit of detection at all locations during the current Quarter 2 2016 monitoring event.

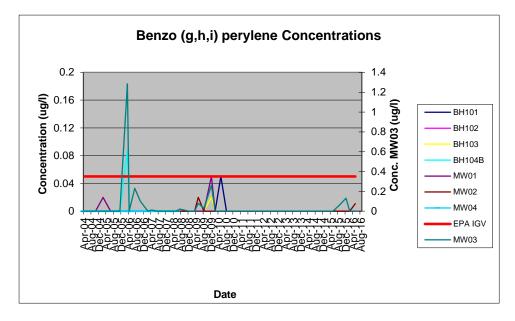


Figure 6.8 – Benzo (g,h,i) perylene Concentrations

Figure 6.8 illustrates the concentrations of **Benzo(g,h,i)perylene** in all monitoring wells over time. Elevated concentrations above the IGV were recorded at BH104B (0.087 μ g/l) on one occasion in March 2006.

Figure 6.9 illustrates elevated concentrations above the IGV recorded at MW03 on 6 no. occasions with the most recent elevated concentration recorded during the Quarter 4 2015 monitoring event (0.053 μ g/l). The previous elevated concentration detected was in Quarter 3 2015 (0.053 μ g/l). The results of all monitoring events from 2010 to the Quarter 2 2015 monitoring event recorded concentrations below the laboratory limit of detection of 0.01 μ g/l at all locations. Concentrations were also below the laboratory limit of detection at all locations during the previous Quarter 1 2016 monitoring event.

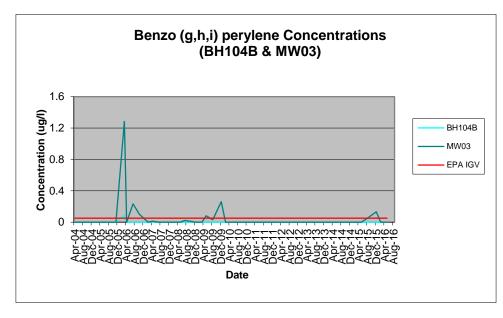


Figure 6.9 – Benzo (g,h,i) perylene in Monitoring Wells BH104B & MW03

Figure 6.10 illustrates the concentrations of **Benzo(a)pyrene** in all groundwater monitoring wells and indicates that Benzo(a)pyrene has been detected historically in all boreholes above the IGV of 0.01 μ g/l. Similarly with the above mentioned trends, the highest concentrations have been detected in MW03 and BH104B. Concentrations have markedly decreased since March 2006 when an elevated concentration of 2.751 μ g/l was detected in MW03, however there have been a number of detections above the IGV, with the most recent elevated level detected in December 2009. Elevated concentrations above the IGV were recorded in BH101, BH103 and MW01 during this same period.

The slightly higher concentrations of Benzo(g,h,i)perylene and Benzo(a)pyrene detected in Quarter 4, 2009 may be attributed to heavy rainfall, which occurred in November of 2009 and as a result possibly mobilized traces of these compounds from the soil. The static water levels for December 2009 ranged between 0.58 and 3.78 mbgl. Since December 2009, concentrations of compounds have notably decreased to below the IGVs.

Benzo(a)pyrene was detected above the IGV limit of 0.01 μ g/l at MW03 (0.108 μ g/l) during the Quarter 4 2015 monitoring event. Benzo(a)pyrene was also detected above the IGV at MW03 (0.052 μ g/l) during the Quarter 3 2015 monitoring event. All other results of all monitoring events from 2010 to the current Quarter 2 2016 monitoring event did not detect other concentrations above the IGV.

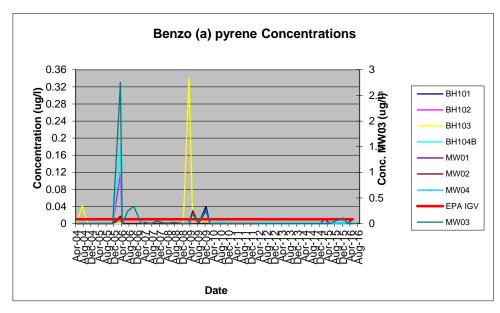


Figure 6.10 – Benzo (a) pyrene Concentrations in all Monitoring Wells

6.2.3 Petroleum Hydrocarbons (TPH)

Historically **Total Petroleum Hydrocarbons (TPH)** including mineral oil, petrol range organics (PRO) and diesel range organics (DRO) have been detected within BH103, BH104B and MW03. Since 2009, speciated hydrocarbon analysis using the Total Hydrocarbon Criteria Working Group (TPHCWG) method has been carried out on all samples to obtain a more accurate profile of TPH within groundwater.

The results of the TPHCWG analysis has indicated that the predominant hydrocarbons detected are in the heavier chain carbon fractions, most notably in the carbon range C12-C16, C16-C21 and C21-C35. **Figure 6.11** illustrates the TPH analysis for the total TPH analysis from C5-C44 in all monitoring wells since 2009. The highest concentrations detected historically are at monitoring wells MW03, BH104B and BH103 respectively.

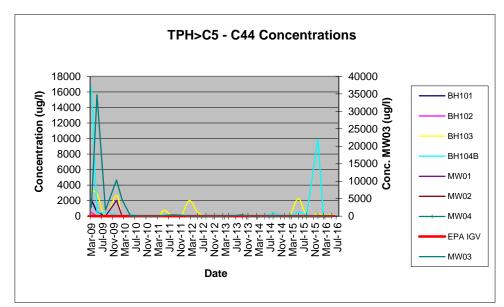


Figure 6.11 – TPH (Carbon Range C5-C44) in all Monitoring Wells



Previous quarterly monitoring reports have outlined the hydrocarbon trends recorded in each well since 2010. This report outlines the trends from 2012 up to and including the current monitoring report.

During the Quarter 1, 2012 monitoring event, hydrocarbons were detected in borehole BH103 only. The predominant aliphatic carbon range comprised C10-C12 (13 μ g/l), C12-C16 (270 μ g/l), C16-C21 (690 μ g/l) and C21-C35 (980 μ g/l). The predominant aromatic carbon range comprised of C16-C21 (250 μ g/l) and C21-C25 (680 μ g/l).

During the Quarter 2, 2012 monitoring event, hydrocarbons were detected in BH103 only. The detected aliphatic carbon range comprised C12-C16 (98 μ g/l), C16-C21 (230 μ g/l) and C21-C25 (170 μ g/l). No detections of aromatic carbons were measured during the Quarter 2 2012 monitoring event.

No hydrocarbons were detected at any location during the Quarter 3 and Quarter 4, 2012 monitoring events.

During the Quarter 1, 2013 monitoring event aromatic hydrocarbons were detected in BH103, BH104B and MW04. The predominant aromatic carbon range comprised C12-C16 ($30 \mu g/I$), C16-C21 (280 $\mu g/I$) and C21-C35 ($100 \mu g/I$) in BH103, C10-C12 ($30 \mu g/I$), C12-C16 ($110 \mu g/I$) and C16-C21 ($80 \mu g/I$) in BH104B and C10-C12 ($20 \mu g/I$) and C12-C16 ($80 \mu g/I$) in MW04. Aliphatic hydrocarbons were detected in BH103 in the ranges C12-C16 ($70 \mu g/I$), C16-C21 ($100 \mu g/I$) and C21-C35 ($90 \mu g/I$).

During the Quarter 2, 2013 monitoring event no aliphatic or aromatic hydrocarbons were detected at any location.

During the Quarter 3, 2013 monitoring event, hydrocarbons of the aliphatic range were detected in MW03 only. The detected aliphatic carbon range comprised C10-C16 (290 μ g/l) and C12-C16 (190 μ g/l). No detections of aromatic carbons were measured during the Quarter 3 2013 monitoring event.

Total Petroleum Hydrocarbons were not detected at any monitoring location during the Quarter 4, 2014 monitoring event. During the monitoring event for Quarter 3 2014 following ranges of the aliphatic hydrocarbons were recorded for BH104B; C12-C16 (150 μ g/l), C16-C21 (250 μ g/l) and C21-C35 (10 μ g/l).

During the Quarter 1 2015 monitoring event, hydrocarbons were detected in MW03, MW04, BH103 and BH104B. The predominant aromatic carbon range comprised C21-C35 (14 μ g/l) in BH103, C12-C16 (27 μ g/l) and C16-C21 (15 μ g/l) in BH104B, C12-C16 (14 μ g/l) in MW03 and C12-C16 (15 μ g/l) in MW04. Aliphatic hydrocarbons were detected in the ranges C16-C35 (54 μ g/l) in BH103, C16-C35 (11 μ g/l) in BH104B and C16-C35 (46 μ g/l) and C35-C44 (12 μ g/l) in MW03.

During the Quarter 2 2015 monitoring event, the TPH concentration in the aromatic C21-C35 range was detected at one shallow groundwater wells BH103 (509 μ g/l). The TPH concentration in the aliphatic range was detected at C16-C35 (1760 μ g/l) in BH103 and C12-C16 (225 μ g/l) and C16-C35 (11 μ g/l) in BH104B.

The Quarter 3 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 (39 μ g/l), C16-C21 (37 μ g/l) and C21-C35 (28 μ g/l) at BH104B, C21-C35 at BH103 (17 μ g/l) and C10-C12 (18 μ g/l) and C12-C16 (29 μ g/l) at MW04. TPH concentrations were detected in the aliphatic ranges C10-C12 (13 μ g/l), C12-C16 (40 μ g/l) and C16-C35 (62 μ g/l) at BH104B and C16-C35 at BH103 (72 μ g/l) and MW03 (14 μ g/l).

The Quarter 4 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 (879 μ g/l), C16-C21 (1380 μ g/l) and C21-C35 (694 μ g/l) at BH104B, C21-C35 at BH103 (60 μ g/l) and C10-C12 (13 μ g/l) and C12-C16 (21 μ g/l) at MW04. TPH concentrations were detected in the aliphatic ranges C10-C12 (495 μ g/l), C12-C16 (3080 μ g/l) and C16-C35 (3360 μ g/l) at BH104B and C16-C35 (231 μ g/l) and C35-C44 (14 μ g/l) at BH103.

For the previous Quarter 1 2016 monitoring event, TPH was detected in samples from the well BH103 were in the aliphatic range C16-C35 (132 μ g/I) and from well MW04 in the aromatic range C12-C16 (15 μ g/I).

During the current Quarter 2 2016 monitoring event, TPH was detected in samples from the well BH103 were in the aliphatic range C16-C35 (150 μ g/l) and in the aromatic range C21-C35 (57 μ g/l) and from well MW04 in the aromatic range C12-C16 (20 μ g/l).



7 CONCLUSIONS

- In accordance with the criteria set out in Schedule 4(ii) of the site's Industrial Emissions Licence Register No. W0184-01, groundwater monitoring was carried out at the ENVA Ireland site on the 25th May 2016 corresponding to Quarter 2 of 2016. Samples were collected at 8 groundwater monitoring wells during this event.
- The results presented have been referenced against Groundwater Threshold Values (GTVs) outlined in the European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. no 9 of 2010), where available. Where GTVs are not available for parameters, results are compared against the Interim Guideline Values (IGVs) set out in the Environmental Protection Agency interim report, 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland'.
- Results of the BTEX and MTBE demonstrate that the levels of Toluene, Ethylbenzene and Xylene, Benzene and MTBE were all below the recommended EPA IGVs.
- The Quarter 1 2016 results of the speciated polycyclic aromatic hydrocarbons indicate that Total PAHs were below the EPA IGV of 0.1 µg/l at all monitoring wells with the exception of BH103 (0.111 µg/l).
- Vinyl Chloride was detected above the GTV of 0.375 μg/l at MW03 (0.6 μg/l) and MW04 (0.9 μg/l). Chloroethane in MW01 (1.1 μg/l) and 1,1-dichloroethene in MW03 (1.7 μg/l) and MW04 (3.6 μg/l) were also detected. However, the results are below their respective limits. All other VOCs and SVOCs were below their respective laboratory limits of detection
- Samples were analysed for speciated phenols to include chlorophenols and the results indicate that there were no detections above the laboratory limits of detection.
- For the current Quarter 2 2016 monitoring event, TPH detections in samples from the well BH103 were in the aliphatic range C16-C35 (150 μ g/l) and in the aromatic range C21-C35 (57 μ g/l), and from well MW04 in the aromatic range C12-C16 (20 μ g/l). Hydrocarbons in the aliphatic range C16-C35 (132 μ g/l) at BH103 and the aromatic range C12-C16 (15 μ g/l) at MW04 were observed during previous Quarter 1 2016 monitoring event. Concentrations in the aliphatic ranges C10-C12 (495 μ g/l), C12-C16 (3080 μ g/l) and C16-C35 (3360 μ g/l) as well as in the aromatic ranges C12-C16 (879 µg/l), C16-C21 (1380 µg/l) and C21-C35 (694 µg/l) were detected at BH104B during the Quarter 4 2015 monitoring event. Also in Quarter 4 2015, TPH concentrations were recorded in the aliphatic ranges C16-C35 (231 μ g/l) and C35-C44 (14 μ g/l) at BH103 and aromatic ranges C21-C35 (60 μ g/l) at BH103 and C10-C12 (13 μ g/l) and C12-C16 (21 μ g/l) at MW04. During Quarter 3 2015, TPH concentrations were also recorded in the aromatic ranges at BH103, BH104B and MW04, as well as in the aliphatic ranges at BH103, BH104B and MW03. Hydrocarbons were detected at BH104B in the aliphatic range and BH103 in both the aromatic and aliphatic ranges during the Quarter 2 2015 monitoring event, as well as MW04 in the aromatic range and BH103, BH104B and MW03 in both the aromatic and aliphatic ranges during Quarter 1 2015. Hydrocarbons were not detected in any monitoring location during the Quarter 4 2014 monitoring event.
- The general trend of contaminant concentrations over time continues to be somewhat variable with compounds not being continually detected in the same borehole on two or three consecutive monitoring rounds. In general, the contaminant levels detected at the Enva facility appear to indicate reducing contaminant concentrations over time with infrequent elevations in some parameters. Further monitoring is recommended to confirm these reductions.



Enva Portlaoise

2016 Groundwater Compliance Monitoring Quarter 3 (July – Sept 2016)

Document Control Sheet

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TABLE OF CONTENTS

1		INTRODUCTION1
	1.1	BACKGROUND
	1.2	OBJECTIVES & SCOPE OF WORK
2		REVIEW OF PREVIOUS DATA2
	2.1	INFORMATION SOURCES
	2.2	SITE SETTING
	2.3	REGIONAL SETTING
		2.3.1 Geology
		2.3.2 Hydrogeology
	2.4	SITE GROUND CONDITIONS
		2.4.1 Licence Conditions
3		METHODOLOGY
	3.1	LABORATORY ANALYSIS
	3.2	PRESENTATION & INTERPRETATION OF RESULTS
4		QUARTER 3 RESULTS AUGUST 20169
5		DISCUSSION OF QUARTER 3 RESULTS
5	5.1	DISCUSSION OF QUARTER 3 RESULTS
5		
5		FIELD PARAMETERS
5	5.2 5.3	FIELD PARAMETERS
5	5.2 5.3 5.4	FIELD PARAMETERS21RESULTS OF BTEX & MTBE21RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)22
5	5.2 5.3 5.4 5.5	FIELD PARAMETERS21RESULTS OF BTEX & MTBE21RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)22RESULTS OF SPECIATED PHENOLS22
5	 5.2 5.3 5.4 5.5 5.6 	FIELD PARAMETERS21RESULTS OF BTEX & MTBE21RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)22RESULTS OF SPECIATED PHENOLS22RESULTS OF SPECIATED PHENOLS22RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS23
5	5.2 5.3 5.4 5.5 5.6 5.7	FIELD PARAMETERS21RESULTS OF BTEX & MTBE21RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)22RESULTS OF SPECIATED PHENOLS22RESULTS OF SPECIATED PHENOLS22RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS23RESULTS OF VOLATILE ORGANIC COMPOUNDS23
5	5.2 5.3 5.4 5.5 5.6 5.7	FIELD PARAMETERS21RESULTS OF BTEX & MTBE21RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)22RESULTS OF SPECIATED PHENOLS22RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS23RESULTS OF VOLATILE ORGANIC COMPOUNDS23RESULTS OF TOTAL PETROLEUM HYDROCARBONS23
	5.2 5.3 5.4 5.5 5.6 5.7 5.8	FIELD PARAMETERS21RESULTS OF BTEX & MTBE21RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)22RESULTS OF SPECIATED PHENOLS22RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS23RESULTS OF VOLATILE ORGANIC COMPOUNDS23RESULTS OF TOTAL PETROLEUM HYDROCARBONS23RESULTS OF INORGANIC ANALYSIS25
	5.2 5.3 5.4 5.5 5.6 5.7 5.8 6.1	FIELD PARAMETERS.21RESULTS OF BTEX & MTBE21RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)22RESULTS OF SPECIATED PHENOLS22RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS23RESULTS OF VOLATILE ORGANIC COMPOUNDS23RESULTS OF TOTAL PETROLEUM HYDROCARBONS23RESULTS OF INORGANIC ANALYSIS25HISTORICAL RESULTS & TRENDS26
	5.2 5.3 5.4 5.5 5.6 5.7 5.8 6.1	FIELD PARAMETERS.21RESULTS OF BTEX & MTBE21RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)22RESULTS OF SPECIATED PHENOLS22RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS23RESULTS OF VOLATILE ORGANIC COMPOUNDS23RESULTS OF TOTAL PETROLEUM HYDROCARBONS23RESULTS OF INORGANIC ANALYSIS25HISTORICAL RESULTS & TRENDS26GROUNDWATER LEVELS OVER TIME26
	5.2 5.3 5.4 5.5 5.6 5.7 5.8 6.1	FIELD PARAMETERS21RESULTS OF BTEX & MTBE21RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)22RESULTS OF SPECIATED PHENOLS22RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS23RESULTS OF VOLATILE ORGANIC COMPOUNDS23RESULTS OF TOTAL PETROLEUM HYDROCARBONS23RESULTS OF INORGANIC ANALYSIS25HISTORICAL RESULTS & TRENDS26GROUNDWATER LEVELS OVER TIME26GROUNDWATER CONCENTRATIONS OVER TIME28
	5.2 5.3 5.4 5.5 5.6 5.7 5.8 6.1	FIELD PARAMETERS21RESULTS OF BTEX & MTBE21RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)22RESULTS OF SPECIATED PHENOLS22RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS23RESULTS OF VOLATILE ORGANIC COMPOUNDS23RESULTS OF TOTAL PETROLEUM HYDROCARBONS23RESULTS OF INORGANIC ANALYSIS25HISTORICAL RESULTS & TRENDS26GROUNDWATER LEVELS OVER TIME26GROUNDWATER CONCENTRATIONS OVER TIME286.2.1 Phenols29

LIST OF FIGURES

Figure 2.1 – Site Location	3
Figure 3.1 – Site Layout Plan with Groundwater Monitoring Locations	7
Figure 6.1 – Ground Elevation (mAOD) in all Monitoring Wells	26
Figure 6.2 – Ground Elevation (mAOD) in Shallow Groundwater Monitoring Wells	27
Figure 6.3 – Ground Elevation (mAOD) in Deep Groundwater Monitoring Wells	27
Figure 6.4 – Phenol Concentrations in all Monitoring Wells	29
Figure 6.5 – PAH (Total) Concentrations in all Monitoring Wells	30
Figure 6.6 – Fluoroanthene Concentrations in all Monitoring Wells	31
Figure 6.7 – Naphthalene Concentrations in all Monitoring Wells	31
Figure 6.8 – Benzo (g,h,i) perylene Concentrations	32
Figure 6.9 – Benzo (g,h,i) perylene in Monitoring Wells BH104B & MW03	33
Figure 6.10 – Benzo (a) pyrene Concentrations in all Monitoring Wells	34
Figure 6.11 – TPH (Carbon Range C10-C44) in all Monitoring Wells	34

LIST OF TABLES

Table 2.1 – Ground Conditions	5
Table 2.2 – Licence Parameters	5
Table 3.1 – Analytical Methodologies – ALS Environmental	6
Table 4.1 – Groundwater Levels (Quarter 3, 2016)1	.0
Table 4.2 – Results of Field Parameters Measured at each Groundwater Monitoring Well (Quarter 3	3,
2016)	
Table 4.3 – Results of BTEX and MTBE1	
Table 4.4 – Results of Speciated PAHs1	.2
Table 4.5 – Results of Speciated Phenols1	.4
Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)1	.5
Table 4.7 – Results of Volatile Organic Compounds (VOCs)1	.7
Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)1	.9
Table 4.9 – Results of Inorganic Analysis2	20
Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow	8
Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow	8
Table 6.3 – Monthly Rainfall Data for Year 2014 for Oak Park, Carlow	
Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow	8
Table 6.5 – Monthly Rainfall Data for Year 2016 for Oak Park, Carlow	8

1 INTRODUCTION

1.1 BACKGROUND

RPS has been commissioned by Enva Ireland Ltd (Enva) to carry out groundwater quality monitoring for environmental compliance, at their facility in the Clonminam Industrial Estate, Portlaoise, Co Laois. Groundwater monitoring has being carried out in strict accordance with criteria set out in Schedule 4(ii) of the site's Industrial Emissions Licence, Register No. W0184-01.

Enva Ireland has been operating under Waste Licence Register No. W0184-01 since January 2004. The licence was amended by the Environmental Protection Agency in December 2013 to conform to the provisions and requirements of the Council Directive 2010/75/EU (Industrial Emissions Directive) and as such is deemed an Industrial Emissions Licence. Enva is required to submit a report to the EPA on a quarterly basis, outlining the existing groundwater quality underlying the site.

A suitably qualified environmental consultant from RPS, collected groundwater samples from a series of 8 monitoring wells (BH101, BH102, BH103, BH104B, MW01, MW02, MW03, MW04) within the site boundary on the 31st of August 2016. The samples underwent laboratory analysis for the suite of parameters specified in Schedule 4(ii) of Industrial Emissions Licence W0184-01. This report outlines the results of the Quarter 3 monitoring for 2016 and reviews historical data recorded at the site.

1.2 OBJECTIVES & SCOPE OF WORK

The specific objectives and scope of work are as follows:

- Review of previous data as provided by Enva Portlaoise;
- Graphical presentation of key compounds and trends; and
- Discussion of results for Quarter 3 2016 within the context of previous results and available guideline concentrations.

2 REVIEW OF PREVIOUS DATA

2.1 INFORMATION SOURCES

The following documents were reviewed as part of this project:

- Industrial Emissions Licence W0184-01 and any available EPA documents from the EPA website;
- Quarterly Groundwater Monitoring Reports (Quarter 1 2004 to Quarter 4 2005), URS;
- Quarterly Groundwater Monitoring Reports (Quarter 1 2006 to Quarter 4 2015), RPS;
- Summary Report on Trend of Contaminant Levels at Enva Ireland Ltd since 2005, Ref: MDE0647RP0001, RPS (2007);
- Groundwater Risk Assessment, Ref: MDE0788Rp0001, RPS (2008);
- Hydrogeological Review and Assessment Report, Ref MDE0973Rp0017F01, RPS (2014);
- Baseline Environment Report, Ref: MDE0973Rp0104; and
- Quarter 1 Groundwater Monitoring Report, RPS (2016).
- Quarter 2 Groundwater Monitoring Report, RPS (2016).

2.2 SITE SETTING

The site is located to the southwest of the town of Portlaoise immediately to the south of the Dublin to Cork railway line. The general area is gently undulating. The site slopes gently to the southwest but to the east of the site the ground slopes gently towards the River Triogue, which is located approximately 1.5 km to the east. The site occupies an area of approximately 1.5 hectares and comprises of an operational waste oil and contaminated soil treatment plant.

The site is located on the outskirts of Portlaoise in an area of agricultural and light industrial development. The site is bounded to the north and east by land belonging to Irish rail, comprising sidings and general storage areas. To the south is a vehicle repair garage, which is elevated above the level of the site by approximately 1.5 m. To the west the site is adjoined by further industrial land, as well as residential land. The site location is presented on **Figure 2.1**.

The site has been in operation since 1978, and the layout has remained relatively consistent. The site layout is presented on **Figure 3.1**. The site is largely covered in hardstanding with some open areas in the far north and northeast of the site. All oil and soil storage areas are suitably bunded and the general standard of housekeeping is good.

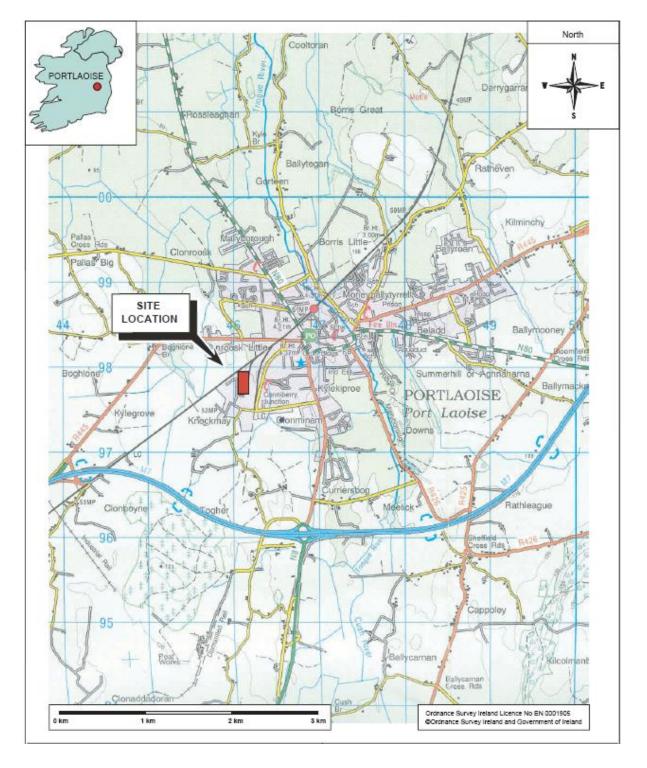


Figure 2.1 – Site Location



2.3 REGIONAL SETTING

2.3.1 Geology

The Geological Survey of Ireland indicates that the regional geology of Portlaoise is typified by Carboniferous Limestone. In the vicinity of the site itself the solid geology comprises the Ballysteen Formation, a micaceous-bioclastic limestone. This well-bedded limestone, with interbeds of shale, is extensively folded, with axes trending north-east to south-west, and becomes increasingly muddy towards the top of the formation. North-east to south-west trending faults are found in the region, with one located approximately 500m to the east of the site. The subsoils in the region comprise mainly Made Ground, around the industrial area, and Limestone Till in the surrounding regions.

2.3.2 Hydrogeology

The limestone is classified by the Geological Survey of Ireland (GSI) as a Locally Important Karstified Aquifer (LI). Porosity is predominantly in the form of fractures, in this aquifer, however the muddy nature of this formation greatly reduces permeability. Vulnerability of this aquifer beneath the site is classified as high, with moderate vulnerability to the east of the site.

The public water supply for Portlaoise is derived from groundwater, utilising three groundwater abstraction well fields comprising of two abstraction wells in each well field. This supply currently comes from the Straboe area, approximately 5.5 km to the north-east of the site. The source protection zone for this water supply extends to within 3.2 km of the Enva site but does not encompass the Enva site.

The GSI record a number of other dug wells and boreholes within the Portlaoise area, including the boreholes installed on the site. The accuracy of the locations of these wells varies. One well, which was drilled in 1899 is recorded as being located immediately to the south of the Enva site. The use of this well is not known and its location is only accurate to 1 km. A second borehole, drilled in 1973 is recorded 1.5 km to the north of the site at Clonroosk; the accuracy of this location is also 1 km so it could be closer or further from the site. The use of this well is not known but its yield is recorded as being poor. There are no other wells recorded within 1 km of the site.

Enva is not aware of any abstraction boreholes within the immediate vicinity of their site.

2.4 SITE GROUND CONDITIONS

A total of eight boreholes have been drilled at the site and the general sequence of ground conditions is presented in **Table 2.1**.

Table 2.1 – Ground Conditions

Strata	Extent	Thickness	Description
Made Ground	BH104	0-3.5 m	Predominantly concrete, with hardcore fill, and clay.
Boulder Clay	All boreholes	<8.5 m	Includes fine to medium, well rounded gravels.
Sand and Gravel	Confined to south east corner of site (BH101, BH104 and MW03)	0-2 m	In general the transition from boulder clay to sand is gradual with changes from gravel, to sandy gravel, to sand.
Limestone Bedrock	Encountered in MW01, MW02 and MW03	Top of limestone ranges from 7.7m to 9m below ground level.	Pale grey, fine-grained bedrock, differentiated from boulders by its un-weathered nature.

The logs for each of the boreholes were previously presented as Appendix B in the RPS Groundwater Risk Assessment Report (Ref: MDE0788Rp0001).

2.4.1 Licence Conditions

The Industrial Emissions Licence requires the regular monitoring and sampling of boreholes BH101, BH102, BH103, BH104B, MW01, MW02, MW03 and MW04. The parameters requiring measurement or analysis are presented in **Table 2.2**.

Table 2.2 – Licence Parameters

Group	Parameters requiring Quarterly Measurement	Parameters requiring Annual Measurement			
	Groundwater Level	Groundwater Level			
	рН	рН			
Field Parameters	Temperature	Temperature			
	Dissolved Oxygen	Dissolved Oxygen			
	Electrical Conductivity	Electrical Conductivity			
	Visual Inspection	Visual Inspection			
	Mineral Oil	Mineral Oil			
	BTEX & MTBE	BTEX & MTBE			
Organics	PAHs	PAHs			
Organics	Phenols	Phenols			
	VOCs	VOCs			
	SVOCs	SVOCs			
Inorganics	-	Total Alkalinity, Calcium, Manganese, Sulphate, Cyanide (Total), Chloride, Sodium,			

3 METHODOLOGY

Groundwater samples were collected from 8 no. on-site groundwater monitoring wells (BH101, BH102, BH103, BH104B, MW01, MW02, MW03, MW04) (Figure 3.1) using dedicated Waterra tubing, in accordance with RPS's standard sampling protocol. A non-return foot valve was fixed to the bottom of the tubing and inserted into the well, close to the base of the borehole. Separate tubing and foot valves were used at each monitoring well to eliminate the possibility of cross contamination.

Groundwater in the well casing is not considered representative of the groundwater quality at a given location. For this reason, three well volumes were purged from each well prior to collection of the groundwater sample. By the time purging was complete all field test water parameters (namely pH, Temperature, Electrical Conductivity and Dissolved Oxygen) were within 10% variance in three consecutive measurements. This ensured that the groundwater sample extracted from the monitoring borehole was representative of the water held in the subsurface strata and not water held stagnant in the borehole casing. The purged volumes were calculated on-site from the measured static water levels and total well depths using an electronic dip meter.

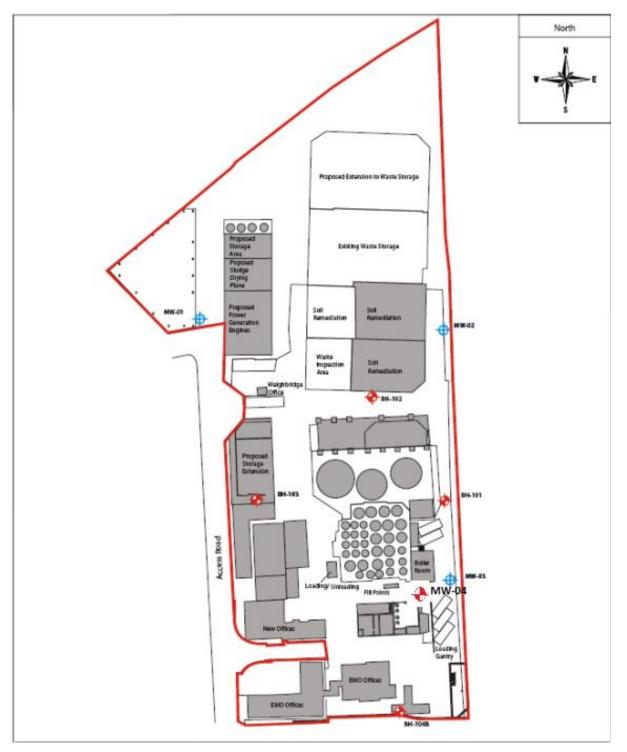
Groundwater samples were collected in laboratory supplied containers and stored in chilled cool boxes following sampling and during transit to the laboratory. A rigorous chain of custody procedure was used during the sample round.

3.1 LABORATORY ANALYSIS

All groundwater samples were analysed at a UKAS accredited laboratory, ALS Environmental for the suite of analyses listed in **Table 3.1**. **Table 3.1** also indicates the analytical techniques used by the laboratory.

Table 3.1 – Analytical Methodologies – ALS Environmental

Parameter	Analytical Methodology
Phenols	GC-MS
Speciated PAHs	GC-MS
BTEX & MTBE	Headspace GC-MS
Petroleum Hydrocarbons	Headspace GC-MS
Volatile Organic compounds & Tentatively Identified Organic Compounds (VOCs & TICs)	Headspace GC-MS
Semi-Volatile Organic compounds & Tentatively Identified Organic Compounds (SVOCs & TICs)	GC-MS





Shallow Monitoring Well locations Deep Monitoring Well locations

Source: URS Environmental Consultants (Ref: 45078497 Issue No. 1)

3.2 PRESENTATION & INTERPRETATION OF RESULTS

The Quarter 3 2016 results are tabulated in **Section 4** and discussed with respect to previous results in **Section 5**. Results are compared against Groundwater Threshold Values (GTVs) outlined in the European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. No 9 of 2010), where available. Where GTVs are not available for parameters, results are compared against the Interim Guideline Values (IGVs) set out in the Environmental Protection Agency interim report, 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland'.

Previous monitoring reports (as listed in **Section 2.1**) provide details of contaminant concentrations since 2004. The data available within these reports has been reviewed and time series plots of key parameters have been compiled. Trends for chlorinated solvents, petroleum hydrocarbons and phenol parameters have been plotted.

Time series plots are presented in **Section 6** and include the results of this Quarter 3 2016 monitoring round. As the monitoring continues in accordance with the Industrial Emissions licence requirements, the plots will be updated with the results of subsequent rounds used to illustrate the results.

Time series plots are also provided for manual water levels where available from previous reports.

4 QUARTER 3 RESULTS AUGUST 2016

The results of all field measurements and laboratory analysis are presented in this section. Results are primarily compared against Groundwater Threshold Values (GTVs) outlined in the European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. No 9 of 2010), where available. Where GTVs are not available for parameters, results are compared against the Interim Guideline Values (IGVs) set out in the Environmental Protection Agency interim report, 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland'.

The results are discussed in relation to appropriate guideline values in **Section 5**. Results that are shown to be above the relevant threshold or guideline values are highlighted in bold and shaded. Results that are shown to be above the relevant laboratory detection limits are highlighted in italics.

Site-specific field parameter measurements were collected during the site visit as per RPS Water sampling protocol.

Table 4.1 – Groundwater Levels	(Quarter 3, 2016)
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Monitoring Well	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04
Depth (mbgl)	6.79	6.47	4.43	4.43 4.58		30.88	14.78	6.51
Static Water Level (mbgl)	4.37	2.87	1.85	0.55	2.83	3.82	4.32	4.02
Ground Level (mAOD)	103.06	102.55	101.16	101.52	102.10 103.12		102.77	-
Water Level (mAOD)	98.69	99.68	99.31	100.97	99.27	99.3	98.45	-
Free Phase Oil (mm)	No detection	No detection	No detection	No detection				

mbgl = metres below ground level

Monitoring Well	pH (pH Units)	Temperature (°C)	Conductivity (μS/cm)	Dissolved O ₂ (ppm)	Observations
BH101	7.83	14.4	1085	3.07	Light grey cloudy colour, some sediment
BH102	7.80	13.5	730	3.41	Clear on purging, slight H ₂ S odour, some suspended solids
BH103	7.55	14.2	844	3.32	Dark grey in colour, very little sediment
BH104B	8.36	14.4	553	2.04	Grey colour on purging, slight H ₂ S odour, very little suspended solids or sediment
MW01	7.43	13.1	739	4.13	Slight H ₂ S odour, grey in colour and very slight oil sheen
MW02	7.66	13.5	717	2.97	Clear with a slight sheen
MW03	7.55	13.5	1594	3.68	Clear/grey colour on purging, very little suspended solids, very slight oil sheen. Samples slightly cloudy
MW04	7.33	14.4	1419	3.22	Light grey/brown colour, very little sediment and suspended solids
Groundwater Threshold Value	-	-	1875	-	-
Interim EPA Guideline Values (Units as indicated)	>6.5 & <9.5	25°C	1000	No abnormal change	-

Table 4.2 – Results of Field Parameters Measured at each Groundwater Monitoring Well (Quarter 3, 2016)

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the GTV are highlighted in bold and shaded.

Table 4.3 – Results of BTEX and MTBE

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Benzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.75	1.0
Toluene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0	<1.0	-	10
Ethylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
m & p-xylene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10 ^{Note 1}
o-xylene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10 ^{Note 1}
MTBE (Methyl Tertiary Butyl Ether)	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0	-	30

Note: No specific IGV for parameter. IGV for Total Xylenes is used as guideline.

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

Table 4.4 – Results of Speciated PAHs

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Naphthalene	μg/l	0.01	<0.01	<0.01	<0.13	0.039	<0.01	<0.01	0.028	0.12	-	1.0
Acenaphthylene	µg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Acenaphthene	µg/l	0.01	<0.01	<0.01	0.075	0.037	<0.01	<0.01	0.096	0.013	-	-
Fluorene	µg/l	0.01	<0.01	<0.01	0.025	0.047	<0.01	<0.01	0.137	0.019	-	-
Phenanthrene	µg/l	0.01	<0.01	0.014	0.013	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Anthracene	µg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.018	<0.01	-	10,000
Fluoranthene	µg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.026	<0.01	-	1.0
Pyrene	µg/l	0.01	0.011	0.019	<0.01	0.035	0.011	<0.01	0.09	<0.01	-	-
Benzo(a)anthracene	µg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.026	<0.01	-	-
Chrysene	µg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.028	<0.01	-	-
Benzo(b)fluoranthene	µg/l	0.01	<0.01	<0.01	0.013	<0.01	<0.01	<0.01	0.019	<0.01	-	0.5

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Benzo(k)fluoranthene	μg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	0.05
Benzo(a)pyrene	µg/l	0.01	<0.01	<0.01	0.04	<0.01	<0.01	<0.01	0.037	<0.01	-	0.01
Indeno(1,2,3-cd)pyrene	μg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.011	<0.01	-	0.05
Dibenz(a,h)anthracene	μg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.011	<0.01	-	-
Benzo(g,h,i)perylene	μg/l	0.01	<0.01	<0.01	0.015	<0.01	<0.01	<0.01	0.035	<0.01	-	0.05
Total EPA-16 PAHs	μg/l	0.1	0.011	0.033	0.181	0.158	0.011	<0.01	0.562	0.151	0.075	0.1

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the GTV are highlighted in bold and shaded.

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

Table 4.5 – Results of Speciated Phenols

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Phenol	μg/l	5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	-	0.5
2,4,6-Trichlorophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	200
2,4-Dichlorophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2,4-Dimethylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Chlorophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	200
2-Methylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Nitrophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
4-Chloro-3-methylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
3+4-Methylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Phenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.5
2-Chlorophenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	200
Bis(2-chloroethyl)ether	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,3-Dichlorobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2-Dichlorobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
1,4-Dichlorobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bis(2-chloroisopropyl)ether	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Methylphenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Hexachloroethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Nitrobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
3&4-Methylphenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Isophorone	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Nitrophenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2,4-Dimethylphenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bis(2-chloroethoxy)methane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2,4-trichlorobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.40
Naphthalene	µg/l	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	1.0
2,4-Dichlorophenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Hexachlorobutadiene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.10
4-Chloro-3-methylphenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2,4,6-Trichlorophenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	200
2,4,5-Trichlorophenol	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Methylnaphthalene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Chloronaphthalene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Dimethylphthalate	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
2,6-Dinitrotoluene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Acenaphthylene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Acenaphthene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2,4-Dinitrotoluene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Dibenzofuran	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
4-Chlorophenyl phenyl ether	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Diethylphthalate	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Fluorene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
4-Bromophenyl phenyl ether	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Hexachlorobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.03
Phenanthrene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Anthracene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10,000
Pyrene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzyl Butyl Phthalate	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzo(a)anthracene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Chrysene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzo(b)fluoranthene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.5
Benzo(k)fluoranthene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.05
Benzo(a)pyrene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.01
Indeno(1,2,3-c,d)pyrene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.05
Dibenz(a,h)anthracene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzo(g,h,i)perylene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the GTV are highlighted in bold and shaded.

Table 4.7 – Results of Volatile Organic Compounds (VOCs)

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Chloromethane	μg/l	1.0	<1.0	<1.0	<1.0	1.5	<1.0	<1.0	<1.0	<1.0	-	-
Chloroethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	8.4	-	-
Bromomethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Vinyl Chloride	μg/l	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.375	-
Trichlorofluoromethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,1-dichloroethene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	30
1,1-dichloroethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.9	3.1	-	-
Cis-1,2-dichloroethene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
MTBE (Methyl Tertiary Butyl Ether)	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0	-	30
2,2-Dichloropropane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,1,1-Trichloroethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	500
1,2-dichloroethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.25	-
1,1-Dichloropropene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Trans-1,2-dichloroethene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	1.0
1,2-dichloropropane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Trichloroethene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	70
Dibromomethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bromodichloromethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Cis-1,3-dichloropropene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Trans-1,3-dichloropropene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Toluene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0	<1.0	-	10
1,1,2-Trichloroethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,3-Dichloropropane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Dibromochloromethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Tetrachloroethene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	40
1,2-Dibromoethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Chlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	1.0
1,1,1,2-Tetrachloroethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Ethylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
m&p-Xylene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
Styrene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
o-xylene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
Isopropylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bromobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
N-Propylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Chlorotoluene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
4-Chlorotoluene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,3,5-Trimethylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Tert-Butylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2,4-Trimethylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Sec-Butylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,3-dichlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
P-Isopropyltoluene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2-dichlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
1,4-dichlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
n-Butylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2-Dibromo-3-chloropropane	µg/I	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	-
1,2,4-Trichlorobenzene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.40
Hexachlorobutadiene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.10

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
1,2,3-Trichlorobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the GTV are highlighted in bold and shaded.

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Aliphatic > C10-C12	μg/l	10	<10	<10	<10	<10	<10	<10	<10	<10	-	-
Aliphatic > C12-C16	μg/l	10	<10	<10	<10	<10	<10	<10	<10	<10	-	-
Aliphatic > C16-C35	μg/l	10	<10	<10	35	<10	<10	<10	<10	<10	-	-
Aliphatic > C35-C44	μg/l	10	<10	<10	10	<10	<10	<10	<10	<10	-	-
Aliphatic > C10-C44	μg/l	10	<10	<10	46	<10	<10	<10	<10	<10	-	10
Aromatic > C10-C12	μg/l	10	<10	<10	<10	<10	<10	<10	<10	<10	-	-
Aromatic > C12-C16	μg/l	10	<10	<10	<10	25	<10	<10	<10	23	-	-
Aromatic > C16-C21	μg/l	10	<10	<10	<10	12	<10	<10	<10	<10	-	-
Aromatic > C21-C35	μg/l	10	<10	<10	11	<10	<10	<10	<10	<10	-	-
Aromatic > C35-C44	μg/l	10	<10	<10	<10	<10	<10	<10	<10	<10	-	-
Aromatic > C10-C44	μg/l	10	<10	<10	11	37	<10	<10	<10	23	-	10

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

Table 4.9 – Results of Inorganic Analysis

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Total Alkalinity	mg/l	10	343	313	356	188	324	301	384	348	-	No abnormal change
Calcium	mg/l	0.2	129	120	130	75.3	59.4	54.8	125	119	-	200
Manganese	mg/l	0.007	0.0395	0.724	1.01	0.45	0.0503	0.0102	0.293	1.22	-	0.05
Sulphate	mg/l	0.1	46.5	28.9	25.3	37.8	16.6	22.4	23.3	<4.4	187.5	200
Cyanide (Total)	mg/l	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.375	0.01
Chloride	mg/l	4	77	5.9	27.7	9.8	11	11.6	213	212	187.5	30
Sodium	mg/l	0.1	51	6.81	12.1	16.7	19.8	18.3	110	121	150	150

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the GTV are highlighted in bold and shaded.

5 DISCUSSION OF QUARTER 3 RESULTS

The results of the Quarter 3 monitoring event for 2016 are presented in **Table 4.1** to **4.9** of this report. For the purpose of this report, the results are compared against the Groundwater Threshold Values (GTVs) outlined in the European Communities Environmental Objectives (Groundwater) Regulations (S.I. No. 9 of 2010) where available. Where GTVs are not available results are compared against the EPA Interim Guideline Values (IGV) as set out in the Interim Report *'Towards Setting Guideline Values for the Protection of Groundwater in Ireland' 2004.* A discussion of the results and their significance is included below.

5.1 FIELD PARAMETERS

The results of the field parameters measured at each groundwater monitoring well are presented in **Table 4.2**. Groundwater samples recorded pH levels ranging between 7.33 and 8.36, all within the EPA Interim guideline range of \geq 6.5 to \leq 9.5. Temperature measurements ranged from 13.3°C to 14.4°C and were below the EPA IGV of 25°C.

Field measurements of Electrical Conductivity levels ranged between 717 μ S/cm and 1594 μ S/cm. Three measurements of Electrical Conductivity were above the IGV of 1000 μ S/cm at BH101 (1085 μ S/cm), MW03 (1594 μ S/cm) and MW04 (1419 μ S/cm), but all however were below the GTV limit of 1875 μ S/cm.

Dissolved oxygen levels ranged between 2.04 and 4.13 ppm. Factors such as climate, nutrients in the water, suspended solids; organic wastes and groundwater inflow can all influence the dissolved oxygen values.

Observations relating to colour and odour varied from well to well as detailed in Table 4.2.

5.2 RESULTS OF BTEX & MTBE

The results of the **BTEX** and **MTBE** analysis are presented in **Table 4.3**. BTEX concentrations are below the associated GTVs and IGVs at all locations. All but one of the BTEX concentrations are below the laboratory of limit of detection at all locations. Toluene was detected at MW102 (1.2 μ g/l), however this is below the IGV of 10 μ g/l. MTBE was detected at MW03 (1.2 μ g/l), however this is below the IGV of 30 μ g/l. MTBE was also below the laboratory limit of detection and IGV at all other locations.

The previous detection of MTBE was in the Quarter 2 monitoring event of 2016 and recorded concentrations above the laboratory limit of detection at BH103 (1.2 μ g/l), MW03 (1.8 μ g/l) and MW04 (1.7 μ g/l). MTBE was also above the laboratory limit of detection at BH103 (1.4 μ g/l), MW03 (2.2 μ g/l) and MW04 (2.1 μ g/) during Quarter 1 2016. These detections are still below the IGV limit however. Prior to this there was a detection of MTBE at BH104B in the Quarter 1 monitoring event of 2012 with a recorded concentration of 280 μ g/l which is above the laboratory limit of detection. This was the only recorded exceedance in Quarter 1 2012.

Monitoring during Quarter 1 and Quarter 2 of 2010 detected exceedances of MTBE at BH103 at a concentration of 16 μ g/l. Subsequent monitoring in 2010 recorded concentrations below the



laboratory limit of detection. Prior to these 2010 monitoring events, concentrations of MTBE at BH103 were recorded at $63 \mu g/l$ in December 2009.

5.3 **RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)**

The results of the Speciated PAH analysis during this monitoring period are presented in **Table 4.4**.

The laboratory limit of detection for Total EPA-16 PAHs is 0.1 μ g/l and has been lowered for comparison with the EPA IGV of 0.1 μ g/l; however this is not accredited. This laboratory limit of detection is above the EPA GTV of 0.075 μ g/l. To identify the compounds, which attributed to these concentrations, speciated PAH analysis was carried out, which reduces the limit of detection for individual parameters to 0.01 μ g/l.

Total Polyaromatic Hydrocarbons were above the IGV limit of 0.1 μ g/l at BH103 (0.181 μ g/l), BH104B (0.158 μ g/l), MW104 (0.562 μ g/l) and MW104 (0.151 μ g/l). Total PAHs were below the IGV of 0.1 μ g/l and the GTV of 0.075 μ g/l at all other locations.

Total PAHs were previously detected above the IGV at BH103 (0.123 μ g/l), BH104B (0.159 μ g/l) and MW04 (0.153 μ g/l) during the Quarter 1 2016 monitoring event and were also above the IGV at BH103 (0.111 μ g/l) during the Quarter 2 2016 monitoring event.

The results of the speciated polycyclic aromatic hydrocarbon analysis detected a number of different compounds in BH101, BH102, BH103, BH104B, MW01, MW03 and MW04 above the laboratory limit of detection. However, with the exception of Benzo (a) pyrene at BH103 (0.04 μ g/l) and MW103 (0.037 μ g/l), none of these compounds were above their respective IGV limits at any location.

5.4 **RESULTS OF SPECIATED PHENOLS**

During previous quarterly monitoring events and sample analysis, total monohydric phenol was determined and historically has been below the laboratory limit of detection of 10 μ g/l since December 2008. It should be noted that the laboratory limit of detection was however above the IGV of 0.5 μ g/l for phenols.

For this reason, samples were analysed for phenols to include chlorophenols. The results of the speciated phenols analysis are presented in **Table 4.5**. The speciated phenol analysis reduces the laboratory limit of detection to $1.0 \mu g/l$ for individual parameters.

The results of the current Quarter 3 2016 speciated phenol analysis confirm concentrations of phenols were below the laboratory limit of detection of $1.0 \mu g/l$ at all locations.

4-Chloro-3-methylphenol was detected at BH104B (1.37 μ g/l) above the laboratory limit of detection during the Quarter 1 2015 analysis. With the exception of this, all other results are consistent with results since the 2012 quarterly monitoring events.

5.5 RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS

The results of the Semi-Volatile Organic Compound analysis are presented in Table 4.6.

There are no GTVs for individual SVOC parameters. No SVOCs were detected above the relevant IGVs during this monitoring period, consistent with the results from the 2015 and 2014 monitoring periods. It should be noted that the laboratory limit of detection was however above the IGVs for some SVOCs, for example the result for 1,2,4-Trichlorobenzene was <1.0 μ g/l but the IGV for this parameter is 0.40 μ g/l, but testing at this limit is not accredited.

The Quarter 3 2013 monitoring event detected two SVOC compounds, Acenaphthene (1.1 μ g/l) and Fluorene (1.5 μ g/l) in MW03. Prior to this detection the Quarter 2 monitoring event of 2012 detected concentrations of Naphthalene and Acenaphthylene in MW03 at concentrations of 2.4 μ g/l and 0.12 μ /l respectively.

5.6 **RESULTS OF VOLATILE ORGANIC COMPOUNDS**

The results of the Volatile Organic Compound analysis are presented in **Table 4.7**. The results of the current Quarter 3 2016 monitoring event indicate that Vinyl Chloride was detected above the GTV of 0.375 μ g/l at MW04 (0.6 μ g/l). The results of the Quarter 2 2016 monitoring event detected that Vinyl Chloride was above the GTV of 0.375 μ g/l at MW03 (0.6 μ g/l) and MW04 (0.9 μ g/l).

Chloroethane at MW04 (8.4 μ g/l) was detected above the limit of detection (1.0 μ g/l), however there is no GTV or IGV limit for Chloroethane. The results of the Quarter 2 monitoring event previously detected Chloroethane in MW01 (1.1 μ g/l).

Chloromethane at BH104B (1.5 μ g/l), MTBE at MW03 (1.2 μ g/l) and Toluene at MW02 (1.2 μ g/l) were also detected. However, the results are below the IGV for MTBE (30 μ g/l) and Toluene (10 μ g/l) and there is no GTV or IGV limit for Chloromethane. All other compounds were below their respective laboratory limits of detection.

Historic groundwater monitoring events detected some parameters above the laboratory limit of detection in November 2009, corresponding to Quarter 4 of 2009. Historically 1,1-Dichloroethane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, MTBE, n-butylbenzene, n-propylbenzene, o-xylene, p-isopropyltoluene, sec-butylbenzene and tert-butylbenzene were detected above the laboratory limits of detection.

The results of the Quarter 3 and Quarter 4 monitoring events of 2009 and all subsequent monitoring events indicate that there were no exceedances of the GTVs or IGVs for specific parameters.

5.7 RESULTS OF TOTAL PETROLEUM HYDROCARBONS

In order to provide a more accurate profile of TPH within the groundwater, speciated hydrocarbon analysis using the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) method was carried out on samples taken at all boreholes. The results of the TPH analysis are presented in **Table 4.8**.

The EPA IGV of 10 μ g/l for the Total Hydrocarbons is deemed comparable with the results for Total Petroleum Hydrocarbons. Some detections of TPH in both the aliphatic and aromatic range were observed during the current Quarter 3 2016 monitoring event. Detections were found in samples from the following wells; at BH103 detections were in the aliphatic range C16-C35 (35 μ g/l), C35-C44 (10 μ g/l) and in the aromatic range C21-C35 (11 μ g/l), at BH104B detections were in the Aromatic range C12-C16 (25 μ g/l), C16-C21 (12 μ g/l) and at well MW04 detections were in the aromatic range C12-C16 (23 μ g/l). Each of these is over both the limit of detection and the IGV for Total Hydrocarbons, which is 10 μ g/l.

The previous Quarter 2 monitoring event detected TPH in the well BH103 were in the aliphatic range C16-C35 (150 μ g/l) and in the aromatic range C21-C35 (57 μ g/l) and from well MW04 in the aromatic range C12-C16 (20 μ g/l).

The Quarter 1 monitoring event of 2016 detected TPH in the aliphatic range C16-C35 (132 μ g/l) at BH103 and in the aliphatic range C12-C16 (15 μ g/l) at MW04.

The Quarter 4 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 (879 μ g/l), C16-C21 (1380 μ g/l) and C21-C35 (694 μ g/l) at BH104B, C21-C35 at BH103 (60 μ g/l) and C10-C12 (13 μ g/l) and C12-C16 (21 μ g/l) at MW04. TPH concentrations were detected in the aliphatic ranges C10-C12 (495 μ g/l), C12-C16 (3080 μ g/l) and C16-C35 (3360 μ g/l) at BH104B and C16-C35 (231 μ g/l) and C35-C44 (14 μ g/l).

The Quarter 3 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 (39 μ g/l), C16-C21 (37 μ g/l) and C21-C35 (28 μ g/l) at BH104B, C21-C35 at BH103 (17 μ g/l) and C10-C12 (18 μ g/l) and C12-C16 (29 μ g/l) at MW04. TPH concentrations were detected in the aliphatic ranges C10-C12 (13 μ g/l), C12-C16 (40 μ g/l) and C16-C35 (62 μ g/l) at BH104B and C16-C35 at BH103 (72 μ g/l) and MW03 (14 μ g/l).

The Quarter 2 monitoring event of 2015 detected TPH in the aromatic range C21-C35 at BH03 (509 μ g/l). TPH concentrations were detected in the aliphatic ranges C16-C35 at BH103 (1760 μ g/l) and BH104B (337 μ g/l), and C12-C16 at BH104B (225 μ g/l).

The Quarter 1 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 at wells MW03 (14 μ g/l), MW04 (15 μ g/l) and BH104B (27 μ g/l), C16-C21 at BH104B (15 μ g/l), and C21-C35 (14 μ g/l) at BH103. TPH concentrations were detected in the aliphatic ranges C16-C35 and C35-C44 at MW03 (46 μ g/l and 12 μ g/l respectively), BH103 (54 μ g/l) and BH104B (11 μ g/l.

No detections of TPH in the aliphatic or aromatic range were observed in any shallow or deep monitoring well locations during the Quarter 4 monitoring event of 2014.

The Quarter 3 monitoring event of 2014 detected TPH concentrations in the aliphatic range at the shallow groundwater well BH104B. The TPH concentration detected was 410 μ g/l. The speciated TPH ranges that contributed to the value of 410 μ g/l were C12-C16 (150 μ g/l), C16-C21 (250 μ g/l) and C31-C35 (10 μ g/l).

The Quarter 3, 2013 monitoring event detected TPH in the aliphatic range in one deep groundwater well, MW03. TPH of the range C10-C12 and C12-C16 were detected at concentrations of 200 μ g/l and 190 μ g/l respectively.



The Quarter 1, 2013 monitoring event detected aliphatic TPH of the range C12-C16, C16-C21 and C21-C35. TPH in the mid to high aromatic ranges were detected in BH103, BH104B and MW04 during the previous Quarter 1 2013 monitoring event. Aromatic TPH of the ranges C12-C16, C16-C21 and C21-C35 were detected in BH103, the ranges C10-C12, C12-C16 and C16-C21 were detected in BH104B and aromatic TPH of the ranges C10-C12 and C12-C16 were detected in MW04.

The Quarter 2 monitoring event of 2012 detected elevated TPH of the aliphatic range C12-C16, C16-C21 and C21-C25 in BH103. Hydrocarbons have been detected in borehole MW03 during Quarter 1 2010, in borehole BH104B during the Quarter 2 2010 monitoring event and in borehole BH104B and MW03 during the Quarter 3 2010 monitoring events. Hydrocarbons have also been detected in BH103, BH104B and MW03 in the Quarter 2 2011 monitoring event and in MW03 in the Quarter 3 and Quarter 4 2011. These detections are discussed further in **Section 6.2.3**.

5.8 **RESULTS OF INORGANIC ANALYSIS**

The results of the inorganic analysis are presented in **Table 4.9**. The following inorganic parameters are required to be analysed on an annual basis in accordance with Schedule D of the Industrial Emissions Licence W0184-01; Total Alkalinity, Calcium, Manganese, Sulphate, Cyanide (Total), Chloride and Sodium.

The results of the inorganic analysis for this monitoring event indicate that Manganese and Chloride were recorded above their respective recommended GTVs or IGV's. The remaining parameters were below their GTV's and IGV's at all locations.

Concentrations of Manganese exceeded the IGV of 0.05 mg/l at 6 no. locations (BH102, BH103, BH104B, MW01, MW03 and MW04) ranging between 0.293 mg/l and 1.22 mg/l. Manganese is a naturally occurring metal and the levels of Manganese detected during the Quarter 3 2015 monitoring event are likely to be naturally occurring.

Concentrations of Chloride were recorded above the GTV limit of 187.5 mg/l at 2 no. locations (MW03 and MW04) ranging between 212 mg/l and 213 mg/l. Chloride concentrations were detected at MW03 and MW04 in Quarter 3 2015 at levels of 241 mg/l and 267 mg/l. Chloride concentrations at these locations are not suspected to be related to current activities. Chloride concentrations will continue to be measured to verify the consistency of these results.

6 HISTORICAL RESULTS & TRENDS

Time series plots are presented in this section and include the results of the Quarter 3 2016 monitoring round. As the monitoring continues in accordance with the Industrial Emissions Licence requirements, the plots will be updated with the results of subsequent rounds and used to illustrate the results.

6.1 GROUNDWATER LEVELS OVER TIME

Figure 6.1 to **Figure 6.3** below illustrates the manually recorded water levels using an electronic probe. The graphs show that groundwater levels can vary considerably between monitoring rounds.

Figure 6.2 illustrates groundwater elevations (mAOD) in shallow groundwater wells (BH101 to BH104B) ranging between approximately 98 mAOD and 102 mAOD.

Figure 6.3 illustrates groundwater elevation (mAOD) in the deeper groundwater wells (MW01 to MW03). The groundwater elevation (mAOD) for these deeper groundwater wells ranges from approximately 97.5 mAOD to approximately 100 mAOD.

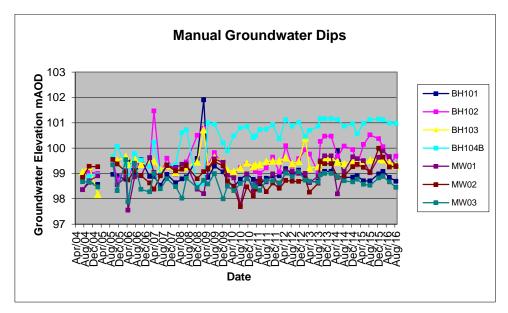


Figure 6.1 – Ground Elevation (mAOD) in all Monitoring Wells



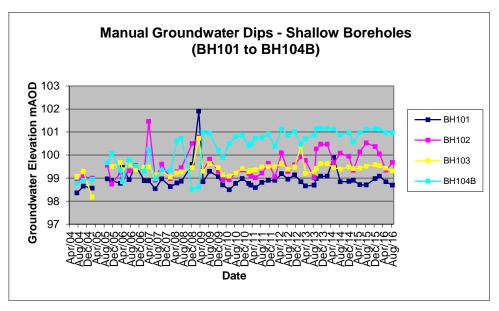
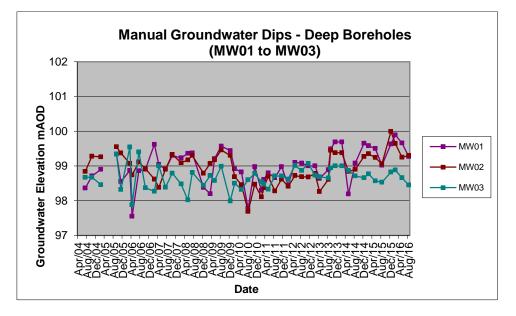


Figure 6.3 – Ground Elevation (mAOD) in Deep Groundwater Monitoring Wells



The groundwater levels generally show a similar pattern of fluctuation over time indicating a degree of connection between boreholes. The graphs demonstrate that groundwater levels can vary considerably between monitoring rounds; the general direction of flow in the shallow and deeper groundwater bearing unit is in an easterly or north easterly direction however there have been some occasional historic cases of groundwater flowing in a south-easterly direction.

In addition, monthly rainfall data for Oak Park, Carlow have been tabulated from Met Éireann to examine the relationship between compounds and rainfall events. The data from Oak Park was chosen as the weather station at Birr, Co. Offaly closed in October 2009. A summary of the rainfall data is in **Tables 6.1** to **6.5**.

Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Rainfall (mm)	70.8	24.5	18.0	56.3	50.2	155.8	76.2	127.7	37.9	63.4	80.9	68.1

Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Rainfall (mm)	76.2	35.8	57.6	44.4	35.6	37.5	32.3	85.6	24.4	170.0	27.7	136.6

Table 6.3 – Monthly Rainfall Data for Year 2014 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Rainfall (mm)	147.2	176.7	65.0	52.6	78.6	61.9	24.6	122.1	18.2	138.2	165.6	47.7

Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	66.0	36.3	53.5	26.3	89.4	29.7	79.4	83.0	17.9	56.8	110.0	270.9

Table 6.5 – Monthly Rainfall Data for Year 2016 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Rainfall (mm)	110.9	95.7	40.6	64.3	61.6	61.7	29.6	46.0	97.4

6.2 GROUNDWATER CONCENTRATIONS OVER TIME

Groundwater quality trends have previously been examined in two reports (URS 2005 and RPS 2007). In addition, RPS carried out a groundwater risk assessment (Ref: MDE0788RP0001, dated November 2008) in which the general trend of contaminant concentrations over time was observed to be erratic with compounds rarely being detected in the same borehole on two consecutive monitoring rounds.

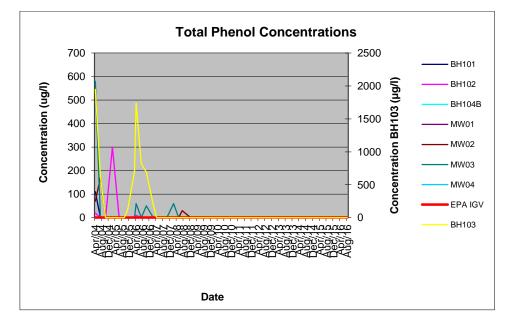
The data available within these reports has been reviewed and time series plots of key parameters have been compiled based on notable trends. Trends for phenols, petroleum hydrocarbons and chlorinated solvents have been plotted as outlined in the following sections.

6.2.1 Phenols

Phenols have been detected historically in all boreholes with the highest concentrations recorded in BH103. However concentrations in BH103 have declined since April 2007. Phenol concentrations have since been recorded below the IGV of 0.5 μ g/l in all monitoring wells since December 2008 indicating natural attenuating conditions within the groundwater.

2,4-Dimethylphenol was detected at a concentration of 0.12 μ g/l during the Quarter 1, 2010 monitoring event. There is no recommended IGV for this parameter. Subsequent to the Quarter 1 2010 monitoring event no detections of phenols have been noted at any monitoring location up to and including the current Quarter 3 2016 monitoring event.





6.2.2 Polyclyclic Aromatic Hydrocarbons

Figure 6.5 below illustrates that PAHs (Polycyclic Aromatic Hydrocarbons) have previously been detected within all monitoring wells above the recommended EPA IGV of 0.1 μ g/l. Historically the highest concentrations have been detected within MW03 and BH104B, with the highest concentration detected in March 2006 (107 μ g/l) and in October 2007 (19.72 μ g/l) respectively. In addition, a range of PAHs including Benzo(a)pyrene, Benzo(g,h,i)perylene, Indeno(1,2,3)cd pyrene, Fluoranthene and Naphthalene have previously been detected in MW03 with **Figures 6.6** to **6.10** illustrating some of the PAH compounds which were detected above their respective IGVs.

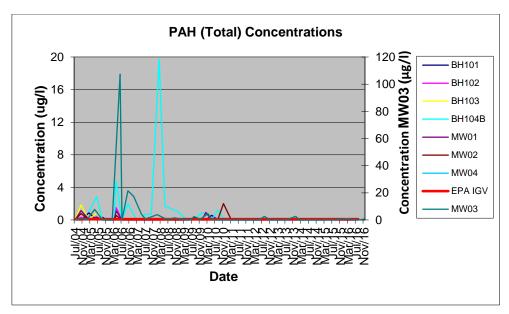
Since 2007 concentrations of PAH have shown a marked decrease and since 2010 detections of PAH have been confined to MW03, MW02 and BH104B. Concentrations of Total PAH above the IGV in 2010 were detected during the Quarter 1 monitoring event in MW03 (0.3 μ g/l), Quarter 2 monitoring event in BH104B (1.2 μ g/l) and Quarter 3 monitoring event in MW02 (2.0 μ gl) and BH104B (0.2 μ gl). There were no elevated concentrations of Total PAH during the Quarter 4 2010 monitoring event.



No Total PAH detections were recorded throughout 2011 and in Q1 of 2012. Total PAH was detected above the IGV in MW03 in the Q2 2012 monitoring event. No Total PAH exceedances were detected from Quarter 3 2012 to Quarter 4 2013 inclusive. Total PAHs were detected at a concentration of 2.62 μ g/l in MW03 during the Q3 2013 monitoring event however; no detections above the laboratory limit were noted during the subsequent monitoring events up to and including the Quarter 2 2015 monitoring event.

Total PAHs were also above the GTV at BH103 (0.093 μ g/l), BH104B (0.159 μ g/l) and MW03 (0.586 μ g/l) during Quarter 3 2015, at BH103 (0.21 μ g/l), MW03 (0.986 μ g/l) and MW04 (0.079 μ g/l) during Quarter 4 2015, and at BH103 (0.123 μ g/l), BH104B (0.159 μ g/l) and MW04 (0.153 μ g/l) during the previous Quarter 1 2016 monitoring event.

During the Quarter 2 2016 monitoring event, Total Polyaromatic Hydrocarbons were detected above the IGV limit of 0.1 μ g/l at BH103 (0.111 μ g/l). Similarly during the current Quarter 3 monitoring event total PAHs were detected above the IGV at BH103 (0.181 μ g/l), BH104B (0.158 μ g/l), MW103 (0.562 μ g/l) and MW104 (0.151 μ g/l).







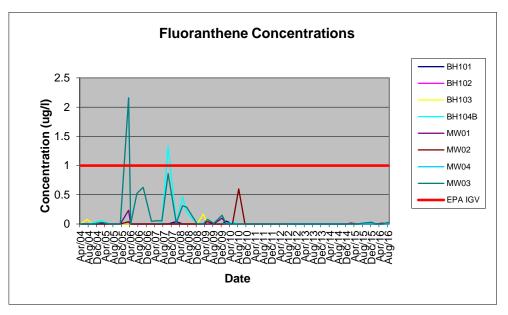


Figure 6.6 illustrates that **Fluoranthene** was previously detected above the IGV of 1.0 μ g/l in groundwater monitoring wells BH104B (October 2007, 1.33 μ g/l) and MW03 (March 2006, 2.158 μ g/l) only. The remaining monitoring wells recorded concentrations below the IGV of 1.0 μ g/l. During the Quarter 3 2016 monitoring event Fluoranthene was detected above the limit of detection at MW03 (0.026 μ g/l) only, this does not exceed the IGV of 1.0 μ g/l.

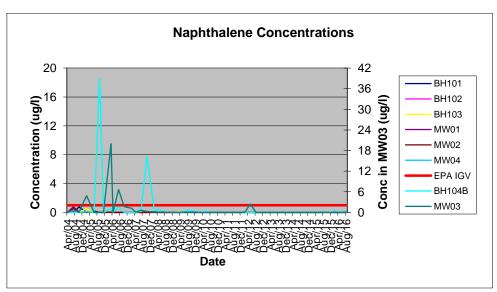


Figure 6.7 – Naphthalene Concentrations in all Monitoring Wells

A similar trend to Fluoroanthene has been noted in **Figure 6.7**, with concentrations of **Naphthalene** recorded above the IGV of 1.0 μ g/l in BH104B and MW03 only. 4 no. exceedances of the IGV were noted in BH104B in September 2005 (39 μ g/l), March 2006 (1.069 μ g/l), July 2006 (1.594 μ g/l) and October 2007 (16.31 μ g/l). Since October 2007, the concentrations in BH104B have decreased below the IGV. There have been 6 exceedances of the IGV of 1.0 μ g/l in MW03, with the highest concentration detected in March 2006 (19.986 μ g/l) and the most recent being the detected in the Quarter 2 2012 monitoring event (2.4 μ g/l). The concentrations detected in August 2010 were

slightly above the laboratory limit of detection of 0.01 μ g/l at BH104B (0.08 μ g/l) and MW03 (0.05 μ g/l); however these levels are deemed low. Concentrations of Naphthalene were below the EPA IGV limit of detection of 1.0 μ g/l at all locations during the Quarter 4 2010, the 2011 and 2012 quarterly monitoring events and the Quarter 1 to Quarter 3 2014 monitoring periods, inclusive. No detections of Naphthalene were noted from the Quarter 4 2014 monitoring event to the Quarter 2 2015 monitoring event. Naphthalene was detected at BH101 (0.011 μ g/l) and MW03 (0.031 μ g/l) during Quarter 3 2015, and at BH103 (0.095 μ g/l) and at MW04 (0.067 μ g/l) during Quarter 4 2015.

Naphthalene was detected during the Quarter 1 2016 monitoring event at BH104B (0.034 μ g/l) and MW04 (0.153 μ g/l)These detections, however, were all below the IGV limit of detection of 1.0 μ g/l. Concentrations of Naphthalene were below the laboratory limit of detection at all locations during the Quarter 22016 monitoring event. During the Quarter 3 2016 monitoring event Naphthalene was detected above the limit of detection at BH103 (0.13 μ g/l), BH104B (0.039 μ g/l), MW03 (0.028 μ g/l) and MW04 (0.12 μ g/l), however these were all below the IGV limit of 1.0 μ g/l.

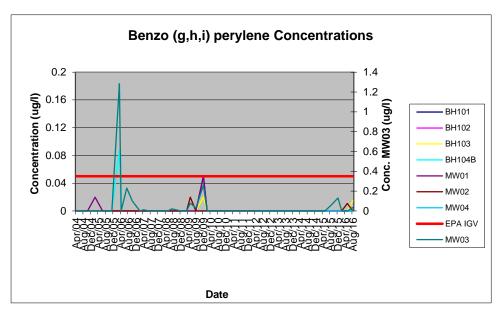


Figure 6.8 – Benzo (g,h,i) perylene Concentrations

Figure 6.8 illustrates the concentrations of **Benzo(g,h,i)perylene** in all monitoring wells over time. Elevated concentrations above the IGV were recorded at BH104B (0.087 μ g/l) on one occasion in March 2006.

Figure 6.9 illustrates elevated concentrations above the IGV recorded at MW03 on 6 no. occasions with the most recent elevated concentration recorded during the Quarter 4 2015 monitoring event (0.053 μ g/l). The previous elevated concentration detected was in Quarter 3 2015 (0.053 μ g/l). The results of all monitoring events from 2010 to the Quarter 2 2015 monitoring event recorded concentrations below the laboratory limit of detection of 0.01 μ g/l at all locations. Concentrations were also below the laboratory limit of detection at all locations during the Quarter 1 2016 monitoring event. Benzo(g,h,i)perylene was recorded in MW02 (0.011 μ g/l) during the Quarter 2 2016 monitoring event, however, this is below the IGV of 0.05 μ g/l. During the current Quarter 3 2016 monitoring event, Benzo(g,h,i)perylene was recorded at BH103 (0.015 μ g/l) and MW03 (0.035 μ g/l). However, this is still below the IGV of 0.05 μ g/l.

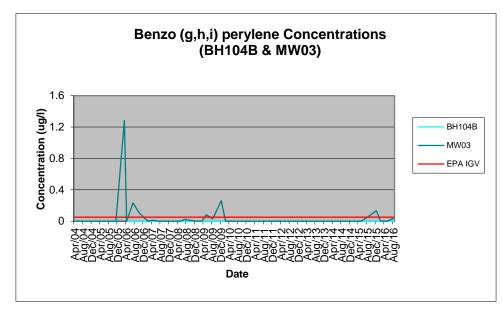


Figure 6.9 – Benzo (g,h,i) perylene in Monitoring Wells BH104B & MW03

Figure 6.10 illustrates the concentrations of **Benzo(a)pyrene** in all groundwater monitoring wells and indicates that Benzo(a)pyrene has been detected historically in all boreholes above the IGV of 0.01 μ g/l. Similarly with the above mentioned trends, the highest concentrations have been detected in MW03 and BH104B. Concentrations have markedly decreased since March 2006 when an elevated concentration of 2.751 μ g/l was detected in MW03, however there have been a number of detections above the IGV, with the most recent elevated level detected in December 2009. Elevated concentrations above the IGV were recorded in BH101, BH103 and MW01 during this same period.

The slightly higher concentrations of Benzo(g,h,i)perylene and Benzo(a)pyrene detected in Quarter 4, 2009 may be attributed to heavy rainfall, which occurred in November of 2009 and as a result possibly mobilized traces of these compounds from the soil. The static water levels for December 2009 ranged between 0.58 and 3.78 mbgl. Since December 2009, concentrations of compounds have notably decreased to below the IGVs.

Benzo(a)pyrene was detected above the IGV limit of 0.01 μ g/l at MW03 (0.108 μ g/l) during the Quarter 4 2015 monitoring event. Benzo(a)pyrene was also detected above the IGV at MW03 (0.052 μ g/l) during the Quarter 3 2015 monitoring event. All other results of all monitoring events from 2010 to Quarter 2 2016 monitoring event did not detect other concentrations above the IGV. During the current Quarter 3 2016 monitoring event Benzo(a)pyrene was detected above the limit of detection (0.01 μ g/l) at BH103 (0.04 μ g/l) and MW03 (0.037 μ g/l), these concentrations are also over the IGV of 0.01 μ g/l.

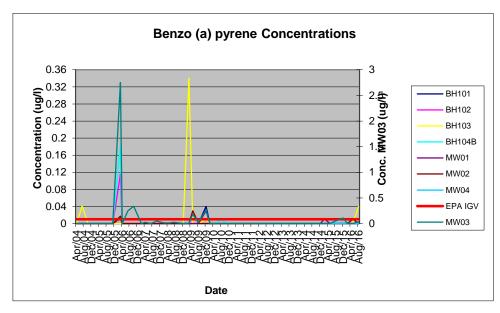


Figure 6.10 – Benzo (a) pyrene Concentrations in all Monitoring Wells

6.2.3 Petroleum Hydrocarbons (TPH)

Historically **Total Petroleum Hydrocarbons (TPH)** including mineral oil, petrol range organics (PRO) and diesel range organics (DRO) have been detected within BH103, BH104B and MW03. Since 2009, speciated hydrocarbon analysis using the Total Hydrocarbon Criteria Working Group (TPHCWG) method has been carried out on all samples to obtain a more accurate profile of TPH within groundwater.

The results of the TPHCWG analysis has indicated that the predominant hydrocarbons detected are in the heavier chain carbon fractions, most notably in the carbon range C12-C16, C16-C21 and C21-C35. **Figure 6.11** illustrates the TPH analysis for the total TPH analysis from C10-C44 in all monitoring wells since 2009. The highest concentrations detected historically are at monitoring wells MW03, BH104B and BH103 respectively.

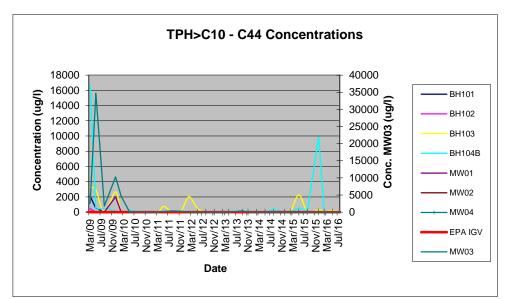


Figure 6.11 – TPH (Carbon Range C10-C44) in all Monitoring Wells



Previous quarterly monitoring reports have outlined the hydrocarbon trends recorded in each well since 2010. This report outlines the trends from 2012 up to and including the current monitoring report.

During the Quarter 1, 2012 monitoring event, hydrocarbons were detected in borehole BH103 only. The predominant aliphatic carbon range comprised C10-C12 (13 μ g/l), C12-C16 (270 μ g/l), C16-C21 (690 μ g/l) and C21-C35 (980 μ g/l). The predominant aromatic carbon range comprised of C16-C21 (250 μ g/l) and C21-C25 (680 μ g/l).

During the Quarter 2, 2012 monitoring event, hydrocarbons were detected in BH103 only. The detected aliphatic carbon range comprised C12-C16 (98 μ g/l), C16-C21 (230 μ g/l) and C21-C25 (170 μ g/l). No detections of aromatic carbons were measured during the Quarter 2 2012 monitoring event.

No hydrocarbons were detected at any location during the Quarter 3 and Quarter 4, 2012 monitoring events.

During the Quarter 1, 2013 monitoring event aromatic hydrocarbons were detected in BH103, BH104B and MW04. The predominant aromatic carbon range comprised C12-C16 ($30 \mu g/I$), C16-C21 (280 $\mu g/I$) and C21-C35 ($100 \mu g/I$) in BH103, C10-C12 ($30 \mu g/I$), C12-C16 ($110 \mu g/I$) and C16-C21 ($80 \mu g/I$) in BH104B and C10-C12 ($20 \mu g/I$) and C12-C16 ($80 \mu g/I$) in MW04. Aliphatic hydrocarbons were detected in BH103 in the ranges C12-C16 ($70 \mu g/I$), C16-C21 ($100 \mu g/I$) and C21-C35 ($90 \mu g/I$).

During the Quarter 2, 2013 monitoring event no aliphatic or aromatic hydrocarbons were detected at any location.

During the Quarter 3, 2013 monitoring event, hydrocarbons of the aliphatic range were detected in MW03 only. The detected aliphatic carbon range comprised C10-C16 (290 μ g/l) and C12-C16 (190 μ g/l). No detections of aromatic carbons were measured during the Quarter 3 2013 monitoring event.

Total Petroleum Hydrocarbons were not detected at any monitoring location during the Quarter 4, 2014 monitoring event. During the monitoring event for Quarter 3 2014 following ranges of the aliphatic hydrocarbons were recorded for BH104B; C12-C16 (150 μ g/l), C16-C21 (250 μ g/l) and C21-C35 (10 μ g/l).

During the Quarter 1 2015 monitoring event, hydrocarbons were detected in MW03, MW04, BH103 and BH104B. The predominant aromatic carbon range comprised C21-C35 (14 μ g/l) in BH103, C12-C16 (27 μ g/l) and C16-C21 (15 μ g/l) in BH104B, C12-C16 (14 μ g/l) in MW03 and C12-C16 (15 μ g/l) in MW04. Aliphatic hydrocarbons were detected in the ranges C16-C35 (54 μ g/l) in BH103, C16-C35 (11 μ g/l) in BH104B and C16-C35 (46 μ g/l) and C35-C44 (12 μ g/l) in MW03.

During the Quarter 2 2015 monitoring event, the TPH concentration in the aromatic C21-C35 range was detected at one shallow groundwater wells BH103 (509 μ g/l). The TPH concentration in the aliphatic range was detected at C16-C35 (1760 μ g/l) in BH103 and C12-C16 (225 μ g/l) and C16-C35 (11 μ g/l) in BH104B.

The Quarter 3 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 (39 μ g/l), C16-C21 (37 μ g/l) and C21-C35 (28 μ g/l) at BH104B, C21-C35 at BH103 (17 μ g/l) and C10-C12 (18 μ g/l) and C12-C16 (29 μ g/l) at MW04. TPH concentrations were detected in the aliphatic ranges C10-C12 (13 μ g/l), C12-C16 (40 μ g/l) and C16-C35 (62 μ g/l) at BH104B and C16-C35 at BH103 (72 μ g/l) and MW03 (14 μ g/l).

The Quarter 4 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 (879 μ g/l), C16-C21 (1380 μ g/l) and C21-C35 (694 μ g/l) at BH104B, C21-C35 at BH103 (60 μ g/l) and C10-C12 (13 μ g/l) and C12-C16 (21 μ g/l) at MW04. TPH concentrations were detected in the aliphatic ranges C10-C12 (495 μ g/l), C12-C16 (3080 μ g/l) and C16-C35 (3360 μ g/l) at BH104B and C16-C35 (231 μ g/l) and C35-C44 (14 μ g/l) at BH103.

The Quarter 1 2016 monitoring event, detected TPH in samples from the well BH103 were in the aliphatic range C16-C35 (132 μ g/l) and from well MW04 in the aromatic range C12-C16 (15 μ g/l).

For the previous Quarter 2 2016 monitoring event, TPH was detected in samples from the well BH103 and were in the aliphatic range C16-C35 (150 μ g/l) and in the aromatic range C21-C35 (57 μ g/l) and from well MW04 in the aromatic range C12-C16 (20 μ g/l).

During the current Quarter 3 2016 monitoring event, TPH was detected in samples from the well BH103 in the aliphatic ranges C16-C35 (35 μ g/l), C35-C44 (10 μ g/l) and in the aromatic range C21-C35 (11 μ g/l), well BH104B in the aromatic ranges C12-C16 (25 μ g/l) and C16-C21 (12 μ g/l) and from well MW04 in the aromatic range C12-C16 (23 μ g/l).

7 CONCLUSIONS

- In accordance with the criteria set out in Schedule 4(ii) of the site's Industrial Emissions Licence Register No. W0184-01, groundwater monitoring was carried out at the ENVA Ireland site on the 31st August 2016 corresponding to Quarter 3 of 2016. Samples were collected at 8 groundwater monitoring wells during this event.
- The results presented have been referenced against Groundwater Threshold Values (GTVs) outlined in the European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. no 9 of 2010), where available. Where GTVs are not available for parameters, results are compared against the Interim Guideline Values (IGVs) set out in the Environmental Protection Agency interim report, 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland'.
- Results of the BTEX and MTBE demonstrate that the levels of Benzene, Toluene, Ethylbenzene, m&p Xylene, o-xylene and MTBE were all below the recommended EPA IGVs.
- The Quarter 3 2016 results of the speciated polycyclic aromatic hydrocarbons indicate that Total PAHs were above the EPA IGV of 0.1 μg/l at four out of eight monitoring wells, BH103 (0.181 μg/l), BH104B (0.158 μg/l), MW103 (0.562 μg/l) and MW104 (0.151 μg/l).
- Vinyl Chloride was detected above the GTV of 0.375 μg/l at MW04 (0.6 μg/l). Chloroethane in MW04 (8.4 μg/l) and Chloromethane in BH104B (1.5 μg/l) were also detected. These results are above the laboratory limit of detection, however, there is no GTV or IGV limit for these parameters. All other VOCs and SVOCs were below their respective laboratory limits of detection.
- Samples were analysed for speciated phenols to include chlorophenols and the results indicate that there were no detections above the laboratory limits of detection.
- For the current Quarter 3 2016 monitoring event, TPH detections in samples from the well BH103 were in the aliphatic range C16-C35 (35 μ g/l) and C35-C44 (10 μ g/l) and in the aromatic range C21-C35 (11 μ g/l), at BH104B were in the Aromatic range C12-C16 (25 μ g/l) and C16-C21 (12 μ g/l) and at well MW04 were in the aromatic range C12-C16 (23 μ g/l). Each of these is therefore over the limit of detection which is 10 μ g/l. During the previous Quarter 2 monitoring event, TPH detections in samples from the well BH103 were in the aliphatic range C16-C35 (150 μ g/l) and in the aromatic range C21-C35 (57 μ g/l), and from well MW04 in the aromatic range C12-C16 (20 μ g/l). Hydrocarbons in the aliphatic range C16-C35 (132 μ g/l) at BH103 and the aromatic range C12-C16 (15 μg/l) at MW04 were observed during the Quarter 1 2016 monitoring event. Concentrations in the aliphatic ranges C10-C12 (495 μ g/l), C12-C16 (3080 μ g/l) and C16-C35 (3360 μ g/l) as well as in the aromatic ranges C12-C16 (879 μ g/l), C16-C21 (1380 μ g/l) and C21-C35 (694 μ g/l) were detected at BH104B during the Quarter 4 2015 monitoring event. Also in Quarter 4 2015, TPH concentrations were recorded in the aliphatic ranges C16-C35 (231 μ g/l) and C35-C44 (14 µg/l) at BH103 and aromatic ranges C21-C35 (60 µg/l) at BH103 and C10-C12 (13 μ g/l) and C12-C16 (21 μ g/l) at MW04. During Quarter 3 2015, TPH concentrations were also recorded in the aromatic ranges at BH103, BH104B and MW04, as well as in the aliphatic ranges at BH103, BH104B and MW03. Hydrocarbons were detected at BH104B in the aliphatic range and BH103 in both the aromatic and aliphatic ranges during the Quarter 2 2015 monitoring event.
- The general trend of contaminant concentrations over time continues to be somewhat variable with compounds not being continually detected in the same borehole on two or three consecutive monitoring rounds. In general, the contaminant levels detected at the Enva facility appear to indicate reducing contaminant concentrations over time with infrequent elevations in some parameters. Further monitoring is recommended to confirm these reductions.



Enva Portlaoise

2016 Groundwater Compliance Monitoring Quarter 4 (Oct – Dec 2016)

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TABLE OF CONTENTS

1		INTRODUCTION1	L
	1.1	BACKGROUND	L
	1.2	OBJECTIVES & SCOPE OF WORK	L
2		REVIEW OF PREVIOUS DATA2	2
	2.1	INFORMATION SOURCES	2
	2.2	SITE SETTING	2
	2.3	REGIONAL SETTING	1
		2.3.1 Geology	1
		2.3.2 Hydrogeology	1
	2.4	SITE GROUND CONDITIONS	1
		2.4.1 Licence Conditions	5
3		METHODOLOGY6	5
	3.1	LABORATORY ANALYSIS6	5
	3.2	PRESENTATION & INTERPRETATION OF RESULTS8	3
4		QUARTER 4 RESULTS DECEMBER 20169)
5		DISCUSSION OF QUARTER 4 RESULTS)
5	5.1	DISCUSSION OF QUARTER 4 RESULTS	
5)
5		FIELD PARAMETERS)
5	5.2 5.3	FIELD PARAMETERS)) L
5	5.2 5.3 5.4	FIELD PARAMETERS)) L
5	5.2 5.3 5.4 5.5	FIELD PARAMETERS 20 RESULTS OF BTEX & MTBE 20 RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS) 21 RESULTS OF SPECIATED PHENOLS 21)) L 2
5	 5.2 5.3 5.4 5.5 5.6 	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS22	
5	 5.2 5.3 5.4 5.5 5.6 	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS22RESULTS OF VOLATILE ORGANIC COMPOUNDS22	
	5.2 5.3 5.4 5.5 5.6 5.7	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS22RESULTS OF VOLATILE ORGANIC COMPOUNDS22RESULTS OF TOTAL PETROLEUM HYDROCARBONS22	
	5.2 5.3 5.4 5.5 5.6 5.7 6.1	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS22RESULTS OF VOLATILE ORGANIC COMPOUNDS22RESULTS OF TOTAL PETROLEUM HYDROCARBONS22HISTORICAL RESULTS & TRENDS25	
	5.2 5.3 5.4 5.5 5.6 5.7 6.1	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS22RESULTS OF VOLATILE ORGANIC COMPOUNDS22RESULTS OF VOLATILE ORGANIC COMPOUNDS22RESULTS OF TOTAL PETROLEUM HYDROCARBONS22HISTORICAL RESULTS & TRENDS25GROUNDWATER LEVELS OVER TIME25	
	5.2 5.3 5.4 5.5 5.6 5.7 6.1	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS22RESULTS OF VOLATILE ORGANIC COMPOUNDS22RESULTS OF TOTAL PETROLEUM HYDROCARBONS22HISTORICAL RESULTS & TRENDS25GROUNDWATER LEVELS OVER TIME30	
	5.2 5.3 5.4 5.5 5.6 5.7 6.1	FIELD PARAMETERS20RESULTS OF BTEX & MTBE20RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)21RESULTS OF SPECIATED PHENOLS21RESULTS OF SPECIATED PHENOLS21RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS22RESULTS OF VOLATILE ORGANIC COMPOUNDS22RESULTS OF VOLATILE ORGANIC COMPOUNDS22RESULTS OF TOTAL PETROLEUM HYDROCARBONS22RESULTS OF TOTAL PETROLEUM HYDROCARBONS25GROUNDWATER LEVELS OVER TIME25GROUNDWATER CONCENTRATIONS OVER TIME306.2.1 Phenols30)))))))

LIST OF FIGURES

Figure 2.1 – Site Location	3
Figure 3.1 – Site Layout Plan with Groundwater Monitoring Locations	7
Figure 6.1 – Ground Elevation (mAOD) in all Monitoring Wells	26
Figure 6.2 – Ground Elevation (mAOD) in Shallow Groundwater Monitoring Wells	27
Figure 6.3 – Ground Elevation (mAOD) in Deep Groundwater Monitoring Wells	28
Figure 6.4 – Phenol Concentrations in all Monitoring Wells	31
Figure 6.5 – PAH (Total) Concentrations in all Monitoring Wells	35
Figure 6.6 – Fluoroanthene Concentrations in all Monitoring Wells	36
Figure 6.7 – Naphthalene Concentrations in all Monitoring Wells	37
Figure 6.8 – Benzo (g,h,i) perylene Concentrations	38
Figure 6.9 – Benzo (g,h,i) perylene in Monitoring Wells BH104B & MW03	39
Figure 6.10 – Benzo (a) pyrene Concentrations in all Monitoring Wells	40
Figure 6.11 – TPH (Carbon Range C10-C44) in all Monitoring Wells	42

LIST OF TABLES

1 INTRODUCTION

1.1 BACKGROUND

RPS has been commissioned by Enva Ireland Ltd (Enva) to carry out groundwater quality monitoring for environmental compliance, at their facility in the Clonminam Industrial Estate, Portlaoise, Co Laois. Groundwater monitoring has being carried out in strict accordance with criteria set out in Schedule 4(ii) of the site's Industrial Emissions Licence, Register No. W0184-01.

Enva Ireland has been operating under Waste Licence Register No. W0184-01 since January 2004. The licence was amended by the Environmental Protection Agency in December 2013 to conform to the provisions and requirements of the Council Directive 2010/75/EU (Industrial Emissions Directive) and as such is deemed an Industrial Emissions Licence. Enva is required to submit a report to the EPA on a quarterly basis, outlining the existing groundwater quality underlying the site.

A suitably qualified environmental consultant from RPS, collected groundwater samples from a series of 8 monitoring wells (BH101, BH102, BH103, BH104B, MW01, MW02, MW03, MW04) within the site boundary on the 6th of December 2016. The samples underwent laboratory analysis for the suite of parameters specified in Schedule 4(ii) of Industrial Emissions Licence W0184-01. This report outlines the results of the Quarter 4 monitoring for 2016 and reviews historical data recorded at the site.

1.2 OBJECTIVES & SCOPE OF WORK

The specific objectives and scope of work are as follows:

- Review of previous data as provided by Enva Portlaoise;
- Graphical presentation of key compounds and trends; and
- Discussion of results for Quarter 4 2016 within the context of previous results and available guideline concentrations.

2 REVIEW OF PREVIOUS DATA

2.1 INFORMATION SOURCES

The following documents were reviewed as part of this project:

- Industrial Emissions Licence W0184-01 and any available EPA documents from the EPA website;
- Quarterly Groundwater Monitoring Reports (Quarter 1 2004 to Quarter 4 2005), URS;
- Quarterly Groundwater Monitoring Reports (Quarter 1 2006 to Quarter 4 2015), RPS;
- Summary Report on Trend of Contaminant Levels at Enva Ireland Ltd since 2005, Ref: MDE0647RP0001, RPS (2007);
- Groundwater Risk Assessment, Ref: MDE0788Rp0001, RPS (2008);
- Hydrogeological Review and Assessment Report, Ref MDE0973Rp0017F01, RPS (2014);
- Baseline Environment Report, Ref: MDE0973Rp0104;
- Quarter 1 Groundwater Monitoring Report, RPS (2016);
- Quarter 2 Groundwater Monitoring Report, RPS (2016); and
- Quarter 3 Groundwater Monitoring Report, RPS (2016).

2.2 SITE SETTING

The site is located to the southwest of the town of Portlaoise immediately to the south of the Dublin to Cork railway line. The general area is gently undulating. The site slopes gently to the southwest but to the east of the site the ground slopes gently towards the River Triogue, which is located approximately 1.5 km to the east. The site occupies an area of approximately 1.5 hectares and comprises of an operational waste oil and contaminated soil treatment plant.

The site is located on the outskirts of Portlaoise in an area of agricultural and light industrial development. The site is bounded to the north and east by land belonging to Irish rail, comprising sidings and general storage areas. To the south is a vehicle repair garage, which is elevated above the level of the site by approximately 1.5 m. To the west the site is adjoined by further industrial land, as well as residential land. The site location is presented on **Figure 2.1**.

The site has been in operation since 1978, and the layout has remained relatively consistent. The site layout is presented on **Figure 3.1**. The site is largely covered in hardstanding with some open areas in the far north and northeast of the site. All oil and soil storage areas are suitably bunded and the general standard of housekeeping is good.

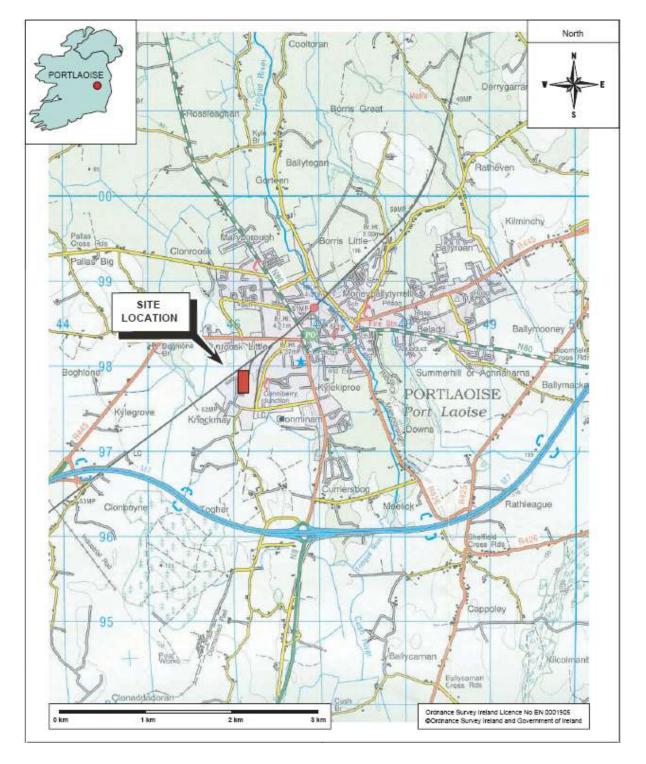


Figure 2.1 – Site Location



2.3 REGIONAL SETTING

2.3.1 Geology

The Geological Survey of Ireland indicates that the regional geology of Portlaoise is typified by Carboniferous Limestone. In the vicinity of the site itself the solid geology comprises the Ballysteen Formation, a micaceous-bioclastic limestone. This well-bedded limestone, with interbeds of shale, is extensively folded, with axes trending north-east to south-west, and becomes increasingly muddy towards the top of the formation. North-east to south-west trending faults are found in the region, with one located approximately 500m to the east of the site. The subsoils in the region comprise mainly Made Ground, around the industrial area, and Limestone Till in the surrounding regions.

2.3.2 Hydrogeology

The limestone is classified by the Geological Survey of Ireland (GSI) as a Locally Important Karstified Aquifer (LI). Porosity is predominantly in the form of fractures, in this aquifer, however the muddy nature of this formation greatly reduces permeability. Vulnerability of this aquifer beneath the site is classified as high, with moderate vulnerability to the east of the site.

The public water supply for Portlaoise is derived from groundwater, utilising three groundwater abstraction well fields comprising of two abstraction wells in each well field. This supply currently comes from the Straboe area, approximately 5.5 km to the north-east of the site. The source protection zone for this water supply extends to within 3.2 km of the Enva site but does not encompass the Enva site.

The GSI record a number of other dug wells and boreholes within the Portlaoise area, including the boreholes installed on the site. The accuracy of the locations of these wells varies. One well, which was drilled in 1899 is recorded as being located immediately to the south of the Enva site. The use of this well is not known and its location is only accurate to 1 km. A second borehole, drilled in 1973 is recorded 1.5 km to the north of the site at Clonroosk; the accuracy of this location is also 1 km so it could be closer or further from the site. The use of this well is not known but its yield is recorded as being poor. There are no other wells recorded within 1 km of the site.

Enva is not aware of any abstraction boreholes within the immediate vicinity of their site.

2.4 SITE GROUND CONDITIONS

A total of eight boreholes have been drilled at the site and the general sequence of ground conditions is presented in **Table 2.1**.

Table 2.1 – Ground Conditions

Strata	Extent	Thickness	Description
Made Ground	BH104	0-3.5 m	Predominantly concrete, with hardcore fill, and clay.
Boulder Clay	All boreholes	<8.5 m	Includes fine to medium, well rounded gravels.
Sand and Gravel	Confined to south east corner of site (BH101, BH104 and MW03)	0-2 m	In general the transition from boulder clay to sand is gradual with changes from gravel, to sandy gravel, to sand.
Limestone Bedrock	Encountered in MW01, MW02 and MW03	Top of limestone ranges from 7.7m to 9m below ground level.	Pale grey, fine-grained bedrock, differentiated from boulders by its un-weathered nature.

The logs for each of the boreholes were previously presented as Appendix B in the RPS Groundwater Risk Assessment Report (Ref: MDE0788Rp0001).

2.4.1 Licence Conditions

The Industrial Emissions Licence requires the regular monitoring and sampling of boreholes BH101, BH102, BH103, BH104B, MW01, MW02, MW03 and MW04. The parameters requiring measurement or analysis are presented in **Table 2.2**.

Table 2.2 – Licence Parameters

Group	Parameters requiring Quarterly Measurement	Parameters requiring Annual Measurement			
	Groundwater Level	Groundwater Level			
	рН	рН			
Field Parameters	Temperature	Temperature			
	Dissolved Oxygen	Dissolved Oxygen			
	Electrical Conductivity	Electrical Conductivity			
	Visual Inspection	Visual Inspection			
	Mineral Oil	Mineral Oil			
	BTEX & MTBE	BTEX & MTBE			
Organics	PAHs	PAHs			
Organics	Phenols	Phenols			
	VOCs	VOCs			
	SVOCs	SVOCs			
Inorganics	-	Total Alkalinity, Calcium, Manganese, Sulphate, Cyanide (Total), Chloride, Sodium,			

3 METHODOLOGY

Groundwater samples were collected from 8 no. on-site groundwater monitoring wells (BH101, BH102, BH103, BH104B, MW01, MW02, MW03, MW04) (Figure 3.1) using dedicated Waterra tubing, in accordance with RPS's standard sampling protocol. A non-return foot valve was fixed to the bottom of the tubing and inserted into the well, close to the base of the borehole. Separate tubing and foot valves were used at each monitoring well to eliminate the possibility of cross contamination.

Groundwater in the well casing is not considered representative of the groundwater quality at a given location. For this reason, three well volumes were purged from each well prior to collection of the groundwater sample. By the time purging was complete all field test water parameters (namely pH, Temperature, Electrical Conductivity and Dissolved Oxygen) were within 10% variance in three consecutive measurements. This ensured that the groundwater sample extracted from the monitoring borehole was representative of the water held in the subsurface strata and not water held stagnant in the borehole casing. The purged volumes were calculated on-site from the measured static water levels and total well depths using an electronic dip meter.

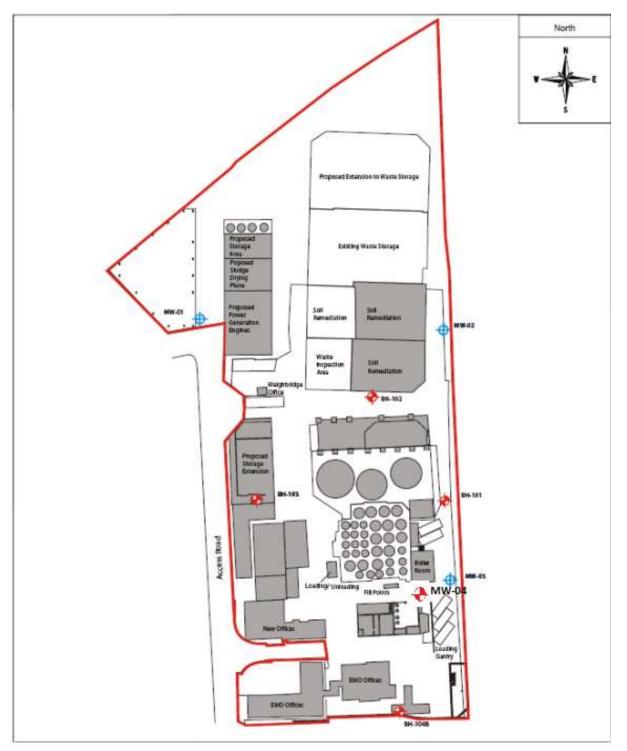
Groundwater samples were collected in laboratory supplied containers and stored in chilled cool boxes following sampling and during transit to the laboratory. A rigorous chain of custody procedure was used during the sample round.

3.1 LABORATORY ANALYSIS

All groundwater samples were analysed at a UKAS accredited laboratory, ALS Environmental for the suite of analyses listed in **Table 3.1**. **Table 3.1** also indicates the analytical techniques used by the laboratory.

Table 3.1 – Analytical Methodologies – ALS Environmental

Parameter	Analytical Methodology
Phenols	GC-MS
Speciated PAHs	GC-MS
BTEX & MTBE	Headspace GC-MS
Petroleum Hydrocarbons	Headspace GC-MS
Volatile Organic compounds & Tentatively Identified Organic Compounds (VOCs & TICs)	Headspace GC-MS
Semi-Volatile Organic compounds & Tentatively Identified Organic Compounds (SVOCs & TICs)	GC-MS





Shallow Monitoring Well locations Deep Monitoring Well locations

Source: URS Environmental Consultants (Ref: 45078497 Issue No. 1)

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3.2 PRESENTATION & INTERPRETATION OF RESULTS

The Quarter 4 2016 results are tabulated in **Section 4** and discussed with respect to previous results in **Section 5**. Results are compared against Groundwater Threshold Values (GTVs) outlined in the European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. No 9 of 2010), where available. Where GTVs are not available for parameters, results are compared against the Interim Guideline Values (IGVs) set out in the Environmental Protection Agency interim report, 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland'.

Previous monitoring reports (as listed in **Section 2.1**) provide details of contaminant concentrations since 2004. The data available within these reports has been reviewed and time series plots of key parameters have been compiled. Trends for chlorinated solvents, petroleum hydrocarbons and phenol parameters have been plotted.

Time series plots are presented in **Section 6** and include the results of this Quarter 4 2016 monitoring round. As the monitoring continues in accordance with the Industrial Emissions licence requirements, the plots will be updated with the results of subsequent rounds used to illustrate the results.

Time series plots are also provided for manual water levels where available from previous reports.

4 QUARTER 4 RESULTS DECEMBER 2016

The results of all field measurements and laboratory analysis are presented in this section. Results are primarily compared against Groundwater Threshold Values (GTVs) outlined in the European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. No 9 of 2010), where available. Where GTVs are not available for parameters, results are compared against the Interim Guideline Values (IGVs) set out in the Environmental Protection Agency interim report, 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland'.

The results are discussed in relation to appropriate guideline values in **Section 5**. Results that are shown to be above the relevant threshold or guideline values are highlighted in bold and shaded. Results that are shown to be above the relevant laboratory detection limits are highlighted in italics.

Site-specific field parameter measurements were collected during the site visit as per RPS Water sampling protocol.

Groundwater samples from the 8 monitoring wells (BH101, BH102, BH103, BH104B, MW01, MW02, MW03, MW04) were collected within the site boundary on the 6th of December 2016 following the methodology outlined in Section 3. The samples were sent to ALS Environmental for laboratory analysis. ALS noted on receipt of analysis that the SVOC bottle for BH101 and LL phenol bottle for MW03 were empty on arrival. As such, the SVOC analysis for BH101 and phenol analysis for MW03 was unable to be carried out.

An additional sample for these two locations was undertaken on the 19th of December, following the methodology outlined in Section 3. The samples were submitted to the lab for SVOC analysis for BH101 and phenol analysis for MW03.

Table 4.1 – Groundwater Leve	Is (Quarter 4, 2016)
------------------------------	----------------------

Monitoring Well	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	
Depth (mbgl)	6.74	6.44	4.41	4.41 4.51		30.87	14.76	6.49	
Static Water Level (mbgl)	4.45	3.52	1.95	1.14	2.46	2.46 3.74		4.12	
Ground Level (mAOD)	103.06	102.55	101.16	101.52	102.10	103.12	102.77	-	
Water Level (mAOD)	98.61	99.03	99.21	100.38	99.64	99.38	98.53	-	
Free Phase Oil (mm)	No detection								

mbgl = metres below ground level

Monitoring Well	рН (рН Units)	Temperature (°C)	Conductivity (μS/cm)	Dissolved O ₂ (ppm)	Observations
BH101	7.47	9.8	1076	4.92	Light grey cloudy colour, some sediment
BH102	7.51	9.5	749	4.31	Clear on purging, some suspended solids
BH103	7.23	8.1	821	3.93	Grey in colour and very little sediment
BH104B	8.11	10.0	675	4.67	Dark grey colour on purging, some suspended solids and slight oil sheen
MW01	7.57	9.3	712	5.15	Clear/slight grey colour
MW02	7.92	8.6	769	3.86	Clear with very little suspended solids or sediment
MW03	7.50	9.7	1411	4.83	Grey colour on purging, very little suspended solids
MW04	6.96	8.8	1323	3.52	Cloudy brown colour, little sediment and suspended solids
Groundwater Threshold Value	-	-	1875	-	-
Interim EPA Guideline Values (Units as indicated)	>6.5 & <9.5	25°C	1000	No abnormal change	-

Table 4.2 – Results of Field Parameters Measured at each Groundwater Monitoring Well (Quarter 4, 2016)

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the GTV are highlighted in bold and shaded.

Table 4.3 – Results of BTEX and MTBE

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Benzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.75	1.0
Toluene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
Ethylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
m & p-xylene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10 ^{Note 1}
o-xylene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10 ^{Note 1}
MTBE (Methyl Tertiary Butyl Ether)	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	1.2	-	30

Note: No specific IGV for parameter. IGV for Total Xylenes is used as guideline.

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

Table 4.4 – Results of Speciated PAHs

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Naphthalene	μg/l	0.01	<0.01	<0.01	<0.05	<0.01	<0.01	<0.01	0.036	<0.17	-	1.0
Acenaphthylene	µg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.013	<0.01	-	-
Acenaphthene	µg/l	0.01	<0.01	<0.01	0.027	<0.01	<0.01	<0.01	0.097	<0.01	-	-
Fluorene	μg/l	0.01	<0.01	0.011	<0.01	0.014	<0.01	<0.01	0.161	0.015	-	-
Phenanthrene	μg/l	0.01	<0.01	0.039	<0.01	<0.01	<0.01	<0.01	0.019	<0.01	-	-
Anthracene	μg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.013	<0.01	-	10,000
Fluoranthene	µg/l	0.01	<0.01	0.026	<0.01	<0.01	0.01	<0.01	0.019	<0.01	-	1.0
Pyrene	µg/l	0.01	<0.01	0.027	<0.01	0.022	0.014	<0.01	0.097	<0.01	-	-
Benzo(a)anthracene	μg/l	0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.027	<0.01	-	-
Chrysene	μg/l	0.01	<0.01	0.012	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	-	-
Benzo(b)fluoranthene	μg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.018	<0.01	-	0.5

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Benzo(k)fluoranthene	μg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	0.05
Benzo(a)pyrene	μg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.032	<0.01	-	0.01
Indeno(1,2,3-cd)pyrene	μg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	0.05
Dibenz(a,h)anthracene	μg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Benzo(g,h,i)perylene	μg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.036	<0.01	-	0.05
Total EPA-16 PAHs	μg/l	0.1	<0.01	0.124	0.027	0.037	0.024	<0.01	0.596	0.015	0.075	0.1

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the GTV are highlighted in bold and shaded.

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

Table 4.5 – Results of Speciated Phenols

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Phenol	μg/l	5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	-	0.5
2,4,6-Trichlorophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	200
2,4-Dichlorophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2,4-Dimethylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Chlorophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	200
2-Methylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Nitrophenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
4-Chloro-3-methylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
3+4-Methylphenol	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

Table 4.6 – Results of Semi-Volatile Organic Compounds (SVOCs)

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Phenol	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.5
2-Chlorophenol	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	200
Bis(2-chloroethyl)ether	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,3-Dichlorobenzene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2-Dichlorobenzene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
1,4-Dichlorobenzene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bis (2-chloroisopropyl) ether	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Methylphenol	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Hexachloroethane	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Nitrobenzene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
3&4-Methylphenol	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Isophorone	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Nitrophenol	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2,4-Dimethylphenol	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bis(2-chloroethoxy)methane	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2,4-trichlorobenzene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.40
Naphthalene	µg/l	2.0	<400	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	1.0
2,4-Dichlorophenol	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Hexachlorobutadiene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.10
4-Chloro-3-methylphenol	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2,4,6-Trichlorophenol	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	200
2,4,5-Trichlorophenol	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Methylnaphthalene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Chloronaphthalene	µg/I	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Dimethylphthalate	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
2,6-Dinitrotoluene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Acenaphthylene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Acenaphthene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2,4-Dinitrotoluene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Dibenzofuran	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
4-Chlorophenyl phenyl ether	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Diethylphthalate	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Fluorene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
4-Bromophenyl phenyl ether	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Hexachlorobenzene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.03
Phenanthrene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Anthracene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10,000
Pyrene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzyl Butyl Phthalate	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzo(a)anthracene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Chrysene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzo(b)fluoranthene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.5
Benzo(k)fluoranthene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.05
Benzo(a)pyrene	µg/l	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.01
Indeno(1,2,3-c,d)pyrene	µg/I	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.05
Dibenz(a,h)anthracene	µg/I	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzo(g,h,i)perylene	µg/I	1.0	<200	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bis(2-ethylhexyl)phthalate	µg/I	5.0	<1000	7.6	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	-	-

Note: Results above the relevant IGV are highlighted in bold. Note: Results above the GTV are highlighted in bold and shaded.

Table 4.7 – Results of Volatile Organic Compounds (VOCs)

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Chloromethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Chloroethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1	3.9	-	-
Bromomethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	-	-
Vinyl Chloride	μg/l	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.375	-
Trichlorofluoromethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,1-dichloroethene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	30
1,1-dichloroethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.6	1.9	-	-
Cis-1,2-dichloroethene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
MTBE (Methyl Tertiary Butyl Ether)	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	1.2	-	30
2,2-Dichloropropane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,1,1-Trichloroethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	500
1,2-dichloroethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.25	-
1,1-Dichloropropene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Trans-1,2-dichloroethene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Benzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	1.0
1,2-dichloropropane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Trichloroethene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	70
Dibromomethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bromodichloromethane	μg/l	1.0	-	-	-	-	-	-	-	-	-	-
Cis-1,3-dichloropropene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Trans-1,3-dichloropropene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Toluene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
1,1,2-Trichloroethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,3-Dichloropropane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Dibromochloromethane	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Tetrachloroethene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	40
1,2-Dibromoethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Chlorobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	1.0
1,1,1,2-Tetrachloroethane	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Ethylbenzene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
m&p-Xylene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
Styrene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
o-xylene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
Isopropylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Bromobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
N-Propylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
2-Chlorotoluene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
4-Chlorotoluene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,3,5-Trimethylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Tert-Butylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2,4-Trimethylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
Sec-Butylbenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,3-dichlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
P-Isopropyltoluene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2-dichlorobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	10
1,4-dichlorobenzene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
n-Butylbenzene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-
1,2-Dibromo-3-chloropropane	µg/I	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	-
1,2,4-Trichlorobenzene	µg/I	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.40
Hexachlorobutadiene	μg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	0.10

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
1,2,3-Trichlorobenzene	µg/l	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	-

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the GTV are highlighted in bold and shaded.

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

Table 4.8 – Results of Total Petroleum Hydrocarbons (Aliphatic/Aromatic)

Parameter	Units	Laboratory Limit of Detection	BH101	BH102	BH103	BH104B	MW01	MW02	MW03	MW04	GTV	IGV
Aliphatic > C10-C12	μg/l	10	<10	<10	<10	<10	<10	<10	<10	<10	-	-
Aliphatic > C12-C16	μg/l	10	<10	<10	<10	<10	<10	<10	<10	<10	-	-
Aliphatic > C16-C35	µg/l	10	<10	13	160	<10	<10	<10	14	<10	-	-
Aliphatic > C35-C44	µg/l	10	<10	<10	14	<10	<10	<10	<10	<10	-	-
Aliphatic > C10-C44	µg/l	10	<10	13	174	<10	<10	<10	14	<10	-	10
Aromatic > C10-C12	µg/l	10	<10	<10	<10	<10	<10	<10	<10	13	-	-
Aromatic > C12-C16	µg/l	10	<10	<10	<10	12	<10	<10	<10	23	-	-
Aromatic > C16-C21	µg/l	10	<10	<10	<10	<10	<10	<10	<10	<10	-	-
Aromatic > C21-C35	µg/l	10	<10	<10	47	<10	<10	<10	<10	<10	-	-
Aromatic > C35-C44	μg/l	10	<10	<10	<10	<10	<10	<10	<10	<10	-	-
Aromatic > C10-C44	µg/l	10	<10	<10	47	12	<10	<10	<10	35	-	10

Note: Results above the relevant IGV are highlighted in bold.

Note: Results above the relevant laboratory limit of detection are highlighted in bold italics.

5 DISCUSSION OF QUARTER 4 RESULTS

The results of the Quarter 4 monitoring event for 2016 are presented in **Table 4.1** to **4.9** of this report. For the purpose of this report, the results are compared against the Groundwater Threshold Values (GTVs) outlined in the European Communities Environmental Objectives (Groundwater) Regulations (S.I. No. 9 of 2010) where available. Where GTVs are not available results are compared against the EPA Interim Guideline Values (IGV) as set out in the Interim Report *'Towards Setting Guideline Values for the Protection of Groundwater in Ireland' 2004.* A discussion of the results and their significance is included below.

5.1 FIELD PARAMETERS

The results of the field parameters measured at each groundwater monitoring well are presented in Table 4.2. Groundwater samples recorded pH levels ranging between 6.96 and 8.11, all within the EPA Interim guideline range of \geq 6.5 to \leq 9.5. Temperature measurements ranged from 8.1°C to 10.0°C and were below the EPA IGV of 25°C.

Field measurements of Electrical Conductivity levels ranged between 675 μ S/cm and 1411 μ S/cm. Three measurements of Electrical Conductivity were above the IGV of 1000 μ S/cm at BH101 (1085 μ S/cm), MW03 (1594 μ S/cm) and MW04 (1419 μ S/cm), but all however were below the GTV limit of 1875 μ S/cm.

Dissolved oxygen levels ranged between 3.52 and 5.15 ppm. Factors such as climate, nutrients in the water, suspended solids; organic wastes and groundwater inflow can all influence the dissolved oxygen values.

Observations relating to colour and odour varied from well to well as detailed in Table 4.2.

5.2 RESULTS OF BTEX & MTBE

The results of the **BTEX** and **MTBE** analysis are presented in **Table 4.3**. BTEX concentrations are below the associated GTVs and IGVs at all locations. All BTEX concentrations are also all below the laboratory of limit of detection at all locations. MTBE was detected at MW03 (1.5 μ g/l) and MW04 (1.2 μ g/l), however these concentrations below the IGV of 30 μ g/l. MTBE was below the laboratory limit of detection and IGV at all other locations.

The previous detection of MTBE was in the Quarter 3 monitoring event of 2016 and recorded concentrations above the laboratory limit of detection at (1.2 μ g/l). MTBE was also above the laboratory limit of detection at BH103 (1.2 μ g/l), MW03 (1.8 μ g/l) and MW04 (1.7 μ g/) during Quarter 2 2016. These detections are still below the IGV limit however. Prior to this there was a detection of MTBE at BH104B in the Quarter 1 monitoring event of 2012 with a recorded concentration of 280 μ g/l which is above the laboratory limit of detection. This was the only recorded exceedance in Quarter 1 2012.

Monitoring during Quarter 1 and Quarter 2 of 2010 detected exceedances of MTBE at BH103 at a concentration of 16 μ g/l. Subsequent monitoring in 2010 recorded concentrations below the



laboratory limit of detection. Prior to these 2010 monitoring events, concentrations of MTBE at BH103 were recorded at $63 \mu g/l$ in December 2009.

5.3 **RESULTS OF SPECIATED POLYAROMATIC HYDROCARBONS (PAHS)**

The results of the Speciated PAH analysis during this monitoring period are presented in **Table 4.4**.

The laboratory limit of detection for Total EPA-16 PAHs is 0.1 μ g/l and has been lowered for comparison with the EPA IGV of 0.1 μ g/l; however this is not accredited. This laboratory limit of detection is above the EPA GTV of 0.075 μ g/l. To identify the compounds, which attributed to these concentrations, speciated PAH analysis was carried out, which reduces the limit of detection for individual parameters to 0.01 μ g/l.

Total Polyaromatic Hydrocarbons were above the IGV limit of 0.1 μ g/l at BH102 (0.124 μ g/l) and MW103 (0.596 μ g/l). Total PAHs were below the IGV of 0.1 μ g/l and the GTV of 0.075 μ g/l at all other locations.

Total PAHs were previously detected above the IGV at BH103 (0.181 μ g/l), BH104B (0.158 μ g/l), MW104 (0.562 μ g/l) and MW104 (0.151 μ g/l) during the Quarter 3 2016 monitoring event and were also above the IGV at BH103 (0.111 μ g/l) during the Quarter 2 2016 monitoring event.

The results of the speciated polycyclic aromatic hydrocarbon analysis detected a number of different compounds in BH101, BH102, BH103, BH104B, MW01, MW03 and MW04 above the laboratory limit of detection. However, with the exception of Benzo (a) pyrene at MW103 (0.032 μ g/l), none of these compounds were above their respective IGV limits at any location.

5.4 **RESULTS OF SPECIATED PHENOLS**

During previous quarterly monitoring events and sample analysis, total monohydric phenol was determined and historically has been below the laboratory limit of detection of 10 μ g/l since December 2008. It should be noted that the laboratory limit of detection was however above the IGV of 0.5 μ g/l for phenols.

For this reason, samples were analysed for phenols to include chlorophenols. The results of the speciated phenols analysis are presented in **Table 4.5**. The speciated phenol analysis reduces the laboratory limit of detection to $1.0 \mu g/l$ for individual parameters.

The results of the current Quarter 4 2016 speciated phenol analysis confirm concentrations of phenols were below the laboratory limit of detection of $1.0 \mu g/l$ at all locations.

4-Chloro-3-methylphenol was detected at BH104B (1.37 μ g/l) above the laboratory limit of detection during the Quarter 1 2015 analysis. With the exception of this, all other results are consistent with results since the 2012 quarterly monitoring events.

5.5 RESULTS OF SEMI-VOLATILE ORGANIC COMPOUNDS

The results of the Semi-Volatile Organic Compound analysis are presented in Table 4.6.

There are no GTVs for individual SVOC parameters. No SVOCs were detected above the relevant IGVs during this monitoring period, consistent with the results from the 2015 and 2014 monitoring periods. It should be noted that the laboratory limit of detection was however above the IGVs for some SVOCs, for example the result for 1,2,4-Trichlorobenzene was <1.0 μ g/l but the IGV for this parameter is 0.40 μ g/l, but testing at this limit is not accredited.

The Quarter 3 2013 monitoring event detected two SVOC compounds, Acenaphthene (1.1 μ g/l) and Fluorene (1.5 μ g/l) in MW03. Prior to this detection the Quarter 2 monitoring event of 2012 detected concentrations of Naphthalene and Acenaphthylene in MW03 at concentrations of 2.4 μ g/l and 0.12 μ /l respectively.

5.6 **RESULTS OF VOLATILE ORGANIC COMPOUNDS**

The results of the Volatile Organic Compound analysis are presented in **Table 4.7**. Chloroethane at MW04 (3.9 μ g/l) was detected above the limit of detection (1.0 μ g/l), however there is no GTV or IGV limit for Chloroethane. The results of the Quarter 3 monitoring event previously detected Chloroethane in MW04 (8.9 μ g/l).

at MW03 (1.6 μ g/l) and MW04 (1.9 μ g/l), and MTBE at MW03 (1.5 μ g/l) and MW04 (1.2 μ g/l) were also detected. However, the results are below the IGV for MTBE (30 μ g/l) and there is no GTV or IGV limit for 1,1-dichloroethane. All other compounds were below their respective laboratory limits of detection.

Historic groundwater monitoring events detected some parameters above the laboratory limit of detection in November 2009, corresponding to Quarter 4 of 2009. Historically 1,1-Dichloroethane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, MTBE, n-butylbenzene, n-propylbenzene, o-xylene, p-isopropyltoluene, sec-butylbenzene and tert-butylbenzene were detected above the laboratory limits of detection.

The results of the Quarter 3 and Quarter 4 monitoring events of 2009 and all subsequent monitoring events indicate that there were no exceedances of the GTVs or IGVs for specific parameters.

5.7 RESULTS OF TOTAL PETROLEUM HYDROCARBONS

In order to provide a more accurate profile of TPH within the groundwater, speciated hydrocarbon analysis using the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) method was carried out on samples taken at all boreholes. The results of the TPH analysis are presented in **Table 4.8**.

The EPA IGV of 10 μ g/l for Total Hydrocarbons is deemed comparable with the results for Total Petroleum Hydrocarbons. Some detections of TPH in both the aliphatic and aromatic range were observed during the current Quarter 4 2016 monitoring event. Detections were found in samples from the following wells; at BH102 detections in the aliphatic range C16-C35 (13 μ g/l), at BH103



detections were in the aliphatic range C16-C35 (160 μ g/l), C35-C44 (14 μ g/l) and in the aromatic range C21-C35 (47 μ g/l), at BH104B detections were in the aromatic range C12-C16 (12 μ g/l), at MW03 detections in the aliphatic range C16-C35 (14 μ g/l), and at well MW04 detections were in the aromatic ranges C10-C12 (13 μ g/l) and C12-C16 (23 μ g/l).

The previous Quarter 3 monitoring event detected TPH in the well BH103 in the aliphatic range C16-C35 (35 μ g/l), C35-C44 (10 μ g/l) and in the aromatic range C21-C35 (11 μ g/l), at BH104B detections were in the aromatic range C12-C16 (25 μ g/l), C16-C21 (12 μ g/l) and at well MW04 detections were in the aromatic range C12-C16 (23 μ g/l).

The Quarter 2 monitoring event of 2016 detected TPH in the well BH103 were in the aliphatic range C16-C35 (150 μ g/l) and in the aromatic range C21-C35 (57 μ g/l) and from well MW04 in the aromatic range C12-C16 (20 μ g/l).

The Quarter 1 monitoring event of 2016 detected TPH in the aliphatic range C16-C35 (132 μ g/l) at BH103 and in the aliphatic range C12-C16 (15 μ g/l) at MW04.

The Quarter 4 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 (879 μ g/l), C16-C21 (1380 μ g/l) and C21-C35 (694 μ g/l) at BH104B, C21-C35 at BH103 (60 μ g/l) and C10-C12 (13 μ g/l) and C12-C16 (21 μ g/l) at MW04. TPH concentrations were detected in the aliphatic ranges C10-C12 (495 μ g/l), C12-C16 (3080 μ g/l) and C16-C35 (3360 μ g/l) at BH104B and C16-C35 (231 μ g/l) and C35-C44 (14 μ g/l).

The Quarter 3 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 (39 μ g/l), C16-C21 (37 μ g/l) and C21-C35 (28 μ g/l) at BH104B, C21-C35 at BH103 (17 μ g/l) and C10-C12 (18 μ g/l) and C12-C16 (29 μ g/l) at MW04. TPH concentrations were detected in the aliphatic ranges C10-C12 (13 μ g/l), C12-C16 (40 μ g/l) and C16-C35 (62 μ g/l) at BH104B and C16-C35 at BH103 (72 μ g/l) and MW03 (14 μ g/l).

The Quarter 2 monitoring event of 2015 detected TPH in the aromatic range C21-C35 at BH03 (509 μ g/l). TPH concentrations were detected in the aliphatic ranges C16-C35 at BH103 (1760 μ g/l) and BH104B (337 μ g/l), and C12-C16 at BH104B (225 μ g/l).

The Quarter 1 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 at wells MW03 (14 μ g/l), MW04 (15 μ g/l) and BH104B (27 μ g/l), C16-C21 at BH104B (15 μ g/l), and C21-C35 (14 μ g/l) at BH103. TPH concentrations were detected in the aliphatic ranges C16-C35 and C35-C44 at MW03 (46 μ g/l and 12 μ g/l respectively), BH103 (54 μ g/l) and BH104B (11 μ g/l.

No detections of TPH in the aliphatic or aromatic range were observed in any shallow or deep monitoring well locations during the Quarter 4 monitoring event of 2014.

The Quarter 3 monitoring event of 2014 detected TPH concentrations in the aliphatic range at the shallow groundwater well BH104B. The TPH concentration detected was 410 μ g/l. The speciated TPH ranges that contributed to the value of 410 μ g/l were C12-C16 (150 μ g/l), C16-C21 (250 μ g/l) and C31-C35 (10 μ g/l).



The Quarter 3, 2013 monitoring event detected TPH in the aliphatic range in one deep groundwater well, MW03. TPH of the range C10-C12 and C12-C16 were detected at concentrations of 200 μ g/l and 190 μ g/l respectively.

The Quarter 1, 2013 monitoring event detected aliphatic TPH of the range C12-C16, C16-C21 and C21-C35. TPH in the mid to high aromatic ranges were detected in BH103, BH104B and MW04 during the previous Quarter 1 2013 monitoring event. Aromatic TPH of the ranges C12-C16, C16-C21 and C21-C35 were detected in BH103, the ranges C10-C12, C12-C16 and C16-C21 were detected in BH104B and aromatic TPH of the ranges C10-C12 and C12-C16 were detected in MW04.

The Quarter 2 monitoring event of 2012 detected elevated TPH of the aliphatic range C12-C16, C16-C21 and C21-C25 in BH103. Hydrocarbons have been detected in borehole MW03 during Quarter 1 2010, in borehole BH104B during the Quarter 2 2010 monitoring event and in borehole BH104B and MW03 during the Quarter 3 2010 monitoring events. Hydrocarbons have also been detected in BH103, BH104B and MW03 in the Quarter 2 2011 monitoring event and in MW03 in the Quarter 3 and Quarter 4 2011. These detections are discussed further in **Section 6.2.3**.

6 HISTORICAL RESULTS & TRENDS

Time series plots are presented in this section and include the results of the Quarter 4 2016 monitoring round. As the monitoring continues in accordance with the Industrial Emissions Licence requirements, the plots will be updated with the results of subsequent rounds and used to illustrate the results.

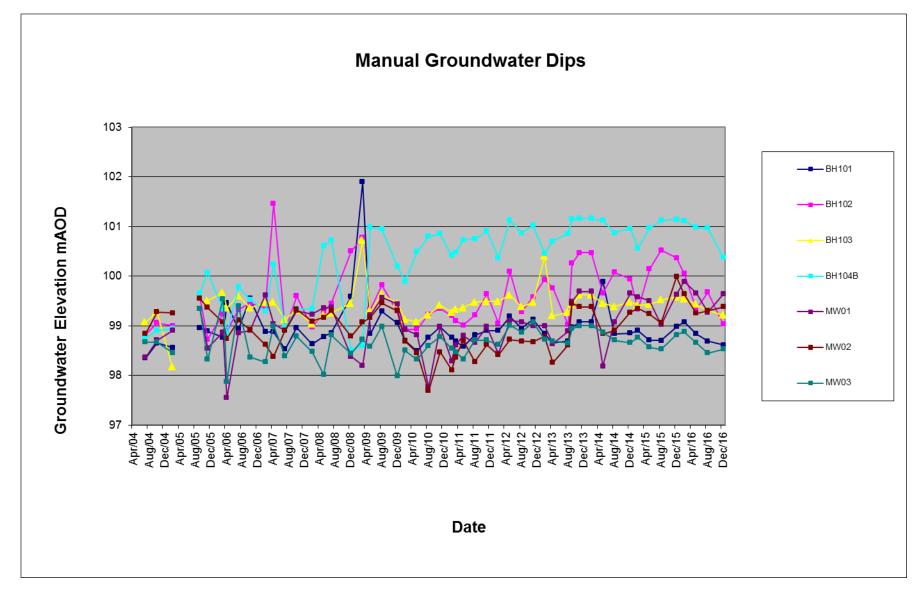
6.1 GROUNDWATER LEVELS OVER TIME

Figure 6.1 to **Figure 6.3** below illustrates the manually recorded water levels using an electronic probe. The graphs show that groundwater levels can vary considerably between monitoring rounds.

Figure 6.2 illustrates groundwater elevations (mAOD) in shallow groundwater wells (BH101 to BH104B) ranging between approximately 98 mAOD and 102 mAOD.

Figure 6.3 illustrates groundwater elevation (mAOD) in the deeper groundwater wells (MW01 to MW03). The groundwater elevation (mAOD) for these deeper groundwater wells ranges from approximately 97.5 mAOD to approximately 100 mAOD.





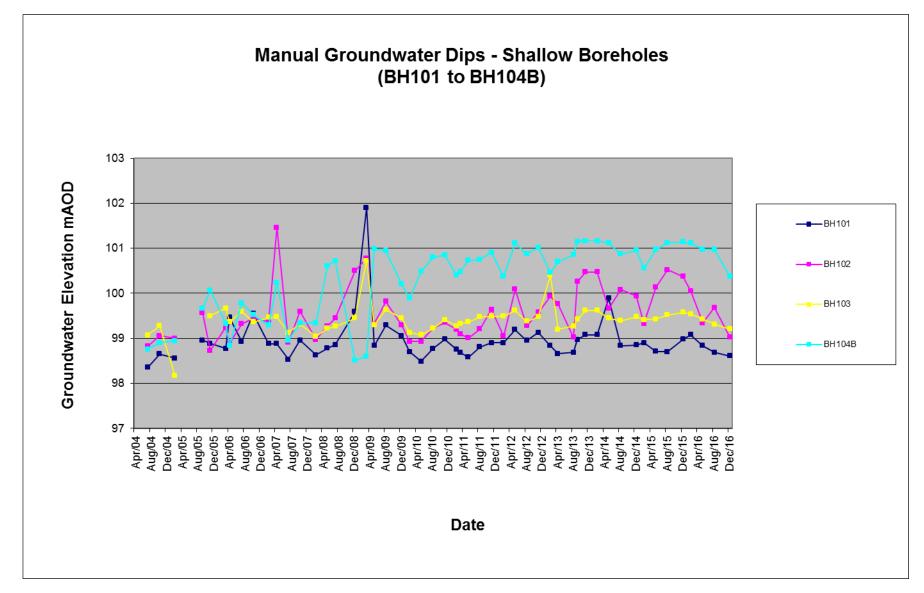
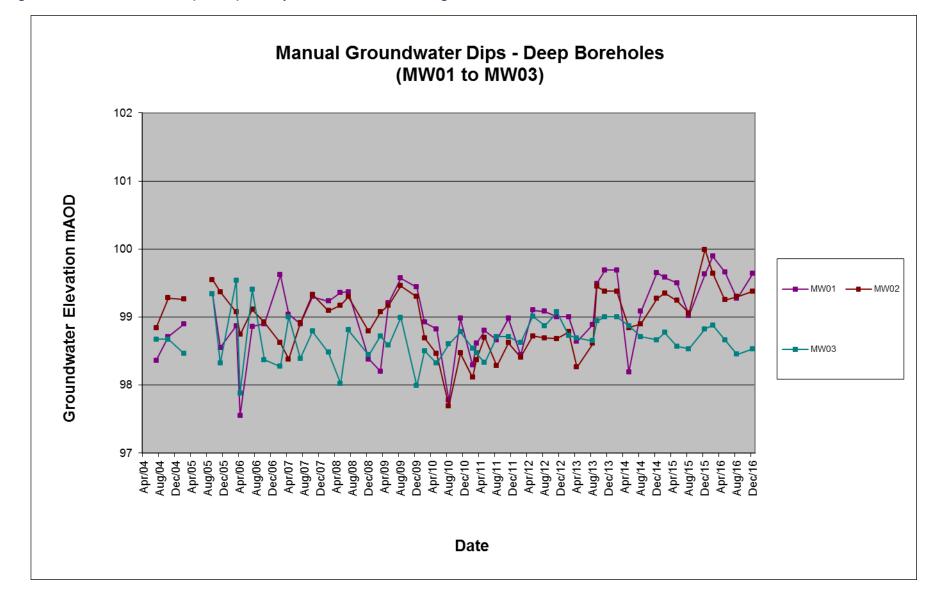
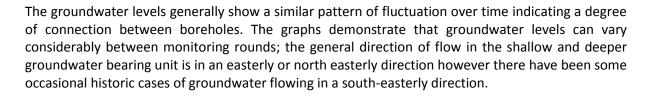


Figure 6.2 – Ground Elevation (mAOD) in Shallow Groundwater Monitoring Wells







In addition, monthly rainfall data for Oak Park, Carlow have been tabulated from Met Éireann to examine the relationship between compounds and rainfall events. The data from Oak Park was chosen as the weather station at Birr, Co. Offaly closed in October 2009. A summary of the rainfall data is in **Tables 6.1** to **6.5**.

Table 6.1 – Monthly Rainfall Data for Year 2012 for Oak Park, Ca	arlow
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Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Rainfall (mm)	70.8	24.5	18.0	56.3	50.2	155.8	76.2	127.7	37.9	63.4	80.9	68.1

Table 6.2 – Monthly Rainfall Data for Year 2013 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Rainfall (mm)	76.2	35.8	57.6	44.4	35.6	37.5	32.3	85.6	24.4	170.0	27.7	136.6

Table 6.3 – Monthly Rainfall Data for Year 2014 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Rainfall (mm)	147.2	176.7	65.0	52.6	78.6	61.9	24.6	122.1	18.2	138.2	165.6	47.7

Table 6.4 – Monthly Rainfall Data for Year 2015 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	66.0	36.3	53.5	26.3	89.4	29.7	79.4	83.0	17.9	56.8	110.0	270.9

Table 6.5 – Monthly Rainfall Data for Year 2016 for Oak Park, Carlow

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	110.9	95.7	40.6	64.3	61.6	61.7	29.6	46.0	97.4	32.3	26.3	80.2

6.2 GROUNDWATER CONCENTRATIONS OVER TIME

Groundwater quality trends have previously been examined in two reports (URS 2005 and RPS 2007). In addition, RPS carried out a groundwater risk assessment (Ref: MDE0788RP0001, dated November 2008) in which the general trend of contaminant concentrations over time was observed to be erratic with compounds rarely being detected in the same borehole on two consecutive monitoring rounds.

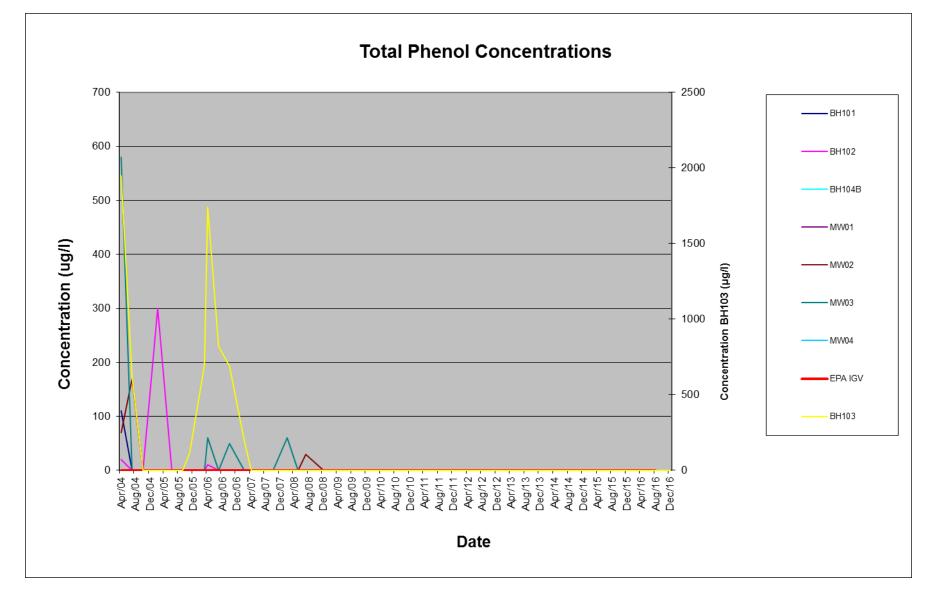
The data available within these reports has been reviewed and time series plots of key parameters have been compiled based on notable trends. Trends for phenols, petroleum hydrocarbons and chlorinated solvents have been plotted as outlined in the following sections.

6.2.1 Phenols

Phenols have been detected historically in all boreholes with the highest concentrations recorded in BH103. However concentrations in BH103 have declined since April 2007. Phenol concentrations have since been recorded below the IGV of 0.5 μ g/l in all monitoring wells since December 2008 indicating natural attenuating conditions within the groundwater.

2,4-Dimethylphenol was detected at a concentration of 0.12 μ g/l during the Quarter 1, 2010 monitoring event. There is no recommended IGV for this parameter. Subsequent to the Quarter 1 2010 monitoring event no detections of phenols have been noted at any monitoring location up to and including the current Quarter 4 2016 monitoring event.







6.2.2 Polyclyclic Aromatic Hydrocarbons

Figure 6.5 below illustrates that PAHs (Polycyclic Aromatic Hydrocarbons) have previously been detected within all monitoring wells above the recommended EPA IGV of 0.1 μ g/l. Historically the highest concentrations have been detected within MW03 and BH104B, with the highest concentration detected in March 2006 (107 μ g/l) and in October 2007 (19.72 μ g/l) respectively. In addition, a range of PAHs including Benzo(a)pyrene, Benzo(g,h,i)perylene, Indeno(1,2,3)cd pyrene, Fluoranthene and Naphthalene have previously been detected in MW03 with **Figures 6.6** to **6.10** illustrating some of the PAH compounds which were detected above their respective IGVs.

Since 2007 concentrations of PAH have shown a marked decrease and since 2010 detections of PAH have been confined to MW03, MW02 and BH104B. Concentrations of Total PAH above the IGV in 2010 were detected during the Quarter 1 monitoring event in MW03 (0.3 μ g/l), Quarter 2 monitoring event in BH104B (1.2 μ g/l) and Quarter 3 monitoring event in MW02 (2.0 μ gl) and BH104B (0.2 μ gl). There were no elevated concentrations of Total PAH during the Quarter 4 2010 monitoring event.

No Total PAH detections were recorded throughout 2011 and in Q1 of 2012. Total PAH was detected above the IGV in MW03 in the Q2 2012 monitoring event. No Total PAH exceedances were detected from Quarter 3 2012 to Quarter 4 2013 inclusive. Total PAHs were detected at a concentration of 2.62 μ g/l in MW03 during the Q3 2013 monitoring event however; no detections above the laboratory limit were noted during the subsequent monitoring events up to and including the Quarter 2 2015 monitoring event.

Total PAHs were also above the GTV at BH103 (0.093 μ g/l), BH104B (0.159 μ g/l) and MW03 (0.586 μ g/l) during Quarter 3 2015, at BH103 (0.21 μ g/l), MW03 (0.986 μ g/l) and MW04 (0.079 μ g/l) during Quarter 4 2015, and at BH103 (0.123 μ g/l), BH104B (0.159 μ g/l) and MW04 (0.153 μ g/l) during the *previous* Quarter 1 2016 monitoring event.

During the Quarter 3 2016 monitoring event, Total Polyaromatic Hydrocarbons were detected above the IGV limit of 0.1 μ g/l at BH103 (0.181 μ g/l), BH104B (0.158 μ g/l), MW103 (0.562 μ g/l) and MW104 (0.151 μ g/l). Similarly during the current Quarter 4 monitoring event total PAHs were detected above the IGV at BH102 (0.124 μ g/l) and at MW03 90.596 μ g/l).

Figure 6.6 illustrates that **Fluoranthene** was previously detected above the IGV of 1.0 µg/l in groundwater monitoring wells BH104B (October 2007, 1.33 µg/l) and MW03 (March 2006, 2.158 µg/l) only. The remaining monitoring wells recorded concentrations below the IGV of 1.0 µg/l. During the Quarter 4 2016 monitoring event Fluoranthene was detected above the limit of detection at BH102 (0.026 µg/l) and MW03 (0.019 µg/l), however these detections do not exceed the IGV of 1.0 µg/l.

A similar trend to Fluoroanthene has been noted in **Figure 6.7**, with concentrations of **Naphthalene** recorded above the IGV of 1.0 μ g/l in BH104B and MW03 only. 4 no. exceedances of the IGV were noted in BH104B in September 2005 (39 μ g/l), March 2006 (1.069 μ g/l), July 2006 (1.594 μ g/l) and October 2007 (16.31 μ g/l). Since October 2007, the concentrations in BH104B have decreased below the IGV. There have been 6 exceedances of the IGV of 1.0 μ g/l in MW03, with the highest concentration detected in March 2006 (19.986 μ g/l) and the most recent being the detected in the Quarter 2 2012 monitoring event (2.4 μ g/l). The concentrations detected in August 2010 were slightly above the laboratory limit of detection of 0.01 μ g/l at BH104B (0.08 μ g/l) and MW03 (0.05

 μ g/l); however these levels are deemed low. Concentrations of Naphthalene were below the EPA IGV limit of detection of 1.0 μ g/l at all locations during the Quarter 4 2010, the 2011 and 2012 quarterly monitoring events and the Quarter 1 to Quarter 3 2014 monitoring periods, inclusive. No detections of Naphthalene were noted from the Quarter 4 2014 monitoring event to the Quarter 2 2015 monitoring event. Naphthalene was detected at BH101 (0.011 μ g/l) and MW03 (0.031 μ g/l) during Quarter 3 2015, and at BH103 (0.095 μ g/l) and at MW04 (0.067 μ g/l) during Quarter 4 2015.

Naphthalene was detected during the Quarter 1 2016 monitoring event at BH104B (0.034 μ g/l) and MW04 (0.153 μ g/l)These detections, however, were all below the IGV limit of detection of 1.0 μ g/l. Concentrations of Naphthalene were below the laboratory limit of detection at all locations during the Quarter 2 2016 monitoring event but detected at BH103 (0.13 μ g/l), BH104B (0.039 μ g/l), MW03 (0.028 μ g/l) and MW04 (0.12 μ g/l) during the Quarter 3 2016 monitoring event. During the current Quarter 4 2016 monitoring event, Naphthalene was detected above the laboratory limit of detection at MW03 (0.036 μ g/) only. However, this is still below the IGV of 1.0 μ g/l.

Figure 6.8 illustrates the concentrations of **Benzo(g,h,i)perylene** in all monitoring wells over time. Elevated concentrations above the IGV were recorded at BH104B (0.087 μ g/l) on one occasion in March 2006.

Figure 6.9 illustrates elevated concentrations above the IGV recorded at MW03 on 6 no. occasions with the most recent elevated concentration recorded during the Quarter 4 2015 monitoring event (0.053 μ g/l). The previous elevated concentration detected was in Quarter 3 2015 (0.053 μ g/l). The results of all monitoring events from 2010 to the Quarter 2 2015 monitoring event recorded concentrations below the laboratory limit of detection of 0.01 μ g/l at all locations. Concentrations were also below the laboratory limit of detection at all locations during the Quarter 1 2016 monitoring event. Benzo(g,h,i)perylene was recorded in MW02 (0.011 μ g/l) during Quarter 2 2016 and in BH103 (0.015 μ g/l) and MW03 (0.035 μ g/l) during Quarter 3 2016, however, these are below the IGV of 0.05 μ g/l. During the current Quarter 4 2016 monitoring event, Benzo(g,h,i)perylene was recorded at MW03 (0.036 μ g/l). However, this is still below the IGV of 0.05 μ g/l.

Figure 6.10 illustrates the concentrations of **Benzo(a)pyrene** in all groundwater monitoring wells and indicates that Benzo(a)pyrene has been detected historically in all boreholes above the IGV of 0.01 μ g/l. Similarly with the above mentioned trends, the highest concentrations have been detected in MW03 and BH104B. Concentrations have markedly decreased since March 2006 when an elevated concentration of 2.751 μ g/l was detected in MW03, however there have been a number of detections above the IGV, with the most recent elevated level detected in December 2009. Elevated concentrations above the IGV were recorded in BH101, BH103 and MW01 during this same period.

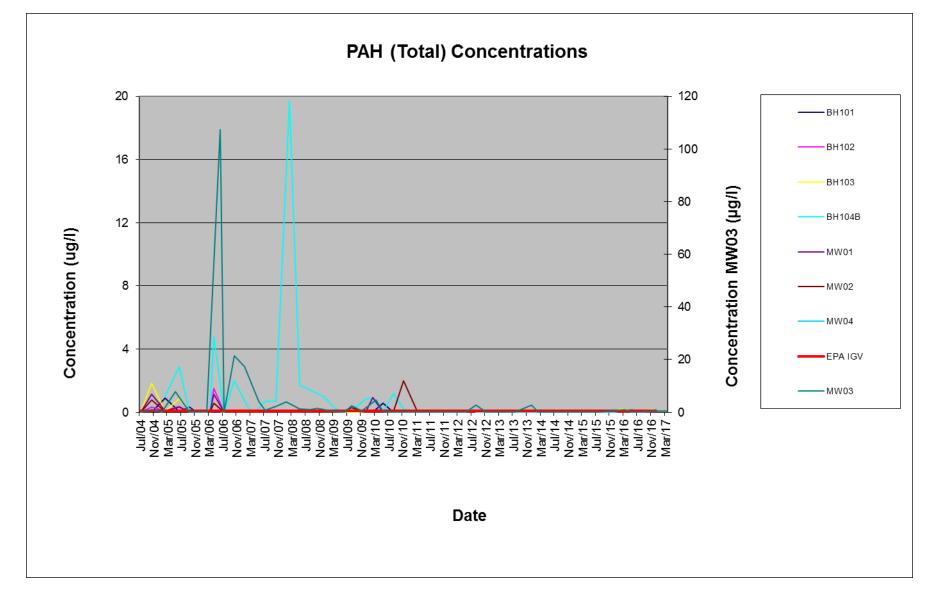
The slightly higher concentrations of Benzo(g,h,i)perylene and Benzo(a)pyrene detected in Quarter 4, 2009 may be attributed to heavy rainfall, which occurred in November of 2009 and as a result possibly mobilized traces of these compounds from the soil. The static water levels for December 2009 ranged between 0.58 and 3.78 mbgl. Since December 2009, concentrations of compounds have notably decreased to below the IGVs.

Benzo(a)pyrene was detected above the IGV limit of 0.01 μ g/l at MW03 (0.108 μ g/l) during the Quarter 4 2015 monitoring event. Benzo(a)pyrene was also detected above the IGV at MW03 (0.052 μ g/l) during the Quarter 3 2015 monitoring event. All other results of all monitoring events from 2010 to Quarter 2 2016 monitoring event did not detect other concentrations above the IGV. During the previous Quarter 3 2016 monitoring event Benzo(a)pyrene was detected at BH103 (0.04 μ g/l)

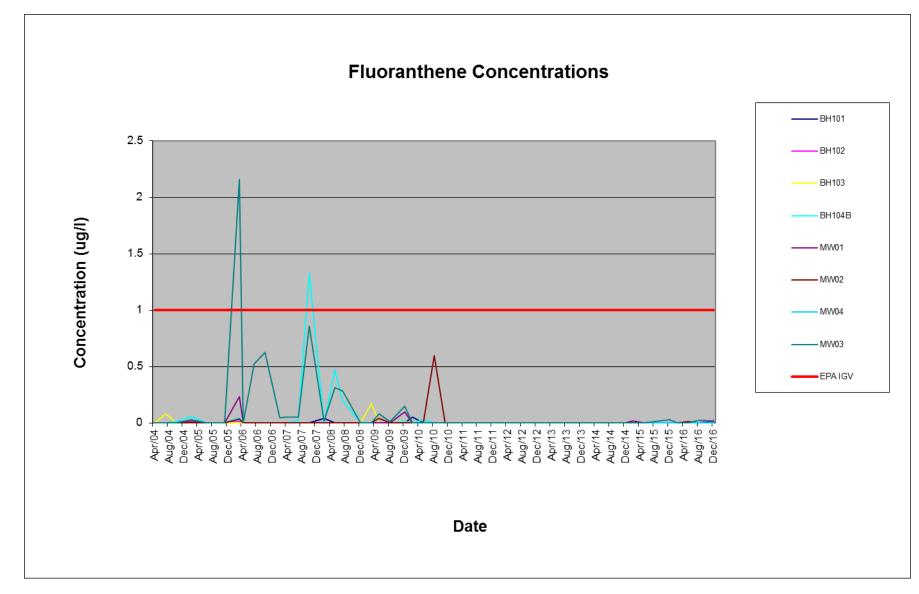


and MW03 (0.037 μ g/l). During the current Quarter 4 2016 monitoring event Benzo(a)pyrene was detected above the limit of detection (0.01 μ g/l) at MW03 (0.032 μ g/l), these concentrations are also over the IGV of 0.01 μ g/l.











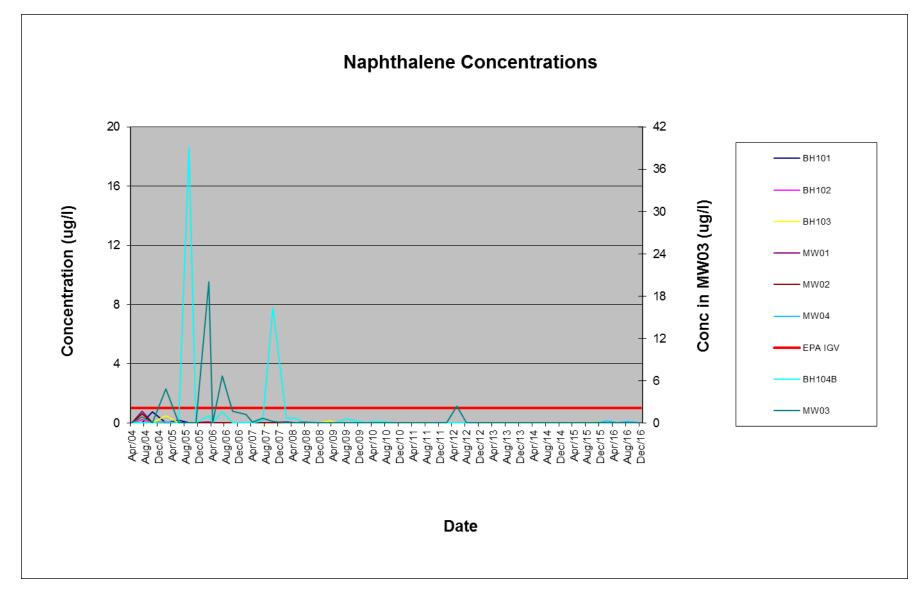


Figure 6.8 – Benzo (g,h,i) perylene Concentrations

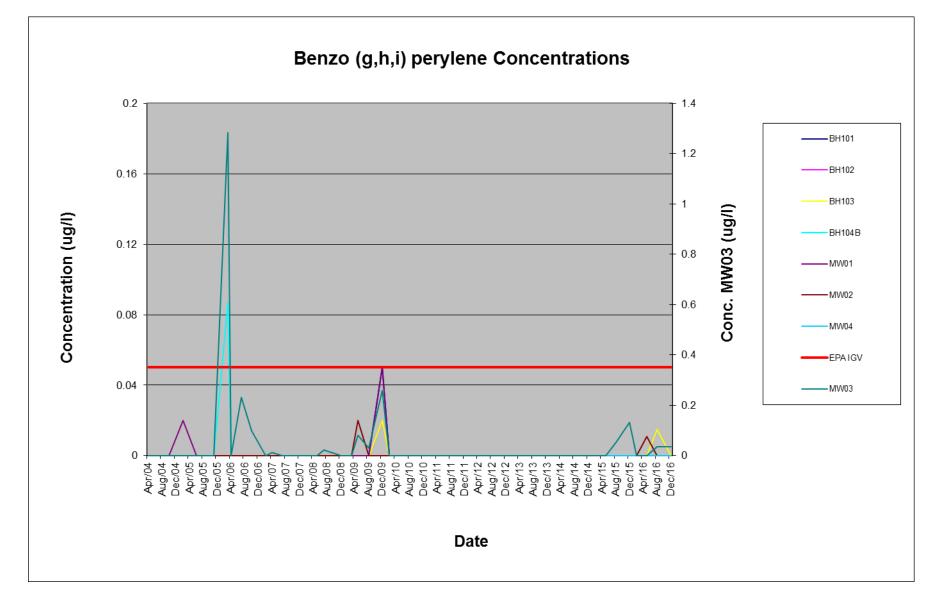
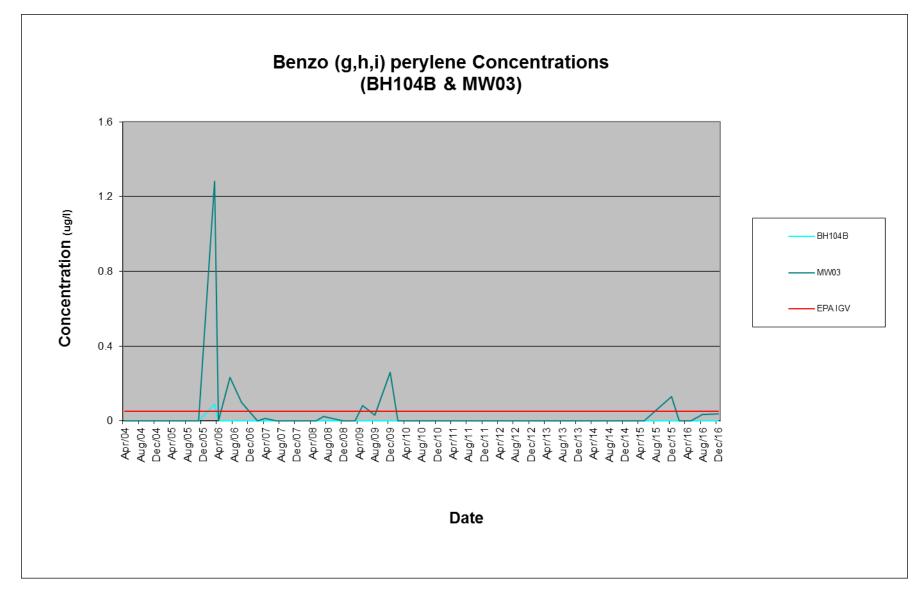
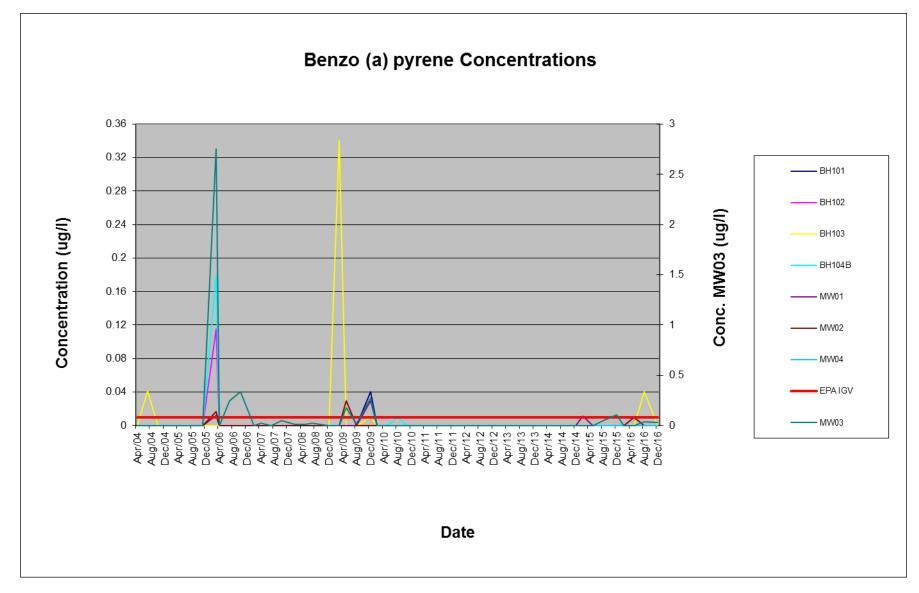


Figure 6.9 – Benzo (g,h,i) perylene in Monitoring Wells BH104B & MW03







6.2.3 Petroleum Hydrocarbons (TPH)

Historically **Total Petroleum Hydrocarbons (TPH)** including mineral oil, petrol range organics (PRO) and diesel range organics (DRO) have been detected within BH103, BH104B and MW03. Since 2009, speciated hydrocarbon analysis using the Total Hydrocarbon Criteria Working Group (TPHCWG) method has been carried out on all samples to obtain a more accurate profile of TPH within groundwater.

The results of the TPHCWG analysis has indicated that the predominant hydrocarbons detected are in the heavier chain carbon fractions, most notably in the carbon range C12-C16, C16-C21 and C21-C35. **Figure 6.11** illustrates the TPH analysis for the total TPH analysis from C10-C44 in all monitoring wells since 2009. The highest concentrations detected historically are at monitoring wells MW03, BH104B and BH103 respectively.

Previous quarterly monitoring reports have outlined the hydrocarbon trends recorded in each well since 2010. This report outlines the trends from 2012 up to and including the current monitoring report.

During the Quarter 1, 2012 monitoring event, hydrocarbons were detected in borehole BH103 only. The predominant aliphatic carbon range comprised C10-C12 (13 μ g/l), C12-C16 (270 μ g/l), C16-C21 (690 μ g/l) and C21-C35 (980 μ g/l). The predominant aromatic carbon range comprised of C16-C21 (250 μ g/l) and C21-C25 (680 μ g/l).

During the Quarter 2, 2012 monitoring event, hydrocarbons were detected in BH103 only. The detected aliphatic carbon range comprised C12-C16 (98 μ g/l), C16-C21 (230 μ g/l) and C21-C25 (170 μ g/l). No detections of aromatic carbons were measured during the Quarter 2 2012 monitoring event.

No hydrocarbons were detected at any location during the Quarter 3 and Quarter 4, 2012 monitoring events.

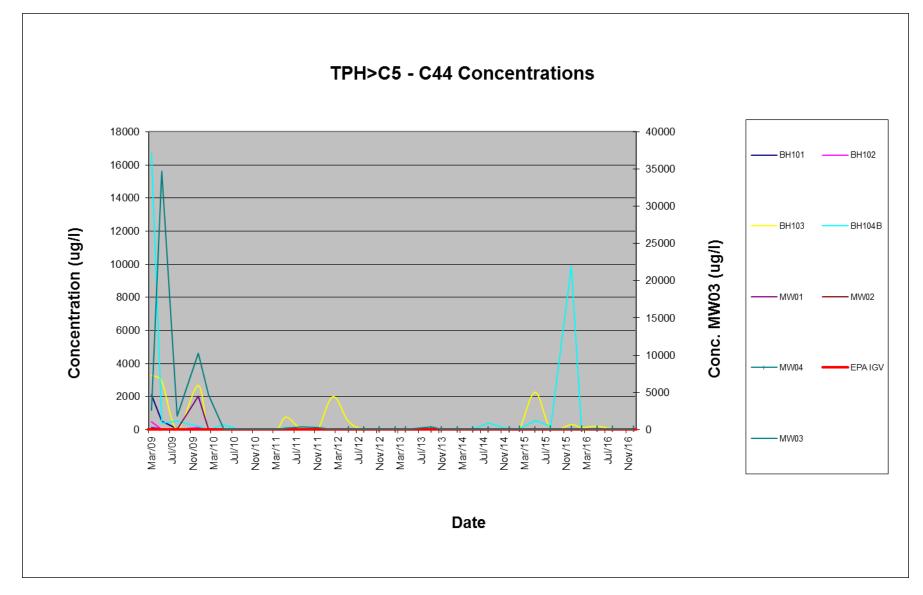
During the Quarter 1, 2013 monitoring event aromatic hydrocarbons were detected in BH103, BH104B and MW04. The predominant aromatic carbon range comprised C12-C16 ($30 \mu g/I$), C16-C21 ($280 \mu g/I$) and C21-C35 ($100 \mu g/I$) in BH103, C10-C12 ($30 \mu g/I$), C12-C16 ($110 \mu g/I$) and C16-C21 ($80 \mu g/I$) in BH104B and C10-C12 ($20 \mu g/I$) and C12-C16 ($80 \mu g/I$) in MW04. Aliphatic hydrocarbons were detected in BH103 in the ranges C12-C16 ($70 \mu g/I$), C16-C21 ($100 \mu g/I$) and C21-C35 ($90 \mu g/I$).

During the Quarter 2, 2013 monitoring event no aliphatic or aromatic hydrocarbons were detected at any location.

During the Quarter 3, 2013 monitoring event, hydrocarbons of the aliphatic range were detected in MW03 only. The detected aliphatic carbon range comprised C10-C16 (290 μ g/l) and C12-C16 (190 μ g/l). No detections of aromatic carbons were measured during the Quarter 3 2013 monitoring event.

Total Petroleum Hydrocarbons were not detected at any monitoring location during the Quarter 4, 2014 monitoring event. During the monitoring event for Quarter 3 2014 following ranges of the aliphatic hydrocarbons were recorded for BH104B; C12-C16 (150 μ g/l), C16-C21 (250 μ g/l) and C21-C35 (10 μ g/l).







During the Quarter 1 2015 monitoring event, hydrocarbons were detected in MW03, MW04, BH103 and BH104B. The predominant aromatic carbon range comprised C21-C35 (14 μ g/l) in BH103, C12-C16 (27 μ g/l) and C16-C21 (15 μ g/l) in BH104B, C12-C16 (14 μ g/l) in MW03 and C12-C16 (15 μ g/l) in MW04. Aliphatic hydrocarbons were detected in the ranges C16-C35 (54 μ g/l) in BH103, C16-C35 (11 μ g/l) in BH104B and C16-C35 (46 μ g/l) and C35-C44 (12 μ g/l) in MW03.

During the Quarter 2 2015 monitoring event, the TPH concentration in the aromatic C21-C35 range was detected at one shallow groundwater wells BH103 (509 μ g/l). The TPH concentration in the aliphatic range was detected at C16-C35 (1760 μ g/l) in BH103 and C12-C16 (225 μ g/l) and C16-C35 (11 μ g/l) in BH104B.

The Quarter 3 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 (39 μ g/l), C16-C21 (37 μ g/l) and C21-C35 (28 μ g/l) at BH104B, C21-C35 at BH103 (17 μ g/l) and C10-C12 (18 μ g/l) and C12-C16 (29 μ g/l) at MW04. TPH concentrations were detected in the aliphatic ranges C10-C12 (13 μ g/l), C12-C16 (40 μ g/l) and C16-C35 (62 μ g/l) at BH104B and C16-C35 at BH103 (72 μ g/l) and MW03 (14 μ g/l).

The Quarter 4 monitoring event of 2015 detected TPH in the aromatic ranges C12-C16 (879 μ g/l), C16-C21 (1380 μ g/l) and C21-C35 (694 μ g/l) at BH104B, C21-C35 at BH103 (60 μ g/l) and C10-C12 (13 μ g/l) and C12-C16 (21 μ g/l) at MW04. TPH concentrations were detected in the aliphatic ranges C10-C12 (495 μ g/l), C12-C16 (3080 μ g/l) and C16-C35 (3360 μ g/l) at BH104B and C16-C35 (231 μ g/l) and C35-C44 (14 μ g/l) at BH103.

The Quarter 1 2016 monitoring event detected TPH in samples from the well BH103 were in the aliphatic range C16-C35 (132 μ g/l) and from well MW04 in the aromatic range C12-C16 (15 μ g/l).

The Quarter 2 2016 monitoring event detected TPH in samples from the well BH103 and were in the aliphatic range C16-C35 (150 μ g/l) and in the aromatic range C21-C35 (57 μ g/l) and from well MW04 in the aromatic range C12-C16 (20 μ g/l).

During the previous Quarter 3 2016 monitoring event, TPH was detected in samples from the well BH103 in the aliphatic ranges C16-C35 (35 μ g/l), C35-C44 (10 μ g/l) and in the aromatic range C21-C35 (11 μ g/l), well BH104B in the aromatic ranges C12-C16 (25 μ g/l) and C16-C21 (12 μ g/l) and from well MW04 in the aromatic range C12-C16 (23 μ g/l).

During the current Quarter 4 2016 monitoring event, TPH was detected in samples from the well BH102 in the aliphatic range C16-C35 (13 μ g/l), well BH103 in the aliphatic ranges C16-C35 (160 μ g/l), C35-C44 (14 μ g/l) and in the aromatic range C21-C35 (47 μ g/l), well BH104B in the aromatic ranges C12-C16 (12 μ g/l), well MW03 in the aliphatic range C16-C35 (14 μ g/l) and from well MW04 in the aromatic ranges the aromatic ranges C10-C12 (13 μ g/l) and C12-C16 (23 μ g/l).

7 CONCLUSIONS

- In accordance with the criteria set out in Schedule 4(ii) of the site's Industrial Emissions Licence Register No. W0184-01, groundwater monitoring was carried out at the ENVA Ireland site on the 6th December 2016 corresponding to Quarter 4 of 2016. Samples were collected at 8 groundwater monitoring wells during this event.
- The results presented have been referenced against Groundwater Threshold Values (GTVs) outlined in the European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. no 9 of 2010), where available. Where GTVs are not available for parameters, results are compared against the Interim Guideline Values (IGVs) set out in the Environmental Protection Agency interim report, 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland'.
- Results of the BTEX and MTBE demonstrate that the levels of Benzene, Toluene, Ethylbenzene, m&p Xylene, o-xylene and MTBE were all below the recommended EPA IGVs.
- The Quarter 4 2016 results of the speciated polycyclic aromatic hydrocarbons indicate that Total PAHs were above the EPA IGV of 0.1 μg/l at two monitoring wells, BH102 (0.124 μg/l) and MW103 (0.596 μg/l).
- 1,1-dichloroethane in MW03 (1.6 μg/l) and MW04 (1.9 μg/l) were also detected. These results are above the laboratory limit of detection, however, there is no GTV or IGV limit for 1,1-dichloroethane. All other VOCs and SVOCs were below their respective laboratory limits of detection.
- Samples were analysed for speciated phenols to include chlorophenols and the results indicate that there were no detections above the laboratory limits of detection.
- For the current Quarter 4 2016 monitoring event, TPH detections in samples from the well BH102 in the aliphatic range C16-C35 (13 μg/l), well BH103 in the aliphatic ranges C16-C35 (160 μg/l), C35-C44 (14 μg/l) and in the aromatic range C21-C35 (47 μg/l), well BH104B in the aromatic ranges C12-C16 (12 μg/l), well MW03 in the aliphatic range C16-C35 (14 μg/l) and from well MW04 in the aromatic ranges the aromatic ranges C10-C12 (13 μg/l) and C12-C16 (23 μg/l). Each of these is therefore over the limit of detection which is 10 μg/l. During the previous Quarter 3 monitoring event, TPH detections in samples from the well BH103 were in the aliphatic range C16-C35 (35 μg/l) and C35-C44 (10 μg/l) and in the aromatic range C21-C35 (11 μg/l), at BH104B were in the aromatic range C12-C16 (25 μg/l) and C16-C21 (12 μg/l) and at well MW04 were in the aromatic range C12-C16 (23 μg/l). Quarter 2 2016, TPH detections in samples from the well BH103 were in the aliphatic range C12-C35 (57 μg/l), and from well MW04 in the aromatic range C16-C35 (132 μg/l) at BH103 and the aromatic range C12-C16 (15 μg/l) at BH103 and the aromatic range C12-C16 (15 μg/l) at MW04 were observed during the Quarter 1 2016 monitoring event.
- The general trend of contaminant concentrations over time continues to be somewhat variable with compounds not being continually detected in the same borehole on two or three consecutive monitoring rounds. In general, the contaminant levels detected at the Enva facility appear to indicate reducing contaminant concentrations over time with infrequent elevations in some parameters. Further monitoring is recommended to confirm these reductions.

Appendix 5

Quarterly Effluent Metal Screen

The metal screen for Q1 2016 is shown in the table below.

Image: Network ICP OES ICP OES ICP OES tection Limit <0.2 <0.1 <0.5 Accredited <0.1 <0.5 Accredited <0.1 <0.5 Image: Network	In Method Lection Limit Accredited Accredited Dissolved Dissolved Calcium Dissolved Dissolved Maguesium Mg/l mg/l mg/l 94.3	Image: Network ICP OES ICP OES ICP OES tection Limit <0.2 <0.1 <0.5 Accredited <0.1 <0.5 Accredited <0.1 <0.5 Image: Network	Image Image ICP OES ICP OES ICP OES ICP OES tection Limit <0.2 <0.1 <0.5 <1.5 Accredited <0.1 <0.5 <1.5 Accredited Accredited Maguesium Dissolved Maguesium Mag/l mg/l ug/l ug/l ug/l Magnesion	In Method ICP OES ICP OES <th>Immethod ICP OES tection Limit <0.2 <0.1 <0.5 <1.5 <7 <20 Accredited Accredited Accredited Dissolved Dissolved Dissolved Dissolved Dissolved Dissolved Magnesium Magnesium Magnesium Magnesium <th></th><th>Me</th><th>1</th><th>Jones Environmer Reference I</th><th></th><th>Report No: Quarte</th></th>	Immethod ICP OES tection Limit <0.2 <0.1 <0.5 <1.5 <7 <20 Accredited Accredited Accredited Dissolved Dissolved Dissolved Dissolved Dissolved Dissolved Magnesium Magnesium Magnesium Magnesium <th></th> <th>Me</th> <th>1</th> <th>Jones Environmer Reference I</th> <th></th> <th>Report No: Quarte</th>		Me	1	Jones Environmer Reference I		Report No: Quarte
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Quarterly Effluent Metal Screen The metal screen for Q2 2016 is shown in the table below.

Deta	Methor	ISO 1:	Sample Identity Jones [Environmen Reference N	ital Io	Report No: Quarterly Effluent 16/8523
Detection Method	Method Detection Limit	ISO 17025 Accredited	Other ID		fluent Effluent Screen 05/05/2016
ICP OES	<0.2	>	Dissolved Calcium	l/6m	344.0
ICP OES	<0.1	>	Dissolved Magnesium	mg/l	73.5
ICP OES	<0.5	>	Dissolved Cadmium	l/gu	<0.5
ICP OES	<1.5	>	Dissolved Chromium	l/bn	3.9
ICP OES	<7	>	Dissolved Copper	l/6n	<2
ICP OES	<20	>	Total Dissolved Iron	l/bn	225
ICP OES	<2	>	Dissolved Manganese	l/bn	589
ICP OES	<2	>	Dissolved Nickel	l/6n	49
ICP OES	3	>	Dissolved Zinc	l/6n	73
ICP OES	<1	>	Dissolved Mercury	l/bn	41
ICP OES	\$	>	Dissolved Lead	l/gu	9

20 12

Quarterly Effluent Metal Screen

The metal screen for Q3 2016 is shown in the table below.

	Detection Method	Method	ICP OES	ICP OES	ICP OES	ICP OES	ICP OES	ICP OES	ICP OES	ICP OES	ICP OES	ICP OES	ICP OES
	Method Detection Limit	ection Limit	<0.2	<0.1	<0.5	<1.5	<7	<20	<2	~2	ŝ	12	
	ISO 17025 Accredited	Accredited	>	>	>	>	>	>	>	>	>	>	13253
Jones Environmer Reference I	Sample Identity	Other ID	Dissolved Calcium	Dissolved Magnesium	Dissolved Cadmium	Dissolved Chromium	Dissolved Copper	Total Dissolved Iron	Dissolved Manganese	Dissolved Nickel	Dissolved Zinc	Dissolved Mercury	
			mg/l	mg/l	l/gu	l/gn	ug/l	ug/l	ug/l	ug/l	ug/l	l/gn	<u> </u>
16/11466	Weekly	PO 2892	383.1	289.2	<0.5	9.7		535	431	41	\$	\ \	

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terly Effluent Metal Screen	etal screen for Q4 2016 is shown in the table below.
Quarterly E	The metal scr

			Jones Environmen Reference M		16/16281
Dete	Method	ISO 17(Sample Identity		Weekly Effluent
Detection Method	Method Detection Limit	ISO 17025 Accredited	Other ID		Weekly Effluent 26/10/2016
ICP OES	<0.2	>	Dissolved Calcium	mg/l	430.5
ICP OES	<0.1	>	Dissolved Magnesium	mg/l	189.6
ICP OES	<0.5	>	Dissolved Cadmium	l/gn	<0.5
ICP OES ICP OES	<1.5	>	Dissolved Chromium	l/gn	19.9
ICP OES	1>	>	Dissolved Copper	l/gn	\bigtriangledown
ICP OES	<20	>	Total Dissolved Iron	ug/l	708
ICP OES	<2	>	Dissolved Manganese	l/gn	365
ICP OES	5	>	Dissolved Nickel	l/an	39
ICP OES	0	>	Dissolved Zinc	1/2n	16
ICP OES		>	Dissolved Mercury	l/an	
ICP OES	ŝ	>	Dissolved Lead]/dft	\$

Appendix 6



Enva Ireland Ltd Raffeen Ind Est, Ringaskiddy, Co.Cork

Tel: 021 438 7200 Fax: 021 438 7299 Email: cork@enva.ie Web: www.enva.ie



RESPIROMETRY REPORT

ENVA PORTLAOISE

One sample was received on the 07.12.16 for evaluation of their effect on activated sludge micro organisms at given dilutions. The methodology for this is by respirometry, which assesses the oxygen uptake of a standard activated sludge versus sludge containing the samples for evaluation, over a 30 minute period. The samples submitted were as follows:

Effluent	Enva Portlaoise	
06.12.16		

The results were as follows: (all results mg/l 02)

Sample		
Time/Mins.	Control	1/5 Dilution
0	9.3	9.0
1	8.6	8.3
2	7.8	7.2
3	6.1	6.3
4	5.5	5.4
5	4.2	4.5
10	3.5	4.3
15	2.6	3.7
20	2.1	2.9
25	1.6	2.1
30	1.1	1.5
% Inhibition		9%

Only samples showing +30% or greater inhibition are considered to have a negative effect on the activated sludge.

As we can see all of the samples proved lower than this in inhibition terms. This indicates that there was no inhibition of the activity of the activated sludge micro organisms from the samples at their respective dilutions.

Signed:

LL_

Date: 13/12/16



Enva Ireland Ltd Raffeen Ind Est, Ringaskiddy, Co.Cork

Tel: 021 438 7200 Fax: 021 438 7299 Email: cork@enva.ie Web: www.enva.ie



RESPIROMETRY REPORT

ENVA PORTLAOISE

One sample was received on 29.06.16 the for evaluation of their effect on activated sludge micro organisms at given dilutions. The methodology for this is by respirometry, which assesses the oxygen uptake of a standard activated sludge versus sludge containing the samples for evaluation, over a 30 minute period. The samples submitted were as follows:

Effluent	Enva Portlaoise	
28.06.16		

The results were as follows: (all results mg/l 02)

Sample Time/Mins.	Control	¹ / ₅ Dilution		
0	9.0	9.1		
1	8.6	8.4		
2	7.4	7.5		
3	6.1	6.3		
4	5.5	5.6		
5	4.7	4.8		
10	3.9	4.1		
15	3.0	3.2		
20	2.5	2.5		
25	1.9	2.1		
30	1.6	1.8		
% Inhibition	31/2	1 %		

Only samples showing +30% or greater inhibition are considered to have a negative effect on the activated sludge.

As we can see all of the samples proved lower than this in inhibition terms. This indicates that there was no inhibition of the activity of the activated sludge micro organisms from the samples at their respective dilutions.

Signed:

14

Date: 5/1/4

Appendix 7



Report Title	Air Emissions Compliance Monitoring Emissions Report		
Company address	Air Scientific Ltd., Unit 5, Caherdavin Business Centre, Caherdavin, Park, Ennis Road, Limerick V94 NT63.		
Stack Emissions Testing Report Commissioned by	ENVA Portlaoise		
Facility Name	ENVA Ireland Ltd, Clonminam Industrial Estate, Portlaoise		
Contact Person	Frances Wright		
EPA Licence Number	W0184-01		
Licence Holder	ENVA Ireland Limited		
Stack Reference Number	Boiler 1		
Dates of the Monitoring Campaign	24-11-2016		
Job Reference Number	ENVATL3241116		
Report Written By	Ms. Shannon Larkin		
Report Approved by	Mr. Gregory Dempsey		
Stack Testing Team	Mr. Mark Mc Garry		
Report Date	23-01-2017		
Report Type	Test Report Compliance Monitoring		
Version	1		
Signature of Approver	Greegery Den proj Team Leader		

Opinions and interpretations expresses herein will be outside the scope of Air Scientific Limited INAB accreditation. This test report shall not be reproduced, without the written approval of Air Scientific Limited. All sampling and reporting is completed in accordance with Environmental Protection Agency Air Guidance Note 2 requirements.



DETAILED IN SCOPE REG NO.319T



Monitoring Objectives

Overall Aim of the monitoring Campaign

The aim of the monitoring campaign was to establish emission concentrations.

Special Requirements

There were no special requirements.

Target Parameters

Carbon Monoxide (CO)	
Oxides of Nitrogen (NOx) as NO ₂	
Sulphur Dioxide (SO ₂)	
Stack Gas Temperature	
Boiler Efficiency	

Emission Limit Values

Boiler 1	mg.m ⁻³
CO	-
NOx as NO ₂	-
SO ₂	<u>11</u>
Stack Gas Temperature	
Boiler Efficiency	11 25

Reference Conditions

Reference Conditions	Value	
Oxygen Reference %	3	
Temperature K	273.15	
Total Pressure kPa	101.3	
Moisture %	Dry	

Overall Results

Boiler 1	Concentration				
Parameter	Units	Result	MU +/-	Limit	Compliant
Carbon Monoxide (CO)	mg.m ⁻³	<1.7	2.2	-	N/a
Oxides of Nitrogen (NOx) as NO2	mg.m ⁻³	164.4	12.2	-	N/a
Sulphur Dioxide (SO ₂)	mg.m ⁻³	<6.1	16.9	-	N/a
Combustion Efficiency	%	92.36		-	N/a

Accreditation	details
Air Scientific Limited	INAB Number: 319T

Process details

Stack Name	Boiler 1	
Process status	Normal	
Capacity (per/hour) (if applicable)	Variable	
Continuous or Batch Process	Continuous	
Feedstock	Natural Gas	
Abatement System	No	
Abatement Systems Running Status	N/a	
Fuel	Natural Gas	
Plume Appearance	No	
Other information	None	

Monitoring, Equipment & Analytical Methods

Parameter	Standard	Technical Procedure	Accredited Testing	Analytical Technique	Equipment / Media	Equipment ID Used on Site
Carbon Monoxide (CO)	EN15058:2006	2004	Yes	Non Dispersive Infra Red	Horiba	
Oxides of Nitrogen (NOx) as NO ₂	EN14792:2006	2002	Yes	Chemiluminescence	Horiba	
Sulphur Dioxide (SO2)	NDIR AG2	2003	Yes	Non Dispersive Infra Red	Horiba	ASLLK12EQ526
Oxygen (%)	EN14789	2008	Yes	Paramagnetic/ Zirconia	Horiba	ASLLK12EQ527 ASLLK14EQ501
Stack Gas Temperature	EN 16911:2013	2005	Yes	Thermocouple	Thermocouple	
Combustion Efficiency	Calculation	R.	4	-	-	

Sampling Deviations

Parameter: Boiler 1	Deviation	
EN15058:2006	None	
EN14792:2006	None	
NDIR AG2	None	
EN14789	None	

Reference Documents

Risk Assessment (RA)	SOP 1011	
Site Review (SR)	SOP 1015	
Site Specific Protocol (SSP)	SOP 1015	

Suitability of Sample Location

General Information	Boiler 1
Permanent/Temporary	Permanent
Inside/ Outside	Inside

Platform Details			
Irish EPA Technical Guidance Note AG1 / BS EN 15259 Platform Requirements	Value	Comment	
Sufficient Working area to manipulate probe and measuring instruments	Yes	-	
Platform has 2 handrails (approx. 0.5m & 1.0 m high)	N/a	-	
Platform has vertical base boards (approx. 0.25 m high)	N/a	-	
Platform has chains / self-closing gates at top of ladders	N/a	2	
There are no obstructions present which hamper insertion of sampling equipment	No	-	
Safe Access Available	Yes	-	
Easy Access Available	Yes	-	

Sampling Location / Platform Improvement Recommendations

None

BSEN 15259 Homogeneity Test Requirements 1.

Select Option :

- 1: There is no requirement to perform a BSEN15259 Homogeneity Test on this stack
- There is no requirement to perform a BSEN B259 Follogeneity fest on this stack
 Test results were obtained from previous Homogeneity test carried out by ASL
 Test results were obtained from previous Homogeneity test carried out by Alternative contractor
 Homogeneity Test is required on this stack and the client has been informed of this requirement.

Stack Diagram

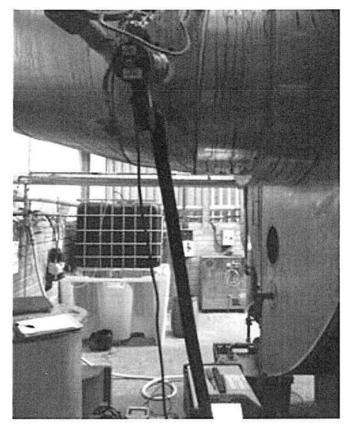


Figure 1: Boiler 1

1. APPENDICES

Appendix I Monitoring Personnel & Equipment

Stack Emissions Monitoring Personnel

Team Leader	Name	Mark McGarry	
	System approval	ASL Team Leader Approved	

Appendix II

Stack Raw Data

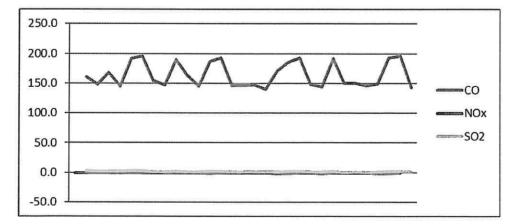
Title:	Determination of	of Con	nbustion Fl	ue Gases		
Method:	EN 14792 / EN 1					
Test Date:	24/11/2016					
Stack Name	Boiler 1					
Reference Conditions						
Measured Oxygen		5.6	%			
Reference Oxygen		3	%			
Parameter			со	NO	SO2	O2
Emission Limit Values	mg.m ⁻³ ref					
Instrument Range	ppm		200	500	1000	25
Span Gas Value	ppm		147	294	638	20.9
Acceptable Gas Range	-		Yes	Yes	Yes	Yes
Calibration Gas Uncertainty	%		1.2	0.6	0.8	0.5
Quality Assurance	Units					
Conditioning Unit Temperature	С		2	2	2	2
Average Temperature	< C		2	2	2	2
Allowable Temperature	-		4	4	4	4
Temperature Acceptable	-		Yes	Yes	Yes	Yes
Pump flow rate	l/min.		0.5	0.5	0.5	0.5
Zero Drift	Units					
Zero (Pre)	ppm		-0.1	0.4	6	0.04
Zero (Post)	ppm		0.4	0.1	2	0.06
Zero drift	ppm		0.5	-0.3	-4	0.02
Allowable Zero Drift (Less than)	ppm		2.94	5.88	12.76	0.418
Adjustable Zero Drift (Less than)	ppm		7.35	14.7	31.9	1.045
Zero Drift Failure (Greater than)	ppm		7.35	14.7	31.9	1.045
Zero Drift Acceptable	-		Yes	Yes	Yes	Yes
Span Drift	Units					
Span Down (Pre)	ppm		146	293	634	20.9
Span Down (Post)	ppm		144	291	630	20.8
Span Drift	ppm		-2	-2	-4	-0.1
Allowable Span Drift (less than)	ppm		2.94	5.88	12.76	0.418
Adjustable Span Drift (Less than)	ppm		7.35	14.7	31.9	1.045
Span Drift Failure (Greater than)	ppm		7.35	14.7	31.9	1.045
Span Drift Acceptable (Y/N)	2 .		Yes	Yes	Yes	Yes
Leak Check			4.47	204	620	20.0
Span Gas Conc.	ppm		147	294	638	20.9
Recorded Conc. down Line	ppm		146	293 -1	634	20.9 0
Leak Detected	ppm		-1 2.04		-4 12.76	0.418
Leak check acceptable (< 2%)	ppm		2.94	5.88		0.418 Yes
Pass	(Y/N)		Yes	Yes	Yes	Tes
Test Conditions	Lipite					
Test Conditions	Units		9.7	9.7	9.7	9.7
Run Ambient Temperature Range	С		5.7	5.1	5.1	5.7

Raw Data

Date/Time	Data source	со	CO2	NOx	O ₂	SO2
		ppm	vol%	ppm	vol%	ppm
24/11/2016 12:57		-0.4	9.6	69.1	5.1	1.1
24/11/2016 12:58		-0.4	9.9	67.4	4.2	0.8
24/11/2016 12:59		-0.4	9.7	69.2	5.7	0.6
24/11/2016 13:00		-1.0	9.9	67.0	4.0	0.6
24/11/2016 13:01		-0.6	8.0	69.7	7.5	0.8
24/11/2016 13:02		-0.4	7.7	68.2	8.1	0.7
24/11/2016 13:03		-0.9	9.8	67.6	4.8	0.5
24/11/2016 13:04		-0.8	9.8	66.4	4.3	0.5
24/11/2016 13:05		-0.5	7.9	68.9	7.6	0.7
24/11/2016 13:06		-0.8	9.5	68.2	5.6	0.4
24/11/2016 13:07		-0.7	9.4	66.4	4.1	0.5
24/11/2016 13:08		-0.7	8.2	69.7	7.2	0.6
24/11/2016 13:09		-0.9	7.9	68.7	7.8	0.7
24/11/2016 13:10		-0.8	9.9	66.2	4.3	0.5
24/11/2016 13:11		-0.9	9.2	66.0	4.3	0.4
24/11/2016 13:12		-0.9	9.9	66.0	4.4	0.4
24/11/2016 13:13		-1.0	10.5	67.7	3.2	0.3
24/11/2016 13:14		-0.7	8.7	69.4	6.0	0.4
24/11/2016 13:15		-1.0	8.1	69.1	7.2	0.5
24/11/2016 13:16		-1.3	7.9	68.5	7.9	0.6
24/11/2016 13:17		-0.9	9.8	66.2	4.5	0.4
24/11/2016 13:18		-0.9	9.8	66.2	4.1	0.4
24/11/2016 13:19		-1.0	7.8	68.0	7.9	0.5
24/11/2016 13:20		-0.4	9.7	66.5	4.7	0.1
24/11/2016 13:21		-0.8	9.7	66.5	4.7	0.3
24/11/2016 13:22		-0.9	9.9	66.0	4.3	0.2
24/11/2016 13:23		-0.7	9.1	66.5	4.5	0.3
24/11/2016 13:24		-1.2	7.6	67.2	8.1	0.7
24/11/2016 13:25		-1.2	8.8	70.1	7.7	0.5
24/11/2016 13:26		-0.9	8.7	65.8	4.0	0.3
Average		-0.8	9.1	67.6	5.6	0.5

Re	fere	ence	d D	Data

	со	NOx	SO₂
		Reference O ₂	
24/11/2016 12:	17-4 D W 100	161.1	<6.1
24/11/2016 12:	-4 7	148.2	<6.1
24/11/2016 12:	-47	167.6	<6.1
24/11/2016 13:0		145.4	<6.1
24/11/2016 13:0		191.3	<6.1
24/11/2016 13:0		196.5	<6.1
24/11/2016 13:0	3 <1.7	154.6	<6.1
24/11/2016 13:0	o4 <1.7	147.0	<6.1
24/11/2016 13:0	os <1.7	190.2	<6.1
24/11/2016 13:0	<1.7	163.7	<6.1
24/11/2016 13:0	7 <1.7	145.5	<6.1
24/11/2016 13:0	08 <1.7	186.4	<6.1
24/11/2016 13:0	9 <1.7	192.4	<6.1
24/11/2016 13:1	10 <1.7	146.3	<6.1
24/11/2016 13:1	1 <1.7	145.9	<6.1
24/11/2016 13:1	2 <1.7	147.3	<6.1
24/11/2016 13:1	13 <1.7	140.5	<6.1
24/11/2016 13:1	14 <1.7	170.9	<6.1
24/11/2016 13:1		185.8	<6.1
24/11/2016 13:1		193.0	<6.1
24/11/2016 13:1		148.3	<6.1
24/11/2016 13:1		144.6	<6.1
24/11/2016 13:1	COMP. CONTRACTOR OF	192.2	<6.1
24/11/2016 13:2		150.7	<6.1
24/11/2016 13:2		150.7	<6.1
24/11/2016 13:2		146.0	<6.1
24/11/2016 13:2	T-100	148.9	<6.1
24/11/2016 13:2	545	193.2	<6.1
24/11/2016 13:2	See State 12.1	195.5	<6.1
24/11/2016 13:2	26 <1.7	142.9	<6.1
Average	<1.7	164.4	<6.1
Uncertainty of Measurement	2.2	12.2	16.9
Uncertainty as % of ELV	3 5 1270 0		-
Standard Requirement	<6%	<10%	<10%



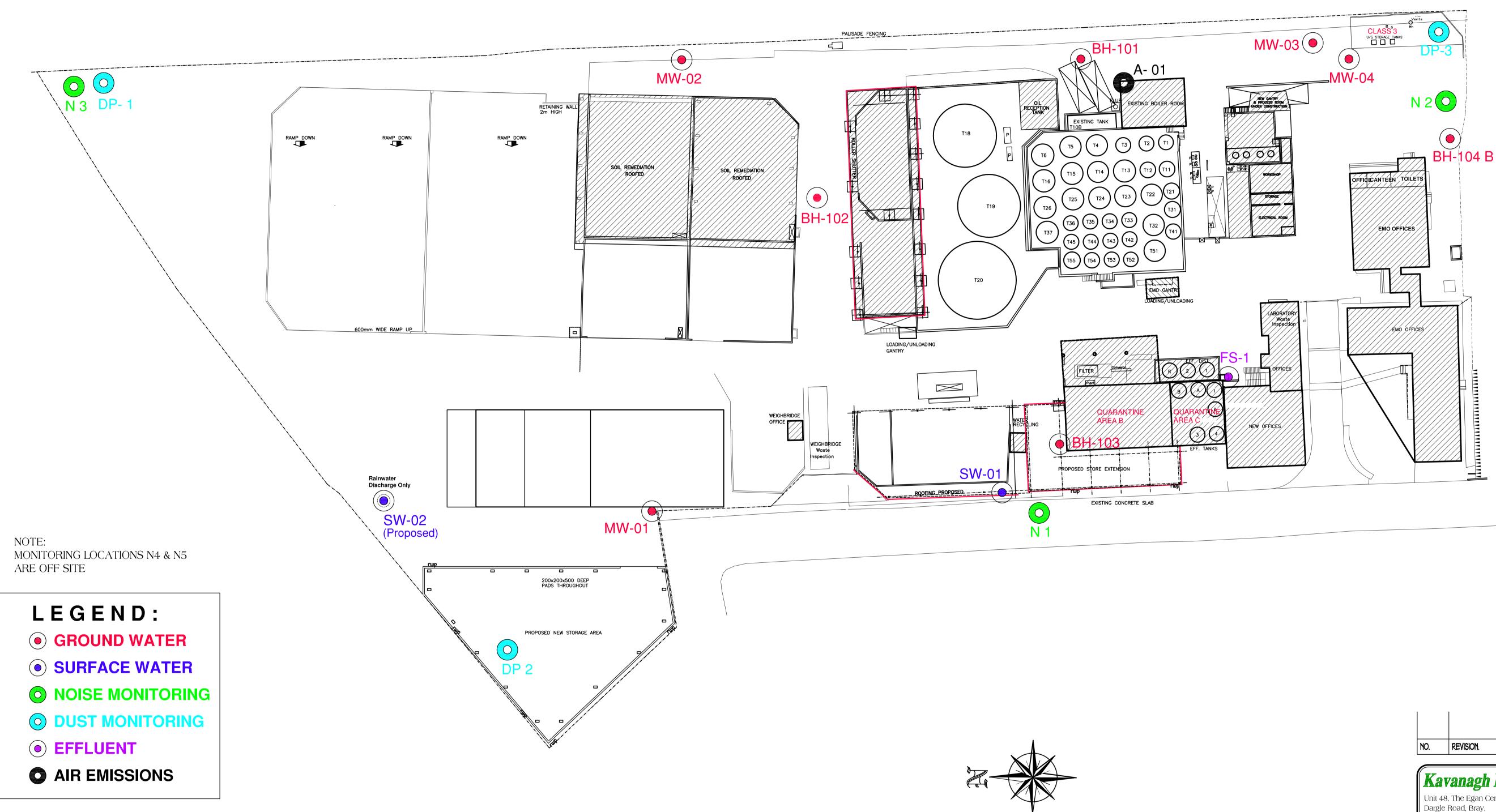
Combustion Efficiency

Parameter	Value
FT	186.3
Ambient Temp	9.4
A2 (Fuel Specific Factors)	0.66
Oxygen level in air	20.9
Measured oxygen	5.6

FT - AT	176.9
A2 / 20.9- O2	0.043137
plus B fuel specific factors	0.009
Calculation of efficiency qA	7.64
%	92.36

 $e^{i\theta}$

Appendix 8



Enva Ireland: Monitoring locations

NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT KAVANAGH RYAN & ASSOCIATES DRAWINGS AND SPECIFICATIONS.

2. ALL DIMENSIONS TO BE CONFIRMED. DO NOT SCALE DRAWING.

NO.	REVISION.		DATE
Ka Unit 4 Dargle		Ryan & Assoc re, Tel. 2765661. Fax. 27 E-mail. kmryan@eircor	
CLIEN	r ste Storage /	Areas.	enva
TITLE			ENVA LIMITED, CLONMINAM IND. EST., PORTLAOISE, Co. LAOIS.
DRAW	^N A.C.	SCALE 1:400.	DRAWING No.
JOB. N	^{/o.} C02104,	DATE Aug. '08.	At-WSA 1.

Appendix 9

