1. Abbreviations and Definitions

Definitions for the Environmental Risk Assessment	
Activity / Event	The specific operation being undertaken relating to the proposed hazard and risk.
Hazard	The hazards category i.e. type of emission.
Source	The pollutants from the activity taking place such as flaring.
Pathway	The pathway the pollutant is taking such as air or unsaturated zones.
Receptor	Those who it may have an adverse effect on i.e. surrounding residents, wildlife and habitats, designated sites.
Exposure Probability	The chance of the hazard occurring without taking into account mitigation measures.
Impact Severity	The impact of the hazard should it occur without taking into account mitigation measures.
Risk Magnitude	A hazard that has been assessed and has been given a risk rating level pre-mitigation measures.
Risk Management	Mitigation measures that will be put in place to control the risks so far as reasonably practicable.
Residual Risk	A hazard that has been assessed and has been given a risk rating level post mitigation measures.
Not Significant	The severity, together with the likelihood of the risk is not expected to cause any harm to the environment.
Low	The severity, together with the likelihood of the risk has low potential to cause harm to the environment.
Medium	The severity, together with the likelihood of the risk has moderate potential to cause harm to the environment.
High	The severity, together with the likelihood of the risk has a high potential to cause harm to the environment.

Table 1: Definitions

2. Methodology

The structure of the Environmental Risk Assessment follows the Environment Agency online guidance and uses a model known as the 'Source-Pathway-Receptor' model. The Environmental Risk Assessment shall:

- identify the risk from the site;
- assess risks and checking they are acceptable;
- justify appropriate measures to control the risk (if needed); and
- present the findings of the risk assessment.

The Environmental Risk Assessment has included the following categories which have been reviewed for applicability within the proposed operations.

- Accidents.
- Air Emissions.
- Climate Change
- Fugitive Emissions.
- Global Warming Potential.
- Noise.
- Odour.
- Releases to Water.
- Visible Emissions.

3. Scoring Criteria

In order to establish a risk rating for each Source-Pathway-Receptor (S-P-R) linkage both the Likelihood (Exposure Probability) and Consequence (Impact Severity) have been issued with a score using Table 2 and Table 3 respectively. The score is used in conjunction with Table 4 to provide an overall risk rating of the activity. All scores and risk ratings are provided on the basis that the mitigation measure are not in place.

The Residual Risk uses the same scoring system but does consider the proposed mitigation measures.

Likelihood	Descriptor
Very Low	Rarely encountered, never reported or highly unlikely.
Low	Infrequent occurrences.
Medium	Can be expected to occur several times per year.
High	Repeated Occurrences.

Table 2: Scoring System Likelihood

Consequence	Descriptor
Very Low	Slight environmental effect that does not exceed a regulatory standard.
Low	Minor environmental effect, may breach a regulatory standard, localised to the point of release with no significant impact.
Medium	Moderate, localised effect on people and the environment in the vicinity of the incident.
High	A major environmental incident resulting in significant damage to the environment and harm to human health.

Table 3: Scoring System Consequence

The risk matrix presented in Table 4 provides a risk rating for each S-P-R linkage identified within this Environmental Risk Assessment.

Risk Rating		Consequence			
		Very Low	Low	Medium	High
Likelihood	Very Low	Not Significant	Not Significant	Low	Low
	Low	Not Significant	Low	Medium	Medium
	Medium	Low	Medium	Medium	High
	High	Low	Medium	High	High

Table 4: Risk Matrix

Environmental risks are assigned a Not Significant, Low, Medium or High risk rating and coded using a colour coded system. A description of each risk rating is presented in Table 5 below.

Consequence	Acceptable	Descriptor
Not Significant	Acceptable	Near-certain that an incident will not occur, or the consequences would not be significant.
Low	Acceptable	Unlikely an incident will occur, or the consequences would be minor confined to the immediate area.
Medium	Tolerable	Activity can only take place provided that impacts are localised and risk remediation is readily
High	Unacceptable	The risk must be further reduced before the activity can commence.

Table 5: Risk Rating Definition

Receptors	Search Radius (km)	Name	Distance (km)	Direction from Site	Grid Reference (Edge)
RAMSAR	10	Humber Estuary	10.00	North	SE 96425 21193
Special Areas of Conservation (SAC)	10	Humber Estuary	10.00	North	SE 96425 21193
Special Protection Areas (SPA)	10	Humber Estuary	10.00	North	SE 96425 21193
Marine Protection Areas (MPA)	10	Humber Estuary	10.00	North	SE 96425 21193
Sites of Special Scientific Interest (SSSI)	2	Broughton Far Wood	0.60	West	SE 96150 10927
		Broughton Alder Wood	1.19	South West	SE 96114 10005
Scheduled Ancient Monuments (SAM)	2	Thornholme Augustinian Priory	1.20	North	SE 96517 12322
National Nature Reserves	2	-	-	-	-
Local Nature Reserves	2	-	-	-	-
Site of Nature Conservation Interest / Local Wildlife Sites (LWS) *Details provided from Lincolnshire Environmental Records Centre (Grid Reference Data Limited)	2	Rowland Plantation	0.27	North	SE 95900 11500
		Broughton Far Wood	0.60	West	SE 96150 10927
		Clapgate Pit	0.70	West	SE 96136 10944
		Broughton East Wood	0.76	South West	SE 96652 10304
		Far Wood Farm Meadow	1.16	South West	SE 95900 09900
		Heron Holt	1.26	South West	-
		Kebb Wood	1.30	North West	SE 95800 12300
		Spring Wood	1.30	West	SE 95300 11200
		Haverholme Common	1.40	North West	SE 95100 12100
		New River Ancholme	1.50	East	SE 98200 11500
		Weir Dyke	1.60	North East	SE 98100 12000
		Broughton West Wood	3.00	South West	SE 95555 09822
Water Features (Closest in All Directions)	2	Ella Beck “Main River”. Circumventing the site.	0.01	North	SE 96780 11165
		Dyke East of Site First drain down gradient of the wellsite	0.58	East	SE 96909 11118
		Small Pond east of Rowland Plantation	0.59	North	SE 96744 11634
		Small Pond at The Lodge. Water on either side of the B1208 road	0.83	South	SE 96715 10292
		Small Ponds at Common Farm	0.96	South East	SE 97492 10465
		Large Pond	0.97	North	SE 96930 12041
		Small Pond at Kebwood Farm	1.04	West	SE 96391 12071
		Small Pond Small Pond south of Broughton Grange	1.06	South	SE 97056 10100
		Small Pond 1 at Far Wood Farm	1.18	South West	SE 96239 10029
		Small Pond 2 at Far Wood Farm	1.18	South West	SE 96256 09995
		Large Pond at near Birdhouse Clough	1.32	North East	SE 98006 11560
		Small Fish Pond 1 at the Priory	1.32	North	SE 96640 12362
		Small Fish Pond 2 at the Priory	1.34	North	SE 96581 12382
		Small Fish Pond 3 at the Priory	1.42	North	SE 96728 12376
		Small Pond 3 at Far Wood Farm	1.42	South West	SE 96154 10003
		Spring 1 near Far Wood Farm	1.43	South West	SE 95923 09966
		Planker Dike	1.49	East	SE 98317 11322
		Spring 2 near Far Wood Farm	1.49	South West	SE 95818 09983
		Appleby Old River Ancholme	1.57	East	SE 98282 11732
		New River Ancholme	1.58	East	SE 98332 11269
		Small Pond SW of Appleby Carrs Pump Station	1.76	North East	SE 97701 12530
		Small Pond at Wressle Wood	1.76	South East	SE 97797 09692
		Small Pond at Broom Hill	1.84	West	SE 95015 11496
		Small Pond at Watermill Place fed by Moor Beck	1.86	South	SE 97035 09324
		Moor Beck Running eastward and joining Ella Beck	1.87	South	SE 97290 09531
		Large Pond at The Follies	1.91	North	SE 96562 12912
		Spring at Westwood Lodge discharging to the east	1.96	South West	SE 95467 09644
		Small Pond at Appleby Carrs Pumping Station	2.00	North East	SE 97891 12751
Sensitive Receptors: Households / Businesses	2	Decoy Cottage	0.48	South East	SE 97275 10822
		Lodge Farm and Adjacent Dwellings	0.50	West	SE 96249 11008
		Broughton Decoy Farm	0.63	South East	SE 97377 10856
		Broughton Grange	0.63	South	SE 96143 10088
		Broughton Grange Cottages & Dog Sanctuary	0.71	South West	SE 96617 10413
		Far Wood Farm	1.08	South West	SE 97001 10369
		Sandbeck	1.10	South East	SE 97547 10207
		Kebwood Farm	1.17	North	SE 96154 12190
		Common Farm	1.20	South East	SE 97528 10400
		Dairy Farm	1.27	South East	SE 97430 09962
		Wressle	1.35	South	SE 97278 09789
		Broughton	1.54	South	SE 96234 09566
		Heron Lodge	1.55	West	SE 95211 10690
		Springwood Lodge & Cottage	1.64	West	SE 95080 11065
		Sandhouse Farm	1.85	North West	SE 95549 12566
		Gokewell Priory Farm (Poultry Farm)	1.96	South West	SE 95016 10056

Table 6: Receptor Details

ID	S-P-R Linkage			Exposure Probability	Impact Severity	Risk Magnitude	Risk Management	Residual Risk
	Source	Pathway	Receptor					
AE1	Exhaust Releases from engines including: • Vehicles. • Ancillary Plant (Generators). • Main Plant (Rig/Well Test Spread).	Emitted to air and carried on wind.	See Receptor Table.	Very Low	Low	Not Significant	Air Quality Impact Assessment concludes no significant impact. Equipment installed, serviced and maintained by competent and qualified contractors. Generators assessed for compliance with Emission Limit Values. Records kept of complaints and subsequent mitigation imposed if necessary. Regular maintenance and inspections conducted as directed by written procedures. Sensitive Receptors in excess of 500 metres away from the development. Trained persons to operate vehicles and site plant. Vehicles and plant serviced and maintained in line with manufacturer requirements. Vehicles and plant switched off when not in use.	Not Significant
AE2	Oil Storage: • Vent line.	Emitted to air and carried on wind.	See Receptor Table.	Very Low	Very Low	Not Significant	Air Quality Impact Assessment concludes no significant impact. Breather line elevated to promote better dispersion of the entrained oil vapours. Dedicated scrubbers in place to remove H2S from natural gas, if necessary. H2S is not anticipated at a level above 5.7 mg/Nm3 as stated within the EA permit. Records kept of complaints and subsequent mitigation imposed if necessary. Sensitive Receptors in excess of 500 metres away from the development. Vent lines subject of a drum filters remove VOC's where necessary.	Not Significant
AE3	Incineration of Natural Gas: • Flare Tip / Stack.	Emitted to air and carried on wind.	See Receptor Table.	Low	Low	Low	Air Quality Impact Assessment concludes no significant impact. Combustion temperature managed to ensure efficient (>98%) combustion efficiency. Combustion unit subject to approval by the EA. Dedicated scrubbers in place to remove H2S from natural gas, if necessary. Equipment installed, serviced and maintained by competent and qualified contractors. Flare monitoring (to be) in place with results reported in accordance with EA permit. H2S is not anticipated at a level above 5.7 mg/Nm3 as stated within the EA permit. Records kept of complaints and subsequent mitigation imposed if necessary. Regular maintenance and inspections conducted as directed by written procedures. Sensitive Receptors in excess of 500 metres away from the development. Trained persons to operate vehicles and site plant. Vehicles and plant serviced and maintained in line with manufacturer requirements.	Not Significant

ID	S-P-R Linkage			Exposure Probability	Impact Severity	Risk Magnitude	Risk Management	Residual Risk
	Source	Pathway	Receptor					
VE1	Exhaust Releases from engines including: • Vehicles. • Ancillary Plant (Generators). • Main Plant (Rig/Well Test Spread).	Emitted to air and carried on wind.	See Receptor Table.	Very Low	Very Low	Not Significant	Air Quality Impact Assessment concludes no significant impact. Equipment installed, serviced and maintained by competent and qualified contractors. Generators assessed for compliance with Emission Limit Values. Records kept of complaints and subsequent mitigation imposed if necessary. Regular maintenance and inspections conducted as directed by written procedures. Sensitive Receptors in excess of 500 metres away from the development. Trained persons to operate vehicles and site plant. Vehicles and plant serviced and maintained in line with manufacturer requirements. Vehicles and plant switched off when not in use.	Not Significant
VE2	Incineration of Natural Gas: • Flare Tip / Stack.	Emitted to air and carried on wind.	See Receptor Table.	Very Low	Low	Not Significant	Air Quality Impact Assessment concludes no significant impact. Combustion temperature managed to ensure efficient (>98%) combustion efficiency. Combustion unit subject to approval by the EA. Dedicated scrubbers in place to remove H2S from natural gas, if necessary. Equipment installed, serviced and maintained by competent and qualified contractors. Flare monitoring (to be) in place with results reported in accordance with EA permit. H2S is not anticipated at a level above 5.7 mg/Nm3 as stated within the EA permit. Records kept of complaints and subsequent mitigation imposed if necessary. Regular maintenance and inspections conducted as directed by written procedures. Sensitive Receptors in excess of 500 metres away from the development. Trained persons to operate vehicles and site plant. Vehicles and plant serviced and maintained in line with manufacturer requirements.	Not Significant

ID	S-P-R Linkage			Exposure Probability	Impact Severity	Risk Magnitude	Risk Management	Residual Risk
	Source	Pathway	Receptor					
OE1	Exhaust Releases from engines including: • Vehicles. • Ancillary Plant (Generators). • Main Plant (Rig/Well Test Spread).	Emitted to air and carried on wind.	See Receptor Table.	Very Low	Low	Not Significant	Equipment installed, serviced and maintained by competent and qualified contractors. Generators assessed for compliance with Emission Limit Values. Odour Management Plan implemented for the site, if required. Records kept of complaints and subsequent mitigation imposed if necessary. Regular maintenance and inspections conducted as directed by written procedures. Sensitive Receptors in excess of 500 metres away from the development. Trained persons to operate vehicles and site plant. Vehicles and plant serviced and maintained in line with manufacturer requirements. Vehicles and plant switched off when not in use. Working personnel subject to a site induction covering odour management.	Not Significant
OE2	Oil Storage • Vent line.	Emitted to air and carried on wind.	See Receptor Table.	Very Low	Low	Not Significant	Breather line elevated to promote better dispersion of the entrained oil vapours. Dedicated scrubbers in place to remove H2S from natural gas, if necessary. H2S is not anticipated at a level above 5.7 mg/Nm3 as stated within the EA permit. Odour Management Plan implemented for the site, if required. Records kept of complaints and subsequent mitigation imposed if necessary. Sensitive Receptors in excess of 500 metres away from the development. Vent lines subject of a drum filters remove VOC's where necessary. Working personnel subject to a site induction covering odour management.	Not Significant
OE3	Incineration of Natural Gas: • Flare Tip / Stack.	Emitted to air and carried on wind.	See Receptor Table.	Low	Low	Low	Combustion temperature managed to ensure efficient (>98%) combustion efficiency. Combustion unit subject to approval by the EA. Dedicated scrubbers in place to remove H2S from natural gas, if necessary. Equipment installed, serviced and maintained by competent and qualified contractors. Flare monitoring (to be) in place with results reported in accordance with EA permit. H2S is not anticipated at a level above 5.7 mg/Nm3 as stated within the EA permit. Odour Management Plan implemented for the site, if required. Records kept of complaints and subsequent mitigation imposed if necessary. Regular maintenance and inspections conducted as directed by written procedures. Sensitive Receptors in excess of 500 metres away from the development. Trained persons to operate vehicles and site plant. Vehicles and plant serviced and maintained in line with manufacturer requirements. Working personnel subject to a site induction covering odour management.	Not Significant
OE4	Gas Refining. • Pipework and Plant.	Emitted to air and carried on wind.	See Receptor Table.	Very Low	Low	Not Significant	Competent personnel only to store / use chemicals. Dedicated scrubbers in place to remove H2S from natural gas, if necessary. Equipment installed, serviced and maintained by competent and qualified contractors. H2S is not anticipated at a level above 5.7 mg/Nm3 as stated within the EA permit. Odour Management Plan implemented for the site, if required. Plant, tanks and pipework tested for leaks prior to first use to confirm integrity. Quantities of odorous products to be kept to a minimum. Records kept of complaints and subsequent mitigation imposed if necessary. Regular maintenance and inspections conducted as directed by written procedures. Sensitive Receptors in excess of 500 metres away from the development. Trained persons to operate vehicles and site plant. Vehicles and plant serviced and maintained in line with manufacturer requirements. Working personnel subject to a site induction covering odour management.	Not Significant

ID	S-P-R Linkage			Exposure Probability	Impact Severity	Risk Magnitude	Risk Management	Residual Risk
	Source	Pathway	Receptor					
OE5	Drilling / Workover / Treatment Operations: • Circulation of Drilling / Well Fluid. • Storage of Drilling / Well Fluid. • Residual Fluids on Plant Surface.	Emitted to air and carried on wind.	See Receptor Table.	Low	Medium	Medium	Breaking containment of tanks and pipework systems shall minimised. Chemicals segregated, stored correctly and sealed when not in use. Cleaning and purging where possible prior to pulling out of hole. Drilling mud provides over balanced weight to prevent gas to surface. Equipment cleaned / purged where possible prior to breaking containment. Equipment installed, serviced and maintained by competent and qualified contractors. Odour Management Plan implemented for the site, if required. Odourless products used ahead of those which give rise to odour where practicable. Plant, tanks and pipework tested for leaks prior to first use to confirm integrity. Plant, tanks and pipework capped / plugged after breaking containment. Plant, tanks and pipework cleaned / purged where possible prior to breaking containment. Products kept within their dedicated storage area when not in use. Quantities of odorous products to be kept to a minimum. Records kept of complaints and subsequent mitigation imposed if necessary. Sensitive Receptors in excess of 500 metres away from the development. Working personnel subject to a site induction covering odour management.	Not Significant
OE6	Ancillary Operations: • Storage and Use of Raw Materials. • Storage of Waste	Emitted to air and carried on wind.	See Receptor Table.	Low	Low	Low	Chemicals segregated, stored correctly and sealed when not in use. Competent personnel only to store / use chemicals. Containers checked on delivery, pre-use and periodically for signs of damage/leaks. Drip trays used for the transfer or decanting of fuel/small volume liquids such as engine oil. Odour Management Plan implemented for the site, if required. Odourless products used ahead of those which give rise to odour where practicable. Products kept within their dedicated storage area when not in use. Quantities of odorous products to be kept to a minimum. Records kept of complaints and subsequent mitigation imposed if necessary. Regular maintenance and inspections conducted as directed by written procedures. Sensitive Receptors in excess of 500 metres away from the development. Skips clearly marked to ensure waste segregation and avoid cross contamination. Skips monitored daily and emptied as required. Skips self-contained / enclosed to prevent emissions. Tanks monitored and emptied as required. Tanks self-contained / enclosed where necessary to limit emissions to air. Working personnel subject to a site induction covering odour management.	Not Significant

ID	S-P-R Linkage			Exposure Probability	Impact Severity	Risk Magnitude	Risk Management	Residual Risk
	Source	Pathway	Receptor					
NE1	Noise Releases from engines including: • Vehicles. • Ancillary Plant (Generators). • Main Plant (Rig/Well Test Spread).	Atmosphere and Ground Vibrations.	See Receptor Table.	Medium	Low	Medium	Compliance with planning authority noise limits. Installation of acoustic barrier where required. Noise monitoring imposed if required. Records kept of complaints and subsequent mitigation imposed if necessary. Regular maintenance and inspections conducted as directed by written procedures. Sensitive Receptors in excess of 500 metres away from the development. Vehicles and plant serviced and maintained in line with manufacturer requirements. Vehicles and plant switched off when not in use.	Not Significant
NE2	Incineration of Natural Gas: • Flare Tip / Stack.	Atmosphere and Ground Vibrations.	See Receptor Table.	Low	Low	Low	Compliance with planning authority noise limits. Installation of acoustic barrier where required. Noise monitoring imposed if required. Records kept of complaints and subsequent mitigation imposed if necessary. Regular maintenance and inspections conducted as directed by written procedures. Sensitive Receptors in excess of 500 metres away from the development. Vehicles and plant serviced and maintained in line with manufacturer requirements. Vehicles and plant switched off when not in use.	Not Significant
NE3	Noise Releases from ancillary operations.	Atmosphere and Ground Vibrations.	See Receptor Table.	Low	Low	Low	Compliance with planning authority noise limits. Installation of acoustic barrier where required. Loading/unloading operations planned for day light hours where possible. Noise monitoring imposed if required. Records kept of complaints and subsequent mitigation imposed if necessary. Regular maintenance and inspections conducted as directed by written procedures. Sensitive Receptors in excess of 500 metres away from the development. Trained operators to load / unload vehicles using MHE plant equipment. Vehicles and plant serviced and maintained in line with manufacturer requirements. Vehicles and plant switched off when not in use. White noise reversing alarms fitted to site vehicles if required.	Not Significant

ID	S-P-R Linkage			Exposure Probability	Impact Severity	Risk Magnitude	Risk Management	Residual Risk
	Source	Pathway	Receptor					
SE1	Permitted Discharge of Uncontaminated Rain Water to Watercourse.	Flow by Gravity.	See Receptor Table.	Very Low	Very Low	Not Significant	Competent persons appointed to open, close and manage the interceptor. Discharge only permitted during low impact activities i.e. production / suspension. Greenfield run-off rate complied with by using an orifice plate or similar. Groundwater monitoring (to be) in place with results reported in accordance with EA permit. Permitted interceptor (separator) installed. Qualified and competent site supervisor appointed. Routine visual check on the containment ditch by operatives.	Not Significant

ID	S-P-R Linkage			Exposure Probability	Impact Severity	Risk Magnitude	Risk Management	Residual Risk
	Source	Pathway	Receptor					
GE1	Indirect input to groundwater from the well including: • Proppant Carrier Fluid • Proppant • Produced Water from Re-Injection	Flow by Gravity / Formation Pressures.	See Receptor Table.	Low	Low	Low	Borehole(s) design approved by the EA under the WR11 Process. Borehole(s) design reviewed by an independent well examiner and the HSE. Borehole(s) designed and constructed to industry standards. Groundwater monitoring (to be) in place with results reported in accordance with EA permit. Loss circulation material available within drilling fluid for drilling activities. No direct input to groundwater is being proposed. Qualified and competent site supervisor appointed. Substances shall be approved for use by the Environment Agency and assesed using JAGDAG methodology. The activity shall be the subject of a Hydraulic Fracture Plan and subject to regulatory approval.	Not Applicable

ID	S-P-R Linkage			Exposure Probability	Impact Severity	Risk Magnitude	Risk Management	Residual Risk
	Source	Pathway	Receptor					
FE1	Air Emission Odour Emission Natural Gas release from the Wellbore.	Carried on Wind	See Receptor Table.	Very Low	Medium	Low	Borehole(s) design reviewed by an independent well examiner and the HSE. Borehole(s) designed and constructed to industry standards. Drilling mud provides over balanced weight to prevent gas to surface. Emergency Response Plan for the site. Gas detectors deployed with an alarm trigger of 5ppm / 7mg.m3 (EH40 WELs). H2S is not anticipated at a level above 5.7 mg/Nm3 as stated within the EA permit. Local Fire & Rescue Service notified of operations. Loss circulation material available within drilling fluid for drilling activities. Odour Management Plan implemented for the site, if required. Plant, tanks and pipework tested for leaks prior to first use to confirm integrity. Qualified and competent site supervisor appointed. Regular maintenance and inspections conducted as directed by written procedures. Sensitive Receptors in excess of 500 metres away from the development. Site based fire risk assessment in place and detailing the mitigation measures. Trained persons to operate vehicles and site plant. Vehicles and plant serviced and maintained in line with manufacturer requirements. Working personnel subject to a site induction covering odour management.	Not Significant
FE2	Air Emission Odour Emission Natural Gas release from the Flare Unit.	Carried on Wind	See Receptor Table.	Low	Medium	Medium	Dedicated scrubbers in place to remove H2S from natural gas, if necessary. Emergency Response Plan for the site. Flare unit to have a permenant source of ignition i.e. pilot light. Gas detectors deployed with an alarm trigger of 5ppm / 7mg.m3 (EH40 WELs). H2S is not anticipated at a level above 5.7 mg/Nm3 as stated within the EA permit. Local Fire & Rescue Service notified of operations. Odour Management Plan implemented for the site, if required. Qualified and competent site supervisor appointed. Regular maintenance and inspections conducted as directed by written procedures. Sensitive Receptors in excess of 500 metres away from the development. Trained persons to operate vehicles and site plant. Vehicles and plant serviced and maintained in line with manufacturer requirements. Working personnel subject to a site induction covering odour management.	Not Significant
FE3	Air Emission Odour Emission Natural Gas release from: • Gas Engine • Gas Turbine	Carried on Wind	See Receptor Table.	Low	Medium	Medium	Dedicated scrubbers in place to remove H2S from natural gas, if necessary. Emergency Response Plan for the site. Gas detectors deployed with an alarm trigger of 5ppm / 7mg.m3 (EH40 WELs). H2S is not anticipated at a level above 5.7 mg/Nm3 as stated within the EA permit. Local Fire & Rescue Service notified of operations. Odour Management Plan implemented for the site, if required. Plant, tanks and pipework tested for leaks prior to first use to confirm integrity. Plant, tanks and pipework cleaned / purged where possible prior to breaking containment. Qualified and competent site supervisor appointed. Regular maintenance and inspections conducted as directed by written procedures. Safety flare installed to incinerate unexpected / blowdown gas. Sensitive Receptors in excess of 500 metres away from the development. Trained persons to operate vehicles and site plant. Vehicles and plant serviced and maintained in line with manufacturer requirements. Working personnel subject to a site induction covering odour management.	Not Significant
FE4	Air Emission Odour Emission Natural Gas release from Pipework and connecting joints.	Carried on Wind	See Receptor Table.	Low	Medium	Medium	Breaking containment of tanks and pipework systems shall minimised. Dedicated scrubbers in place to remove H2S from natural gas, if necessary. Gas detectors deployed with an alarm trigger of 5ppm / 7mg.m3 (EH40 WELs). H2S is not anticipated at a level above 5.7 mg/Nm3 as stated within the EA permit. Leak Detection and Repair Plan for the site. Local Fire & Rescue Service notified of operations. Odour Management Plan implemented for the site, if required. Plant, tanks and pipework tested for leaks prior to first use to confirm integrity. Plant, tanks and pipework capped / plugged after breaking containment. Plant, tanks and pipework cleaned / purged where possible prior to breaking containment. Qualified and competent site supervisor appointed.	Not Significant

ID	S-P-R Linkage			Exposure Probability	Impact Severity	Risk Magnitude	Risk Management	Residual Risk
	Source	Pathway	Receptor					
							Regular maintenance and inspections conducted as directed by written procedures. Sensitive Receptors in excess of 500 metres away from the development. Working personnel subject to a site induction covering odour management.	
FE5	Air Emission Odour Emission Fume Emissions from Chemical Reactions.	Carried on Wind	See Receptor Table.	Very Low	Low	Not Significant	Chemicals segregated, stored correctly and sealed when not in use. Competent personnel only to store / use chemicals. COSHH Assessments and SDS sheets in place for hazardous substances. COSHH Items stored appropriately in accordance with SDS and regulations. Drip trays used for the transfer or decanting of fuel/small volume liquids such as engine oil. Leak Detection and Repair Plan for the site. Loss circulation material available within drilling fluid for drilling activities. Odour Management Plan implemented for the site, if required. Plant, tanks and pipework tested for leaks prior to first use to confirm integrity. Plant, tanks and pipework capped / plugged after breaking containment. Plant, tanks and pipework cleaned / purged where possible prior to breaking containment. Qualified and competent site supervisor appointed. Regular maintenance and inspections conducted as directed by written procedures. Sensitive Receptors in excess of 500 metres away from the development. Spillage response procedure for the site established. Suitable spillage kits available on site / transport vehicles. Working personnel subject to a site induction covering odour management.	Not Significant
FE6	Air Emission Visible Emission Litter	Carried on Wind	See Receptor Table.	High	Very Low	Medium	Litter cleared routinely as part of working day. Operations planned / designed to minimise transport and handling operations. Provision of adequate refuse receptacles for both inside and outside working areas. Records kept of complaints and subsequent mitigation imposed if necessary. Sensitive Receptors in excess of 500 metres away from the development.	Not Significant
FE7	Air Emission Visible Emission Dust	Carried on Wind	See Receptor Table.	High	Very Low	Medium	Avoid activities that present dust if high winds occur. Operations planned / designed to minimise transport and handling operations. Records kept of complaints and subsequent mitigation imposed if necessary. Trained persons to operate vehicles and site plant.	Not Significant
FE8	Surface Water Emission • Leaks from process pipework. • Leaks from storage vessels. • Leaks from plant. • Leaks from welfare pipework. • Leaks from foul sewage pipework.	Flow by Gravity.	See Receptor Table.	High	Very Low	Medium	Breaking containment of tanks and pipework systems shall minimised. Competent persons appointed to open, close and manage the interceptor. Discharge only permitted during low impact activities i.e. production / suspension. HDPE membrane is in place and the subject of visual inspection where possible. Leak Detection and Repair Plan for the site. Permitted interceptor (separator) installed. Plant, tanks and pipework tested for leaks prior to first use to confirm integrity. Plant, tanks and pipework capped / plugged after breaking containment. Plant, tanks and pipework cleaned / purged where possible prior to breaking containment. Qualified and competent site supervisor appointed. Records kept of complaints and subsequent mitigation imposed if necessary. Regular maintenance and inspections conducted as directed by written procedures. Routine visual check on the containment ditch by operatives. Spillage response procedure for the site established. Suitable spillage kits available on site / transport vehicles. Surface water monitoring (to be) in place with results reported in accordance with EA permit. Vehicles and plant serviced and maintained in line with manufacturer requirements.	Not Significant

ID	S-P-R Linkage			Exposure Probability	Impact Severity	Risk Magnitude	Risk Management	Residual Risk
	Source	Pathway	Receptor					
FE10	Groundwater Emission • Leaks from process pipework. • Leaks from storage vessels. • Leaks from plant. • Leaks from welfare pipework. • Leaks from foul sewage pipework.	Percolate to underlying Groundwaters.	See Receptor Table.	High	Very Low	Medium	Breaking containment of tanks and pipework systems shall minimised. Leak Detection and Repair Plan for the site. Plant, tanks and pipework tested for leaks prior to first use to confirm integrity. Plant, tanks and pipework capped / plugged after breaking containment. Plant, tanks and pipework cleaned / purged where possible prior to breaking containment. Qualified and competent site supervisor appointed. Records kept of complaints and subsequent mitigation imposed if necessary. Regular maintenance and inspections conducted as directed by written procedures. Spillage response procedure for the site established. Suitable spillage kits available on site / transport vehicles. Surface water monitoring (to be) in place with results reported in accordance with EA permit. Vehicles and plant serviced and maintained in line with manufacturer requirements.	Not Significant
FE12	Groundwater Emission • Drilling Fluid. • Well Treatment Fluid (Non-Returns). • Circulation / Suspension Fluid.	Flow by Gravity / Formation Pressures.	See Receptor Table.	High	Very Low	Medium	Borehole(s) design approved by the EA under the WR11 Process. Borehole(s) design reviewed by an independent well examiner and the HSE. Borehole(s) designed and constructed to industry standards. COSHH Assessments and SDS sheets in place for hazardous substances. Groundwater monitoring (to be) in place with results reported in accordance with EA permit. Loss circulation material available within drilling fluid for drilling activities. Qualified and competent site supervisor appointed. Records kept of complaints and subsequent mitigation imposed if necessary. Water based drilling fluid used whilst drilling through near surface (<400m) aquifers.	Not Significant
FE13	Noise and Vibration Emission • Mechanical Failures. • Mechanical Defects.	Atmosphere and Ground Vibrations.	See Receptor Table.	Medium	Very Low	Low	Plant, tanks and pipework tested for leaks prior to first use to confirm integrity. Records kept of complaints and subsequent mitigation imposed if necessary. Regular maintenance and inspections conducted as directed by written procedures. Sensitive Receptors in excess of 500 metres away from the development. Trained persons to operate vehicles and site plant. Vehicles and plant serviced and maintained in line with manufacturer requirements.	Not Significant

ID	S-P-R Linkage			Exposure Probability	Impact Severity	Risk Magnitude	Risk Management	Residual Risk
	Source	Pathway	Receptor					
AC1	Transferring Substances: • Spillages. • Overfilling. • Incorrect Connections.	Vapours Carried on Wind. Flow by Gravity.	See Receptor Table.	Low	Medium	Medium	Competent personnel only to store / use chemicals. COSHH Assessments and SDS sheets in place for hazardous substances. Drip trays used for the transfer or decanting of fuel/small volume liquids such as engine oil. Emergency Response Plan for the site. HDPE membrane is in place and the subject of visual inspection where possible. Operations planned / designed to minimise transport and handling operations. Qualified and competent site supervisor appointed. Records kept of complaints and subsequent mitigation imposed if necessary. Secondary containment installed to prevent spill onto tertiary containment system (HDPE). Spillage response procedure for the site established. Suitable spillage kits available on site / transport vehicles. Surface water monitoring (to be) in place with results reported in accordance with EA permit. Where HDPE failure is suspected, non-intrusive testing shall be undertaken.	Not Significant
AC2	Poor Storage Arrangements of Hazardous Substances	Vapours Carried on Wind. Flow by Gravity.	See Receptor Table.	Low	Medium	Medium	Chemicals segregated, stored correctly and sealed when not in use. Competent personnel only to store / use chemicals. COSHH Assessments and SDS sheets in place for hazardous substances. COSHH Items stored appropriately in accordance with SDS and regulations. Emergency Response Plan for the site. HDPE membrane is in place and the subject of visual inspection where possible. Qualified and competent site supervisor appointed. Records kept of complaints and subsequent mitigation imposed if necessary. Secondary containment installed to prevent spill onto tertiary containment system (HDPE). Spillage response procedure for the site established. Where HDPE failure is suspected, non-intrusive testing shall be undertaken.	Not Significant
AC3	Incompatible Substances coming into contact. (Unwanted Reactions).	Vapours Carried on Wind. Flow by Gravity.	See Receptor Table.	Very Low	Medium	Low	Chemicals segregated, stored correctly and sealed when not in use. Competent personnel only to store / use chemicals. COSHH Assessments and SDS sheets in place for hazardous substances. COSHH Items stored appropriately in accordance with SDS and regulations. Emergency Response Plan for the site. HDPE membrane is in place and the subject of visual inspection where possible. Operations planned / designed to minimise transport and handling operations. Qualified and competent site supervisor appointed. Regular maintenance and inspections conducted as directed by written procedures. Spillage response procedure for the site established. Suitable spillage kits available on site / transport vehicles. Where HDPE failure is suspected, non-intrusive testing shall be undertaken.	Not Significant
AC4	Runaway Reactions	Vapours Carried on Wind. Flow by Gravity.	See Receptor Table.	Very Low	Medium	Low	Competent personnel only to store / use chemicals. COSHH Assessments and SDS sheets in place for hazardous substances. Emergency Response Plan for the site. HDPE membrane is in place and the subject of visual inspection where possible. Qualified and competent site supervisor appointed. Regular maintenance and inspections conducted as directed by written procedures. Spillage response procedure for the site established. Suitable spillage kits available on site / transport vehicles. Where HDPE failure is suspected, non-intrusive testing shall be undertaken.	Not Significant
AC5	Impact from Fire Water: • Use of Fire Water	Flow by Gravity.	See Receptor Table.	Low	Low	Low	Competent persons appointed to open, close and manage the interceptor. Emergency Response Plan for the site. Groundwater monitoring (to be) in place with results reported in accordance with EA permit. HDPE membrane is in place and the subject of visual inspection where possible. Qualified and competent site supervisor appointed. Secondary containment installed to prevent spill onto tertiary containment system (HDPE). Site based fire risk assessment in place and detailing the mitigation measures. Site designed to flood in the first instance before over spilling.	Not Significant

ID	S-P-R Linkage			Exposure Probability	Impact Severity	Risk Magnitude	Risk Management	Residual Risk
	Source	Pathway	Receptor					
AC6	Fire and Associated Fumes.	Smoke and Embers Carried on Wind. Spread of fire on the Ground.	See Receptor Table.	Low	High	Medium	Breaking containment of tanks and pipework systems shall minimised. Breather line elevated to promote better dispersion of the entrained oil vapours. Chemicals segregated, stored correctly and sealed when not in use. Competent personnel only to store / use chemicals. COSHH Assessments and SDS sheets in place for hazardous substances. COSHH Items stored appropriately in accordance with SDS and regulations. Emergency Response Plan for the site. Fire awareness training / site induction for personnel. Fire points, extinguishers and a fire water tank located around the site. Gas detectors deployed with an alarm trigger of 5ppm / 7mg.m3 (EH40 WELs). Leak Detection and Repair Plan for the site. Local Fire & Rescue Service notified of operations. Permit to work system implemented to authorise specific works i.e. hot/cold works. Plant, tanks and pipework tested for leaks prior to first use to confirm integrity. Plant, tanks and pipework capped / plugged after breaking containment. Plant, tanks and pipework cleaned / purged where possible prior to breaking containment. Regular maintenance and inspections conducted as directed by written procedures. Safety flare installed to incinerate unexpected / blowdown gas. Security measures implemented at site. Sensitive Receptors in excess of 500 metres away from the development. Site based fire risk assessment in place and detailing the mitigation measures. Spillage response procedure for the site established. Suitable spillage kits available on site / transport vehicles. Vehicles and plant serviced and maintained in line with manufacturer requirements.	Not Significant
AC7	Vandalism	Various - acts of vandalism may cause fires, loss of containment from containers, damage to site equipment, etc.	See Receptor Table.	Very Low	High	Low	Chemicals segregated, stored correctly and sealed when not in use. Emergency Response Plan for the site. Records kept of complaints and subsequent mitigation imposed if necessary. HDPE membrane is in place and the subject of visual inspection where possible. Secondary containment installed to prevent spill onto tertiary containment system (HDPE). Security measures implemented at site.	Not Significant
AC8	Spillage and Leaks as a result of vehicle related accidents.	Vapours Carried on Wind. Flow by Gravity.	See Receptor Table.	Low	Medium	Medium	Emergency Response Plan for the site. HDPE membrane is in place and the subject of visual inspection where possible. Operations planned / designed to minimise transport and handling operations. Permitted interceptor (separator) installed. Qualified and competent site supervisor appointed. Sensitive Receptors in excess of 500 metres away from the development. Surface water monitoring (to be) in place with results reported in accordance with EA permit. Trained persons to operate vehicles and site plant. Vehicles and plant serviced and maintained in line with manufacturer requirements.	Not Significant

ID	Event	Impact	Risk Management
CC1	Increase in summer temperature (~7°C) and dryer summers.	Dryer conditions may result in an increase of dust emissions from the site.	Use of dust suppressant sprays (water dampening) if dust is identified. Where site remediation works or construction activities take place consider the use of less dusty material.
		The surface temperature of plant and equipment may cause additional stress and expansion, particularly on pipework and fittings.	Ensure new equipment is designed to cope with foreseeable stress and expansion where possible. Undertake regular inspections followed by preventative maintenance on site plant and equipment.
		Odour may become more prevalent from the storage of hydrocarbons and other materials.	Implementation of an odour management plan in line with permit conditions should odour arise causing impact on the surrounding receptors.
		Potential for an increase in fires, particularly wildfires on neighbouring land.	Maintain relationship with local fire authority and keep them updated over site inventory. Continue to take note of the local news during hot conditions and sites vulnerable to wildfires.
		Increase in energy demands for plant cooling units or personnel cooling units.	Where possible ensure plant and equipment can facilitate higher temperatures in the first instance. Utilise onsite electricity production in the first instance where possible to facilitate cooling units.
		Increase in water demands for dust suppression or site operations.	Ensure mains water supply and/or imported supply is capable of meeting site demand. Utilise site surface water and spray over site for dust suppression. Calculate the volume of water needed for operations with significant consumption. Consider alternatives to water for well treatments where possible or plan works around seasons.
CC2	Extreme variability with regards to winter temperatures.	Colder temperatures could lead to the freezing of site systems such as pipework, plant and surface water management systems.	Where fluids have the potential to freeze within pipework, lagging shall be used.
		Damage to plant and equipment through repeated freezing and thawing of water.	Where fluids have the potential to freeze within pipework, lagging shall be used. Undertake regular inspections followed by preventative maintenance on site plant and equipment.
CC3	Extreme Rainfall intensity (20% increase on todays values) Winter rainfall increase (Anticipated to be 40%)	External flooding events leading to power loss or interruptions.	Utilise onsite electricity (gas) production in the first instance where possible and have a back up diesel system should mains power be unavailable.
		External flooding events leading to site access and egress restrictions for emergency services, staff and deliveries.	Adopt suitable measures for managing surface water onsite including the availability of pumps to clear flooded areas near the site and on the site.
		Internal flooding events leading to power loss or interruptions.	Utilise onsite electricity (gas) production in the first instance where possible and have a backup system should mains power be unavailable. Ensure that suitable drainage arrangements and storage and back up storage (tanks) are available. Ensure electrical components are elevated when flooding becomes apparent.
		Internal flooding events leading to infrastructure damage.	Ensure that suitable drainage arrangements and storage and back up storage (tanks) are available. Undertake regular inspections followed by preventative maintenance on site plant and equipment. Ensure interceptor is maintained, drainage channels are clear and seek alternative means of water disposal (tankered offsite)
		Internal flooding event leading to floodwater and surface waters being contaminated.	Ensure that suitable drainage arrangements and storage and back up storage (tanks) are available. Ensure interceptor is maintained, drainage channels are clear and seek alternative means of water disposal (tankered offsite)
		Internal flooding events leading to drain and interceptor to be overwhelmed.	Ensure that suitable drainage arrangements and storage and back up storage (tanks) are available. Ensure interceptor is maintained, drainage channels are clear and seek alternative means of water disposal (tankered offsite)
CC4	Increase in sea level rises (~0.6m)	Permanent or frequent flooding at the site. (Wellsite is within 20 km of the Humber River.)	Undertake a flood risk assessment and regularly review, taking note of historic events. Ensure the availability of emergency pumps should flooding be anticipated more foreseeable. Protection of control and electrical systems. Identification of 'flat bottom' tanks / equipment that have the potential to floating.
		Localised impact on groundwater (<20km from the coastline) by increasing groundwater levels and artesian pressures.	Consideration of tidal reach. Consideration of artesian pressures whilst drilling through groundwater systems. Undertake a flood risk assessment and regularly review, taking note of historic events. Ensure the availability of emergency pumps should flooding be anticipated more foreseeable. Protection of control and electrical systems. Identification of 'flat bottom' tanks / equipment that have the potential to floating.
CC5	River flow variability. (50% flow increase) or (80% flow decrease)	Potential to inhibit drainage and lead to localised flooding.	Ensure that suitable drainage arrangements and storage and back up storage (tanks) are available. Discharge to surface water when permitted to do so, utilise additional storage where possible. Undertake a flood risk assessment and regularly review, taking note of historic events. Ensure the availability of emergency pumps should flooding be anticipated more foreseeable. Protection of control and electrical systems. Identification of 'flat bottom' tanks / equipment that have the potential to floating.

Global Warming Potential								
Year	Activity	Substance	Formula	Atmospheric Lifetime (Years)	Global Warming Potential (GWP)	Direct / Indirect Releases	Released Mass (Tonnes)	Global Warming Potential of Emissions (Released Mass x GWP)
01	Wellsite construction operations - Wellsite extension. Wressle-2 and Wressle 3 - Drilling, Workover, Testing Operations. Wressle-1 Well continues production operations.	Carbon Dioxide	CO2	Variable	1	Direct	40,506.00	40,506.00
		Methane	CH4	12.3	28		97.80	2,738.40
		Nitrous Oxide	N2O	120	265		0.67	178.08
02	Wressle-1 Well, Wressle-2 Well and Wressle-3 Well in Production with intermittent Workovers.	Carbon Dioxide	CO2	Variable	1	Direct	20,787.00	20,787.00
		Methane	CH4	12.3	28		89.80	2,514.40
		Nitrous Oxide	N2O	120	265		0.22	58.83
03	Wressle-1 Well, Wressle-2 Well and Wressle-3 Well in Production with intermittent Workovers.	Carbon Dioxide	CO2	Variable	1	Direct	106.00	106.00
		Methane	CH4	12.3	28		0.17	4.70
		Nitrous Oxide	N2O	120	265		0.00	0.80
04	Wressle-1 Well, Wressle-2 Well and Wressle-3 Well in Production with intermittent Workovers.	Carbon Dioxide	CO2	Variable	1	Direct	106.00	106.00
		Methane	CH4	12.3	28		0.17	4.70
		Nitrous Oxide	N2O	120	265		0.00	0.80
05	Wressle-1 Well, Wressle-2 Well and Wressle-3 Well in Production with intermittent Workovers.	Carbon Dioxide	CO2	Variable	1	Direct	106.00	106.00
		Methane	CH4	12.3	28		0.17	4.70
		Nitrous Oxide	N2O	120	265		0.00	0.80
06	Wressle-1 Well, Wressle-2 Well and Wressle-3 Well in Production with intermittent Workovers.	Carbon Dioxide	CO2	Variable	1	Direct	531.00	531.00
		Methane	CH4	12.3	28		0.37	10.44
		Nitrous Oxide	N2O	120	265		0.02	3.98
07	Wressle-1 Well, Wressle-2 Well and Wressle-3 Well in Production with intermittent Workovers.	Carbon Dioxide	CO2	Variable	1	Direct	106.00	106.00
		Methane	CH4	12.3	28		0.17	4.70
		Nitrous Oxide	N2O	120	265		0.00	0.80
08	Wressle-1 Well, Wressle-2 Well and Wressle-3 Well in Production with intermittent Workovers.	Carbon Dioxide	CO2	Variable	1	Direct	106.00	106.00
		Methane	CH4	12.3	28		0.17	4.70
		Nitrous Oxide	N2O	120	265		0.00	0.80
09	Wressle-1 Well, Wressle-2 Well and Wressle-3 Well in Production with intermittent Workovers.	Carbon Dioxide	CO2	Variable	1	Direct	106.00	106.00
		Methane	CH4	12.3	28		0.17	4.70
		Nitrous Oxide	N2O	120	265		0.00	0.80
10	Wressle-1 Well, Wressle-2 Well and Wressle-3 Well in Production with intermittent Workovers.	Carbon Dioxide	CO2	Variable	1	Direct	106.00	106.00
		Methane	CH4	12.3	28		0.17	4.70
		Nitrous Oxide	N2O	120	265		0.00	0.80
11	Wressle-1 Well, Wressle-2 Well and Wressle-3 Well in Production with intermittent Workovers.	Carbon Dioxide	CO2	Variable	1	Direct	531.00	531.00
		Methane	CH4	12.3	28		0.37	10.44
		Nitrous Oxide	N2O	120	265		0.02	3.98
12	Wressle-1 Well, Wressle-2 Well and Wressle-3 Well in Production with intermittent Workovers.	Carbon Dioxide	CO2	Variable	1	Direct	106.00	106.00
		Methane	CH4	12.3	28		0.17	4.70
		Nitrous Oxide	N2O	120	265		0.00	0.80
13	Wressle-1 Well, Wressle-2 Well and Wressle-3 Well in Production with intermittent Workovers.	Carbon Dioxide	CO2	Variable	1	Direct	106.00	106.00
		Methane	CH4	12.3	28		0.17	4.70
		Nitrous Oxide	N2O	120	265		0.00	0.80
14	Decommissioning of Wressle-1 Well, Wressle-2 Well and Wressle-3 Well.	Carbon Dioxide	CO2	Variable	1	Direct	106.00	106.00
		Methane	CH4	12.3	28		0.17	4.70
		Nitrous Oxide	N2O	120	265		0.00	0.80
15	Site Restoration.	Carbon Dioxide	CO2	Variable	1	Direct	2,075.00	2,075.00
		Methane	CH4	12.3	28		1.74	48.61
		Nitrous Oxide	N2O	120	265		0.04	10.07
						Total GWP of Emissions		71,122.22

ENERGY SOURCES, CONVERSION EFFICIENCY AND EMISSIONS FACTORS				
ID	Energy Source	Location of Emission	Delivered to Primary Conversion Factor	CO2 Factor (t/mwh, Primary)
001	Electricity	Indirect	2.4	0.166
002	Gas Oil	Direct	1	0.25
003	Natural Gas	Direct	1	0.19

ENERGY EMISSIONS FACTORS					
ID	Energy Source	MWh	Delivered to Primary Conversion Factor	CO2 Factor (t/mwh, Primary)	CO2 Emissions (Tonnes)
001	Electricity	11,038.00	2.4	0.166	4,397.54
002	Gas Oil	85,188.00	1	0.25	21,297.00
003	Natural Gas	236,218.00	1	0.19	44,881.42
				Total CO_2 Emissions (Tonnes)	70,575.96