Cuadrilla Balcombe Limited

Balcombe 2z Hydrocarbon Well Testing

Environmental Report

RSK/MA/P661310-04-rev02

OCTOBER 2017

RSK GENERAL NOTES

Project No.: P661310

Title: Balcombe 2z Hydrocarbon Well Testing

Client: Cuadrilla Balcombe Limited

Date: 25 October 2017

Status: Rev 02

CONTENT

Abbreviations

AA	Appropriate Assessment
AADT	Annual Average Daily Traffic
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
AQMAs	Air Quality Management Areas
AQS	Air Quality Strategy
BAP	UK Biodiversity Action Plan
BGS	British Geological Survey
DB	Decibel
Defra	Department for Environmental, Food and Rural Affairs
DfT	Department for Transport
DMRB	Design Manual for Road and Bridges
EA	Environment Agency
EHO	Environmental Health Officer
EIA	Environmental Impact Assessment
ES	Environmental Statement
EPA	Environmental Protection Act 1990
EPR	Environmental Permitting Regulations 2010
EPUK	Environmental Protection UK
EQS	Environmental Quality Standard
GCN	Great Crested Newt
GGS	Ground Gas Solutions Ltd.
GLVIA3	Guidelines for Landscape and Visual Impact Assessment 3rd Edition
HA	Hectares
HGV	Heavy Good Vehicles
HPDE	High Density Polyethylene
HRA	Habitat Regulations Assessment
IAQM	Institute of Air Quality Management
JNCC	Joint Nature Conservation Committee
km	Kilometers
LBAPs	Local Biodiversity Action Plans
LCA	Landscape Character Area
LDV	Light Duty Vehicle
LNR	Local Nature Reserve
LVA	Landscape and Visual Appraisal
LVIA	Landscape and Visual Impact Assessment
LWS	Local Wildlife Site
m	Metres

MAGIC	Multi-Agency Geographic Information on the Countryside
MSDC	Mid Sussex District Council
NCA	National Landscape Character Area
NERC	Natural Environment and Rural Communities Act
NPPF	National Planning Policy Framework
PEA	Preliminary Ecological Appraisal
PRoW	Public Right of Way
PPG	Planning Practise Guidance
PSD	Priority Substances Directive
SAC	Special Area of Conservation
SFRA	Strategic Flood Risk Assessment
SM2	Wildlife Acoustics Song Meter 2 Bat+
SNCI	Site of Nature Conservation Importance
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
SPZ	Source Protection Zone
TMP	Traffic Management Plan
VOA	Volatile Organic Analysis
WCA	Wildlife and Countryside Act 1981
WFD	Water Framework Directive
WSCC	West Sussex County Council

1 INTRODUCTION

1.1 Background

1.1.1 The Balcombe 2z hydrocarbon borehole ("the borehole") was drilled into the Lower Stumble underground geological formations by Cuadrilla Balcombe Limited ("Cuadrilla") in 2013 under planning permission WSCC/027/10/BA. The borehole extends approximately 820 metres (m) vertically and 520m laterally. The 2010 planning permission allowed the flow rates in the borehole to be tested and monitored but these works could not be completed within the time limits that were imposed on the works. Therefore, Cuadrilla secured a temporary planning permission in 2014 (ref: WSCC/005/14/BA) to stimulate the borehole, test and monitor the flows, plug and abandon the borehole and then restore the land back to its original use as forestry storage. The site has been subject to hydrocarbon exploration since 1986 when Conoco drilled the Balcombe 1 exploration well.

1.1.2 Due to the length of time and effort it has taken to commence operational activity in Cuadrilla's Lancashire licence area and the reduction in available UK service support brought about by a decline in oil prices, the borehole flow testing and monitoring has not been completed and the 2014 planning permission has now expired. Also, during the period there have been changes to the Environment Agency (EA) permitting requirements for the Balcombe site which has required assessment by Cuadrilla. Cuadrilla would still like to undertake these flow testing and monitoring works so is now applying to West Sussex County Council (WSCC) for a new temporary planning permission. The description of development is:

> *"…..Temporary permission for exploration and appraisal comprising the flow testing and monitoring of the existing hydrocarbon lateral borehole along with site security fencing, the provision of enclosed testing flare and site restoration…."*

1.1.3 With the exception of an increase in the height of the workover rig from 22m to 32m, the proposed development is the same as that which was granted planning consent in 2014. Planning permission is now being sought for a temporary two-year period and the proposed work involves flow testing and pressure monitoring of the existing exploration borehole. If this testing reveals that the hydrocarbon reserves are not of sufficient quantity and/or quality to commercially extract then the existing borehole would be plugged with cement and the land restored back to its previous use as forestry storage. In the event that the borehole testing and pressure monitoring confirms that there are hydrocarbon reserves that could be commercially extracted then the existing borehole would be temporarily suspended whilst a separate planning application prepared for a future production phase. In accordance with section 38(6) of the *Planning and Compulsory Purchase Act 2004*, any future application would be considered against the development plan at the time of the application, unless material considerations indicate otherwise.

1.1.4 A detailed explanation of each stage is provided in section 2.3 below.

1.1.5 As part of the proposed works, Cuadrilla is seeking to test the underground limestone rock layer which it has already been determined is (i) hydrocarbon bearing, and (ii) has a significant level of natural fracturing. As such, the proposed flow testing operations do not involve any hydraulic fracturing and for the avoidance of doubt Cuadrilla can confirm that it is not proposing to hydraulically fracture this well in the future.

1.1.6 The previous drilling that has been undertaken revealed that the hydrocarbons in the borehole constitute oil and gas resources. Therefore, in the context of paragraph 091 of Planning Practice Guidance (PPG) (ref: 27-091-20140306), the borehole contains conventional hydrocarbons.

1.2 EIA Screening

1.2.1 As the proposed development falls within Part 2(e) of Schedule 2 of *The Town and Country Planning (Environmental Impact Assessment) Regulations 2017* ("EIA Regulations"), a formal request for an Environmental Impact Assessment (EIA) screening opinion was issued to WSCC in July 2017 in accordance with Regulation 6(1) of the EIA Regulations.

1.2.2 WSCC issued their EIA screening opinion in August 2017, which concluded that the proposed development does not have the potential to generate significant environmental effects within the meaning of the EIA Regulations. Therefore, the proposed development does not need to be subject to EIA and there is no requirement for the planning application to be accompanied by an Environmental Statement (ES).

1.3 Purpose of Report

1.3.1 Although WSCC has confirmed that EIA is not required, there is still the potential that the proposed development could generate environmental effects. Subsequently, the purpose of this report is to identify any potential environmental impacts and effects that might be experienced during the six-month flow testing, pressure monitoring and borehole plug and abandonment works, and where necessary to outline those mitigation measures that would be put into place to avoid or minimise any predicted, adverse effects.

1.3.2 It should be noted that this report does not consider the scenario where the borehole is temporarily suspended after the flow testing and pressure monitoring works have been completed. This is because any environmental effects during this suspension period would be negligible as all plant, machinery, equipment and personal would be removed from the site whilst a separate planning application for a future production stage is submitted and determined. Any potential environmental effects associated with that production stage would be assessed separately as part of the determination of that planning application.

1.4 Structure of Report

1.4.1 Following this introductory section, this report is structured as follows:

- Section 2 describes the existing site and its immediate surroundings, and provides an overview of the three stages of the proposed works;
- Section 3 identifies the scope of the environmental assessment that has been undertaken and describes the assessment methodology that has been employed;
- On a topic-by-topic basis, sections 4 to 10 report the results of the environmental assessments that have been undertaken. To ensure consistency, a standard format has been used for each technical section;
- Section 10 summarises the main findings of the report; and
- Technical appendices 2.1 to 9.2 include any technical reports that have been prepared to support each of the assessments.

2 THE SITE AND PROPOSED DEVELOPMENT

2.1 Site Location

2.1.1 The existing Well 2z borehole is located at the lower stumble exploration site, which is situated off London Road (B2036), approximately 800m to the south of the village of Balcombe. Vehicular access is provided by an existing track located off London Road.

2.1.2 The closest residential property to the site is Kemps Farm, which is located approximately 380m to the north.

2.1.3 The site is located in a predominantly rural area and is bounded by the B2036 to the west, an area of forestry storage to the north, and the existing access track to the south and east. Beyond this, is the London to Brighton railway line. Surrounding the site is Lower Stumble Wood and Lower Beanham Wood, both of which have been designated as Ancient Woodland. A location plan (Figure 2.1) is provided at the end of this section.

2.2 Site Characteristics

2.2.1 The site extends to 0.73 hectares (ha) (0.58 ha for the above ground works) and comprises a flat rectangular area of hard standing with the Well 2z borehole at the centre and 2m high security fencing around its perimeter.

2.2.2 The site was established as an onshore exploration site in 1986 by Conoco (UK) Ltd, drilling the Balcombe 1 exploration well to depth of approximately 1725m. The Balcombe 1 well has been plugged and abandoned.

2.2.3 The site was last used in September 2013 as an exploration well site and is located within an area of forestry usage which is currently managed by the landowner, the Balcombe Estate.

2.2.4 The existing exploration pad is underlain by a self-contained impermeable, high-density polyethylene (HDPE) membrane in the rig/well testing area. This prevents any possible spillages from operations migrating into local surface water and groundwater receptors.

2.3 Environmental Baseline

Ecology

2.3.1 There are three statutory designated sites within 2km of the site centre point, comprising two Local Nature Reserves (LNRs) and one Area of Outstanding Natural Beauty (AONB).

2.3.2 There are several SSSIs in the wider area, including the Cow Wood & Harry's Wood Site of Special Scientific Interest (SSSI) and the Wakehurst & Chiddingly Woods SSSI. The site intersects SSSI Impact Risk Zones for these sites.

2.3.3 Ashdown Forest, which is designated as a Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and Special Area of Conservation (SAC) is located approximately 10.5km to the east of the site. Despite the distance between the site and this sensitive area, a Habitat Regulations Assessment (HRA) Screening Assessment has been submitted with this planning application.

2.3.4 There are five non-statutory designated sites within 2km of the site centre point, all of which are Local Wildlife Sites (LWSs). The closest is the Rowhill and Station Pastures LWS, which comprises two unimproved pastures separated by a wooded stream valley.

Landscape

2.3.5 The site is located in the High Weald AONB, which is considered to be one of the best surviving, coherent, medieval landscapes in northern Europe. Under the EIA Regulations, an AONB is identified as a sensitive area.

Heritage

2.3.6 The ground within the site has previously been disturbed so has low potential for the presence of archaeological remains.

2.3.7 Kemp's House forms part of the Kemps Farm complex and is grade II* listed. It is located approximately 380m to the north of the site.

Hydrogeology

2.3.8 The Lower Stumble prospect is located on an east-west trending anticlinal structure of Alpine origin in the centre of the Weald Basin, 5km north west of Haywards Heath. The target formation for the borehole is the Middle Kimmeridge Micrite at approximately 760m below the surface.

2.3.9 The site is not located in a Ground Water Source Protection Zone (SPZ), which is an area that provides additional protection to safeguard drinking water quality.

2.3.10 A groundwater monitoring well is located in the southern part of the site, which has been drilled into the Ashdown Beds.

Hydrology

2.3.11 There are two watercourses located within 100m of the site located in Lower Stumble Wood and Lower Beanham Wood. The site is located in Flood Zone 1, which means that it has a low probability of flooding i.e. land having a less than 1 in 1,000 annual probability of river or sea flooding. Notwithstanding this, there is an area of land with a high probability of flooding (Flood Zone 3) located to the south of the site close to the boundary with the B2036.

Air Quality

2.3.12 The site is not located in an Air Quality Management Area (AQMA).

Accessibility

2.3.13 There are no public rights of way (PRoW) within or in close proximity to the site. The closest public footpath is approximately 500m north west of the site off the B2036, and the Sussex Ouse Valley Way lies approximately 1,300m to the south.

2.4 Proposed Development

2.4.1 The proposed development consists of three stages, as detailed below:

Stage 1: Exploration well testing operations

2.4.2 Stage 1 involves setting the site up, preparing the borehole for the flow testing, undertaking the flow testing and pressure monitoring over a period of 60 days.

Borehole preparation and flow initiation operations

2.4.3 The borehole preparation and flow initiation operations will be undertaken over a period of 4-6 days on a daytime basis only. The operations will involve the mobilisation of plant/equipment on the site, cleaning up the wellbore utilising diluted hydrochloric acid, at a [10%] concentration through coiled tubing inserted into the well, a nitrogen lift to initiate the flow of hydrocarbons from the well, and the installation of the pump jack/beam pump. A crane up to 40m in height will be required to support the coiled tubing, and a work over rig will be needed to help set up the pump jack/beam pump.

Flow testing

2.4.4 The flow testing operations will be undertaken over approximately fourteen days and will require a pump jack/beam pump to be installed to pump fluid from the borehole to storage tanks on the site. An enclosed flare with a maximum height of 13.7m will be located on the site and will be used to burn off any associated gas produced during the well flow test period. The hydrocarbon flow from the well will last for no longer than seven days and during this time the flare will be available for operations on a 24-hour basis.

Pressure monitoring

2.4.5 Once the flow testing has been completed the pump jack/beam pump will be removed and the pressure gauges will be installed in the borehole. This is estimated to take 2-3 days to complete. The borehole will then be shut in and secured for a period of up to 60 days. During this time, there will be no activity on the site.

2.4.6 If the flow testing and pressure monitoring works reveal that any hydrocarbon reserves are not of sufficient quantity and/or quality to extract in the future then stage 2 will commence.

Stage 2: Plug and abandonment of borehole

2.4.7 As part of stage 2, the borehole will be sealed with cement and secured. The well steel casing will be cut off approximately 1.5 m below ground level and a steel plate welded to the remaining casing stub. The well head and well cellar will be removed and the cellar filled in. The temporary impermeable membrane will then be removed from the site in preparation for stage 3.

2.4.8 It is estimated that stage 2 will take a maximum of eight weeks to complete.

Stage 3: Demobilisation and site restoration

2.4.9 Stage 3 involves removing all of the plant and equipment from the site and restoring the land back to its former use in accordance with best practice and the requirements of the extant environmental permit(s). It is estimated that this will take approximately one week to complete.

2.5 Potential Future Production Stage

2.5.1 Should the borehole flow testing and pressure monitoring works reveal that there are hydrocarbon reserves that could viably be extracted in the future, then after stage 1 has been completed the borehole would be temporarily suspended, whilst a new planning application was prepared and submitted for the production stage. During this period, all plant and machinery would be removed from the site and the land would effectively lie dormant pending the outcome of the planning application.

Timescales and programme

2.5.2 The borehole flow testing and pressure monitoring data will require analysis. The analysis will enable Cuadrilla to decide whether or not to seek the necessary planning, permitting and other approvals required to take the site forward as a production site. This analysis and assessment process will take approximately six to nine months to complete after the flow testing and pressure monitoring has finished and the data been collected. In the event that the assessment concludes that a future production phase would be commercially viable, then an additional 18 months would be required to apply for and secure the necessary planning, environmental permitting and other permissions required for production operations. The borehole will be safely suspended during any such application period. If the results of the assessment are that commercial production would not be viable then the exploration well will be plugged with cement and the site restored.

Working hours

2.5.3 Mobilisation and equipment set up, de-mobilisation and restoration and the movement of all Heavy Goods Vehicles (HGVs) to and from the site will be undertaken during standard working hours i.e. 07:30 to 18:30 Monday to Friday; and 08:00 to 13:00 on Saturdays. The well plug and abandonment works (stage 2) will be undertaken up to 22:00 on weekdays and 08:00 to 13:00 on Saturdays. The flow testing operations (maximum 14 days) and borehole pressure monitoring (maximum 60 days) will be undertaken over 24 hours, but will not require any HGV vehicle movements. The only potential exception to this is in the unlikely event of a borehole

control situation where work needs to be undertaken urgently, which may require the movement of plant, materials and staff personnel outside of standard working hours.

Site accessibility

2.5.4 Entry into the site will be from the existing access to Lower Stumble Wood and the Balcombe Estate's forestry and farming activities from the B2036. As this access has previously been used for hydrocarbon exploration and given the temporary nature of the proposed development, it is not considered necessary at this stage to make any improvements to the access.

2.5.5 All HGVs will access the site via junction 10a of the M23 motorway and not from the south via Cuckfield.

Plant and equipment

2.5.6 The following plant and equipment will be required to support the proposed operations:

- Work over rig and associated lighting (32m);
- Crane (40m);
- Pump jack/beam pump (10m);
- Enclosed flare (13.7m);
- Coiled tubing;
- Coiled tubing unit;
- Separator;
- Oil tank;
- Flowback tanks;
- Acid pump;
- Acid storage tanks;
- Nitrogen pump;
- Nitrogen storage tanks;
- Task-based lighting (up to 9m);
- Waste skips;
- Site offices/welfare facilities; and
- Car parking and vehicle turning area

2.5.7 The tallest piece of equipment that will be used on the site will be the crane that is required to support the coiled tubing unit during the injection of diluted acid and subsequently nitrogen into the borehole. This will have an approximate height of approximately 40m, but will be required for less than one-week.

2.5.8 The work over rig will extend to 32m and will be required for part of stage 1, and stage 2 of the proposed operations. During the 60-day pressure monitoring, the boom of the work over rig will be lowered, so will have a height of approximately 6m.

Site drainage

2.5.9 The part of the site that accommodates the borehole and any fuels/chemicals is underlain by a 33.5m x 33.5m impermeable HDPE membrane, which will collect all surface water. This will then be directed to a cellar where it will be stored pending transportation by tanker to an EA approved waste water treatment facility. The HDPE membrane will be constructed in accordance with good practice i.e. Construction Industry Research and Information Association (CIRIA) R164 and C736.

2.5.10 Any rainwater that falls outside of the membrane area will naturally percolate through the stoned surface to sub-surface receptors. It should be noted that to prevent potential leaks and spills, any tanks on the site that store liquids will be subject to three levels of containment. In addition, the site is underlain by wadhurst clay, which naturally restricts the flow of water.

Boundary treatment

2.5.11 The site is currently bounded by a 2m high security fence, which will remain in place during stages 1 and 2. Depending on the potential risk to the proposed operations from protestors there may be the need to increase the height of the security fencing to 4m, but this will be reviewed shortly before the works are due to commence.

Lighting

2.5.12 All operational areas of the site will be lit with task-based lighting e.g. SMC TL90, lighting towers, which will be inward facing to avoid disturbance to sensitive receptors e.g. neighbouring properties and bats that use the surrounding vegetation to commute and forage.

2.5.13 As the well cement plug and abandonment works (stage 2) will be undertaken until 22:00, the work over rig will be lit with downward facing lighting.

2.5.14 Any lighting that is used on the site will be completely sealed for safety resistance to a naked flame and spark proof.

Waste

2.5.15 It is anticipated that the proposed operations will generate the following waste streams:

- Vented nitrogen from the nitrogen lift of the well;
- Return water from the borehole;

- Flared gas (hydrocarbon);
- Mud and cement used in the plug and abandonment works;
- HPDE membrane;
- General office waste; and
- Sanitary waste.

2.5.16 All waste materials, including wastewater and fluids from the exploration borehole testing operations will be removed by licenced operators and disposed of at authorised waste treatment facilities that are permitted to accept and treat the waste. Foul sewage will be collected in portable site toilet facilities and these will be emptied periodically with disposal to an approved location.

2.6 Environmental Permits

2.6.1 The proposed operations are covered by two permits that have previously been issued by the Environment Agency under the *Environmental Permitting (England and Wales) Regulations 2010:*

- Mining waste permit (ref: EPR/AB3307XD), which was issued in July 2013 and covers the management of non-inert, non-hazardous and hazardous extractive waste, with a management facility; and
- Radioactive substances regulations permit (ref: EPR/PB3439DP), which was issued in September 2013 and allows Cuadrilla to accumulate and dispose of any radioactive waste.

2.6.2 The permits require air quality, surface water and ground water to be monitored during the proposed operations.

2.6.3 In response to a Regulation 60 request from the EA, an application to update the two permits has been issued and is currently being considered by the EA.

530000 531000 532000

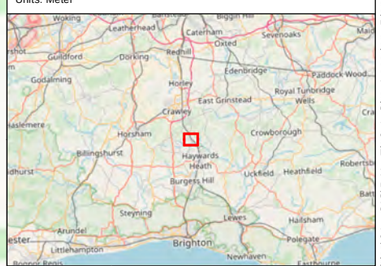
130000 129000 128000

Balcombe
Wood
Five Acre Wood
Furze Wood
Banks Wood
Ashen Wood
Four Acre Coppice
Two Acre Shaw
Westup Farm
Long Shaw
Balcombe
Peter's Wood
Furzefield
Eight Acre Shaw
Brook Wood
Brook Cottage
Hagland Wood
Spring Shaw
Rowhill House
Kemps Farm
Rowhill Wood
Seyron Wood
Poorfield Shaw
Pilstye Wood
Lower Stumble Wood
Upper Beanham Wood
Lower Beanham Wood
Bushey Wood
Furland Wood
Sand's Wood
Long Wood
Pilstye Farm
Upper Pilstye Cottages
White House Cottages
White House
Little Sion Wood
Coombehole Wood
Sidnye
Bowder's Farm
North Lodge
Balcombe Place
Batchelor's Cottages
Stonehall Farm
Wharf Cottages
The Mill House
Great Burrow Wood
Northlands Wood
Upper Stumble Wood
Stumble Field Wood
Unitroy Cottages
Nettlefield Wood
Hook Wood
Sedgy Wood
Hookb
Farm
ry Wood
Wood
B2036
PW
BRAMBLE HILL
BRAMBLE HILL
STOCKSFIELD ROAD
HAYWARDS HEATH ROAD
VICTORIA ROAD
DEANLAND ROAD
COMBERS
BARN MEWS
FOXMEWS
GLEBE VW
OLDLANDS AVENUE
NEWLANDS ROAD
LONDON ROAD
ROCKS LA
ROCKS LANE
WESTUP ROAD
WESTUP ROAD
ROWHILL LANE
ROWHILL LANE
B2028
B2028
B2028
MILL LANE
MILL LANE
HAYWARDS HEATH ROAD
STONEHALL LANE
BORDERHILL LANE
WHITETHROAT LANE
CHERRY LANE
ROWHILL LANE

Legend:

- Site Boundary - Above Ground Works
- Site Boundary - Below Ground Works

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description
00	17/10/2017	First Draft

Balcombe 2z Hydrocarbon Well Testing

TITLE:

Figure 2.1:
Site Location Plan

0 100 200 300 400
Metres

SCALE: 1:10,000 @ A3

N W E S

REV 00

Document Path: P:\660000 - EPD Projects\661280 - PI\00 Graphics\01 - GIS\BAL_Fig2-1_Site_Location_Plan.mxd

3 ASSESSMENT METHODOLOGY AND SCOPE

3.1 Scope of the Assessment

3.1.1 This report covers those environmental issues where there is the greatest potential for environmental effects to be generated. The decision on which topics to cover and which to scope out is based on the experience of the assessment team, the content of the 2014 planning application and the pre-application consultation that has been undertaken with WSCC.

3.1.2 Those topics that have been scoped out of the assessment and the rationale for the decisions are summarised below:

- *Archaeology and land use:* The land has previously been disturbed and there is no requirement to disturb underlying soils;
- *Heritage:* The site is 380m from Kemp's House and there is natural screening i.e. Stumble Wood located between the two land uses. Subsequently, there is limited potential for any impact on the setting of the listed building;
- *Dust:* As the well borehole testing occurs primarily below the surface and all fluid brought to the surface is stored in sealed tanks, there is little chance of any dust from the testing operation. As the site is being restored to forestry storage there is minimal requirement to remove stone/concrete from the site;
- *Odour:* During the flow testing, any associated natural gas associated with the exploration well testing will be flared, thereby reducing the risk of possible odour;
- *Access:* The site is 500m from the nearest public footpath and will not impact the users of the footpath either directly or indirectly; and
- *Socioeconomics:* Due to the temporary nature of the proposed development it will not create a large number of new job opportunities.

3.2 Assessment Methodology

3.2.1 A detailed description of the assessment methodology that has been used for each of the assessments is detailed in the relevant technical sections (4-10) of this report. As a general approach, a standard environmental assessment methodology has been adopted whereby impacts and effects have been considered against the current environmental baseline conditions. In some cases, this has required visiting the site and the surrounding area to undertake surveys, such as noise monitoring and updating the landscape photography.

3.2.2 In each of the assessments it has been assumed that all of the required mitigation measures that have been identified form part of the proposed development. Therefore, no pre-mitigation assessment has been undertaken and all impacts and effects that have been predicted are residual.

3.2.3 Through the issue of a negative EIA screening opinion, WSCC has confirmed that the proposed development does not have the potential to generate any significant environmental effects. Therefore, this report does not refer to the "significance" of effects. However, it does provide commentary on the characteristics of the predicted effects, including:

- Are the predicted effects positive or adverse?
- Are the predicted effects direct or indirect?
- Are the predicted effects permanent or temporary?
- Will the predicted effects be experienced over the short, medium or long term?
- Will the magnitude of the predicted effects be negligible, minor, moderate or major?
- Are the predicted effects reversible?

3.3 Limitations of Assessment

3.3.1 The assessments that are presented in sections 4 to 10 of this report are based on the information that is currently available about the proposed development. Once a contractor has been appointed to implement the proposed development details could potentially alter, such as the predicted traffic flows. Whilst any change is likely to be minimal, it is important to recognise that there are limitations to each of the assessments that have been undertaken. Further explanation is provided in each technical section of this report. To mitigate the limitations pf the assessment contractors will be selected to execute the works as reasonably practicable to the parameters established within this Environmental Report.

4 NOISE

4.1 Introduction

4.1.1 The proposed works at the Balcombe 2z borehole site will involve the following three stages:

- Stage 1: Exploration borehole testing and operations which includes borehole preparation and flow initiation operations, flow testing and pressure monitoring;
- Stage 2: Plug and abandonment of the well; and
- Stage 3: Demobilisation and restoration of the site.

4.1.2 RSK has been commissioned by Cuadrilla Balcombe Limited to undertake an assessment of the potential noise from the proposed operation of the Balcombe 2z borehole site. The assessment is based on the computer noise modelled plant and baseline data gathered from a noise survey at locations representing the closest noise sensitive receptors.

Objectives

4.1.3 The objectives for the noise survey and assessment are as follows:

- Measure noise levels at locations representative of nearby residential receptors, in order to determine the pre-existing noise environment;
- Determination of noise emissions from the proposed development site. This is in order to quantify the potential impact from the site upon the proposed residential receptors;
- Assess modelled noise levels against the criteria identified in the National Planning Policy Framework (NPPF, 2012) – Technical Guidance Notes'; and
- Where necessary recommend mitigation measures to minimise plant noise.

4.2 Legislation, Policy and Guidance

4.2.1 The following documents have been used in the noise assessment process for the proposed development.

BS 7445-1 to 3 "Description and measurement of environmental noise"

4.2.2 The three-part standard BS 7445 provides the framework within which environmental noise should be quantified. Part 1 (2003) provides a guide to quantities and

procedures and Part 2 (1991) provides a guide to the acquisition of data pertinent to land use. Part 3 (1991) provides a guide to the application of noise limits.

4.2.3 BS7445 provides the framework within which environmental noise should be quantified and procedures to be followed. The standard also refers to BS EN 61672-1: 2013 'Electroacoustics. Sound Level Meters Specifications', which prescribes the equipment necessary for such measurements. Whilst BS 7445 does not prescribe the meteorological conditions under which noise measurements should or should not be taken, it does (part 2, paragraph 5.4.3.3) recommend that in order:

"…*to facilitate the comparison of results (measurements of noise from different sources), it may be necessary to carry out measurements under selected meteorological conditions which are reproducible and correspond to quite stable propagation conditions*…"

4.2.4 These conditions include:

- wind speed not exceeding 5 m/s (measured at a height of 3 to 11 m above the ground);
- no strong temperature inversions near the ground; and
- no heavy precipitation.

National Planning Policy Framework (NPPF)

4.2.5 The National Planning Policy Framework (NPPF) (published March 2012) is the means by which noise is considered within the planning regime. The NPPF provides a series of policies, giving local authorities the flexibility in meeting the needs of local communities. An associated technical guidance note for NPPF provides noise limits when determining planning applications covering minerals extraction. The noise limits from the NPPF technical guidance are presented in Table 4.1.

Table 4.1: Assessment Criteria

Time Period	First Aim	Alternative Limit
Day: 0700 – 1900	Background $L_{A90,t}$ + 10dB	As close as possible to the L_{A90}+10dB, with an upper limit of 55dB $L_{Aeq,1hour}$
Evening: 1900 – 2200		Background $L_{A90,t}$ + 10dB
Night: 2200 - 0700		42 dB $L_{Aeq,1hour}$

4.2.6 It is recognised that where the first aim of the NPPF imposes an unreasonable burden on the operations the alternative limits can apply.

ISO 9613-2: 1996 "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation"

4.2.7 ISO 9613 details a methodology for propagation of sound outdoors, in order to predict the levels of environmental noise at a distance from a number of sources. The methodology predicts a long-term average A-weighted sound pressure level (SPL), which encompasses a wide variety of environmental conditions.

Design Manual for Road and Bridges (DMRB)

4.2.8 The DMRB provides the assessment process and criteria for assessing changes in traffic flows as a result of a development intervention. The DMRB provides a screening approach to increases in traffic flows with an indication of impact based on an increase in flows of 25% or greater.

4.2.9 For the stages of operation at the site, it had been established in section 8, that the impact due to the additional traffic would be minimal (substantially below 25% increase). As such, traffic noise impact as a result of the proposed development is not assessed in this document.

4.3 Assessment Methodology

Noise from the proposed site operation (mineral extraction)

4.3.1 Following the guidance provided by the NPPF – 2012, the predicted plant noise level at the facade of the nearest noise sensitive receptors will be compared to the noise limits presented in Table 4.1.

4.4 Environmental Baseline

4.4.1 An unattended noise measurement was taken between 20 September 2017 and 28 September 2017. Additional attended measurements were taken on 20, 21 and 28 September 2017.

Meteorological Conditions

4.4.2 On the 20 September 2017 the temperature fluctuated between 11°C and 14°C, cloud cover, but with no precipitation. There was no wind present for most of the attended measurements apart from an occasional light breeze.

4.4.3 On the 21 September 2017 the temperature fluctuated between 12°C and 18°C, with no precipitation and it varied between sunny to partially cloudy. There was no wind present for most of the attended measurements apart from an occasional light breeze.

4.4.4 On the 28 September 2017 the temperature fluctuated between 11°C and 14°C, cloudy, but with no precipitation. There was no wind present for most of the attended measurements apart from an occasional light breeze.

4.4.5 Weather is therefore not considered to have adversely affected the measurements.

4.4.6 In order to check the weather data during the unattended survey, archive weather data from was taken from www.wunderground.com Station ID:IWSXHAYW3 located roughly 4.3 km from the unattended monitoring position.

4.4.7 The daily weather data is presented in Table 4.2.

Table 4.2: Daily weather during the unattended noise survey

Date / Time	Temp ºC	Wind Speed m/s	Wind Direction	Precipitation mm
20/09/2017	16.2	<1.5	WSW	0
21/09/2017	17.9	<2	W	1.8[1]
22/09/2017	14.4	<1	W	0
23/09/2017	17.2	<1	WNW	0
24/09/2017	17.6	<1.5	W	1.3[1]
25/09/2017	18.8	<2	NW	2.8[1]
26/09/2017	19.4	<1	NNW	0
27/09/2017	18.8	<1.5	NW	12.7[1]
28/09/2017	16.9	<2	N	6.9[1]

Equipment

4.4.8 Noise monitoring was undertaken using the following equipment:

Table 4.3: Monitoring equipment

Equipment	Type	Serial number	Calibration date
Class 1 Sound Level Meter	Rion NL-52	775956	25/07/2017
Class 1 Sound Level Meter	Rion NL-32	01013661	12/06/2017
Acoustic Calibrator	Rion NC-74	34678492	30/08/2017
Acoustic Calibrator	Cirrus CR 511E	41950	02/08/2017

4.4.9 The measurements were undertaken in free field conditions with the microphone positioned away from reflecting surfaces and at 1.5 m above the ground height to the requirements of BS 7445.

[1] Data during rain periods have been isolated and removed.

4.4.10 The calibration of the sound level meters was checked before and after the measurements, using the acoustic calibrator at 94 dB at 1 kHz. A drift of -0.1 dB or no drift were observed after each measurement.

4.4.11 The sound level meter used conforms to the requirements of BS EN 61672-1: 2013 Electroacoustics. Sound level meter, Specifications. The calibrator used conforms to the requirements of BS EN 60942: 2003 Electroacoustics, Sound calibrators. The equipment used has a calibration history that is traceable to a certified calibration institution.

Identification of Noise Sensitive Receptors

4.4.12 The closest receptors to the Cuadrilla Balcombe Limited site are identified as residential properties in Table 4.4. They are presented alongside the attended and unattended monitoring positions in Figure 4.

Table 4.4: Residential Receptor Locations

ID		Receptor	Distance from Site [m]
R1		Kemp Farm	380
R2		Upper Pilstye Cottage	765
R3		Pilstye Farm Cottage	810
R4		Norfolk Cottage	775
R5		Peartree cottage	745

Attended Monitoring

4.4.13 The attended noise surveys were undertaken on 20, 21 and 28 September 2017 during day (07:00 – 19:00), evening (19:00 – 22:00) and night (22:00 – 07:00) periods. The noise environment at each receptors location is described in Table 4.5.

Table 4.5: Noise Environment

Location	Period	Noise Environment
R2	Day	Farming activities, occasional car and farming vehicles passing, ducks in the adjacent pond.
	Evening	Bird noise and occasional traffic on London Road.
	Night	Bird noise and occasional traffic on London Road.
R3	Day	Farming activities and traffic on London Road and Cherry Lane.
	Evening	Train passes, occasional traffic on London Road and Cherry Lane, plane passes.
	Night	Train passes, occasional traffic on London

Location	Period	Noise Environment
		Road and Cherry Lane, plane passes.
R4	Day	Light breeze through foliage and occasional traffic on London Road.
	Evening	Plane passes and occasional traffic on London Road.
	Night	Plane passes and occasional traffic on London Road.
R5	Day	Busy traffic on Hayward Heath Road, gunshots from the nearby forest, train passes and bird noise.
	Evening	Busy traffic on Hayward Heath Road and train passes.
	Night	Moderate traffic on Hayward Heath Road.

4.4.14 The results of the survey are reproduced in full as Appendix 4.2 and summarised in Table 4.6.

Table 4.6: Attended Noise Level Measurement Results

Location	Date	Time Period	Start Time	Duration (hh:mm)	Statistical Parameters, dB			
					$L_{Aeq,T}$	$L_{Amax,T}$	$L_{A10,T}$	$L_{A90,T}$
R2	20/09/17	Day	17:26	01:00	59.5	88.3	49.1	37.8
	28/09/17	Evening	19:34	01:00	35.1	59.4	37.0	29.0
	21/09/17	Night	23:15	01:00	33.3	57.2	36.0	26.3
R3	20/09/17	Day	16:14	01:00	49.5	75.3	46.8	40.4
	21/09/17	Evening	21:05	01:00	44.7	74.7	39.6	29.9
	21/09/17	Night	22:05	01:00	39.3	73.8	36.6	26.7
R4	20/09/17	Day	12:26	01:00	51.0	80.3	53.2	45.0
	28/09/17	Evening	20:50	01:00	43.2	74.9	44.0	31.6
	20/09/17	Night	00:22	01:00	28.6	60.0	30.3	23.7
R5	21/09/17	Day	11:11	01:00	70.3	89.8	74.7	47.4

Location	Date	Time Period	Start Time	Duration (hh:mm)	Statistical Parameters, dB			
					$L_{Aeq,T}$	$L_{Amax,T}$	$L_{A10,T}$	$L_{A90,T}$
	21/09/17	Evening	19:33	01:00	69.9	87.5	73.0	40.7
	20/09/17	Night	22:00	01:00	63.5	87.3	61.6	30.2

Unattended Monitoring

4.4.15 Due to the close proximity of Kemps Farm [R1] to the site, this is considered to be the most sensitive receptor. The meter was placed in the front garden of the house at Kemps Farm, approximately 380 m from the site. The noise environment was composed of traffic noise from London Road, train passes on the nearby railway and to a lesser extent bird noise.

4.4.16 The results of the survey are reproduced in Appendix 4.1.A and summarised in Table 4.7.

Table 4.7: Unattended Noise Level Measurement Results

Date	Time Period	Start Time	Duration (hh:mm)	Statistical Parameters, dB			
				$L_{Aeq,T}$	$L_{Amax,T}$	$L_{A10,T}$	$L_{A90,T}$
20/09/17	Day	17:26	12:00	54.7	84.5	56.0	43.3
	Evening	19:00	03:00	50.9	79.3	51.4	37.2
	Night	22:00	09:00	51.3	87.8	43.9	33.9
21/09/17	Day	07:00	12:00	54.3	87.8	56.2	44.9
	Evening	19:00	03:00	48.7	76.3	48.7	38.8
	Night	22:00	09:00	50.3	90.7	43.0	35.4
22/09/17	Day	07:00	12:00	63.9	88.9	58.4	41.9
	Evening	19:00	03:00	50.3	74.1	50.8	39.1
	Night	22:00	09:00	51.9	90.7	44.0	35.7

Date	Time Period	Start Time	Duration (hh:mm)	Statistical Parameters, dB			
				$L_{Aeq,T}$	$L_{Amax,T}$	$L_{A10,T}$	$L_{A90,T}$
23/09/17	Day	07:00	12:00	55.7	89.5	55.0	40.9
	Evening	19:00	03:00	49.7	81.8	50.2	37.0
	Night	22:00	09:00	45.9	84.1	43.2	33.4
24/09/17	Day	07:00	12:00	55.1	87.5	53.4	40.7
	Evening	19:00	03:00	49.6	76.5	50.9	39.8
	Night	22:00	09:00	32.5	62.0	37.7	34.6
25/09/17	Day	07:00	12:00	54.0	92.1	53.7	40.4
	Evening	19:00	03:00	49.0	67.2	47.6	35.1
	Night	22:00	09:00	44.6	73.6	40.4	33.0
26/09/17	Day	07:00	12:00	53.3	85.3	53.4	39.8
	Evening	19:00	03:00	50.0	73.4	49.0	36.6
	Night	22:00	09:00	51.5	90.5	42.8	33.5
27/09/17	Day	07:00	12:00	53.6	84.8	55.0	41.9
	Evening	19:00	03:00	N/A[2]	N/A[2]	N/A[2]	N/A[2]
	Night	22:00	09:00	42.8	76.2	51.2	37.1
28/09/17	Day	07:00	11:00	64.6	93.7	56.1	41.8
Summary*			**Day**	59.1	93.7	55.2	41.7
			Evening	49.8	81.8	49.8	37.7

[2] No data available due to rain during this period

Date	Time Period	Start Time	Duration (hh:mm)	Statistical Parameters, dB			
				$L_{Aeq,T}$	$L_{Amax,T}$	$L_{A10,T}$	$L_{A90,T}$
			Night	48.9	90.7	43.3	34.6

*Statistical analysis averaged over periods.

4.5 Mitigation

4.5.1 No incorporated mitigation has been considered for the noise assessment because as a worst-case, the predicted effects are considered minor.

4.6 Predicted Effects

Overview

4.6.1 A computer noise model has been created in order to determine the plant noise level at the façade of the nearest receptors arising from operations within the site. Predictions have been undertaken using Soundplan v7.4, which incorporates methodology specified within ISO 9613-2. The noise prediction method described in ISO 9613 is suitable for a wide range of engineering applications where the noise level outdoors is of interest. The noise source(s) may be moving or stationary and the method considers the following major mechanisms of noise attenuation:

- Geometrical divergence (also known as distance loss or geometric damping);
- Atmospheric absorption;
- Ground effect;
- Reflection from surfaces; and
- Screening by obstacles and buildings.

Assumptions

4.6.2 The ISO 9613-2 method predicts noise levels under meteorological conditions favourable to noise propagation from the sound source to the receiver, such as downwind propagation, or equivalently, propagation under a moderate ground based temperature inversion as commonly occurs at night.

4.6.3 The model has been set up using the following parameters:

Table 4.8: Modelling parameters

Item	Setting
Algorithms	Source noise - ISO 9613:-2:1996 'Attenuation of sound during propagation outdoors – general method of calculation'
Ground Absorption	Acoustically soft (assumed 0.7 coefficient) – mostly farming land with roads and scattered houses. Acoustically hard (assumed 0.4 coefficient) – mostly gravel and high-density polyethylene (HDPE) membrane around the well area.
Meteorological Conditions	10 degrees Celsius 70% humidity Wind from source to receiver
Façade Corrections	A free-field level predicted value at 1m from the façade is taken into consideration for the purpose of assessment.
Receptor Height	Ground Floor 1.5m above ground (daytime hours only) First Floor 4m above ground
Source Modelling	See Section 4.6.4
Terrain	Terrain contours intervals of 2m have been imported into the model
Site Layout	Digitised based on aerial imagery with 50cm resolution

Plant Noise Level

4.6.4 The activities modelled for the operation of the Balcombe 2z borehole site were determined using plant unchanged from the Noise Impact Appraisal issued to Cuadrilla Resources Limited by Spectrum Acoustics Consultants (ref: PJ3171/13181 – September 2013). Noise levels for the various plant involved with the phases have been taken from BS5228-1 or provided by manufacturer information. Plant noise levels are presented in Tables 4.9 to Table 4.12.

4.6.5 Site operations consist of:

- Stage 1: Exploration well testing and operations which includes borehole preparation and flow initiation operations, flow testing and pressure monitoring;
- Stage 2: Plug and abandonment of the borehole; and
- Stage 3: Demobilisation and restoration of the site.

4.6.6 During stage 1 and stage 2 the plant will be static, however during stage 3 plant will be moving across the total surface of the site. For moving plant to take into account worst case noise emissions, plant will be assumed to be located at the closest distance from each receptor. This approach considers that any single receptor will be continuously exposed to the highest task noise emissions arising from the closest point within the working area. In reality, works are not entirely static and therefore it is unlikely that any task will emit the predicted noise levels continuously to any single

receptor. No noisy plant will be used during Stage 1: pressure monitoring, and therefore has not be quantitatively assessed.

Table 4.9: Adopted sound power levels stage 1 - borehole preparation and flow initiation operations

Plant List: Stage 1 - Borehole Preparation and Flow Initiation Operations							
Plant	Noise Data			On time (%)	Number of plant items	Modelling Type	Calculated L_w dB(A) from Lp
	Plant Ref	Type	Lp (at 10m) dB(A)				
Diesel generator	C 4.79	-	64	100	1	Point Source	92
Wheeled Mobile crane	C 4.43	35t	70	100	1	Point Source	98
Work over rig	Measured	3 t	74	100	1	Point Source	102

Table 4.10: Adopted sound power levels stage 1 – flow testing

Plant List: Stage 1 – Flow Testing							
Plant	Noise Data			On time (%)	Number of plant items	Modelling Type	Calculated L_w dB(A) from Lp)
	Plant Ref	Type	Lp (at 10m) dB(A)				
Diesel generator	C 4.79	-	64	100	1	Point Source	92
Beam pump	measured	-	67	100	1	Point Source	95
SMC TL90 LED lighting tower	Manufacturer data	-	62 (at 7 m)	100	7	Point Source	87

Table 4.11: Adopted sound power levels stage 2 – plug and abandonment

Plant List: Stage 2 – Plug and Abandonment							
Plant	Noise Data			On time (%)	Number of plant items	Modelling Type	Calculated L_w dB(A) from Lp)
	Plant Ref	Type	Lp (at 10m) dB(A)				
Diesel generator	C 4.79	-	64	100	1	Point Source	92
Work	Measure	3 t	74	50	1	Point	99

over rig	d					Source	
Gas Cutter	C 1. 18	-	69	25	1	Point Source	91
Hand Held Welder	C 3. 31	-	63	25	1	Point Source	85
Generato r for Welding	3. 32	-	73	25	1	Point Source	95

4.6.7 Additional plant have been added for Stage 2 to take into account the sealing and securing of the borehole.

4.6.8 In the absence of plant list for Stage 3 from the client, the following plant and percentage of on-time have been assumed by RSK. The plant noise levels are presented in Table 4.12. The works extent for Stage 3 will be modelled as an area source covering the area to be cleared as plant such as dozers or wheeled excavators will move around the site.

Table 4.12 Adopted sound power levels stage 3 - demobilisation and restoration of the site

Plant List: Stage 3 – Demobilisation and Restoration of the Site								
Plant	Noise Data			On time (%)	Number of plant items	Screening /dB	Total Correction / dB	Total Lp at 10m dB(A)
	Plant Ref	Type	Lp (at 10m) dB(A)					
Dozer	C 2.1	20t	75	30	2	0	-2	73
Hand held pneumatic breaker	C 1.6		83	20	2	-10	-14	69
Compress-or	C 5.5	1t	65	20	2	-10	-14	51
Lorry with lifting boom	C 4.53	6t	77	20	1	0	-7	70
Wheeled excavator	C 4.10	18t	66	30	1	0	-5	61
Dumper	C 4.4	9t	76	20	3	0	-2	74
Handtools	-	-	-	-	-	-	-	-
							TOTAL	**78**
							Calculated L_W dB(A) from Lp)	***106***

Spatial scope

4.6.9 Locations of the noise sources and plant activities areas used for the computer modelling have been taken from the site plan drawing provided by Cuadrilla (reference *Figure 3 Proposed Site Plan*).

4.6.10 Distribution maps of the modelled activities are presented in Figure 4.2 to Figure 4.4

4.6.11 A summary of predicted noise levels from the different phases at the closest properties to the works and the corresponding assessment criteria is presented in Table 4.13.

4.6.12 An assessment for the proposed operation at the site has been conducted at ground floor during daytime and first floor during evening and night time, each of those at the most exposed facades of the residential receptors for the site operations.

Table 4.13: Assessment

Receptor	Period	Criteria (Background $L_{A90,t}$ + 10dB)	Highest Predicted Site Operation Noise Levels / dB $L_{Aeq, T}$			
			Stage 1		Stage 2	Stage 3
			Borehole preparation and flow initiation operations (daytime)	Flow testing (24 hours)	Plug and abandonment of the well (day and evening)	Demobilisation and restoration of the site (daytime)
R1 (Kemps Farm)	Day	52	39	34	40	41
	Evening	48	N/A	34	40[1]	N/A
	Night	45	N/A	34	N/A	N/A
R2	Day	48	25	20	26	27
	Evening	39	N/A	22	27	N/A

Receptor	Period	Criteria (Background $L_{A90,t}$ + 10dB)	Highest Predicted Site Operation Noise Levels / dB $L_{Aeq, T}$			
			Stage 1		Stage 2	Stage 3
			Borehole preparation and flow initiation operations (daytime)	Flow testing (24 hours)	Plug and abandonment of the well (day and evening)	Demobilisation and restoration of the site (daytime)
	Night	36	N/A	22	N/A	N/A
R3	Day	50	21	17	22	24
	Evening	40	N/A	18	23	N/A
	Night	37	N/A	18	N/A	N/A
R4	Day	55	31	27	31	34
	Evening	42	N/A	28	33[1]	N/A
	Night	34	N/A	28[1]	N/A	N/A
R5	Day	57	16	11	17	18
	Evening	51	N/A	12	18	N/A
	Night	40	N/A	12	N/A	N/A

[1] *Below criteria but above measured background level*

4.6.13 The assessment of impact is undertaken by comparing the measured background noise level (L_{A90}) plus 10 dB to the calculated plant level (L_{Aeq}) at each receptor (NPPF first criteria). Since the calculated plant level (L_{Aeq}) at each receptor was below the first aim criteria within NPPF technical guidance, it was not necessary to assess the results against the alternative limit presented in Table 4.1.

4.6.14 Although the calculated plant level (L_{Aeq}) at each receptor is below the "first aim" criteria set in NPPF, they are above the measured background level (L_{A90}) at some receptors. As a result, the site activities may be audible at the properties facades however unlikely to be dominant in the existing environment. The above assessment indicates that noise from the site operations with respect to residential receptors is a minor, adverse direct impact. The impact will only be during the duration of the works and therefore temporary.

4.7 Conclusion

4.7.1 An impact assessment of the Cuadrilla Balcombe Limited site has been undertaken taking into account criteria within National Planning Policy Framework technical guidance notes.

4.7.2 RSK has undertaken a site background noise survey and a computer modelling exercise in order to identify likely plant noise in comparison with baseline existing noise levels at residences.

4.7.3 The plant noise levels have been predicted to be below the first aim of the NPPF technical guidance (<10 dB above background) during the periods of operation. As such, the impact at residences of the operation and demobilisation of the site would be minor.

530000 531000 532000

130000

129000

Westup Farm
Peter's Wood
Furzefield
Long Shaw
Balcombe
ROCKS LA
LONDON ROAD
NEWLANDS
OLDLANDS AVENUE
FOXWELLS
GLEBE WAY
Great Burrow Wood
Northlands Wood
ROWHILL LANE
Brook Cottage
WESTUP ROAD
Brook Wood
Upper Stumble Wood
R5
MPR5
Hagland Wood
Spring Shaw
Kemps Farm
Kemp Farm R1
Unattended monitoring
Stumble Field Wood
Unitroy Cottages
HAYWARDS HEATH ROAD
Nettlefield Wood
Rowhill House
R4
MPR4
Rowhill Wood
Lower Stumble Wood
Upper Beanham Wood
Bowder's Farm
B2036
Poorfield Shaw
North Lodge
Lower Beanham Wood
Pilstye Wood
Bushey Wood
Furland Wood
STONEHALL LANE
Coombehole Wood
Upper Pilstye Cottages
R2
WHITETHROAT LANE
MPR2
R3
MPR3
Sand's Wood
BORDEHILL LANE
Pilstye Farm
Long Wood

Legend:

- SIte Boundary - Above Ground Works
- Site Boundary - Below Ground Works
- Noise Sensitive Receptor
- Attended Monitoring
- Unattended Monitoring

Project Engineer: Johan Toussaint
03/10/2017

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description
00	11/10/2017	First Draft

Balcombe 2z Hydrocarbon Well Testing

TITLE: Figure 4.1: Noise Sensitive Receptors and Monitoring Points

0 100 200
Metres
SCALE: 1:7,500 @ A3

N W E S

REV 00

Document Path: P:\660000 - EPD Projects\661280 - PI\00 Graphics\01 - GIS\BAL_Aco_Fig4-1_Receptor.mxd

530900
531000
531100
129300
129200
B2036 (London Road)
54.5m

Legend:

- Site Boundary - Above Ground Works
- Site Boundary - Below Ground Works
- Fence
- 1 Impermeable Membrane
- 2 Acid Pump
- 3 Acid Tank
- 4 Oil Tank
- 5 Flowback Tank
- 6 Separator
- 7 Borehole
- 8 Coiled Tubing Unit
- 9 Nitrogen Tank
- 10 Lockers
- 11 Toilet/Showers
- 12 Lab/Ladies Toilet
- 13 MDL Canteen
- 14 Toolpusher
- 15 Potable Water
- 16 Skip
- 17 Flare
- 18 Muster Station
- 19 Car Parking
- 20 Crane
- 21 Workover Rig
- 22 Beam Pump

Noise Source

- Crane
- Diesel Generator
- Workover Rig

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description
00	11/10/2017	First Draft

Balcombe 2z Hydrocarbon Well Testing

TITLE: Figure 4.2:
Distribution of Modelled Noise Sources
(Stage 1 - Borehole Preparation and
Flow Initiation Operations)

0 10 20
Metres
SCALE: 1:750 @ A3

N
W E
S

REV 00

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530900

531000

531100

129300

129200

B2036 (London Road)

54.5m

Legend:

- Site Boundary - Above Ground
- Site Boundary - Below Ground Works
- Fence
- 1 Impermeable Membrane
- 2 Acid Pump
- 3 Acid Tank
- 4 Oil Tank
- 5 Flowback Tank
- 6 Separator
- 7 Borehole
- 8 Coiled Tubing Unit
- 9 Nitrogen Tank
- 10 Lockers
- 11 Toilet/Showers
- 12 Lab/Ladies Toilet
- 13 MDL Canteen
- 14 Toolpusher
- 15 Potable Water
- 16 Skip
- 17 Flare
- 18 Muster Station
- 19 Car Parking
- 20 Crane
- 21 Workover Rig
- 22 Beam Pump

Noise Source

- Beam Pump
- Diesel Generator
- Lighting Rig

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description
00	11/10/2017	First Draft

Balcombe 2z Hydrocarbon Well Testing

TITLE:
Figure 4.3:
Distribution of Modelled Noise Sources
(Stage 1 - Flow Testing)

0 10 20
Metres
SCALE: 1:750 @ A3

N W E S

REV 00

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530900
531000
531100
129300
129200
B2036 (London Road)
54.5m

Legend:

- Site Boundary - Above Ground Works
- Site Boundary - Below Ground Works
- Fence
- 1 Impermeable Membrane
- 2 Acid Pump
- 3 Acid Tank
- 4 Oil Tank
- 5 Flowback Tank
- 6 Separator
- 7 Borehole
- 8 Coiled Tubing Unit
- 9 Nitrogen Tank
- 10 Lockers
- 11 Toilet/Showers
- 12 Lab/Ladies Toilet
- 13 MDL Canteen
- 14 Toolpusher
- 15 Potable Water
- 16 Skip
- 17 Flare
- 18 Muster Station
- 19 Car Parking
- 20 Crane
- 21 Workover Rig
- 22 Beam Pump

Noise Source

- Diesel Generator
- Gas Cutter
- Generator for Welding
- Hand Held Welder
- Workover Rig

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description
00	11/10/2017	First Draft

Balcombe 2z Hydrocarbon Well Testing

TITLE:
Figure 4.4:
Distribution of Modelled Noise Sources
(Stage 2 - Plug and Abandonment of the Well)

0 10 20
Metres
SCALE: 1:750 @ A3

N
W E
S

REV 00

Document Path: P:\660000 - EPD Projects\661280 - PI\00 Graphics\01 - GIS\BAL_Aco_Fig4-4_Stage2_Plug_and_Abandonment.mxd

530900
531000
531100
129300
129200
B2036 (London Road)
54.5m

Legend:

- Site Boundary - Above Ground Works
- Site Boundary - Below Ground Works
- Sites Clearance Works Extent

Project Engineer: Johan Toussaint
03/10/2017

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter

Rev	Date	Description
00	11/10/2017	First Draft

Balcombe 2z Hydrocarbon Well Testing

TITLE: Figure 4.5:
Distribution of Modelled Noise Sources
(Stage 3 - Demobilisation and Restoration of the Site)

0 10 20
Metres
SCALE: 1:750 @ A3

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REV 00

Document Path: P:\660000 - EPD Projects\661280 - P\00 Graphics\01 - GIS\BAL_Aco_Fig4-5_Stage3_Site_Clearing.mxd

5 AIR QUALITY

5.1 Introduction

5.1.1 As part of the 2014 planning permission a detailed air quality assessment was prepared. Given the time that has passed since this application a fully revised air quality assessment has been prepared using latest guidance and data and is presented in full in Appendix 5.1 (Air Quality Assessment – Technical Report).

5.1.2 As the borehole is already located at the application site, there will be no significant construction or any drilling works. Odour and dust associated with this type of well testing development are typically minimal and given the closest residential receptor is approximately 350m from the site, it is considered that these emissions will be negligible and assessment of odour and dust has been scoped out of the air quality assessment.

5.1.3 The assessment will therefore focus on the assessment of potential operational phase impacts on local air quality as follows:

- Exhaust emissions from traffic associated with the proposed development;
- Emission to air from flaring of gas; and
- Emission to air from generators used to power equipment on site.

5.2 Legislation, Policy and Guidance

Legislation

5.2.1 The applicable legislative framework is summarised as follows:

Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS), 2007;

- Air Quality (England) Regulations 2000;
- Air Quality (England) Regulations, 2002;
- Air Quality Standards Regulations, 2010;
- European Union Ambient Air Quality Directive (2008/50/EC);
- Environment Act 1995; and
- Ionising Radiations Regulations 1999 and Approved Code of Practice and Guidance

5.2.2 Further details of the legislative frameworks related to the air quality assessment are provided within the Appendix 5.1.

5.2.3 The relevant[3] AQS objectives for England and Wales to protect human health and for the protection of vegetation and ecosystems are summarised in Table 5.1.

Table 5.1: Air Quality Objectives/Standards Relevant to the proposed development

Substance	Averaging period	Exceedances allowed per year	Ground level concentration limit (µg/m^3)
AQS Objectives for Protection of Human Health			
Nitrogen dioxide (NO_2)	Annual	-	40
	1 hour	18	200
Carbon Monoxide (CO)	8-hour	-	10,000
Particulate Matter (PM_{10})	Annual		40
	24-hour	35	50
Particulate Matter ($PM_{2.5}$)	Annual	-	25
AQS Objectives for Protection of Vegetation and Ecosystems			
Oxides of nitrogen (NO_x)	Annual	-	30

5.2.4 The assessment of radon gas exposure levels requires the consideration of the Ionising Radiations Regulations 1999 and the Approved Code of Practice and guidance. The following limits are considered relevant to this assessment:

A maximum dose constraint of 0.3 mSv/yr (300 µSv/yr) for any source from which radioactive discharges are made; and

Statutory dose limit of 1 mSv/yr (1000 µSv/yr).

Planning Policy

National Planning Policy Framework (NPPF)

5.2.5 Section 11 of the NPPF deals with Conserving and Enhancing the Natural Environment, and states that the intention is that the planning system should prevent '*development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability*' and goes on to state that '*new development [should be] appropriate for its location*' and '*the effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or*

[3] Relevance, in this case, is defined by the scope of the assessment.

proposed development to adverse effects from pollution, should be taken into account.'

5.2.6 With specific regard to air quality, the NPPF states that:

'*Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan'*.

Local Planning Policy

5.2.7 Mid-Sussex District Council (MSDC) are in the process of updating their local plan, but the current local plan is the saved policies from the Mid-Sussex Local Plan 2004. The 2004 Local Plan policies aim to *'…protect existing water resources and to encourage a reduction in the pollution of land, air and water…'*. Policy CS22 states:

'Development will only be permitted which does not cause unacceptable levels of pollution to land, air or water in terms of noise, dust, fumes, vibration, light or heat.

Permission will not be granted for development on a site adjacent to an existing use which, as a source of pollution, would have an adverse effect on the proposed development.'

Guidance

5.2.8 The following guidance documents have been used during the preparation of the air quality assessment, further details of which are set out in Appendix 5.1:

- 2017 Environmental Protection UK (EPUK) & Institute of Air Quality Management (IAQM) 'Land-Use Planning & Development Control: Planning for Air Quality';
- 2016 Environment Agency and Department for Environment, Food and Rural Affairs (Defra) 'Air Emission Risk Assessment for your Environmental Permit'; and
- 2006 Environment Agency 'Initial Radiological Assessment Methodology', Parts 1 and 2.

5.3 Assessment Methodology

5.3.1 The approach taken for assessing the potential air quality impacts of the proposed development can be summarised as follows:

- Correspondence with the local authority on the proposed development in terms of air quality;
- Baseline characterisation of local air quality;
- Qualitative assessment of air quality impacts relating to traffic during the operational phase of the proposed development using 2017 EPUK-IAQM guidance;
- Quantitative assessment of air quality impacts during the operational phase of the proposed development using detailed dispersion modelling assessment of exhaust emissions from the proposed flare and generator engines on human receptors and at ecologically sensitive sites; and
- Assessment of the potential exposure of members of the public resulting from the discharge of radon-222 gas to the atmosphere using the Environment Agency's initial radiological assessment methodology.

5.3.2 Prior to commencing with the air quality assessment, RSK sent the proposed methodology to the Environmental Health Officer (EHO) at MSDC, but at the time of writing had not received a response.

5.3.3 Appendix 5.1 (Air Quality Assessment – Technical Report) provides full details of the methodology adopted including the parameters used within the detailed dispersion modelling assessment.

5.4 Environmental Baseline

5.4.1 The site is not located within or close to any Air Quality Management Areas (AQMAs).

5.4.2 Baseline monitoring data from pre-drill environmental monitoring has been undertaken on behalf of Cuadrilla at and near to the site for a period of approximately one month. Of relevance to the assessment presented within this report, the monitoring included NO_2 sampling using passive diffusion tubes. The results were well below the annual mean objective for NO_2, however given the short duration the data is not strictly comparable with the annual mean objectives. Further details on this monitoring data have been provided within the technical report in Appendix 5.1.

5.4.3 Background NO_2, $PM_{10,}$ $PM_{2.5}$ and CO concentrations for the study area are available from the national maps provided by Defra as part of the Local Air Quality Management Support website. This data is presented within Appendix 5.1. Background concentrations do not exceed the relevant annual average air quality objectives.

5.4.4 Based on the baseline information, it is considered unlikely that there would be an exceedance of the relevant air quality objectives in the immediate vicinity of the application site, under existing baseline conditions.

5.5 Mitigation

5.5.1 No mitigation is specifically proposed in relation to air quality given the limited emissions to air related to the proposed works. Gas flaring activity will occur for 7 days and generators are expected to be used on site for up to 12 weeks and will be switched off when not required (including outside of site working hours). Air quality monitoring will be conducted prior to, during and post well testing in response to the requirements of the existing environmental permits.

5.6 Predicted Effects

Emissions to Air from Operational Phase Traffic

5.6.1 Cuadrilla has advised that the maximum traffic flows associated with the proposed development, in any one day, will be:

- 22 cars; and
- 23 Heavy Goods Vehicles (HGVs).

5.6.2 These maximum flows are predicted for only one day, with traffic flows on the other operational days predicted to be lower.

5.6.3 Table 5.2 presents a comparison of the relevant EPUK-IAQM screening criteria for traffic generation and the maximum daily traffic flows related to the proposed development. The traffic flows generated by the proposed development are well below the EPUK-IAQM screening criteria; therefore, no perceptible impacts are expected and further assessment of the operational phase traffic is not required.

Table 5.2 Air Quality Screening Criteria from EPUK-IAQM Guidance and Comparison with the Proposed Development

EPUK-IAQM Screening Criteria	Comparison of proposed development to screening criteria
A change of Light Duty Vehicles (LDVs) of: More than 500 Annual Average Daily Traffic (AADT)	**Criteria not exceeded:** The maximum daily car trip generated by the proposed development is estimated to be 22 car trips, well below 500 AADT.
A change of Heavy Duty Vehicles (HDVs) of: More than 100 AADT	**Criteria not exceeded:** The maximum daily car trip generated by the proposed development is estimated to be 23 HGV trips, well below 500 AADT.

Operational Phase Emissions from Flaring and Generator Engines

5.6.4 The main potential impact of the proposed development is considered to be emissions from the proposed enclosed ground flare and the two generator engines on the sensitive receptors in the area surrounding the proposed development site.

Full results of the dispersion modelling exercise can be found in the technical report in Appendix 5.1 and have been summarised below.

Human Receptors

5.6.5 The predicted annual and hourly NO_2 concentrations, annual and 24-hour mean PM_{10}, annual mean $PM_{2.5}$ and maximum 8-hourly rolling mean carbon monoxide (CO) concentrations at each of the defined human receptor locations, with the proposed development operational, are all well below the relevant AQS objectives.

5.6.6 The magnitude of change of all pollutant concentrations are considered to be negligible at all sensitive human receptors assessed, except for one location for hourly mean NO_2 concentrations. For the 99.79th percentile hourly mean NO_2 concentration, a small change in concentration is predicted at one residential receptor. However, the 99.79th percentile results assume the plant (one flare and two generators) are operational for an entire year as a worst-case scenario, when in reality the flare will only operate for 7 days and only one generator is expected to be operational at any one time for a period of up to 12 weeks. Taking the conservative nature of the assessment into account and the total predicted concentrations which are well below the relevant objective, the impact in terms of 1 hour mean NO_2 concentrations is considered to be negligible.

5.6.7 The impacts on air quality at sensitive human receptors are therefore found to be short-term, direct, temporary, reversible and negligible.

Ecological Receptors

5.6.8 The predicted change in annual mean NO_x concentrations and nitrogen and acid deposition at designated ecological sites was found to be imperceptible and the proposed development did not cause any new exceedance of the relevant objectives.

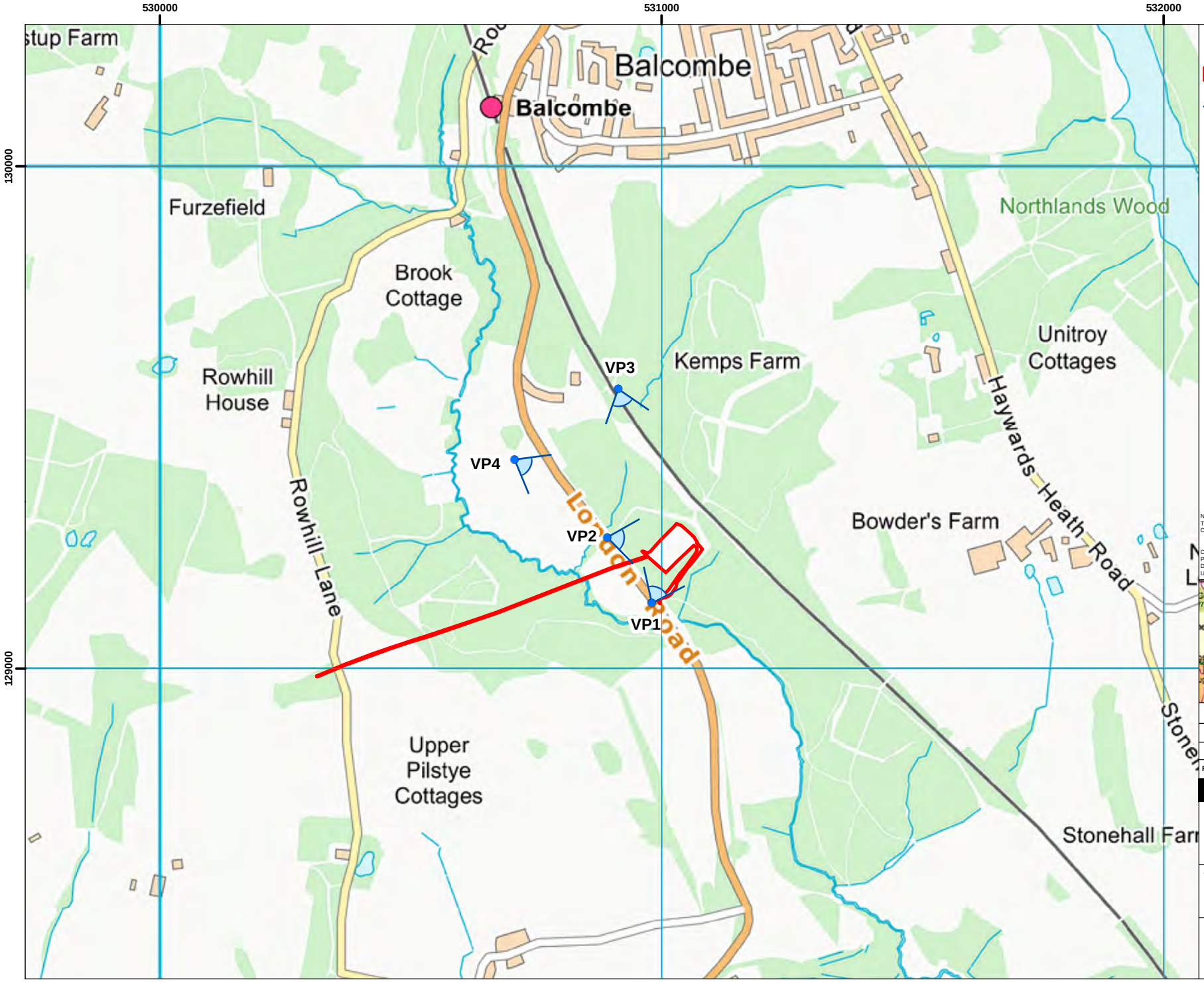
5.6.9 The impacts on air quality at designated ecological sites are therefore concluded to be short-term, direct, temporary, reversible and negligible.

Operational Phase Discharge of Radon to Air

5.6.10 Appendix 5.1 presents the results of the initial radiological assessment to consider the potential exposure of members of the public in relation to radon gas potentially released to air from the proposed development. The assessment estimates that a member of a local resident family living 100m from the flare could potentially receive an effective dose of 0.0005µSv/yr as a result of hypothetical discharge. The estimated exposure is well below the maximum dose constraint of 300 µSv/yr for a single source and the statutory dose limit of 1000 µSv/yr. Therefore the impact from discharge of radon to air is considered to be negligible.

5.7 Conclusion

5.7.1 The assessment concludes that the air quality impact of the proposed development is negligible. As this assessment has determined that the operational phase impacts on local air quality are not significant, additional mitigation measures have not been recommended and the residual impacts are considered to be acceptable.

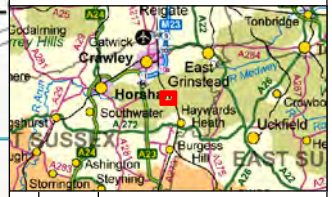


Legend:

- Balcombe Site Boundary (Indicative Only)
- 76 Degree Field of View

Notes:-
This map contains data from the following sources-
Ordnance Survey 2016-05-10

Coordinate System: British National Grid
Projection: Transverse Mercator
Datum: OSGB 1936
Units: Meter



Rev	Date	Description
00	04/10/2017	Boundary update
00	02/10/2017	First Draft

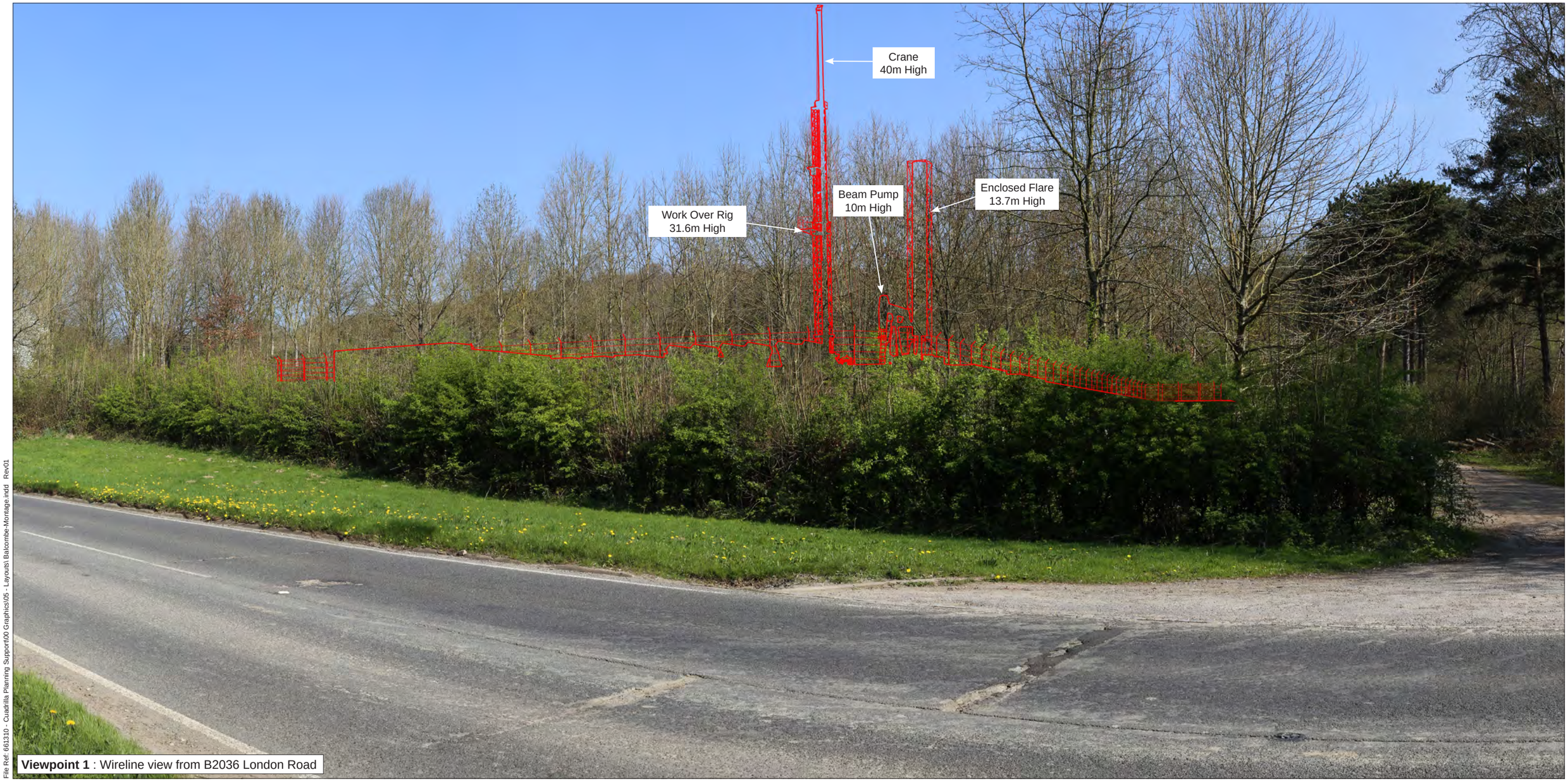
Cuadrilla Balcombe Ltd

TITLE:
Figure 6.1
Viewpoint Locations

0 100 200 300
Metres
SCALE: 1:10,000 @ A4

REV 01

Document Path: P:\660000 - EPD Projects\661310 Cuadrilla Planning Support\00 Graphics\01 - GIS\A4-Montage_VPLocs.mxd



Viewpoint 1 : Wireline view from B2036 London Road

File Ref: 661310 - Cuadrilla Planning Support\00 Graphics\05 - Layouts\ Balcombe-Montage.indd Rev01

Viewpoint 1:
NGR : 530980, 129130
Direction of View : 25º
Included Angle of View : 76º

Elevation Above OS Datum : 54m
Distance to Site Fence : 68m
Date of Photo : 7th April 2017
Time of Photo : 11:13am

Camera Height Above Ground : 1.6m
Correct Viewing Distance : 30cm at A3

11/10/2017 | Rev : 01

Note:
Views of the top part of the 40m high Crane and 31.6m high work over rig are visible in the centre of the view over intervening woodland. While glimpses during winter will be likely through the intervening woodland of the 40m high Crane, 31.6m high Work Over Rig and the 13.7m high Enclosed Flare. Views of the other plant and equipment from the site location are likely to be heavily filtered by the intervening woodland.

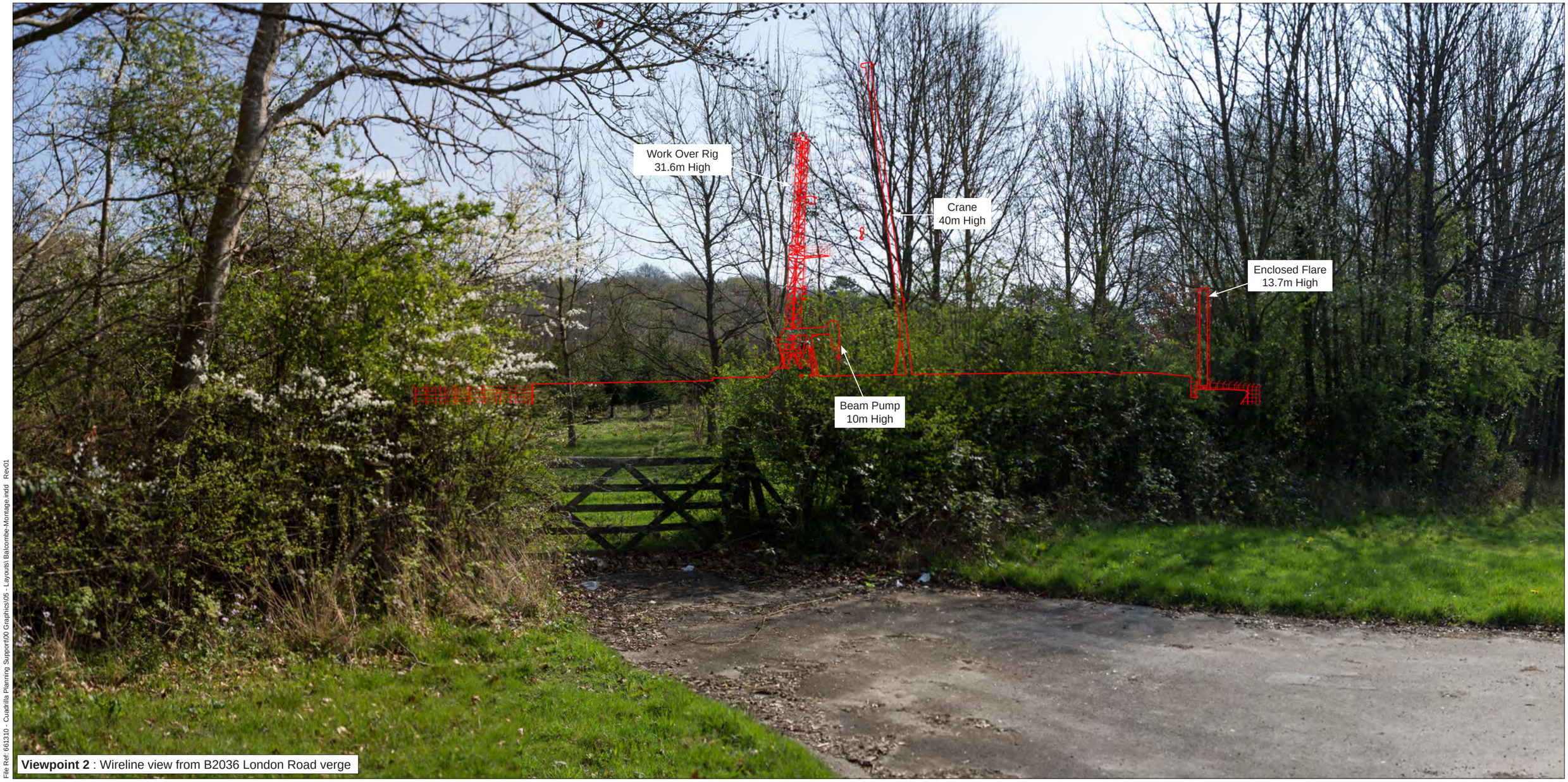
Figure: 6.2
Viewpoint 1: Wireline View
Lower Stumble Exploration Site,
London Road, Balcombe

Cuadrilla Balcombe Ltd

Viewpoint 1 : Photomontage view from B2036 London Road

File Ref: 661310 - Cuadrilla Planning Support\00 Graphics\05 - Layouts\ Balcombe-Montage.indd Rev01

	Viewpoint 1: NGR : 530980, 129130 Direction of View : 25º Included Angle of View : 76º	Elevation Above OS Datum : 54m Distance to Site Fence : 68m Date of Photo : 7th April 2017 Time of Photo : 11:13am	Camera Height Above Ground : 1.6m Correct Viewing Distance : 30cm at A3 11/10/2017 | Rev : 01	**Note:** Views of the top part of the 40m high Crane and 31.6m high work over rig are visible in the centre of the view over intervening woodland. While glimpses during winter will be likely through the intervening woodland of the 40m high Crane, 31.6m high Work Over Rig and the 13.7m high Enclosed Flare. Views of the other plant and equipment from the site location are likely to be heavily filtered by the intervening woodland.	**Figure: 6.3** **Viewpoint 1: Photomontage View** **Lower Stumble Exploration Site, London Road, Balcombe** **Cuadrilla Balcombe Ltd**



Viewpoint 2 : Wireline view from B2036 London Road verge

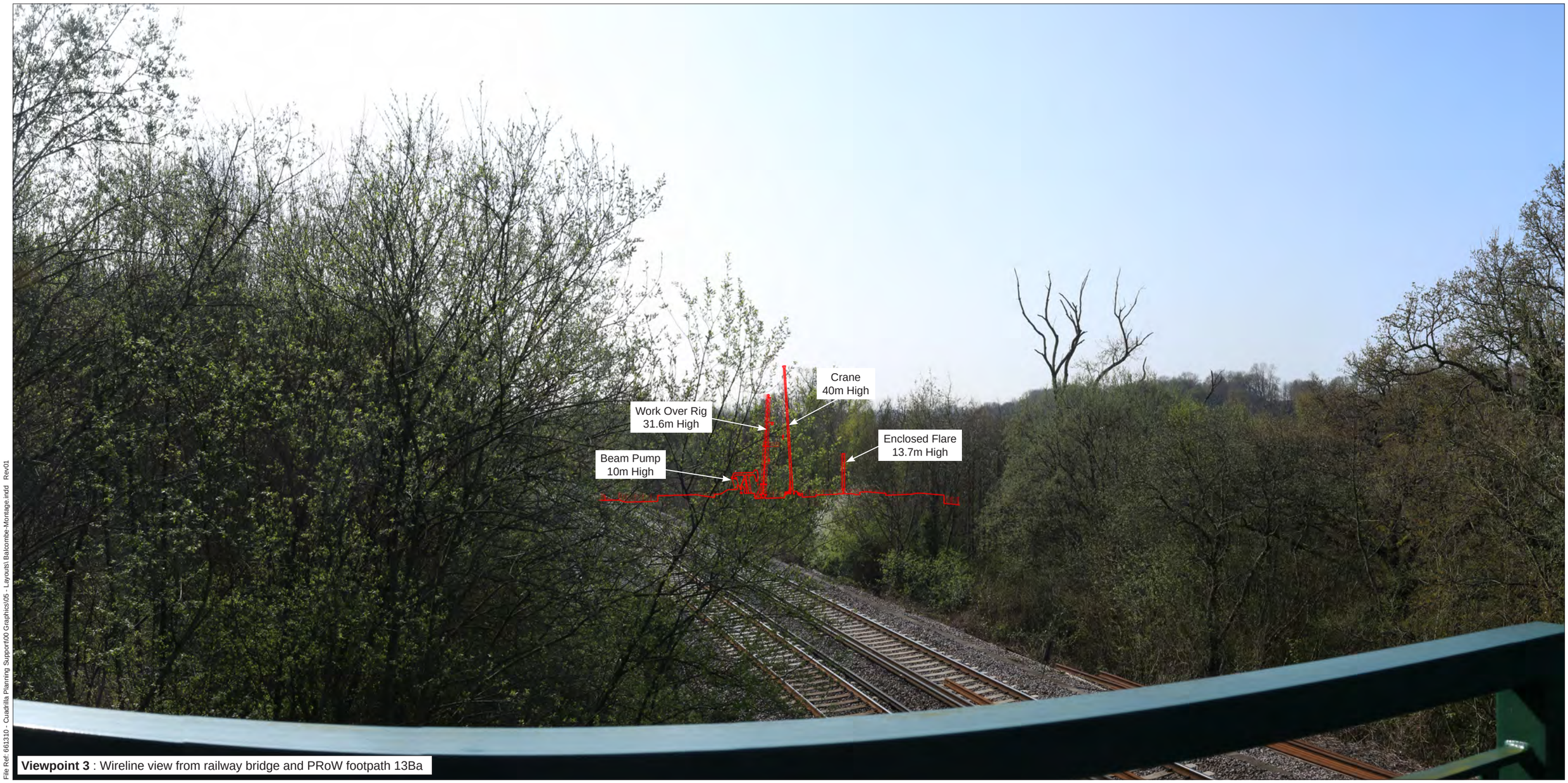
File Ref: 661310 - Cuadrilla Planning Support\00 Graphics\05 - Layouts\ Balcombe-Montage.indd Rev01

	Viewpoint 2: NGR : 530891, 129261 Direction of View : 98º Included Angle of View : 76º	Elevation Above OS Datum : 56m Distance to Site Fence : 86 Date of Photo : 7th April 2017 Time of Photo : 11:22am	Camera Height Above Ground : 1.6m Correct Viewing Distance : 30cm at A3 11/10/2017 | Rev : 01	**Note:** Views of the 40m high crane and 31.6m high work over rig will be filtered by intervening trees. Views of the other components from the rig location are to be obscured by intervening conifers, trees and hedgerow.	**Figure: 6.4** **Viewpoint 2: Wireline View** **Lower Stumble Exploration Site, London Road, Balcombe** **Cuadrilla Balcombe Ltd**

File Ref: 661310 - Cuadrilla Planning Support\00 Graphics\05 - Layouts\ Balcombe-Montage.indd Rev01

Viewpoint 2 : Photomontage view from B2036 London Road verge

	Viewpoint 2: NGR : 530891, 129261 Direction of View : 98º Included Angle of View : 76º	Elevation Above OS Datum : 56m Distance to Site Fence : 86 Date of Photo : 7th April 2017 Time of Photo : 11:22am	Camera Height Above Ground : 1.6m Correct Viewing Distance : 30cm at A3 11/10/2017 | Rev : 01	**Note:** Views of the 40m high crane and 31.6m high work over rig will be filtered by intervening trees. Views of the other components from the rig location are to be obscured by intervening conifers, trees and hedgerow.	**Figure: 6.5** **Viewpoint 2: Photomontage View** **Lower Stumble Exploration Site, London Road, Balcombe** **Cuadrilla Balcombe Ltd**



Viewpoint 3 : Wireline view from railway bridge and PRoW footpath 13Ba

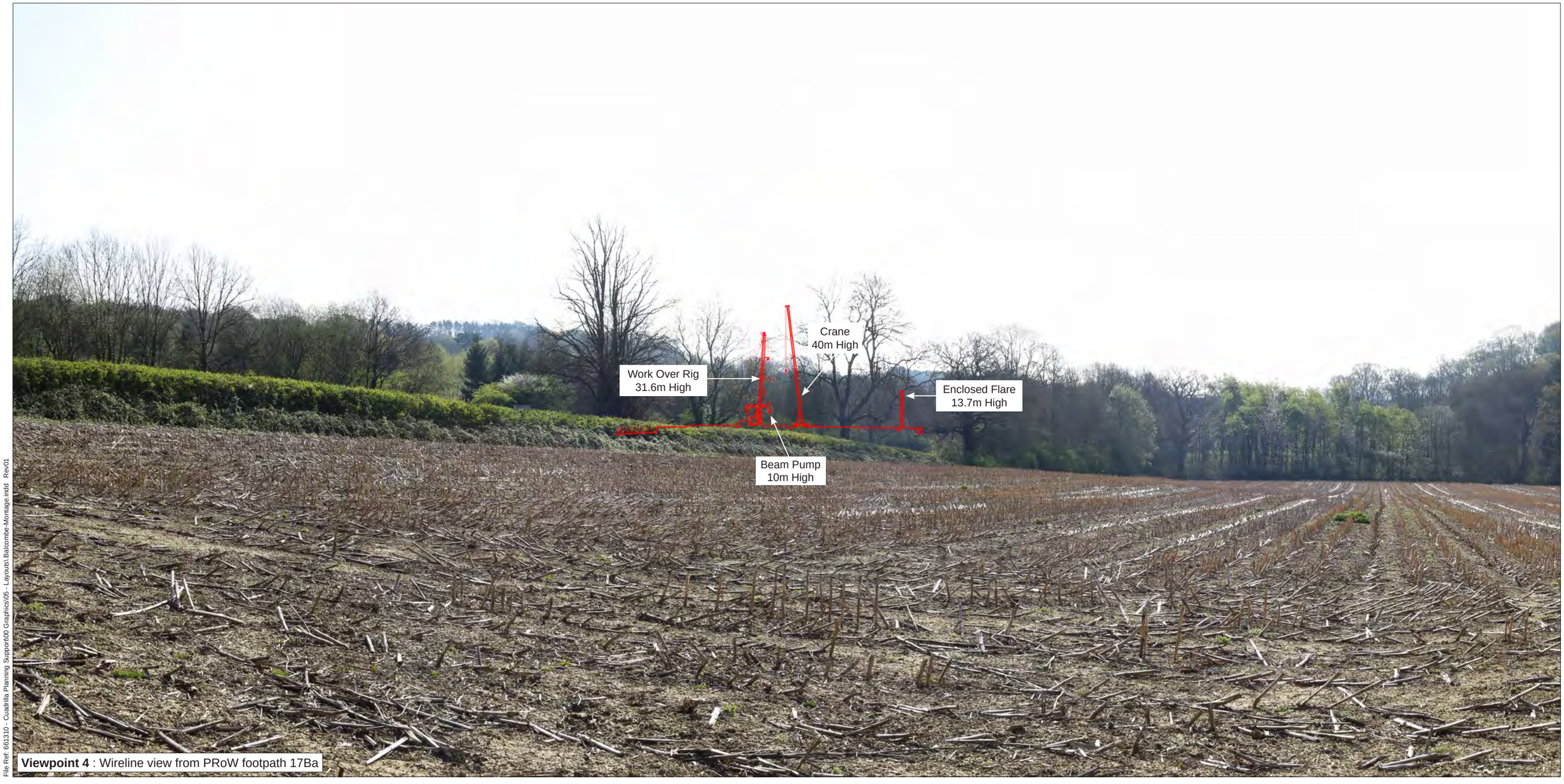
File Ref: 661310 - Cuadrilla Planning Support\00 Graphics\05 - Layouts\ Balcombe-Montage.indd Rev01

	Viewpoint 3: NGR : 530913, 129557 Direction of View : 162º Included Angle of View : 76º	Elevation Above OS Datum : 82m Distance to Site Fence : 291m Date of Photo : 7th April 2017 Time of Photo : 9:55am	Camera Height Above Ground : 1.6m Correct Viewing Distance : 30cm at A3 11/10/2017 | Rev : 01	**Note:** Views of the top of the 40m high Crane will be partially visible and glimpses of the top of the 31.6m high Work Over rig through intervening woodland. Views of the remaining plant and equipment of the site will be heavily filtered by intervening vegetation.	**Figure: 6.6** **Viewpoint 3: Wireline View** **Lower Stumble Exploration Site, London Road, Balcombe** **Cuadrilla Balcombe Ltd**

Viewpoint 3 : Photomontage view from railway bridge and PRoW footpath 13Ba

File Ref: 661310 - Cuadrilla Planning Support\00 Graphics\05 - Layouts\ Balcombe-Montage.indd Rev01

	Viewpoint 3: NGR : 530913, 129557 Direction of View : 162º Included Angle of View : 76º	Elevation Above OS Datum : 82m Distance to Site Fence : 291m Date of Photo : 7th April 2017 Time of Photo : 9:55am	Camera Height Above Ground : 1.6m Correct Viewing Distance : 30cm at A3 11/10/2017 | Rev : 01	**Note:** Views of the top of the 40m high Crane will be partially visible and glimpses of the top of the 31.6m high Work Over rig through intervening woodland. Views of the remaining plant and equipment of the site will be heavily filtered by intervening vegetation.	**Figure: 6.7** **Viewpoint 3: Photomontage View** **Lower Stumble Exploration Site, London Road, Balcombe** **Cuadrilla Balcombe Ltd**



Viewpoint 4 : Wireline view from PRoW footpath 17Ba

File Ref: 661310 - Cuadrilla Planning Support\00 Graphics\05 - Layouts\ Balcombe-Montage.indd Rev01

	Viewpoint 4: NGR : 530707, 129416 Direction of View : 120º Included Angle of View : 76º	Elevation Above OS Datum : 66m Distance to Site Fence : 325m Date of Photo : 7th April 2017 Time of Photo : 10:16am	Camera Height Above Ground : 1.6m Correct Viewing Distance : 30cm at A3 11/10/2017 | Rev : 01	**Note:** Views of the tops of the 40m high Crane and the 31.6m high Work Over Rig will be partially visible in between mature trees within the centre of the view. The hedgerow in the foreground of the view along the London Road will screen the bottom section of the site location and the plant and equipment of the site are likely to be heavily filtered by intervening mature trees, woodland and hedgerow.	**Figure: 6.8** **Viewpoint 4: Wireline View** **Lower Stumble Exploration Site, London Road, Balcombe** **Cuadrilla Balcombe Ltd**

File Ref: 661310 - Cuadrilla Planning Support\00 Graphics\05 - Layouts\ Balcombe-Montage.indd Rev01

Viewpoint 4 : Photomontage view from PRoW footpath 17Ba

	Viewpoint 4: NGR : 530707, 129416 Direction of View : 120º Included Angle of View : 76º	Elevation Above OS Datum : 66m Distance to Site Fence : 325m Date of Photo : 7th April 2017 Time of Photo : 10:16am	Camera Height Above Ground : 1.6m Correct Viewing Distance : 30cm at A3 11/10/2017 | Rev : 01	**Note:** Views of the tops of the 40m high Crane and the 31.6m high Work Over Rig will be partially visible in between mature trees within the centre of the view. The hedgerow in the foreground of the view along the London Road will screen the bottom section of the site location and the plant and equipment of the site are likely to be heavily filtered by intervening mature trees, woodland and hedgerow.	**Figure: 6.9** **Viewpoint 4: Photomontage View** **Lower Stumble Exploration Site, London Road, Balcombe** **Cuadrilla Balcombe Ltd**

6 LANDSCAPE AND VISUAL

6.1 Introduction

6.1.1 This section comprises an appraisal of the existing landscape and visual baseline and identifies potential landscape and visual effects of the proposed operations.

6.2 Legislation, Policy and Guidance

National Policy

NPPF

6.1.1 National landscape policy is found within the following document:

- The Department of Communities and Local Government (2012) National Planning Policy Framework (NPPF).
- The NPPF sets out the Government's planning objectives to contribute to and enhance the natural and local environment by *"protecting and enhancing valued landscapes"* (Para. 109, Page 25).

Local Policy

West Sussex Minerals Local Plan 2003[4]

6.1.2 Saved policy 12 within the adopted West Sussex Minerals Local Plan states *"Some mineral working may be accommodated within Areas of Outstanding Natural Beauty, but mineral workings considered likely to damage irreversibly the intrinsic qualities of these areas will be refused. The highest standards will be required in all measures to mitigate the impact of working and to promote rapid reclamation, unless it can be demonstrated that rapid reclamation is not practicable. Mineral applications will be subject to the most rigorous examination which will include an assessment of:*

a) The need for the development, in terms of national considerations of mineral supply: and the impact of permitting the development, or refusing it, on the local economy;

b) Whether alternative supplies can be made available at reasonable cost; and the scope for meeting the need in some other way;

c) Any detrimental effect of the proposals on the environment and landscape and the extent to which that should be moderated; and

[4] West Sussex County Council (July 2003) West Sussex Minerals Local Plan 2003;

d) In the case of extensions to existing workings, the extent to which the proposal would achieve an enhancement to the local landscape," (Para 4.16, Page 30).

Mid Sussex Local Plan

6.1.2.1 The site is located within the boundary of Mid Sussex District Council (MSDC). The main local policy document is as follows:

- Mid Sussex District Council (adopted May 2004) Mid Sussex Local Plan

6.1.3 Saved policy C1 states "*Outside built-up area boundaries ... the remainder of the plan area is classified as a Countryside Area of Development Restraint where the countryside will be protected for its own sake. Proposals for development in the countryside, particularly that which would extend the built-up area boundaries beyond those shown will be firmly resisted and restricted to:*

(a) proposals reasonably necessary for the purposes of agriculture or forestry;...

(c) in appropriate cases, proposals for the extraction of minerals or the disposal of waste;...

(e) proposals for facilities which are essential to meet the needs of local communities, and which cannot be accommodated satisfactorily within the built-up areas;

(f) proposals for which a specific policy reference is made elsewhere in this Plan," (Para 3.23, Page 19).

6.1.4 Within the District's Areas of Outstanding Natural Beauty (AONB), Policy C4 states "*Within the Sussex Downs and High Weald Areas of Outstanding Natural Beauty, as shown on the Proposals Map and its Insets, the aim to conserve and enhance natural beauty is regarded as the overall priority. Proposals for development will be subject to the most rigorous examination and only those which comply with this aim will be permitted. Development will not be permitted in the Sussex Downs and High Weald Areas of Outstanding Natural Beauty, unless:*

(a) it is reasonably necessary for the purposes of agriculture or some other use which has to be located in the countryside;

(b) it is essential for local social and / or economic needs; or

(c) it can be demonstrated that the development would be in the national interest and that no suitable sites are available elsewhere.

In considering development proposals within or immediately adjacent to the AONB, including those regarded as exceptions, particular attention will be paid to the siting, scale, design, external materials and screening of new buildings that are proposed in order to ensure that they enhance, and do not detract from, the visual quality and essential characteristics of the area," (Para 3.40, Pages 23-24).

Guidance

6.1.5 The proposed development has been screened by the local planning authority as not requiring an Environmental Impact Assessment (EIA). This report is therefore a 'Landscape and Visual Appraisal' as opposed to a 'Landscape and Visual Impact Assessment' (LVIA). The methods of appraisal used however are based on the broad principles established and approaches recommended in best practice guidance GLVIA3[5].

6.1.6 GLVIA3 states that the assessment of effects should be tailored to the particular circumstances in each case which applies to either formal assessments as part of an EIA or appraisals outside the formal requirements of EIA, as is the case for the proposed development.

6.3 Assessment Methodology

6.3.1 The sensitivity of the landscape (whether a landscape character area or designated landscape resource) has been assessed by using two key considerations:

- The **susceptibility** of its key characteristics to the type of landscape changes likely to be associated with the proposed development. The key characteristics of the landscape include: scale; enclosure; landform; landcover; landscape pattern; and manmade influences.

  The susceptibility of the landscape is categorised as High, Medium or Low using professional judgement.

- The **value** or importance understood to be attached to the landscape.

  The value of the landscape is categorised as High, Medium or Low using professional judgement.

  High value would be a designated and highly valued landscape of scenic quality and rarity on a national/international scale (National Park, AONBs, World Heritage Sites). Low value would be a non-designated landscape in poor condition could include elements and/or areas that are generally negative in character with few valued features.

6.3.2 Assessment of the magnitude of landscape effect may take account of the following criteria and professional judgement is used to determine the relevance and appropriate weighting to be attributed to each:

- The **degree of change** that takes place.

  The degree of likely landscape change is assessed as High, Medium, Low or Negligible. A judgement of a High change is typically defined as: the proposed development forming a prominent landscape element or would result in a

[5] The Landscape Institute and the Institute of Environmental Management and Assessment (2013) Guidelines for Landscape and Visual Impact Assessment, Third Edition (GLVIA3).

substantial alteration to key landscape characteristics. A judgement of a Negligible degree of change is typically defined as: the proposed development would be a barely perceptible landscape element or would not change the key landscape characteristics.

- The geographical **extent** of the landscape area that would be changed;
- The likely **duration** of the change to the landscape character would be long term, medium term or short term; and
- The potential **reversibility** of the change to the landscape (however, as duration and reversibility are interlinked, if a development is deemed to be permanent in duration, reversibility is not a relevant consideration).

6.3.3 A final judgement will be made on the overall level of effect on the landscape through a combination of all of the above six considerations. Overall effects will be described using a four-point scale of: major; medium; minor; or negligible and the nature of effect will also be judged as: adverse; beneficial; or neutral (however, a negligible level of effect will not typically be described as being adverse, beneficial or neutral).

6.3.4 Professional judgement and experience is used to produce the assessment of effects; however, reasoning is provided in the text as to how this conclusion has been reached.

Visual

6.3.5 The sensitivity of visual receptors has been assessed by using two key considerations:

- The **susceptibility** of the receptors to the types of change proposed.

  The susceptibility of visual receptors is categorised as High, Medium or Low using professional judgement. Typically, receptors demonstrating high susceptibility are people with a particular interest in their available view or with prolonged viewing opportunities such as: residential locations; tourist destinations providing a specific important and highly valued view; recreational hilltops; public rights of ways; ornamental parks/designed landscapes; and national trails. Typically, receptors demonstrating low susceptibility are people engaged in outdoor sport or recreation; people at their place of work including places of employment industrial buildings and commercial buildings.

- The **value** or importance understood to be attached to a view.

  The value of views is categorised as High, Medium or Low using professional judgement. Importance of views will be categorised based on the recognition of the value attached to views (planning designations or heritage assets) or indicators of the value attached to the view by visitors.

6.3.6 Assessment of the magnitude of visual effect may take account of all of the following and professional judgement is used to determine the relevance and appropriate weighting to be attributed to each:

- The **degree of visual change** that takes place.

  The degree of likely visual change is assessed as High, Medium, Low or Negligible. A judgement of a High degree of change is typically defined as: the visual changes associated with the proposed development would form a prominent element within the view, resulting in a prominent change to the quality and character of the view. A judgement of a Negligible degree of change is typically defined as: the visual changes associated with the proposed development would result in a barely perceptible change in the view, or would cause no change to the existing view.

- The geographical extent of the area from which the change would be visible (however this consideration is not relevant when considering the view from a single viewpoint);

- The likely **duration** of the visual change would be long term, medium term or short term; and

- The potential reversibility of the change to the view (however, as duration and reversibility are interlinked, if a development is deemed to be permanent in duration, reversibility is not a relevant consideration).

6.3.7 A final judgement will be made on the overall level of effect on the visual receptors through a combination of all of the above six considerations Overall effects will be described using a four-point scale of: major; medium; minor; or negligible and the nature of effect will also be judged as: adverse; beneficial; or neutral (however, a negligible level of effect will not typically be described as being adverse, beneficial or neutral).

6.3.8 Professional judgement and experience is used to produce the assessment of effects however reasoning is provided in the text as to how this conclusion has been reached.

Scope of the Appraisal

Baseline Studies

6.3.9 Baseline landscape and visual assessments are undertaken in parallel, and are informed by a combination of desk and field based techniques.

6.3.10 Preliminary identification, description and evaluation of the existing landscape and visual context of the study area involved a desk based review and interrogation of the following information sources:

- Ordnance Survey mapping and aerial photography relating to existing landform, vegetation, settlement patterns, promoted viewpoints and drainage regimes;

- Plans containing information relating to landscape designations and landscape related policies at the local, regional and national level;

- The Multi-Agency Geographical Information for the Countryside website; managed by Natural England (available at http://www.magic.gov.uk);

- National landscape character areas (NCAs) as defined by Natural England; and

- Local landscape character assessment, as defined by Mid Sussex District Council.

Study Area

6.3.11 Following the findings of the preliminary landscape and visual desk and site based assessment; the extent of the study area has been defined as a 1.0 km radius from around the site fence.

6.3.12 It is considered that the nature and form of the proposed development would be such that landscape and visual effects would be experienced within an approximate 1.0 km study radius from the site fence.

Project Envelope

6.3.13 The appraisal considers a "realistic worst case" approach to the project design parameters, which considers the physical appearance and dimensions of the proposed development, for example the height, width, length, materials etc; and the project duration and construction programme.

Baseline Field Survey

6.3.14 The field survey was undertaken during periods of clement weather from public highways, public rights of way (PRoW) and publicly accessible areas, including areas of public open space. The study area was visited on: 7th April 2017.

6.3.15 Site work involved:

- A corroboration of the findings of the desktop review;

- Additional information on landscape elements, character, views and localised screening; and

- Photography from representative viewpoints.

6.4 Environmental Baseline

Landscape Baseline

Site Description

6.4.1 The rectilinear site is 0.58 ha in size and located within the Lower Stumble Wood approximately 800m south of the village of Balcombe, West Sussex. The site is an existing drill rig pad and comprises of hard standing with the 2z borehole in the centre and bound by 2m high security fencing. The site is accessible from a vehicular access track located off London Road (B2036). The site is situated within a predominantly wooded rural landscape and sits within a secluded valley with ridgelines to the north-east and south-west of the site. See above sections 2.1 Site Location and 2.2 Site Description for further information.

Site context

6.4.2 North of the site is Lower Stumble Wood comprising of ancient and semi natural woodland. The closest residential property to the site is Kemps Farm located approximately 380m to the north. Landform rises to the northeast and east of the site and is wooded with the London to Brighton Railway Line nearby running in a north-westerly to south-easterly direction. South of the site is further ancient and semi-natural woodland named the Lower Beanham Wood. West of the site is London Road (B2036) and runs in a northwest to southeast direction.

Landscape Designations

6.4.3 The site is located within the High Weald Area of Outstanding Natural Beauty (AONB), The key characteristics of the AONB are "….*dispersed settlements, ancient routeways, an abundance of small ancient woods, gills and shaws, and small irregularly shaped and productive fields. They are all draped over a deeply incised and ridge landform of clays and sandstones, and are loosely related to socio-economic characteristics that have roots deep in history*…." (Mid Sussex District Council[6])

Landscape Character

6.4.4 Considering published landscape character documents which are relevant to the site and the proposed development, the following two documents have been referenced:

- Natural England (2013) National Character Area Profile 122: High Weald; and
- Mid Sussex District Council (2005) A Landscape Character Assessment for Mid Sussex.

[6] Mid Sussex District Council (2017) Areas of Outstanding Natural Beauty, Webpage located: http://www.midsussex.gov.uk/leisure-recreation-tourism-events/nature-conservation/areas-of-outstanding-natural-beauty/

6.4.5 The MSDC's "A Landscape Character Assessment for Mid Sussex" document provides a local level landscape character assessment which includes information at an appropriate scale to consider the landscape character of the site and study area in greater detail.

The site is located within landscape character area (LCA) **High Weald**, the key characteristics relevant to the site location are as follows:

- *"Wooded, confined rural landscape of intimacy and complexity, perceived as attractive, locally secluded and tranquil.*
- *Complex sandstone and clay hilly landscape of ridges and secluded valleys centred on the western end of Forest Ridge of the High Weald plateau deeply cut by numerous gill streams and with sandrock crags...*
- *Includes major reservoir at Ardingly and adjoins Weir Wood Reservoir.*
- *Significant woodland cover, a substantial portion of it ancient, including some larger woods and a dense network of hedgerows and shaws, creates a sense of enclosure, the valleys damp, deep and secluded.*
- *Pattern of small, irregular-shaped assart fields, some larger fields and small pockets of remnant heathland...*
- *Dense network of twisting, deep lanes, droveways, tracks and footpaths.*
- *Dispersed historic settlement pattern on high ridges, hilltops and high ground, the principal settlements East Grinstead and some expanded and smaller villages.*
- *Some busy lanes and roads including along the Crawley–East Grinstead corridor.*
- *London to Brighton Railway Line crosses the area,"* [7](Page 74).

Visual Baseline

Visual Context

6.4.6 The site is an existing exploration drill pad and has been previously used since 1986 with recent activity in 2013. The site is located within the Lower Stumble Wood and accessible via a vehicular access off London Road approximately 800m to the south of the village of Balcombe. The site is well screened by surrounding woodland and sits within a secluded valley.

[7] Mid Sussex District Council (2005) A Landscape Character Assessment for Mid Sussex.

6.4.7 There are limited views of the site due to the confined, wooded nature of the area. Kemps Farm located approximately 380m to the north-west of the site is the only property likely to experience views of the site.

6.4.8 Publicly accessible locations from which the site is potentially visible are:

- London Road (B2306), which runs along the west of the site;
- London to Brighton Railway Line to the northeast of the site;
- PRoW Footpath 17Ba (part of High Weald Circular 4 Walk), which runs to the west of the site; and
- PRoW Footpath 13Ba (part of High Weald Circular 4 Walk), located to the north-west of the site and accesses through Kemps Farm.

Representative Viewpoints

6.4.9 Four viewpoints to represent the available views of the site from within the study area have been selected to aid this assessment and are listed in **Table 6.1** below. The viewpoint locations illustrated on **Figure 6.1**. Illustrative photomontage visualisations of the proposed development are presented on **Figures 6.2 - 6.9**. It should be noted that the illustrative photomontages represent a worst-case scenario, as they illustrate all of the proposed project elements (i.e. crane, work over rig, beam pump/pump jack and enclosed flare) on site at the same time. However, in practice this would not be the case.

Table 6.1: Representative viewpoints

VP Ref	Name	Grid Ref. & Elevation (AOD)	Direction of View & Distance to Site Fence	Reasons for selection
VP1	B2036 London Road	530980, 129130 & 54 m	View north east & 68m to Site Fence.	Representative of views of users from the B2036 London Road opposite the site entrance.
VP2	B2036 London Road verge	530891, 129261 & 56 m	View east & 86m to Site Fence.	Representative of views of users from the B2036 London Road verge adjacent to the Christmas tree plantation looking East.
VP3	Railway bridge and PRoW footpath 13Ba	530913, 129557 & 82 m	View south & 291m to Site Fence.	Representative of views from railway bridge and PRoW footpath 13Ba.

VP Ref	Name	Grid Ref. & Elevation (AOD)	Direction of View & Distance to Site Fence	Reasons for selection
VP4	PRoW footpath 17Ba	530707, 129416 & 66 m	View south east & 325m to Site Fence.	Representative of views from the PRoW footpath 17Ba and south west of Kemps Farm

6.5 Mitigation

6.5.1 Embedded mitigation measures that will contribute in avoiding or minimising landscape and visual effects are as follows:

- The proposed development has the benefit of utilising an existing drill rig pad and was previously used in 2013 as an exploration well site. The presence and use of an existing drill pad would suggest that the site and local landscape are less susceptible to the proposed change;
- The site has the benefit of being located within a secluded valley and within an area of ancient and semi-natural woodland which provides screening, and therefore visibility of the site from the surrounding area is limited and localised; and
- The applicant has sought to limit the scale of the proposed development as far as is reasonably possible.

6.6 Predicted Landscape Effects

Landscape Features

6.6.1 The operational works will utilise the existing vehicular access to Lower Stumble Wood and the existing Balcombe Estate's forestry and farming activities from London Road (B2036). Access was previously used for hydrocarbon exploration sampling. The construction phase will include all HGVs accessing the site via junction 10a of the M23 motorway and not from the south.

6.6.2 The proposed development will largely utilise areas of the existing hard standing and the operational works would not involve the loss of any landscape features such as woodland, trees or hedgerow. There are therefore no effects to existing landscape features during the operational works.

Landscape Designations and Landscape Character

6.6.3 The proposed development would introduce additional plant and equipment into the existing drill pad site which would minimise direct effects on the local landscape.

6.6.4 The key considerations in assessing the level of effect which the proposed development would have on the landscape are:

- The local landscape character area High Weald LCA is described as a wooded, confined rural landscape with a substantial portion of ancient woodland that creates a sense of enclosure that is secluded. The site is adjacent to ancient woodland and Gill streams, which are identified as key characteristics to the landscape character area. The High Weald AONB and High Weald LCA is of **High** value due to the area being of national landscape value;

- The susceptibility of the local landscape to the type of changes associated with the proposed development should consider the use of an existing drill pad which has previously carried out drilling activities and was last used in 2013. These existing features of the drill pad contribute to the local landscape having a less natural appearance and suggests the ability to accommodate change. The landform and wooded surroundings means the area has good ability to accommodate the change proposed. The landscape is therefore considered to have a **Low** susceptibility to change;

- The proposed development will be in keeping with the appearance of the existing site and previous uses; and the landform and woodland cover of the landscape lend its self to limiting inter-visibility locally within the study area and within the wider landscape. It is considered that the proposed development would be a barely perceptible landscape element and would not change the key landscape characteristics, which indicates that it would give rise to a low degree of change;

- The geographical extent of the effects will be limited and localised to the existing site which is contained by surrounding woodland; and

- The duration of operational effects will be short term (6 months) and therefore both temporary and reversible once operations are completed. The proposed development would reach at most 40 m in height due to the crane that would only be a temporary feature for less than one-week. The proposed development would also include an approximately 31.6m high work over rig which would be temporary for 20 weeks with 60 days the rig being limited to a height of 6 metres. The other tall components are a 13.7m high enclosed flare and a 10m high beam pump/pump jack.

Combining all of the above criteria, the direct level of landscape effect on the landscape character and AONB would be locally **Minor adverse** and indirect effects of the wider landscape would be **Negligible**.

Visual Effects

The following are the identified effects on the representative viewpoints:

Viewpoint 1: View from B2036 London Road Opposite the Site Entrance Looking North East (See Figures 6.2 and 6.3)

6.6.5 The viewpoint is representative of users of London Road (B2036) with the direction of view to the north east towards the site entrance and Lower Stumble Wood. The top part of the 40m high Crane and 31.6m high work over rig are visible in the centre of the view over intervening woodland. While glimpses during winter will be likely through the intervening woodland of the 40m high crane, 31.6m high work over rig and the 13.7m high enclosed flare. Views of the other plant and equipment from the site location are likely to be heavily filtered by the intervening woodland.

6.6.6 The sensitivity of the receptor based on susceptibility and value is considered to be **Medium** as it is representative of views by people travelling by car.

6.6.7 The tall vertical components of the proposed development would be perceived as background components within the view that would largely go unnoticed and lead to a minor change within the view that is temporary. The remaining parts of the site would be screened by the intervening woodland and be imperceptible from the view. The degree of change is therefore considered to be **Low** as the addition of the proposed development to an existing drill pad, would result in the temporary crane and work over rig being at most partially viewed over intervening woodland.

6.6.8 The duration of effect is short term for 6 months, the crane at 40m high would only be onsite for less than a week while the work over rig at 31.6m high at most would be onsite for 20 weeks with 60 of those days being limited to 6m in height. Therefore, the duration of the visual change would be temporary and reversible once operations have been completed.

6.6.9 Based on these considerations, the level of effect experienced at this viewpoint is considered to be **Minor** and **adverse**.

Viewpoint 2: View from the B2036 London Road Verge Adjacent to the Christmas Tree Plantation Looking East (See Figures 6.4 and 6.5)

6.6.10 The viewpoint is representative of users of London Road (B2036) with the direction of the view looking east onto Lower Stumble Wood. Views of the 40m high crane and 31.6m high work over rig will be filtered by intervening trees. Views of the other components from the rig location are to be obscured by intervening conifers, trees and hedgerow.

6.6.11 The sensitivity of the receptor based on susceptibility and value is considered to be **Medium** as it is representative of views by people travelling by car.

6.6.12 The filtered views of the crane and work over rig would be perceived as background components within the view that would largely go unnoticed and lead to a minor change within the view that is temporary. The remaining parts of the site would be screened by the intervening hedgerow and woodland and would be imperceptible from the view. The degree of change is therefore considered to be **Low** as the addition of the proposed development to an existing drill pad, would result in the temporary crane and work over rig being at most partially viewed over intervening woodland

6.6.13 The duration of effect is short term for 6 months, the crane at 40m high would be only be onsite for less than a week while the work over rig at 31.6m high at most would be onsite for 20 weeks with 60 of those days being limited to 6m in height. Therefore the duration of visual change would be temporary and reversible once operations have been completed.

6.6.14 Based on these considerations the level of effect experienced at this viewpoint is considered to be **Minor** and **adverse.**

Viewpoint 3: View from Railway Bridge Looking South (See Figure 6.6 and 6.7)

6.6.15 The viewpoint is representative of users of the Railway Bridge and PRoW footpath 13Ba (part of the High Weald Circular Walk 4) with the direction of the view looking south along the railway track towards Lower Stumble Wood. Views of the top of the 40m high crane will be partially visible and glimpses of the top of the 31.6m high work over rig through intervening woodland. Views of the remaining plant and equipment of the site will be heavily filtered by intervening vegetation.

6.6.16 The sensitivity of the receptor based on susceptibility and value is considered to be **High** as it is representative of views by users of a PRoW.

6.6.17 The tops of the temporary crane and work over rig would be barely perceptible in the distance and with the majority of the site being well filtered if not screened by intervening woodland. The degree of change is therefore considered to be **Negligible**.

6.6.18 The duration of effect is short term for 6 months, the crane at 40m high would be only be onsite for less than a week while the work over rig at 31.6m high at most would be onsite for 20 weeks with 60 of those days being limited to 6m in height. The duration of visual change is therefore temporary and reversible once operations have been completed.

6.6.19 Based on these considerations the level of effect experienced at this viewpoint is considered to be **Minor** and **adverse**.

Viewpoint 4: View from the PRoW South West of Kemps Farm Looking South East Across the B2036 London Road (See Figures 6.8 and 6.9)

6.6.20 The viewpoint is representative of users of PRoW footpath 17Ba (part of the High Weald Circular Walk 4) with the direction of the view looking south east over a rolling arable field onto a hedgerow running along London Road with mature trees and Lower Stumble Wood beyond. Views of the tops of the 40m high crane and the

31.6m high work over rig will be partially visible in between mature trees within the centre of the view. The hedgerow in the foreground of the view along the London Road will screen the bottom section of the site location and the plant and equipment of the site are likely to be heavily filtered by intervening mature trees, woodland and hedgerow.

6.6.21 The sensitivity of the receptor based on susceptibility and value is considered to be **High** as it is representative of views by users of a PRoW.

6.6.22 The tops of the temporary crane and work over rig would be barely perceptible in the distance and a small change within the existing view. The degree of change is considered to be **Negligible**.

6.6.23 The duration of effect is short term for 6 months, the crane at 40m high would be only be onsite for less than a week while the work over rig at 31.6m high at most would be onsite for 20 weeks with 60 of those days being limited to 6m in height. The duration of visual change would be temporary and reversible once operations have been completed.

6.6.24 Based on these considerations the level of effect experienced at this viewpoint is considered to be **Minor** and **adverse.**

6.7 Conclusion

6.7.1 The consideration of landscape effects has focused on the effects experienced on the national designation High Weald AONB and the local landscape character area High Weald LCA with ancient woodland. It has been considered that the direct effect on the landscape character and AONB would be locally **Minor** adverse and indirect effects on the wider area would be **Negligible**. Landscape effects experienced from the proposed development would therefore be unobtrusive. The main summary of comments regarding landscape effects are as follows:

- The highly valued and sensitive High Weald AONB and LCA are susceptible to change due to the proposed development utilising an existing drill rig pad.
- It is considered that the proposed development will alter a very small geographical area that is secluded and surrounded by woodland cover within the context of a large-scale landscape character area and is therefore considered to be localised.
- The duration of operation will be for 6 months and therefore temporary and reversible once operations are completed.
- The level of landscape effect would be short term.

6.7.2 The consideration of visual effects has focused on the effects experienced at four representative viewpoints which are representative of views of the proposed development from within a 1 km study area. No effects have been identified which are greater than **Minor** and **adverse** and therefore it is deemed that overall visual effects experienced due to the proposed development would be of unobtrusive nature. The main summary of comments regarding visual effects is as follows:

- There are relatively few visual receptors within the study area which have the potential to experience visual effects of the proposed development given the secluded, wooded and enclosed nature of the location;
- The addition of the proposed development to an existing drill rig pad that was previously used in 2013;
- The tall components partially visible over the woodland or intervening vegetation would result in a barely perceptible change in views even with the tall vertical components that include the crane, work over rig and enclosed flare.
- The work-over rig would be used for a small amount of time within a temporary period (6 months) with the effects caused by the crane to only last less than 1 week, the effects of the work over rig to last no more than 20 weeks with 60 of those days the height being limited to 6m.

7 ECOLOGY

7.1 Introduction

7.1.1 This section presents the findings of an ecological assessment undertaken for the proposed development.

7.2 Legislation, Policy and Guidance

7.2.1 There are a number of Acts, Directives and international conventions which aim to conserve biodiversity and nature conservation interest in the UK. Those which are relevant to the proposed development have been summarised below.

Wildlife and Countryside Act 1981 (as amended) (WCA)

7.2.2 This legislation provides a range of protection relating to wild birds, plants and other animals including bats, Great Crested Newt, reptiles, Badger and Hazel Dormice.

Countryside and Rights of Way Act 2000

7.2.3 This legislation strengthens the protection of Sites of Special Scientific Interest (SSSI) and protected species. Some provisions have now been superseded by the NERC Act 2006 (see below).

Natural Environment and Rural Communities Act 2006 (NERC)

7.2.4 This legislation imposes a duty on public bodies to conserve biodiversity, including a requirement to compile a list of habitats and species of principal importance for the purpose of conserving biodiversity.

National Parks and Access to the Countryside Act 1949

7.2.5 This legislation provides a framework for creating National Parks, Areas of Outstanding Natural Beauty (AONB) and Local Nature Reserves (LNR).

Protection of Badgers Act 1992

7.2.6 This legislation protects badgers from cruelty including injury, killing and disturbance

Birds Directive 1979

7.2.7 This legislation establishes a comprehensive network of Special Protection Areas (SPA) and bans activities that directly threaten birds.

Habitats Directive 1992, Conservation of Habitats and Species Regulations 2010

7.2.8 This legislation protects species and habitats and gives protection to Special Areas of Conservation (SAC) which form part of the Natura 2000 network.

National Planning Policy Framework (NPPF)

7.2.9 The NPPF establishes a number of core land use planning principles that should underpin both plan making and decision taking, including contributing to conserving and enhancing the natural environment.

7.2.10 The relevant section of the NPPF for ecology (Section 11) is entitled – "Conserving and enhancing the natural environment", and it states that the planning system should contribute to and enhance the natural and local environment through the following measures:

- Protecting and enhancing valued landscapes, geological conservation interests and soils;
- Recognising the wider benefits of ecosystem services;
- Minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures; and
- Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability; and remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.

Non Statutory Policies

7.2.11 In 1994 the UK Government ratified the Convention on Biological Diversity and published the UK Biodiversity Action Plan (BAP). In 2012 the UK Post-2010 Biodiversity Framework was published which sets out the objectives for biodiversity in the UK until 2020. The habitats and species listed in this framework are the same as those listed in the now defunct UK BAP, but are now referred to as Priority Habitats and Priority Species.

7.2.12 BAPs define actions and measures to meet the objectives defined in a Strategy, and specify measurable targets. Accordingly, BAPs determine the broad habitats and species that are of value to the natural environment of the UK, and identify actions and projects that could be undertaken to help protect or enhance the national biodiversity. The UK BAP species relate to the requirement of Section 41 of Natural Environment and Rural Communities Act, 2006 and include all species and habitats of principal importance.

7.2.13 Local Biodiversity Action Plans (LBAPs) are implemented through planning policy, identifying habitats and species of particular value or endangerment at the local, county, district or regional level. As such, LBAPs have no statutory status, but provide a framework for implementing conservation requirements. Sussex Biodiversity Partnership's "A Biodiversity Action Plan for Sussex" has been considered for this assessment.

7.2.14 Local Wildlife Sites (or County Wildlife Sites or Sites of Importance for Nature Conservation) are sites of local conservation interest designated by the relevant Local Planning Authority.

7.3 Assessment Methodology

Background Data Search

7.3.1 A desk-based assessment was undertaken in April 2017 covering a 2-km radius from the centre of the proposed site. Information was collated from the organisations and websites listed below:

- Multi-Agency Geographic Information on the Countryside (MAGIC) website (www.magic.gov.uk);
- Local records centre (Sussex Biodiversity Records Centre), and;
- The Joint Nature Conservation Committee (JNCC) website (www.jncc.gov.uk).

Preliminary Ecological Appraisal (PEA)

7.3.2 The habitat survey centred on the Phase 1 Habitat Survey approach (Joint Nature Conservation Committee 2010) as extended for use in Environmental Impact Assessments (Institute of Environmental Assessment 1995). This involves the following elements:

- Habitat mapping using a set of standard colour codes to indicate habitat types on a Phase 1 Habitat Map; and
- Description of features of possible ecological or nature conservation interest in notes relating to numbered locations on the Phase 1 Habitat Map, called 'Target Notes'.

7.3.3 Basic Phase 1 Habitat Survey methods are described in detail in Joint Nature Conservation Committee (JNCC 2010). Limits to the achievable reliability of the method are discussed in Cherrill & McClean (1999).

7.3.4 Plant nomenclature in this report follows Stace (2010) for native and naturalised species of vascular plant. Introduced species and garden varieties were identified using the relevant texts. Plant names in the text are given with scientific names first, followed by the English name in brackets.

Invasive Plant Species

7.3.5 Phase 1 Habitat survey does not involve exhaustive surveying for any individual plant species, but if invasive plant species, *e.g. Fallopia japonica* (Japanese Knotweed), *Heracleum mantegazzianum* (Giant Hogweed) or *Impatiens glandulifera* (Indian Balsam), were seen during the normal course of the survey they were noted and reported.

Habitat Assessment for Protected Vertebrates

General

7.3.6 The suitability of the site for protected animals was assessed. Taking into account the location and habitats at the site, assessment was carried out for:

- Badgers (*Meles meles*);
- Great Crested Newts (*Triturus cristatus*) (and other amphibians);
- bat species;
- common reptiles,
- breeding birds (common nesting birds and Nightjar), and
- Hazel Dormice (*Muscardinus avellanarius*).

Further details of the assessment methods are given below.

Badgers

7.3.7 The site was assessed for Badgers and focused in areas that might be used by Badger (*Meles meles*) for commuting, foraging and sett-building. Signs of Badgers include setts, tracks, footprints, hair on barbed wire fences, feeding signs, and dung pits.

Great crested newts

7.3.8 The terrestrial habitats were assessed for their suitability for Great Crested Newts. Suitable habitat generally includes rough grassland and woodland where they can forage and hibernate, and requires good links (with cover from predators) between such areas and the ponds where they breed.

Bats

7.3.9 Habitat was assessed for commuting and foraging bats. Areas of particular interest vary between species, but generally include habitats with good numbers of insects, such as woodland, scrub, hedges and species-rich or rough grassland.

7.3.10 Trees were assessed for their potential to support roosting bats. Suitable features include cracks, splits and rot holes.

7.3.11 Bat activity surveys followed methodology outlined in published guidelines to identify any areas of high commuting and/or foraging activity and also to confirm the species involved (large roosts can sometimes also be identified from patterns of activity). Survey visits were undertaken in May, June and September 2017.

7.3.12 A Wildlife Acoustics Song Meter 2 Bat+ (SM2) detector was also installed within the drilling platform to monitor activity in the vicinity of the works footprint. The SM2s provided complementary data collected over a minimum of five consecutive nights in accordance with published guidelines.

7.3.13 SM2s were deployed in May, June and September 2017 for at least five consecutive nights to provide information on the level of bat activity and composition of bat species using the site, the relative importance of features and locations, and how patterns of bat activity may change throughout the year.

Reptiles

7.3.14 The site was assessed for reptiles, with particular attention to features that provide suitable basking areas (*e.g.* south-facing slopes), hibernation sites (*e.g.* banks, walls, piles of rotting vegetation) and opportunities for foraging (*e.g.* rough grassland and scrub).

Nesting birds

7.3.15 The site was assessed for nesting birds. Birds nest in a wide variety of habitats including scrub, hedges and trees, as well as on open ground.

Hazel dormice

7.3.16 The habitats were assessed for their general suitability for Hazel Dormice. Dormice generally use areas of dense woody vegetation cover, and are more likely to be found where there is a wide diversity of woody species contributing to three-dimensional habitat complexity, a number of food sources, plants suitable for nest-building material, and good connectivity to other areas of suitable habitat.

Other UK BAP species

7.3.17 The site was also assessed for its potential for Nightjar (*Caprimulgus europaeus*) and European Hedgehog (*Erinaceus europaeus*).

Habitat Regulations Assessment (HRA) Screening

7.3.18 The site is 8.9 km from Ashdown Forest Special Area of Conservation (SAC) and Special Protection Area (SPA) therefore an HRA screening was required to consider potential effects of the proposals on this internationally important site.

7.3.19 It is the competent authority's role (West Sussex County Council) to undertake a Habitats Regulation Assessment (HRA) if it is deemed necessary. A shadow HRA screening report has been prepared (see Appendix 7.3) to provide the competent authority with the information they may require to conclude whether the proposed development would require an Appropriate Assessment (AA), in accordance with *The Conservation of Habitats and Species Regulations 2010*.

7.3.20 The desk study, together with a preliminary ecological appraisal, has been used to determine any potential impacts of the proposed development on the habitats and species listed as "primary reasons" or "qualifying features" for the SAC/SPA.

7.4 Validity of Data

7.4.1 According to Natural England advice, survey data should not be over two years old for medium-high impact schemes or multi-plot or phased developments. Surveys up to four years old may be acceptable for low impact schemes (i.e. small areas of work or temporary land take), as long as the habitats have not changed significantly in that time period. Where a European Protected Species licence is required after the grant of planning permission, Natural England expects applicants to check - by walk-over survey not more than three months before the submission of a licence application - that conditions have not changed significantly since surveys were carried out for the original planning application.

7.5 Environmental Baseline

Designated sites

7.5.1 There are three statutory designated sites and five non-statutory designated sites within 2 km of the site. Statutory designated sites include the High Weald Area of Outstanding Natural Beauty (AONB), Rowhill Copse Local Nature Reserve (LNR) and Ardingly Reservior LNR. Non-statutory designated sites include Rowhill and Station Pastures Local Wildlife Site (LWS), Balcombe Marsh LWS, Balcombe Estate Rocks LWS, Ardingly Reservoir and Loder Valley Nature Reserve LWS and Balcombe Lake and Associated Woodland LWS.

7.5.2 The site also lies within a Site of Special Scientific Interest (SSSI) Impact Risk Zone and there are large areas of ancient woodland within 2 km of the site centre point.

7.5.3 Ashdown Forest Special Area of Conservation (SAC) and Special Protection Area (SPA) is 8.9 km from the nearest part of the site.

Protected and noteworthy species records

7.5.4 At least 110 noteworthy species were recorded from places within 2 km of the site centre point. Of these, 5 are amphibians, 56 are birds, 2 are fish, 7 are invertebrates, 1 is a lichen, 27 are plants, at least 8 are mammals and 4 are reptiles.

Habitats

7.5.5 The habitat types within the survey area (defined on *Figure 1* of the PEA report (*Appendix 7.1*)) include the following:

- plantation woodland (broadleaved and coniferous);
- scattered trees;
- dense scrub;
- hedgerows;
- amenity grassland;
- ruderal vegetation on hard-standing; and
- fences, bare ground and hard standing.

7.5.6 The works footprint (as shown on *Figure 1* of the PEA report) is comprised solely of existing hard-standing.

Protected Species

7.5.7 Works are restricted to an area of existing hard-standing so although adjacent land is suitable for a number of protected species, the only protected species which could be indirectly affected by the proposed development are foraging and commuting bats.

7.5.8 Habitats within the immediate surroundings of the works footprint were found to provide suitable foraging and commuting opportunities for bats during the activity and static surveys which recorded at least five bat species using the site. See *Appendix 7.2* for further details.

7.6 Mitigation

7.6.1 Although no Badger signs or setts were found during the survey and there are no records of Badgers in the vicinity of the site, the scrubbed banks to the north and east of the works footprint do provide suitable sett building habitat. Therefore, should evidence of Badgers within these areas be noted during works an ecologist should be consulted and further action may be required.

7.6.2 Vegetation clearance is unlikely to be required as part of the proposed development however if required any vegetation clearance should be conducted outside the breeding bird season (March to August inclusive). If this is not possible then a watching brief by an ecologist would be required to ensure that no nesting birds are present no more than 48 hours prior to vegetation being cleared. If nests were found to be present during this time work would have to stop until the nestlings had fledged. If vegetation clearance is undertaken outside of the nesting season then nesting birds do not have to be considered.

7.6.3 Although there is no suitable habitat within the works footprint, light spill onto adjacent habitat where a Glow-worm was found should be avoided. Mitigation to protect bats will also protect Glow-worms using adjacent habitat.

7.6.4 Although there is no suitable habitat for Hedgehog within the works footprint, adjacent woodland, scrub and hedgerows do provide opportunities for foraging and hibernation. Fences around the works footprint are not impenetrable to small mammals therefore it is possible that Hedgehogs could commute across this area. Any excavations should be covered at night or a ramp provided to reduce the risk of trapping Hedgehogs (and other small mammals).

7.6.5 The lighting plan should seek to keep areas where high bat activity was recorded (*i.e.* surrounding woodland boundaries) as dark as possible.

7.6.6 To minimise the potential disturbance to bats during periods of 24 hour working all operational areas of the drilling platform will be lit with task-based lighting which will be inward facing to avoid light spill to areas outside of the works footprint and therefore minimising the potential for negative impacts to bats. Lighting cowls will be utilised to further reduce light spillage to areas outside of the works footprint. This is particularly important for bat species that are less tolerant of artificial light such as Myotis sp. which were frequently encountered during the site surveys so are known to use the habitats surrounding the works footprint.

7.6.7 An enclosed flare will be situated within the stone drilling platform fenced compound which offers negligible potential for foraging and commuting bats which will likely utilise the habitats surrounding the works footprint. Additionally, this area will also be lit during the testing phase which will further dissuade bats from entering the working footprint. This combination of factors will limit the potential for bats to be disturbed by the light produced by the flare. The potential impact of the flare on bat species in the area is therefore deemed to be negligible.

7.7 Predicted Effects

Designated sites

7.7.1 The proposed works will not affect any designated sites found within 2km. The Ashdown Forest Special Area of Conservation (SAC) and Special Protection Area (SPA) lies within 10km of the site however due to the distance from the proposed works and mitigation measures applied to protect other protected species, there will be no effect on the SAC/SPA.

SSSI impact risk zones

7.7.2 As the proposed works are in connection with the exploration for and appraisal of oil and gas reserves Natural England should be consulted prior to any works taking place.

Habitats

7.7.3 Areas of planted vegetation have been created to act as a screen to works previously undertaken on the area of hard-standing. They provide habitat for nesting birds and some potential for reptiles however they contain common and widespread plant species.

7.7.4 The only habitats directly affected by the works are hard-standing and ruderal vegetation, which are of negligible value to biodiversity.

Protected species

7.7.5 The surveys were sufficient to show that GCN, reptiles, Hazel Dormice and Nightjar are absent from the site and no further action is required regarding these species.

7.7.6 Habitat surrounding the works footprint is suitable for foraging and commuting bats (and other nocturnal animals such as Glow-worm and Hedgehog). Lighting of the works area could have an adverse effect on nocturnal animals using the surrounding habitat. The effect will be short term (*i.e.* no more than six months) and the use of lighting will be minimised as much as possible.

7.7.7 The client will also endeavour to carry out the most disturbing works to bats (*i.e.* works which require night time lighting) outside the active season for bats (November to April) and where this is not possible the mitigation measures outlined in the bat report (Appendix 7.2) will be put in place therefore the likelihood of the effect is low.

7.8 Conclusion

7.8.1 As the works are restricted to existing areas of hard-standing (which are unsuitable for protected species) and will not result in any habitat loss, there will be no direct effects on ecology. However, there is potential for indirect effects (*i.e.* light spill) to affect protected species. The mitigation outlined above will reduce the amount of light reaching adjacent habitats and protect nocturnal species using the surrounding area. It is therefore concluded that the works will have a minimal effect on protected sites and species.

8 TRAFFIC AND TRANSPORT

8.1 Introduction

8.1.1 This section describes the effects that the proposed development is likely to have on traffic flows within the local area. In line with good practice, a Traffic Management Plan (TMP) will be implemented by the appointed contractor, an outline of which is provided at section 8.5 and is likely to be conditioned as part of any planning permission.

8.1.2 After completion of the borehole exploration and appraisal programme, the surface site would be cleared of all equipment and restored to its former hard standing status. Subsequently, there will be no long-term effects from the proposed development from a traffic and transport perspective.

8.2 Legislation, Policy and Guidance

8.2.1 The relevant guidance which has been used to assess the effects of the proposed development comprises the following:

- National Planning Policy Framework (DCLG, 2012);
- Planning Practice Guidance (DCLG, 2016); and
- WSCC Transport Assessment Methodology

8.2.1.1 National guidance recommends that a transport assessment should be submitted where a development generates significant amounts of transport movements. Referring to the WSCC methodology, this defines significant to be in excess of 20 HGV movements per day.

8.3 Assessment Methodology

8.3.1 To assess the likely effect of construction traffic on the local area the WSCC Transport Assessment Methodology is considered.

8.3.2 Information provided by Cuadrilla indicates the predicted traffic generated by the proposed operations based on workers and HGV movements. This data has been compared to the WSCC significance threshold to determine if further assessment is required.

8.3.3 The construction effects have been considered by examining the different vehicle requirements over the three stages of work, as outlined in section 2. These briefly comprise the following:

- Stage 1: Exploration borehole testing operations;

- Stage 2: Plug and abandonment of the borehole; and
- Stage 3: Demobilisation and site restoration.

8.4 Environmental Baseline

8.4.1 The application site is located adjacent to a purpose-built access road which links to B2036 London Road, approximately 1km south of Balcombe village. The B2036 connects junction 10a of the M23 motorway and beyond to Crawley with Cuckfield and Haywards Heath.

8.4.2 The M23 provides the main strategic route to the site for HGVs while light vehicles can also approach the site from the A272.

8.4.3 London Road is a B classified road which is a single carriageway road providing the only connection from the site to the strategic road network. It primarily serves the village of Balcombe along with a number of rural properties along its route. It is generally subject to a 50mph speed limit to the north of Balcombe, reducing initially to 40mph and then 30mph through the village. South of the village the speed limit increases to 60mph, including the section onto which access to the application site will be provided.

8.4.4 There are bus stops immediately outside the site offering a 2 hourly service to Hurstpierpoint and Crawley via Balcombe. Balcombe benefits from a railway station with passenger rail services connecting Brighton and Bedford via London. However, it is expected that road transport will form a significant part in worker movements and for all materials and equipment.

8.5 Mitigation

8.5.1 Although there is no discernible effect on the traffic flow as a result of the proposed operations a TMP has been developed to ensure that HGVs only use appropriate routes to access the site.

8.5.2 HGV traffic will be limited to accessing the site using B2036 London Road from the M23 motorway. HGVs will be limited to a left in/right out turn into London Road. Accessing the B2036 to the south of the application site will be restricted for construction traffic. This route is illustrated in Appendix 8.1.

8.5.3 The TMP will be developed prior to any works being carried out on the application site and shall provide details as appropriate, but not necessarily be restricted to the following matters:

- The anticipated number, frequency and types of vehicles used during the proposed development;
- The method of access and routing of vehicles including consideration of routing to/from the south;

- The parking of vehicles by site operatives and visitors;
- The loading and unloading of plant, materials and waste;
- The storage of plant and materials used in the development;
- The erection and maintenance of security hoarding (if relevant);
- The provision of works required to mitigate the impact of development upon the public highway (including the provision of temporary Traffic Regulation Orders);
- Details of public engagement both prior to and during the proposed development;
- Traffic management schemes such as restrictions on timings, associated signage etc; and
- Measures to ensure that HGVs avoid travelling past Balcombe Church of England Primary School (a) 30 minutes before and 15 minutes after the start of the school day; and (b) 15 minutes before and 30 minutes after the end of the school day on any school day.

8.5.4 Entry into the surface exploration site would be from the existing access to Lower Stumble Wood and the Balcombe Estate's forestry and farming activities from London Road (B2036), to the west of the site. Given that this access has previously been used for hydrocarbon exploration and the temporary nature of the development proposed, it is not considered necessary at this stage to improve the access further.

8.5.5 The access track and hard surfaced existing bell mouth will be kept clear of debris during all site operations and approved highway signage will remain in situ throughout the three stages of the proposed development. All HGVs associated with the proposed development will access the site via Junction 10a of the M23 motorway and not from the south via Cuckfield.

8.6 Predicted Effects

8.6.1 Access to the site for the exploration well testing equipment would be from the M23 motorway junction 10A and along the B2036 London Road. Journeys to and from the site would avoid the peak traffic flow periods except in the case of emergency. Access to the site for operatives travelling in light vehicles would depend on the location of their accommodation and may come from the north or south along the B2036 London Road. It is assumed for assessment purposes that workers will be distributed approximately 75% to the north and 25% to the south.

8.6.2 The rural nature of the road network surrounding the site is factored into the construction traffic effects; as such a specific HGV route has been developed. It is possible to assess the likely effect of construction traffic along this route by examining the volume of construction traffic provided by Cuadrilla. The graph

provided by Cuadrilla and contained in Appendix 8.2 outlines three key stages, which are presented in further detail in Table 8.1 below.

Table 8.1: Balcombe 2z Hydrocarbon Well Testing – Estimated HGV Movements

Stage	Activity	Approximate Timescales	Estimated HGV Movements	Maximum daily HGV movements
1	Mobilisation / equipment set up	1 week	Approximately 65 two-way vehicles movements. This equates to an average of 9 two-way vehicle movements per day.	20 two-way vehicle movements.
	Flow test	2 weeks	Approximately 97 two-way movements. This equates to an average of 6 two-way vehicle movements per day.	23 two-way vehicle movements.
	Pressure monitoring	7 weeks	Approximately 8 two-way vehicle movements. This equates to an average of less than 1 two-way vehicle movement per day.	4 two-way vehicle movements.
2	Plug and abandonment of well	4 weeks	Approximately 94 two-way movements. This equates to an average of 3 two-way vehicle movements per day.	10 two-way vehicle movements.
3	Demobilisation and site restoration	4 days	Approximately 34 two-way vehicle movements. This equates to an average of 8 two-way vehicle movements per day.	12 two-way vehicle movements.
TOTAL		**115 days of activity**	**298 two-way vehicle movements (149 in and 149 out)**	

8.6.3 This graph shows the daily two-way movements of vehicles for each type (HGV and cars/vans), which would typically occur between 07:30 and 18:30 hours.

8.6.4 As discussed above these figures were examined to identify the maximum volume of HGVs on any given day with consideration for the duration of such an effect. It is clear from the graph that the two-way movement of HGVs only exceeds the WSCC threshold of 20 HGVs per day on a single occasion for a duration of one day out of 115 days of activity.

8.6.5 For the majority of the time – 7 weeks during pressure monitoring in stage 1, there will be no HGV movements as monitoring of the flow and the associated pressure gauges is undertaken. As outlined in Section 8.5, it is considered that the existing site access could accommodate the proposed development without any further improvements. It is also expected that the level of traffic generated by the proposed development would be likely to have a negligible impact on the local highway network.

8.6.6 In terms of light vehicles, it is estimated that up to 22 car/van movements may be generated by the activities at the peak with a typical value of 16 movements during site mobilisation and demobilisation and just 8 movements during the 7-week pressure monitoring stage. Given the distribution of these movements to north and south directions from the site access, it is likely to result in a negligible effect on the local highway network.

8.7 Conclusion

8.7.1 This assessment provides a summary of the likely increase in traffic flows associated with the proposed development. Utilising data provided by Cuadrilla it is considered that the proposed operations will have a negligible effect on the local road network.

8.7.2 The local highway network has sufficient capacity to accommodate the level of temporary traffic during the operational period.

8.7.3 The proposed mitigation measures, comprising good practice preparation of a TMP, should be sufficient to overcome any concerns raised over increased HGV and non-HGV movements generated during the proposed operations.

9 HYDROLOGY, FLOOD RISK AND DRAINAGE

9.1 Introduction

9.1.1 The purpose of this section is to assess the potential impacts of the project on flood risk, hydrology and surface water drainage.

9.1.2 In particular, it considers the potential effects of flooding on the site and also the effect of the site operation on flood risk, hydrology and drainage.

9.1.3 This section directly references the documentation previously submitted in support of 2013 planning application (LPA Ref: WSCC/063/13/BA), in particular the Planning Statement (Version 2.0 November 2013) and Report on Drainage Strategy (Version 1.0 August 2013) included in Appendices 9.1 and 9.2 respectively.

9.2 Legislation, Policy and Guidance

9.2.1 The following lists the relevant national legislation and local policy with relevance to this assessment.

National Policy and Legislation

- National Planning Policy Framework (NPPF) (2012) – in particular Chapter 10 "*Meeting the challenge of climate change, flooding and coastal change*";
- Planning Practice Guidance (PPG);
- Flood and Water Management Act 2010;
- Water Resources Act 1991;
- The Water Act 2003; and
- Water Framework Directive (2000).

Local Policy

- The West Sussex County Council adopted Minerals Local Plan (2003);

9.2.2 Other relevant legislation which has been taken into account includes:

- Environmental Protection Act 1990 – establishes the legislative framework for identifying and dealing with contaminated land and water;
- Environment Act 1995 – created a number of new agencies including the Environment Agency and set new standards for environmental management;

- Groundwater Regulations 1998;
- Environmental Permitting Regulations 2010 (as amended) – includes the discharge of water and groundwater activities;
- Environmental Protection (Duty of Care) Regulations 1991 (as amended) – ensures that waste is properly stored while on the premises and that it is adequately packaged for transportation; and
- Environmental Damage (Prevention and Remediation) Regulations 2009 – aim to prevent and remedy damage to land, water and biodiversity

9.3 Assessment Methodology

9.3.1 A full assessment of the various flood risks has been undertaken, together with an assessment on the site drainage regime and potential impact on the surrounding hydrological network.

9.3.2 This assessment has involved a review of the previous documentation submitted as part of the 2013 application (much of which is still valid) and a site walkover survey undertaken in October 2017.

9.3.3 No 3rd party consultation has been undertaken during the course of this assessment.

9.4 Environmental Baseline

9.4.1 The following section describes the current baseline environment at the site in its current context, dealing with flood risk, hydrology and drainage.

9.4.2 Figure 9.1 illustrates the potential receptors surrounding the site.

9.4.3 **Fluvial Flood Risk**: The site of the pad and the access track from London Road are located within the Environment Agency (EA) Flood Zone 1. This is the **low** risk flood zone considered to have a less than 1 in 1000 year (i.e. a probability of less than 0.1%) chance of flooding from rivers or streams.

9.4.4 **Tidal Flood Risk**: The site is located far enough inland so as not to be at risk from tidal flood risk.

9.4.5 **Surface Water (Pluvial) Flood Risk**: According to EA data, the majority of the site is shown to be at a very low risk from flooding associated with surface water flooding. Two isolated areas of 'low' and 'low to medium' risk are shown adjacent to the southeast and southwest site boundary respectively.

9.4.6 The site is located within an area considered by the Strategic Flood Risk Assessment (SFRA) prepared by West Sussex County Council to have a low to medium risk of flooding from surface water flows.

9.4.7 As the site is on locally level ground with surrounding levels falling to the south, and given the presence of the railway line on a raised embankment to the north forming an effective control on surface water flows from higher ground, the site is concluded to be at a **low** risk from surface water flooding.

9.4.8 **Groundwater Flood Risk**: The site is located within an area that is considered to be potentially at medium risk of flooding from groundwater flooding. However, given the underlying geology, and as the site is on ground that is locally elevated above the valley floor and outside of the fluvial floodplain (considered indicative of potentially worst case groundwater flooding potential), it is concluded to be at **low** risk from this source of flooding.

9.4.9 **Sewer Flood Risk**: According to the SFRA mapping there are no records of historical sewer flooding in the area and given the rural location of the site, with a lack of sewer infrastructure considered to be present, it is concluded that the site is at **low** risk of flooding from this potential source of flooding.

9.4.10 **Artificial/Reservoir Flood Risk**: The only potential artificial source of flooding in the area is the Ardingly Reservoir which is located some 1.5km to the east of the site. The reservoir is in the neighbouring catchment to that of the site and separated from it by significantly higher ground that forms the watershed. The site is concluded to be at **negligible** risk from this source of potential flood risk.

9.4.11 The EA flood maps indicate that a small length of London Road to the southwest of the site as being within Flood Zone 3 (High Risk). However, given the change in elevation along the section of the road indicated as being at risk, it is concluded that any flood depths will be shallow and safe access/egress could be maintained at all times.

9.4.12 The proposed development is not specifically categorised under the 'Flood Risk Vulnerability Classification' in the NPPF. However, based on a review of the other uses listed within the classes provided, this proposed development is considered to best fit within the 'less vulnerable' category.

9.4.13 The 'Flood Risk Vulnerability and Flood Zone Compatibility' matrix (NPPF) indicates that 'less vulnerable' development is appropriate in Flood Zone 1.

9.4.14 There is no known history of flooding within the area and the SFRA for the area also has no historical record.

9.4.15 **Hydrology:** The site review has identified two surface water streams (both unnamed) located in the Lower Stumble woodland and Lower Beanham woodland respectively. The Lower Stumble woodland stream is located approximately 100 meters to the north-west of the site. The Lower Beanham woodland stream is located approximately 30 meters to the south of the site.

9.4.16 The Lower Beanham woodland stream is understood to be seasonally dry. Both streams flow in approximately a southerly direction where they enter a larger watercourse (unnamed) which generally flows in a south-easterly direction towards the River Ouse.

9.4.17 This larger water course is located approximately 125m south of the site. The two smaller streams join the larger water course in close proximity to the main road between Balcombe and Cuckfield.

9.4.18 Ground Gas Solutions Ltd were commissioned previously (prior to 2013) to undertake a surface water sampling strategy from 5 identified sampling points as illustrated in Figure 9.2. The sampling strategy has established a baseline of water quality. As a minimum 3 were taken from locations 1, 2, 3, 4 and 5 before the drilling of the 2z borehole was undertaken in 2013.

9.4.19 **Site Drainage**: A topographic view of the proposed borehole testing site set up is shown in figure 9.3. The blue line indicates the area (approximately 33.5m x 33.5m) where an impermeable membrane has been installed.

9.4.20 The remainder of the site compound (measuring approximately 90m x 55m) will continue to infiltrate into the underlying strata, albeit at a reduced rate due to the compacted stone laid to facilitate vehicle movements and site activity.

9.4.21 A French drain runs along the site compound perimeter. An oil interceptor has been built into the drainage system along with a sump. A 150mm butterfly valve system is in place to prevent discharge from the site. The valve is accessible from a manhole cover situated adjacent to the oil interceptor. The valve will be shut during the operational phase of work.

9.4.22 The overflow outlet pipe from the perimeter French drain discharges to the stream channel approximately 60m to the southeast of the site.

9.4.23 The site walkover indicated no land drains within the vicinity of the site.

9.5 Mitigation

9.5.1 **Flood Risk:** The site is assessed as having a **low** risk of flooding from all sources including fluvial, tidal, surface water, groundwater and artificial drainage.

9.5.2 Due to the low risk, no site-specific flood risk mitigation measures are recommended.

9.5.3 **Hydrology:** The two identified small watercourses closest to the site are located 100m to the northwest (Lower Stumble Stream) and 30m to the southeast (Lower Beanham Woodland Stream).

9.5.4 Analysis of the localised topography and catchments has concluded that there will be no predicted impacts on the Lower Stumble Stream to the northwest, as this drains the plantation land to the north, but not the site area itself.

9.5.5 The site area would naturally drain into the catchment of the Lower Beanham Woodland stream to the southeast.

9.5.6 The French drain incorporating an oil interceptor running around the site perimeter discharges into the watercourse via a 6inch diameter pipe. This connection is designed as a high-level overflow and runs with a trickle flow under normal wetter

conditions when the isolation valve is open. The valve will be shut during the operational phase of the works ensuring no offsite discharges whatsoever.

9.5.7 In line with previous recommendations a post operational phase of surface water monitoring should be implemented to ensure no adverse impacts on the surface water environment.

9.5.8 **Drainage**: The site membrane has been constructed in a central area of the site of approx. 0.11 hectares (33.5m x 33.5m). The method of installation included a contractor tidying the existing site area and re rolling to a flat surface. A perimeter bund from used railway sleepers has been laid and protective geotextile has been laid on top of the stone surface area within the bund.

9.5.9 A fully welded 1.0mm textured HDPE membrane has been installed to the geotextile area, sealed to concrete slab edge with metal battening and fixed to the top of sleepers. The HDPE membrane is textured to prevent slippage. A further 500g/m^2 protective geotextile over HDPE area has been fixed to the perimeter sleepers.

9.5.10 A nominal “pump sump” approx. 2m x 2m x 0.3m deep in the corner of the lined area nearest to existing oil interceptor has been established to pump off liquids contained within the bunded area. An access ramp in/out of the area in timber/stone has been installed. To protect the HDPE membrane further, 70mm thick rig mats (5m x 1m) have been provided to the entire area excluding 3m x 3m for the cellar.

9.5.11 The fuel tank is double skinned (secondary containment) in line with the Oil Storage Regulations. Chemicals are stored in containers containing drip trays. Any oils, diesels, chemicals in use shall be stored on drip trays.

9.5.12 The concrete slab has Aco drains flowing into the cellar forming a sealed impermeable area. The surface water from the pad will be directed into the cellar and be disposed of off-site via a suction tanker to a waste water treatment works.

9.5.13 The Site HSE Advisor will visually inspect the butterfly valve on a daily basis during drilling and well testing. No discharges are allowed from the oil interceptor at any time.

9.6 Predicted Effects

9.6.1 **Flood Risk**: The site is wholly located within flood risk zone 1 (low risk in relation to either tidal or fluvial flooding). The predicted effects of the site operation on fluvial and tidal flooding are **negligible**, both in the short, medium and long term

9.6.2 Given the site setting within the local topography of the surrounding land, the site is not considered to be at risk from surface water (overland flow) flooding. The predicted effects of the site operation on surface water flooding are **minor adverse**, in the short term and **negligible** in the medium and long term.

9.6.3 Given the underlying geology, the site is not considered to be at risk from groundwater flooding. The predicted effects of the site operation on groundwater

flooding are **minor adverse**, in the short term and **negligible** in the medium and long term.

9.6.4 The site is predicted to have a **negligible** effect on the additional forms of flood risk including sewer flood risk and flood risk from artificial drainage. These effects are predicted to be negligible in the short, medium and long term.

9.6.5 **Hydrology and Drainage**: Surface water and water used in the drilling operation on the 33.5m x 33.5m pad will be contained within the site and removed as necessary by tanker ensuring no offsite discharges from this area and therefore a negligible effect on the nearby watercourses.

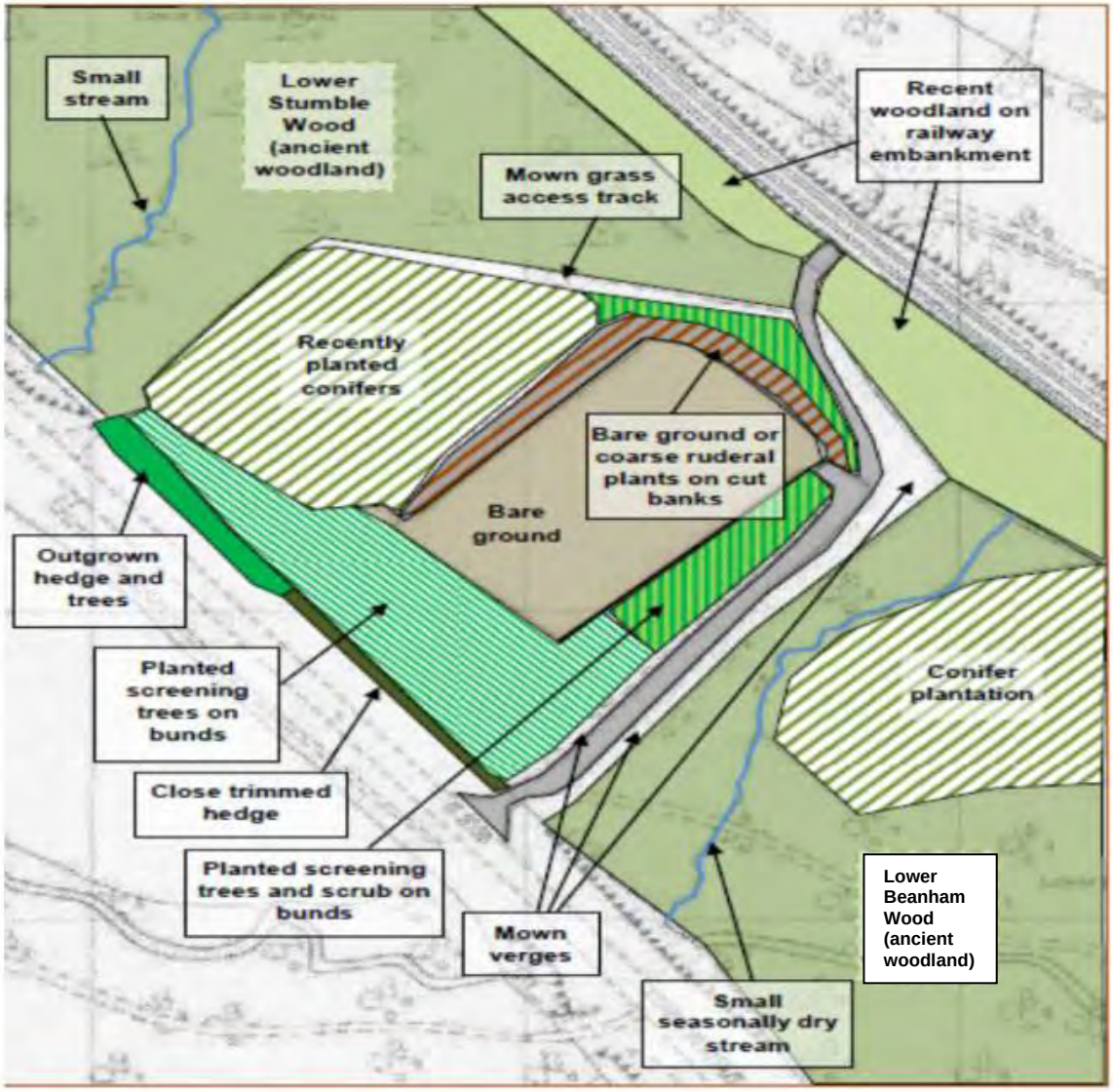
9.6.6 The remaining area of the site compound (measuring approximately 90m x 55m) will continue to infiltrate into the underlying soils. However, given that the compacted hardcore and gravel finish will likely have a lower infiltration rate than the natural soils and some sub surface flow is expected, a perimeter French drain has been installed which outfalls via an oil interceptor into the stream to the southeast via a 150mm outfall. Under normal conditions this drain discharges via a trickle flow to the watercourse, however, during the operational phase, the butterfly valve will be shut and any excess water tankered offsite, ensuring that there will be a **negligible** impact on the surrounding hydrology in the short term. In the medium to long term whilst the site is not operational the trickle discharge to the watercourse during wetter conditions can be maintained from the perimeter French drain, ensuring a **negligible** impact on the receiving watercourse.

9.6.7 No discharge to local watercourses will take place from the pad area and no silting will arise as a result of the on-site exploratory operations. There will be a **minor** to **negligible** impact on the surrounding hydrology.

9.7 Conclusion

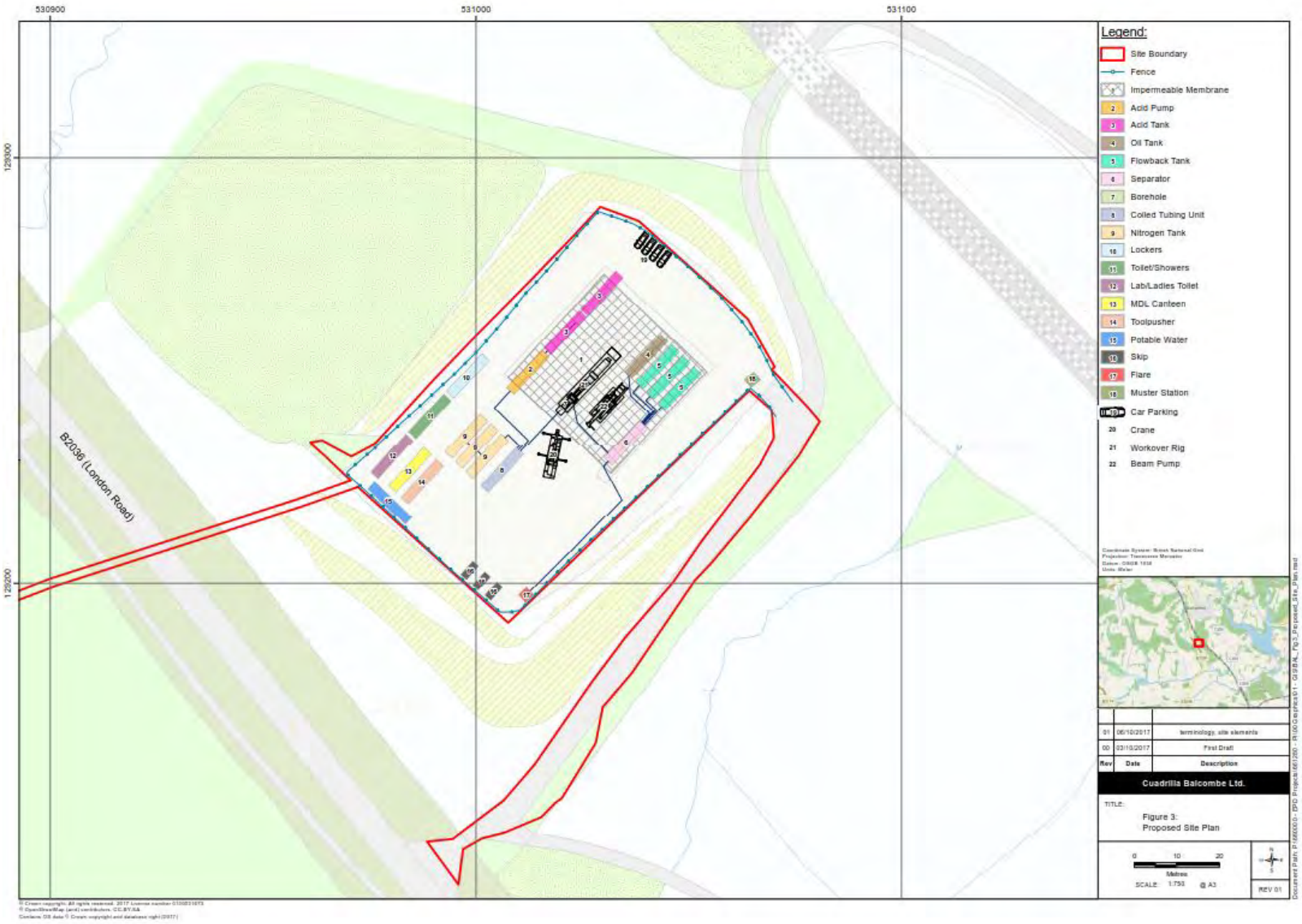
9.7.1 The potential short, medium and long-term effects on flood risk, hydrology and drainage have been assessed with respect to the operation of the site. All effects have been assessed as **minor** to **negligible**.

9.7.2 All minor effects are considered temporary in nature and most critically, any short term **minor** effects will be **reversible** and should be controllable by the mitigation described herein.



RSK	Surrounding Site Receptors	**Client:**	Cuadrilla Resources Limited	**Figure No:**	9.1
		Site:	Balcombe	**Job No:**	661310
		Scale:	NTS	**Source:**	Client

RSK	Surface Water Sampling Locations	**Client:**	Cuadrilla Resources Limited	**Figure No:**	9.2
		Site:	Balcombe	**Job No:**	661310
		Scale:	NTS	**Source:**	Client



RSK	Proposed Site Plan	**Client:**	Cuadrilla Resources Limited	**Figure No:**	9.3
		Site:	Balcombe	**Job No:**	661310
		Scale:	NTS	**Source:**	Client

10 HYDROGEOLOGY AND POLLUTION CONTROL

10.1 Introduction

10.1.1 This section aims to outline, and give an understanding of, the physical environment of the site in relation to the proposed activities. Factors such as geology and hydrogeology have the potential to affect the proposed development in terms of safety and integrity. This may in turn have direct and indirect effects on the environment and these effects may be temporary or permanent, positive or adverse.

10.2 Legislation, Policy and Guidance

10.2.1 The following policy and legislation is considered relevant to the assessment of potential impacts to groundwater and soils. A summary is given to the more significant legislation:

- Directive establishing a framework for community action in the field of water policy - Water Framework Directive (WFD) (2000/60/EC) and the Groundwater Daughter Directive to the Water Framework Directive (2006/118/EC):

  The WFD is designed to enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands that depend on the aquatic ecosystems, to promote the sustainable use of water, to reduce pollution of water, especially by “priority” and “priority hazardous” substances and to ensure progressive reduction of groundwater pollution. The WFD requires a management plan for each river basin be developed every six years.

- Priority Substances Daughter Directive to the Water Framework Directive (2008/105/EC)

  The Priority Substances Directive (PSD) 2008/105/EC is a “Daughter” Directive of the WFD, which sets out a priority list of substances posing a threat to or via the aquatic environment. The PSD establishes environmental quality standards for priority substances, which have been set at concentrations that are safe for the aquatic environment and for human health. In addition, there is a further aim of reducing (or eliminating) pollution of surface water (rivers, lakes, estuaries and coastal waters) by pollutants on the list. The WFD requires that countries establish a list of dangerous substances that are being discharged and an Environmental Quality Standard (EQS) for them. In England and Wales, this list is provided in the River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010. In order to achieve the objectives of the WFD, classification schemes are

used to describe where the water environment is of good quality and where it may require improvement.

- Water Resources Act (1991)

  The Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009 updated the Water Resources Act 1991, which introduced the offence of causing or knowingly permitting pollution of controlled waters. The Act provides the Environment Agency (EA) with powers to implement remediation necessary to protect controlled waters and recover all reasonable costs of doing so.

- Environmental Protection Act 1990: Part 2A.

  Part IIA of the Environmental Protection Act 1990 (EPA) and its associated Contaminated Land Regulations 2000 (SI 2000/227), which came into force in England on 1 April 2000, form the basis for the current regulatory framework and the statutory regime for the identification and remediation of contaminated land. Part IIA of the EPA 1990 defines contaminated land as 'any land which appears to the local authority in whose area it is situated to be in such a condition by reason of substances in, on or under the land, that significant harm is being caused, or that there is significant possibility of significant harm being caused, or that pollution of controlled waters is being or is likely to be caused'. Controlled waters are considered to include all groundwater, inland waters and estuaries;

  In August 2006, the Contaminated Land (England) Regulations 2006 (SI 2006/1380) were implemented, which extended the statutory regime to include Part IIA of the EPA as originally introduced on 1 April 2000, together with changes intended chiefly to address land that is contaminated by virtue of radioactivity. These have been replaced subsequently by the Contaminated Land (England) (Amendment) Regulations 2012, which now exclude land that is contaminated by virtue of radioactivity; and

  The intention of Part IIA of the EPA is to deal with contaminated land issues that are considered to cause significant harm on land that is not undergoing development (see Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance, April 2012). This document replaces Annex III of Defra Circular 01/2006, published in September 2006 (the remainder of this document is now obsolete).

- Directive on the management of waste from extractive industries - Mining Waste Directive (2006/21/EC);
- Directive on environmental liability with regard to the prevention and remedying of environmental damage - Environmental Liability Directive (2004/35/EC);
- The Environmental Permitting (England and Wales) Regulations 2016. (2016 No. 1154);
- Borehole Sites and Operations Regulations (1995) SI No. 1995: 2038;

- Offshore Installations and Wells (Design and Construction, etc) Regulations (1996);
- West Sussex Minerals Local Plan (July 2003)
  - The county council is the mineral planning authority for West Sussex and is responsible for all mineral planning matters throughout the county. The plan identifies that the national policy seeks to encourage the full exploration and appraisal of hydrocarbons and to ensure the maximum economic exploitation of oil and gas reserves over time. However, the plan states that the grant of a licence for exploration and development does not mean that a planning application to extract hydrocarbons will be granted;
  - Policy 26 of the identifies five specific areas of environmental impact that need to be considered before permission is granted for the exploration, appraisal and/or commercial development, including the safeguarding of water supplies and the water environment; and
  - Policy 27 states that permission for hydrocarbon exploration will normally be granted subject to compliance with the issues addressed in Policy 26 having regard to the limited duration and area of the activity.
- Environment Agency, Onshore Oil and Gas Sector Guidance, Version 1.0 August 2016.
- West Sussex Joint Minerals Local Plan – Proposed Submission Draft (Regulation 19) January 2017
  - The draft minerals local plan (although in draft form provides an understanding of how the local authority will seek to manage minerals extraction in the relevant period to 2033) identifies oil and gas as being exploited on a limited scale within the county but accepts that further development could take place. Strategic Objective 12 aims to protect the environment and local communities from unacceptable impacts of any proposal for oil and gas development, whilst recognising the national commitment to maintain and enhance energy security in the UK; and
  - Policy M7a (Hydrocarbon development not involving hydraulic fracturing) states that proposals for exploration, appraisal and production phases of oil and gas projects, including extensions to existing sites will be permitted provided that amongst other items, no unacceptable impacts would arise from the on-site storage or treatment of hazardous substances and/or contaminated fluids above or below ground.

10.3 Assessment Methodology

10.3.1 Once the existing baseline environmental conditions are established, the potential for the proposed development to generate environmental effects is assessed. This includes the potential impacts of the proposed development on the surrounding environment, specifically the groundwater regime and ground conditions from

potential sources of contamination. The sources of contamination can be from the proposed development or they can already be present in the baseline environment and have an effect on the proposed development or the environment as a result of the proposed project being undertaken.

Magnitude of impact

10.3.2 For the assessment of potential impacts to groundwater and ground conditions the magnitude of potential impact at any of the identified sensitive receptors as defined within the baseline condition is set out in Table 10.1. It is worth nothing that impacts can be beneficial to the site and the surrounding area as well as adverse.

Table 10.1: Criteria grading for determining the potential magnitude of impact

Magnitude	Description
Major	Irreversible or long-term change well outside the range of natural variation where recovery could be protracted (>10 years) to a large area or an area remote from the development. Potential hazard to human health.
Moderate	A change outside the bounds of natural variation to a large area or an area remote from the development, which will recover over a medium period of time (5-10 years)
Minor	A change within the bounds of natural variation to an area in close proximity to the site, which will recover over a short period (0-5 years)
Negligible	A change well within the bounds of natural variation. No effect detectable or recovery within a short timescale (<1 year)
No Change	No loss or alteration. Change does not affect fabric of asset, contribution setting makes to significance of asset, or extent to which significance can be experienced.

Sensitivity of receptors in the physical environment

10.3.3 In order to evaluate the relative sensitivity of receptors to the proposed development a reference list defining the degree of sensitivity is indicated in Table 10.2.

Table 10.2: Receptor sensitivity

Receptor Sensitivity	Surrounding Environment	Site End Users / Operators
High	Groundwater in principal aquifer and in an area with groundwater of high vulnerability and thin superficial cover material. Areas of contaminated land. Areas of previous mineral extraction or areas designated as safeguarded for mineral extraction. Areas of known/confirmed groundwater contamination.	Residential with gardens used for vegetable gardening. Allotments and other operations for growing plants for consumption. Groundwater used for potable consumption. Construction workers.
Medium	Groundwater in secondary (A, B or undifferentiated) aquifer and in areas with intermediate groundwater vulnerability and moderate superficial cover material. Soils with a moderate risk of damage during construction.	Public open-space and residential development with limited garden. Schools and playing fields. Buildings and building material
Low	Groundwater in non-aquifer and in areas with low groundwater vulnerability and significant cover of superficial soils. Soils with low risk of damaging during construction.	Commercial or industrial end use. Site construction plant.

10.4 Environmental Baseline

10.4.1 Environmental baseline data, which is considered relevant to hydrogeology and pollution control, is presented largely from publicly available data although some site-specific information is used from the works undertaken on site in 2013. Baseline environmental data includes details about ground conditions (geology), potential sources of contamination, the hydrogeological regime and potentially sensitive receptors (human health and the environment).

Geology

10.4.2 According to the published geological map (solid and drift) from the British Geological Survey (BGS) – Sheet 302 (Horsham), the site is underlain by Head deposits, which overlie Wadhurst Clay Formation of the Hastings Beds. Head deposits are described as comprising poorly sorted gravel, sand and clay deposits derived from solifluction and/or hillwash and soil creep.

10.4.3 Two borehole records from the BGS have been obtained to confirm the shallow geology of the area. The general stratigraphy of the geology beneath the site has been determined from a geological log produced from drilling 'the borehole' in 2013. The following data confirms shallow geology:

- Borehole referenced TQ32NW6 is located about 100m northwest of the site. Completed in 1986 by G.Stow Co. Limited the borehole extends to 15.2m below ground (bgl) and to comprise Wadhurst Clay, described as blue clay and slates (0.0m to 10.6m bgl) and blue clay and mudstones (10.6m to 15.2m bgl). It is noted that the borehole record shows groundwater was struck at 21m bgl and rest water level was recorded at 3.83m bgl. There is uncertainty over the accuracy of the water strike measurement as the total well depth was recorded as 15.2m bgl; and

- Borehole referenced TQ32NW7 is located approximately 650m north of the site. Completed in 1933 this borehole confirmed Lower Tonbridge Wells Sand to 75'6" (23.01m) and Wadhurst Clay for the remainder of the depth to 184' (56.08m). Water is recorded at 152' (46.33m) with a rest water level of 129' (39.32m). A pumping test was undertaken upon completion of the drilling works with a suction depth of 160' (48.77m) and a reported yield of 700 gallons per hour (3.18m^3/hour).

10.4.4 Two boreholes were drilled on site, including a vertical borehole and a directionally drilled borehole. Details from 'the [vertical] borehole' (Balcombe 2z) has been used to confirm the geological succession, which is presented in Table 10.3.

Table 10.3: Generalised stratigraphic succession from Balcombe 2z borehole

Chronostratigraphy	Lithostratigraphy	Formation [EA aquifer designation]	Depth range
Cretaceous (lower)	Wealden Group	Wadhurst Clay [Unproductive]	0.0m – 50m
		Ashdown Beds [Secondary]	50m – 250m
	Purbeck Group	Durlston Formation [Secondary]	250m – 270m

		Lulworth Formation [Secondary]	270m – 470m
		Purbeck Evaporites [Secondary]	470m - 495m
Jurassic (upper)	Portland Group	Portland Beds [Secondary]	495m – 560m
	Kimmeridge Clay [Target formation]	Kimmeridge Clay [Unproductive]	560m – 820m

Note: The Kimmeridge Clay Formation contains two layers of micrite, called Kimmeridge I Micrite and Kimmeridge J Micrite at depths of approximately 760m bgl and 790m bgl respectively. Aquifer designations provided by the Environment Agency are indicated with the formation name.

10.4.5 The Wadhurst Clay formation is described as comprising soft, dark grey thinly-bedded mudstones (shales) and mudstones with subordinate beds of pale grey siltstone, fine grained sandstone, shelly limestone, clay ironstone and rare pebble beds. The Ashdown Beds Formation comprises siltstones and silty fine-grained sandstones with subordinate amounts of finely-bedded mudstone.

10.4.6 The Purbeck Group is described as comprising interbedded mudstones, limestones and evaporates of marginal freshwater, brackish and marine origin. The underlying Portland Group is comprised layers of predominantly limestone with the lower parts predominantly dolomitic sandstones and sands with some mudstones/shales and thin beds or nodular layers of micrite.

10.4.7 The Kimmeridge Clay Formation is the target formation for the Balcombe-2z borehole and it includes mudstones with thin siltstone and cementstone beds and locally occurring layers of sands and silts. Micrite bands within the clay formation have been identified and the Balcombe-2z borehole extends within one of these bands (I Micrite) and the log records no significant faults or structures being identified.

10.4.8 The rocks of the Weald are folded into a pericline with its major axis roughly from west-northwest to east-southeast and as a result of this pericline the oldest rocks are exposed at the centre away from which the rocks dip in all directions. Subsequent weathering has exposed sandstone ridges overlooking clay bottomed valleys. The structure of the Weald principally reflects the generally extensional regime of the underlying faulting of the Jurassic strata. Consequently, the Wealden strata are affected by valley bulge and cambering (particularly in the central Weald) and this process can locally cause great disruption of strata and groundwater flow through these disturbed sequences is very complicated.

10.4.9 Between 1000m and 1500m south of the site are two regional faults, which trend in an east to west direction and both with downthrow to the south. The closest is the Pilstye Farm Fault and the farthest is called the Sidnye Farm Fault. The Pilstye Farm Fault truncates a series of north to south trending faults, one of which passes very close to the site. The BGS map (Sheet 302) provides no name for this fault. The

faulting complicates regional groundwater flow with the juxtaposition of different aquifer units on either side of the fault to create a mixture of unproductive and highly productive planar features that are poorly investigated.

Hydrogeology

10.4.10 The Wadhurst Clay Formation separates the overlying Tunbridge Wells Formation (absent beneath the site) and the Ashdown Formation. The Wadstone Clay is understood to act as an aquiclude, confining groundwater within the underlying Ashdown Formation, which is classified as a secondary aquifer at a regional scale. The primary recharge mechanism for the Ashdown Formation is direct recharge at outcrop owing to the overlying confining clay.

10.4.11 The hydrogeology of the Ashdown Formation is complex and not well understood. The aquifer is thought to be a stack of discontinuous layers allowing groundwater movement between and through them. The lack of correlation of water levels even between closely situated boreholes is a further indication of a patchy, multi-layered aquifer, without a single water table. This description is typical of the Lower Cretaceous/Upper Jurassic aquifers, which are dominantly sands or poorly cemented sandstones and water movement is principally through the matrix. As rock sequences, these strata comprise alternating sands and mudstones frequently forming multi aquifer systems although the layers are not always laterally extensive, which adds further to the complexity of the aquifer system.

10.4.12 The structural geology of the Weald has a significant influence on groundwater flow. Groundwater tends to flow down dip towards the axis of synclines and away from the axis of anticlines. The presence of faulting in the area causes large variations in water level, which have not been well studied or documented. For example, where faulting inhibits groundwater flow, rest water levels in boreholes either side of faults may be very different. Consequently, it is often difficult to predict the potentiometric levels in boreholes.

10.4.13 Beneath the Wealden Group is the Purbeck Group, comprising the Lulworth Formation and the overlying Durlston Formation. The lower part of the Lulworth Formation is dominated by a thinly bedded fine grained limestone with some marley layers and evaporates. Limestones of the Lulworth Formation are classified as Secondary aquifers on a regional scale containing water of limited importance for supply due to their very limited outcrop. Whilst fractured limestone within the Lulworth Formation have been recorded as high yielding close to outcrop, the formation at the site is confined beneath 270m of overlying formations, including 50m of unproductive clay of the Wadhurst Clay. Any water present within the Lulworth Formation at the site is likely to be very old and therefore of poor quality, with minimal or no resource value.

10.4.14 The Durlston Formation mainly comprises limestone and shales.

10.4.15 The Purbeck Group and Portland Group can all logically be regarded as part of the same aquifer system where groundwater movement is generally intergranular with some fracture flow in the limestone horizons. Large volumes of water can be released from the fractured limestone although it can be very hard due to contact

with the limestone and the evaporates and it is of limited importance for supply as the outcrop is very limited.

Ground conditions

Former land use

10.4.15 According to historical maps, the site does not appear to have been previously developed (before the Balcombe 1 (Conoco) drilling works were undertaken in 1986). Lower Stumble Wood to the north and Lower Beanham Wood to the south may have been forested at some time but no other significant industry is understood to have taken place on site or within the immediate surrounding area.

Landfill

10.4.16 According to EA data there is a former landfill site approximately 660m north of the site referred to as Oldlands Avenue landfill site. It is understood that the site was operated between 31 December 1962 and 31 December 1984. The exact nature of waste imported onto the site is unclear but the EA data shows this to include inert (e.g. glass, concrete, bricks, tiles, stones and soil), commercial (e.g. waste from trade premises, businesses, sporting facilities and recreation or entertainment venues) and household waste (e.g. waste dwellings of various types including houses, caravans, houseboats, campsites, prisons and waste from educational establishments).

10.4.17 Details of the site operator are not available and the construction method used for the landfill is also unknown, i.e. it is not known if a base or cap layer has been engineered to limit leachate and gas generation. The landfill is located about 105m above ordnance datum (AOD), compared to the site, which is located at 55m AOD.

Pollution

10.4.18 The EA data confirms the presence of a permitted industrial activity (code A30) on site for the mining and waste industry. The permit (reference - 400553) covers two time periods – calendar year 2013 and January to September 2014. The EA compliance rating scores for the two-time periods shows no breaches of the permit for the operational period.

Surface water

10.4.19 A tributary to the River Ouse flows northwest to southeast approximately 100m southwest of the site. The tributary receives water from several springs in the area, which appears at the boundary of the Wealden Clay (impermeable) and the overlying Lower Tunbridge Wells Sand (permeable). The point at which the tributary enters the River Ouse is approximately 950m to the southeast.

10.4.20 The site is within a surface water safeguard zone (SWSGZ4008), which is designated on the basis of risks from pesticides (Metaldehyde) and turbidity.

Groundwater

10.4.21 Background groundwater quality information was obtained by Ground Gas Solutions Ltd. (GGS) through the collection of a series of groundwater samples from a borehole drilled on site. It is understood that the borehole is screened within the Ashdown Beds (secondary A aquifer), which is confined by the overlying Wadhurst Clay

(unproductive strata). The monitoring well is located within the southern part of site, which is assumed to be down hydraulic gradient assuming groundwater flow is to the south-southeast. GGS confirm the groundwater at this location is artesian.

10.4.22 GGS collected groundwater samples on four separate occasions during July and August 2013. They conclude from their data set that the majority of analytes are below the relevant quality criteria although for some determinants, particularly metals and sodium these criteria were exceeded. GGS conclude these values are indicative of potentially poor quality water. It is unsurprising that the water quality in these strata is poor given the low yield and the lack of local connection to surface recharge mechanisms.

10.4.23 GGS also state the presence of dissolved carbon dioxide, methane and ethane and they identify the lack of current UK standards for these gases in groundwater but confirm the results are relatively elevated. The following range of dissolved gas results are presented by GGS:

Methane (CH_4) – 6.72-12.4mg/l;

Carbon dioxide (CO_2) – 0.67-14.96mg/l; and

Ethane (C_2H_6) – 0.28-1.05mg/l

10.4.24 The Conoco well, drilled in 1986 (Balcombe 1) identified that the Ashdown beds contained groundwater that had a relatively high methane and ethane concentration. The following results were reported:

Methane (CH_4) – 54,000ppm (38.54 mg/l); and

Ethane (C_2H_6) – 1,335ppm (1.79 mg/l)

10.4.25 In addition, the BGS has undertaken a survey of UK groundwater to establish background dissolved methane concentrations. The reported concentrations for the Ashdown Formation is approximately 0.05mg/l (70ppm), which is less than the concentration reported from the Conoco boreholes and from GGS in 2013. The GGS data and Connoco borehole (Balcombe 1) relate to the Ashdown Beds at roughly the same location but the exact position of the BGS borehole used to collect their data is not known.

10.4.26 The site is not within a groundwater safeguarding zone. These are zones that have been designated by the EA in which the use of certain substances must be carefully managed to prevent the pollution of raw water sources that are used to provide drinking water. The safeguard zones are an initiative between the EA and the water companies and they are one of the main tools for delivering the drinking water protection objectives for the WFD.

10.4.27 There are no licensed groundwater abstractions within 1km of the site and the site is not within a groundwater source protection zone (SPZ).

10.4.28 According to EA data, shallow soils beneath the site and in the immediate surrounding area have a low sensitivity to surface contamination.

10.4.29 The head deposits beneath the site, which are very limited in aerial extent, are classified as a secondary (undifferentiated) aquifer, which is typical of units that have a variable hydraulic conductivity and where it has not been possible to fully characterise the rock. The thin ribbon of alluvium associated with the tributary to the River Ouse is classified as a secondary A aquifer, which is capable of providing localised base flow to surface water and local groundwater abstraction.

10.4.30 The Wadhurst Clay is classified as an unproductive aquifer due to its low hydraulic conductivity and negligible significance for water supply or river base flow. The shallower geological units (Lower Tunbridge Wells Sand) on higher ground to the northeast of the site are classified as a secondary A aquifer. These aquifers are described as permeable layers that can support water supplies and river base flow on a local scale only. Indeed, a spring-line is present at the base of the overlying Lower Tonbridge Wells Sand and is likely to represent under drainage from this unit.

10.5 Mitigation

10.5.15 This section presents the embedded mitigation that is already part of the site infrastructure design and the process methodology that will be adopted during the site works. The mitigation is designed to provide protection to human health and the environment, including soil quality and groundwater.

Environmental setting

10.5.16 The conceptual understanding of the geology beneath the site demonstrates a relatively complex structure, comprising faulted blocks with permeable strata juxtaposed against less permeable strata and fault lines acting as both planes of increased or reduced permeability. The Wadhurst Clay, which is 50m thick beneath the site, provides a layer of protection between the surface and the groundwater within the underlying Ashdown Beds. GGS has confirmed groundwater within the Ashdown Beds to be artesian and therefore an upward hydraulic gradient is established between these strata and shallow soils. The Ashdown Beds are classified as a secondary aquifer and groundwater quality may be low (saline) with poor sustainable yields therefore it is considered to have medium to low sensitivity. Groundwater within the vicinity of the site is not used for domestic or industrial water supplies and according to the EA the shallow soils are not considered sensitive to surface contamination.

Well integrity

10.5.17 The test well is constructed using a series of concentric steel casing and cement sheathes with other mechanical isolation devices installed as part of the well construction process. The cementing programme is designed as Cuadrilla's standard approach to providing life-of-well barriers, according to the Oil & Gas UK Well Integrity Guidelines. The construction of the well has been designed to prevent the migration or transport of fluids between different aquifer layers that are not normally

hydraulically connected. The steel casing is cemented into place immediately upon completion of installation. The cement forms an impermeable barrier between the rock and the steel casing and seals up any conduit, which may connect different aquifer units or the ground surface that would normally be isolated by layers of lower permeable clay (e.g. Wadhurst Clay). As the borehole is advanced through deeper drilling, smaller rings of steel casing are installed with additional layers of cement grout between the new and previously installed steel casing and the surrounding rock. The steel and concrete layers provide multiple layers of protection for aquifer units, each of which limits the likelihood that hydrocarbons from the target layer will migrate from within the well to shallower units.

Chemical fluids

10.5.18 The volume of maximum dilution 10% hydrochloric acid (HCl) is a non-hazardous substance to groundwater is expected to be in the order of 20m. The diluted hydrochloric acid reacts primarily with carbonate solids to produce carbon dioxide and water. The wellbore was drilled through the Micrite which is an argillaceous carbonate. The Argillaceous material is unaffected by HCl. The purpose of a “diluted acid wash” is to clean the immediate wellbore area. Typical radial penetration from the wellbore is less than 6 inches, and can only be to natural permeability (in this case in the form of natural fractures). No fractures are induced hydraulically during this treatment.

Impermeable membrane

10.5.19 An impermeable membrane has been placed beneath the site where chemicals and liquid waste have previously been stored and where drilling operations have previously been undertaken. The membrane will prevent vertical infiltration of surface water into the ground. Due to the timeframe from original installation to the actual operation of the site, the membrane will be inspected and modified to comply with the obligations established in CIRI C736 as pers EA Onshore Oil and Gas Sector Guidance Version 1.0. Water falling onto the site is intercepted and directed to a collection chamber, from which it is pumped and removed off site. Water intercepted by the membrane includes rainwater, fire water and liquid spills, etc. The membrane will prevent water impacting shallow soils where it may have a negative effect on soil quality. The impermeable membrane, underlying 50m of natural clay and the likely upward hydraulic gradient from the groundwater within the Ashdown Beds will also prevent water entering the secondary aquifer.

Chemical storage

10.5.20 The storage of diesel and other fuels, which may be required to power site equipment such as pumps and generators, etc will be undertaken in accordance with the Control of Pollution (Oil Storage) Regulations (2001). The storage containers will be double skinned so that leaks will be contained within the tank construction. The tanks will be inspected daily for the occurrence of leaks or water entering the secondary containment. All storage containers will be labelled with the capacity of the tank and its content. No fuel will be stored underground.

10.5.21 All refuelling operations will be undertaken during day time hours and by a person qualified to undertake the works. This will prevent overtopping from occurring. A secondary containment will be located below the fuel lines or temporary storage container spill to prevent spillage of fuels to ground and a spill kit will also be present

at all times in the event that a spill occurs. The mobile secondary containment units will be removed immediately after use to prevent a build-up of rainwater, which will reduce the efficiency when they are used during fuelling operations.

10.5.22 All liquids removed from the test well (spent acid (<10% solution), water/hydrocarbon mix) will be collected and stored in individual containers, which will be located on the impermeable membrane. The containers will be labelled. They will be checked daily for integrity until their removal from site for disposal. Any spills or leaks from these containers will be captured by the site drainage system, which is above the impermeable membrane and the liquids will be diverted to the collection chamber where they will be removed and removed from site for disposal. No spilled liquids on site will enter the underlying soil or groundwater.

10.5.23 To reduce the likelihood of stored chemicals impacting the ground all liquids that could adversely impact the environment will be stored in accordance with the manufacturers recommendation and will include the use of bunds and drip trays. All drip trays will be routinely inspected for liquid contents and emptied as necessary to maintain an adequate detention volume should spills or leaks occur. Material safety data sheets (MSDS) from the supplier will be retained on site for use in an emergency and safety procedures, including tool box talks will be provided to all site staff to raise awareness of actions to be taken in the event of an incident.

Emergency response – fire

10.5.24 The site has an emergency response procedure in place and this will be implemented in the event of a fire. It is likely that any fire on site will be tackled through the use of water. Fire-fighting water will initially be contained on site and directed to the collection sump. A 24-hour emergency spill response contractor will bring a tank to site to assist the emergency services so that all water from within the site can be removed for off-site disposal. The tanker will operate as long as fire water is being generated and as long as disposal or storage of water is required.

Groundwater monitoring

10.5.25 Groundwater monitoring will be undertaken during the site works at a minimum of monthly frequency, starting immediately before works commence. Water samples will be collected utilising an inverted Volatile Organic Analysis (VOA) sampling methodology to prevent the de-gassing of dissolved gases from the water at surface. It is envisaged that groundwater samples will be collected during the following phases of work:

- Sample 1-3: Prior to Stage 1 commencing (three samples for baseline – at least one-week separation between samples);
- Sample 4: Day 2-4 of borehole preparation operations;
- Sample 5: End of flow test period (within 1-week); and
- Sample 6: One month after flow test period sample

10.5.26 The proposed sampling methodology will be implemented once approval in writing has been obtained from the Environment Agency (EA) including the period after the flow testing has been completed. It is assumed that the monitoring borehole will be decommissioned as per the EA specification as part of the site decommissioning activities.

10.5.27 Records relating to sample collection and analysis will be maintained. The following information will be collected:

- Physical properties of groundwater during collection to include pH, redox potential, temperature and dissolved oxygen concentration;
- Calibration certificates for all equipment used for field data collection including calibration readings collected in the field;
- Ground gas monitoring data, including methane (CH_4), carbon dioxide (CO_2), oxygen (O_2) and
- Details of accreditation for testing and analysis (including laboratory).

10.5.28 The following parameters (as scheduled in the 2010 permit to operate a mining waste operation issued by the Environment Agency – EPR/AB3307XD) will be analysed for all groundwater samples collected from the site monitoring borehole:

- Carbon dioxide, heavy metals, strontium, earth metals, dissolved methane, dissolved ethane, dissolved propane, dissolved butane, ammoniacal nitrogen, nitrite and nitrate, biological oxygen demand, chemical oxygen demand, pH, salinity, total dissolved solids, total petroleum hydrocarbons, total suspended solids.

10.5.29 Chemical test results obtained from site analysis will be collated and presented to the EA as soon as reasonably practicable. The EA will be made aware of any amendments that are made to the report and all data will be retained for at least six years for inspection.

Land quality

10.5.30 Soils samples were taken at the site prior to any development works taking place. The purpose of this baseline sampling was to determine the soil quality prior to development on site. Upon completion of all site works, including decommissioning and the removal of the basal protector layer additional soil samples will be collected to confirm the nature of the soil quality. The results from the chemical analysis will be assessed against current standards that are appropriate to the proposed end use of the site and the results will be provided to the EA as soon as practicable after the assessment. The following analysis is envisaged and it will be presented to the EA for approval before the sampling commences:

- Metals, pH, total petroleum hydrocarbons.

10.6 Predicted Effects

10.6.15 Groundwater impacts from the proposed works are possible from surface spills or release from underground infrastructure. Release from the borehole can include entry of the acid solution into formations not initially intended or the release of water-hydrocarbon mix during the testing phase. Release from the well can also include dissolved gasses entering formations through which the boring intersects and these gasses can migrate through the aquifer independently of groundwater although their movement is determined by the permeability of the rock, just as the movement of groundwater is.

10.6.16 The predicted effects on groundwater from surface sources of contamination or hazardous material are likely to be indirect and adverse although the effects are unlikely to migrate through the full thickness of clay (50m), which is why the EA has classified soils in this area to have a low sensitivity to surface contamination. In addition, the artesian conditions identified by the GGS monitoring on site suggest that the upward hydraulic gradient would prevent dissolved contamination penetrating a significant depth into the clay. The proposed mitigation measures described above and the natural geology and groundwater regime beneath the site means that the magnitude of the predicted effects from surface contamination is likely to be negligible and easily reversible through the implementation of normal engineering practices, including testing and risk assessment, which can be incorporated during the decommissioning phase. The likelihood of surface contamination or hazardous chemicals effecting groundwater within the underlying secondary aquifer is very low.

10.6.17 Impact from below ground sources will be significantly reduced through the presence of mitigation measures incorporated into the well design, which includes multiple layers of steel casing and intermediate cement layers. The likelihood of impact occurring is very low. Any effect on the surrounding ground and groundwater is significantly reduced but the predicted effects will be dependent on the location of the release within the underlying geology. Any release is likely to result in an adverse and direct effect on groundwater, with a medium to long term impact. Groundwater flow in the underlying aquifers is likely to be low therefore residence time of any effect within the aquifer will be high and the effect experienced over a long period. However, due to the low sensitivity of the aquifer and the low likelihood of occurrence it is unlikely that the magnitude of the impact will exceed low/moderate.

10.6.18 Impact to soils from surface contamination will be limited vertically as penetration into the ground will be curtailed by the low permeability of the clay and the impermeable membrane beneath parts of the site where hazardous material and chemicals are stored and where well testing operations are undertaken. Other mitigation measures are in place to control the release of chemicals and the management of water levels above the impermeable layer, although defects and small leakages are possible. The indirect consequence of contamination effecting shallow soils may result in a lateral spread of contamination with minimal penetration. The predicted effects are likely to be temporary and easily dealt with during decommissioning and are therefore considered to be of a short duration and of negligible magnitude.

10.6.19 Hydrocarbons and dissolved gases are already present within the Kimmeridge Clay (target formation for the test bore) and the overlying Ashdown Beds (determined by the EA, the monitoring well on site and the Balcombe 1 borehole (Conoco borehole)). Release of gas into the surrounding geology is unlikely to occur due to the mitigation from the well design steel casing a cement sheaths. The construction of the well is entirely directed to prevent the migration or transport of fluids between subsurface layers of impermeable rock formations that lie between the hydrocarbon producing formations and the groundwater. The magnitude of change is likely to be negligible or minor and therefore any residual effects over the medium to long term will be negligible.

10.6.20 Acids are not presently found in the formations naturally so release from the test bore will have an immediate and direct impact to the surrounding rock. If the release is within the Wadhurst Clay the impact would be extremely limited in distribution from the well and therefore the effect would be of negligible magnitude, which would occur for a medium period of time. The likelihood of diluted acid being released in to the clay is very low.

10.6.21 Accidental spills from mobile chemicals that are either being used or stored on site have the potential to impact the shallow soil quality beneath the site and also the quality of the underlying groundwater in the secondary aquifer. It is envisaged that stored chemicals will include fuel, hydrochloric acid ($20m^3$), water/hydrocarbon mix and spent chemicals, etc. The release of chemicals onto the ground may have a direct adverse effect on soils and groundwater quality, which may be temporary or permanent. The likelihood of chemical spills entering the ground is very low due to the mitigation measures put into place and the protection provided by the low permeability clay layer from ground level to a depth of 50m.

10.7 Conclusion

10.7.1 Shallow soils are classified by the EA as having a low sensitivity to surface contamination. The presence of an impermeable membrane beneath part of the site and the implementation of liquid management plans on site will also significantly reduce the likelihood of impacting shallow soils beneath the site. Any impact of shallow soils is likely to be limited in aerial and vertical extent and easily characterised and managed during the site decommissioning.

10.7.2 Although the underlying geology and groundwater movement beneath the site is relatively complex it is not locally used for economic purpose and the EA states it has a low sensitivity to surface contamination. All the proposed mitigation measures embedded into the well design will reduce the likelihood of liquid or gaseous escape into the surrounding formations. However, these formations already contain similar material as that proposed to be extracted and therefore additional non-hazardous chemicals in significant quantity are not being injected into the formation. The period of testing is very short and therefore any predicted effects on the deeper geology and groundwater quality are likely to be negligible despite them potentially being permanent.

10.7.3 Any predicted effects on shallow soil conditions will be localised and easily managed during sampling and assessment within the decommissioning phase of the proposed development. Groundwater quality is already impacted by dissolved gasses and

likely saline conditions and therefore not locally utilised. There is a very low likelihood of groundwater impact and this will be managed and monitored during the work and as part of the decommissioning with the full engagement of the EA during all stages of the project.

11 SUMMARY AND CONCLUSIONS

11.1.1 This document has provided a background to the proposed development, described the environmental conditions at the site and the immediate surroundings, and outlined the key stages of the proposed temporary well flow testing and monitoring operations.

11.1.2 Through the issue of a negative EIA screening opinion, WSCC has confirmed that the proposed development is unlikely to generate any significant environmental effects. Therefore, this report has concentrated on those environment topics where there is the potential for insignificant adverse, effects to be generated by the proposed development. In particular this has concentrated on the characteristics of any predicted adverse environmental effects once mitigation measures have been implemented, such as the temporal nature of the effect and whether it will be direct or indirect.

11.1.3 It can be concluded that as a worst case there is the potential for some minor, direct and indirect adverse effects to be experienced at sensitive receptors. However, any minor, adverse effects will be experienced for a temporary period i.e. 6 months, and will be reversible. For the majority of the environmental topics that have been considered in this report, predicted environmental effects will be negligible.