

Appendix E.1

Phase 1 Ground Conditions Assessment





Bodelwyddan Solar and Energy Storage

Phase 1 Ground Conditions Assessment

On behalf of **Bodelwyddan Solar and Energy Storage Ltd**

Project Ref: 333101605 / 3502 | Revision: 01 | Date: July 2025

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Document Control Sheet

Project Name: Bodelwyddan Solar and Energy Storage

Project Ref: 333101605

Report Title: Phase 1 Ground Conditions Assessment

Doc Ref: 333101605 - 3502 (GCA Phase 1) - Revision 01

Date: July 2025

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Revision	Date	Description	Prepared	Reviewed	Approved
00	14/03/25	Final for Issue	RP	NH	CC
01	16/07/25	Amended following revisions to red line boundary	NH	GS	GS

This report has been prepared by Stantec UK Limited ('Stantec') on behalf of its client to whom this report is addressed ('Client') in connection with the project described in this report and takes into account the Client's particular instructions and requirements. This report was prepared in accordance with the professional services appointment under which Stantec was appointed by its Client. This report is not intended for and should not be relied on by any third party (i.e., parties other than the Client). Stantec accepts no duty or responsibility (including in negligence) to any party other than the Client and disclaims all liability of any nature whatsoever to any such party in respect of this report.

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1 Introduction

1.1 Preamble

- 1.1.1 Stantec UK Ltd. (Stantec) has been commissioned by Bodelwyddan Solar and Energy Storage Ltd (the Client) a Special Purpose Vehicle (SPV) owned by Island Green Power UK Limited ,to prepare a Phase 1 Ground Conditions Assessment (GCA) for the development of proposed solar photovoltaic (PV) electricity generating system and battery energy storage system (BESS), associated solar arrays, inverters, transformers, cabling, substations, access tracks, landscaping and ecological enhancements, fencing/CCTV and associated ancillary development for 40 years (the Proposed Development), within land predominantly to the north-west of Bodelwyddan and St. Asaph in Conwy and Denbighshire, Wales (the Site).
- 1.1.2 As the Proposed Development exceeds the 10MW threshold for energy generating projects in Wales it constitutes a Development of National Significance (DNS) under the Planning (Wales) Act 2015. The Planning (Wales) Act states that Welsh Ministers are to determine DNS projects and applications should be made directly to them. The framework for applying for a DNS is detailed within the Developments of National Significance (Procedure) (Wales) Order 2016, as amended. The DNS application process is managed by Planning and Environment Decisions Wales (PEDW) on behalf of the Welsh Ministers.
- 1.1.3 This report presents the findings of desk study research, a Tier 1 contamination Preliminary Risk Assessment, and a preliminary ground stability assessment (refer to **section 1.6** for a description of information sources utilised).
- 1.1.4 Attention is drawn to the Essential Guidance for Report Readers included after the main report text.

1.2 Proposed Development

- 1.2.1 The Proposed Development comprises a solar photovoltaic (PV) electricity generating system and battery energy storage system ('BESS'), associated PV solar arrays, inverters, transformers, cabling, substations, access tracks, landscaping, ecological enhancement areas and associated ancillary development.
- 1.2.2 The solar PV arrays are anticipated to be mounted on metal frames, which will likely be mounted on shallow 'mini-pile' foundations comprising metal posts driven into the ground to a depth of approximately 2 m to 4 m or weighed down using concrete feet or other non-ground penetrative techniques. For the purposes of this assessment, it is assumed that the 'mini-pile' foundation option will be used.

- 1.2.3 Substations, conversion units and inverters may be required at each of the solar array sites, these are anticipated to be small-scale in construction and founded upon shallow foundations, e.g., ground-bearing slab.
- 1.2.4 The cable trenches are anticipated to be shallow (less than 2 m deep) and narrow (less than 2 m wide) with the potential for several trenches close to each other being required in certain areas. Any crossings of watercourses or roads by the cable route will be minimised by design, however where crossings are necessary these are anticipated to be installed using trenchless methods, e.g., horizontal directional drilling (HDD) or pipe-jacking.
- 1.2.5 The operational lifespan of the Proposed Development is anticipated to be up to 40 years. The Scheme will then be decommissioned, and the Site can be returned to its former agricultural use.

1.3 Context

- 1.3.1 This report has been prepared in a planning context (rather than a Part 2A statutory contaminated land context) and forms part of the documentation that supports the Environmental Statement (ES), to be submitted in support of the application for planning permission for the Scheme.
- 1.3.2 Planning Policy Wales (PPW) states that planning decisions need to take into account the potential hazard that contamination presents to the development itself, its occupants and the local environment. As such, the potential for land contamination is a material planning consideration when a new planning application is assessed by the LPA, but it is the developer's responsibility to ensure that development of the Site is suitable for its proposed use.
- 1.3.3 The Planning Act 2008 sets out the thresholds for nationally significant infrastructure projects (NSIPs) in the energy sector. For electricity generating stations (meeting the thresholds set out in the Planning Act 2008), the Overarching NPS (EN-1) in conjunction with any of the relevant technology specific NPSs will be the primary policy for Secretary of State decision making.

1.4 Objectives

- 1.4.1 The objective of this report is to identify the likely ground conditions using published and publicly available information (see below for sources of information accessed) and to assess whether there are land instability or contamination risks associated with the ground conditions that require management (remediation or mitigation).

1.5 Methodology

- 1.5.1 Reference has been made to guidance given in *Development of Land Affected by Contamination: A Guide for Developers* (WLG & NRW 2023) which outlines the information required by Local Planning Authorities (LPA) in order for them

to determine planning applications and then the subsequent discharge of associated land contamination conditions. This guidance document provides an overview of good practice for land contamination management procedures which, if followed, will help meet the information requirements of the LPA during development of that land.

- 1.5.2 The following summarises the ground conditions assessment methodology adopted by Stantec with a more detailed description in our guide entitled *Stantec Guide: Methodology for Assessment of Land Contamination (Wales)*, a copy of which is presented in **Annex 1**.

Assessment of Ground Conditions - Contamination

- 1.5.3 Our methodology follows guidance on how to assess and manage the risks from land contamination given in “Land Contamination Risk Management” (LCRM) (EA, 2025).
- 1.5.4 The principal planning objective in respect of contamination is to ensure that any unacceptable risks to human health, buildings and other property and the natural and historical environment from the contaminated condition of the land are identified so that appropriate action can be considered and taken to address those risks.
- 1.5.5 LCRM presents a three-stage process to the management of contaminated land:
- Stage 1 = Risk Assessment
 - Stage 2 = Options Appraisal
 - Stage 3 = Remediation
- 1.5.6 The Stage 1 risk assessment is undertaken in a phased manner comprising three tiers, with the three tiers being:
- Tier 1 – “Preliminary Risk Assessment” – a qualitative assessment forming part of a Phase 1 report;
 - Tier 2 – “Generic Risk Assessment” - a quantitative assessment using published criteria to screen site-specific ground condition data forming part of a Phase 2 report; and
 - Tier 3 – “Detailed Risk Assessment” – a quantitative assessment involving the generation of site-specific assessment criteria (SSAC).
- 1.5.7 The underlying principle is the evaluation of *contaminant linkages* in order to assess whether the presence of a source of contamination could potentially lead

to harmful consequences. A pollutant linkage consists of the following three elements:

- A source of contamination or hazard that has the potential to cause harm or pollution;
- A pathway for the hazard to move along / generate exposure; and
- A receptor which is affected by the hazard.

1.5.8 Each tier of risk assessment comprises the following four stages:

- Hazard Identification – identifying potential contaminant sources on and off Site;
- Hazard Assessment – assessing the potential for unacceptable risks by identifying what pathways and receptors could be present, and what pollutant linkages could result (forming the Conceptual Site Model (CSM));
- Risk Estimation – estimating the magnitude and probability of the possible consequences (what degree of harm might result to a defined receptor and how likely); and
- Risk Evaluation – evaluating whether the risk needs to be, and can be, managed.

1.5.9 This report presents a Tier 1 Preliminary Risk Assessment.

Assessment of Ground Conditions - Instability

1.5.10 The preliminary ground stability assessment methodology adopted by Stantec follows the guidance on the development of unstable land given in Planning Policy Guidance Note 14: Development on Unstable Land¹ (Welsh Government, 1990) which states that *“instability which may pose a threat to development and/or public safety, and which therefore needs to be considered in land-use decisions, is caused by both natural processes and by human activities. The ground movements which result are variable in their extent and in their effects on the ground surface, and subsequently on development... Whatever the ultimate cause of instability, the triggering factor which initiates instability problems is very often human activity. Thus, the act of development in a green field site of the intensification of development in areas which are already developed may result in instability which may affect both the development and the land surrounding it”*.

1.5.11 This desk-based study comprises a review of existing readily available published sources of geological, geomorphological, hydrogeological and/or

¹ WLGA and NRW, 2023, Development of Land Affected by Contamination: A Guide for Developers

mining information on the Site and its surroundings and a historical review including mapping and aerial imagery, if appropriate.

- 1.5.12 The preliminary stability assessment includes for example, where relevant, a review of geological hazards for the Site such as natural and man-made (mining) cavities, landslide, cambering and block movement, collapsible and compressible soils, running sand, and subsidence and heave due to volumetric change in the ground.

1.6 Sources of Information

- 1.6.1 The following sources of information have been used in the preparation of this report, it should be noted that the date that each source was accessed is given in the references section of this report:

- Enviro+Geo Insight Report (environmental data report and historical mapping²) relating to the Site, provided by Groundsure (GS, 2024) which is presented in **Annex 2**.
- Review of the Natural Cavity and Artificial non-coal (underground) mining cavity databases managed and enhanced by Stantec.
- Review of borehole records held by the British Geological Society (BGS) accessed via their website, <http://www.bgs.ac.uk/data/boreholescans/home.html>. Copies of which are presented in **Annex 3**.
- Review of geological mapping held by the BGS accessed via their website <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>.
- Review of DEFRA's MAGIC (Multi-Agency Geographic Information for the Countryside) website, <http://www.magic.gov.uk>. The MAGIC website provides authoritative geographic information about the natural environment from across government.
- A review of the Regionally Important Geodiversity Sites (RIGS) layer on the Welsh Government's DataMapWales map viewer.
- A search of the Stantec project database to identify any ground condition reports near the Site (within 250 m).
- A review of the Denbighshire County Council Planning Portal located at <https://www.denbighshire.gov.uk/en/planning-and-building-regulations/search-and-comment-on-planning-applications.aspx> and the Conwy County Borough Council Planning Portal located at

² It is recognised that the site boundary shown in the Groundsure Report reflects the proposed red line boundary at an earlier stage in the project, with Land Parcel 4 being approximately half of its final size, the cable route between Land Parcel 1 and the A55 being on a different alignment, and a slight change to cable route alignment to the south-west of Kimmel Park. Although the boundary has changed, the mapping and data provided in the Groundsure is still considered to provide adequate coverage.

<https://npe.conwy.gov.uk/Northgate/EnglishPlanningExplorer/generalsearch.aspx>

- Contaminated land enquiries were made to Denbighshire County Council and Conwy County Borough Councils. Copies of the responses (where received) are included in **Annex 4**.
- A freedom of information request was made to Natural Resources Wales for any environmental information relevant to the Site. A copy of the response is included in **Annex 5**.
- A review of Unexploded Ordnance (UXO) risk map records of Unexploded Bomb Risk prepared by Zetica Ltd. and located at <https://zeticauxo.com/downloads-and-resources/risk-maps>.
- A review of a UXO Desk Study and Risk Assessment prepared for the site by Zetica Ltd. A copy of the UXO Desk Study is presented in **Annex 6**.
- A review of historical aerial photography presented on Google Earth.

2 Land Use Information

2.1 Introduction

- 2.1.1 This section presents a summary of current and historical land uses on and immediately adjacent to the Site. Land use is used to inform the hazard identification element of the risk assessment.

2.2 Site Location and Description

- 2.2.1 The Site location inset presented on **Figure 1** shows the location of the Proposed Development, as presented within the Site Location Plan (Ref 01).

- 2.2.2 As shown on **Figure 1** (Site Location and Layout Plan) the Site has been divided into the following sub-divisions:

- Land Parcel 1 – Land Parcel 1 is located approximately 3 km to the north-west of Bodelwyddan and approximately 1.1 km from the eastern edge of Abergele and occupies an area of approximately 19.8 hectares (ha). Rhuddlan Road (A547) is present immediately south of the land parcel, and un-named access roads form the eastern and western boundaries. The northern boundary is formed by a watercourse named the Bodoryn Cut. Current land use within Land Parcel 1 is agricultural, with several fields separated by hedgerows and drainage ditches. An electricity transmission line crosses through the western end of the parcel on a north-south alignment. Land use surrounding Land Parcel 1 is similarly agricultural, with the exception of a waste bulking station located immediately to the north-east, a skip-hire company and waste transfer station approximately 90 m to the north-east and a household waste recycling centre approximately 130 m to the north. A residential property is present immediately to the south, with further residential properties and a farm present approximately 130 m to the east.
- Land Parcel 2 – Land Parcel 2 is located to the east of Land Parcel 1, approximately 1.6 km to the north-west of Bodelwyddan and approximately 2.0 km from the eastern edge of Abergele, occupying an area of approximately 12 ha. Current land use within this parcel is agricultural, comprising three fields separated by hedgerows. Land Parcel 2 is bordered to the north by the Bodoryn Cut, to the east by Gors Road, to the south by Rhuddlan Road (A547) and to the west by further agricultural and equestrian-use land.
- Land Parcel 3 occupies an area of approximately 57 ha and is directly to the east of Land Parcel 2 beyond Gors Road. It is located approximately 2.8 km from the eastern edge of Abergele, and approximately 1.5 km north of Bodelwyddan. Land Parcel 3 is bordered to the north by the Bodoryn Cut, to the east by an access track (Quarry Line Path) beyond which is agricultural

land and a residential property. To the south Land Parcel 2 is bordered by Rhuddlan Road, woodland and a solar farm.

- Land Parcel 4 – Land Parcel 4 occupies an area of approximately 6 ha, and is located directly (beyond Rhuddlan Road) south of Land Parcel 3. It comprises agricultural land and is bounded by woodland to the east and by Rhuddlan Road to the north, beyond which is a solar farm and the agricultural land within Land Parcel 3. To the south Land Parcel 4 borders further agricultural land. To the west Land Parcel 4 borders St George (a road) beyond which is further agricultural land.
- Land Parcel 5 – Land Parcel 5 occupies an area of approximately 52 ha, and is situated south of Land Parcel 3 (beyond Rhuddlan Road), and approximately 100 m east of Land Parcel 4. It comprises agricultural land, bordered to the north by Rhuddlan Road and a residential property with associated gardens, beyond which is a solar farm and the agricultural land within Land Parcel 3. To the east Land Parcel 3 is bordered by Ronaldsway (a road) and a residential property with associated gardens and grounds to the east, beyond which is further agricultural land and a residential property. Land Parcel 3 is bordered to the south by further agricultural land, and to the west by woodland.
- Land Parcel 6 – Land Parcel 6 occupies an area of approximately 10.4 ha, and is located immediately south of Land Parcel 5. It comprises agricultural land and is bounded by woodland to the east and Land Parcel 4 to the north. To the west and south Land Parcel 6 borders further agricultural land.
- Cable Route – The Cable Route extends from the southern boundary of Land Parcel 1 down past the A55. It then continues towards the west for approximately 1.2 km. before continuing further south for another 1.2 km. it then extends west to the POC. The Cable Route is approximately 8 km in length.
- BESS and POC – The BESS and POC are located approximately 3.5 km south-east from the other land parcels and occupy an area of approximately 6 ha. It comprises

2.3 Historical Land Use

- 2.3.1 This section presents a summary of the historical land uses on the Site and in the immediate surrounding area. The historical land use information is based on Ordnance Survey (OS) maps dated between 1883 and 2024, provided within the Groundsure Report presented in **Annex 2**, supplemented by a review of historical aerial photographs available within Google Earth and other sources of historical information as listed in **Section 1**.
- 2.3.2 The Site is located in a predominantly rural area, surrounded by agricultural land and woodland, where the main developments in the nearby area are the Kinmel Park Industrial Estate at Bodelwyddan and the St. Asaph Business Park. On

this basis the review of historical land uses focuses on the land use within 100 m of the Site, however where notable land uses with a higher potential for contamination are noted the assessment buffers may be extended.

2.3.3 **Table 2.1** below presents a summary of the historical on-Site and off-Site land uses within each parcel of land and the POC.

Table 2.1 - Site History

Land Parcel	Site History Description
1	Mapping dated between 1871 and 1875 shows that this land Parcel 3 comprises undeveloped agricultural land. The surrounding land use is also open fields and agricultural land. with a small cluster of residential properties (Pen-y-ffordd) located immediately adjacent to the south of the parcel. A road (later labelled Rhuddlan Road / A547) is present immediately south of the parcel, with a further residential property (Penffordd) to the south of the road. A farm (Gofer) is recorded approximately 130 m to the east. By 1911, several of the residential properties at Pen-y-ffordd are shown to have been demolished, followed by Penffordd by 1949. Further significant changes are not recorded until 2006, when historical aerial imagery shows that the existing waste transfer station has been constructed immediately north-east of the land parcel, the existing skip hire company / waste transfer station has been constructed approximately 90 m to the north west of the land parcel, and the existing household waste recycling centre has been constructed approximately 100 m to the north of the land parcel. Gofer, approximately 130 m to the west, is shown to have been extended with additional residential properties and agricultural outbuildings. Aerial imagery dated 2009 shows the existing electricity transmission line to have been constructed through the western end of the land parcel. Further significant changes are not recorded.
2	Mapping dated 1871 - 1876 shows that this parcel of land is comprised of open fields. A small number of residential properties (Bodoryn Cottages) are recorded adjacent to the parcel's south-eastern corner, beyond the adjacent access road. A farm (Gofer) is recorded approximately 130 m to the west. Further significant changes are not recorded until 2006 when Gofer, approximately 130 m to the west, is shown to have been extended with additional residential properties and agricultural outbuildings, as well an oval-shaped race track within the field immediately west of Land Parcel 2. Subsequent aerial imagery does not record any further changes on-Site. The racing track to the west appears to be disused by 2018.
3	Mapping dated 1871 shows Land Parcel 3 to comprise open fields crossed by drainage ditches. This land is indicated to be "<i>Site of battle between Saxons and Welsh, fought in 795</i>". A small building labelled "Morfa" (later "Ty'n-y-Caeau" – which translates to "House in the fields") is present in the centre east of the parcel. Further residential properties are present in the immediate vicinity of the land parcel (Bodoryn Cottages, Morfa Cottage, Pen-y-Bont, Glan-y-gors etc.). Mapping dated 1949 records a "Mineral Railway" crossing the south-eastern corner of the land parcel.

Land Parcel	Site History Description
	Ty'n-y-Caeau appears to have been demolished by the mid-1960s. By 1980 the mineral railway is shown to have been removed and a sewage works was constructed approximately 350 m north of the land parcel. Between the 1980s and the 2000s the sewage works was repeatedly extended to its existing configuration (measuring approximately 125 m by 250 m) approximately 130 m north of the land parcel. Aerial imagery dated 2016 shows a solar farm under construction immediately south of the land parcel. Further significant changes are not recorded.
4	Land Parcel 4 appears to have remained as agricultural land since at least 1871, the surrounding land use has remained similarly agricultural or woodland until 2016 when a solar farm was constructed immediately to the north, beyond the A547.
5	Mapping dated 1871 shows Land Parcel 5 to comprise open fields crossed by drainage ditches. The surrounding land use is similarly agricultural, or woodland, with occasional residential properties, a farm (Sun Farm) and a chapel recorded in the immediate vicinity of the land parcel. Mapping dated 1949 records a "Mineral Railway" crossing through the west of the land parcel. By 1980 the mineral railway is shown to have been removed. Further significant changes are not recorded until 2016 when a solar farm was constructed immediately to the north, beyond the A547.
6	Land Parcel 6 appears to have remained as agricultural land since at least 1871, the surrounding land use has remained similarly agricultural or woodland.
BESS and POC	Mapping dated 1871 - 1876 shows that the POC is located within open fields separated by drainage ditches. Further significant changes are not recorded until 1985 when an electricity transmission line is recorded approximately 30 m to the south. In the late 1990s / early 2000s St Asaph Business Park, an estate of commercial / small light industrial properties was constructed immediately north of the land parcel on previously agricultural land. The units within 50 m of the BESS and POC appear to be occupied by an ambulance service training facility, a lifeboat service office and training facility and a police facility. Between 2009 and 2015 a large (approximately 340 m by 80 m) electricity substation was constructed immediately east of the land parcel.
Cable Corridor	The majority of the Cable Corridor is located within areas that have remained as either agricultural land or as existing roads since the late 1800s, with the surrounding land uses being typically agricultural or woodland, and with occasional residential properties and farms adjacent to the roads. Areas of notable different land uses are identified as follows: Approximately 930 m from the western end of the Cable Corridor between the Cable Corridor and Land Parcel 1, the route crosses an area of land that remained as agricultural land (crossed by St. Asaph Road) until the construction of the A55 between 1964 and 1980.

Land Parcel	Site History Description
	A further 310 m east along the cable route, at approximate National Grid Reference (NGR) 296900 E, 376260 N, the cable route passes beneath a road immediately north-west of an area of land that remained in agricultural use until approximately the late 1930s / early 1940s when the adjacent land appears to have begun use as the minerals processing area for an adjacent "Lime Works", later named "Parc-y-Meirch Quarry", with the main quarry pit some 500 m to the south. The processing area appears to have been extended between the 1950s and the 1990s, including the installation of railway sidings (removed by 1980). Contemporary aerial imagery shows this area to still be in use for minerals processing from the quarry which has since extended further to the south. A small gas works was present immediately adjacent to the cable route between the late 1800s and the 1960s, at approximate NGR 297635 E, 376045 N. Following cessation of use as a gasworks, the buildings appear to have been converted to use as a residential property (Yr Hen Weithdy, or "The Old Workshop"). An approximately 280 m length of the cable route within the woodland to the east of the former gas works follows the path of a former mineral railway, recorded on mapping dated 1949 and 1961 and removed by 1980. The railway appears to have run between the lime works / quarry east through the woodland, then north through further woodland, and Land Parcels C and E, to a railway connection to the north. Approximately 460 m further along the cable route to the east (approximate NGR 297035 E, 376330 N), an approximately 550 m length of the cable route runs parallel to the A55 within land that has remained in agricultural use since at least the late 1800s. Service stations with fuel filling stations associated with the A55 were constructed in the 1980s in areas of former woodland approximately 130 m east and 220 m north-east of the cable route at approximate NGR 298625 E, 375685 N. The land approximately 220 m east of the cable route at approximate NGR 298770 E, 375200 N, has remained as woodland and parkland associated with a stately home (Kinmel Hall) until 1915 when the woodland was partially removed and Kinmel Park Training Area (also known as Kinmel Park Camp) was constructed. The camp was built to train troops in the first world war and was later used to house troops (Coflein, 2024³). The majority of the camp comprised blocks of barracks and associated facilities, the nearest of these was located 550 m east of the Site. The land in the west of the camp appears to have remained as open land, noting a shooting range located approximately 340 m east of the cable route. Post-war the majority of the camp was demolished, and the land has subsequently been used as the Kinmel Park Industrial Estate. A small area of the camp retained its military use and today is still used for training. Following the construction of the A55 in the 1980s, the Kinmel Park Industrial Estate to the north of the road was subsequently extended to the west, and by 2001 had been extended up to the fuel filling station approximately 250 m north-east of the cable route. The final 400 m of the cable route, up to the boundary with the POC and BESS Site, runs along the western and southern perimeters of St Asaph Business Park, an estate of commercial / small light industrial properties constructed on previously agricultural land in the late 1990s / early 2000s.

³ <https://coflein.gov.uk/en/site/401319/>

Land Parcel	Site History Description
	The units within 50 m of the cable route appear to be occupied by "Laser Micromachining Ltd" who " <i>develop complex micro-products using custom-built tools with the latest industrial pulsed lasers</i> " ⁴ and by Denbighshire Care and Repair, who provide maintenance services for elderly residents of Denbighshire.

2.4 Review of Database Searches

2.4.1 Information on the industrial setting, and pertinent Environmental Regulation Permits and authorisations for the Site and the immediate environs is presented in the Groundsure Report (GS, 2024) and reproduced in **Annex 2**. The results of the database search are summarised in the following tables and discussed in the following sections.

Table 2.2 Summary of Selected Industrial Setting

Data Type	Number on Site ⁽¹⁾	Number within 50 m of Site ⁽¹⁾	Number within 250 m of Site ⁽¹⁾
Waste Regulation			
Landfill Sites	0 (0)	0 (1)	0 (0)
Waste Management Facilities	0 (0)	1 (0)	2 (0)
Statutory Permits/Authorisations			
Pollution Prevention and Control ⁽²⁾	0 (0)	0 (0)	0 (0)
Registered Radioactive Substances	0 (0)	0 (0)	0 (0)
Planning Hazardous Substance Consents	0 (0)	0 (0)	0 (0)
COMAH Sites ⁽³⁾ and NIHHS Sites ⁽⁴⁾	0 (0)	0 (0)	0 (0)
Potential Contaminative Uses			
Petrol Stations & Garages	0 (0)	0 (0)	2 (0)
Relevant Historical and Recent Industrial and Energy Land Uses	0 (0)	5 (0)	Multiple
Discharge Consents	0 (0)	5 (1)	7 (4)
Pollution Records			
Contaminated Land Register Entries and Notices	0	0	0
Pollution Incidents to Controlled Waters	0	1	5
Note: 1) Numbers in brackets denotes number of authorisations, licences or permits that are lapsed, revoked, cancelled, superseded, defunct, surrendered, not applicable, withdrawn or not yet started. 2) Includes Integrated Pollution Controls, Integrated Pollution Prevention and Control, Local Authority Integrated Pollution Prevention and Control and Local Authority Pollution Prevention and Control permits. 3) COMAH denotes Control of Major Accident Hazards 4) NIHHS denotes Notification of Installations Handling Hazardous Substances			

⁴ <https://www.lasermicromachining.com/>

Landfill Sites

- 2.4.2 The Groundsure Report records that there is one historical landfill located within 250 m of the Site. This landfill, named “Gofer Refuse Tip”, site reference “CL5E23” is shown to occupy an area of approximately 18.5 hectares and is located immediately north-west of Land Parcel 2 and approximately 100 m north-east of Land Parcel 1. The landfill is indicated to have been operated by “Aberconwy District Council” and “Urban District Council of Abergele” between 1970 and 1985. The landfill is indicated to have received “*inert, industrial, commercial, household*” wastes.
- 2.4.3 The present-day household waste recycling centre is now located on the south-western corner of the former landfill.
- 2.4.4 This landfill is not recorded on the 1:2,500 scale historical map dated 1977. The historical mapping does not show any evidence of excavation or mineral extraction, i.e., the creation of a void, in the area of the landfill prior to landfilling taking place. A review of contemporary LIDAR imagery indicates that ground level of the completed landfill is raised above the surrounding ground level.
- 2.4.5 The historical landfill appears to have been formed by placing materials upon the existing land surface, i.e., is of a ‘land raise’ type. It is not therefore anticipated to benefit from any containment, or a basal liner.
- 2.4.6 The off-Site landfill will be taken forwards for assessment as a SPC. The potential for this landfill to generate contamination is considered to be Moderate, but it is noted that the landfill is located hydraulically downgradient (north) of the Site and therefore the likelihood for contamination to migrate south, against the anticipated groundwater flow direction, is assessed to be Low.

Waste Management Facilities

- 2.4.7 The Groundsure Report records that there is only one historical waste management facility on the Site – this is listed as a planning application for “*construction of a building to enclose existing recycling yard*”. However, when checking the planning application reference provided on the Conwy County Borough Council planning portal, the co-ordinates of the application are shown to be for the existing skip hire yard to the north of Land Parcel 1.
- 2.4.8 The Groundsure Report records multiple off-Site waste management facilities, however upon review it is evident that these are limited to:
- The existing household waste recycling centre / civic amenity site in the south-western corner of the former Gofer landfill, located approximately 130 m to the north of the Land Parcel 1.
 - Reference EWC001 / MB3097TG / EA/EPR/MB3097TG/T001 / EA/EPR/JP3594FJ/V002, effective since 2005 and operated by Environmental Waste Controls Ltd., and Bryson Recycling Ltd.,

permitting the transfer of up to 50,000 tonnes per year of commercial and industrial wastes.

- The existing waste bulking station immediately north-east of Land Parcel 1.
 - Reference EA/EPR/HP3591EZ/A001 / HP3591EZ, effective since 2011 and operated by Conwy County Borough Council, permitting the transfer of household, commercial and industrial wastes.
- The existing skip yard / waste transfer station to the north of the waste bulking station, approximately 90 m to the north of Land Parcel 1.
 - Reference EA/EPR/FP3994FS/A001 / JP3894FM / FP3994FS, effective since 1994 and operated by Thorncliffe Building Supplies Ltd and historically by Windmill Ltd, permitting the transfer of up to 93,540 tonnes per year of commercial and industrial wastes.

2.4.9 These off-Site features will be taken forwards for assessment as SPCs, noting that these are recently constructed facilities, operated under Environmental Permits which control the activities taking place, and therefore the potential for these features to generate contamination is considered to be Very Low.

Petrol Stations and Garages

2.4.10 There are two current petrol stations within 250 m of the Site, both of which are associated with a service station on the A55. The nearest of these is located approximately 135m to the east of the Cable Corridor (over 1 km from the Solar Site).

2.4.11 On the basis of the distance between the petrol stations and the Site, and the anticipated absence of shallow groundwater flow within the Diamicton deposits that underlie the whole area beneath the cable route and the petrol stations, these features will not be taken forwards for assessment as SPCs.

Relevant Historical and Recent Industrial and Energy Land Uses

2.4.12 The Site appears to have remained as either open agricultural land, woodland or roads since the early 1900s. On-Site historical and recent industrial land uses have not been identified.

2.4.13 Off-Site relevant historical and recent industrial and energy land uses within 50 m of the Site are described below.

- A small gas works was present immediately adjacent to the cable route (noting that the Groundsure Report incorrectly identifies this record as being on the Site) between the late 1800s and the 1960s, at approximate NGR 297635 E, 376045 N. Following cessation of use as a gasworks, the buildings

appear to have been converted to use as a residential property (Yr Hen Weithdy, or “The Old Workshop”).

- A “Lime Works”, later the processing area for a limestone quarry, is recorded immediately south of the cable route at approximate National Grid Reference (NGR) 296900 E, 376260 N. The main quarry pit is located some 500 m to the south. The processing area appears to have been extended between the 1950s and the 1990s, including the installation of railway sidings (removed by 1980), and an electricity substation. Contemporary aerial imagery shows this area to still be in use for minerals processing from the quarry which has since extended further to the south.
- St Asaph Business Park, an estate of commercial / small light industrial properties constructed on previously agricultural land in the late 1990s / early 2000s to the immediate north of the BESS and POC and immediate east of the eastern terminus of the cable route. The units within 50 m of the cable route appear to be occupied by “Laser Micromachining Ltd” who “develop complex micro-products using custom-built tools with the latest industrial pulsed lasers” and by Denbighshire Care and Repair, who provide maintenance services for elderly residents of Denbighshire.
- Former Gofer Landfill and the associated Household Waste Recycling Centre, skip yard and waste transfer station, as described in the sections above.
- Mapping dated 1949 records a “Mineral Railway” crossing the south-eastern corner of Land Parcel 3 and the west of land Parcel 5. The railway was removed by 1980.
- Between 2009 and 2015 a large electricity substation was constructed immediately east of the BESS and POC.
- Fuel filling stations associated with the A55 are present approximately 130 m east and 220 m north-east of the cable route.
- The north-eastern extent of the Kinmel Park Industrial Estate is located approximately 250 m north-east of the cable route. The nearest building to the site is a factory that produces products from recycled plastic.
- A former military camp (Kinmel Park Camp) is located approximately 220 m north-east of the cable route, noting that the main area of structures within the camp was located in excess of 500 m from the cable route. The open land in the west of the camp is likely to have been used for training. It cannot be ruled out that training also took place within the woodland to the west of the camp through which the cable route passes.
- A small sewage treatment works is located approximately 250 m east of the cable route, at approximate NGR 297180 E, 376820 N.

- 2.4.14 The off-Site former gas works will be taken forwards for assessment as a SPC, noting that this was only a small-scale works and it is at least 60 years since the works ceased operation, and has since been converted to use as a private residence. The potential for ongoing contamination associated with this historical gas works use is therefore assessed to be Low.
- 2.4.15 The former lime works, later the processing area for the limestone quarry will be taken forwards as SPCs, noting that the main minerals processing activities (e.g., washing, crushing, grading etc) are not deemed to be potentially contaminative, and the potential for contamination associated with this area is limited to workshops, stores, refuelling areas for plant etc. In absence of a reconnaissance walkover of this facility to identify any such uses, it is assumed (to provide a suitably protective assessment) that these activities may take place within 50 m of the Site. The potential for ongoing contamination associated with this minerals processing land use is assessed to be Low.
- 2.4.16 The off-Site waste transfer station, small sewage treatment works, skip yard and household waste recycling centre will be taken forwards for assessment as SPCs, noting that these are recently constructed facilities (with the exception of the small sewage treatment works), operated under Environmental Permits which control the activities taking place, and therefore the potential for these features to generate contamination is considered to be Very Low.
- 2.4.17 The former mineral railway is not taken forwards as a SPC on the basis of its short-term use, followed by its removal, with 50 years of subsequent agricultural use of the land.
- 2.4.18 The early 2000s commercial units (lifeboat offices and training, ambulance service training and police facility) within 100 m of the Site within the adjacent St. Asaph business park will be taken forwards as SPCs, on the basis of the limited potential for leaks or spillages of any fuels or chemicals stored in these units. The potential for ongoing contamination associated with the Business Park units is assessed to be Low.
- 2.4.19 The recently constructed electricity substation will be taken forwards as a SPC, as it is understood⁵ that the transformers in the substation are oil cooled (up to 100,000 litres per transformer) and that *“the oil-filled transformer includes an oil bunding system. This is a closed compartment designed to capture any leakages in a limited area”* and *“in case of oil spillage, 110% of the capacity can be collected”*. Additionally *“diesel fuel is contained in the service/day tank(s)”* and *“The fuel oil bunding system is formed as a closed compartment designed to capture any leakages in a limited area underneath the tank and avoid oil spillage on the floor”*. Given the recent construction and the physical control systems built into the substation, the potential for ongoing contamination associated with the substation is assessed to be Low.

⁵ DONG, 2013, Burbo Bank Extension Offshore Wind Farm, Environmental Statement Volume 1 – Chapter 6: Project Description

2.4.20 The A55 fuel filling stations and the recycled plastic products factory will both be taken forwards as SPCs. The potential for ongoing contamination associated with the fuel stations and factory is assessed to be Moderate.

2.4.21 The former military camp is taken forwards as a potential source of contamination, noting that this relates to unexploded ordnance associated with troop training only. The potential UXO hazard may also extend out into the surrounding woodlands.

Discharge Consents

2.4.22 The Groundsure Report (**Annex 2**) indicates that there are no active permitted discharge consents on the Site, and three consents identified within 50 m of the Site.

2.4.23 The consents identified within 50 m of the Site relate to:

- Discharge of 'site drainage' from the minerals processing area immediately south of the cable route to the Nant Ddu Stream under a consent granted in 2023. The Nant Ddu Stream appears to flow northwards to the south-eastern corner of Land Parcel 1 where contemporary OS mapping indicates that it either sinks or enters a culvert.
- Discharge of "*trade discharges – process effluent – water company (WTW)*" to a stream approximately 40 m north of the cable route, the stream then flows north, away from the cable route and does not flow through or near any of the land parcels.
- Discharge of treated sewage effluent at the household waste recycling centre / waste transfer station to the north of Land Parcel 1, to the Bodoryn Cut. The Bodoryn Cut flows to the north-east, adjacent to the northern boundary of Land Parcels 2 and 3.
- Discharge of treated sewage effluent from a residential property approximately half way between Land Parcels 1 and 2, via a reed bed, to a tributary of the Afon Gele.

2.4.24 The active discharge consents greater than 50 m from, but within 250m of the Site permit the releases of treated sewage effluent from residential properties, or Site drainage, to watercourses.

2.4.25 The off-Site discharge consents will not be taken forwards for assessment as SPCs as the watercourses that are discharged to do not flow through the Site and the substances being discharged (drainage water or treated sewage effluent) are not considered to present a credible hazard to a development of this nature.

Pollution Incidents

2.4.26 The Groundsure Report indicates that there are no recorded historical pollution incidents on Site.

2.4.27 A single incident is recorded within 50 m of the Site, approximately 20 m north of the north-eastern corner of Land Parcel 3, involving the release of “natural organic material” in 2002 and was classified by NRW as “Category 3 (Minor)” in respect of impact to water, and “Category 4 (No Impact)” in respect of impact to land.

2.4.28 This off-Site pollution incident will not be taken forward for assessment as a SPC due to the assessed minor impact associated with the release of substances that are unlikely to persist after 22 years.

2.5 Regulatory Enquiries

Conwy County Borough Council

2.5.1 A request for information was sent to Conwy County Borough Council in relation to the historical land use of the Site, private water abstractions, and other available geo-environmental related information.

2.5.2 A copy of the Council’s response is provided in **Annex 4**, and confirms that:

- There is a closed landfill site (Gofer) located within 250m of the Site.
 - *“Part of the planning process for a development to the closed landfill site required action to be carried out by the developer in accordance with the requirements of a contaminated land remediation strategy, including ground gas protection measures to ensure that the development was considered suitable for use”.* Conwy CBC’s planning portal has been reviewed for planning applications relating to the former landfill, however none of the relevant planning applications had documents available to review.
- There are no known private water supplies located within 250m of the Site.

Denbighshire County Council

2.5.3 A request for information was sent to Denbighshire County Council in relation to the historical land use of the Site, private water abstractions, and other available geo-environmental related information.

2.5.4 A copy of the Council’s response is provided in **Annex 4**, and confirms that:

- The Council is not aware of any land within 250m of the Site that has been classified as Contaminated Land (including ground investigated or designated under Part 2A).
- There are no known private water supplies located within 250m of the Site.
- The Council is not aware of any known animal burial sites pursuant to the provisions of the Animal Health Act 1981 and the Animals (Miscellaneous Provisions) Order 1927, within 250m of the Site.

Natural Resources Wales

- 2.5.5 A further request for information was sent to NRW requesting information in relation to the historical land use of the Site and other available geo-environmental related information.
- 2.5.6 A copy of NRW's response is provided in **Annex 5**, and did not provide any additional information to that provided within the Groundsure Report.

2.6 Review of Unexploded Ordnance Risk

- 2.6.1 Zetica Ltd.'s Unexploded Bomb (UXB) risk map (Zetica, 2025) shows the indicative potential for UXB to be present as a result of World War Two (WWII) aerial bombing and indicates that there is a Low potential for UXB to be present within the Site.
- 2.6.2 Zetica's map records Kinmel Park Camp was a Luftwaffe target during WWII.
- 2.6.3 Whilst Zetica have identified a Low potential for UXB to be present, given the limitation of the Zetica mapping (i.e., relates to UXB only) and the identified presence of potential military activity, e.g., troop training, and military targets in the immediate vicinity of the Site, it was recommended that a detailed UXO risk assessment is carried out by a UXO specialist to assess the potential risks associated with the presence of UXO.
- 2.6.4 A UXO Desk Study and Risk Assessment was consequently commissioned from Zetica Ltd. The UXO assessment aims to *"gain a fair and representative view of the potential UXO hazard on or affecting the Site in accordance with the Construction Industry Research and Information Association (CIRIA) C681 'Unexploded Ordnance (UXO), a Guide for the Construction Industry'".*
- 2.6.5 The UXO assessment identifies that for the majority of the site, including Land Parcels 1 to 6 and the BESS and POC and most of the cable route, the risk of UXO being present is "Low". A "Low" risk is defined by Zetica Ltd. as *"there is no positive evidence that UXO is present, but its occurrence cannot be totally discounted"*.
- 2.6.6 A section of the cable route to the south-west of Kinmel Park Camp (see Extract 2.1 below) has been assessed as being at "Moderate" risk of UXO, defined by

Zetica Ltd. as “*There is positive evidence that ordnance was present or that other uncharted ordnance may be present as UXO*”.

Extract 2.1 Preliminary UXO hazard zone plan of the southern part of the site (after Zetica, 2025)



2.6.7 The potential UXO hazard identified in this “Moderate” hazard area is identified as land service ammunition (LSA) e.g., grenades, mortars, pyrotechnics, and small arms ammunition (SAA). The report states that “*SAA is not considered to provide a significant UXO hazard*” and therefore the Moderate hazard is driven by the LSA.

2.6.8 In areas of Low UXO hazard, Zetica Ltd. recommend a formal UXO awareness briefing for staff involved in excavations, and do not identify constraints associated with boreholes/piling or horizontal directional drilling and pipe jacking.

2.6.9 In areas of Moderate UXO hazard, Zetica Ltd. recommend the following.

- A formal UXO awareness briefing for all staff involved in excavations.
- Prior to intrusive works a non-intrusive UXO detection survey is recommended. The aim is to map shallow-buried UXO for investigation or avoidance. Analysis of the survey data should be undertaken in the office by a suitably trained and qualified geophysics specialist to determine the limits of detection and enable effective target selection. From this, a priority ranking can be established for those targets most likely to be UXO. On completion of the survey, potential UXO targets can be avoided (where practical) or

investigated and removed by an Explosive Ordnance Clearance (EOC) team. Any hazardous UXO uncovered should be rendered safe by an Explosive Ordnance Disposal (EOD) team.

2.6.10 It should be noted that this Phase 1 Ground Conditions Assessment does not purport to be a UXO Risk Assessment.

3 Environmental Setting

3.1 Introduction

3.1.1 Information on the environmental setting is used to inform the Ground Stability Risk Assessment presented in **Section 4** and to identify potential pathways and receptors as part of the Tier 1 (geoenvironmental) risk assessment presented in **Section 5**.

3.2 Geology

Published Geological Maps

3.2.1 The following British Geological Survey (BGS) geological maps of England and Wales have been reviewed, alongside the BGS' GeoIndex online map viewer.

- Sheet 107, Denbigh (Solid and Drift), 1:50,000 scale, 1973.
- Sheet 95, Rhyl (Solid alongside Drift), 1:63,360 scale, 1970.

3.2.2 The superficial deposits and bedrock geology present at the Site as recorded by the BGS, are described in the table below and are shown on **Figures 2 and 3**.

Table 3-1 Superficial Deposits and Bedrock Geology Present on-Site, as Recorded by the BGS

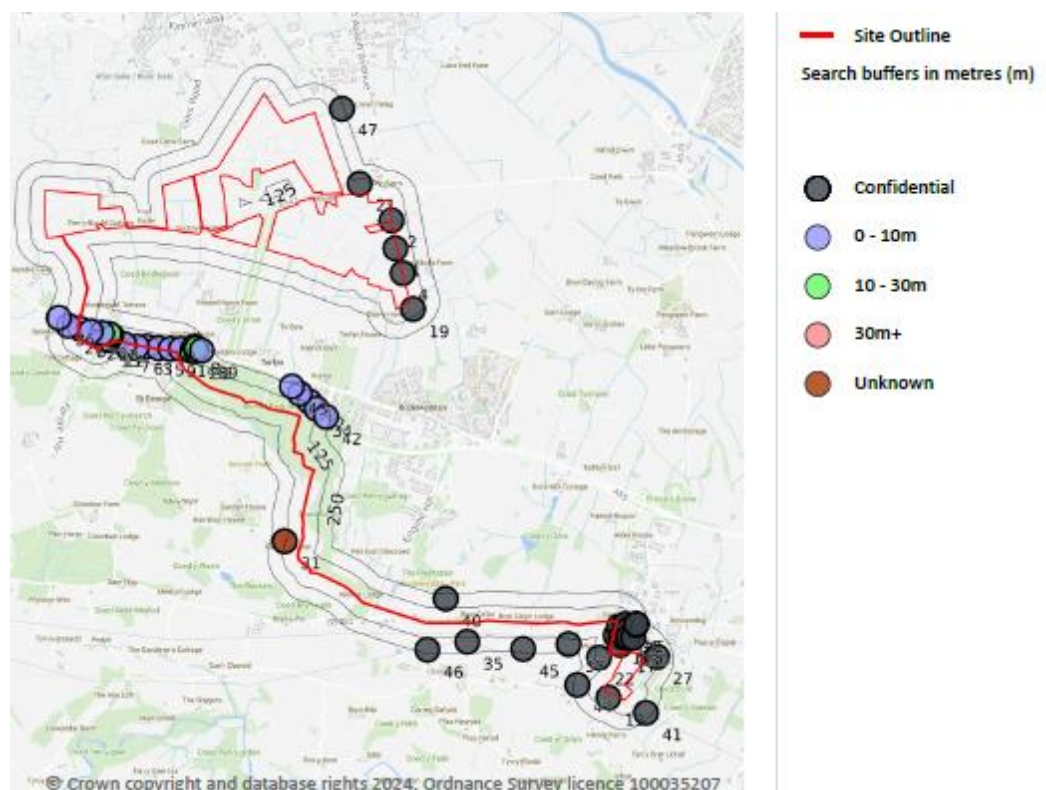
Stratum	BGS Description	Areas Present
Superficial Deposits		
Tidal Flat Deposits – Clay, Silt and Sand	"unconsolidated sediment, mainly mud and/or sand".	Land Parcels 1, 2, 3, 4 and 5 Northern-most 40 m of cable route
Till, Devensian – Diamicton	"Clay and silty clay, commonly pebbly and sandy, stiff, possibly interbedded with sand and gravel-rich lenses and rare peat".	Land Parcels 1, 2, 3, 4, 5 and 6 - potentially at surface along the southern boundary of Land Parcels 1 to 5 and all of Land Parcel 6. BESS and POC Majority of the Cable Route
Bedrock Geology		
Kinnerton Sandstone Formation – Sandstone	'dominantly aeolian ... sandstone, red-brown to yellow, generally pebble-free, fine- to medium-grained, cross-stratified'.	Present beneath superficial deposits across majority of Land Parcel 3 and northern half of Land Parcel 5
Warwickshire Group – Mudstone, Siltstone and Sandstone	'predominantly red, brown or purple-grey sandstone, siltstone and mudstone, some grey strata, coals not common, local conglomerates, localised beds of Spirorbis limestone'.	Present beneath superficial deposits across all of Land Parcels 1, 2, 4 and 6, southern quarter of Land Parcel 3 and southern half of Land Parcel 5. Present beneath superficial deposits across Majority of BESS and POC with the exception of an approximately 70 m wide section

Stratum	BGS Description	Areas Present
		extending from the south-western corner. (present beneath the overlying Kinnerton Sandstone in the remainder of Land Parcels 3 and 5). Present beneath superficial deposits across northern-most 680 m and southern-most 600 m of Cable Route.
Clwyd Limestone Group – Limestone	'a diverse range of limestone facies with subordinate sandstone and mudstone units, and exhibiting local dolomitisation'.	Present beneath superficial deposits across the majority of cable route with the exception of the northern-most 680 m and southern-most 600 m, and an approximately 70 m wide section of the BESS and POC.

Historical BGS Borehole Records

- 3.2.3 The BGS' archive of exploratory hole records has been reviewed.
- 3.2.4 There are no publicly available exploratory holes located within 250 m of Land Parcels 1 to 6 or the BESS and POC within the BGS' archive, noting that there are a number of confidential records which have not been reviewed.
- 3.2.5 As shown on the extract below, there are multiple BGS archive exploratory boreholes located along the route of the A55, which the cable route crosses approximately 930 m south of its northern terminus and then runs partially parallel to for roughly 1 km. 19No. of the publicly available boreholes are located within 50 m of the Site and one is located on-Site.

Extract 3.1 Locations of BGS Archive Exploratory Holes



3.2.6 A selection of the boreholes located along this length of the A55 have been reviewed and the geology encountered is summarised in the table below.

Table 3-2 Geology Encountered Within A55 Boreholes

Stratum	Thickness (m)	Typical Description
Topsoil	0.20 – 0.30	Topsoil
Diamicton	Proved to a maximum thickness of 11.85m (base not proved)	Typically firm to very stiff, becoming hard with depth, reddish and greyish brown mottled orange and grey, silty to very silty CLAY, occasionally laminated and fissured. Occasionally with “ <i>varying gravel content</i> ”, “ <i>sand veins</i> ”, and pockets of green silt. Within uppermost 2.0 m occasionally with beds of sandy SILT or silty and/or clayey GRAVEL. Notably SH97NE82 proved 2.1 m thickness of “silt and gravel” and terminated at 2.4 m bgl within sandy gravel and clay.
Notes: Informed by BGS archive exploratory holes SH97NE71, SH97NE72, SH97NE73, SH97NE74, SH97NE75, SH97NE76, SH97NE77, SH97NE78, SH97NE79, SH97NE80, SH97NE81 SH97NE82, SH97NE84, SH97NE85, SH97NE86 and SH97NE87.		

Review of Stantec Archive Historical Reports

- 3.2.7 A review of Stantec's archive of historical reports did not identify any relevant documents within 250m of the Site.

3.3 Radon

- 3.3.1 As recommendations regarding radon protection measures would apply only to proposed occupied structures e.g., staff / control buildings (if such structures were to be constructed) the review is focussed on land where the BESS and POC are proposed to be located.
- 3.3.2 The Groundsure Report indicates that the majority of the BESS and POC Land Parcel is located within an area where less than 1% of homes exceed the UK Health Security Agency (UKHSA) radon action level of 200 Bq/m³. A limited area in the south-west of the BESS and POC is located within an area where between 1% and 3% of homes exceed the UKHSA Action Level.
- 3.3.3 Radon is not identified as a potential hazard requiring mitigation in the context of the Proposed Development.

3.4 Hydrogeology

Characteristics & Aquifer Designations

- 3.4.1 The aquifer designations, as classified by NRW for the various strata underlying the Site are provided in the table below. These are consistent across the whole Site wherever these strata are present.

Table 3-3 Aquifer Designations

Stratum	Description	Areas Present
Superficial Deposits		
Tidal Flat Deposits	Secondary Undifferentiated Aquifer	Land Parcels 1 to 5 Northern-most 40 m of cable route
Diamicton	This classification is applied by NRW 'where it is not possible to attribute either category A or B to a rock type. These layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type'.	Land Parcels 1 to 5 (beneath overlying tidal flat deposits) and Land Parcel 6 BESS and POC Cable Route
Bedrock Geology		
Kinnerton Sandstone Formation – Sandstone	Principal Aquifer	Present beneath superficial deposits across majority of Land Parcel 3 and northern half of Land Parcel 5

Stratum	Description	Areas Present
Clwyd Limestone Group – Limestone	Defined by NRW as “geology that exhibit high irregular and/or fracture permeability. They usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale”.	Present beneath superficial deposits across all of Land Parcels 1, 2, 4 and 6, southern quarter of Land Parcel 3 and southern half of Land Parcel 5. Present beneath superficial deposits across Majority of BESS and POC with the exception of an approximately 70 m wide section extending from the south-western corner. (present beneath the overlying Kinnerton Sandstone in the remainder of Land Parcels 3 and 5). Present beneath superficial deposits across northern-most 680 m and southern-most 600 m of Cable Route.
Warwickshire Group – Mudstone, Siltstone and Sandstone	Secondary A Aquifer Defined by NRW as “permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers”.	Present beneath superficial deposits across the majority of cable route with the exception of the northern-most 680 m and southern-most 600 m, and an approximately 70 m wide section of the BESS and POC.

Groundwater Vulnerability

3.4.2 The information provided in the Groundsure Report relating to groundwater vulnerability is summarised in the table below. These classifications are consistent across the whole Site wherever these strata are present.

Table 3-4 Groundwater Vulnerability

Stratum	Description	Areas Present
Superficial Deposits		
Tidal Flat Deposits – Clay, Silt and Sand	The Groundsure report indicates that groundwater within the superficial Secondary Undifferentiated Aquifer is of ‘High’ vulnerability. The Environment Agency (EA)⁶ define “High” vulnerability as “areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits”.	Land Parcels 1 to 5 Northern-most 40 m of cable route

⁶ Definitions of groundwater vulnerability tiers are provided in the Environment Agency’s 2017 report SC040016/R – “New groundwater vulnerability mapping methodology in England and Wales”, with the stated aim of the methodology, and associated maps generated by this methodology, being to “allow Environment Agency and Natural Resources Wales permitting staff, and planners, consultants and other groundwater technical specialists to assess whether a proposed development or activity is in an area of high, medium or low vulnerability”.

Stratum	Description	Areas Present
Till – Diamicton	The Groundsure Report indicates that groundwater within the Secondary Undifferentiated Diamicton aquifer is of 'Low' to 'Medium' vulnerability. The EA define "Medium" vulnerability as "intermediate between high and low vulnerability", where "Low" is defined as "areas that provide the greatest protection to groundwater from pollution. They are likely to be characterised by low leaching soils and/or the presence of superficial deposits characterised by a low permeability".	Land Parcels 1 to 5 (beneath overlying tidal flat deposits) and Land Parcel 6 BESS and POC Cable Route
Bedrock Geology		
Kinnerton Sandstone Formation - Sandstone	The Groundsure Report indicates that groundwater within the Secondary A Aquifer is of 'Low' to 'Medium' vulnerability.	Present beneath superficial deposits across majority of Land Parcel 3 and northern half of Land Parcel 5
Warwickshire Group – Mudstone, Siltstone and Sandstone	The Groundsure Report indicates that groundwater within the Secondary A Aquifer is of 'Low' to 'Medium' vulnerability.	Majority of cable route with the exception of the northern-most 680 m and southern-most 600 m, and an approximately 70 m wide section of the BESS and POC.
Clwyd Limestone Group - Limestone	The Groundsure Report indicates that groundwater within the Principal limestone aquifer is of 'Low' to 'Medium' vulnerability.	All of Land Parcels 1, 2, 4 and 6, southern quarter of Land Parcel 3 and southern half of Land Parcel 5. Majority of BESS and POC with the exception of an approximately 70 m wide section extending from the south-western corner. Also present at depth beneath the overlying Kinnerton Sandstone in the remainder of Land Parcels 3 and 5. Northern-most 680 m and southern-most 600 m of Cable Route.

Groundwater Abstractions & Source Protection Zones

- 3.4.3 The majority of the Proposed Development comprises either PV arrays which are anticipated to be constructed on shallow foundations, or cables which are anticipated to be constructed in shallow trenches. It is considered that the likelihood of the Proposed Development impacting upon abstractions (both in terms of chemical quality, and groundwater flow or quantity) is highly limited. On this basis a search buffer of 250 m has been selected for the identification of

groundwater abstractions (including private water supplies) and groundwater Source Protection Zones (SPZs).

- 3.4.4 The BESS and POC in the south-east of the Site may include structures with piled foundations. The BGS indicate that the BESS and POC Land Parcel is underlain by deposits of Diamicton which, elsewhere within the vicinity of the Proposed Development, has been shown to be predominantly cohesive and in excess of 12 m thick (likely more than this, noting that the base of the stratum was not proven). Whilst potentially contaminative current and historical land uses have not been identified within this Land Parcel, there remains the potential for any piled foundations (if they were to be used) to impact groundwater quality (if they were to penetrate the Diamicton, and extend into the underlying mudstone, siltstone and sandstone of the Warwickshire Group and the limestone of the Clwyd Limestone Group), e.g., via increased turbidity during installation, or via migration of concrete bleed waters. A search buffer of 250 m around the POC and BESS has been used for the identification of groundwater abstractions (including private water supplies) and groundwater SPZs.

Groundwater Source Protection Zones

- 3.4.5 The Groundsure Report records that the Site is not located within a groundwater Source Protection Zone and no such zones are present within 250 m of the Site (or within the report search radius of 500 m).

Groundwater Abstractions

- 3.4.6 The Groundsure Report records that there are no active recorded abstractions (sites extracting more than 20 cubic metres of water a day) within 250 m of the Site (or within the report search radius of 500 m). The nearest historical record is 600 m south of the mid-section of Cable Route for 'farming and domestic' use.
- 3.4.7 As described in Section 2.5 above, Conwy County Borough Council and Denbighshire County Council have both confirmed that they are unaware of any non-licenced (i.e., less than 20 cubic metres of water a day) abstractions for private water supplies within 250 m of the Site.

Groundwater Flooding

- 3.4.8 The potential for groundwater flooding has been reviewed only in areas of proposed structures, i.e., the BESS and POC. The Groundsure Report indicates that this Land Parcel is at a Low risk of groundwater flooding.
- 3.4.9 It should be noted that this report is a land condition assessment and does not purport to be a flood risk assessment.

Summary

- 3.4.10 The Land Parcels within which the solar PV arrays are to be constructed are predominantly underlain by Tidal Flat Deposits. The remainder of the Proposed Development is underlain by Till, Devensian - Diamicton.
- 3.4.11 The available relevant historical archive borehole information is limited to an approximately 1 km long section of the Cable Route and indicates that the Diamicton at this location is in excess of 12 m thick and is described as a typically firm to very stiff, silty to very silty CLAY, occasionally laminated and fissured and occasionally gravelly, or with distinct gravel lenses. The Diamicton is classified by NRW as a Secondary Undifferentiated aquifer. On this basis it is highly unlikely that there is any large-scale functional permeability through the significant thickness of Diamicton to the underlying bedrock Principal and Secondary A Aquifers.
- 3.4.12 The majority of the land within the Site will be used either for the construction of a cable route (cables placed within a trench anticipated to be 2 m deep, dug from the surface and surrounded by clean backfill material) or for the construction of PV arrays which will rest upon shallow foundations placed within the Diamicton. Given the shallow foundations and thickness of the low permeability stratum it is considered that a credible pollutant linkage will not be created. On the basis of the above, for the Land Parcels and Cable Route, Groundwater (resource), and Groundwater (biodiversity) will not be taken forward for assessment as receptors.
- 3.4.13 Only the BESS and POC may include structures with more significant foundations (deeper penetration), and whilst it is likely that (given the nature of the proposed structures) shallow foundations will be utilised, at this stage it cannot be ruled out that deep piled foundations may be required and therefore there is a limited potential that during the construction phase only, a potential risk to hydrogeology will be present. On the basis of the above, within the BESS and POC, Groundwater (resource), and Groundwater (biodiversity) will be taken forward for assessment as receptors during the construction phase only.

3.5 Hydrology

- 3.5.1 The majority of the Proposed Development comprises either PV arrays anticipated to be constructed on shallow foundations, or cables anticipated to be constructed in shallow trenches. It is considered that the likelihood of the Proposed Development impacting upon abstractions (both in terms of chemical quality, and water flow or quantity) is highly limited. On this basis a search buffer of 100 m has been selected for the identification of hydrological receptors (250 m for abstractions) for areas of the Site to be used either as solar farm or as parts of the cable route.

Surface Water Features & Operational Catchments

BESS and POC

- 3.5.2 There are no statutory Main Rivers located within 250 m of the BESS and POC Land Parcel.
- 3.5.3 Historical and contemporary OS mapping records a ditch along part of the eastern boundary of the BESS and POC Land Parcel. This ditch appears to be isolated and does not connect to a wider network of ditches.
- 3.5.4 The Welsh Government's DataMapWales, showing the "*Water Framework Directive – River Waterbody Catchments Cycle 3*" layer, shows the BESS and POC Land Parcel to be located within the "Pont Robin Cut (Bodelwyddan)" water body, which received a WFD classification of Poor for ecological quality and High for chemical quality.

Land Parcels and Cable Route

- 3.5.5 The Bodoryn Cut which runs along the northern boundary of Land Parcels 1 to 3 is classified by NRW as a statutory Main River. It is likely that the Bodoryn Cut provides drainage of the Tidal Flat Deposits.
- 3.5.6 The historical and contemporary OS mapping records a series of field drains / ditches within Land Parcels 1 to 6, that appear to connect and flow north towards the Bodoryn Cut.
- 3.5.7 Further small streams and ponds are present within Kinnel Park Wood, through which the Cable Route passes.
- 3.5.8 The Welsh Government's DataMapWales indicates that the Land Parcels and Cable Route cross several catchments, as detailed in the table below:

Table 3-5 Summary of Surface Water Body Information – Land Parcels and Cable Route

Water Body Name / Reference	Description
Gele (Land Parcels 1 to 6, 5.3 km of Cable Route (running south from Land Parcel 1))	2018 WFD classification of Moderate for Ecological quality and High for Chemical quality. The watercourse to which this WFD water body relates is the River Gele, located some 600 m to the north of the Site.
Pont Robin Cut (Bodelwyddan) (Remainder of the Cable Route)	2018 WFD classification of Poor for Ecological quality and High for Chemical quality. The watercourse to which this WFD water body relates is an un-named tributary of the River Clywd, located some 3 km to the north of the Site.

Surface Water Abstractions

- 3.5.9 The Groundsure Report indicates that there are no recorded licenced surface water abstractions within 250 m of any part of the Site.

Flood Risk

- 3.5.10 Flood events have the potential to transfer contaminated water and sediments. Natural Resources Wales' Flood Map for Planning⁷ records that Land Parcels 1 to 6, and approximately the western-most 50 m of the Cable Route are located within a Flood Zone 3 benefitting from flood defences, defined by NRW as land with a *"combined 1% risk of flooding from rivers and the sea including climate change"*.
- 3.5.11 The remainder of the Cable Route and the BESS and POC Land Parcel are shown to be located in a Flood Zone 1, defined by NRW as land with a *"less than a 0.1% chance of main river and sea flooding in any given year"*.
- 3.5.12 It should be noted that the statement above does not purport to be a flood risk assessment.

Summary

BESS and POC

- 3.5.13 Surface water (biodiversity) will be taken forward in this assessment and will be considered a sensitive receptor. On the basis that surface waters are not indicated to be utilised within 250 m of the BESS and POC, surface water (resource) will not be taken forward as a receptor for consideration in the assessment of this area of the Site.

Cable Route

- 3.5.14 Due to the presence of occasional streams and ponds along the Cable Route, surface water (biodiversity) will be taken forward in this assessment and will be considered a receptor. On the basis that surface waters are not indicated to be utilised on or within 1 km of the Cable Route, surface water (resource) will not be taken forward as a receptor for consideration in the assessment of this area.

Land Parcels 1 to 6

- 3.5.15 Due to the presence of a Main River (Bodoryn Cut) immediately north of Land Parcels 1, 2 and 3, and a network of drainage ditches throughout the Land Parcels that appear to drain north towards the Bodoryn Cut, surface water (biodiversity) will be taken forward in this assessment and will be considered a receptor. On the basis that surface waters are not indicated to be utilised on or within 250 m of the Land Parcels, surface water (resource) will not be taken

⁷ <https://flood-map-for-planning.naturalresources.wales/>

forward as a receptor for consideration in the assessment of these areas of the Site.

3.6 Terrestrial Ecology

3.6.1 The Groundsure Report indicates that there are no designated Sites of Special Scientific Interest, Special Areas of Conservation, Special Protection Areas, Local or National Nature Reserves, wetlands of international importance as designated under the Ramsar Convention within 1 km of the BESS and POC or within 250 m of Land Parcels 1, 2, 3, 4, 5 and 6 or the Cable Route.

3.6.2 **Ancient Woodland** - The Groundsure Report records several areas of designated ancient woodland (including restored ancient woodland, but not plantations on ancient woodland sites) within 250 m of the Proposed Development as described below.

- A restored ancient woodland located immediately east of Land Parcels 4 and 5 and immediately west of Land Parcel 6.
- A restored ancient woodland immediately north of the Cable Route beneath Glascoed Road, to the west of the junction with Engine Hill.
- A restored ancient woodland immediately south-west and 120 m north of the Cable Route within Kinmel Park Wood (noting that Kinmel Park Wood itself is not designated as ancient woodland).
- Ancient woodland immediately north of the Cable Route beneath an unnamed access road, at the junction with Primrose Hill.
- Ancient woodland approximately 40 m south of the Cable Route, on the western edge of the processing area for the limestone quarry.
- Ancient woodlands approximately 140 m north, 200 m north and 180 m east of the Cable Route beneath Glascoed Road.
- Ancient woodland located approximately 140 m east of the BESS and POC Land Parcel.

3.6.3 **Summary** - Given the limited ground disturbance to be undertaken within the Land Parcels and the Cable Route, only areas of ancient woodland located immediately adjacent to these elements of the Proposed Development have been taken forwards for assessment.

3.6.4 Furthermore, where the Cable Route is located beneath existing roads, the potential for the Proposed Development to impact upon areas of nearby ancient woodland is considered to be (following construction) unchanged from the existing situation and therefore ancient woodlands adjacent to the Cable Route where the Cable Route is beneath an existing road will not be taken forwards for assessment.

- 3.6.5 On the basis of the above, only the restored ancient woodland located immediately east of Land Parcels 4 and 5 and immediately west of Land Parcel 6, and the ancient woodland approximately 140 m east of the BESS and POC will be taken forwards for assessment as ecological receptors.

3.7 Geological Designations

- 3.7.1 Geodiversity can be defined as “*The natural range (diversity) of geological (rocks, minerals, fossils), geomorphological (landforms, topography, physical processes), soil and hydrological features. It includes their assemblages, structures, systems and contributions to landscapes*” (Gray, 2013). These protected sites include geological sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs) and Local Geology sites.
- 3.7.2 The Groundsure Report indicates that the Site is not located within 250 m of any geologically designated SSSI.
- 3.7.3 A review of the Regionally Important Geodiversity Sites (RIGS) data layer on the Welsh Government’s DataMapWales viewer shows there are no RIGS located within 250 m of the Site.
- 3.7.4 On this basis, geodiversity will not be taken forward as a receptor for consideration in this assessment.

3.8 Archaeological Setting and Buildings

- 3.8.1 A preliminary appraisal of readily available sources of information has been undertaken to determine whether archaeological settings and property requires consideration within the ground condition assessment. It should be noted the statement regarding the archaeological setting does not purport to be an archaeological risk assessment.
- 3.8.2 A search buffer of 50 m has been applied for the identification of archaeological / building receptors.
- 3.8.3 Within the scope of this assessment, the potential for the Site to present a hazard to buildings (property), including statutorily designated archaeological receptors considers the migration of existing contamination from on-site sources only, e.g., if existing contamination within the Site were to migrate and come into contact with foundations, contaminated dusts were to blow to an adjacent site, or ground gases from an on-site source were to migrate into an off-site building and increase the risk of explosion. Other pathways for potential harm to be caused to property (buildings) receptors, such as damage due to ground borne vibrations or groundwater level change during or as a result of construction are outside the scope of this assessment.
- 3.8.4 The Groundsure Report identifies that there are no World Heritage Sites, Scheduled Ancient Monuments or National Parks within 250 m of Land Parcels 1 to 6 or the BESS and POC Land Parcel. St George is designated as a

Conservation Area but this is more than 100 m from the Site and therefore considered not to be within a credible zone of influence of the Proposed Development in respect of contaminant migration.

3.8.5 There are no recorded Listed Buildings within 50 m of the BESS and POC, and there are two Listed Buildings within 50 m of Land Parcels 1 to 6, described below:

- Toll Bar Cottage - Grade II Listed – located adjacent to the southern boundary of Land Parcel 1, beyond Rhuddlan Road.
- Bodoryn Cottages - Grade II Listed – located between the eastern boundary of Land Parcel 2 and the western boundary of Land Parcel 3.

3.8.6 Large parts of the Cable Route, all of Land Parcel 4 and approximately 20% of Land Parcel 5 are located within Kinmel Park, a registered park and garden.

3.8.7 On the basis of the above, archaeological setting will be taken forward in this assessment as a receptor for consideration.

4 Ground Stability Hazard Assessment

4.1 Introduction

- 4.1.1 The potential for land instability at the Site has been considered, in relation to;
- Naturally occurring geological hazards including Natural Cavities;
 - Artificial Cavities;
 - Potentially adverse foundation conditions including slope stability.
- 4.1.2 Consideration is given below to the potential for stability constraints arising from existing ground conditions at the Site, as identified in this data review.

4.2 Natural and Mining Cavities

Natural Cavities

- 4.2.1 A search of the Stantec Natural Cavities Database and a review of the Groundsure Report indicate that there is a one recorded natural cavity located within 250 m of the Site. This feature called “St. George’s Cave” comprises a “*solution widened joint or fissure*” and is located approximately 140 m to the south of the Cable Route within the limestone quarry processing area. Further features are located at distance from the Site within the area underlain by the Clwyd Limestone Group, including a sinkhole and a swallow hole recorded approximately 1.4 km to the south of the Cable Route. Vadose cave features are recorded approximately 2.6 km to the west of Land Parcel 1.
- 4.2.2 The geomorphology of the area is such that water flowing down from the higher land to the south of the Site, underlain by the less permeable Elwy Formation (mudstone, siltstone and sandstone) flows onto land underlain by the Clwyd Limestone. Across geological time, water flowing through limestone slowly dissolves the rock, widening joints and fissures and creating cave systems.
- 4.2.3 Overall, based on the ground conditions, the geomorphology of the Site and the presence of similar karstic dissolution features in the surrounding area the potential for natural cavities to be present beneath the Site is considered to be **Moderate**.

4.3 Historical Mineral Working

- 4.3.1 A review of the Stantec Mining Cavities Database indicates that there are multiple historical mining features located within the vicinity of the Site.
- 4.3.2 Predominantly these features are located to the south of the Cable Route and BESS and POC Land Parcel, within the area underlain by bedrock Clwyd

Limestone Group, with the nearest off-Site feature being an historical lead mine immediately south of the Site within an inset of Land Parcel 5's eastern boundary, and a further historical lead mine located approximately 220 m to the south of Glascoed.

- 4.3.3 A limestone quarry (formerly a 'lime works') has been present immediately south of the Cable Route at approximate National Grid Reference (NGR) 296900 E, 376260 N, since approximately the late 1930s / early 1940s with the main quarry pit some 500 m to the south. The works / mineral processing area appears to have been extended between the 1950s and the 1990s, including the installation of railway sidings (removed by 1980). Contemporary aerial imagery shows this area to still be in use for minerals processing from the quarry which has since extended further to the south.
- 4.3.4 The historical mapping also records multiple "old shaft", "old shaft (lead)", "air shaft" and "old lead mine" within 500 m of the Cable Route to the south of Kinmel Park Wood / Glascoed. Similar historical mining features have not been identified on, or in the vicinity of Land Parcels 1 to 6 or the BESS and POC Land Parcel.
- 4.3.5 The BGS Mineral Resource Map indicates that the Site does not lie within a Mineral Safeguarding Area for any mineral.
- 4.3.6 Overall, based on the ground conditions, the geomorphology of the Site, the potential for man-made mineral excavations to be present is considered to be **Moderate to High**

4.4 Slope Instability

- 4.4.1 The BGS interactive viewer landslide layer shows that the Site is not located on or within 100m of mapped landslides.
- 4.4.2 The topography within the Site and across the surrounding area falls to the north and north-east towards the River Clywd. Land Parcels 1 to 6 appear to be approximately level at an approximate elevation of 4 mAOD whereas the BESS and POC Land Parcel 1re at an approximate elevation of 45 to 50 mAOD rising across the parcel north to south.
- 4.4.3 The potential for landslide hazards is considered to be **Very Low** for the majority of the Site, noting that localised areas of the Cable Route may have ground conditions where the landslide hazard are considered to be Moderate

4.5 Naturally Occurring Geological Hazards

- 4.5.1 An assessment of potential geological hazards that may give rise to instability or adverse foundation or construction conditions as supplied by the BGS from their National Geoscience Information Service (NGIS) are presented in the Groundsure Report reproduced in **Annex 2**. The assessment is generated automatically based on digital geological maps and the scope and the accuracy

is limited by the methods used to create the dataset and is therefore only indicative for the search area.

- 4.5.2 The information contained in the report has been reviewed and where considered necessary has been reassessed by Stantec considering the specific information available for the Site with the potential hazards being rated as very low, low, moderate, high or very high in general accordance with the criteria given by the BGS property hazard rating system. The Stantec assessment of the potential for geological hazards to be present on the Site is summarised in the table below.

Table 4-1 Stantec Assessment of Geological Hazards On-Site

Hazard	Hazard Potential	Comment
Collapsible Ground Stability	Very Low to Low	On the basis of the information reviewed, the ground conditions are expected to be such that a rapid reduction in volume is not expected to occur when they are loaded and saturated with water
Compressible Ground Stability	Very Low (Cable Route and BESS and POC) Moderate to High (Land Parcels 1 to 6)	On the basis of the information reviewed, the ground conditions are expected to be such that layers of very soft compressible materials such as organic clay or peat are not expected to be present beneath the Cable Route and the BESS and POC Land Parcel which are predominantly underlain by Diamicton. In these areas, a Very Low hazard potential has been assigned. Land Parcels 1 to 6 are shown by the BGS to be underlain by Tidal Flat Deposits, which typically comprise organic rich, soft clay. In these areas a Moderate to High hazard potential has been assigned.
Dissolution	Moderate	See Natural Cavities section above.
Landslide Ground Stability	Very Low	See Slope Instability section above.
Running Sand	Very Low (Cable Route and BESS and POC) Moderate (Land Parcels 1 to 6)	Land Parcels 1 to 6 are underlain by Tidal Flat Deposits, described by the BGS as “a <i>heterogenous mixture of clay, sand, gravel, and boulders varying widely in size and shape</i> ”. These deposits may be water bearing with groundwater within the depth of typical foundation excavations, and there is assessed to be a Moderate hazard potential for running sand to occur in these areas, in any excavations beneath the water table. It is noted that within Land Parcels 1 to 6 the proposed development principally comprises PV arrays on shallow piled foundations, however there may be a requirement for cables within shallow trenches, or for kiosks/transformers on shallow / ground bearing foundations. The BESS and POC Land Parcel and the majority of the Cable Route are located in areas underlain by Diamicton which has been found in BGS archive exploratory hole records to be predominantly cohesive is not anticipated to be water bearing. Running sands are not anticipated in excavations within this stratum, and the hazard potential for parts of the Site underlain by Diamicton is therefore Very Low.
Shrinking or Swelling Clay	Low to High	The cohesive Diamicton that forms the surface geology across the majority of the Site is expected to be of typically of low to medium volume change potential. Upper weathered layers are anticipated to be typically of medium volume change potential and the in-situ non-weathered

Hazard	Hazard Potential	Comment
		material is anticipated to be of typically low volume change potential. The volume change potential of Tidal Flat Deposits is typically highly variable, depending upon the sand content (sandy clay is typically lower volume change potential) and the organic content (e.g., peaty clay is typically moderate to high).

4.6 Potential Adverse Ground Conditions

- 4.6.1 The nature and full extent of the strata at the Site have not been determined at the time of writing. In due course this information will be required to inform the detailed design of foundations and infrastructure.
- 4.6.2 The Site is underlain by predominantly cohesive Diamicton deposits which are typically of medium volume change potential within the upper, weathered layers, and beneath Land Parcels 1 to 6, by Tidal Flat Deposits which are anticipated to be of highly variable volume change potential, varying by sand and organic content. Consideration should be given during the design of the proposals where the Proposed Development crosses boundaries between strata of differing volume change potential, and thus where differential movements could occur.
- 4.6.3 In order to minimise the risk associated with the potential for shrink swell to affect the Cable Route, the solar arrays or the BESS and POC (including any foundations and structures), ground investigation and testing will be needed.
- 4.6.4 It is understood that the Cable Route will be constructed predominately as an open-cut trench and will be backfilled with a granular fill. The temporary works design for the cable trench should consider impacts upon shallow groundwater flows, e.g., if flows will be obstructed during construction by trench shoring to maintain an open excavation. Dewatering of excavations will need appropriate management of arisings.
- 4.6.5 Diamicton can contain sulphate minerals which in the presence of groundwater and air can give rise to aggressive conditions for buried concrete i.e., the production of chemical agents that are destructive to buried concrete. Whilst this is a naturally occurring hazard / is normal in this stratum, this potential should be considered further, and data collected through ground investigation.
- 4.6.6 The geology at the Site needs to be confirmed through Site investigation and testing. Potential risk associated with swelling / shrinkable clays can be mitigated through best practice engineering design in accordance with current British Standards and, for residential development, bespoke industry technical standards produced by the National House Building Council (NHBC) and Building Research Establishment publications.
- 4.6.7 Based on the preliminary findings we recommend undertaking an Extended Cavities Occurrence Assessment to better define the likelihood of hazard

occurrence and implications for the Proposed Development given the likely tolerances of the various elements.

5 Tier 1 Preliminary Risk Assessment (Land Contamination)

5.1 Approach and Outline Conceptual Model

- 5.1.1 The land contamination risk assessment presented in this section is a Tier 1 Preliminary Risk Assessment (PRA). A summary of the guidance for the assessment of land contamination and the approach developed and adopted by Stantec is presented in **Annex 1**.
- 5.1.2 A conceptual model identifies the types and locations of potential contamination sources, the identification of potential receptors and the identification of potential transport/migration pathways.
- 5.1.3 Guidance requires a risk assessment to include the following steps:
- Identify the hazard - establish contaminant sources.
 - Assess the hazard - use a source-pathway-receptor (S-P-R) pollutant linkage approach to find out if there is the potential for unacceptable risk.
 - Estimate the risk - predict what degree of harm or pollution might result and how likely it is to occur.
 - Evaluate the risk - decide whether a risk is unacceptable.
- 5.1.4 The findings for each step are summarised in the following subsections.

5.2 Hazard Identification (Sources of Potential Contamination)

- 5.2.1 The on-Site and off-Site sources of potential contamination (SPCs) identified and associated contaminants of concern (COC) are presented in the tables below. It should be noted that whilst ground instability hazards have been identified these are not considered in this section of the report and the reader should refer to **Section 4** above for a preliminary appraisal of ground stability issues.
- 5.2.2 The potential contaminants identified for each land use are derived based on professional judgement and reference to published guidance. A Hazard Classification Score (HCS) has been assigned to each SPC to describe the potential for the current and historical activities associated with the source to generate or release contamination. Each SPC is score between 1 (Very Low) with a limited potential to generate / release contamination, e.g., residential use or agricultural land, to 5 (Very High) where likely widespread elevated

concentrations of contamination would be anticipated e.g., hazardous waste landfills, gas or chemical works etc.

Table 5-1 Potential Sources of Contamination – BESS and POC

SPC Reference	Description and Hazard Classification Score	Location	Potential Contaminants of Concern (COC)
On-Site			
1	Agricultural land. The majority of the land within the Site appears to have remained as agricultural land since the 1870s HCS = 1	All	Agrichemical Residues (not bulk storage)
Off-Site			
2	Farms – there are multiple historical and modern farms located in the immediate vicinity of the Site. There is the potential for bulk storage of fuels and agrichemicals to have taken place within the farms. HCS = 2	Various around Site	Petroleum hydrocarbons (fuels/oils), agrichemicals, asbestos in construction materials
12	St. Asaph Business Park – Predominantly commercial units including offices, police station, ambulance and lifeboat service training facilities, small-scale manufacturing. HCS = 2	Nearest units are approximately 30 m north	Petroleum hydrocarbons (fuels / oils), Polycyclic Aromatic Hydrocarbons (PAHs), Volatile and Semi-Volatile Organic Compounds (VOCs and SVOCs), Poly- and Per-Fluoroalkyl Substances (PFAS).
13	Large National Grid Substation – HCS assigned reflects the recent construction and managed operational controls HCS = 2	Immediately east of BESS and POC	Petroleum hydrocarbons

Table 5-2 Potential Sources of Contamination – Land Parcels 1 to 6 and Cable Route

SPC Reference	Description	Location	Potential Contaminants of Concern (COC)
On-Site			
1	Agricultural land. The majority of the land within the Site appears to have remained as agricultural land since 1871. HCS = 1	All	Agrichemical Residues (not bulk storage)

SPC Reference	Description	Location	Potential Contaminants of Concern (COC)
Off-Site			
2	Farms – there are multiple historical and modern farms located in the immediate vicinity of the Site. There is the potential for bulk storage of fuels and agrichemicals to have taken place within the farms. HCS = 2	Various around Site	Petroleum hydrocarbons, agrichemicals
3	Former Lime Works, later used as minerals processing area associated with main quarry pit located approximately 500 m to the south. HCS = 2	Immediately south of the cable route at approximate National Grid Reference (NGR) 296900 E, 376260 N	Petroleum hydrocarbons (fuels/oils)
4	Gas works – was a small gas works from late 1800s to 1960, and following this the building appears to have been converted to a residential property. HCS = 2 ⁸	Immediately adjacent to the cable route	Petroleum hydrocarbons, BTEX, halogenated compounds, organic solvents, phenols, polycyclic aromatic hydrocarbon (PAHs), metals, cyanides (free, complex and total), sulphate, sulphide and asbestos
5	Landfill (Gofer Refuse Tip) – indicated to have been operated by 'Aberconwy District Council' and 'Urban District Council of Abergele' between 1970 and 1985. HCS = 4	Immediately north-west of Land Parcel 2 and approximately 100 m north-east of Land Parcel 1	Landfill gases (methane, carbon dioxide, hydrogen sulphide) Metals, petroleum hydrocarbons, PAHs, asbestos, volatile and semi-volatile organic compounds, inorganic compounds (ammoniacal nitrogen, cyanide, chloride etc.)
6	Waste bulking station – effective since 2011 and operated by Conwy County Borough Council, permitting the transfer of household, commercial and industrial wastes. HCS = 2	Immediately north east of Land Parcel 1	Petroleum hydrocarbons, metals, asbestos, PAHs, inorganic compounds (ammoniacal nitrogen, cyanide, chloride etc.)

⁸ It is noted that Table 1 of the Methodology provided in Annex 1 states that gas works are assigned a HCS of 5. In this instance a lower HCS has been adopted on the basis of the small-scale nature of the gas works and the subsequent use of the gas works as a residential property.

SPC Reference	Description	Location	Potential Contaminants of Concern (COC)
7	Existing skip yard/waste transfer station – effective since 1994 and operated by Thorncliffe Building Supplies Ltd and historically by Windmill Ltd, allowing for commercial and industrial waste. HCS = 2	Approximately 90 m to the north of Land Parcel 1	Petroleum hydrocarbons, metals, asbestos, PAHs, inorganic compounds (ammoniacal nitrogen, cyanide, chloride etc.)
8	Existing household waste recycling centre – effective since 2005 and operated by Environmental Waste Controls Ltd, allowing for the removal of both commercial and industrial wastes. HCS = 2	Approximately 130 m north of Land Parcel 1	Petroleum hydrocarbons, metals, asbestos, PAHs, inorganic compounds (ammoniacal nitrogen, cyanide, chloride etc.)
9	Fuel filling stations HCS = 3	Approximately 130 m east and 220 m north-east of Cable Route.	Petroleum hydrocarbons (fuels / oils), PAHs, Volatile and Semi-Volatile Organic Compounds (VOCs and SVOCs)
10	Recycled plastic products factory HCS = 2	Approximately 250 m north-east of Cable Route	Petroleum hydrocarbons (fuels / oils), PAHs, VOCs and SVOCs, Poly- and Per-Fluoroalkyl Substances (PFAS), phthalates.
11	Historical Lead Mine HCS = 2	Adjacent to Land Parcel 5 within inset part of the parcel's eastern boundary	Lead

5.2.3 A plan showing the locations of the above SPCs is provided as **Figure 4**.

5.2.4 On-Site SPCs within the BESS, POC, Land Parcels 1 to 6 and the Cable Route are limited to agrichemicals (residues only) associated with a long-standing history of agricultural use. A further assessment has been undertaken of the risks presented to on-Site human health and property – buildings receptors from off-Site SPCs.

5.2.5 For each of these scenarios an over-arching hazard classification score has been assigned as follows:

- BESS, Substation, Land Parcels and CRCs with no on-Site identified SPCs other than agrichemical residues – **Very Low** (1).

- BESS and POC – Off-Site sources – **Low** (2) due to the presence of an off-Site farm, a recently constructed large electricity substation with bulk hydrocarbons storage and St. Asaph Business Park.
- Land Parcels and Cable Route - Off-Site sources – **High** (4) due to the presence of an off-Site landfill, waste transfer station, skip yard, minerals processing area / former quarry and a former small gas works.

5.3 Hazard Assessment

- 5.3.1 To determine whether the identified hazards pose a risk it is necessary to identify the presence of potential receptors and pathways by which these receptors can be exposed to the hazard.

Identification of Potential Pathways

- 5.3.2 Potential hazards require a pathway connecting the source (if present) to potential receptors to impact upon the receptors. These pathways are capable of conveying the potential contaminants identified. Pathways may be anthropogenic (artificial) or natural.
- 5.3.3 Anthropogenic pathways are artificial routes capable of conveying contaminants and include such routes as surface water drains, high permeability backfill materials, poorly consolidated Made Ground, mine workings faults, mining induced fissures from subsidence, foundations, and persons disturbing contamination sources in such a way as to liberate contaminants.
- 5.3.4 Table 3 of the Stantec Guide: methodology presented in **Annex 1** describes the possible pathways for each receptor type.
- 5.3.5 It is noted that the historical landfill and skip yard are located to the north of the Site. The hydraulic gradient in this area is anticipated to be to the north, towards the coast and the River Gele, and making it unlikely that groundwater contamination would migrate to the south. The landfill and skip yard are also separated from the Site by Bodoryn Cut. Therefore, if any gaseous contamination were to be present, it would be cut off by the watercourse prior to reaching the Site.

Receptor Identification

- 5.3.6 Potential receptors identified by this assessment and the determination of their sensitivity/value are presented in the tables below. The receptor sensitivity classifications are defined in Table 2 of **Annex 1**.

Table 5-3 Potential Receptors

Receptor	Comment	Receptor Sensitivity/Value
Human Health – On-Site	Construction and decommissioning – Ground workers constructing or decommissioning the BESS and POC Operation – Workers / maintenance staff at BESS and POC.	High (4)
Human Health – Off-Site	Same for Construction and Operation Residents of adjacent properties	Very High (5)
Groundwater (resource)	Same for Construction, Operation and Decommissioning Licenced groundwater abstractions have not been identified within 250 m of any part of the Site. Superficial – Tidal Flat Deposits and Diamicton = Secondary Undifferentiated Aquifer – mostly clayey / low permeability Bedrock – Kinnerton Sandstone Formation and Clwyd Limestone Group = Principal Aquifers. Bedrock – Warwickshire Group = Secondary A Aquifer.	Very Low (1) Moderate (3) Low (2)
Groundwater (biodiversity)	Taken forwards as a receptor for BESS and POC during Construction Phase only. Shallow groundwater within the superficial Diamicton is not anticipated. Groundwater likely to be present within the underlying bedrock strata (Secondary A and Principal Aquifers). A review of OS mapping does not record the presence of any bogs, wetlands, marshes or other potentially groundwater supported ecological sites within 0.5 km of the BESS and POC.	Very Low (1)
Surface Water (resource)	Licenced surface water abstractions have not been identified within 250 m of any part of the Site. The Site is located within surface water catchments which have WFD classifications for chemical quality of High.	Very High (5)
Surface Water (biodiversity)	Site is located within WFD RBMP catchments with Ecological status of 'Poor' to 'Moderate'.	Moderate (3)

Receptor	Comment	Receptor Sensitivity/Value
Property - Buildings	BESS and POC - Construction and Decommissioning – No existing structures identified on the Site. No listed buildings or archaeological receptors have been identified within 50 m.	Eliminated
	Land Parcels and Cable Route – Construction and Decommissioning. Two Grade II listed buildings have been identified within 50 m of Land Parcels 1 to 6, both are cottages.	Moderate (3)
	Regionally important electricity generation and transmission infrastructure present during operational phase.	Moderate (3)
Terrestrial Ecology	Multiple areas of ancient woodland are present immediately adjacent to the Site.	Low (2)
Geodiversity	The BESS, POC, Land Parcels 1 to 6 and the Cable Route are not located within 0.25km of any geologically designated SSSI or geologically designated Local site (RIGS)	Eliminated

5.4 Risk Estimation

- 5.4.1 When there is a pollutant linkage (and therefore some measure of risk) it is necessary to determine whether the risk matters and therefore whether further action is required.
- 5.4.2 Risk estimation involves predicting the likely consequence (what degree of harm the receptor might suffer) and the probability that the consequences will arise (how likely the outcome is given the likely scale of contamination and the probability of exposure).
- 5.4.3 Preliminary risk estimation is based the evaluation of available data (which has been summarised and presented in this report). Without actual data from physical site investigation works, there is always a degree of uncertainty regarding the actual presence of potentially harmful contamination.
- 5.4.4 On-Site SPCs within the BESS, POC, Land Parcels 1 to 6 and the Cable Route are limited to agrichemicals (residues only) associated with a long-standing history of agricultural use. A further assessment has been undertaken of the risks presented to on-Site human health and property – buildings receptors from off-Site SPCs.
- 5.4.5 The estimated risks for each of the receptors in each of the assessed areas of the Scheme are summarised in the tables below. These should be read in

conjunction with the tables in **Annex 7** which set out the classification of risk which is a combination of consequence and probability for each potential pollutant linkage identified for the sources in **Table 5.4** and **Table 5.5**. Definitions for probability and consequence are in Table 4 and Table 5 of **Annex 1** (respectively).

- 5.4.6 It is noted that where there are multiple receptors within a single class e.g., for human health where residential neighbours may be present adjacent to some areas but absent from others, the 'worst-case' sensitivity for that receptor is adopted to provide a conservative assessment.

Table 5-4 Summary of Estimated Risk – BESS, POC, Land Parcels 1 to 6 and Cable Route without On-Site SPCs (other than agrichemical residues within agricultural land)

Receptor	Construction and Decommissioning (without mitigation)	Operation (without mitigation)
Human Health – On-Site	Very Low	Very Low
Human Health – Off-Site	Very Low	Very Low
Groundwater (resource)	Very Low	Very Low
Groundwater (biodiversity)	Very Low	Very Low
Surface Water (resource)	Very Low	Eliminated
Surface Water (biodiversity)	Very Low	Very Low
Terrestrial Ecology	Very Low	Very Low
Property (buildings)	Very Low	Very Low

Table 5-5 Summary of Estimated Risk – BESS and POC, Off-Site SPCs

Receptor	Construction and Decommissioning (without mitigation)	Operation (without mitigation)
Human Health – On-Site	Low*	Low
Property (buildings)	Eliminated (receptor not present on-Site at these phases)	Low
The likelihood of contamination, if present, migrating onto the Site is limited by the underlying geology		

Table 5-6 Summary of Estimated Risk – Land Parcels and Cable Route - Off-Site SPCs

Receptor	Construction and Decommissioning (without mitigation)	Operation (without mitigation)
Human Health – On-Site	Moderate	Low
Property (buildings)	Eliminated (receptor not present on-Site at these phases)	Moderate

Receptor	Construction and Decommissioning (without mitigation)	Operation (without mitigation)
Note: A lower risk to human health is assessed during the operational phase as, whilst the sources and the pathways are unchanged, the likelihood of the contaminant linkage being realised is reduced on the basis of there being only limited occupation in these areas of the Site by end users, e.g., during routine maintenance on the arrays. The risk to human health during construction and Buildings during operation of Moderate used a likelihood of Low. If the factors presented in 5.3.5 are accepted then the likelihood could be Unlikely and the estimated risk would be Low.		

5.5 Risk Evaluation

- 5.5.1 Possible pollutant linkages are determined using professional judgement. If a linkage is considered plausible with some associated risk, even if estimated to be low, it is considered that this represents a potentially 'unacceptable risk' and therefore requires further consideration.
- 5.5.2 Risk reduction can be achieved through implementation of remediation or mitigation measures or through further tiers of assessment following collection of Site-specific data.
- 5.5.3 The potential for the above sources of potential contamination to affect receptors (human health, groundwater, surface water, ecology, buildings) has been assessed during the construction phase and the operational phase of the development and a number of plausible contaminant linkages have been identified.

BESS, POC, Land Parcels 1 to 6 and Cable Route - No on-Site SPCs – Without Mitigation

- 5.5.4 Within the BESS, POC, Land Parcels 1 to 6 and the Cable Route, where on-Site SPCs have not been identified (other than agrichemical residues associated with long-standing agricultural use), the estimated risk level for each linkage has been assessed typically as **Very Low** during the construction, operational and decommissioning phases. This is principally driven by the absence of significant on-Site or off-Site SPCs with a credible migration pathway.
- 5.5.5 For a risk assessed as **Very Low** there is a low possibility that harm could arise to a receptor and in the event of such harm being realised it is not likely to be severe.

Risks to Identified Receptors from Off-Site SPCs Without Mitigation

BESS and POC

- 5.5.6 The risks to on-Site human health during the construction phase are assessed as **Low** during the construction, operational and decommissioning phases. During the operational phase, the risks to Property (buildings) are also assessed to be **Low**.
- 5.5.7 For a risk assessed as **Low** the definition is it is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm would at worst normally be mild.

Land Parcels and Cable Route

- 5.5.8 The risks to on-Site human health are assessed as **Moderate** during the construction and decommissioning phases and **Low** during the operational phase. During the operational phase, the risks to Property (buildings) – property are also assessed as **Moderate**. It should be noted that these risks are assessed as worst-case and are localised to areas within 250 m of the identified off-Site SPCs only (pending further investigation).
- 5.5.9 For a risk assessed as **Moderate** the definition is it is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild.

Risk Mitigation

- 5.5.10 These risks may be mitigated by design, i.e., avoidance of areas where SPCs have been identified, and where avoidance is not possible, by the investigation of SPCs and appropriate design of the proposed structures e.g., appropriate concrete class design, inclusion of gas protection measures where enclosed structures are proposed in an area where landfill gas risks have been identified, use of clean cover systems to break pathways between near-surface contamination and end-users, etc.
- 5.5.11 As with all construction projects, 'embedded' risk mitigation is provided by following industry good practice measures e.g., the contractor promoting good hygiene, provision of personal protective equipment (PPE) etc. to reduce human health risks, and by following measures likely to be outlined within a Construction Environmental Management Plan (CEMP) such as siting compounds or excavated arisings on areas underlain by impermeable hardstanding and away from watercourses / ditches, the use of bunded fuel storage, the maintenance and use of spill kits, siting of stockpiles etc. to reduce risks to controlled waters and ecological receptors.

5.5.12 On the basis of the above, the assessed off-site risks to human health during the construction phase would be reduced to Low.

6 Climate Change

6.1.1 Climate change requires the design and implementation of land contamination risk management reduction measures to account for Extreme Weather Events (EWE). EWE considers not just the general increase in magnitude such as temperature but also the intensity such as increasingly intense precipitation causing run-off or short-term groundwater level rise of surface flooding. Examples of EWE and the potential effects during construction and operation are presented below:

Construction

- Increased frequency of extreme weather. 1) Damage, delay, health and safety impacts, increased costs.
- Increased temperatures, prolonged periods of hot weather. e.g., warm and dry conditions exacerbate dust generation and dispersion, health risks to construction workers.
- Increased precipitation and intense periods of rainfall. 1) Flooding of works and soil erosion. 2) Increased risk of contamination of waterbodies due to run-off 3) Disruption to supply of materials and goods.

Operation

- Increased precipitation, especially in Winter. 1) Flooding. 2) Water scour causing structural damage. 3) Weakening or wash-out of structural soils. 4) Change in ground water level and soil moisture.
- Gales. 1) Damage from wind borne debris. 2) Additional or uneven loading of structures. 3) Disruption and potential danger to crossing users (including pedestrians and cyclists). 4) Damage to trees / landscaping.
- Temperature extremes / dry periods. 1) Stress on structures and technology; 2) Stress on surfaces e.g., difficulties with maintaining required texture depth during construction and operation; 3) Challenges for maintenance regimes.

6.1.2 In relation to this assessment, the identified baseline conditions could evolve through changes to long term groundwater levels and increased seasonal variations of groundwater levels potentially affecting geology and soils and therefore structures and other elements of the Scheme that interact with the ground. EWEs leading to more frequent and higher intensity precipitation, or hotter drier conditions could lead to increased erosion/deterioration of unprotected natural surfaces and other effects on Geology and Soils.

6.1.3 Consideration of the potential effects of climate change on Ground Conditions leading to impacts on the Scheme will be conducted during detailed design, and

suitable design parameters adopted to account for any potential adverse impacts including slope angles and vegetation selection.

7 Conclusions and Recommendations

7.1 Geo-environmental Conclusions

- 7.1.1 The potential risks to the identified receptors (human health, groundwater, surface water, ecology, buildings) presented by the identified on and off-Site sources of potential contamination have been assessed during the construction, operational and decommissioning phases of the development and a number of plausible contaminant linkages have been identified.

BESS and POC

- 7.1.2 On-Site potential sources of contamination at the BESS and POC are limited to agrichemical residues resulting from a longstanding history of agricultural use. Off-Site potential sources of contamination in the vicinity of the BESS and POC include the nearby St. Asaph Business Park, the adjacent recently constructed substation, and farms.
- 7.1.3 In absence of any mitigation, the estimated risk level for each linkage associated with the on-Site sources has been assessed as **Very Low** during the construction, operation and decommissioning phases. Linkages associated with off-Site sources are assessed as **Low**.
- 7.1.4 It is likely that the foundation solution for the BESS and POC will be shallow, e.g., ground bearing slabs, strips or pads. Following ground investigation, should piled foundations be found to be required, and if the piles are required to extend to a depth that they would penetrate through the superficial Diamicton then there is the potential for short-term temporary release of sediment into the underlying aquifers depending on the piling technique used (noting that private or licenced abstractions which could be impacted by the sediment have not been identified). In this worst-case scenario, a **Low** risk to groundwater (resource) is assigned to the BESS and POC during the construction phase only.

Land Parcels 1 to 6 and Cable Route

- 7.1.5 On Site potential sources of contamination at the Land Parcels and Cable Route are limited to agrichemical residues resulting from a longstanding history of agricultural use. Off-Site potential sources of contamination in the vicinity of Land Parcels 1 to 6 and the Cable Route include farms, a former lime works that later has been used as the minerals processing area associated with a quarry, a small gas works, a landfill, a skip yard, fuel filling stations, part of an industrial estate and a waste bulking station.
- 7.1.6 In absence of any mitigation the estimated risk level for each linkage associated with the on-Site sources has been assessed as **Very Low** during the construction, operation and decommissioning phases. The estimated risk level for each linkage associated with the off-Site sources has been assessed as

Moderate during the construction and decommissioning phases and **Low to Moderate** during the operational phase. It should be noted that these risks are assessed using worst-case assumptions regarding contaminant migration which are considered potentially onerous. Additionally, the off-Site sources are localised to areas within 250 m of the identified off-Site SPCs only (pending further investigation).

Risk Mitigation

- 7.1.7 Whilst the adoption of risk mitigation measures does not change the consequence of the hazard being realised as the receptor sensitivity and severity of the potential source are unchanged, the likelihood of harm arising from the hazard (i.e., the risk) is reduced.
- 7.1.8 Risks may be mitigated by design, i.e., avoidance of areas where SPCs have been identified, and where avoidance is not possible, by the investigation of SPCs and appropriate design of the proposed structures.
- 7.1.9 As with all construction projects, ‘embedded’ risk mitigation is provided by following industry good practice measures to reduce human health risks, and by following measures likely to be outlined within a Construction Environmental Management Plan (CEMP) to reduce risks to controlled waters and ecological receptors.
- 7.1.10 On the basis of adoption of the above, the likelihood of the potential risks being realised is reduced to As Low As Reasonably Possible (ALARP).

Unexploded Ordnance

- 7.1.11 The UXO Desk Study and Risk Assessment identifies that for the majority of the site, including Land Parcels 1 to 6 and the BESS and POC and most of the cable route, the UXO hazard is “Low”. A section of the cable route to the south-west of Kinmel Park Camp has been assessed as being “Moderate” UXO hazard.
- 7.1.12 In areas of Low UXO hazard, Zetica Ltd. recommend a formal UXO awareness briefing for staff involved in excavations, and do not identify constraints associated with boreholes/piling or horizontal directional drilling and pipe jacking.
- 7.1.13 In areas of Moderate UXO hazard, Zetica Ltd. recommend a formal UXO awareness briefing for all staff involved in excavations and a non-intrusive survey and clearance of identified UXO hazards in the Moderate UXO hazard area prior to intrusive works.
- 7.1.14 On the basis of adoption of the above, the likelihood of the potential UXO risks being realised is reduced to As Low As Reasonably Possible (ALARP).

7.2 Land Stability & Geotechnical Considerations

- 7.2.1 The nature and full extent of the strata at the Site have not been determined at the time of writing. In due course this information will be required to inform the detailed design of foundations and infrastructure.
- 7.2.2 The Site is underlain predominantly by cohesive Diamicton deposits of the Lowestoft Formation which is typically of medium volume change potential within the upper, weathered layers, and by Tidal Flat Deposits which are anticipated to be of highly variable volume change potential, varying by sand and organic content. Consideration should be given during the design of the proposals where the Proposed Development crosses boundaries between strata of differing volume change potential, and thus where differential movements could occur.
- 7.2.3 In order to minimise the risk associated with the potential for shrink swell to affect both the Cable Route, the solar arrays, the BESS and POC (including any foundations and structures), ground investigation and testing will be needed.
- 7.2.4 It is anticipated that the Cable Route will be constructed as an open-cut trench and backfilled with a granular fill. The temporary works design for the cable trench should consider impacts upon shallow groundwater flows, e.g., if flows will be obstructed during construction by trench shoring required to maintain an open excavation.
- 7.2.5 Diamicton can contain sulphate minerals which in the presence of groundwater and air can give rise to aggressive conditions for buried concrete i.e., the production of chemical agents that are destructive to buried concrete. Whilst this is a naturally occurring hazard / is normal in this stratum, this potential should be considered further, and data collected through ground investigation.
- 7.2.6 The geology at the Site needs to be confirmed through Site investigation and testing. Potential risk associated with swelling / shrinkable clays can be mitigated through best practice engineering design in accordance with current British Standards.
- 7.2.7 A search of the Stantec Natural Cavities Database and a review of the Groundsure Report indicate that there is a one recorded natural cavity located within 250 m of the Site. Further features are located at distance from the Site within the area underlain by the Clwyd Limestone Group, including a sinkhole and a swallow hole recorded approximately 1.4 km to the south of the Cable Route. The geomorphology of the area is such that water flowing down from the higher land to the south of the Site, underlain by the less permeable Elwy Formation (mudstone, siltstone and sandstone) flows onto land underlain by the Clwyd Limestone. Across geological time, water flowing through limestone slowly dissolves the rock, widening joints and fissures and creating cave systems. Based on these ground conditions, the geomorphology of the Site and

the presence of similar karstic dissolution features in the surrounding area there is considered to be a Moderate potential for natural cavities to be present beneath the Site.

7.3 Uncertainties and Data Gaps

- 7.3.1 Whilst the information used in this assessment is considered robust and suitable for purpose, the available ground investigation data relates only to a small proportion of the Site, therefore there is uncertainty around the actual ground conditions beneath the majority of the Site, in particular those parts where on-Site and off-Site sources of potential contamination have been identified.

7.4 Recommendations

- 7.4.1 Based on the preliminary findings we recommend undertaking an Extended Cavities Occurrence Assessment to better define the likelihood of hazard occurrence and implications for the proposed scheme given the likely tolerances of the various elements.
- 7.4.2 Potentially unacceptable risks associated with possible contamination have been identified (even a very low risk may be unacceptable depending on the perception and risk adversity of the stakeholder). It should however be noted that the source-pathway-receptor contaminant linkages via which these assessed risks arise all relate to off-Site sources, and are all able to be readily managed through adoption of standard practices such as awareness raising, good hygiene design evolution. Furthermore, it should be noted that the risks associated with the more significant sources, e.g. landfill gas risks, are limited to a small proportion of the Site only, i.e., the land within 250 m of the off-Site historical landfill.
- 7.4.3 It is recommended that an intrusive investigation is undertaken to characterise the conditions at the Site. The ground investigation should be designed to allow the further evaluation of the pollutant linkages identified and facilitate design requirements for risk reduction measures, if required.
- 7.4.4 The recommendations of the UXO Desk Study and Risk Assessment should be followed, i.e., awareness briefings for staff involved in excavations and a non-intrusive survey and clearance of identified UXO hazards in the Moderate UXO hazard area prior to intrusive works.
- 7.4.5 Ground investigation is also likely to be required to provide geotechnical information to assist in the design of the Scheme.

Essential Guidance for Report Readers

- 1) This report has been prepared within an agreed timeframe and to an agreed budget that will necessarily apply some constraints on its content and usage. The remarks below are presented to assist the reader in understanding the context of this report and any general limitations or constraints. If there are any specific limitations and constraints, they are described in the report text.
- 2) The opinions and recommendations expressed in this report are based on statute, guidance, and best practice current at the time of its publication. Stantec UK Ltd (Stantec) does not accept any liability whatsoever for the consequences of any future legislative changes or the release of subsequent guidance documentation, etc. Such changes may render some of the opinions and advice in this report inappropriate or incorrect and the report should be returned to us and reassessed if required for re-use after one year from date of publication. Following delivery of the report, Stantec has no obligation to advise the Client or any other party of such changes or their repercussions.
- 3) Some of the conclusions in this report may be based on third party data. No guarantee can be given for the accuracy or completeness of any of the third-party data used.
- 4) Historical maps and aerial photographs provide a “snapshot” in time about conditions or activities at the Site and cannot be relied upon as indicators of any events or activities that may have taken place at other times. It is possible for developments to have occurred between surveys that are not shown or for the map record to have been censored for military security.
- 5) The absence of cavity records in the Stantec natural and mining cavities (non-coal) databases is not considered as conclusive as to the absence of these features and we do not warrant that the data is complete or error free.
- 6) The conclusions and recommendations made in this report and the opinions expressed are based on the information reviewed and/or the ground conditions encountered in exploratory holes and the results of any field or laboratory testing undertaken. There may be ground conditions at the Site that have not been disclosed by the information reviewed or by the investigative work undertaken. Such undisclosed conditions cannot be considered in any analysis and reporting.
- 7) It should be noted that this report is a land condition assessment and does not purport to be an ecological, flood risk or archaeological survey and additional specific surveys may be required.
- 8) The identification of invasive and/or noxious plants such as Japanese Knotweed is outside the remit of our appointment.
- 9) This report has been written for the sole use of the Client stated at the front of the report in relation to a specific development or scheme. The conclusions and recommendations presented herein are only relevant to the scheme or the phase of project under consideration. This report shall not be relied upon or transferred to any other party without the expressed written authorisation of Stantec. Any such party relies upon the report at its own risk.
- 10) The interpretation carried out in this report is based on scientific and engineering appraisal carried out by suitably experienced and qualified technical consultants based on the scope of our engagement. We have not considered the perceptions of, for example, banks, insurers, other funders, lay people, etc., unless the report has been prepared specifically for that purpose. Advice from other specialists may be required such as the legal, planning and architecture professions, whether specifically recommended in our report or not.
- 11) Public or legal consultations or enquiries, or consultation with any Regulatory Bodies (such as the Environment Agency, Natural England or Local Authority) have taken place only as part of this work where specifically stated.

Figures

Annex 1

Stantec Guide: Methodology for Assessment of Land Contamination (Wales)

Annex 2 Groundsure Report

Annex 3 Extracts of Relevant BGS Archive Exploratory Holes

Annex 4 Regulatory Consultation Responses – Local Planning Authorities

Annex 5 Regulatory Consultation Responses – Natural Resources Wales

Annex 6 UXO Desk Study and Risk Assessment

Annex 7 Tables of Estimated Risk