

Denny to Wishaw Network Upgrade (DWNO)

Stage 1 Peat Management Plan
WB Route - New Build OHLine

SP Transmission

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1 Introduction

1.1 Background

- 1.1.1 AECOM Limited (AECOM) have been appointed by SP Transmission (the Applicant) to produce a Stage 1 Peat Management Plan (PMP) for the New Build Overhead Line works as part of the larger Denny to Wishaw Network Upgrade project.
- 1.1.2 The overall Denny to Wishaw Network Upgrade (the 'Project'), as described within Volume 1, Chapter 4 of the EIA Report, is covered under three separate Peat Management Plans (one for the uprated overhead lines, one for the new build overhead line and one for the substations). As such, when referring to the 'Proposed Development' within this PMP this covers the works associated with the new build overhead line works. Reference shall be made to the other PMPs where peat management details relating to the other parts of the Project is required.
- 1.1.3 SP Transmission worked with the National Energy System Operator (NESO) to identify that, for the UK to meet its net-zero carbon emissions targets, there is a requirement to reinforce the electricity network between Denny and Wishaw. This led to the development of the Denny to Wishaw Network Optimisation (DWNO) project. The Proposed Development is required to enable this reinforcement and also deliver connections to meet the NESO's Pathway to 2030 Holistic Network Design (HND). The published HND sets out the blueprint for the onshore and offshore transmission infrastructure that's required to support the forecasted growth in the UK's renewable electricity to create a pathway to Net Zero. The studies undertaken as part of the NESO's Pathway to 2030 HND also recommended the development of the overall Denny to Wishaw Network Upgrade Scheme Project.
- 1.1.4 This document has been prepared to inform the Scottish Ministers (by way of the Energy Consents Unit (ECU)), local planning authorities of Falkirk Council and North Lanarkshire Council and statutory consultees (Scottish Environment Protection Agency (SEPA) and NatureScot) of the proposed peat management methods to be employed during the construction of the Proposed Development.
- 1.1.5 The works involved with the new build overhead lines are generally associated with the WB route presented within the EIA Report for the Project, however, as the existing overhead line removal (CB route) is adjacent to the new build this PMP also covers this aspect and the undergrounding of the existing AA route which is within the same general corridor as the WB and CB routes. The ground related works involved with the aspects of the Project covered by this PMP are as follows:
- The construction of approximately 19km of a new 400kV operational capacity overhead line (known as the 'WB Route') which comprises of 62 new towers;
 - Removal of the existing overhead line (inclusive of towers) between Cumbernauld and Bonnybridge Substations (known as the 'CB Route');
 - The undergrounding of two sections of existing overhead line to the south of Bonnybridge Substation with three new Cable Sealing Ends (CSE) and associated new towers, two new temporary towers associated with the cable sealing ends and the removal of existing towers where these are replaced by the underground cabling (known as the 'AA Route');
 - Creation of temporary construction compounds at each tower location within the Proposed Development covering both the new build and dismantling of existing tower locations;;
 - Creation of level areas for use as pulling positions for the wiring operations;
 - 20 no. Distribution line works constructed as part of the WB Route (2 no. Permanent diversion through undergrounding, 17 no. Temporarily dipped through undergrounding, and 1 no. permanently diverted with a new Overhead Line constructed to the west of the existing); and
 - Installation of temporary access tracks from public roads to the infrastructure locations within the Proposed Development.

- 1.1.6 **Figure 2** located within **Appendix A** contains plans showing the works associated with the New Build Overhead Line works.
- 1.1.7 Note at the time of writing peat probing for the Proposed Development was ongoing. As such, estimation of peat depth and extent across the Proposed Development was not available for use in this PMP. Peat volumes can therefore not be estimated at this stage and mitigation to reduce peat disturbance and/or excavation cannot be confirmed. This PMP therefore provides the principles that will be followed as part of the Proposed Development without the specific detail. On completion of the peat probing survey for the Proposed Development, this PMP will be updated and completed to take account of the peat probing data available and resubmitted.

1.2 Site Description

- 1.1.8 The location of the New Build Overhead Line route (WB), existing overhead line removal (CB) and undergrounding route (AA) considered as part of the Proposed Development is shown on **Figure 1**, in **Appendix A**. Note wayleaves are included along the alignments of the temporary access tracks and a limit of deviation is included for both the new build overhead line (WB route) and undergrounding route (AA) for the purposes of the planning application with these shown on the plans included as **Figure 2**, in **Appendix A**.
- 1.1.9 The New build Overhead Line is approximately 19km in length and extends from Bonnybridge Substation in the north to just north of Glenmavis in the south with the route comprising 62 new towers. It is routed to the south of the substation crossing two existing 132kV overhead lines routes, referred to as the CB Route and the AA Route, then heads southeast towards the Forth and Clyde Canal. This section of the New build Overhead Line is located within the Antonine Wall World Heritage Site (WHS) Buffer Zone. From here the New build Overhead Line crosses the Canal, Antonine Wall and the Glasgow (Queen St.) – Edinburgh Railway Line in a southern direction to Howie Rig. It then heads southwest largely following the existing CB Route to the north / northwest of the Slamannan Plateau Special Protection Area (SPA). The New build Overhead Line crosses into North Lanarkshire to the north of Fannyside Muir continuing towards Palacerigg Country Park. The New build Overhead Line includes an approximate 750m spur which connects it to the existing Cumbernauld Substation, and which will allow the existing CB Route between Bonnybridge and Cumbernauld to be removed in its entirety. From Cumbernauld Substation, the main WB line is routed through part of Palacerigg Country Park heading south towards Greengairs. It is routed southwest from here crossing the A73 to the north of Riggend. From here the route heads south to the east of Glenmavis / west of Stand where it meets the reconfigured XX Route.
- 1.1.10 The existing overhead line route to be dismantled as part of the Proposed Development (CB Route) extends from Cumbernauld in its western extent to Bonnybridge Substation in its eastern extent. For much of the route, the existing overhead line follows the New build Overhead Line (WB route).
- 1.1.11 The existing overhead line which is to have sections undergrounded (AA Route) is present towards the western extent of the Proposed Development and leads from Bonnybridge Substation in the north to a point approximately 2.65km south of Bonnybridge Substation at its southern extent.
- 1.1.12 The land use across the Proposed Development varies between agricultural, areas of woodland, open areas of grassland and modified peat bog (towards its centre to the east of Cumbernauld Substation). Localised built-up land in the form of infrastructure is cross by or within the route, typically recorded as local roads, rail lines, the Forth and Clyde Canal and the A73. The Proposed Development is also recorded to cross areas noted as former open cast coal as shown on **Figure 4** within **Appendix A**.

1.3 Objectives

- 1.1.13 This Stage 1 PMP relates to the works associated with the construction of the New Build Overhead Line. The Stage 1 PMP has been prepared to satisfy the requirements of the Environmental Impact Assessment (EIA) (detailed in **Section 2** below) and to ensure that there has been systematic consideration of peat management and a quantitative assessment throughout the development process. Although a single EIA Report has been produced for the Project, three separate PMPs have been produced grouping the key aspects into uprated overhead lines, new build overhead line and substations. Therefore this Stage 1 PMP should be read in conjunction with the associated Substations PMP and Uprated Overhead Lines PMP.
- 1.1.14 The Stage 1 PMP looks to address the design principles set out by regulators as identified in Section 2 by providing background details on the possible peat deposits based on desk based sources, an investigation on the peat extent and depth in areas of the Proposed Development where peat has been identified as likely being present, details on how the disturbance on peat has been avoided or minimised, details on the elements of the Proposed Development that are likely to require peat excavation, details on the approximate predicted volumes of peat that would be excavated during the construction activities, an estimation on the characteristics of the peat that would be excavated, and the principles of how and where this excavated peat would be stored, reused and managed.
- 1.1.15 Note at this stage as the peat probing for the Project has not yet been completed, full details on the likely peat deposits disturbed and excavated including estimated volumes cannot be provided. General principles to be followed are provided in this document and on completion on the peat probing this PMP will be updated to include all required details and confirm proposals.
- 1.1.16 A Stage 2 PMP shall be prepared by the Principal Contractor and / or their Designer considering the management of peat for the works post-consent / pre-construction following further development and finalisation of the Proposed Development and on any further information becoming available (e.g. further ground investigation).

2 Stage 1 Peat Management Plan

- 2.1.1 This Stage 1 Peat Management Plan considers the excavation of peat and soils resulting from construction of the Proposed Development. It considers the potential for minimising the excavation and disturbance of the peat in order to avoid or reduce the generation of any unnecessary surplus of soil and peat.

2.1 Design Principles

- 2.1.2 As relates to the hierarchy of design principles to minimise the impacts associated with excavation of peat SEPA follows those of the waste hierarchy set out in the Waste Framework Directive (WFD) 2008/98 as below:
- **Prevention:** The best management option for waste peat is to prevent or limit its production. This can be done through design, positioning infrastructure in shallower peat or through consideration of alternative construction methods or engineering solutions e.g. floated roads;
 - **Reuse** (on site or off site for peatland restoration): Using excavated peat in construction or reinstatement (where suitable) e.g., restoration of temporary infrastructure, peatland restoration etc. SEPA's preference is for all peat excavated onsite to be reused within the site itself;
 - **Recycling / Recovery / Treatment:** Where peat cannot be reused on site or off site for restoration, it may be used for agricultural benefit or treated / blended with other materials to form a soil substitute or used in other relevant works. This use would require a waste management license or registration as an exempt activity and compliance with the legal requirements;
 - **Storage:** Temporary storage of peat on site (for example, during short periods in the construction phase) and then reuse. Should the peat become unsuitable for reuse during storage, it would be classed as a waste material; and
 - **Disposal (Waste):** Only after all other options have been explored and discounted would this option be considered.
- 2.1.3 In addition to the SEPA hierarchy, NPF4 mitigation hierarchy as presented within the guidance document "Advising on peatland, carbon-rich soils and priority peatland habitats in development management" ¹ includes for the following:
- Avoid – by removing the impact outset.
 - Minimise – by reducing the impact.
 - Restore – by repairing damaged habitats.
 - Offset – by compensating for residual impacts that remains, with preference to on-site over off-site measures.
 - Enhance – biodiversity, including restoring degraded habitats and building and strengthening nature networks.
- 2.1.4 Note this PMP covers the aspects of the SEPA hierarchy and the first three points from the NPF4 hierarchy. The purpose of a PMP is not to also cover off offsetting or enhancement with these aspects generally covered in a Landscape Habitat Management Plan (LHMP) where considered.
- 2.1.5 Three main stages within the development process are defined within the guidance and describe what data should be gathered and assessed to inform the site specific PMP:
- **Stage 1:** Environmental Impact Assessment (EIA);
 - **Stage 2:** Post-consent / pre-construction; and
 - **Stage 3:** Construction.

¹ NatureScot (2023) Advising on peatland, carbon-rich soils and priority peatland habitats in development management. Available at: [Advising on peatland, carbon-rich soils and priority peatland habitats in development management | NatureScot](#)

- 2.1.6 This report has been prepared in accordance with the requirements for Stage 1.
- 2.1.7 As part of the development process, SEPA were contacted and provided Pre-Application Consultation advice. This advice indicated that the Stage 1 PMP typically corresponds with the Outline PMP as highlighted within the Pre-Application Consultation advice. This report details the methodologies required to assess all potential surplus peat materials and presents estimates from the Designer of the expected volume of excavated peat materials and anticipated reuse locations with associated estimated volumes.

2.2 Policy and Guidance for Peat Management

2.1.8 The significance of peatlands is most evident in their protection by various legislation, policy and local, national or international initiatives including, but not limited to:

- United Kingdom Biodiversity Action Plan (UKBAP)²;
- Scotland's National Peatland Plan (SNH, 2015)³;
- European Council Habitats Directive 92/43/EEC (Council of the European Communities, 1992)⁴;
- Scottish Biodiversity List (SBL) (Scottish Government, 2013)⁵;
- European Council Water Framework Directive 2000/60/EC (Council of the European Communities, 2000)⁶;
- Scottish Government discussion paper on the Management of Carbon-Rich Soils (Scottish Government, 2010)⁷;
- Scottish Soil Framework (Scottish Government, 2009)⁸; and
- Climate Change Plan (2017-2032) (Scottish Government, 2017)⁹.

2.1.9 SEPA has a statutory and legislative duty to ensure that where peat spoil is generated during construction; that it is stored, reused, treated or disposed of correctly; which may require authorisation or permits.

2.1.10 As such, the following documents were referred to for guidance during the preparation of this PMP:

- Advising on peatland, carbon-rich soils and priority peatland habitats in development management¹
- Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste¹⁰;
- SEPA Regulatory Guidance – Developments on Peat and Off-site Uses of Waste Peat¹¹;
- SEPA Planning Advice Note - Assessing the Impact of Developments on peatland and Carbon Rich Soils¹²;
- Good Practice During Wind Farm Construction¹³;
- Peatland Survey. Guidance on Developments on Peatland¹⁴;

² United Kingdom Biodiversity Action Plan (UKBAP) (1994) Biodiversity The UK Action Plan. Available at:

<https://data.jncc.gov.uk/data/cb0ef1c9-2325-4d17-9f87-a5c84fe400bd/UKBAP-BiodiversityActionPlan-1994.pdf>

³ Scottish Nature Heritage (2015) Scotland's National Peatland Plan. Available at: <https://www.nature.scot/doc/scotlands-national-peatland-plan-working-our-future>

⁴ Council of the European Communities (1992) European Council Habitats Directive 92/43/EEC. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A01992L0043-20130701>

⁵ Scottish Government (2013) Scottish Biodiversity List (SBL). Available at: <https://www.nature.scot/doc/scottish-biodiversity-list>

⁶ Council of the European Communities (2000) European Council Water Framework Directive 2000/60/EC. Available at: <https://www.legislation.gov.uk/eu/2000/60/contents>

⁷ Scottish Government (2010) Scottish Government discussion paper on the Management of Carbon-Rich Soils. Available at: <https://www.iucn-uk-peatlandprogramme.org/news/scottish-government-publishes-discussion-paper-carbon-rich-soils>

⁸ Scottish Government (2009) Scottish Soil Framework. Available at: <https://www.gov.scot/publications/scottish-soil-framework/#:~:text=Published%201%20May%202009&text=This%20framework%20is%20aimed%20at,keyword%20stakeholders%20with%20an%20interest.>

⁹ Scottish Government (2017) Update to the Climate Change Plan (2018-2032). Available at:

<https://www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/>

¹⁰ Scottish Renewables, SEPA (2012). Developments on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste, Version 1.

¹¹ SEPA (May 2017). SEPA Regulatory Guidance – Developments on Peat and Off-site Uses of Waste Peat, SEPA Guidance, WST-G-052. Version 1.

¹² SEPA (2025) SEPA Planning Advice Note – Assessing the impact of developments on peatland and carbon rich soils, December 2025

¹³ Scottish Renewables, Scottish Natural Heritage, SEPA, Forestry Commission Scotland, Historic Environment Scotland, Marine Scotland Science, AECOW (2019). *Good Practice During Wind Farm Construction*, 4th Edition.

¹⁴ Scottish Government, Scottish Natural Heritage, SEPA (2017). *Peatland Survey. Guidance on Developments on Peatland*

- Floating Roads on Peat¹⁵;
- Constructed Tracks in the Scottish Uplands¹⁶;
- Restoration Techniques using Peat Spoil from Construction Works¹⁷;
- Peatland Action – Technical Compendium¹⁸;
- Guidance on Design Principles for Renewable Energy Development on Peatland on the National Forests and Land¹⁹;
- A risk-based approach to peatland restoration and peat instability²⁰; and
- Windfarms and blanket peat²¹

2.1.11 Additionally, the publication of the National Planning Framework (NPF) 4²² has illustrated the importance of more considered practices within peatlands. Policy 5 of NPF4 states:

a) Development proposals will only be supported if they are designed and constructed: i) In accordance with the mitigation hierarchy by first avoiding and then minimising the amount of disturbance to soils on undeveloped land; ii) In a manner that protects soil from damage including from compaction and erosion, and that minimises soil sealing.

c) Development proposals on peatland, carbon-rich soils and priority peatland habitat will only be supported for: i) Essential infrastructure and there is a specific locational need and no other suitable site; iv) The generation of energy from renewable sources that optimises the contribution of the area to greenhouse gas emissions reductions targets; iv) Restoration of peatland habitats.

d) Where development on peatland, carbon-rich soils or priority peatland habitat is proposed, a detailed site specific assessment will be required to identify: i) the baseline depth, habitat condition, quality and stability of carbon rich soils; ii) the likely effect of the development on peatland, including on soil disturbance; iii) the likely net effect of the development on climate emissions and loss of carbon.

2.1.12 As such, the details required in line with NPF4 have been considered in this Stage 1 (Outline) PMP.

¹⁵ Scottish Natural Heritage, Forestry Commission Scotland (2010). *Floating Roads on Peat*, August 2010.

¹⁶ Scottish Natural Heritage (2015) *Constructed Tracks in the Scottish Uplands*, 2nd Edition, updated September 2015

¹⁷ EnviroCentre on behalf of SEPA (2011) *Restoration Techniques using Peat Spoil from Construction Works*, Final Report, July 2011.

¹⁸ NatureScot (2024) *Peatland Action – Technical Compendium* [online], available: <https://www.nature.scot/doc/peatland-action-technical-compendium> [last accessed July 2024].

¹⁹ Forestry and Land Scotland (2024) *Guidance on Design Principles for Renewable Energy Development on Peatland on the National Forests and Land*, Version 1, January 2024

²⁰ Mills, A.J. and Rushton, D. (2023) *A risk-based approach to peatland restoration and peat instability*. NatureScot Research Report 1259

²¹ Lindsay, R. and Bragg, O. (2005) *Windfarms and blanket peat – A report on the Derrybrien bog slide*, Second Edition

²² The Scottish Government (2024) *National Planning Framework 4*, available: <https://www.gov.scot/publications/national-planning-framework-4/>

3 Ground Conditions

- 3.1.1 A Geotechnical and Geo-Environmental Desk Study has been produced by AECOM covering the Proposed Development (inclusive of the updated overhead line), which is provided as a Technical Appendix (Volume 3) associated with Volume 1, Chapter 10 of the EIA Report submitted for the project. The below subsections summarise the relevant information pertaining to this PMP from the desk study produced and supplements this with further detail where required.

3.1 Topography

- 3.1.2 Ordnance Survey topographic information was obtained for the Proposed Development. This file was used to produce the contour data as shown on **Figure 2** within **Appendix A**. A brief summary of the elevation data is also presented below.
- 3.1.3 The topographic data for the Proposed Development is variable and undulates across the routes. At the northernmost extent, around Bonnybridge Substation, the ground level is recorded at approximately 30mAOD, which increases to around 170mAOD at around the proposed new tower location of WB035. From there, the Proposed Development remains relatively flat ranging in level from approximately 150mAOD to 170mAOD. The spur to connect to Cumbernauld substation has a more sharp decrease in elevation, dropping to approximately 120mAOD from approximately 150mAOD across the 750m length.

3.2 Geology and Soil Maps

- 3.1.4 The BGS GeoIndex²³ indicates that while the majority of the Proposed Development is recorded to be underlain by glacial till, localised areas of a variety of deposits are recorded. Raised marine deposits are present in the northern extent in the vicinity of Bonnybridge Substation. Alluvial deposits are also recorded to be present in the northern extent, as well as more locally in the vicinity of Rowan Tree Burn, Cameron Burn and in the vicinity of Hulks Road. Glacial Hummocky deposits are recorded locally in the northern section of the scheme. Pockets of peat are recorded in the upland flatter areas of the Proposed Development from around WB047 to the west and down to Glenmavis, with a large deposit of peat recorded to the east of Cumbernauld. There are also localised areas where superficial deposits are recorded but are unclassified or are simply classified as sediment. Other areas have no superficial deposits recorded, indicating bedrock is at or near ground level.
- 3.1.5 The National Soil Map of Scotland²⁴ records a variety of soils recorded along the Proposed Development including brown earth soils, humus-iron podzols, noncalcareous gleys, peaty and mineral alluvial soils, basin peat, peaty gleys and areas recorded as being formerly open cast mines.
- 3.1.6 Review of the 2016 Carbon and Peatland Map layer of the National Soil Map of Scotland Interactive Map Viewer¹⁵ indicates that while much of the Proposed Development is underlain by Class 0 mineral soils or Class -2 non-soils, significant portions, particularly towards the centre of the WB route (also effecting the western half of the CB route) are also underlain by soils classified as Class 1, Class 3, Class 4 and Class 5.
- 3.1.7 Reference shall be made to **Figures 3, 4 and 5**, within **Appendix A**, which shows the BGS superficial information, National Soil Map of Scotland Data and 2016 Carbon and Peatland Map data respectively, as relates to the Proposed Development.
- 3.1.8 Note the following also provides further details on the classifications recorded on the 2016 Carbon and Peatland Map:
- Class 0 – Generally mineral soils where peatland habitats are not typically found;

²³ BGS (2024) GeoIndex Onshore, Available: <https://mapapps2.bgs.ac.uk/geoindex/home.html> [accessed March 2026]

²⁴ NatureScot (2024) National Soil Map of Scotland Interactive Map Viewer, Available: https://map.environment.gov.scot/Soil_maps/?layer=1# [accessed March 2026]

- Class 1 – Nationally important carbon-rich soils, deep peat and priority peatland habitat. Areas likely to be of high conservation value;
 - Class 2 – Nationally important carbon-rich soils, deep peat and priority peatland habitat. Areas of potentially high conservation value and restoration potential;
 - Class 3 – Dominant vegetation cover is not priority peatland habitat but is associated with wet and acidic type. Occasional peatland habitats can be found. Most soils are carbon-rich soils, with some areas of deep peat.
 - Class 4 – Predominately mineral soils where some peat soil may be encountered. The areas are unlikely to be associated with peatland habitats or wet and acidic type soils. The area is also unlikely to contain carbon-rich soils; and
 - Class 5 – Recorded as a peat soil, where the soil information takes precedence over the vegetation data. No peatland habitat is recorded within the area; however, the soils are likely to be carbon-rich and contain deep peat. Bare soils may also be present within the area.
- 3.1.9 Based on review of the available desk-based information, it is anticipated that peat will be encountered as part of the Proposed Development, particularly to the east of Cumbernauld Substation and as such will require further consideration.

3.3 Historic OS Mapping and Aerial Photography Review

- 3.1.10 Historic OS mapping was reviewed for the Proposed Development as part of the Groundsure Report obtained for the Desk Studies and is included as Appendix D of the AECOM Geotechnical and Geo-Environmental Desk Study which is included as a Technical Appendix (Volume 3) of Volume 1, Chapter 10 of the EIA Report. A review of aerial photographs relating to the Proposed Development was also undertaken using the historical aerial imagery time slider of Google Earth³⁰.
- 3.1.11 Review of the earliest available map from 1888 for the proposed Route identified that the route was generally undeveloped mainly agricultural land with localised areas of forestry or farm structures, with a large expanse of upland recorded as Fannyside Muir. Infrastructure links such as roads and railways are also present along the route along with mining related activities. Through the maps reviewed, in general the land use typically continues to be undeveloped land used for agricultural use although further built-up area and infrastructure links are present within and in the vicinity of the Proposed Development. Review of the 1975 map shows that the Bonnybridge Substation is present at its northern extent. Cumbernauld had mostly been constructed at this time, however while the associated substation is not yet present the map recorded an “electrical transmission line” terminating adjacent to its current position. At the southernmost extent, where the proposed route ties in, no XX route is present at this time. On review of the mapping, the mining related activities generally become less recorded on the mapping as reviewed through the years to eventually be typically not shown.
- 3.1.12 Review of historic aerial imagery typically agrees with the development shown on the mapping reviewed. As relates to peat, the imagery reviewed does seem to show potential areas where peat may be present which typically correspond to the recorded peat locations as per Section 3.2 of this document.

4 Peat within the Development

4.1 Field Observations

- 4.1.1 Site walkovers were undertaken across the Proposed Development as part of the development of the desk study and the EIA Report. Generally, the site walkovers agreed with the information obtained through the desk-based research presented above. The area for the Proposed Development is mosaic of damp habitats on flat or gently undulating ground, the majority of which is used for grazing. A further large proportion is open moorland or associated habitats, or woodland. Also present across the survey area were scattered trees and scrub. These are common and widespread but do enhance the habitat resource within the Proposed Development. Peat was identified within the Proposed Development particularly associated with the areas to the east of Cumbernauld Substation to around the southern extent of the AA route. Although peat exposure at surface were noted, these were identified as being degraded or modified and did not identify how the structure of the peat varies with depth.

4.2 Definitions of Peat

- 4.1.2 The Scottish Government Peat Landslide Hazard Best Practice Guide (2017) uses the following Joint Nature Conservation Committee (JNCC) report 455 'Towards an Assessment of the State of UK Peatlands' definition for classification of peat deposits:
- Peaty (or organo-mineral) soil: a soil with a surface organic layer less than 0.5 m deep;
 - Peat: a soil with a surface organic layer greater than 0.5 m deep which has an organic matter content of more than 60%; and
 - Deep Peat: a peat soil with a surface organic layer greater than 1.0 m deep.

4.3 Peat Depth Assessment

- 4.1.3 It is clear from the desk-based research completed along with the site walkovers, that peat is not present across the entire Proposed Development, however, widespread deposits are likely present to the east of Cumbernauld Substation as well as more locally present at other locations along the Proposed Development. During the writing of this document, a peat probing survey is currently underway across the Proposed Development where peat deposits have been identified as likely being present. Areas identified during the desk study and site walkovers have been targeted to provide an estimation of peat extent and depth associated with the proposed locations of infrastructure. **Figure 6** within **Appendix A** shows the proposed locations of probes. Note that the sheets shown as part of **Figure 6** within **Appendix A** only covers those areas of the Proposed Development where peat has been identified as potentially being present and therefore where probing has been completed. It should also be highlighted that the number and locations of the proposed probes may vary depending on the presence of services and peat depth identified.
- 4.1.4 As the peat probing survey is currently ongoing a summary of the peat depths and extents cannot be provided at this stage. On completion of the probing this section shall be updated to summaries the probing completed and resubmitted as part of the planning application for approval.

4.4 Peat Conditions at Site

4.4.1 Field Observations

- 4.1.5 For the purposes of this PMP, the peat has been separated into three distinct layers taking cognisance of the JNCC report 455 peat classifications, as reported in Section 4.2. These layers are:

- Where peat or peaty soils is recorded $\leq 0.5\text{m}$ thick from ground level to underlying substrate:
 - Peaty Soil
 - Where peat is recorded with thicknesses $>0.5\text{m}$ from ground level to underlying substrate:
 - Acrotelm – the shallow fibrous layer overlying deeper deposits of peat.
 - Catotelm – the deeper, typically amorphous peat layer.
- 4.1.6 In relation to the boundary between the acrotelm and catotelm this is generally defined by the lowest level of the water table. Acrotelm represents the upper fibrous vegetation mat where accretion of material is occurring, with the NatureScot Research Report 1259 further identifying the acrotelm as lying above the seasonal water table fluctuations and displaying active root growth with some tensile strength exhibited. The catotelm underlies the acrotelm within the permanently saturated zone and comprises decomposing vegetation. Catotelmic peat is variable in characteristics, with the decomposition of fibres generally increasing with depth, ranging from semi-fibrous in nature through to amorphous where the original structure of the plant is completely decomposed. Water content can be highly variable and as fibre content affects structural strength of the material.
- 4.1.7 As at this stage of the development of the Proposed Development, only peat probing is being completed to characterise the peat deposits identified, no samples of peat are to be recovered, and no monitoring of groundwater levels will be available. As such, a site-specific determination of the layer thicknesses associated with the acrotelm and catotelm cannot be made at this stage. Instead for the purposes of estimated peat volumes for this Outline PMP, an estimated average thickness of 0.50 m for the acrotelm layer has been applied throughout. This depth is consistent with the observed range of thicknesses included within Lindsay and Bragg – Windfarms and blanket peat²⁴ which suggest the acrotelm is typically around 0.5m in thickness. Even though the estimated acrotelm thickness is 0.50m , it is noted that, due to the commercial forestry activity in the area (particularly within the main works area), the acrotelm may also contain part of the upper catotelm.
- 4.1.8 Based on the above and on completion of the peat probing survey, to estimate the volumes of peat across the Proposed Development the following assumptions are to be made:
- Where $\leq 0.5\text{m}$ of peat (i.e. shallow peat) is recorded, the peat is to be classified as 'Peaty Soil'.
 - Where $>0.5\text{m}$ of peat is recorded, an average acrotelm thickness of 0.5m is to be applied to the earthwork's footprint with the remaining thickness then estimated to be the catotelmic layer.

4.4.2 Peatland Condition Assessment

- 4.1.9 As part of the EIA process AECOM undertook a UK Habitat (UKHab) survey across the Proposed Development with the results of this covered by Volume 1, Chapter 8 of the EIA Report. Due to the length of the site a number of habitats have been identified as containing peatland or bogs (or variants thereon). A complete list can be found in Table 8.1 of Volume 1, Chapter 8 of the EIA Report.
- 4.1.10 The survey area is dominated by a mosaic of damp habitats on flat or gently undulating ground, the majority of which is used for grazing. A further large proportion is open moorland or associated habitats or woodland. The survey completed for the Proposed Development mainly comprises damp semi-improved neutral grassland followed by degraded blanket bog and non-Scottish Biodiversity List (SBL) marshy grassland.
- 4.1.11 Blanket bog of the National Vegetation Classification (NVC) type M17a/M18a has been recorded within the Proposed Development between WB031 (CB015) and WB032 (CB016). Outwith this area, degraded bogs are a common feature within the local area, occurring in large swathes across the landscape generally to the east of Cumbernauld Substation to around WB035.
- 4.1.12 **Figure 8.3 of Volume 2** of the DWNO EIA Report shows the areas of bog as identified from the UK Habitat survey completed for the Proposed Development.
- 4.1.13 Potentially highly/ moderately / low / unimportant Groundwater Dependent Terrestrial Ecosystems (GWDTE) have been recorded within the Proposed Development as identified by **Figure 8.5 of Volume 2** of the DWNO EIA Report. In many of the instances where peat has been identified within

the Proposed Development by the desk-based sources, either they are not identified as a GWDTE, or only small parts of the wider peat body is identified as a GWDTE.

5 Sources of Peat During Construction

- 5.1.1 The following activities are likely to generate excavation of peat during the construction process:
- Construction of temporary access routes;
 - Temporary Construction Compounds;
 - Construction of new tower foundations;
 - Dismantling of existing towers;
 - Creation of pulling positions;
 - Permanent and temporary undergrounding of existing overhead cables associated with both high voltage line (AA route) and distribution line works; and
 - Installation of new 33kv wooden pole overhead line diversion.
- 5.1.2 As identified in Section 4.3, peat has been identified across much of the Proposed Development, although not all areas have had peat deposits identified. Therefore the sources of peat during construction are limited to those areas where peat has been identified in combination with the proposed infrastructure. In any case, given the recorded locations of the peat deposits and the proposed infrastructure, it is expected that peat deposits will be disturbed and excavated. This means the peat will require temporary and permanent relocation. **Figure 6** within **Appendix A** provides the layout of the Proposed Development along with areas of anticipated peat deposits and the peat probing locations. This section of the document considers those works locations which are anticipated to be underlain by peat deposits as per **Figure 6** within **Appendix A**.
- 5.1.3 All efforts to minimise impact on peat and requirement for excavation of peat – while taking account of other constraints – have been made in the design process informed by desk study, walkover observations, peat depth surveys (ongoing but will be completed) and peatland condition assessment.

5.1 Temporary Access Tracks

- 5.1.4 Temporary access tracks are proposed as part of the Proposed Development to provide access from public highways to the infrastructure locations during construction. Wherever possible, existing non-public roads and tracks will be utilised with upgrading works completed, where necessary, to ensure the existing access tracks are suitable for use as part of the Proposed Development. Where existing access tracks are not present to the infrastructure locations, temporary new access tracks will be constructed which will primarily comprise of stone fill. The reason for the stone access tracks for the new build towers is that these are designed to accommodate heavy plant loads required for the construction works and are suitable in a variety of ground conditions. Where the stone access tracks are constructed, the proposed width of these are 4m (including construction areas) extending to 6m wide at bends. Where any existing tracks are modified or new stone tracks are constructed, when the tracks are no longer required these will be reinstated to their previous condition with all peat excavated reinstated. At present it is considered that surface vegetation and soil, including peat, will be stripped to suitable substrate to allow construction of the temporary stone access tracks, however, this is likely dependant on the depth of peat present and will require confirmation following completion of the peat probing exercise currently ongoing.
- 5.1.5 Locally as part of the Proposed Development trackway will be utilised. The use of trackway will involve the laying of plastic tracks (approximately 4.0m wide including construction areas) directly onto the ground surface and hence no stripping of soil will be required, with no peat generated for reinstatement or reuse.
- 5.1.6 **Figure 2** and **Figure 6** within **Appendix A** identifies what type of access track is currently proposed to be constructed across the Proposed Development.

5.2 Temporary Construction Compounds

- 5.1.7 Each tower location for both new build towers and dismantling of existing towers is required to have a construction compound at its base. Each of these compounds will be approximately 50 x 50m in area, and will comprise a laydown area, turning head, and segregated bunding area. These proposed construction compounds will provide welfare facilities for construction staff, storage of plant, storage of materials and equipment to carry out the works safely, and bunding areas for storage and final reinstatement of excavated materials. Within these compounds a temporary crane pad and/or a stone piling pad would be constructed, where required, to allow the works, or more likely the installation of the new towers. For the compounds it is anticipated the surface vegetation and soils, including peat deposits, would be stripped to create a suitable level and stable platform for the construction works. The excavated material for the compounds would be stored adjacent to the area of excavation and, given these are temporary, will be fully reinstated when no longer required.

5.3 Construction of New Tower Foundations

- 5.1.8 The foundation design for the towers forming the New build Overhead Line is subject to the GI works and detailed design process. Pad and column, micro-pile and rock anchor are all potential construction methods which could be adopted for the tower foundations. Average, dimensions for each foundation are 4m x 4m x 0.5m. Due to restricted working room, no more than two excavations will be open at any time.
- 5.1.9 The type of foundation used will be informed by the peat probing currently ongoing, as well as the ground investigation which will be completed post-consent for the detailed design process. An assumption of the foundation type will be made based on the peat depths recorded from the peat probing and used in the calculation of the volume of peat displaced as a result of the foundations being installed for the purposes of this Stage 1 PMP. Where peat is present within the footprints of the new towers, these deposits will require excavation at the location of the foundations and permanent reuse within the Proposed Development.

5.4 Dismantling of Existing Towers

- 5.1.10 Dismantling of existing towers are proposed as part of the Proposed Development along the CB route as well as more locally along the AA route as identified on **Figure 2** within **Appendix A**, although only a limited number of towers along the AA route are expected to have peat present. Where towers are proposed to be dismantled, as relates to the disturbance of peat, this would involve excavation of the surface material to a minimum depth of approximately 1.5m to allow the existing foundations to be removed to this depth. The excavated peat would then be reinstated on top and surrounding the foundations excavated once the tower has been dismantled. The disturbance and excavation of the peat associated with the removal of the existing tower foundations would therefore be considered as temporary with the peat reinstated once the foundations are removed.

5.5 Pulling Positions

- 5.1.11 Pulling positions are proposed as part of the Proposed Development. At the locations of the pulling positions, it is proposed that the area will be levelled and trackway installed to create a stable platform. Based on the proposed locations of these from **Figure 6** within **Appendix A**, as relates to the Proposed Development a number of pulling positions are anticipated to have peat underlying and as such would have at least some of the peat deposits stripped to create the level platform. The works involved would be temporary and therefore any peat stripped to create a level platform would be stored adjacent to the area of excavation and reinstated when the position is no longer required.

5.6 Distribution Line Works

5.6.1 Undergrounding of Cables

5.1.12 As part of the Proposed Development existing distribution lines are proposed to be diverted to allow construction of the Proposed Development, both in the temporary and permanent case, by undergrounding the cables. The process of dipping existing distribution lines consists of digging a track between the relevant existing poles or across the new line where alignment is diverted away from the existing, before laying the existing distribution line underground and covering with the excavated soil. Although there are numerous diversions proposed as part of the Proposed Development, only the below listed are noted to be in areas where peat has potentially been identified and so are considered specifically within this PMP:

- Between towers WB012 and WB013 (permanent);
- Between towers WB016 and WB018 (temporary);
- Between towers WB021c and WB026 (permanent);
- Between towers WB030 and WB031 (temporary);
- Between towers WB038 and WB039 (temporary);
- Between towers WB046 and WB047 (temporary); and
- Between towers CB014 and CB015 (temporary).

5.6.2 Diversion of Overhead Lines

5.1.13 As well as diverting existing overhead distribution lines by undergrounding cables, in two instances permanent diversion of the overhead line itself is proposed. These relate to the diversions between WB16 and WB18 and between WB040 and WB042. In these instances, the towers constructed would comprise of wooden poles which are founded into the ground on smaller foundations than the proposed towers as part of the rest of the Proposed Development with generated peat volumes, where peat is encountered, anticipated to be insignificant.

6 Proposed Mitigation During Construction

- 6.1.1 There are four main types of impact on peat which can occur during construction. These are:
- Loss of structural integrity and peat strength, due to stripping off or damaging the surface vegetation turf, excavation, handling and transporting peat (particularly wet, subsurface peat);
 - Erosion and gullyng, caused by exposure and desiccation of bare peat surfaces primarily caused by water erosion, due to surface runoff after rainfall;
 - Contamination, caused by leaks, spillages or inappropriate laydown of materials; and
 - Peat slide, caused by laying wet peat on top of wet peat, laying other heavy materials (including excavated mineral soils or other construction materials) on top of wet peat or by inappropriate stockpiling, such as attempting to create stockpiles of peat that are too high, without bunding, engineering or geotechnical support.
- 6.1.2 A range of methods and control measures can be adopted to minimise the impact on peat which are described below and are designed to prevent these impacts from occurring. This best practice guidance shall be adhered to throughout the construction phase.

6.1 Access Tracks

- 6.1.3 As previously discussed, much of the access tracks for the Proposed Development are to be constructed using temporary stone fill, with trackway already being proposed where considered suitable. At present as the peat probing is currently ongoing and therefore peat depth results are not yet confirmed, it is considered that the peat underlying the footprint of the new stone access tracks will be stripped as part of its construction.
- 6.1.4 Note once the peat probing is complete and where peat depth >1.0m is identified, consideration as to other forms of forming the temporary access tracks will be given, such as floating the tracks on top of the peat. This will be confirmed by the designer once the peat depth data is available.
- 6.1.5 As the current assumption is the temporary stone access tracks will require excavation of peat to suitable substrate, with the peat then temporarily stored adjacent to the area of excavation ahead of being reinstated, the following best practices should be considered.
- Trackside ditches should capture surface water (within the acrotelm) before it reaches the track;
 - Any additional interceptor drains associated with the track construction will be constructed to be shallow and flat bottomed (and preferably entirely within the acrotelm to limit drawdown of the water table);
 - Any stripped peat turves to be placed back in the invert and sides of the ditch to stabilise the banks and assist regeneration.
 - Any excavation within peat creates the potential for minor slippages to occur from the cut face of the peat mass. Accordingly;
 - Free faces to be inspected for evidence of instability (cracking, bulging, excessive discharge of water or sudden cessation in discharge); and
 - Where peat is to be stored adjacent to an excavation, stability analysis will be conducted to determine Factor of Safety (FoS) and an acceptable FoS adopted for loaded areas.
- 6.1.6 With the underlying peat currently assumed to be removed from the footprint of the access track, the temporary tracks have the potential to disrupt natural hydrological drainage pathways. Therefore, appropriate drainage will be designed to mitigate this. Further details of the drainage will be developed as the detailed design of the Proposed Development is progressed and will be contained in the Stage

2 PMP post consent as well as being contained within the Construction Environmental Management Plan (CEMP).

6.2 Temporary Compounds

- 6.1.7 At present as the peat probing is currently ongoing and therefore peat depth results are not yet confirmed, it is anticipated that all temporary compounds will have any peat stripped as part of the construction.
- 6.1.8 Note once the peat probing is complete and where peat depth >1.0m is identified, consideration as to other forms of forming the temporary compounds will be given, such as floating the compound on top of the peat. This will be confirmed by the designer once the peat depth data is available.
- 6.1.9 Where the temporary compounds are excavated into the peat, these have the potential to disrupt natural hydrological drainage pathways. Therefore, appropriate temporary drainage will be designed to mitigate this. Further details of the drainage will be developed as the detailed design of the Proposed Development is progressed and will be contained in the Stage 2 PMP post consent as well as being contained within the Construction Environmental Management Plan (CEMP).
- 6.1.10 Good practice guidance in association with the excavated platform and drainage are as follows:
- Any ditches should capture surface water (within the acrotelm) before it reaches the compound;
 - Any additional interceptor drains associated with the compound should be shallow and flat bottomed (and preferably entirely within the acrotelm to limit drawdown of the water table); and
 - Any excavation within peat creates the potential for minor slippages to occur from the cut face of the peat mass. Accordingly;
 - Free faces should be inspected for evidence of instability (cracking, bulging, excessive discharge of water or sudden cessation in discharge); and
 - Where peat is to be stored adjacent to an excavation, stability analysis should be conducted to determine Factor of Safety (FoS) and an acceptable FoS adopted for loaded areas.

6.3 Construction of New Towers

- 6.1.11 The foundation solution for the new proposed towers has not yet been determined as these will depend on the results of the ground investigation completed and could vary from tower to tower based on the findings. However, it is expected that the majority of towers will be formed with shallow pad foundations and hence require excavation of the full depth of peat across the foundation footprint. Where deep peat is identified from the peat probing survey, consideration of micro piling the foundations would be given however this will be dependent on other factors and it should be noted that at least 1.0m of surface deposits including peat would be excavated to form these.

6.4 Peat Excavation, Storage & Transport

- 6.1.12 As described previously there are three distinct layers of peat considered for this document; for peat depths <0.5m thickness these are considered as peaty soil, and for peat depths >0.5m these are considered as acrotelm (including the vegetated turves) with underlying catotelm. These distinct layers should be recognised during peat excavation and reuse activities.
- 6.1.13 If peat is to be reused or reinstated with the intention that its supported habitat continues to be viable, the following good practice applies:
- Where excavation is required, superficial materials will be carefully separated during excavation, to keep peat (and peaty soils) and other soil materials (e.g. glacial till, alluvium, weathered rock, etc) apart. Turves of peat (approximately 0.3m to 0.5m thick) should be cut and relocated temporarily nearby. These peat turves can then be used to support revegetation of excavated areas and new fill areas (turves shall be placed vegetation up).

- Where the peat is in excess of 0.5 m thick, the acrotelm and catotelm will be separated, with the acrotelm retained for surface in-situ reinstatement;
- Turves will be as large as possible to minimise desiccation during storage;
- Mineral soils are to be transported and stored separately to reduce the risk of contamination of excavated peat; and
- The timing of excavation of peat shall avoid periods of very wet weather and multiple handling of peat should be avoided to reduce the risk of peat losing its structural integrity.

6.4.1 Temporary Storage

6.1.14 Peat storage will be required as part of the Proposed Development where peat is encountered given that much of the proposed works are temporary. It is anticipated all stored peat will be reinstated / reused within the Proposed Development by the end of the construction phase. Where excavated peat is not immediately relocated or reused, proposed temporary storage areas are typically adjacent to the area of excavation or in the case of the temporary compounds for the towers, with the compound area. All efforts will be made to avoid double handling of the peat generated from the works, however, in the cases of the temporary infrastructure this is not likely to be possible, as full reinstatement when the infrastructure is no longer required, is generally proposed. To ensure the proposed temporary storage areas are suitable in terms of environment, construction practicality and safety, the areas will be assessed at a site level by the ECoW, geotechnical engineer and Contractor's temporary works engineer using the guiding principles below:

- Where possible peat shall be excavated, stored and reused as turves. The turves will be stored green side up to avoid drying out of the peat and encourage regrowth;
- Peat turves should be stored in wet conditions or irrigated to prevent desiccation (once dry, peat will not rewet);
- Stockpiling of peat should be in large volumes to minimise exposure to wind and sun but with due consideration for slope stability;
- Excavation and handling of peat can cause the internal structure of the peat to deteriorate. The peat can therefore be a greater hazard when temporarily stored with this loss of structure and strength requiring to be considered and monitored during temporary storage;
- Where minimal peat underlies the ground surface, the peat will be stripped back to the underlying superficial deposits or rock to allow stockpiling to be undertaken to a maximum of 1.0 m thick (unless otherwise agreed by the Geotechnical Engineer). Where peat is approved to be stored higher than 1.0 m this should not be stored greater than 2.0 m, as this can lead to stability issues and could damage the peat itself, and all peat material underlying the proposed storage area will require removal prior to the stockpile being formed to ensure sliding risk is controlled;
- Cut off ditches and suitable treatment systems should be considered and installed at temporary storage areas, to ensure any leachate or sediment from stored peat does not reach any watercourse; and
- Monitor areas of peat / storage during period of wet weather, or during snow melt, to identify early signs of peat instability.

6.1.15 Where peat cannot be transferred immediately to an appropriate reuse area, short term storage (<2 months) will be required. The following good practice applies:

- Peat should be stored around the perimeter at sufficient distance from the cut face to prevent overburden induced failure;
- Local gullies, drainage lines, wet ground and steep slopes should be avoided;
- Stored upper turves (incorporating vegetation) should be organised and identified for reinstatement adjacent to like communities in the intact surrounding peat blanket; and

- Drying of stored peat should be avoided by irrigation (although this is unlikely to be significant for peat materials stored less than 2 months).

6.1.16 Where longer term storage is required (>2 months) the following good practice applies:

- Peat generated should be transported directly to its allocated reuse area to minimise the volume being stockpiled, with the possibility of drying out, where possible;
- Drying of stored peat should be avoided by irrigation, particular in hotter and drier months. Care shall be taken to use a fine spray to irrigate the peat to avoid run-off and / or oversaturation; and
- Monitoring of large areas after wet weather or snow melt.

6.4.2 Handling

6.1.17 The following will be considered when handling peat:

- Care will be taken when excavating peat to ensure that the acrotelm and catotelm layers are not mixed during stripping and storing;
- Handling peat can cause the internal structure to deteriorate and therefore make it more of a hazard when relocated due to a loss of shear strength. Peat will be relocated as close as practicable to where it was excavated or be reinstated in the area from which it was excavated. Care will be taken when transporting peat to avoid causing unnecessary structural damage;
- The removal of peat from site is considered to be the least desirable environmental option and is not currently anticipated;
- Where possible the peat will be excavated, relocated and re-use/reinstated as turves. Turves will be relocated green side up to avoid drying out of peat and encourage regrowth. If it is not possible the peat will be reseeded when it is re-used. Where additional reseeded is deemed necessary a suitable seed mix will be agreed with NatureScot and the local planning authority. Restoration/reseeding to be monitored by ECoW throughout the works and in the first growing season post-construction (subject to further reseeded within 2 years). Monitoring detailed below;
- Peat will be relocated and reused as close to the source of excavation as possible, to promote habitat similar to the surrounding areas and promote vegetation regrowth towards natural conditions. This also reduces the haulage distance which should be kept at a minimum throughout the works to reduce potential impact on the peat/soil structure and reduce carbon emissions. Peat handling can also increase the bulking factor of the material (which at present is currently assumed to be 25%) which has an impact on volumes of peat to be reused;
- Where peat is to be reused/reinstated, the placement of the catotelmic materials will be in the bottom layers, with the acrotelmic materials to the top.

6.1.18 A detailed storage and handling plan will be prepared by the Principal Contractor as part of the construction phase PMP, including:

- Best estimate excavation volume at each infrastructure location (including peat volume split into peaty soil, acrotelm or 'turf' and catotelm);
- Volume to be stored locally and volume to be transferred directly on excavation to reuse areas elsewhere to minimise handling;
- Location and size of storage area relative to natural peat morphology and drainage features; and
- Irrigation requirements and methods to minimise desiccation of excavated peat during short term storage.

6.1.19 These parameters will be determined by the contractor prior to construction.

6.4.3 Transport

6.1.20 Movement of turves should be kept to a minimum once excavated, and therefore it is preferable to transport peat planned for translocation and reinstatement to its destination at time of excavation.

- 6.1.21 If HGVs are used for transporting non-peat material and excavated peat, measures should be taken to minimise the risk of cross-contamination.
- 6.1.22 Care shall be taken when transporting the peat to avoid causing unnecessary structural damage.

6.4.4 Reinstatement & Restoration of Disturbed Areas

- 6.1.23 As part of the Proposed Development, is considered all peat excavated as part of the works will be reused or reinstated within the Proposed Development. This will require confirmation following completion of the ongoing peat probing survey and consideration of the results. All temporary works areas (e.g. access roads, compound and working areas) will be fully reinstated to pre-construction levels once no longer needed with the peat excavated restored to its previous level. Where peat is excavated from permanent works (i.e. construction of new tower foundations, and permanent diversion by undergrounding cables or diverting the alignment of the overhead line) it is anticipated that the volumes of peat excavated and requiring permanent reuse would not be significant and as such could be reused over the area of peat disturbed as part of the works along with the peat reinstated as part of the temporary works (i.e. at the towers any additional peat excavated as part of the tower foundations could be reused along with the peat excavated for the temporary compound to reinstate the compound area and for the undergrounding any additional peat displaced by the installation of the cable could be spread across the surface of the cable trench). Further detail on the peat reuse/reinstatement as part of the Proposed Development, including estimated volumes, will be provided in **Section 7** of this PMP once the peat probing survey is completed.
- 6.1.24 The following shall be considered when considering reinstatement of disturbed areas of peat:
- Undertake reinstatement / relocation and revegetation works as soon as possible;
 - Where required, consider exclusion of livestock and deer from areas of the route-undergoing peat reinstatement;
 - As far as is reasonably practicable, reinstatement should be carried out concurrently with construction rather than at its conclusion; and
 - To ensure safe reuse, all peatland reuse/reinstatement works should be subject to assessment by a geotechnical specialist, ensuring that emplacement of peat will not increase the likelihood of peat instability.

7 Site Based Excavation & Management Assessment

7.1 Estimated Peat Excavation

- 7.1.1 Based on the details of the Proposed Development, the total volume of peat to be excavated has been calculated and is summarised in **Table 7-1**. At present, as the peat probing survey for the Proposed Development is ongoing estimated peat depths are not fully known and therefore complete estimated peat excavation volumes cannot yet be determined. Anticipated sources of peat are presented in Section 5. When considering the excavated peat volume, areas of temporary works are neglected from the calculation as the peat excavated from these will be fully reinstated when they are no longer required. The calculations presented in **Table 7-1** will therefore present excavation volumes where permanent reuse of the peat is required. This section will be updated to estimate peat excavation volumes once the peat probing exercise is completed.
- 7.1.2 The estimate will include a breakdown of the peaty soil, acrotelmic and catotelmic peat quantities based on the assessed proportion of each material as discussed earlier in Section 4.4.1.
- 7.1.3 Note that the excavated volumes relating to the Proposed Development will be provided by the Designer for the works and not calculated by AECOM. The volumes provided will be approximate and will require refinement as the detailed design progresses. This further refinement will be taken into consideration within the Stage 2 (Detailed) PMP post consent / pre-construction.

Table 7-1 Excavation Materials Management Plan

Description	Total Estimated Peat Volume (m ³)	Estimated Peaty Soils Volume (m ³)	Estimated Acrotelmic Peat Volume (m ³)	Estimated Catotelmic Peat Volume (m ³)
Construction of new tower foundations	TBC following completion of peat probing	TBC following completion of peat probing	TBC following completion of peat probing	TBC following completion of peat probing
Distribution line works	TBC following completion of peat probing	TBC following completion of peat probing	TBC following completion of peat probing	TBC following completion of peat probing
Total*	TBC following completion of peat probing	TBC following completion of peat probing	TBC following completion of peat probing	TBC following completion of peat probing
Total (25% bulking factor applied)	TBC following completion of peat probing	TBC following completion of peat probing	TBC following completion of peat probing	TBC following completion of peat probing

* No bulking factors have been applied to the volumes

7.2 Peat Relocation and Reuse

7.2.1 Peat Reuse

- 7.1.4 Based on current design proposals, an outline approach for managing peat generated as a result of the works is presented below.
- 7.1.5 Note where tree stumps are present these can be chipped and turned into mulch for reuse or reinstatement.
- 7.2.1.1 Temporary**
- 7.1.6 It is anticipated that all peat excavated from the temporary works (e.g. access tracks, construction compounds, dismantling of existing towers, pulling positions and diversion of distribution lines) will be fully reinstated when the infrastructure is no longer required. All peat excavated from the temporary

works will temporarily be stored adjacent to the area of excavation, or in the case of the temporary compounds within the works area itself following stripping.

- 7.1.7 A calculation of the volume of peat to be reinstated as part of the temporary works has not been made as all peat excavated as part of the temporary works will be fully reinstated when the temporary works are no longer required.

7.2.1.2 Permanent

- 7.1.8 Permanent reuse of peat is anticipated to be required associated with those works presented in **Table 7-1**. It is anticipated the peat excavated requiring permanent reuse locations will not be significant and can be spread over the area from which it was excavated along with the reinstatement of the peat excavated as part of the temporary works, essentially increasing the thickness of peat slightly in the area. This will be confirmed following the completion of the peat probing and consideration of peat depths in the design and be presented in the updated PMP submitted as part of the application. The table below presents the data anticipated to be presented in the updated PMP following completion of the probing, however, this is subject to change depending on the peat volumes estimated.

Table 7-2 - Permanent Peat Reuse Volumes

Location	Area (m ²)	Anticipated deposition Depth (m)	Relocation Capacity
Temporary Compound associated with new tower foundation	<i>TBC following completion of peat probing</i>	<i>TBC following completion of peat probing</i>	<i>TBC following completion of peat probing</i>
Reinstatement of permanent cable undergrounding associated with distribution line works	<i>TBC following completion of peat probing</i>	<i>TBC following completion of peat probing</i>	<i>TBC following completion of peat probing</i>
Total	<i>TBC following completion of peat probing</i>	<i>TBC following completion of peat probing</i>	<i>TBC following completion of peat probing</i>

7.3 Peat Balance

- 7.1.9 Based on the understanding of the peat generating activities and the potential reuse/reinstatement locations, it is anticipated that all peat generated from the Proposed Development will be able to be reused within the Proposed Development. This will be confirmed in the updated PMP completed following completion of the ongoing peat probing survey.
- 7.1.10 Note that as the detailed design is still being progressed, further refinement in the peat volumes (both excavated and relocation) is likely to occur. As such following the updated PMP submitted on completion of the currently ongoing peat probing survey, a Stage 2 (Detailed) PMP will be produced to cover the detailed design, post-consent, prior to construction.

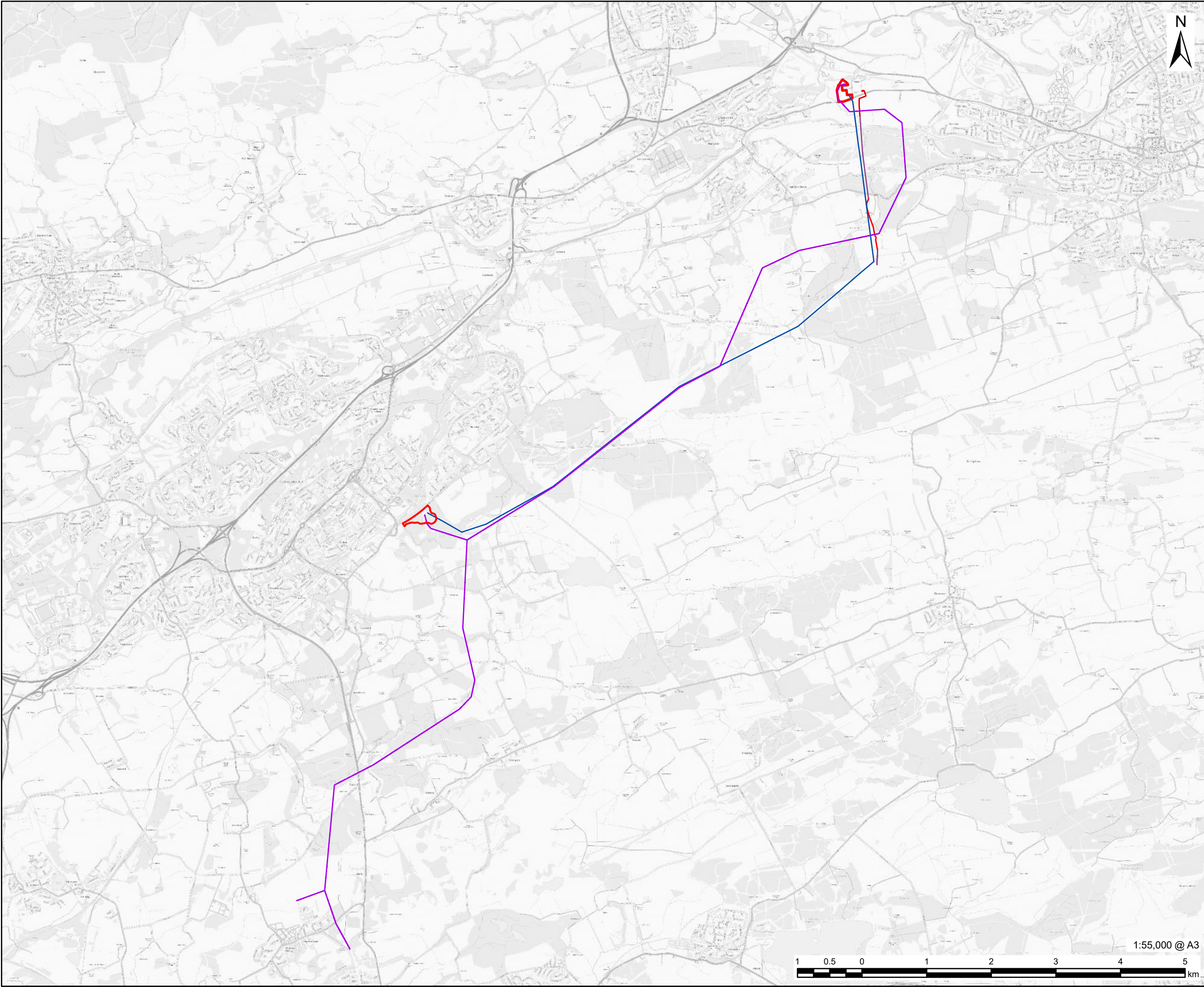
8 Monitoring & Inspection

- 8.1.1 The construction phase of the Proposed Development would be supported by a geotechnical engineer and ECoW. There would be frequent, routine and regular inspections of peat in all stockpiles and temporary storage areas as part of the PMP audit process. Inspections would assess in situ peat physical conditions, integrity of containment and temporary drainage conditions, and they would seek to confirm that stockpile design and management was adequate to prevent erosion and peat slide. These inspections would take place weekly (at a minimum) during stockpile creation and storage.
- 8.1.2 Should any problems be observed during regular visual inspections of peat stockpiles, this would invoke implementation of an appropriate corrective action which would be recorded and monitored for effectiveness. All reuse areas are to be monitored long term to assess new growth, germination of seed bank and overall vegetation cover. Vegetation establishment will be assessed during monitoring and appropriate remedial actions taken if vegetation cover is inadequate in line with landscaping requirements. Types of corrective actions would include, but would not necessarily be limited to:
- Modification of temporary drainage;
 - Additional or modified bunding;
 - Incorporating of sediment fencing if required; and
 - Light re-grading to correct any areas of surface erosion, etc.
- 8.1.3 Regular, frequent inspections of peat conditions during construction and reuse/restoration phases of work would be carried out by the Geotechnical Engineer and ECoW as follows:
- Peat surface, peat profile and peat consistency conditions would be carried out as part of ground investigations prior to the start of construction. This information would provide detailed information on the baseline conditions for each part of the infrastructure footprint;
 - Reinstated/reused peat conditions would be inspected immediately after reuse to ensure that the methods detailed in the PMP had been correctly implemented and to inform any corrective actions should they be required;
 - The physical condition of peat would be retained as carefully as possible both at the peat storage and the peat reinstatement/reuse stages. This is particularly important for vegetation establishment;
 - Within 3 months of completion of works in any area, the ECoW inspects the reinstatement efforts to determine satisfactory placement of sub-soil, topsoil and turves;
 - Monitoring for success could involve fixed-point photo monitoring, fixed-point vegetation quadrat sampling, and condition assessment all undertaken by the ECoW;
 - For long terms monitoring the ECoW (or other qualified person) undertakes an inspection of all reinstated areas at the end of the first growing season following completion of reinstatement with the following suggested frequency following year 2, 5, 10 and then every 5 years until 30 years, or until restoration has been deemed a success; and
 - The ECoW will complete a daily diary of onsite activities which is then compiled as part of a monthly ECoW report which will include information relating to peat restoration/reuse, these reports will be available at the request of the Planning Authority.

9 Conclusions

- 9.1.1 This Stage 1 (Outline) PMP follows the guiding principles and has been created in adherence with best practice guidance. It is acknowledged that this PMP is currently incomplete and does not currently identify permanent peat excavation volumes or their associated peat reuse. On completion of the peat probing currently ongoing across the Proposed Development where peat has been identified, this document will be updated and confirm the peat management proposals for the Proposed Development.
- 9.1.2 On completion of the PMP it is expected the document will address the following peat related issues:
- The depth and condition of peat deposits across the Proposed Development;
 - The peat generating activities associated with the Proposed Development and the volumes of excavated peat that require permanent relocation, along with its suitability for reuse peat;
 - The capacity to reuse the peat on-site for reinstatement;
 - Peat handling and temporary storage; and
 - Monitoring of the reinstated peat or peatland habitat following deposition.
- 9.1.3 Note that the estimate of the peat extents, depths and volumes within the finalised PMP will be based on a series of assumptions for the Proposed Development including measurement of the current design compared to existing ground level and using ground models developed through the desk based and peat probing data available. Such parameters can still vary over small scale and therefore topographic changes in the substrate, historical ground disturbance, etc. may impact the total accuracy of the volume calculations. The peat volumes provided as part of the complete PMP will be refined further as part of the detailed design, taking account of any further information obtained (e.g. ground investigation data across the Proposed Development) and as the geotechnical design develops to the fully mature construction design. This PMP will identify peat reuse and relocation areas for all peat generated as part of the Proposed Development with it currently anticipated all peat will be able to be reused within the Proposed Development, although this will require confirmation in the updated PMP submitted as part of the planning application following completion of the peat probing currently ongoing.
- 9.1.4 It is expected that a Stage 2 PMP will be generated post consent to update this Stage 1 PMP with any new information obtained and based on a more refined design. The Stage 2 PMP will also provide further details on the peat reuse / relocation areas if required. Following this a Construction Phase PMP will be developed by the Contractor which will be an update of the Stage 1 and 2 PMPs and which will be constantly updated and maintained throughout the site works.
- 9.1.5 The implementation of a construction phase PMP would ensure a commitment from the Contractor to excavating, handling, storing, transporting and reinstating peat that follows good practice and ensures protection of peat throughout the construction and post construction phases. A series of good practice standards detailed within this PMP relating to excavation, handling and storage of peat will be utilised to maintain the structural integrity of excavated peat and its suitability for reuse.

Appendix A – Figures



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LEGEND

-  Substation Site Boundary
-  New Build Overhead Line
-  CB Alignment
-  AA Alignment
-  AA Route Undergrounding

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ISSUE PURPOSE

Peat Management Plan

PROJECT NUMBER

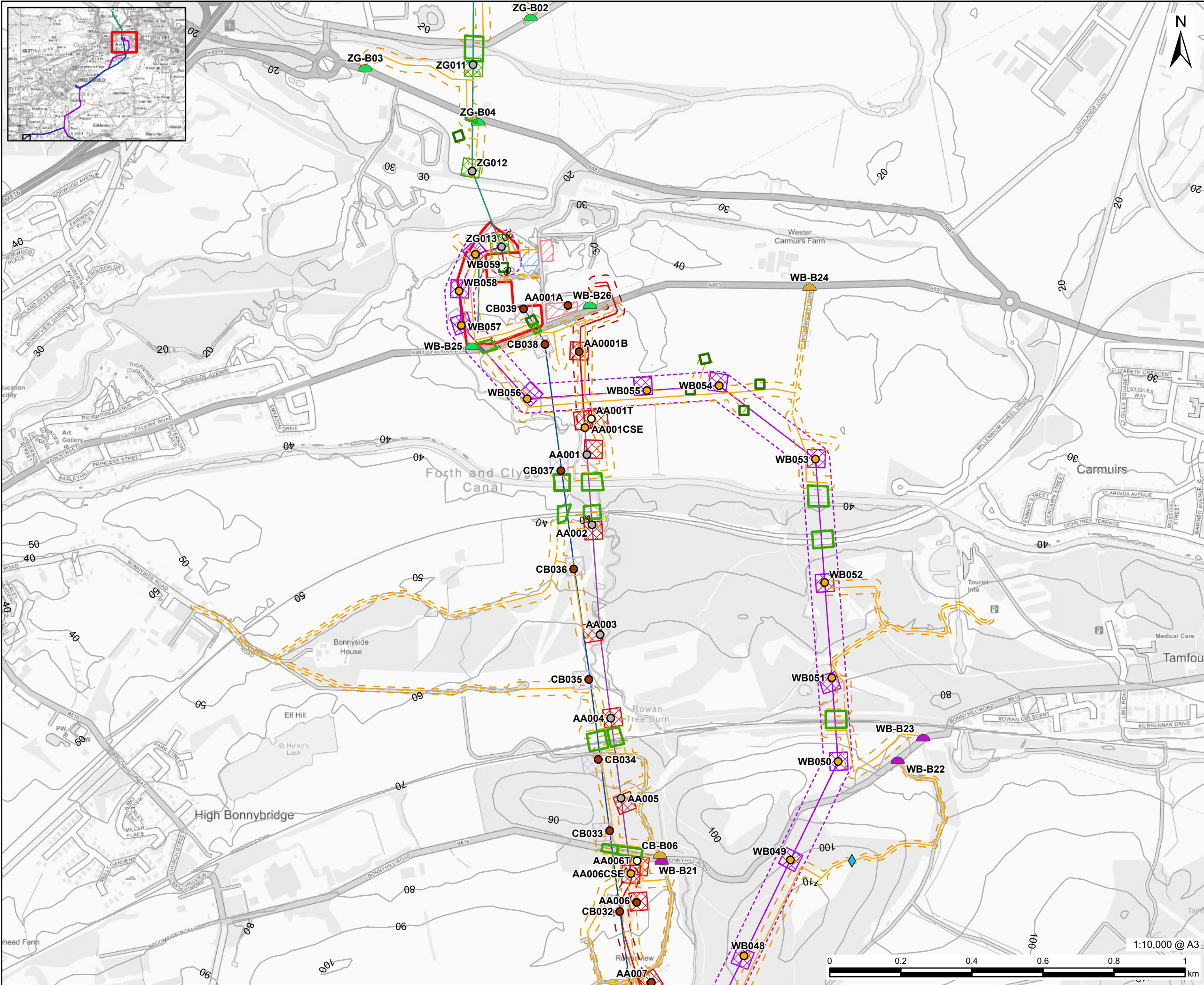
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FIGURE TITLE

Overview

FIGURE NUMBER

Figure 1



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- LEGEND**
- Bonnybridge Substation Site Boundary
 - Existing Tower
 - New Tower
 - Temporary Tower
 - Tower to be Removed
 - New Build Tower Compound
 - ZG Tower Compound
 - CB Tower Compound
 - AA Tower Compound
 - New Build Overhead Line
 - ZG Uprated Overhead Line
 - CB Route Removal
 - AA Alignment
 - AA Route Undergrounding
 - New Build Overhead Line Limit of Deviation
 - AA Route Undergrounding Limit of Deviation
 - Temporary Trackway
 - Temporary Stone Track
 - Temporary Trackway Proposed Access Limit of Deviation
 - Substation Site Compound
 - Substation Laydown Area
 - Water Crossing
 - Scaffolding
 - Pulling Position
 - Contours (10m)

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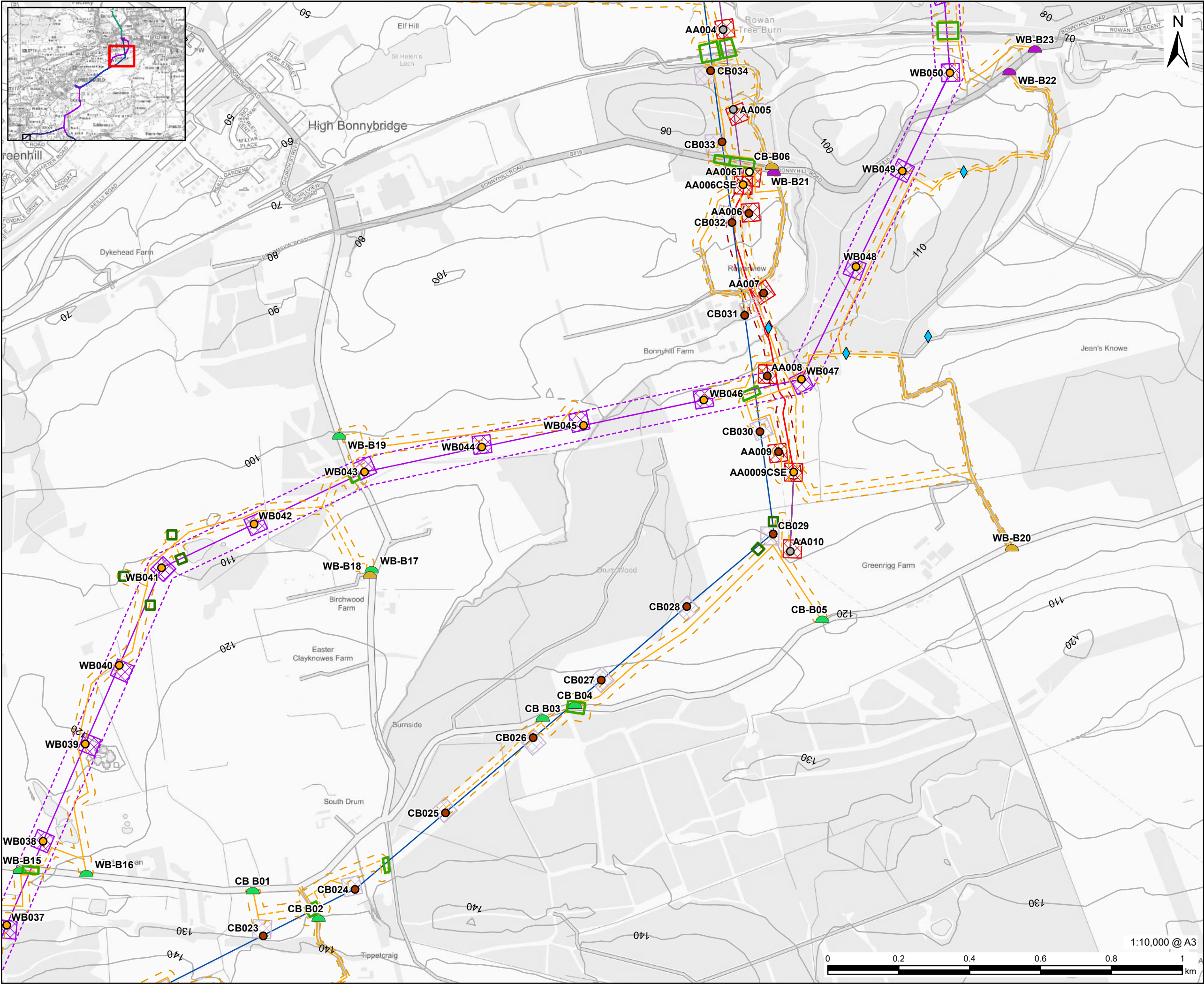
ISSUE PURPOSE
Peat Management Plan

PROJECT NUMBER
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FIGURE TITLE
Layout

FIGURE NUMBER
Figure 2 (Sheet 1 of 7)

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- LEGEND**
- Existing Tower
 - New Tower
 - Temporary Tower
 - Tower to be Removed
 - New Build Tower Compound
 - CB Tower Compound
 - AA Tower Compound
 - New Build Overhead Line
 - CB Route Removal
 - AA Alignment
 - New Build Overhead Line Limit of Deviation
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 - Temporary Stone Track
 - Temporary Trackway Proposed Access Limit of Deviation
 - Water Crossing
 - Scaffolding
 - Pulling Position
 - Contours (10m)

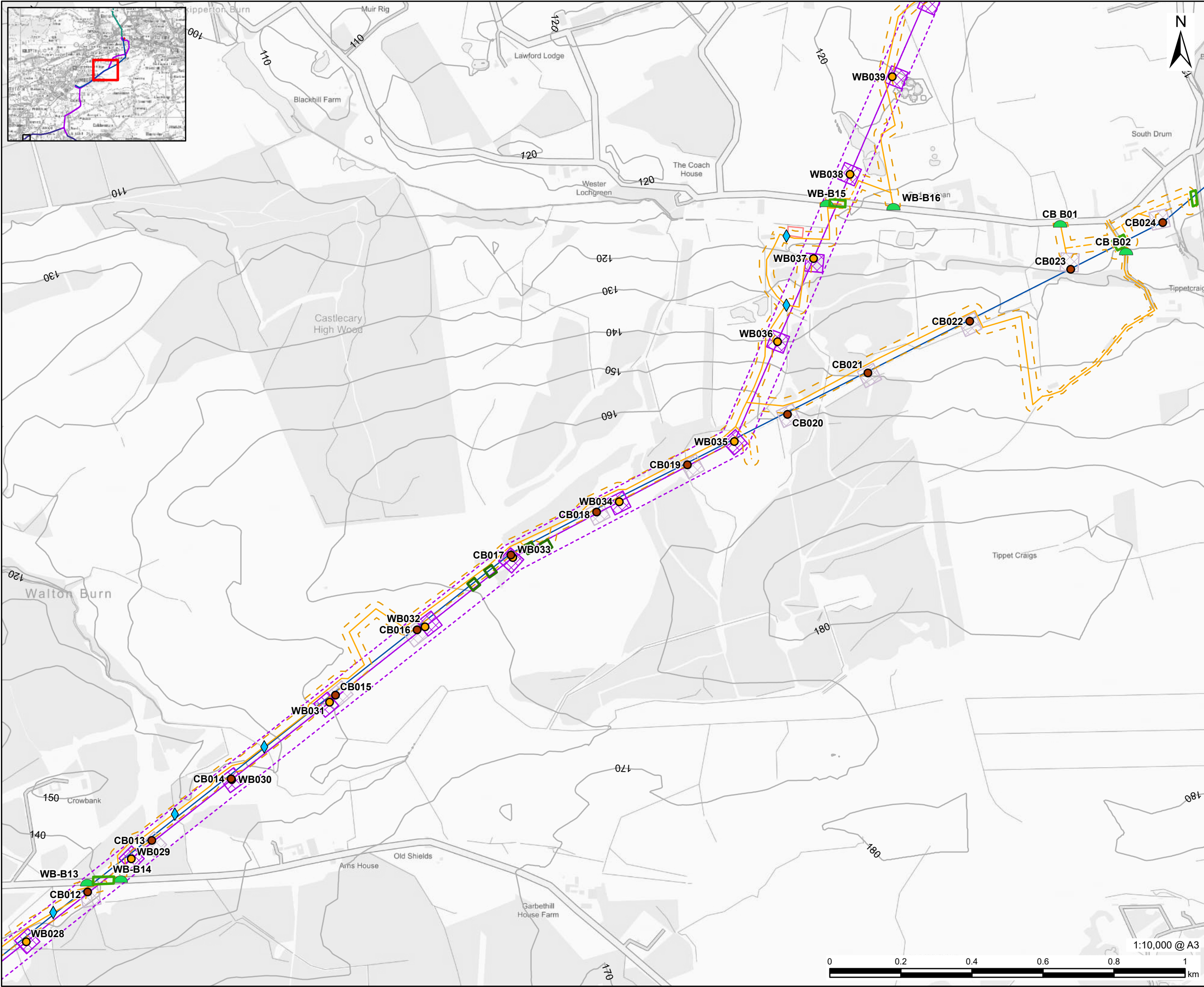
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FIGURE TITLE
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FIGURE NUMBER
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- LEGEND**
- New Tower
 - Tower to be Removed
 - New Build Tower Compound
 - CB Tower Compound
 - New Build Overhead Line
 - CB Route Removal
 - New Build Overhead Line Limit of Deviation
 - AA Route Undergrounding Limit of Deviation
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 - Temporary Stone Track
 - Temporary Trackway Proposed Access Limit of Deviation
 - Overhead Line Site Compound
 - Water Crossing
 - Scaffolding
 - Pulling Position
 - Contours (10m)

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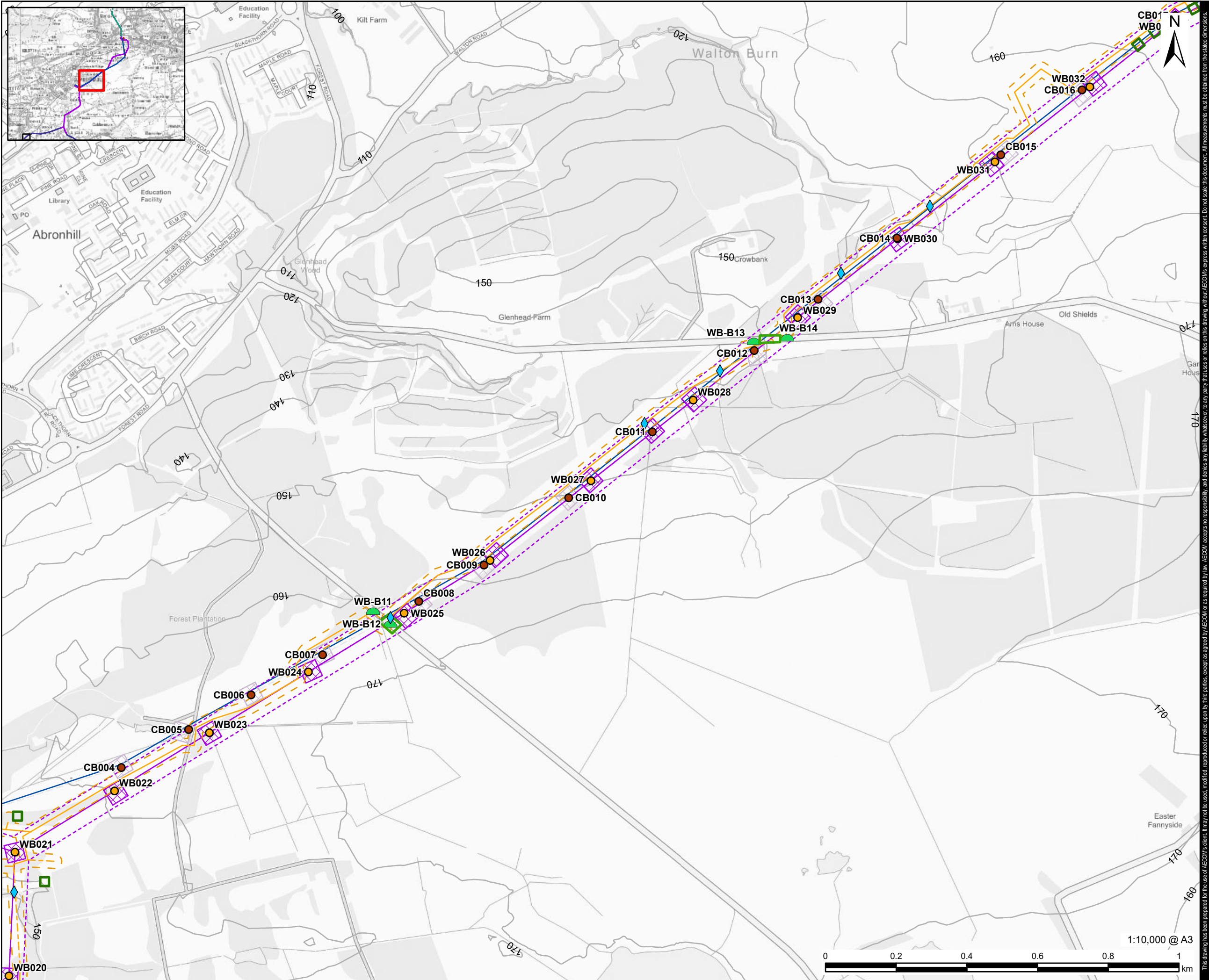
ISSUE PURPOSE
Peat Management Plan

PROJECT NUMBER
60602788

FIGURE TITLE
Layout

FIGURE NUMBER
Figure 2 (Sheet 3 of 7)

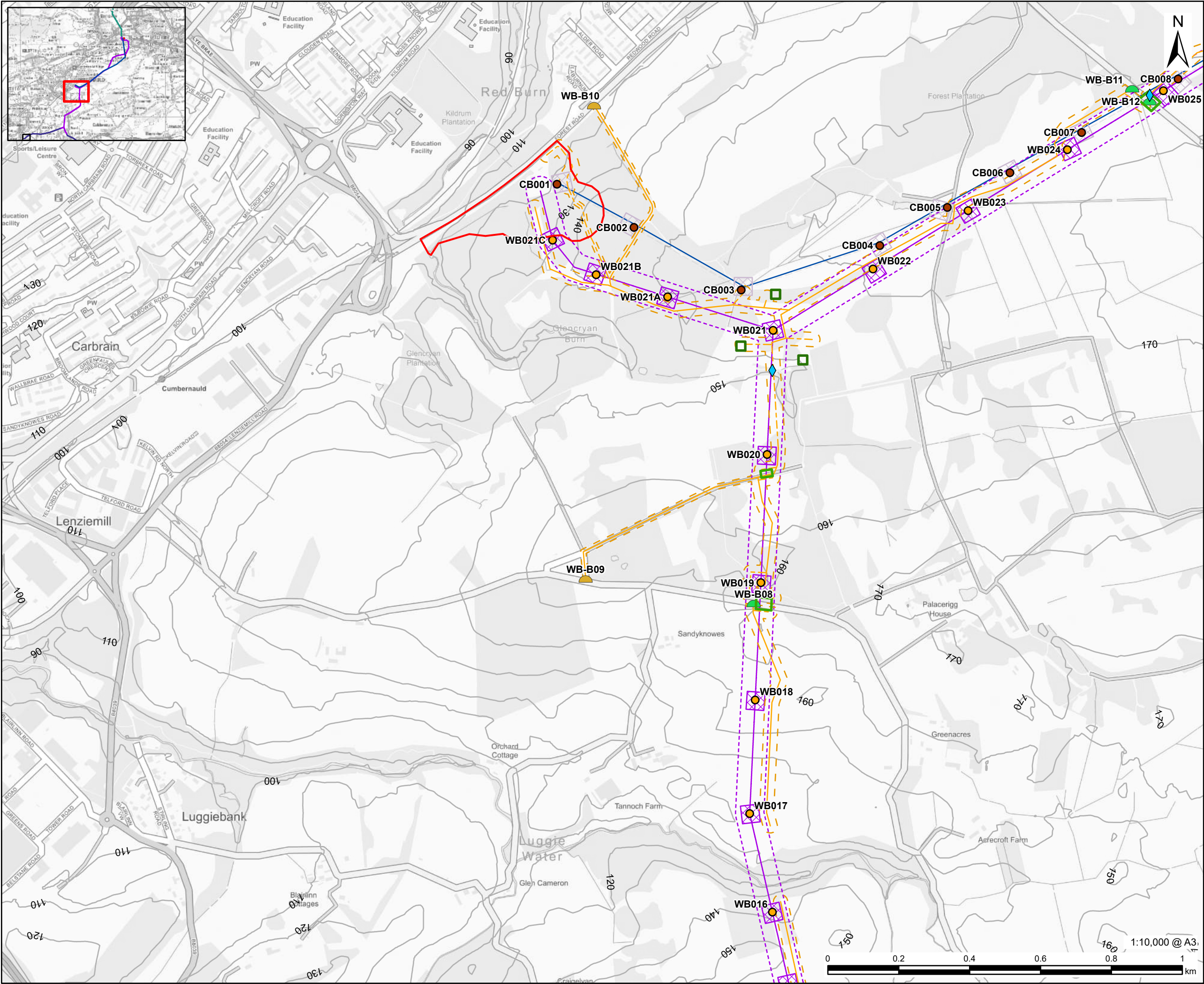




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LEGEND

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- Tower to be Removed
- New Build Tower Compound
- CB Tower Compound
- New Build Overhead Line
- CB Route Removal
- New Build Overhead Line Limit of Deviation
- AA Route Undergrounding Limit of Deviation
- Temporary Trackway
- Temporary Stone Track
- Temporary Trackway Proposed Access Limit of Deviation
- Water Crossing
- Scaffolding
- Pulling Position
- Contours (10m)

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- LEGEND**
- Cumbernauld Substation Site Boundary
 - New Tower
 - Tower to be Removed
 - New Build Tower Compound
 - CB Tower Compound
 - New Build Overhead Line
 - CB Route Removal
 - New Build Overhead Line Limit of Deviation
 - AA Route Undergrounding Limit of Deviation
 - Temporary Trackway
 - Temporary Stone Track
 - Temporary Trackway Proposed Access Limit of Deviation
 - Water Crossing
 - Scaffolding
 - Pulling Position
 - Contours (10m)

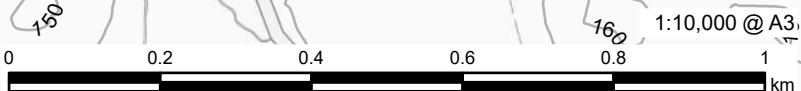
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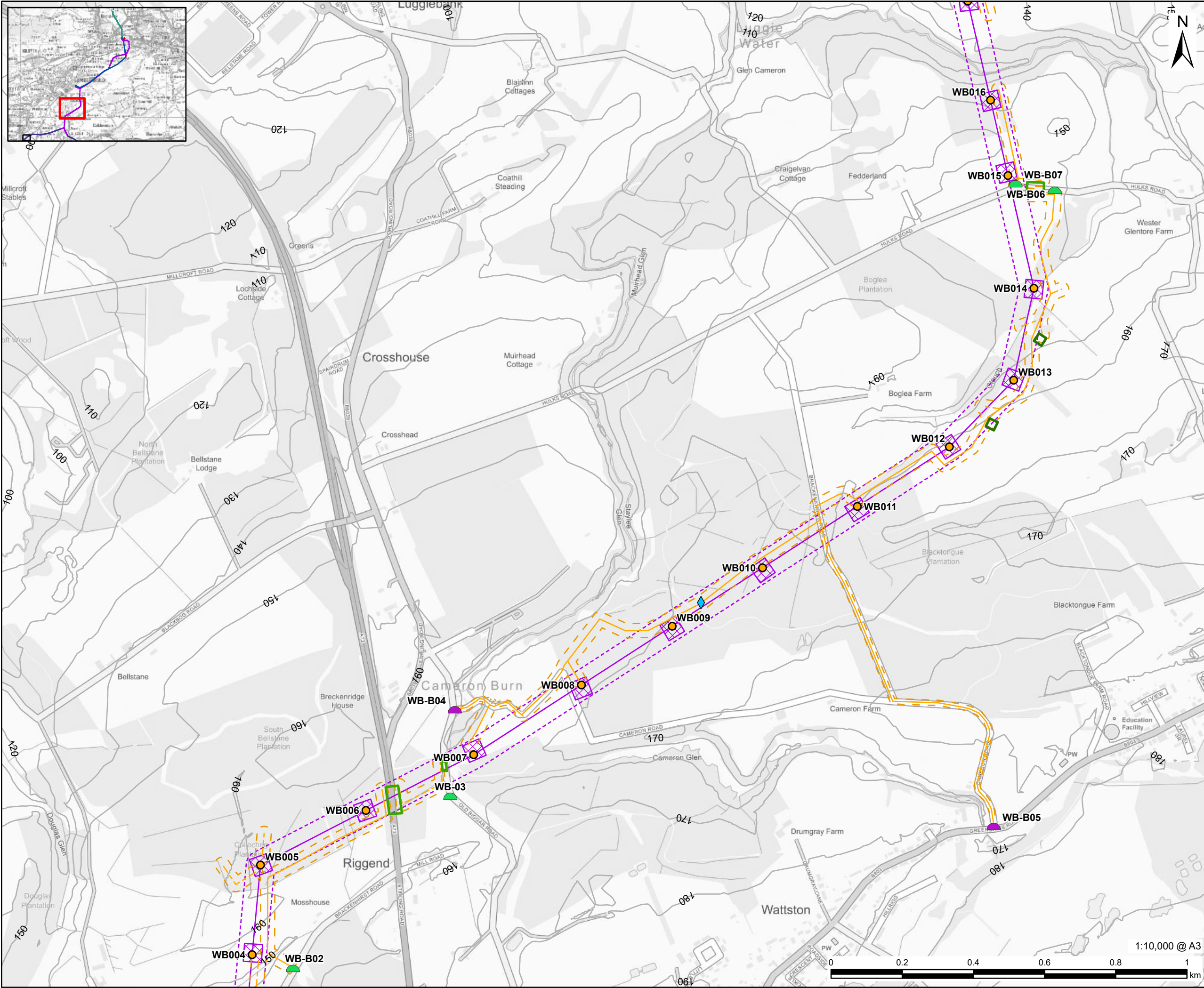
ISSUE PURPOSE
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FIGURE TITLE
Layout

FIGURE NUMBER
Figure 2 (Sheet 5 of 7)

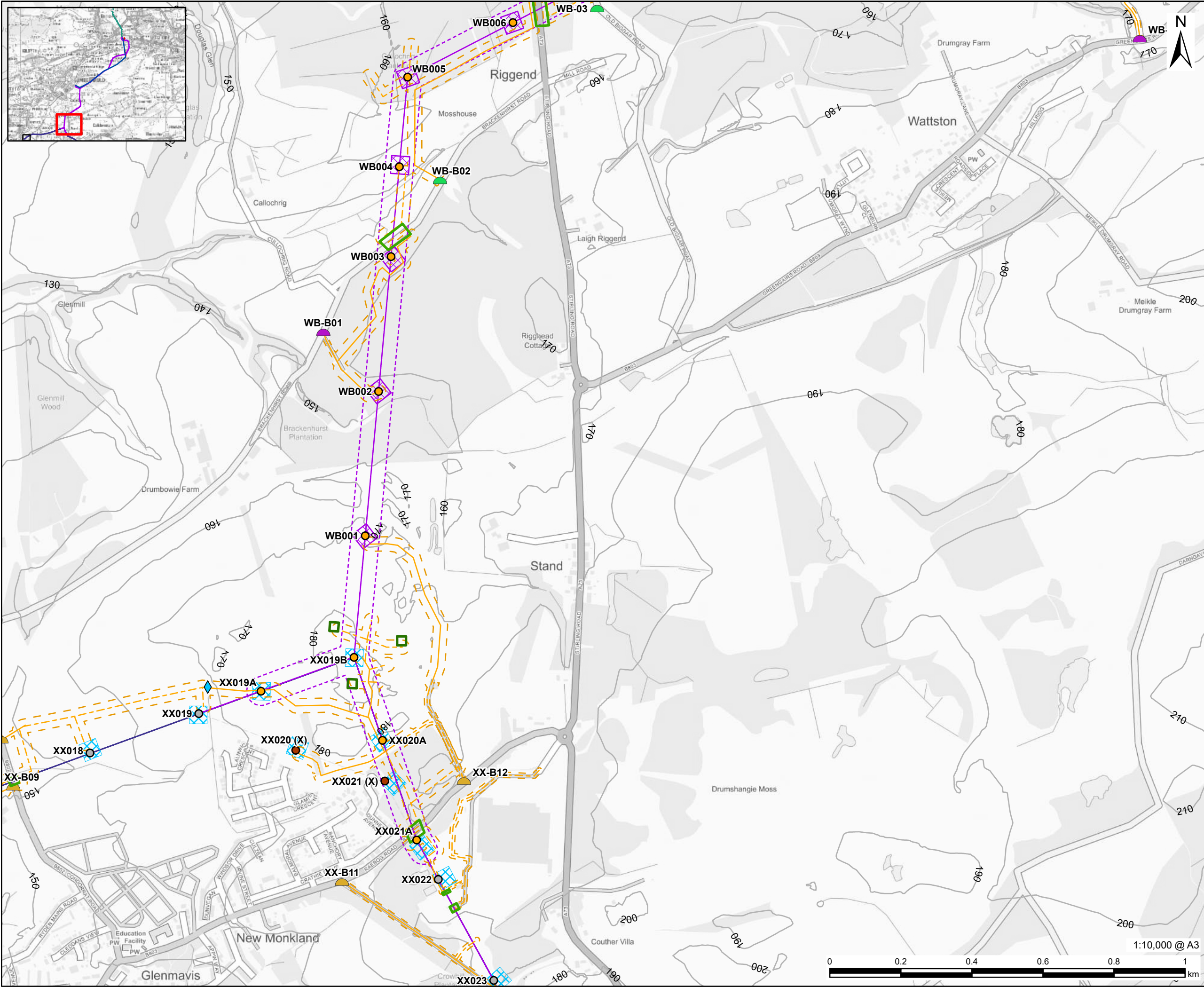




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LEGEND

- New Tower
- New Build Tower Compound
- New Build Overhead Line
- New Build Overhead Line Limit of Deviation
- AA Route Undergrounding Limit of Deviation
- Temporary Trackway
- Temporary Stone Track
- Temporary Trackway Proposed Access Limit of Deviation
- Water Crossing
- Scaffolding
- Pulling Position
- Contours (10m)

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FIGURE TITLE
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FIGURE NUMBER
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- LEGEND**
- Existing Tower
 - New Tower
 - Tower to be Removed
 - New Build Tower Compound
 - XX Tower Compound
 - New Build Overhead Line
 - XX Updated Overhead Line
 - New Build Overhead Line Limit of Deviation
 - AA Route Undergrounding Limit of Deviation
 - Temporary Trackway
 - Temporary Stone Track
 - Temporary Trackway Proposed Access Limit of Deviation
 - Water Crossing
 - Scaffolding
 - Pulling Position
 - Contours (10m)

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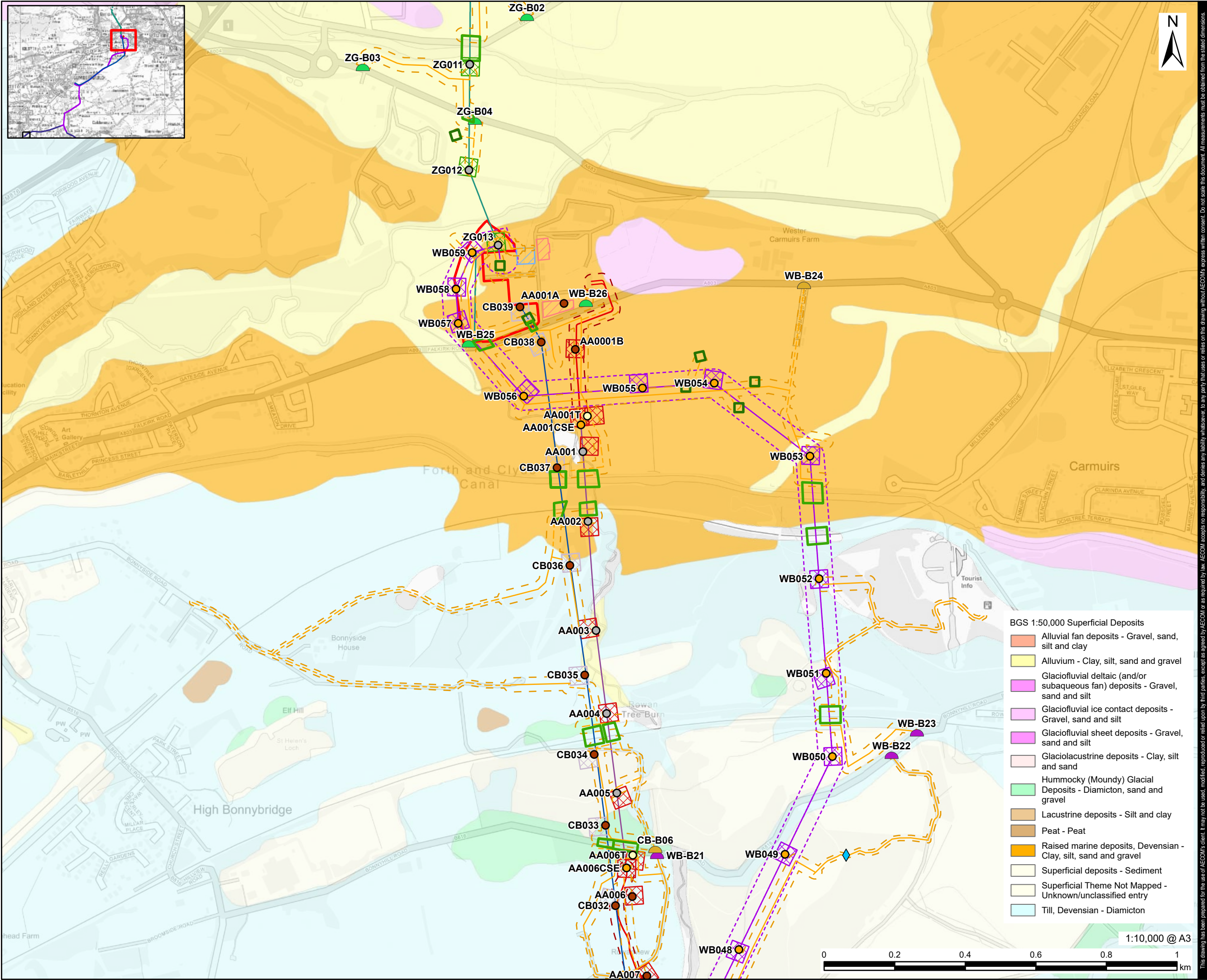
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Layout

FIGURE NUMBER
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- Existing Tower
- New Tower
- Temporary Tower
- Tower to be Removed
- Bonnybridge Substation Site Boundary
- New Build Tower Compound
- ZG Tower Compound
- CB Tower Compound
- AA Tower Compound
- New Build Overhead Line
- ZG Uprated Overhead Line
- AA Alignment
- AA Route Undergrounding
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- Substation Site Compound
- Substation Laydown Area
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- Scaffolding
- Pulling Position

BGS 1:50,000 Superficial Deposits

- Alluvial fan deposits - Gravel, sand, silt and clay
- Alluvium - Clay, silt, sand and gravel
- Glaciofluvial deltaic (and/or subaqueous fan) deposits - Gravel, sand and silt
- Glaciofluvial ice contact deposits - Gravel, sand and silt
- Glaciofluvial sheet deposits - Gravel, sand and silt
- Glaciolacustrine deposits - Clay, silt and sand
- Hummocky (Moundy) Glacial Deposits - Diamicton, sand and gravel
- Lacustrine deposits - Silt and clay
- Peat - Peat
- Raised marine deposits, Devensian - Clay, silt, sand and gravel
- Superficial deposits - Sediment
- Superficial Theme Not Mapped - Unknown/unclassified entry
- Till, Devensian - Diamicton

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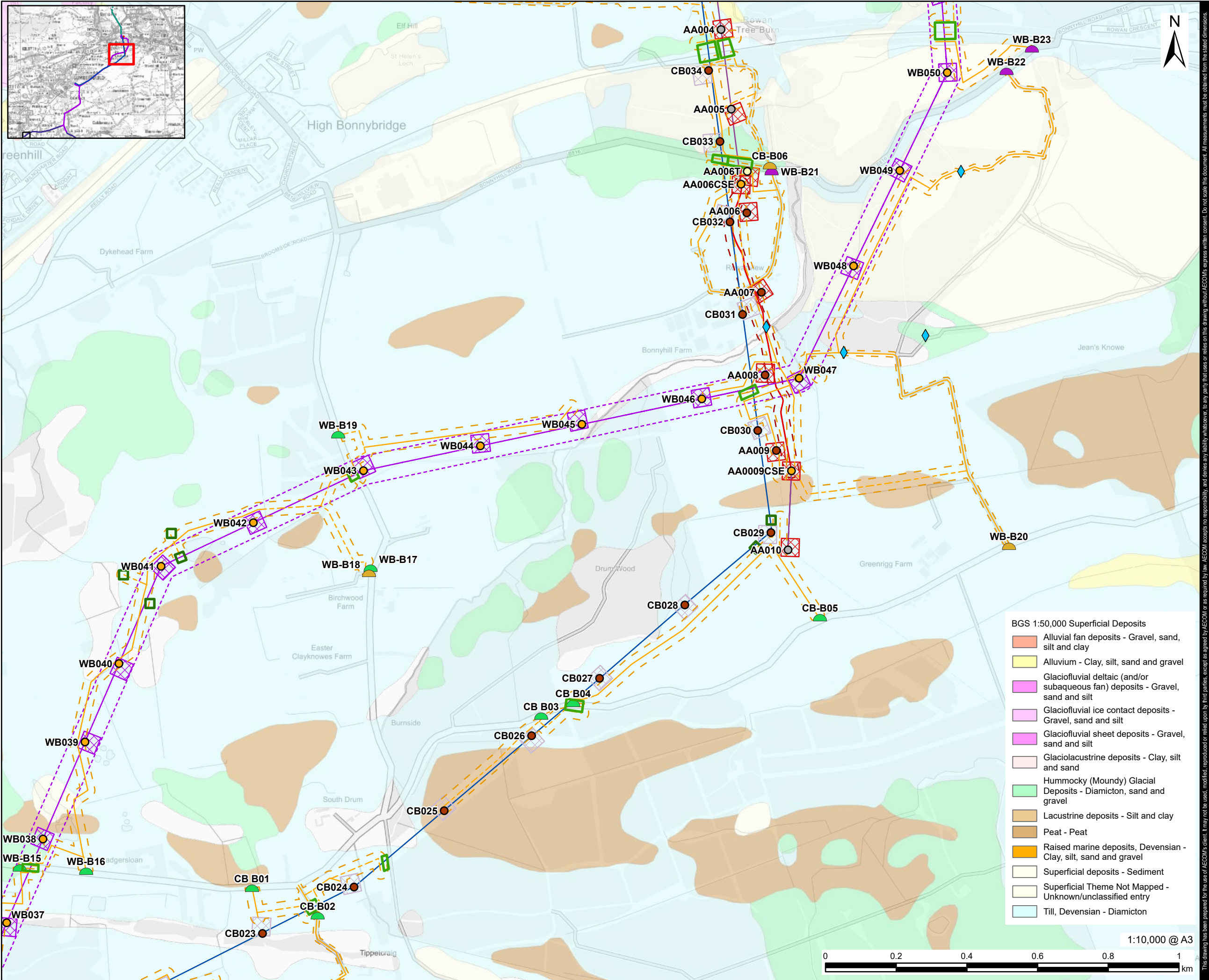
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FIGURE TITLE

Superficial Geology

FIGURE NUMBER

Figure 3 (Sheet 1 of 7)



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- New Tower
- Temporary Tower
- Tower to be Removed
- New Build Tower Compound
- CB Tower Compound
- AA Tower Compound
- New Build Overhead Line
- AA Alignment
- AA Route Undergrounding
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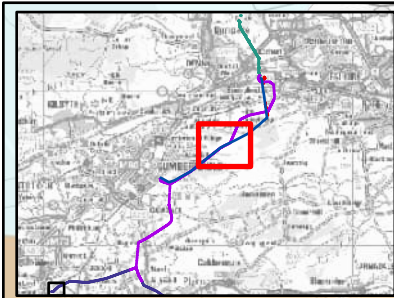
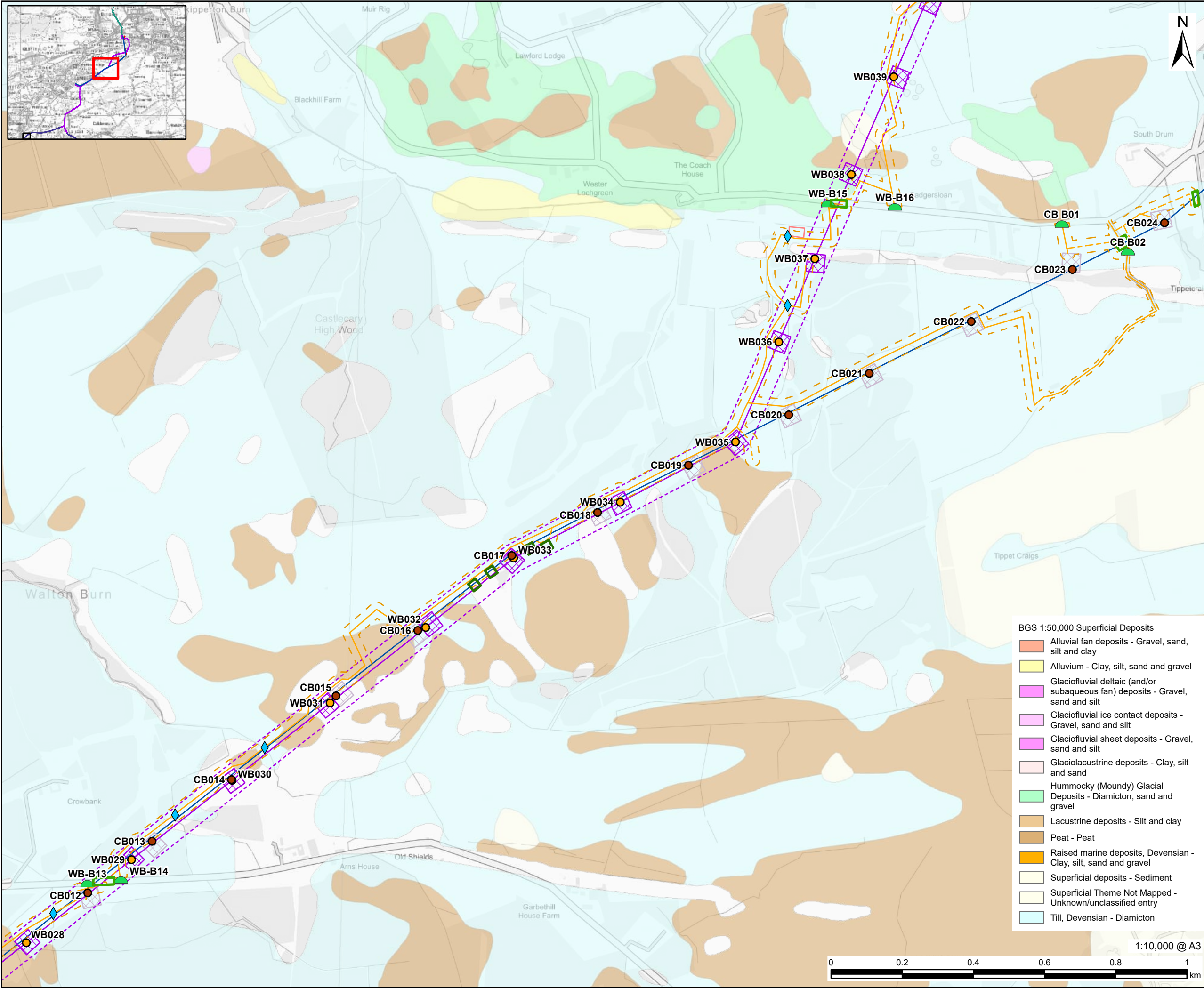
FIGURE NUMBER
Figure 3 (Sheet 2 of 7)

BGS 1:50,000 Superficial Deposits

- Alluvial fan deposits - Gravel, sand, silt and clay
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1:10,000 @ A3

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LEGEND

- New Tower
- Tower to be Removed
- New Build Tower Compound
- CB Tower Compound
- New Build Overhead Line
- New Build Overhead Line Limit of Deviation
- Temporary Trackway
- Temporary Stone Track
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BGS 1:50,000 Superficial Deposits

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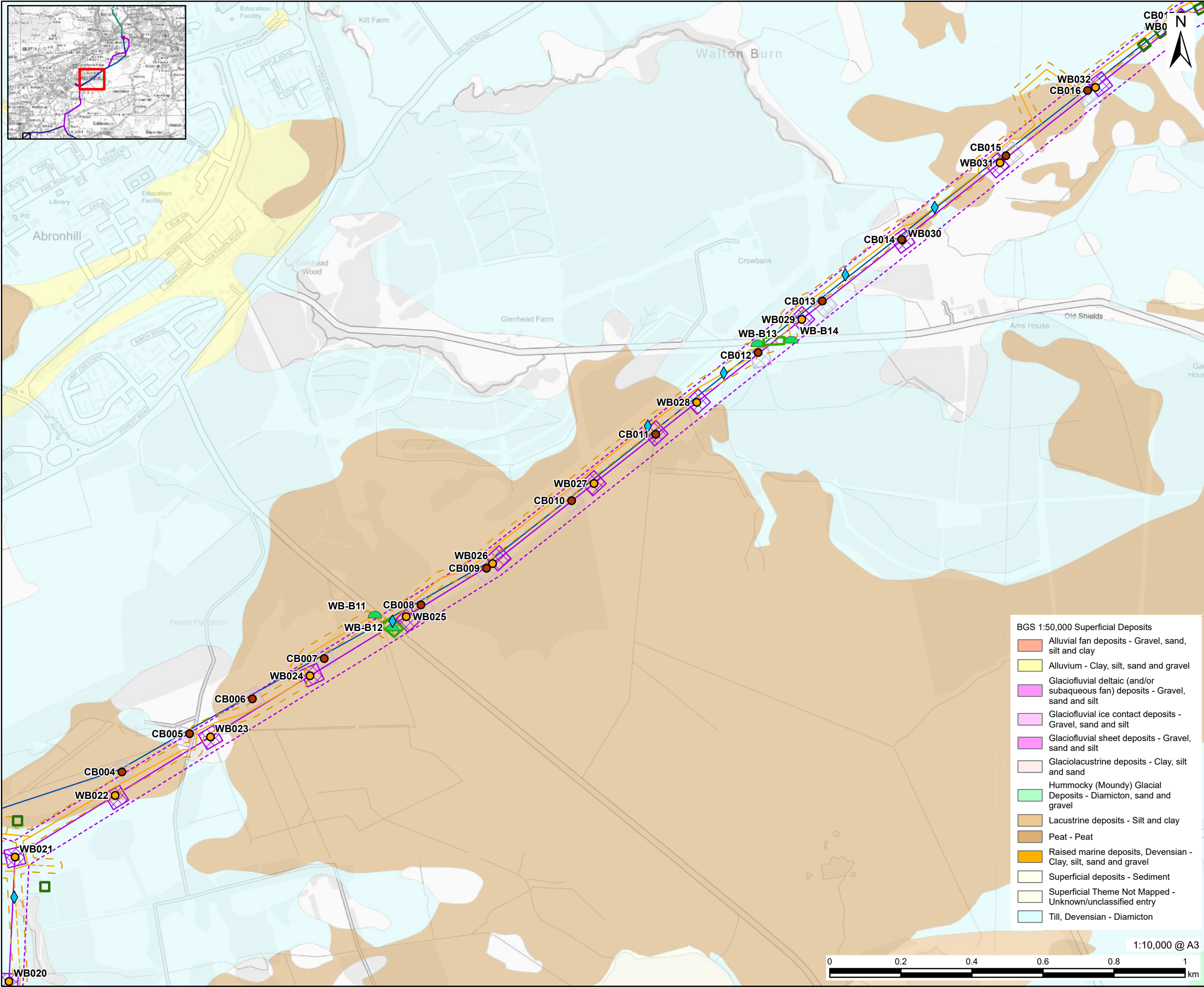
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FIGURE TITLE
Superficial Geology

FIGURE NUMBER
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- New Tower
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 - New Build Tower Compound
 - CB Tower Compound
 - New Build Overhead Line
 - New Build Overhead Line Limit of Deviation
 - Temporary Trackway
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- BGS 1:50,000 Superficial Deposits
- Alluvial fan deposits - Gravel, sand, silt and clay
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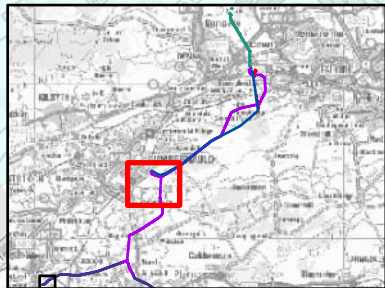
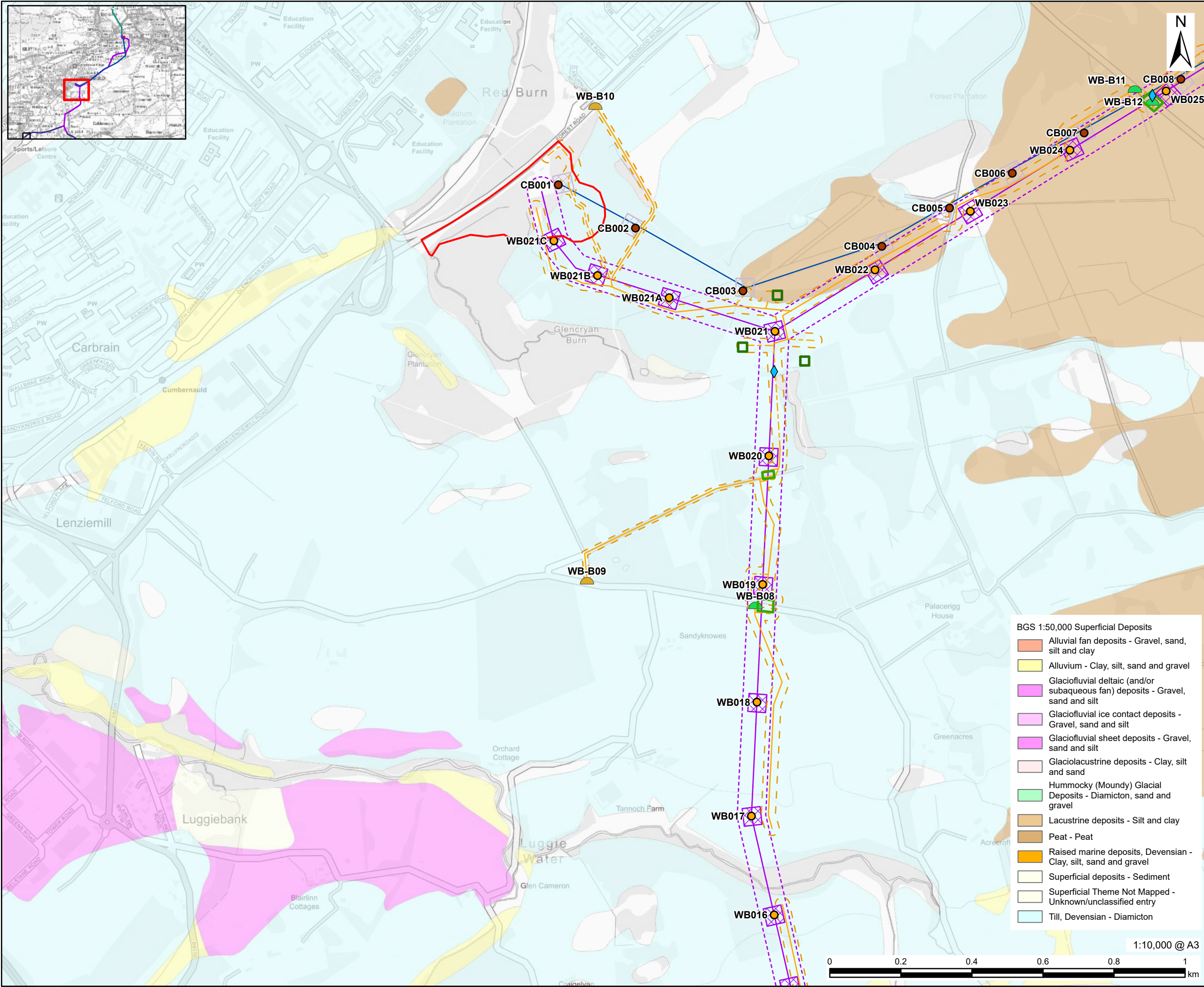
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PROJECT NUMBER
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FIGURE TITLE
Superficial Geology

FIGURE NUMBER
Figure 3 (Sheet 4 of 7)



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- LEGEND**
- New Tower
 - Tower to be Removed
 - Cumbernauld Substation Site Boundary
 - New Build Tower Compound
 - CB Tower Compound
 - New Build Overhead Line
 - New Build Overhead Line Limit of Deviation
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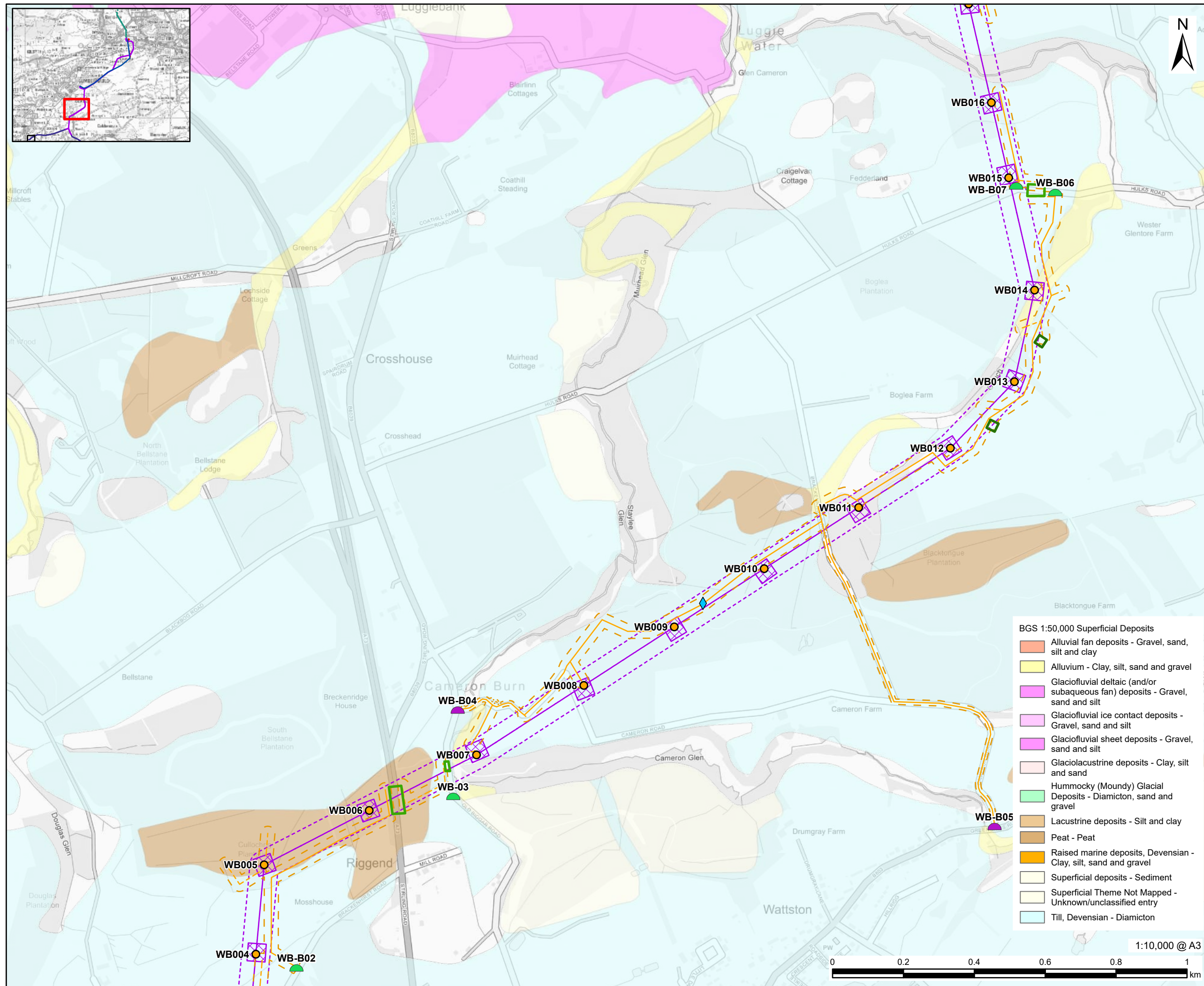
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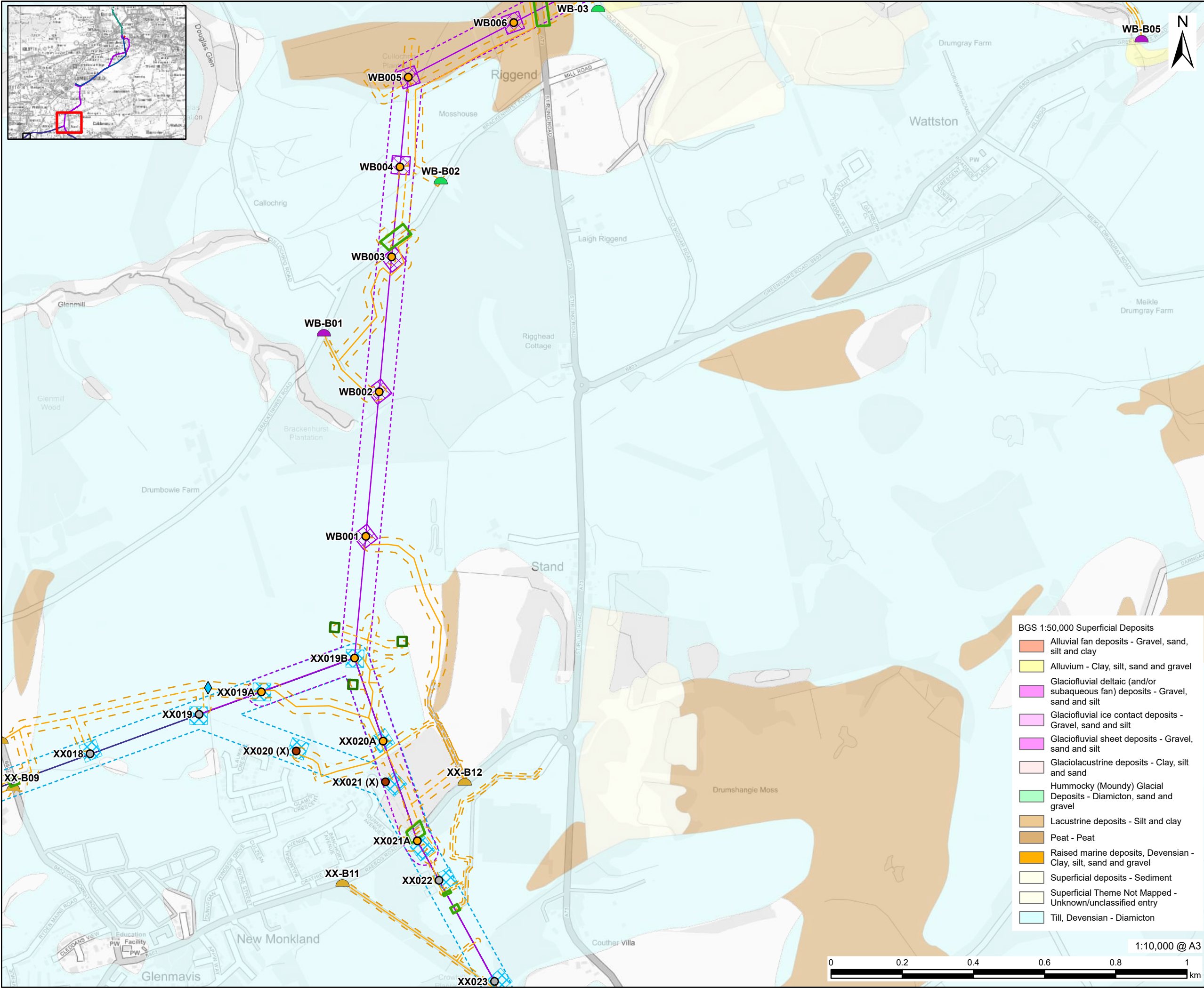
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FIGURE NUMBER
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- Existing Tower
 - New Tower
 - Tower to be Removed
 - New Build Tower Compound
 - XX Tower Compound
 - New Build Overhead Line
 - XX Upgraded Overhead Line
 - New Build Overhead Line Limit of Deviation
 - XX Upgraded Overhead Line Wayleave Corridor
 - Temporary Trackway
 - Temporary Stone Track
 - Temporary Trackway Proposed Access Limit of Deviation
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- BGS 1:50,000 Superficial Deposits**
- Alluvial fan deposits - Gravel, sand, silt and clay
 - Alluvium - Clay, silt, sand and gravel
 - Glaciofluvial deltaic (and/or subaqueous fan) deposits - Gravel, sand and silt
 - Glaciofluvial ice contact deposits - Gravel, sand and silt
 - Glaciofluvial sheet deposits - Gravel, sand and silt
 - Glaciolacustrine deposits - Clay, silt and sand
 - Hummocky (Moundy) Glacial Deposits - Diamicton, sand and gravel
 - Lacustrine deposits - Silt and clay
 - Peat - Peat
 - Raised marine deposits, Devensian - Clay, silt, sand and gravel
 - Superficial deposits - Sediment
 - Superficial Theme Not Mapped - Unknown/unclassified entry
 - Till, Devensian - Diamicton

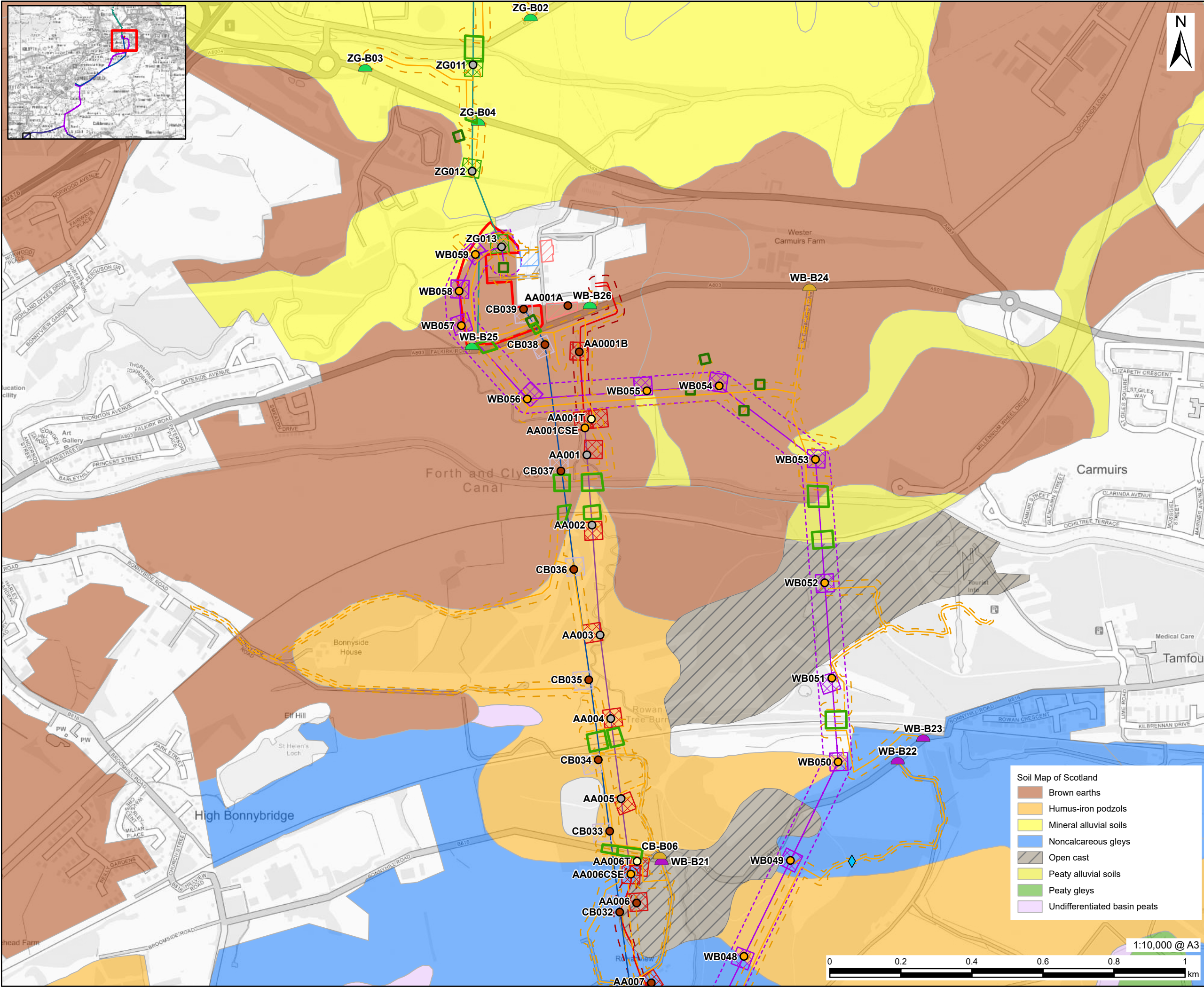
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ISSUE PURPOSE
Peat Management Plan

PROJECT NUMBER
60602788

FIGURE TITLE
Superficial Geology

FIGURE NUMBER
Figure 3 (Sheet 7 of 7)



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- LEGEND**
- Existing Tower
 - New Tower
 - Temporary Tower
 - Tower to be Removed
 - Bonnybridge Substation Site Boundary
 - New Build Tower Compound
 - ZG Tower Compound
 - CB Tower Compound
 - AA Tower Compound
 - New Build Overhead Line
 - ZG Upgraded Overhead Line
 - AA Alignment
 - AA Route Undergrounding
 - New Build Overhead Line Limit of Deviation
 - AA Route Undergrounding Limit of Deviation
 - Temporary Trackway
 - Temporary Stone Track
 - Temporary Trackway Proposed Access Limit of Deviation
 - Substation Site Compound
 - Substation Laydown Area
 - Water Crossing
 - Scaffolding
 - Pulling Position

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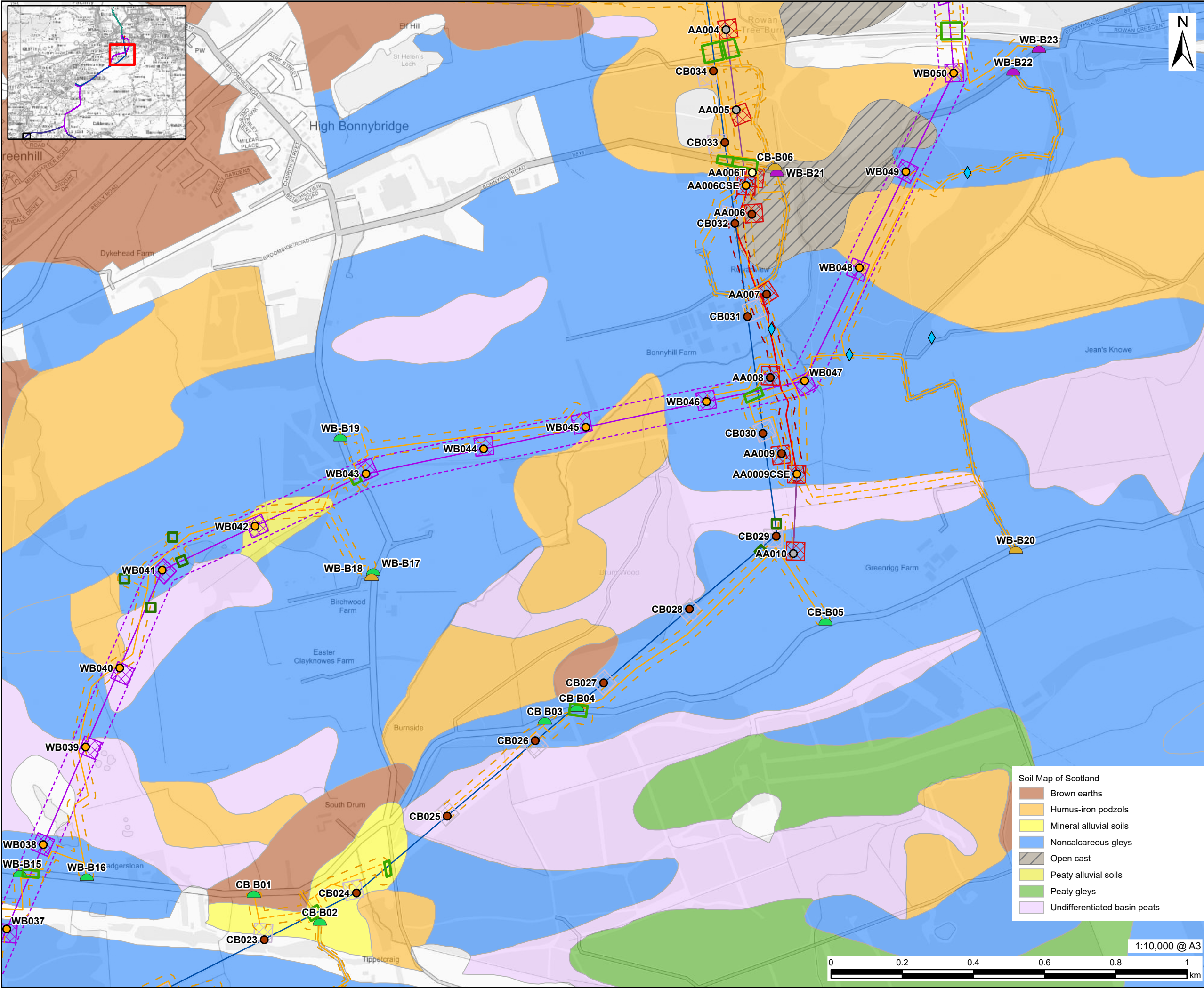
PROJECT NUMBER
60602788

FIGURE TITLE
Soil Map of Scotland

FIGURE NUMBER
Figure 4 (Sheet 1 of 7)

- Soil Map of Scotland**
- Brown earths
 - Humus-iron podzols
 - Mineral alluvial soils
 - Noncalcareous gleys
 - Open cast
 - Peaty alluvial soils
 - Peaty gleys
 - Undifferentiated basin peats





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LEGEND

- Existing Tower
- New Tower
- Temporary Tower
- Tower to be Removed
- New Build Tower Compound
- CB Tower Compound
- AA Tower Compound
- New Build Overhead Line
- AA Alignment
- AA Route Undergrounding
- New Build Overhead Line Limit of Deviation
- AA Route Undergrounding Limit of Deviation
- Temporary Trackway
- Temporary Stone Track
- Temporary Trackway Proposed Access Limit of Deviation
- Water Crossing
- Scaffolding
- Pulling Position

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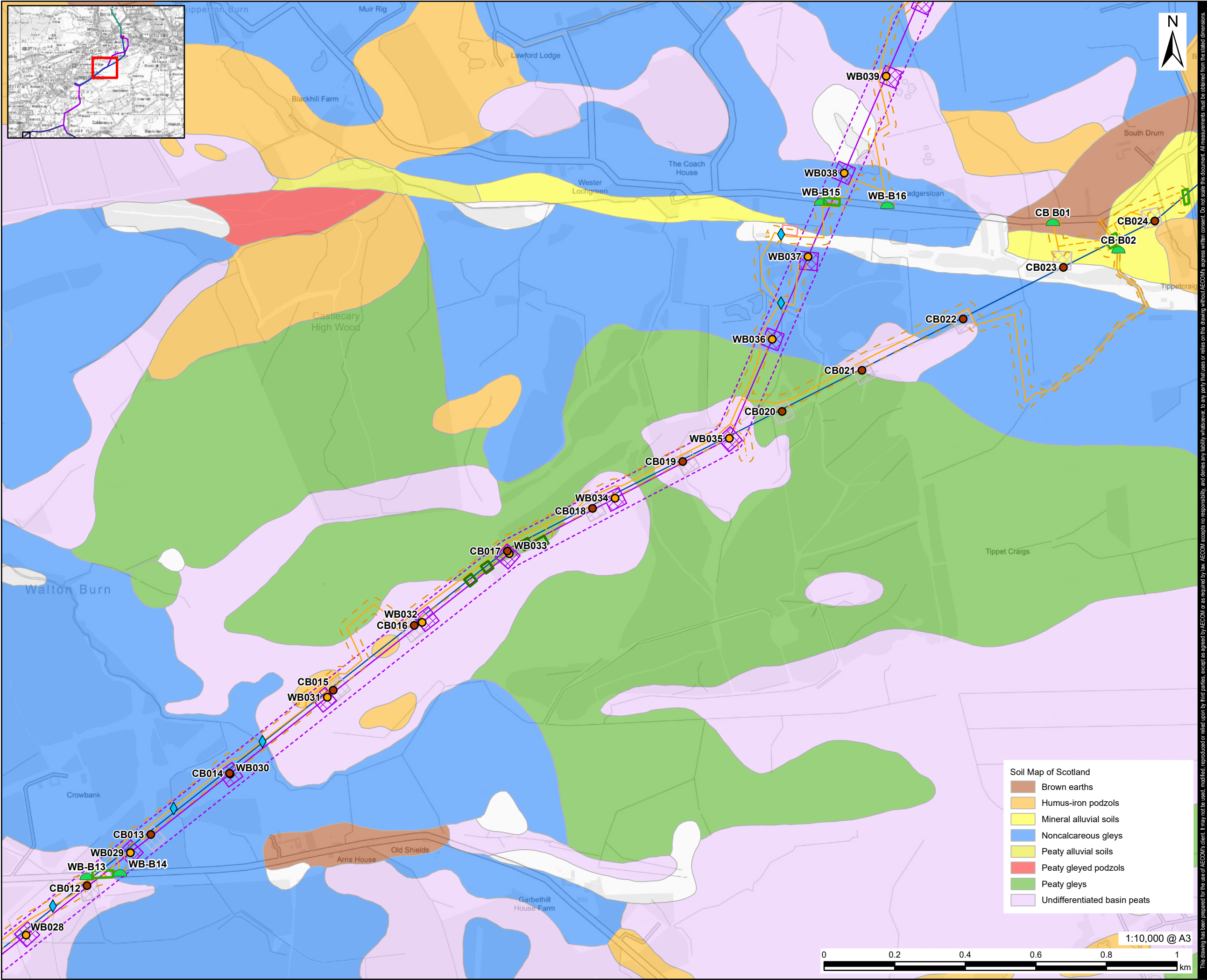
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FIGURE TITLE

Soil Map of Scotland

FIGURE NUMBER

Figure 4 (Sheet 2 of 7)



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LEGEND

- New Tower
- Tower to be Removed
- New Build Tower Compound
- CB Tower Compound
- New Build Overhead Line
- New Build Overhead Line Limit of Deviation
- Temporary Trackway
- Temporary Stone Track
- Temporary Trackway Proposed Access Limit of Deviation
- Overhead Line Site Compound
- Water Crossing
- Scaffolding
- Pulling Position

Soil Map of Scotland

- Brown earths
- Humus-iron podzols
- Mineral alluvial soils
- Noncalcareous gleys
- Peaty alluvial soils
- Peaty gleyed podzols
- Peaty gleys
- Undifferentiated basin peats



NOTES

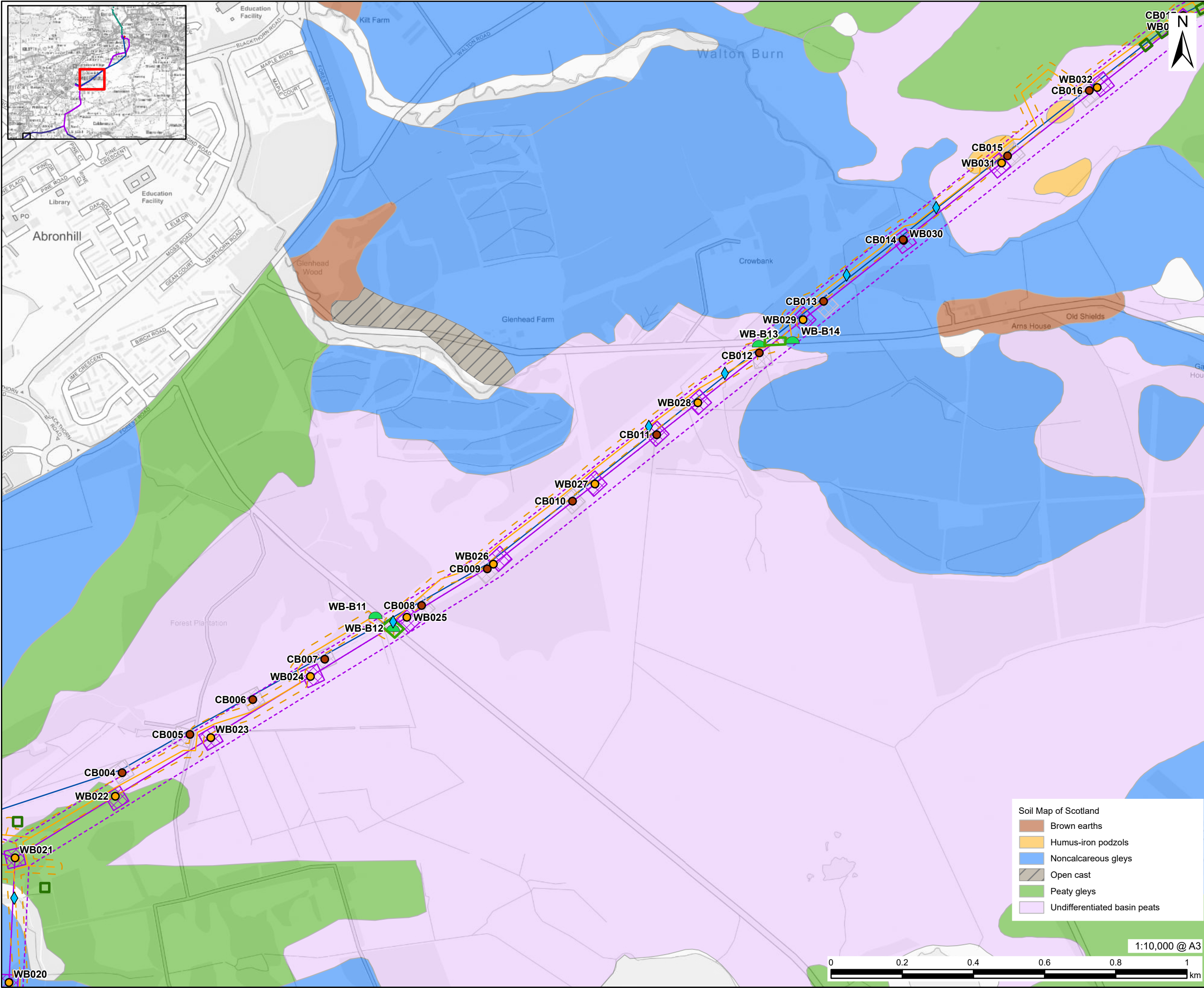
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ISSUE PURPOSE
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FIGURE TITLE
Soil Map of Scotland

FIGURE NUMBER
Figure 4 (Sheet 3 of 7)



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- LEGEND**
- New Tower
 - Tower to be Removed
 - New Build Tower Compound
 - CB Tower Compound
 - New Build Overhead Line
 - New Build Overhead Line Limit of Deviation
 - Temporary Trackway
 - Temporary Stone Track
 - Temporary Trackway Proposed Access Limit of Deviation
 - Water Crossing
 - Scaffolding
 - Pulling Position

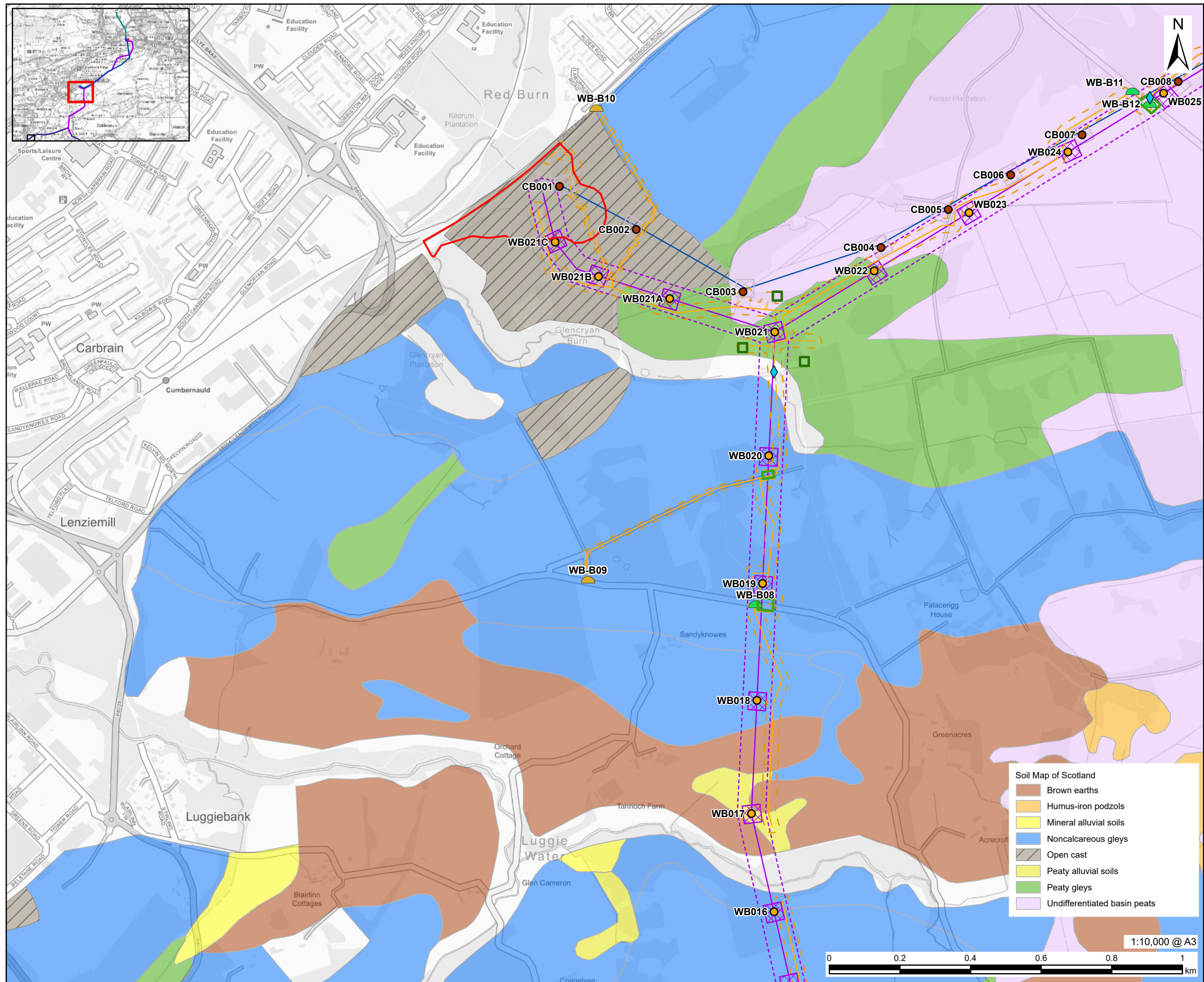
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FIGURE TITLE
Soil Map of Scotland

FIGURE NUMBER
Figure 4 (Sheet 4 of 7)



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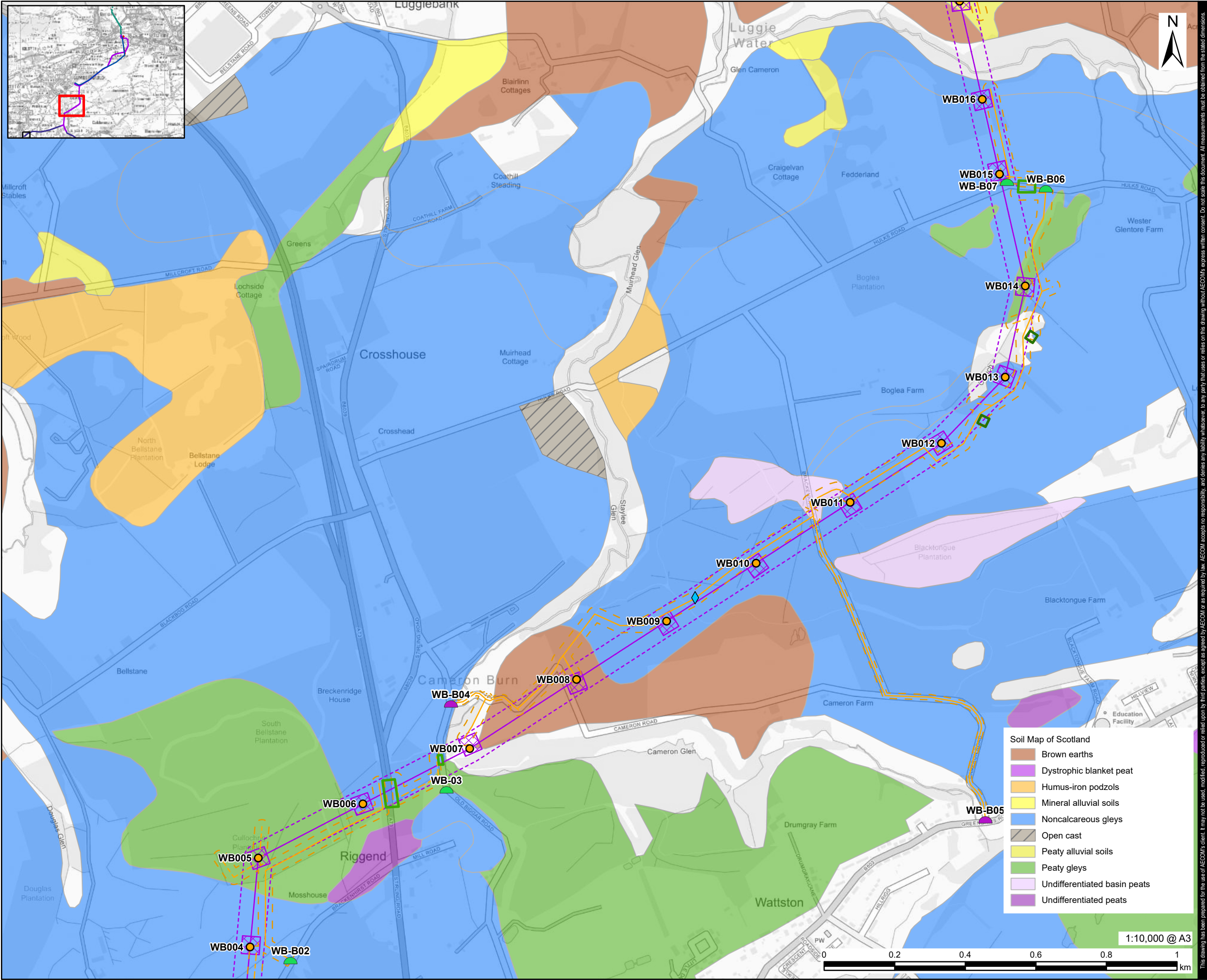
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LEGEND

- New Tower
- Tower to be Removed
- Cumbernauld Substation Site Boundary
- New Build Tower Compound
- CB Tower Compound
- New Build Overhead Line
- New Build Overhead Line Limit of Deviation
- Temporary Trackway
- Temporary Stone Track
- Temporary Trackway Proposed Access Limit of Deviation
- Water Crossing
- Scaffolding
- Pulling Position

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ISSUE PURPOSE
Peat Management Plan
PROJECT NUMBER
60602788
FIGURE TITLE
Soil Map of Scotland
FIGURE NUMBER
Figure 4 (Sheet 5 of 7)



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LEGEND

- New Tower
- New Build Tower Compound
- New Build Overhead Line
- New Build Overhead Line Limit of Deviation
- Temporary Trackway
- Temporary Stone Track
- Temporary Trackway Proposed Access Limit of Deviation
- Water Crossing
- Scaffolding
- Pulling Position

Soil Map of Scotland

- Brown earths
- Dystrophic blanket peat
- Humus-iron podzols
- Mineral alluvial soils
- Noncalcareous gleys
- Open cast
- Peaty alluvial soils
- Peaty gleys
- Undifferentiated basin peats
- Undifferentiated peats

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ISSUE PURPOSE
Peat Management Plan

PROJECT NUMBER
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FIGURE TITLE
Soil Map of Scotland

FIGURE NUMBER
Figure 4 (Sheet 6 of 7)

1:10,000 @ A3

0 0.2 0.4 0.6 0.8 1 km

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