

New House Farm, Luzlow, Bagnall, Stoke-On-Trent ST9 9JZ

Development of a Battery Energy Storage System

ALTERNATIVE SITE ASSESSMENT

FEBRUARY 2024



REPORT CONTROL

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/1 INTRODUCTION

- 1.1. This standalone Alternative Site Assessment has been prepared by Energy Planning (part of the PWA Planning Group) on behalf Root-Power (South) Limited ('the applicant') to submit a planning application for the development of a Battery Energy Storage System (BESS) and associated infrastructure ('the proposed development') at Land at New House Farm, Luzlow, Bagnall, Stoke-On-Trent, ST9 9JZ ('the site').
- 1.2. This document provides an overview as to why other sites, including urban brownfield sites have been discounted.

/2 SITE DESCRIPTION

- 2.1 The application site extends to approx. 2.03ha and is located on land to the west of Luzlow Lane. The site comprises agricultural land and encompasses one field, with an access track located through a neighbouring field. Little Armshead Farm is located to the south of the site with New House Farm situated to the northeast. Vehicular access to the site is to be provided via an existing field access connecting with Luzlow Lane on the eastern site boundary, which will be widened as part of the development.
- 2.2 The site's immediate surrounding area is considered to be rural with agricultural and other rural uses. The site lies within the Green Belt as per the Staffordshire Moorlands Local Plan 2014-2033 (Adopted September 2020) and is screened by vegetation and tall trees to the south and west.
- 2.3 A location plan showing the site within its immediate setting is submitted with the application. The site within its context can also be seen in Figure 1 below. The National Grid Cellarhead Substation is located 950m to the east of the site.

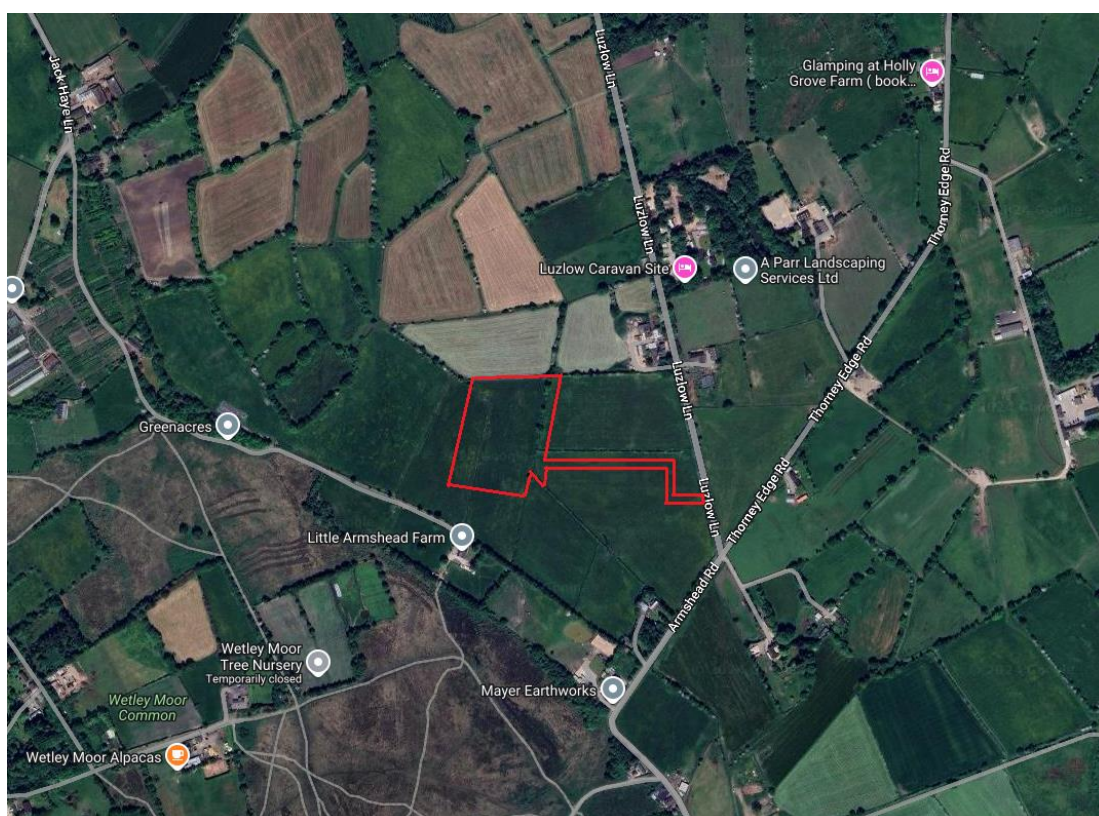


Figure 1: Application site location, redline boundary (Source: Google Maps, not to scale)



- 2.4 The site lies within Flood Zone 1 where the risk of flooding is at its lowest. There are no heritage designations associated with the site, or the surrounding area.
- 2.5 There are no Public Rights of Way on or adjacent to the site. The site lies within the National Landscape Character 64 Potteries and Churnet Valley.
- 2.6 The site lies within the SSSI Impact Risk Zone of Wetley Moor, approximately 130m to the south of the site. Figure 2 below shows the location of the site (redline boundary) in relation to said impact zone.

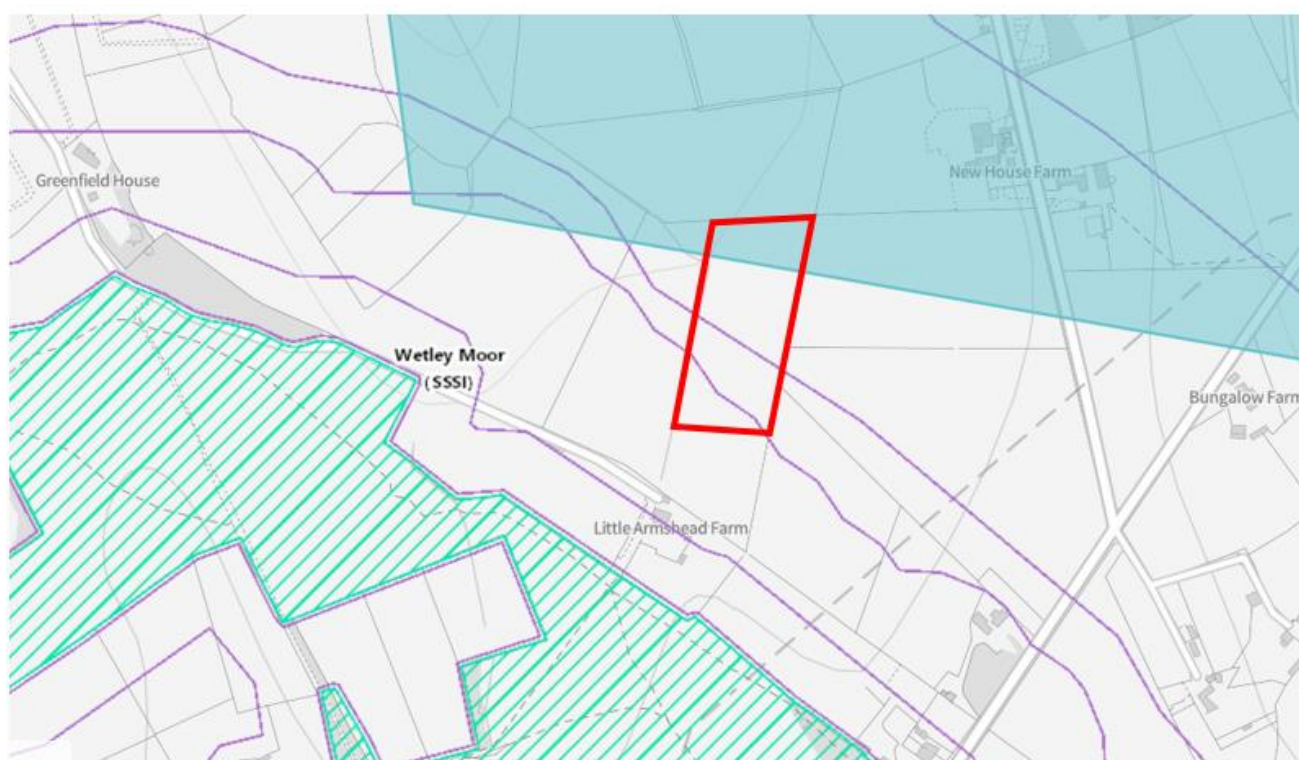


Figure 2: SSSI Impact Risk Zone Source: Magic Map NTS



/3 PROPOSED DEVELOPMENT

- 3.1 The proposed development comprises a battery energy storage system (BESS) to provide energy balancing services to the National Grid. This type of facility operates by taking excess electricity from the Grid at times of low demand when energy would otherwise be lost, storing it in batteries, and releasing it back to the Grid when demand is high. Energy storage facilities therefore improve the efficiency of existing energy production facilities, notably from renewables where production is intermittent and based on external conditions. BESS can also operate in several different modes to provide grid stability services, such as managing voltage and frequency imbalances as renewable generation dips up and down.
- 3.2 The layout of the proposed development is shown in Proposed Site Plan (ref LZL-BESS-001.5 rev2) submitted in support of this full planning.
- 3.3 The UK government estimates technologies like battery storage systems – supporting the integration of more low-carbon power, heat and transport technologies – could save the UK energy system up to £40 billion by 2050, ultimately reducing people’s energy bills¹.
- 3.4 Furthermore, between 2015 and 2021, the UK’s electricity system operator (ESO) curtailed, or discarded, over 13% of the total wind energy generated, with a high of 19% of generation in 2020. Some wind farms have been recording to be discarding between 20% and 50% of their output (REF). ²Research from LCP³ has found that an increase of 20GWh of battery storage could reduce the amount of wasted wind power in Britain by 50%.
- 3.5 The proposed development would comprise of the following equipment housed within a fenced compound:
- 24no. Battery Clusters
 - 12no. BESS Transformers
 - 1no. Site Welfare and LV Switchroom placed on paving slabs at the corners
 - 2no. 132kV Substation Switchrooms

¹ <https://www.nationalgrid.com/stories/energy-explained/what-is-battery-storage>

² <https://www.ref.org.uk/ref-blog/371-constraint-payments-to-wind-power-in-2020-and-2021>

³ <https://www.current-news.co.uk/cost-of-wind-curtailment-hits-record-high-of-507m-in-2021/#:~:text=It%20follows%20research%20from%20LCP,when%20renewable%20generation%20outstrips%20demand>



- 1no. 33kV/415V Site Supply Transformer
- 1no. 132kV Substation within a compound including a DNO a BESS transformer and 2no. 33kV BESS Switchrooms. This compound to have a bunded foundation
- 2no. car parking spaces
- 2no. Water Tanks
- 1no. Fire Hydrant

- 3.6 The compound will be a total of 114m in length by 71m in width with three rows of battery clusters and transformers accessed by two internal access tracks with two gates from the access road to the site. There are three switchrooms, one at the end of each row of battery cabinets. The substation compound lies to the south of the rows of battery clusters.
- 3.7 The compound surface would comprise primarily of permeable ground, with the BESS clusters sat on screw piles on concrete foundations, the invertors will have bunded concrete foundations and the switchroom will be placed on paving slabs in the corners. Internal access tracks within the compound would consist of a type 1 compacted stone.
- 3.8 Access to the site will be taken via an existing access point off Luzlow Lane and will be upgraded as required to provide suitable access. The compound would be surrounded by a fence, with an appropriate landscaping scheme around the perimeter and the BESS.
- 3.9 Any planning permission to be granted onsite would be temporary in nature and required only for the lifespan of the development. Following the lifespan of the development (40 years), the proposed development site would then be decommissioned, and the site would be restored to its former use as agricultural land.



/4 ALTERNATIVE SITE SELECTION

- 4.1. To provide context to how this location was selected, it is helpful to understand how the process begins for these types of developments, and in particular how a grid connection offer is achieved. Grid connection for battery storage is a highly specialised requirement given the need to both import and export energy from and to the grid as required. Viable grid connections are therefore not commonplace. Root-Power (South) have received a formal grid offer allowing for the grid connection included within the proposed development.

CAPACITY AND A POINT OF CONNECTION

- 4.2. The process of applying for a grid connection begins with a search for available capacity on the grid, meaning an ability to connect a utility scale BESS in a timely and costly manner to a point in the electricity network, i.e. no significant upgrades to the network are required to facilitate the connection. This involves extensive engagement with the grid network operator (National Grid Electricity Distribution). Once capacity is found, it is then imperative to then find and secure the rights to a site of suitable size within a viable distance from a grid point of connection (POC).
- 4.3. Typically, utility-scale renewable and battery projects can only be connected into grid supply points which are substations that connect the transmission (national) to the distribution (local) electricity network. These substations are commonly located on the edges of major urban settlements which often overlap with planning policies to restrict the spread of those urban settlements such as Greenbelt designations.
- 4.4. The feasibility of projects is constrained to within a 2km cable route of the POC – which is an underground 132 kV cable running to Cellarhead Substation. Beyond this distance, cabling costs become prohibitive, with an approximate cost of £1 million per kilometre for 132kV cables. This limitation ensures the economic viability of the project while minimising the environmental and planning disturbance caused by a long cable route.
- 4.5. Furthermore, the selected cable route must be practically viable, allowing for excavation and cable laying. The route may traverse public highways or, if appropriate consents are secured, third-party land. This consideration ensures that the chosen route is both technically feasible and aligned with regulatory and community standards.



- 4.6. The site selection for the proposed BESS project is driven by a careful evaluation of technical, economic, and practical factors. The connection into Cellarhead Substation, with its 132kV capacity, serves as an ideal connection point, considering financial viability, technical restrictions, and cable route feasibility. We believe that this approach aligns with the project's objectives and contributes to the sustainable integration of battery energy storage in the designated area.
- 4.7. There are a number of locational constraints associated with the deployment of energy storage facilities. In order for an energy storage connection to be viable, the point of connection must meet the following criteria:
- It must be located on a part of the electricity network that has available capacity;
 - It must be located at a strategic substation; and
 - It must be located at a substation with available demand capacity.
- 4.8. Such criteria are not commonplace. The above criteria are however all met at the point of connection for the proposed development, with the grid connection located to the east of the site into Cellarhead Grid Supply Point, located along Rownall Road, Wetley Rocks, Staffordshire. In addition, there is a willing landowner, who supports the scheme.
- 4.9. Further to the above, locating such facilities within urban areas is often not feasible, even if there is adequate grid capacity, largely due to the availability and suitability of those sites as well as competition from other land users such as residential and commercial development which frequently makes those locations unviable.
- 4.10. BESS projects are developed subsidy free, and the investment case has to meet strict criteria to be fundable. One of the criteria is grid connection and being in proximity to equipment that is capable of accommodating the scale of the project. Proximity can vary between connection points; however, generally the closer the site is to the connection point, the better from a technical and financial point of view.
- 4.11. On the point of economic viability, the battery storage market is currently facing unprecedented headwinds on both the cost and revenue generation side. The combination of COVID on the supply side and the significant uptake in Electric Vehicles (EVs) driven by net zero policies on the demand side, driven by the implementation of Governments targets for net zero across the world, drove the price of lithium, a significant cost input of the

batteries, up some 800%. In order to meet forward orders and the continued expectation of demand, battery manufacturers entered into long term supply contracts with the mines at record high prices for lithium. Whilst the price of lithium has come back from record highs, the cost of the batteries, as a result, has not fallen.

- 4.12. As we have previously outlined, renewable energy supply cannot be achieved without battery storage and to enable the delivery of the significant amount of batteries we need connected to the grid, we have to make the sites as cost effective and viable as practically possible. This is possibly the most crucial element of site selection after available capacity.

SITE SEARCHING AND LOCATIONAL CONSTRAINTS

- 4.13. Once the required capacity and Point of Connection (PoC) were found, a 2km radius search was undertaken from the PoC in order to identify land available for the proposed development. As part of the site selection, the applicant spoke with a number of significant landowners in the area, accounting within a viable distance of the PoC. A map of the area is shown below in Figure 4. The green cross hatch area indicates Green Belt allocation within Staffordshire Moorlands District Council Policies Map 2011-2030, with the application site outlined in red, and other consented/proposed renewable energy sites shown as blue.

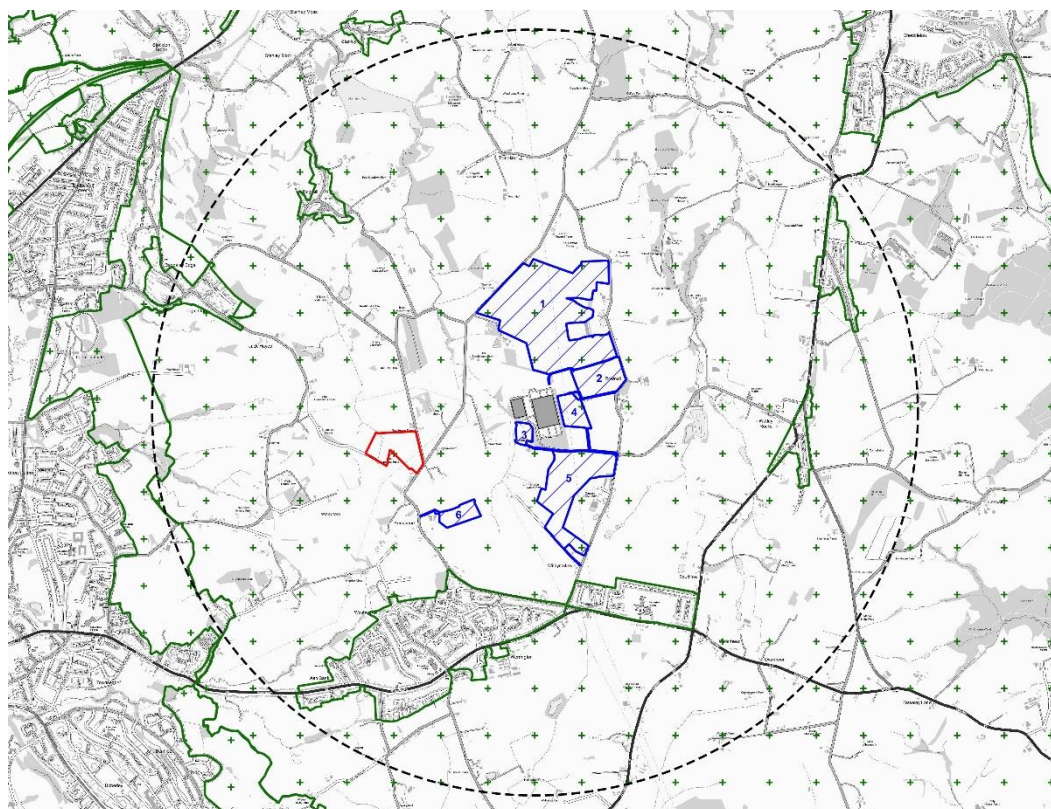


Figure 4: Map of the Search Area and Green Belt Constraint



- 4.14. For a targeted capacity of 99MW, a plot of land at least 2ha in size is required to fit the installed capacity, with suitable access and cable routes. Additional area for proposed landscaping to meet the 10% BNG requirements is also required.
- 4.15. A range of technical, environmental and economic factors were also utilised when assessing suitable sites for the proposed development. Key determining factors for a viable site include:
- Proximity to sensitive receptors
 - the site must be an appropriate distance from sensitive receptors such as domestic, ecological and sensitive commercial (e.g. schools/hospitals/care homes) so as to not cause nuisance by way of noise or visual disruption - this is achieved at this site.
 - Access and feasibility
 - the site must have a workable topography and have either an existing access or the ability to construct an access for heavy goods vehicles including low loaders, cranes and aggregate vehicles - the drainage and transport assessments submitted with this application demonstrate that this is the case at this site.
 - Site size and shape
 - Land must be of an appropriate scale to accommodate a distribution scale BESS. When considering necessary infrastructure involved (substation, BESS equipment, ancillary equipment, screening), internal separation distances mandated by regulations (e.g. fire specific BESS separation distances) and BNG requirements, this usually is a minimum of 2 hectare. The site complies with these parameters.
 - Development plan policy
 - where possible, avoiding planning restricted areas including Green Belt, Conservation Areas, Landscape Areas or any other local planning restrictions. When applying the above constraints, this often leads to a conflict as large open space near major settlements (where Grid Supply Points are located) are rarely devoid of any planning restriction. Other than Green Belt, which applies to the whole of the 2km around the POC, there are no other such constraints around the site.
 - Agricultural land quality
 - land is prioritised in terms of arable potential looking at the Agricultural Land Classification with the preference being Brownfield and higher grade ALC land.



Figure 5 demonstrates that the site and surrounds is Grade 4, and therefore not best and most versatile land.

- Landscape and visual impact
 - Any site should either benefit from existing screening or have the capacity to be screened from any sensitive receptor including public viewpoints, heritage assets or domestic residences. The LVIA provided as part of the Environmental Statement provides the assessment in this regard and demonstrates that the majority of impacts are highly localised.
- Nature conservation and potential for enhancement
 - The site must not be high quality land from an ecological standpoint with a high baseline biodiversity (such as wild grassland or woodland areas) or feature any protected species. Where possible land is selected which can achieve the minimum 10% Biodiversity Net Gain on-site - this is achieved in site here.
- Flood risk; and
 - No sensitive equipment such as the batteries or the DNO substation can be placed within key flood zones due to possible water damage incurred from flood risk - the site is within flood zone 1.
- Land availability
 - It must be possible to acquire land for an appropriate time, cost and scale to allow for construction, operation and decommissioning the project. This adds difficulty to acquiring land in heavily commercial/industrial areas where commercial rates make energy projects unviable. This typically makes arable land the most viable option for any energy scheme. Here, there is a willing land owner.
- Ground conditions
 - Sites must be devoid of unsuitable ground conditions including steep topography, heavily flooded ground or potentially contaminated sites as is the case here.

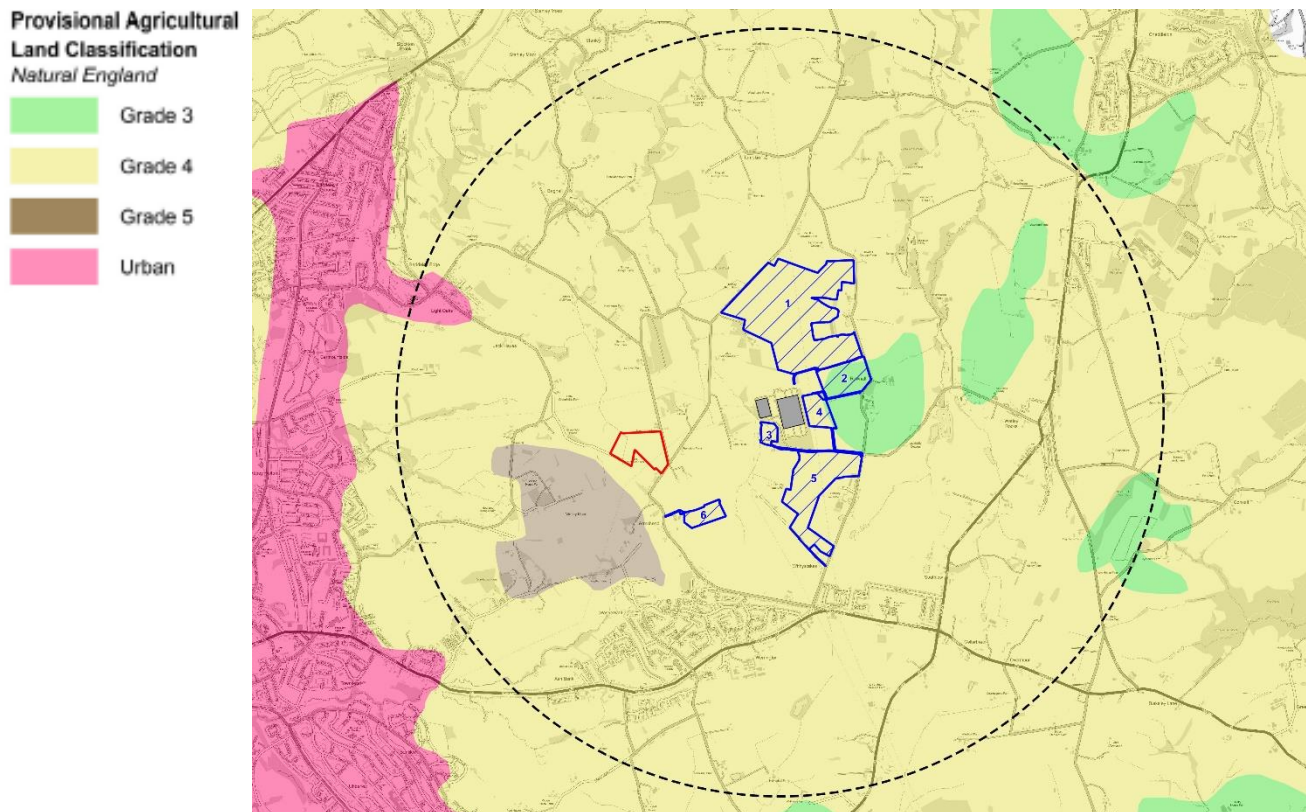


Figure 5: Map of the Search Area and ALC Constraints

- 4.16. A search of suitable land options was undertaken and 31 landowners were contacted by letter twice with the only response coming from the Landowner of the proposed site. The map below shows the point of connection as an orange crosshair with a 2km radius search area. The proposed site location is outlined in green. The red and purple outlines indicate the contacted landowners at different times. With the red sites contacted in the first instance, and the purple lines represent landowners contacted a few months later to expand the search. The purple dots represent renewable projects within the search area.

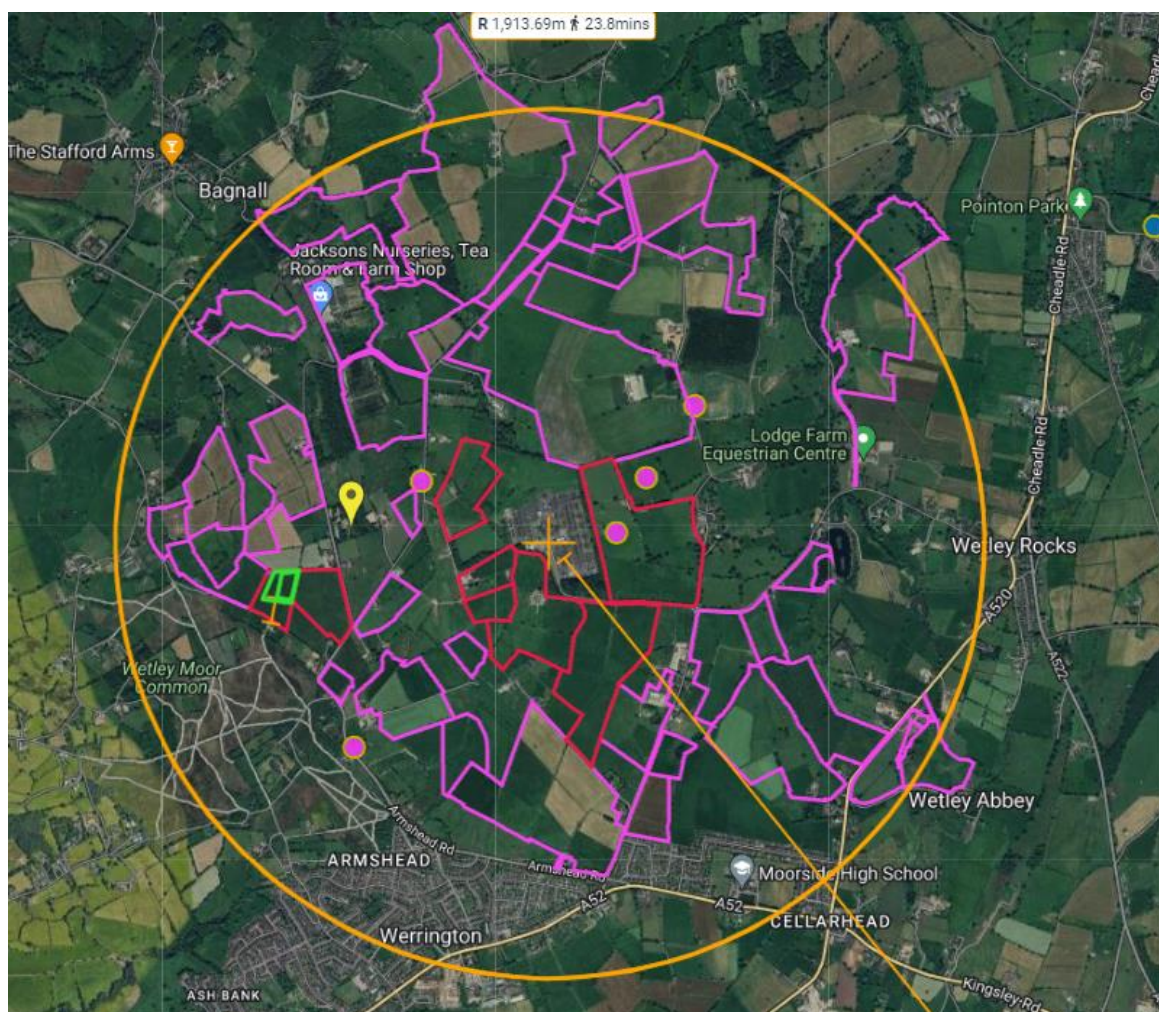


Figure 6: Map of the Search Site: Source Root-Power (South)

- 4.17. Following the above intensive site searching process, the site subject to this application was selected by the applicant on the basis of its proximity to the PoC.

NEXT STEP – REQUEST FOR GRID CONNECTION

- 4.18. Once the above PoC has been identified, an application for the spare capacity is then made to National Grid Electricity Distribution (NGED) at a cost to the applicant. If the application is successful, the grid connection offer is made exclusively available only from the site that it is applied for, with connection to the PoC. At this stage, and going forwards, the site cannot then be changed as this is the agreed and offered grid connection point.



/5 CONCLUSION

5.1. In line with the above, there are no other preferred locations for the proposed development, with no urban locations or brownfield sites meeting the above criteria which is commonplace; hence, why a number of BESS sites across the country are within the countryside and/or Green Belt. In this instance, all land within 2km of the site is Green Belt, and none is subject to lesser constraints than the application site.

5.2. Indeed, there is an urgent need to decarbonise our energy supply, recognised nationally and by the Council. The government has set ambitious energy storage requirement targets, eyeing 20 GWh by 2035 ⁴. The applicants have secured a connection to the Grid proposed by this development, with the intention to connect the project before then, at the earliest opportunity. It is also noteworthy that at paragraph 168 of the NPPF, it is stated that:

"When determining planning applications for renewable and low carbon development, local planning authorities should:

a) Not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions."

5.3. The proposed site meets all the specified criteria identified with paragraph 4.15 and is the only site identified by the applicant suitable for the proposed development within the 2km search radius of the PoC. The application site was also promoted by a willing landowner.

5.4. The availability of connection options for BESS is limited and many are situated within Green Belt given the location of the larger substations able to accommodate these connections also being within the greenbelt. These sites must be utilised in order for the UK to secure sufficient battery storage to deliver its transition to a low carbon electricity generation, meet its carbon reduction targets, and maintain an effective electricity grid in the coming decades. Without a storage facility at the application site, the region will be at increasing risk of localised grid failure which could not be effectively mitigated by storage facilities in other parts of the country due to the effect of power losses when electricity is transmitted over long distances.

⁴ <https://assets.publishing.service.gov.uk/media/656ef4871104cf000dfa74f3/uk-battery-strategy.pdf>



- 5.5. As aforementioned, the proposed development would provide essential energy balancing services to the National Grid. The proposed development would actively contribute towards the UK's Carbon Dioxide reduction targets, as electricity would be drawn from the Grid at times of low demand, stored in highly efficient battery units, and then released when required, to satisfy said demands.
- 5.6. The intermittent nature of renewable energy is such that, depending on site specific conditions, electricity is produced, then lost if demand is low. In 2022, National Grid paid wind farms £215m to stop producing energy due to a lack of storage facilities available to the network. These 'constraint costs' as National Grid has labelled them, is expected to rise to £2.5bn during the middle of this decade. When demand is higher, greater generation from non-renewable sources is required to meet demand. Energy storage facilities such as that proposed would reduce the reliance on non-renewable resources, thus decreasing Carbon Dioxide emissions. The presence of sufficient storage developments will lead to a reduction in the level of renewable energy projects required across the UK as their efficiency is enhanced significantly when utilised alongside energy storage. Intermittent renewable energy supply does not work without storage and by making renewable energy projects more effective via storage, we can protect hundreds of thousands of acres of greenbelt and the wider countryside.
- 5.7. The applicant, YLEM Energy (South), have received a formal grid offer allowing for the connection to be included within the proposed development area.
- 5.8. We have set out that there is capacity at the Cellarhead Substation to accommodate the proposal and as such this is the only PoC available. We have explained that the availability of a grid connection is critical when undertaking a site search for proposals such as this. The availability of suitable substations to connect battery storage is so limited that many of the remaining opportunities are located within the Green Belt. These sites must be utilised if the UK is to secure sufficient battery storage to maintain an effective electricity grid in the coming decades. Without a storage facility at this location, the region will be at increasing risk of localised grid failure and blackouts which could not be effectively mitigated by storage facilities in other parts of the country due to the effect of power losses when electricity is transmitted over long distances.



- 5.9. We have explored a 2km radius and as with all energy infrastructure projects, the closer the scheme lies in relation to the Point of Connection (PoC) (or, into the existing grid network), the greater the prospect it has of being delivered as the scheme is likely to be more viable. This is simply because fewer materials are required, fewer electrical inefficiencies arise and PoC designs are usually simpler. This is especially pertinent in an environment where solar and BESS projects are required to be developed subsidy-free, without tax-payer support. Therefore, land close to the National Grid Electricity Distribution or local distribution network connection point of suitable size is required. To make a connection to the network, it is necessary to install a new circuit (ideally underground cable) to the nearest point on the network that can accommodate the site export capacity.
- 5.10. Whilst the proposed development is not for the production of renewable energy, it will facilitate renewable energy developments and is recognized by the UK government as playing a key role to achieving Net Zero. The storage facility will take up energy at times of low demand and release it back to the grid at times of demand. One major drawback of renewable projects has been that the energy they produce is largely dependent on conditions on site beyond the control of the developer (i.e. wind speed, light, etc.), meaning some energy produced is wasted if not needed at that time. Energy storage facilities can balance energy production with need, thus dramatically increasing the utilisation of energy produced by renewable sources.
- 5.11. It is considered that the environmental benefits associated with this increase in efficiency justifies the development of such a facility in line with the provisions of the NPPF.
- 5.12. As stated in the Planning Statement, the proposal is considered to comply with the requirements of the NPPF with regards to its location within the Green Belt. It is considered that the site constitutes grey belt in the context of the new NPPF (paragraph 155), whereby developments such as this are not inappropriate. If the LPA disagree, it is however considered that the harm by reason of inappropriateness plus any additional harm is clearly outweighed by the locational constraints of the development and the wider environmental benefits of this proposal, such that this amounts to very special circumstances to justify its Green Belt location.



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