

Chapter 05: Need, Alternatives and Design

Environmental Impact Assessment
Report for:

Westfield Substation Extension

Chapter Table of Contents

5.	Need, Alternatives and Design Evolution	5-3
5.1	Need.....	5-3
5.2	Site Selection and Alternatives	5-5
5.3	The Former Westfield Opencast Mine Employment Area.....	5-7
5.4	GIS v AIS	5-9
5.5	Environmental and Planning	5-10
5.6	The Proposed 33kV Undergrounding of the Kelty – Cowdenbeath No.1 and No.2 Circuits.....	5-15
5.7	Temporary Drainage Scheme	5-15
5.8	Design Evolution.....	5-15

5. Need, Alternatives and Design Evolution

5.1 Need

- 5.1.1 The TKUP is a strategic electricity transmission reinforcement required to increase north-to-south power transfer capacity, reduce constraints on the transmission system and facilitate the connection and transfer of clean power generation. It forms part of the wider programme of electricity infrastructure needed to support the transition to a low-carbon electricity system and to meet the requirements identified for the 2030 period.
- 5.1.2 In broad terms, TKUP comprises three distinct components delivered across phases: (i) the addition of 400kV extensions to the existing 275kV substations at Westfield and Mossmorran, (ii) the establishment of a new 400kV substation at Conland, (altogether referred to as “the Substations”), and (iii) the uprating of the existing overhead line route between the SSEN Transmission boundary at Tealing to Kincardine North from 275kV to 400kV operation. The project will create a reinforced 400kV transmission corridor through Fife, using the existing overhead line throughout, and will provide additional capacity and resilience across the wider transmission network.
- 5.1.3 The works are technically and operationally connected, but they perform distinct roles. The overhead line uprating will provide the 400kV transmission path needed to move power across the network. However, it cannot collect and transfer wider generation capacity, or deliver the associated system interconnectivity benefits, unless the related 400kV substations are in place and capable of receiving, transforming and distributing power at the required voltage. The full strategic benefits of TKUP will therefore only be realised when the substations and overhead line works are completed and commissioned together as an integrated transmission reinforcement.

Need for TKUP

- 5.1.4 The principal driver for TKUP is the requirement to reinforce the transmission network to accommodate increasing power flows from renewable and low-carbon generation, reduce network constraints and support security of supply. The reinforcement has been identified as a CP2030 project and is required to support the timely delivery of wider electricity system objectives.

Role of the Overhead Line Works

- 5.1.5 The overhead line performs the primary strategic transfer function within TKUP. By uprating the existing line to operate at 400kV, it provides the transmission path through which power can be moved across the country and through which generation from surrounding areas can be collected and transferred onto the wider network. Its role is therefore to increase the carrying capability of an established transmission corridor, support higher north-to-south power flows and collect and transmit the wider system connectivity and generation needs associated with the substations.
- 5.1.6 This overhead line element is not a new linear route. It is an uprating of an existing 275kV overhead line to 400kV operation, with the principal physical changes being related to the conductors, insulators and associated fittings, together with alterations required to connect the line into the new 400kV substations at Conland, Westfield and Mossmorran.

- 5.1.7 The Westfield substation will also serve Eastern Green Link 4 ('EGL4'). EGL4 is a major electricity transmission project being developed by SPEN and National Grid, comprising a 2GW high-voltage direct current (HVDC) subsea link between Fife in Scotland and Norfolk in England. The project is designed to increase the capacity of the UK transmission network, enabling more renewable electricity generated in Scotland to be transported to areas of high demand across Great Britain. EGL4 will support the transition to a cleaner energy system while improving grid resilience, flexibility and long-term energy security.
- 5.1.8 EGL4 is planned to connect into Westfield 400kV substation, and that connection requires the extension to be completed timeously to ensure Westfield will be available in sufficient time to support load testing and staged commissioning. The timely delivery of Westfield is therefore a key programme requirement, alongside the wider TKUP need to establish a 400kV transmission corridor through the east of Scotland.

Role of the Individual Substations

- 5.1.9 As well as serving a strategic role, each substation also performs a distinct and necessary network function in its own right. The substations are not merely ancillary to the overhead line works; they are enduring transmission nodes which support system operation, enable customer renewable generation connections, provide local and regional network capacity, and allow the existing network to be operated safely and efficiently as it transitions to 400kV capability.
- 5.1.10 **Westfield substation extension** is a critical transmission hub for the east of Scotland. It is required to: (i) facilitate the connection of EGL4, (ii) create capacity for connection of potential future renewable and low-carbon generation projects, (iii) provide a replacement for the equipment within the existing 275kV substation which is reaching the end of its useful life, and (iv) provide a 400kV node capable of supporting the wider TKUP transmission corridor. Westfield plays an important role in the context of TKUP, and it is also an essential transmission hub for the east of Scotland.
- 5.1.11 **Mossmorran substation extension** is required to: (i) establish connectivity as part of the wider TKUP system, (ii) facilitate and enable contracted and consented renewable generation connections of 500MW by 2031/2032 that would otherwise be unable to connect, and (iii) provide a strategic 400kV node. Its delivery is therefore important not only for TKUP as a whole, but also for the progression of local and regional clean power connections.
- 5.1.12 **Conland substation** is required to: (i) support higher-voltage system connectivity with the SSEN Transmission network and wider SP Transmission system, (ii) ensure security of supply is maintained to the Glenrothes grid when the transmission system is uprated to 400kV, (iii) support the wider SPT transmission system, and (iv) provide capacity for connection of potential future renewable and low-carbon generation projects. Conland therefore performs an important system role as part of the reinforced corridor and as a network node serving wider operational requirements.

Need for the Westfield Substation

- 5.1.13 The principal driver for TKUP is the requirement to reinforce the transmission network to accommodate increasing power flows from renewable and low-carbon generation, reduce network constraints and support security of supply. The reinforcement has been identified as a CP2030 project and is required to support the timely delivery of wider electricity system objectives.

- 5.1.14 Westfield is a critical transmission hub for the east of Scotland. It is required to facilitate the connection of EGL4, create capacity for connection of potential future renewable and low-carbon generation projects and provide a 400kV node capable of supporting the wider TKUP transmission corridor. There is also an asset-driven need associated with existing equipment at Westfield, with the new substation providing an enduring replacement and reinforcement. Even if the overhead line upgrading were not ultimately consented for 400kV operation, SPT would retain a need for transmission infrastructure at this location.
- 5.1.15 The project has a direct interface with EGL4. EGL4 is planned to connect into the new Westfield 400kV substation, and that connection requires Westfield to be available in sufficient time to support load testing and staged commissioning. The timely delivery of Westfield is therefore a key programme requirement for the wider transmission network, alongside the wider TKUP need to establish a 400kV transmission corridor through the east of Scotland.

5.2 Site Selection and Alternatives

- 5.2.1 The site selection process has been undertaken in accordance with Regulation 5 (2) (d) and Schedule 4, paragraph 2 of the EIA Regulations, which requires a description of reasonable alternatives studied and the reasons for selecting the chosen option. Regulation 5 (2) (d) and Schedule 4, paragraph 2 of the EIA Regulations, where Schedule 4, paragraph 2 states that:
- “A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.”*
- 5.2.2 An environmentally led site selection was undertaken to consider the potential extension to Westfield Substation and to identify the most appropriate location for the extension, taking into account known environmental considerations and technical considerations identified by SPEN, alongside considerations of economic viability and deliverability. The site selection process considered the requirements of the Horlock Rules, which provide guidelines for the siting and design of new substations, or substation extensions, to avoid or reduce the environmental effects of such developments. The Horlock Rules require the consideration of the overall system options and site selection; amenity, cultural or scientific value of sites; local context, land use and site planning; and design.
- 5.2.3 The guidelines set out in the Holford Rules – including the recommendation that, *“when siting substations, due account shall be taken of the effects of the terminal towers and line-connection works required, and wherever practicable screening through ground form or vegetation should be used”* - have also been considered in the site selection and design process for the substation extension.
- 5.2.4 The consideration of alternatives for the proposed development has been undertaken through a structured process:
- Identification of the Area of Search, defined primarily by operational and electrical engineering requirements associated with the existing transmission network; and

- Assessment of Site Suitability, whereby the preferred technically feasible location has been evaluated against environmental, planning and deliverability considerations to confirm its appropriateness.

- 5.2.5 This approach reflects established practice for transmission infrastructure projects, where technical and safety requirements of the electricity network are often a primary determinant of location before environmental considerations are appraised.
- 5.2.6 Accordingly, the sections below set out the Technical, Environmental and Economic considerations relating to the site for the proposed development.
- 5.2.7 The initial basis for considering the proposed substation extension was the requirement for a site area of approximately 1 hectare (100m x 100m). The development requires a level platform, typically constructed from cast concrete and enclosed by perimeter fencing.
- 5.2.8 As the design progressed, the required area increased to accommodate the full 400 kV substation infrastructure such as increased GIS building size, earthworks, access arrangements, drainage, operational clearances, utility diversions. The resulting development envelope therefore expanded to ensure sufficient space for the assets associated with the Westfield 400 kV extension

‘No Development’ Scenario

- 5.2.9 A ‘do nothing’ scenario was considered as an alternative. Under this scenario, no reinforcement of the network would take place in the Fife area, and the existing Westfield Substation and associated OHL network would continue to operate at current capacity. This would fail to address the identified need to uprate the network to maintain security of supply, meet demand, and ensure compliance with technical standards. Therefore, from a strategic network perspective, the ‘do nothing’ option is not considered a reasonable or sustainable alternative.

Establishing the Area of Search

Technical Requirements

- 5.2.10 The need for the proposed development arises from reinforcement requirements within the existing transmission network and the operational need to expand capacity at Westfield Substation. The defining constraint influencing site selection is the requirement to integrate directly with the existing overhead line (OHL) transmission infrastructure and associated switching arrangements.
- 5.2.11 In particular, the extension requires connections to the existing transmission network via the existing overhead line networks which converge at the site for YS and YJ Routes. located immediately to the west of the existing substation. This requirement arises from the configuration of the live transmission circuits and the need to maintain continuity, safety clearances and operational resilience during both construction and operation.
- 5.2.12 This approach is consistent with SPEN’s statutory duty under the Electricity Act 1989 to develop and maintain an efficient, co-ordinated and economical system of electricity transmission.
- 5.2.13 n. Connection at an alternative location would require substantial diversion of existing high-voltage OHL infrastructure, introduction of additional terminal towers and lengths of OHL, extended outages, and significant additional engineering works. Such works would introduce increased

environmental effects, higher cost, longer delivery programmes and increased risk to network security.

- 5.2.14 These operational requirements mean that proximity to the existing substation and direct alignment with, or close proximity to both YJ Route and YS Route are fundamental design parameters rather than locational preferences. Consequently, the realistic area of search is confined to land immediately adjacent to the existing Westfield Substation facility.

Identification and Assessment of the Preferred Site

- 5.2.15 Having established the technically feasible area of search, alternative land parcels within and adjacent to this area were reviewed to identify the most suitable location for the extension.
- 5.2.16 The existing Westfield Substation is surrounded by operational OHL infrastructure which limits expansion opportunities in some directions. Land to the east and south is constrained by existing transmission infrastructure and operational clearances, while land to the north is constrained by the B9097 corridor and surrounding land uses. As shown on **Figure 12.1**, the proposed EGL4 project is also located in close proximity, being in close proximity to the east.
- 5.2.17 Within the defined area of search, therefore, the land immediately west of the existing substation was identified as the preferred option as it:
- Enables direct connection to YJ Route and YS Route where they converge without additional diversion works;
 - Allows an offline construction approach, minimising disruption to the operational network;
 - Provides sufficient space for construction, drainage and mitigation measures;
 - Does not potentially impact the location of the EGL4 project; and
 - Maintains operational separation between existing and new infrastructure.
- 5.2.18 Micrositing within this western area considered existing vegetation, drainage features, local topography, and opportunities for screening in accordance with the Horlock and Holford Rules. However, given the location of the YS and YJ towers at their closest points to one another, and the location of the road, there were not many options for refinement, and an area which extends west and south-west represented the only realistically feasible option.
- 5.2.19 The selection of this site therefore represents an optimisation exercise within a technically constrained search area, rather than a comparison between geographically separate alternative sites. It also looks to review this location from an environmental and planning perspective.

5.3 The Former Westfield Opencast Mine Employment Area

- 5.3.1 The Former Westfield Opencast Mine Employment Area was reviewed as a potential alternative location following comments received within Fife Council's pre-application response. The site lies relatively close to the existing Westfield Substation and was therefore considered by the Council as an appropriate comparator to test whether a reasonable alternative location existed outwith the preferred western extension area.

- 5.3.2 In accordance with SP Energy Networks' Approach to Routeing and Environmental Impact Assessment, the identification of a preferred substation location requires a balanced consideration of technical, environmental and economic factors, alongside the licence obligations placed on SPT as transmission operator to develop, maintain and operate an efficient, co-ordinated and economical system under Section 9(2) of the Electricity Act 1989. Within this legislative framework, a new substation site immediately adjacent to the existing Westfield substation and existing line entries represents a more optimal solution than the alternative Former Westfield Opencast Mine Employment Area identified within the FifePlan Local Development Plan.
- 5.3.3 Co-locating new infrastructure beside established high-voltage assets is consistent with established industry routeing and siting principles, including the Holford Rules, which emphasise the need to minimise additional landscape and visual effects through alignment with existing transmission corridors. Similarly, the Horlock Rules, which guide the siting of substations, support the consolidation of associated infrastructure to reduce incremental environmental impacts and avoid the introduction of new visual and land-use footprint in previously unaffected areas. The adjacency of the proposed site to existing grid infrastructure minimises the requirement for new overhead line deviations, earthworks and access infrastructure, thereby lowering potential environmental disturbance and construction impacts, in line with SPEN's commitment to achieving an appropriate balance of environmental, technical and economic considerations. Furthermore, the utilisation of a site directly connected to existing transmission assets improves engineering efficiency, shortens connection distances and reduces future operational complexity, supporting SPT's licence duty to ensure network reinforcements are both technically robust and economic for consumers.
- 5.3.4 In addition, whilst the proposed substation would be industrial in appearance, it would be unmanned for the majority of its operational life, with personnel visits only likely for periodic maintenance or to address a fault. In this respect it would not align with the intent of the Fifeplan Local Plan policy 5: Employment and Property.
- 5.3.5 The review appraised the location in terms of how it performed against technical, environmental and deliverability criteria. The assessment drew upon available British Geological Survey (BGS) mapping, SEPA datasets, historic mapping records and published information relating to former opencast operations, together with engineering considerations specific to electricity transmission infrastructure.
- 5.3.6 Although the Former Westfield Opencast Mine Employment Area site benefits from a previously developed character and employment allocation, the engineering requirements of a high-voltage transmission substation differ significantly from typical commercial or industrial development. Substation platforms require stable ground conditions to maintain precise alignment tolerances for electrical equipment, minimise differential settlement, and ensure long-term operational reliability over an anticipated lifespan of decades. Consequently, ground certainty and predictable geotechnical performance are critical site selection factors.
- 5.3.7 The principal constraint associated with the former opencast site relates to ground conditions arising from historic extraction and restoration activities. Opencast mining typically results in extensive areas of reworked and backfilled material, often comprising made ground of variable composition, thickness and compaction. Such ground conditions can exhibit unpredictable settlement behaviour and may contain voids or weak zones. For development requiring heavy electrical plant and rigid structural tolerances (such as the proposed development), these

- conditions introduce elevated risks of differential settlement, structural distortion and increased maintenance requirements over time.
- 5.3.8 Development at this location would therefore be likely to require substantial ground investigation, potential excavation and replacement of unsuitable material, or adoption of engineered foundation solutions such as deep piling or ground improvement techniques. These measures would introduce additional construction complexity and extended programme durations compared with development on more naturally stable ground.
- 5.3.9 Hydrological and hydrogeological considerations represent a further potential constraint. Former quarry and opencast sites frequently exhibit altered groundwater regimes resulting from excavation below natural ground levels and subsequent infilling. At the former Westfield opencast site, the presence of standing waterbodies and mapped indications of elevated groundwater levels suggest that groundwater control measures may be required during construction, alongside permanent drainage infrastructure during operation.
- 5.3.10 For transmission infrastructure, which typically requires a self-draining and resilient platform capable of operating without reliance on active management systems, such conditions introduce long-term operational risk. The potential need for ongoing pumping or engineered drainage solutions would reduce operational resilience and increase maintenance requirements when compared with the preferred site.
- 5.3.11 Additional potential constraints associated with former extraction sites include the presence of residual contamination, ground gases, and significant level variations across the site. While these matters could potentially be addressed through further investigation and mitigation, they collectively introduce uncertainty at an early stage of project development and reduce confidence in programme certainty and deliverability.
- 5.3.12 When considered alongside the technical requirement to connect efficiently to existing transmission infrastructure, the former opencast employment area was not considered provide the same engineering or operational advantages as the preferred western extension site. Development at the quarry location would likely necessitate additional infrastructure works, increased lengths of new OHL and terminal towers, increased earthworks and more complex foundation solutions, resulting in greater environmental disturbance and higher delivery risk.
- 5.3.13 On a comparative basis, , it performs materially less favourably when assessed against the combined technical, environmental and deliverability criteria applied throughout the site selection process. The site is accordingly discounted from further consideration as a 'reasonable alternative'.

5.4 GIS v AIS

- 5.4.1 Air Insulated Switchgear (AIS) and Gas Insulated Switchgear (GIS) are different technologies used in the electricity industry, with AIS using air for insulation, requiring a larger footprint, lower initial cost and more frequent maintenance, while GIS uses inert gas, providing a compact, reliable, and low-maintenance solution at a higher upfront cost. Considerations include space availability, economic considerations, and environmental conditions, with AIS being suitable for larger sites, and GIS preferred for space-limited, high-pollution, or harsh environments.

- 5.4.2 In this case, both options were considered. However, an offline build of a 400kv, GIS, double busbar substation was the preference due to its lower capital cost, shorter delivery programme and reduced outage requirements, which maximises security of supply during construction and minimises operational costs. As the GIS systems requires less space it is also considered the most appropriate from an environmental perspective, reducing the footprint and extent of environmental impacts.
- 5.4.3 Having established the need for network reinforcement, alternative technical approaches were considered to deliver the required capacity upgrade. This included consideration of alternative substation technologies, such as GIS versus AIS, with reference to technical suitability, operational efficiency, and environmental constraints, as detailed above. Following the selection of the preferred technology, potential locations for the substation extension were assessed, taking into account environmental, technical, and operational factors, including proximity to the existing Westfield Substation, land availability, and potential impacts on the surrounding landscape.
- 5.4.4 This approach ensures that the EIA considers both the strategic need for network reinforcement and the most appropriate technical and locational solutions to deliver it, while providing a clear rationale for why the proposed extension represents the preferred alternative.

5.5 Environmental and Planning

- 5.5.1 Following identification of the technically feasible area of search and selection of a preferred western extension site, a detailed environmental and planning review was undertaken to confirm whether any environmental constraint existed that would either preclude development or indicate that an alternative location within or adjacent to the defined search area would be environmentally preferable.
- 5.5.2 This stage therefore represents a confirmation exercise, testing the preferred site against a comprehensive range of environmental considerations. The purpose of this assessment is to demonstrate that the selected location not only satisfies technical requirements but also represents a deliverable environmental solution achievable within those constraints.
- 5.5.3 Environmental considerations were applied consistently across topics to ensure that conclusions regarding site suitability were transparent and proportionate.

Planning

- 5.5.4 The preferred site lies outwith settlement boundaries and is therefore identified as Countryside under FIFEplan Policy 7. However, electricity transmission infrastructure is recognised as essential enabling infrastructure within national policy, and the principle of development in this location reflects the operational requirement to expand an existing substation rather than introduce new infrastructure into undeveloped areas:
- The site lies approximately 1km outside the settlement boundary of Ballingry, Lochore, Crosshill, and Glenraig.
 - The area north of the existing facility, and south of the B9097, forms part of a Green Network policy area route (Westfield – Kinglassie: ref KLSGN01).

- Some of the land west of the existing substation lies within a hazard pipeline consultation zone (Shell Expro St Fergus/Mossmorran NGL Pipeline), operated by Shell UK.
- The entire site is designated as a mineral search area, with low protection and high protection areas.

5.5.5 Importantly, these designations extend across the broader landscape surrounding the existing substation and do not uniquely affect the preferred site. As such, planning policy considerations did not identify a materially preferable alternative location within the area of search.

5.5.6 In contrast, siting development away from the established infrastructure corridor would introduce new development pressures elsewhere in the countryside, potentially increasing policy conflict. The preferred site therefore aligns with the planning principle of consolidating infrastructure where similar development already exists.

5.5.7 The site's location outside the settlement boundary means that, under FIFEplan Policy 7 (Development in the Countryside), the site is identified as 'Countryside'.

5.5.8 The entire site is a designated mineral search area on the FIFEplan. As is outlined within the Phase 1 Ground Investigation Report submitted in support of the application, a desk-based geological review indicates that the site is underlain by glacial till deposits over sedimentary bedrock of the upper limestone formation, with limited localised peat recorded toward the southern extent.

5.5.9 As set out in NPF4 Annex B, National Development 3 (Strategic Renewable Electricity Generation and Transmission Infrastructure), and as supported by NPF4 Policy 11 (Energy), there is an overriding need for electricity transmission infrastructure with these types of development considered to be of national importance. The UK and Scottish Governments have set legally binding targets to reach net zero in greenhouse gas emissions and end their contributions to climate change by 2050 and 2045 in the Climate Change Act 2008 and Climate Change (Scotland) Act 2009 respectively. Decarbonisation of the energy sector is a central pillar of both governments' net zero strategies meaning the way in which energy is generated, transported and used is undergoing transformational change.

5.5.10 As such, as required by Policy 33 (c) (i), there is an overriding need for the proposed development. Furthermore, prior extraction of the mineral cannot reasonably be undertaken. This is due to the presence of existing electrical infrastructure on the site, and timing related pressures - electrification and commissioning of the site is scheduled for October 2030, and there is no window within the construction programme for mineral extraction works. As such, the proposed development is in accordance with Policy 33 (c).

Ground Conditions

5.5.11 Desk-based geological review indicates that the preferred site is underlain by superficial Till deposits over sedimentary bedrock of the Upper Limestone Formation, with limited localised peat recorded toward the southern extent. These conditions are typical of the wider area and are not anticipated to introduce abnormal engineering constraints. Ground conditions therefore do not represent a limiting factor in site selection and allow standard engineering solutions to be implemented.

- 5.5.12 By comparison, the wider area presents conditions commonly associated with historic extraction and backfilling, including:
- Variable made ground of uncertain composition;
 - Potential voiding and differential settlement risk;
 - Increased requirement for deep or reinforced foundations; and
 - Uncertainty regarding long-term platform stability.
- 5.5.13 Given the need for precise tolerances and long-term stability associated with high-voltage electrical equipment, these uncertainties represent a significant comparative disadvantage. Ground conditions therefore positively informed selection of the preferred site.
- 5.5.14 The Coal Authority identifies the site as within a Coal Mining Reporting Area, but not a Development High-Risk Area. Historical mapping indicates the former Capledrae Colliery, approximately 225m north of the site.

Hydrology and Flood Risk

- 5.5.15 Hydrological review identified minor drains and unnamed watercourses to the south of the existing substation, alongside areas of potential pluvial flooding identified on SEPA mapping.
- 5.5.16 The preferred site benefits from relatively level topography and sufficient available land to incorporate drainage infrastructure within the site boundary. This enables a gravity-led drainage solution supported by Sustainable Drainage Systems (SuDS), reducing reliance on mechanical pumping and minimising long-term operational maintenance.
- 5.5.17 The ability to embed drainage mitigation within the layout was a key factor confirming environmental suitability.
- 5.5.18 In contrast, the former quarry contains large water bodies and evidence of altered groundwater regimes, which could require permanent management measures and introduce increased construction and operational risk. These factors reinforced the environmental preference for the western extension site.

Transport

- 5.5.19 The preferred site directly adjoins existing substation access arrangements connected to the B9097, an established route capable of accommodating abnormal loads and heavy goods vehicles associated with electricity infrastructure.
- 5.5.20 Utilising existing access infrastructure avoids the need for new road construction, reduces land take, and limits disturbance to surrounding land uses. Construction traffic effects are therefore concentrated within an established infrastructure corridor.
- 5.5.21 No alternative location within the area of search offered comparable access advantages. Development at a separate site would likely necessitate new access infrastructure, increasing environmental effects and land disturbance.

- 5.522 In terms of transport and access, the existing infrastructure surrounding the Westfield substation is not a constraint for development in this area. The site benefits from direct proximity to the B9097, which is an established route capable of accommodating the heavy goods vehicles (HGVs) and maintenance plant associated with energy infrastructure.

Cultural Heritage

- 5.523 No designated heritage assets are located within 1km of the site, and the proposed development would therefore have no direct impact on designated assets. Although assets exist in the wider landscape, their distance, and the intervening topography and vegetation, makes significant impact on their setting unlikely. Micro-siting in relation to designated assets is therefore not applicable.
- 5.524 The Fife County Historic Environment Record (HER) identifies seven non-designated buildings or archaeological sites within the Initial Study Area (ISA), mainly related to modern industrial activity, a possible 20th-century war camp, and isolated Roman and medieval finds. These are not considered significant enough to constrain the proposed development location.
- 5.525 No known heritage sites exist within the proposed extension area. Desk-based review, including historic mapping and aerial photography, indicates that the extension site has remained as open grassland since the mid-19th century. Therefore, the extension option is not constrained by direct effects on non-designated archaeological remains, although micro-siting provisions will be applied if previously unidentified remains are encountered.

Landscape and Visual

- 5.526 The site is situated within the Lowland Hills and Valleys (LCT 186), a character type defined by a variety of subtle landforms and expansive, medium-scale agricultural patterns. Locally, the landscape is characterised by a shallow 'bowl' or basin-like topography, with the site occupying relatively flat ground at approximately 85m aOD. This low-lying position, combined with rising ground and ridgelines to the north, south, and west, creates a sense of containment that naturally limits intervisibility with the wider landscape, confining the primary visual envelope to the immediate local context.
- 5.527 The surrounding area is heavily influenced by large-scale industrial and infrastructure elements. To the north lies the Westfield Energy Recovery Facility and associated reservoirs, while the eastern portion of the site is occupied by an existing electrical substation. The presence of OHL towers bisecting the site, alongside the nearby settlement of Ballingry to the west, provides a busy, functional, and industrialised context.
- 5.528 The site is defined by intensely managed arable farmland and a functional industrial footprint. Vegetation is primarily concentrated along field boundaries, consisting of a mix of treed hedgerows and stockproof fencing, with a notable embankment of vegetation running along the northern boundary with the B9097. While a triangular patch of rough grassland exists adjacent to the substation, providing some localised habitat variety, the overall fabric is considered to be in a modified condition with limited biodiversity value, dominated by the utilitarian presence of the substation's palisade fencing and electrical infrastructure.
- 5.529 Visual receptors are largely limited to users of the adjacent B9097 and nearby Core Paths, where views are often filtered by roadside planting. While more elevated, panoramic views are available

from the Upland Hills (LCT 182) to the north-west, the site is viewed from these distances as a small component of a wider landscape already characterised by energy infrastructure and urban development.

Summary

5.5.30 The environmental appraisal demonstrates that:

- No overriding environmental constraints affect the preferred site;
- Environmental considerations do not identify a superior alternative within the defined area of search; and
- Consolidation alongside existing infrastructure represents the option with the lowest overall environmental effect.

5.5.31 The preferred western extension site is therefore confirmed as both technically necessary and environmentally appropriate.

5.5.32 The environmental considerations are summarised in **Table 5.1** and relevant policy and environmental constraints illustrated on **Figure 6.3**.

Table 5.1: Environmental Site Selection Issues Summary

Environmental Consideration	Summary
Planning	There are allocations/designations within the FIFEplan, which should be considered including: • Green Network Policy Area Route (Westfield-Kinglassie: ref KLSGN01); • Hazard Pipe Consultation Zone (Shell Expro St Fergus/Mossmorran NGL Pipeline, operated by Shell UK); • Mineral Search Area; and • The existing Westfield Substation and surrounding area is outwith the settlement boundaries of Ballingry, Lochore, Crosshill and Glenraig.
Ground Conditions	Located within a Coal Mining Reporting Areas (but not a Development High Risk Area) but outwith past historical mining issues. Underlying geology generally comprises superficial deposits of Till underlain by sedimentary bedrock with some localised areas of peat.
Hydrology and Flood Risk	A series of drains and unnamed watercourses located to the south of the existing Westfield substation.
Transport	Existing vehicular access from the B9097 into the existing Westfield substation.
Noise	Noise sensitive receptors are located to the north-east of the existing substation.

Environmental Consideration	Summary
Cultural Heritage	No designated heritage assets within 1km of the existing Westfield substation. A number of non-designated buildings and archaeological sites located in proximity.
Landscape	Situated in a flat "bowl" at 85m aOD, the site is enclosed by ridgelines that naturally limit intervisibility and restrict the visual envelope to the local area. The baseline is defined by a busy industrial corridor, dominated by the existing substation, and prominent OHL towers.
Ecology	The site has low biodiversity value, with views primarily filtered by roadside embankments and field vegetation.

5.6 The Proposed 33kV Undergrounding of the Kelty – Cowdenbeath No.1 and No.2 Circuits

5.6.1 Other options were explored for routing the 33kV cables along the B9097 from the north-west of the substation. However, this option was not pursued due to the following factors:

- Significant ground elevation differences;
- The embankment of a dismantled railway;
- The need to cross an existing railway overbridge (constructed in the 1960s);
- The presence of three Scottish Water mains; and
- The existing road drainage system.

5.7 Temporary Drainage Scheme

5.7.1 The location and configuration of temporary SuDS associated with the construction of the substation has been informed principally by local topography, drainage characteristics and the availability of suitable land within proximity to the construction area. As such, there is limited scope for meaningful consideration of materially different locations at the EIA stage. The temporary SuDS will be positioned, as far as practicable, to make effective use of natural falls and provide appropriate treatment and attenuation of construction runoff, while avoiding unnecessary land take and environmental constraints. The detailed arrangement will therefore be refined during detailed design and construction planning, with the final solution selected to provide effective drainage while minimising environmental effects.

5.8 Design Evolution

5.8.1 The design of the proposed extension has evolved through an iterative and multidisciplinary process integrating engineering design, environmental assessment and stakeholder consultation.

Design evolution formed a core component of the alternatives process, ensuring that environmental effects were avoided or reduced wherever practicable rather than addressed solely through mitigation after design completion.

- 5.8.2 Rather than representing a fixed proposal assessed retrospectively, the final layout reflects successive refinements responding to emerging environmental information and technical constraints.
- 5.8.3 Initial layouts were informed by operational safety clearances, connection requirements to tower YJ085 and requirements for offline construction. These parameters defined the outer development envelope within which environmental optimisation could occur. The initial size parameter used for the proposed development was circa 100m x 100m, with an initial red line boundary extending only as far as the line of trees/the hedgerow to the south-west boundary as shown on **Image 5.1** below.

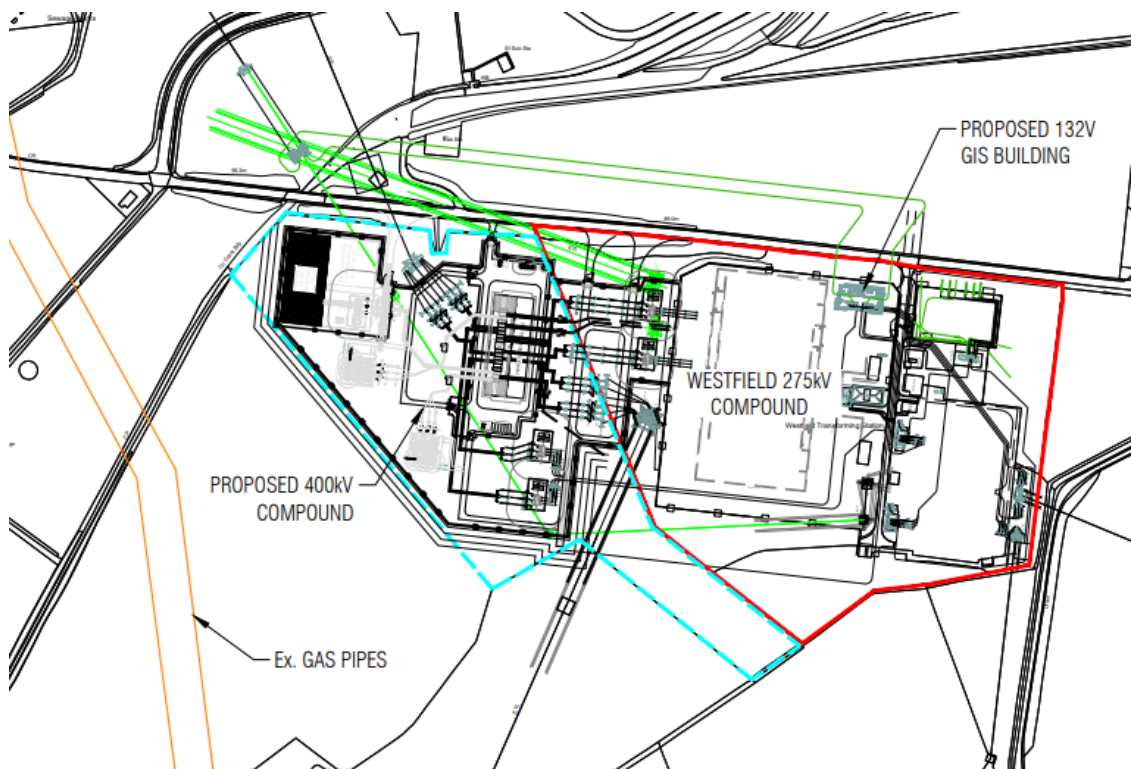


Image 5.1: Initial Westfield Substation Extension layout.

- 5.8.4 Following evolution of the substation design it became apparent that the site was not of a sufficient size to be able to accommodate the different elements of the proposed development, in particular the Customer Connections and general infrastructure. This required an increase in the red line boundary, extending to the south-west, as shown on **Image 5.2** below.

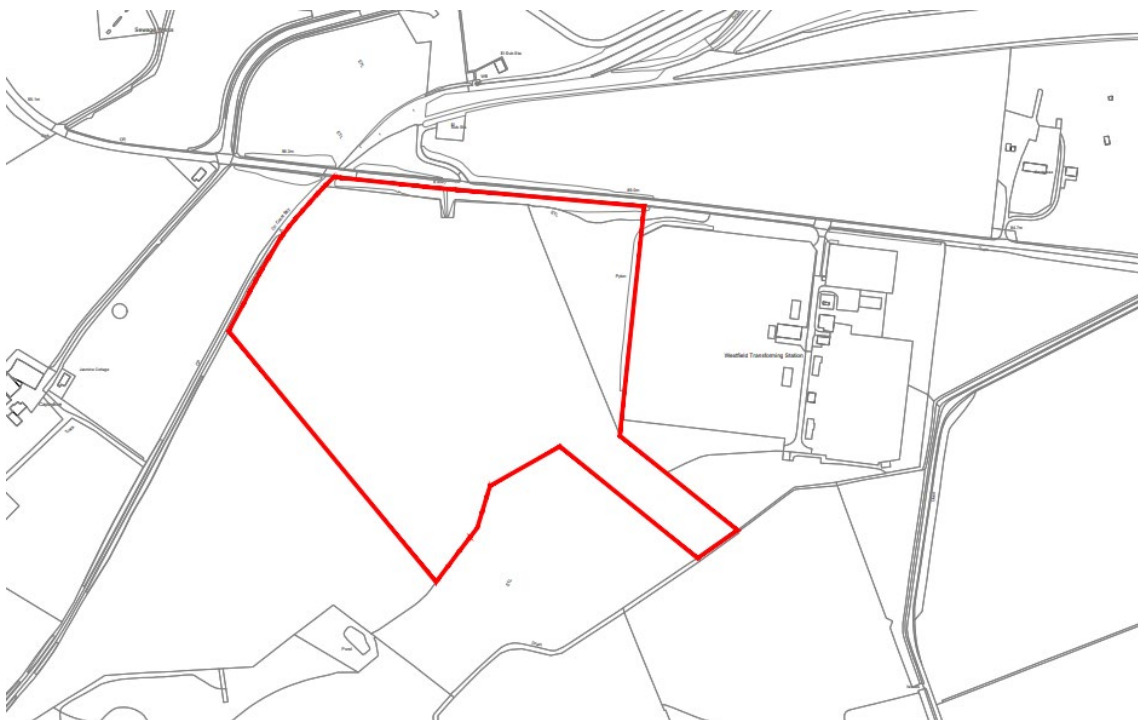


Image 5.2: Enlarged Red Line Boundary (1)

5.8.5 Whilst the above red line boundary was sufficiently sized to be able to accommodate the necessary infrastructure and customer connections, further iteration required a further extension to the south to accommodate proposed Sustainable Drainage solutions and proposed landscaping measures. This modest extension to the red line required an increase in the width of the 'spur' extending south-east to the existing ditch. In addition, the red line was extended east along the proposed access road to ensure all required works to facilitate access were included in the red line. This further extension is illustrated on **Image 5.3** below.



Image 5.3: Enlarged Red Line Boundary (2)

5.8.6 The final refinement of the red line boundary occurred later in the evolution of the design, and was enlarged to accommodate the changes required within the existing Westfield Substation, and specifically the reconfiguration of the 275kV elements. This red line is illustrated on **Image 5.4** below reflects the final and current red line boundary.

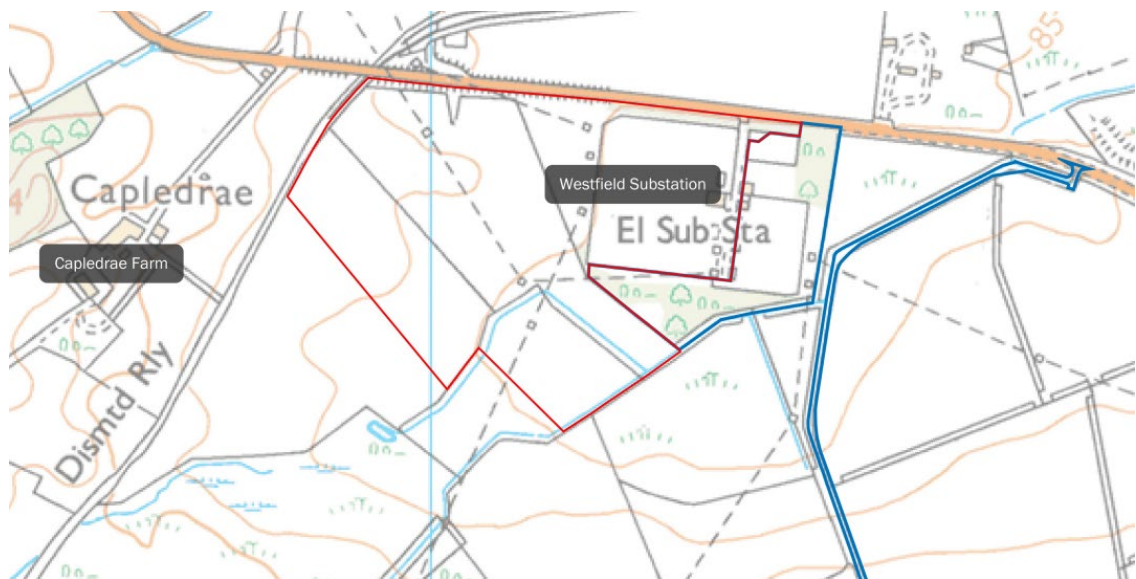


Image 5.4: Final Red Line Boundary

5.8.7 These design iterations explored alternative platform locations and infrastructure arrangements within the western area. Each iteration incorporated progressive refinements while responding to the technical constraints previously identified. The design process sought to balance engineering requirements with environmental and landscape considerations, with particular emphasis on the following objectives:

- Minimising cut-and-fill operations in order to reduce earthworks, limit landscape disturbance, and improve overall construction efficiency;
- Maximising the reuse of excavated material within the site to reduce off-site export and import of materials, thereby lowering environmental impacts associated with haulage and disposal;
- Refining the layout to retain existing vegetation belts and hedgerows wherever practicable, recognising their ecological, landscape, and visual screening value;
- Prioritising the retention of vegetation along the northern boundary to maintain established screening from the B9097 and nearby sensitive receptors;
- Using hydrological assessment findings to inform the relocation and configuration of drainage infrastructure, ensuring avoidance of sensitive features while enabling gravity-led discharge toward southern watercourses;
- Integrating Sustainable Drainage Systems (SuDS), including swales and filter drains, at an early design stage so that drainage features function not only as engineering infrastructure but also as landscape and environmental mitigation measures; and
- Evolving access arrangements to maximise the use of existing infrastructure and minimise the need for new ground disturbance. Construction working areas and temporary compounds were progressively repositioned during design development to reduce potential impacts on retained vegetation and drainage features.

- 5.8.8 Landscape mitigation measures were embedded as integral elements of the design from the outset, rather than being introduced as post-design additions. This integrated approach helped ensure that environmental considerations informed the overall layout and form of development. Key measures include:
- Landform modelling and the creation of landscaped bunding to assist visual integration and screening;
 - Retention and reinforcement of existing vegetation along the northern boundary to maintain effective screening; and
 - Careful siting and orientation of structures in response to local topography, allowing built elements to sit more naturally within the surrounding landscape.
- 5.8.9 Consultation with statutory and non-statutory stakeholders informed refinement of the layout, including consideration of environmental sensitivities and opportunities for mitigation.
- 5.8.10 The final design represents the environmentally optimised solution achievable within the operational and technical constraints of the transmission network. Environmental considerations have directly influenced layout, access, drainage and mitigation strategy, demonstrating that avoidance and reduction of environmental effects has been embedded throughout the project's development.