Restoration Project

NESO Driven Works EJP
Version: 1.0
11/12/2024

Restoration			
Name of Scheme	**Restoration**		
Investment Driver	Wider Works		
BPDT / Scheme Reference Number	SPT200875		
Outputs	• CB (Air Insulated Busbars) (OD) (6) • CB (Air Insulated Busbars) (OD) (-6) • Switchgear – Other (3) • Voltage Transformer (VT) (4) • Earth Switch (AIB) (5) • Disconnector (AIB) (-4) • Disconnector (AIB) (-2) • Voltage Transformer (VT) (1) • Voltage Transformer (VT) (-1) • Substation Cable - 1 core per phase (0.12) • Substation Cable - 1 core per phase (-0.12) • Wound Plant Protection (7) • Feeder Protection (1)		
Cost	£4.69m		
Delivery Year	October 2030		
Applicable Reporting Tables	BPDT (Section 5.1 – Project Meta Data, and Section 6.1 – Scheme C&V Load Actuals)		
Historic Funding Interactions	Previously needs approved under T2 scheme SPT200129		
Interactive Projects	N/A		
Spend Apportionment	**ET2**	**ET3**	**ET4**
	£0.12m	£4.57m	£0.00m

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1. Executive Summary

This engineering justification paper (EJP) sets out the continued need case for works across the SPT network to reduce switching risks under restoration conditions and support system restoration[1] within the shortest time possible. This is a continuation of the works previously approved within SPT's RIIO-T2 business plan under Ofgem Scheme Reference SPT200129, updated to reflect learning and system development since the RIIO-T2 planning period.

The works proposed in this project are as follows:

- At Coylton 275kV substation install a disconnecting circuit breaker (DCB), and two point on wave (POW) relays.
- At Currie 275kV substation install two circuit breakers, a disconnector and two POW relays.
- At Dalmarnock 275kV substation install a DCB and POW relay.
- At Denny North 275kV substation install a POW relay.
- At Easterhouse 275kV substation install a DCB and POW relay.
- At Smeaton 275kV substation install a DCB and a POW relay.

The total cost estimate of this project is £4.69m, and these works are currently programmed to be completed in October 2030.

This EJP is submitted for Ofgem's assessment of needs and cost for approval of baseline allowance within RIIO-T3 plan.

[1] In The Grid Code System Restoration is defined as "*the procedure necessary for a recovery from a Total Shutdown or Partial Shutdown*", while Total Shutdown is defined as "*the situation existing when all generation has ceased and there is no electricity supply from External Interconnections and, therefore, the Total System has shutdown…*".

2. Introduction

This EJP sets out SP Transmission's plans to continue with the Restoration programme of works set out in RIIO-T2 under SPT200129, with updates to reflect lessons learned within T2 delivery and system development plans. The project will upgrade five existing transmission sites, installing POW relays, DCBs and circuit breakers on key circuits and transformers to minimise switching risks under restoration conditions and support system restoration in the shortest time possible.

It should be noted this project is distinct from Transmission Upgrade – C&F DRZ (OSR SPT200914) also included within our RIIO-T3 plan. Both are required for completion within the period and complement each other with methods of restoration of the system.

3. Background Information

In the past, restoration plans for the SP Transmission (SPT) system relied on starting a large coal-fired generation unit from [redacted]. Following the closure of large Scottish Black Start capable power stations, Scotland is no longer able to recover more than a small portion of its demand without external assistance. In the case of a System Restoration event, this means that an extensive transmission 'spine' has to be energised during the restoration to connect Scotland to generation in England.

Very high inrush currents associated with transformer energisation are known to cause significant disturbances. The magnitude of the disturbance depends on the rating of the transformer, the point on wave where each breaker pole closes and the system fault level (i.e. system strength).

During system restoration, energising long lines and large transformers can cause very large transients which will significantly disturb a weak network and pose a significant risk to power island stability. These disturbances increase the risk to running generation which is at risk of trip due to operation of overvoltage protection. They therefore increase the risk of a shutdown of parts (or all) of the re-energised network, which in turn leads to potentially significant delays in achieving partial and full restoration of customer demand.

During RIIO-T2, a programme of works is ongoing to improve the capability of the system to manage the challenges of re-building the network through the following:

1. Reconfiguration of the network
    a. Segregate large transformers from spine transmission circuits to minimise switching disturbances
    b. Utilise circuit breakers with pre-insertion resistors or controlled point-on-wave switching to aid re-energisation of large plant from a weak system
    c. Improve substation flexibility – move away from back-to-back mesh substation arrangements and adopt double-busbar configurations
2. Ensure that plant is capable of delivering local system services that are critical during the recovery
    a. Provision of adequate voltage and frequency control
    b. Provision of adequate system strength (inertia and fault infeed)

The approved RIIO-T2 business plan proposal for restoration works was based on a phased approach and a number of site upgrades were planned to be undertaken within the RIIO-T3 period. This EJP

reaffirms the continued need, details the proposed interventions and requests the allowances required to complete these works.

Table 1: System Requirements and Design Parameters

System Design Table	Circuit/Project	Colyton 275kV	Currie 275kV	Dalmarnock 275kV	Denny North 275kV	Easterhouse 275kV	Smeaton 275kV
Thermal and Fault Design	Existing Voltage (if applicable)	275kV	275kV	275kV	275kV	275kV	275kV
	New Voltage	N/A	N/A	N/A	N/A	N/A	N/A
	Existing Continuous Rating (if applicable)	2000A	2000A	2000A	N/A	2500A	2000A
	New Continuous Rating	2000A	2000A	2000A	N/A	2500A	2000A
	Existing Fault Rating (if applicable)	40/40kA	40/40kA	40/40kA	N/A	40/40kA	40/40kA
	New Fault Rating	40/40kA	40/40kA	40/40kA	N/A	40/40kA	40/40kA
ESO Dispatchable Services	Existing MVAR Rating (if applicable)	N/A	N/A	N/A	N/A	N/A	N/A
	New MVAR Rating (if applicable)	N/A	N/A	N/A	N/A	N/A	N/A
	Existing GVA Rating (if applicable)	N/A	N/A	N/A	N/A	N/A	N/A
	New GVA Rating	N/A	N/A	N/A	N/A	N/A	N/A
System Requirements	Present Demand (if applicable)	N/A	N/A	N/A	N/A	N/A	N/A
	2050 Future Demand	N/A	N/A	N/A	N/A	N/A	N/A
	Present Generation (if applicable)	N/A	N/A	N/A	N/A	N/A	N/A
	Future Generation Count	N/A	N/A	N/A	N/A	N/A	N/A
	Future Generation Capacity	N/A	N/A	N/A	N/A	N/A	N/A
Initial Design Considerations	Limiting Factor	N/A	N/A	N/A	N/A	N/A	N/A
	AIS / GIS	AIS	AIS	AIS	N/A	AIS	AIS
	Busbar Design	N/A	N/A	N/A	N/A	N/A	N/A
	Cable / OHL / Mixed	N/A	N/A	N/A	N/A	N/A	N/A
	SI	No SI	No SI	No SI	No SI	No SI	No SI

4. Optioneering

Optioneering for the completion of these works was completed in the RIIO-T2 business plan submission. The works in this paper were identified, justified and in the RIIO-T2 Final Determination approved by Ofgem and this project is a continuation of these works, with updates based on lessons learned and network development since project conception. As a result, no further optioneering is detailed within this paper.

4.1 Preferred Option - completion of works across six identified sites

Table 2: Works in RIIO-T3

Site and Equipment	Voltage (kV)	Rating (MVA)	Works Required
Coylton SGT1	275/132	240	275kV DCB & POW
Coylton SGT2	275/132	240	POW
Currie - Sighthill 2 circuit	275	180	POW+Breaker+Disconnector 275kV
Currie SGT2A	275/132	240	POW+Breaker 275kV
Dalmarnock SGT1	275/132	240	275kV DCB & POW
Denny SGT3	275/132	240	POW
Easterhouse SGT1	275/33	120	275kV DCB & POW
Smeaton - Portobello – Shrubhill 2 circuit	275	120/120	275kV DCB & POW

Table 3: Summary of Considered Options

Options	Map	Layout of Substation/ Connection	Layout of all Route Works	Relevant Survey Works	Narrative Consenting Risks	Narrative Preferred Option	Narrative Rejection
Preferred Option: Installation of POW relays/DCBs/circuit breakers across six sites.	Refer to Appendix A	Refer to Appendix A	N/A	N/A	All works within existing substation footprints therefore no consenting risks.	Continuation of RIIO-T2 project.	N/A

Table 4: System Requirements and Design Parameters for the considered Options

System Design Table	Circuit/Project	**Preferred Options -** Installation of POW relays/DCBs/circuit breakers across six sites.	**Rejected – Baseline:** Do Nothing / Delay
Thermal and Fault Design	Existing Voltage (if applicable)	275kV	N/A
	New Voltage	N/A	N/A
	Existing Continuous Rating (if applicable)	3150A	N/A
	New Continuous Rating	3150A	N/A
	Existing Fault Rating (if applicable)	40/40kA	N/A
	New Fault Rating	40/40kA	N/A
ESO Dispatchable Services	Existing MVAR Rating (if applicable)	N/A	N/A
	New MVAR Rating (if applicable)	N/A	N/A
	Existing GVA Rating (if applicable)	N/A	N/A
	New GVA Rating	N/A	N/A

System Requirements	Present Demand (if applicable)	N/A	N/A
	2050 Future Demand	N/A	N/A
	Present Generation (if applicable)	N/A	N/A
	Future Generation Count	N/A	N/A
	Future Generation Capacity	N/A	N/A
Initial Design Considerations	Limiting Factor	N/A	N/A
	AIS / GIS	AIS	N/A
	Busbar Design	N/A	N/A
	Cable / OHL / Mixed	N/A	N/A
	SI	No SI	N/A

5. Proposed Works & Associated Cost

Within the RIIO-T2 EJP for this project, EJP reference EJP_SPT_SPT200128, the following works were identified for completion in the RIIO-T3 period.

Table 5: Proposed sites within RIIO-T2 EJP for delivery in RIIO-T3 Period

Site and Equipment	Voltage (kV)	Rating (MVA)	Works Required
Coylton SGT1	275/132	240	275kV DCB & POW
Coylton SGT2	275/132	240	POW
Currie – Sighthill 2 circuit	275	180	275kV DCB & POW
Currie SGT2	275/132	240	POW+Breaker 275kV
Dalmarnock SGT1or2	275/132	240	275kV DCB & POW
Denny SGT3	275/132	240	275kV DCB & POW
East Kilbride SGT1	275/33	120	275kV DCB & POW
Easterhouse SGT1	275/33	120	275kV DCB & POW
Glenrothes SGT1	275/33	120	275kV DCB & POW
Glenrothes SGT2	275/33	120	275kV DCB & POW
Kaimes SGT2	275/33	120	POW
Smeaton – Portobello – Shrubhill 2 circuit	275	120/120	POW+Breaker 275kV

As the RIIO-T2 project has been delivered to align with the wider portfolio of works across the network, both East Kilbride and Kaimes have been brought forward to deliver within the T2 period. Additionally, Glenrothes has been identified as no longer required due to the network reconfiguration through wider works project TKUP, which will establish a new 400kV substation on the circuits from SSEN-T's area which will in turn supply the existing Glenrothes 275kV substation. Appropriate circuit breakers and relays will be installed at the new proposed substation (Conland 400kV substation) as part of the TKUP project. Currie SGT2 (now Currie SGT2A due to development at Currie) has been completed within RIIO-T2 period to better align with the Local Joint Restoration Plan (LJRP) instead of Currie SGT3 (originally identified for completion in the T2 period), therefore Currie SGT3 will now be completed in T3.

Further, Denny North has developed since the RIIO-T2 planning timescales, no DCB is now required on Denny SGT3 as per the above due to existing circuit breakers, therefore only a POW relay is required. At Smeaton 275kV substation, there is space limitation preventing the installation of a circuit breaker in addition to existing disconnector, therefore it is proposed to replace the existing disconnector and proposed circuit breaker with a DCB.

The resulting project therefore requires the following, explained in further detail in Project Summary below.

Table 6: Requirements in RIIO-T3

Site and Equipment	Voltage (kV)	Rating (MVA)	Works Required
Coylton SGT1	275/132	240	275kV DCB & POW
Coylton SGT2	275/132	240	POW
Currie – Sighthill 2 circuit	275	180	POW+Breaker+Disconnector 275kV
Currie SGT3	275/132	240	POW+Breaker 275kV

Dalmarnock SGT1	275/132	240	275kV DCB & POW
Denny SGT3	275/132	240	POW
Easterhouse SGT1	275/33	120	275kV DCB & POW
Smeaton – Portobello – Shrubhill 2 circuit	275	120/120	275kV DCB & POW

5.1. Project Summary

Pre-Engineering Works

The following list is indicative based on previous experience of such projects and as such should not be read as definitive. The following surveys will be carried out, where appropriate:

- Topological survey of the sites.
- GPR survey of areas to be re-excavated to validate approximate locations of buried services.
- Ground bearing capacity checks.

Coylton 275kV Substation

- Remove existing H53.
- Install 275kV DCB and associated earth switch on HV side of Coylton SGT1.
- Fit PoW on new DCB.
- Fit PoW on existing 275kV circuit breaker L40.

Currie 275kV Substation

- Install 275kV circuit breaker and associated disconnector and earth switches on Currie – Sighthill 2 circuit.
- Install 275kV circuit breaker and associated earth switches on HV side of Currie SGT3.
- Fit PoW on both new circuit breakers.

Dalmarnock 275kV Substation

- Remove existing 275kV disconnector H13A.
- Install 275kV DCB and associated earth switch on 275kV side Dalmarnock SGT1.
- Fit PoW on new DCB.

Denny North 275kV Substation

- Fit PoW on existing 275kV circuit breaker H140 (SGT3 circuit).

Easterhouse 275kV Substation

- Remove existing H13.
- Install 275kV DCB and associated earth switch on HV side of Easterhouse SGT1.
- Fit PoW on new DCB.

Smeaton 275kV Substation

- Remove existing L23.
- Install 275kV DCB and associated earth switch on Portobello / Shrubhill 2 circuit.
- Fit PoW on new DCB.

5.2. Project Cost

5.2.1. Estimated Total Project Cost

A Business Plan provision and estimated cost of the Restoration project is indicated in the following table. Costs provided below are "direct costs", so neither risk contingency nor indirect costs have been included.
Project costs for each site within the Restoration project are summarised in the cost breakdown below:

Table 7: Project Cost Breakdown

Item	Description	[redacted]
1	Overhead Line and Underground Cable	
2	Protection and Control	
3	Coylton	
4	Currie	
5	Dalmarnock	
6	Easterhouse	
7	Smeaton	

Expenditure incidence is summarised below:

Table 8: Summary of Expenditure Incidence (£m, 2023/24)

Energisation Year	Yr. 2026: Direct CAPEX	Yr. 2027: Direct CAPEX	Yr. 2028: Direct CAPEX	Yr. 2029: Direct CAPEX	Yr. 2030: Direct CAPEX	Yr. 2031: Direct CAPEX	RIIO-T2 Total: Direct CAPEX	RIIO-T3 Total: Direct CAPEX	Total: Direct CAPEX
2030	£0.12	£0.13	£0.73	£1.57	£1.62	£0.54	£0.12	£4.57	£4.69

5.3. Regulatory Outputs

The primary asset outputs for this project are identified in table below. Note, this is exclusive of risk and indirects.

Table 9: Primary Asset Outputs

Asset Heading	Asset Category	Asset Sub-Category Primary	Voltage	Intervention	Volume Measure	Units	Volume	[redacted]
Assets	Circuit Breaker	CB (Air Insulated Busbars) (OD)	275kV	Addition	Addition	Each	6.00	
Civils	Circuit Breaker	CB (Air Insulated Busbars) (OD)	275kV	Addition	Addition	Each	6.00	
Assets	Circuit Breaker	Switchgear - Other	<=33kV	Addition	Addition	Each	3.00	
Assets	Instrument Transformers	Voltage Transformer (VT)	33kV	Addition	Addition	Each	4.00	

								[redacted]
Assets	Other switchgear	Earth Switch (AIB)	275kV	Addition	Addition	Each	5.00	
Assets	Other switchgear	Disconnector (AIB)	275kV	Replacement	Disposal	Each	-4.00	
Assets	Other switchgear	Disconnector (AIB)	275kV	Replacement	Addition	Each	2.00	
Assets	Instrument Transformers	Voltage Transformer (VT)	275kV	Replacement	Addition	Each	1.00	
Assets	Instrument Transformers	Voltage Transformer (VT)	275kV	Replacement	Disposal	Each	-1.00	
Assets	Cable	Substation Cable - 1 core per phase	<=33kV	Replacement	Addition	km	0.12	
Civils	Cable	Substation Cable - 1 core per phase	33kV	Replacement	Addition	km	0.12	
Protection	Protection & Control	Wound Plant Protection	275kV	Replacement	Addition	Each	7.00	
Protection	Protection & Control	Feeder Protection	275kV	Replacement	Addition	Each	1.00	

5.4. Environmental and Consents Works

There are no expected environmental and consents works anticipated for the completion of this project, as all works are within existing substation sites. Environmental surveys will be completed where required and works planned accordingly.

6. Deliverability

We have applied SPT project management approach to ensure that this project work is delivered safely, and in line with the agreed time, cost and quality commitments. We have a proven track record of delivering essential transmission network upgrade projects and will draw upon this knowledge and experience to effectively manage these works. We will assign a dedicated Project Manager to the works at every stage who is responsible for overall delivery of the scope and is the primary point of contact for all stakeholders.

6.1. Delivery Schedule

A standard approach has been applied to the planning phase of these works and that will continue for the reporting and the application of processes and controls throughout the lifecycle. Table below summarises the key milestones within the delivery schedule of the Restoration project. A full project programme can be found in Appendix B.

It should be noted that where possible, works and outages have been aligned with ongoing works at each site, however as our portfolio of works develops this will be kept under review to ensure the most efficient delivery at each site, therefore the programme as shown is subject to change.

Table 10: Summary of Key Milestones within the Project Delivery Schedule

Item	Project Milestone	Estimated Completion Date
1	Pre-Design Surveys	July 2025
2	SCA Approved	July 2026
3	Tender Design and Technical Specification	February 2027
4	Contract Award (DCB/CB)	October 2026
5	Contract Award (POW Relay)	April 2027
6	Site Start	March 2028
7	Plant Commissioned	October 2030

Regular meetings with the Project and Construction Management Teams shall be undertaken to assess the ongoing effectiveness of the Project Management interfaces.

The Project Manager will facilitate internal Project Team Meetings, in which project progress and deliverables will be reviewed and any arising risks or issues will be discussed and addressed.

6.2. Risk and Mitigation

A Project Risk Register will generated collaboratively during the initial project kick-off meeting to identify any risks, which if realised, could result in deviation from the delivery plan. Mitigation strategies will be developed to manage the risks identified and these will be implemented by the Project Manager (PM). The risk register shall remain a live document and will be updated regularly by the project team. Currently, the top scheme risks are:

- Interaction with ongoing works at each site – this will be mitigated by monitoring of overall portfolio of works, and interaction with PMs of co-located works.
- Retrofit of POW relays on existing breakers – flagged as a lesson learned from RIIO-T2 project. Mitigation of this risk is early site surveys and, where required, early engagement with manufacturers for retrofit options.

6.3. Quality Management

SPT adopts a 'life cycle' approach to Quality Management in major project delivery. Our Management Systems are certified to ISO 9001, ISO 14001 and ISO 45001. The key quality management areas are detailed below:

6.3.1. Quality Requirements During Project Development

Any risk or opportunity that may affect the quality of the product are detailed in the Project Risk Register. The suppliers of main equipment may also receive a Factory Acceptance Test Inspection when the asset is being built.

6.3.2. Quality Requirements in Tenders

Each contract that SPT issues has a standard format. Specifically in relation to quality, this will include a Contractors' Quality Performance Requirement (CQPR). This CQPR represents a specification that details roles and responsibilities for all parties during the works, frequency and format of reporting. It will also specify the document management process to be adhered to during

the delivery of the project. In addition to the CQPR, each project has a contract specific Quality Management Plan, detailing the inspection and testing regime for works as well as the records to be maintained.

6.3.3. Monitoring and Measuring During Project Delivery

SPT Projects undertake regular inspections on projects to monitor and measure compliance with SPT Environmental, Quality and Health and Safety requirements, as detailed in the contract specifications for the work. This also includes oversight of contractors. All inspections are visual, with the person undertaking the inspection ensuring that evidence of the inspection and any actions raised are documented.

The following inspections are completed:

- Quality Inspections (monthly)
- Environmental Inspections (monthly, with weekly review by third party Environmental Clerk of Works)
- Safety Assessments & Contractor Safety Inspection (daily, with full time Site Manager)
- Project Management Tours (monthly)

The scope of audits and inspections is set to ensure compliance with the following:

- Procedures & Guides
- Planned arrangements for ISO 9001, 14001 & 18001
- Legal and other requirements.

6.3.4. Post Energisation

SPT Projects and SPT Operations carry out a Defect Liability Period Inspection within the Contract Defect Liability Period with the aim of identifying any defects and rectifying them with the contractors.

6.4. Environmental Sustainability

IMS-01-001 encompasses all activities undertaken within and in support of SP Energy Networks three Licences. This includes operational and business support functions concerned with management of SP Transmission, SP Distribution and associated regulatory and commercial interfaces, products, services and their associated environmental, social and economic impacts. The policy makes the following commitments which shall be respected in any works associated with this scheme.

SP Energy Networks will incorporate environmental, social and economic issues into our business decision-making processes, ensuring compliance with or improvement upon legislative, industry, regulatory and other compliance obligations. We will deliver this by being innovative and demonstrating leadership on the issues which are important to us and our stakeholders, and will:

- Ensure the reliability and availability of our Transmission and Distribution network whilst creating value and delivering competitiveness by increasing efficiency and minimising losses.
- Reduce greenhouse gas emissions in line with our Net Zero Science Based GHG target, which is a target of 90% reduction in GHG emissions by 2035 (TBC) from a 2018/19 baseline.
- Integrate climate change adaptation requirements into our asset management and operations processes to support business resilience and reduce the length and time of service interruptions.

- Consider whole life cycle impacts to reduce our use of resources to sustainable levels, improve the efficiency of our use of energy and water and aim for zero waste.
- Improve land, air and watercourse quality by preventing pollution and contamination and protecting and enhancing biodiversity in our network areas.
- Improve our service to local communities, supporting their economic and social development, protecting vulnerable customers, and respecting human rights.

ENV-04-014 gives specific guidance on the management of incidents with environmental consequence, or potential for environmental consequences, over and above the general requirements for the management of incidents.

6.5. Stakeholder Engagement

SPT is committed to delivering optimal solutions in all the projects we undertake. A key part of this is engaging with relevant stakeholders throughout the project development and delivery process. Stakeholders can include customers, regulatory bodies and other statutory consultees, national and local government, landowners, community groups, and local residents and their representatives (e.g., MPs, MSPs and councillors). Community impacts associated with construction activities are considered at project initiation by completion of a Community Communications Plan, which details the stakeholders relevant to the project, the communication channels that will be used to engage with them, the information that will be provided to and sought from them, and the timescales over which this will happen. It considers any sensitivities that may require increased stakeholder consultation and details specific events that will be held with stakeholders during the development of the project.

As part of this project, SPT will engage with statutory consultees associated with the planning application for these works - the Local Authority, SEPA and Nature Scot - and the third-party landowner.

Due to the location and nature of this project, no particular sensitivities or community impact issues have been identified, but a general level of interest from local representatives has been noted and we will continue to engage with them throughout the project. Stakeholder engagement to date has informed the details of the construction and permanent drainage details for the works.

7. Conclusion

This EJP demonstrates the need to complete works identified within RIIO-T2.
The main conclusions of this EJP are:

- It is necessary to invest in transmission infrastructure at six key existing sites as a continuation of the works completed within RIIO-T2.
- The proposed reinforcement scheme plays a vital role minimise switching risks under restoration conditions and support System Restoration in the shortest time possible.

This EJP is submitted for Ofgem's assessment of needs and cost for approval of baseline allowance within RIIO-T3 plan.

8. Appendices

Appendix A – Maps and Diagrams

Appendix B – Project Delivery Schedule

Appendix A: Maps and Diagrams

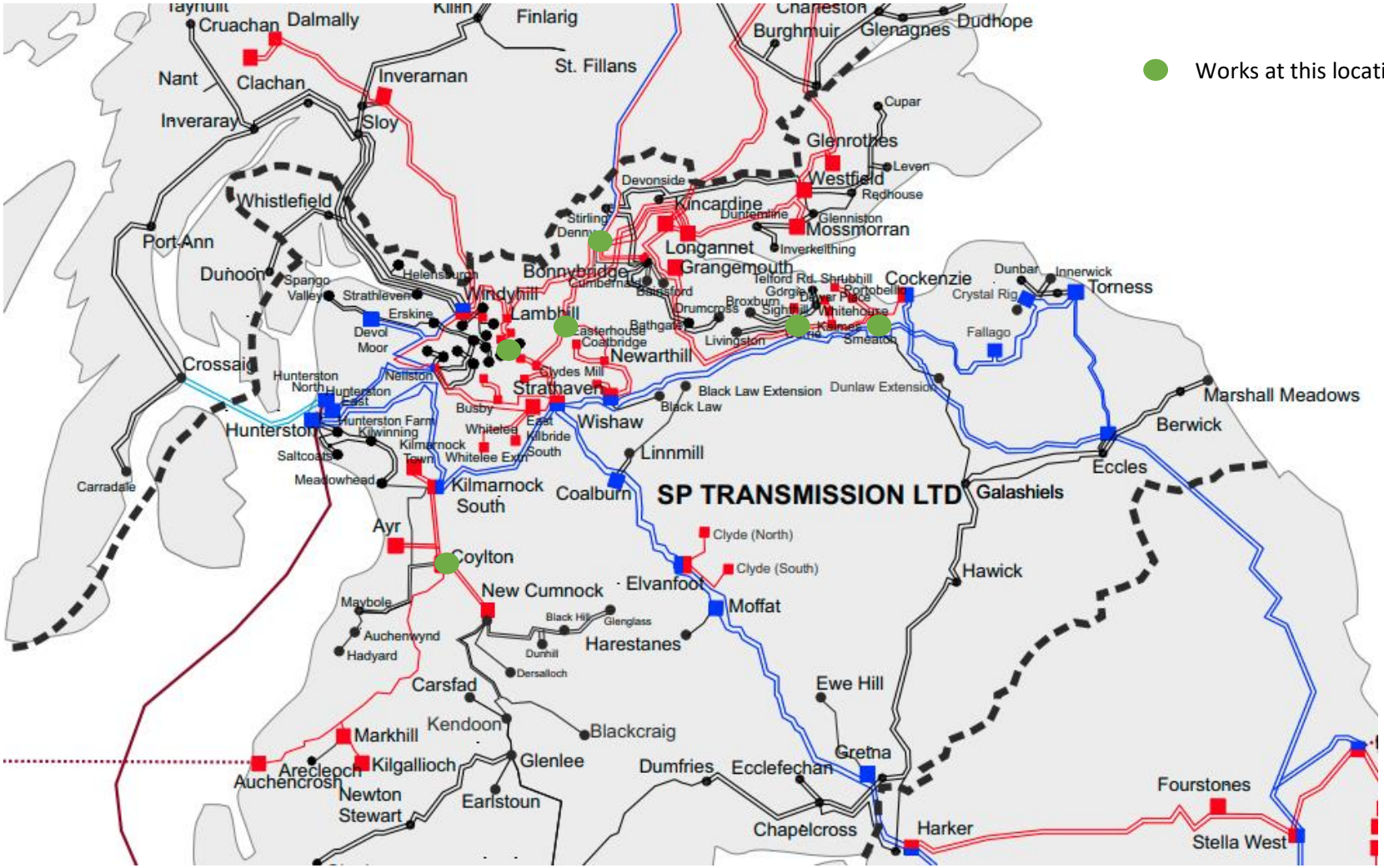

Figure A: Locations of works to be completed in RIIO-T3 Period