Regional Development Plan

Walpole GSP - Peterborough (EPN)

Planner	Peter Rye
Version	2.0
Date	13/03/2014

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

Document History

Version	Date	Revision Class	Originator	Section Update	Details
1.2	13/03/2014	Major	Peter Rye	1.2, Appendix D	Expenditure aligned to the 19th February 2014 NAMP version J less indirect costs.
1.2	13/03/2014	Major	Peter Rye	1,2,3,4,5	RDP narrative updated to reflect latest position
1.2	1303/2014	Major	Peter Rye	1.2, Appendix E, Appendix F	LI and HI output measures updated in line with current NAMP plan and RIG tables
1.2	13/03/2014	Minor	Peter Rye	2.2	Network changes in progress updated to reflect interventions to date
1.2	13/03/2014	Major	Peter Rye	4	Recommended strategy reflects latest position
1.2	13/03/2014	Major	Peter Rye	Appendix G, Appendix I	Generation activity reflects latest position
1.2	20/03/2014	Minor	Steve Mould	All sections	All sections checked for consistent section numbering, content etc.

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Contents

1 Executive Summary

This Regional Development Plan (RDP) reviews UK Power Networks (UKPN) EPN HV and EHV network in the Peterborough area, supplied from Walpole Grid Supply Point (GSP).

The 132kV network from Walpole to Peterborough also feeds Grid Substations at Walsoken and March, which are covered by RDP01, which therefore has an influence on the strategy for the 132kV network feeding Peterborough.

The most significant load in the area is the city of Peterborough itself, although the strategy also extends to the immediately surrounding area.

The key infrastructure in the area is Peterborough Power Station (420MW CCGT), and the traction supplies at BR Nene and BR Bretton which feed the East Coast Main Line railway. However, the power station only operates intermittently at present.

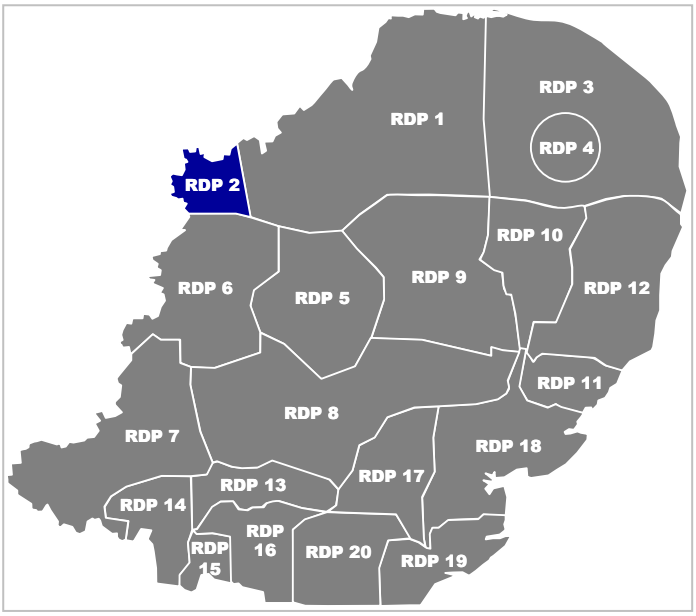


Figure 1 – Area covered by the RDP

Network Rail were considering replacing the 132kV feeder stations with larger 400kV stations and auto-transformers, but it now seems more likely that they will actually be requesting additional capacity for the 132kV stations.

1.1 Summary of issues addressed

Peterborough City Council is keen to see the area develop, and there have been some ambitious plans for growth in the past, although little of this has materialised so far due to the economic situation. There are several housing developments presently under way, although these are not expected to have a significant effect on demand.

The most significant current development is a proposed new commercial / industrial park in the southwest area of the city. This has an estimated peak demand of 18MVA and is proposed to be supplied as an 'inset' network from an IDNO-owned primary substation that will be supplied at 33kV from Peterborough Central Grid.

There is also a significant volume of renewable generation proposals in the area which will have an effect of the operation of the network in future. This area therefore forms part of the 'Flexible Plug & Play' trial area, which is designed to facilitate the connection of such generation.

P2/6 analysis of the 132kV network feeding Peterborough from Walpole does not show any major issues in the near future, but it is anticipated that additional 132kV circuit capacity will be needed in around 10 years time. It is anticipated that the most cost-effective solution to this issue will be to establish a new GSP to the North of the city.

1.2 Recommended strategy

There are no plans to make any fundamental changes to the topography of the network in the area. The proposed strategy therefore primarily consists of dealing with reinforcement issues as they occur, as it is difficult to put any likely timeframe to the proposed developments due to the economic situation.

There are reinforcement schemes proposed for a number of sites across the city which will address the immediate issues, but it is also anticipated that some new substations may need to be developed over time, and

it may therefore be advisable to consider the purchase of suitable 'reserved' sites in the near future as land could become very scarce and expensive as and when the economy recovers.

Investment Profile

The Figure below provides the projected expenditure profile for reinforcement and asset replacement projects (LRE and NLRE) in this RDP for both DPCR5 and ED1. This information is taken from the NAMP version 19th February 2014.

Type	DPCR5 2013-15	2015 /2016	2016 /2017	2017 /2018	2018 /2019	2019 /2020	2020 /2021	2021 /2022	2022 /2023	RIIO-ED1 Total
LRE	£8.0m	£0.8m	£0.9m	£1.3m	£0.1m	£0.7m	£2.6m	£1.9m	£0.0m	£8.4m
NLRE	£0.4m	£1.1m	£0.0m	£0.0m	£0.0m	£0.0m	£0.0m	£0.0m	£0.0m	£1.1m
TOTAL	£8.4m	£1.9m	£0.9m	£1.3m	£0.1m	£0.7m	£2.6m	£1.9m	£0.0m	£9.4m

Table 1. LRE and NLRE expenditure profile

Output Measures

The figure below provides the expected Load Indices (LI) for all substations covered in this RDP at the end of the ED1 period (2022/23). Substations with a projected load index of LI4 and LI5 will be specifically targeted for improvement and are detailed in this document, with the resulting improvement also shown in the figure below.

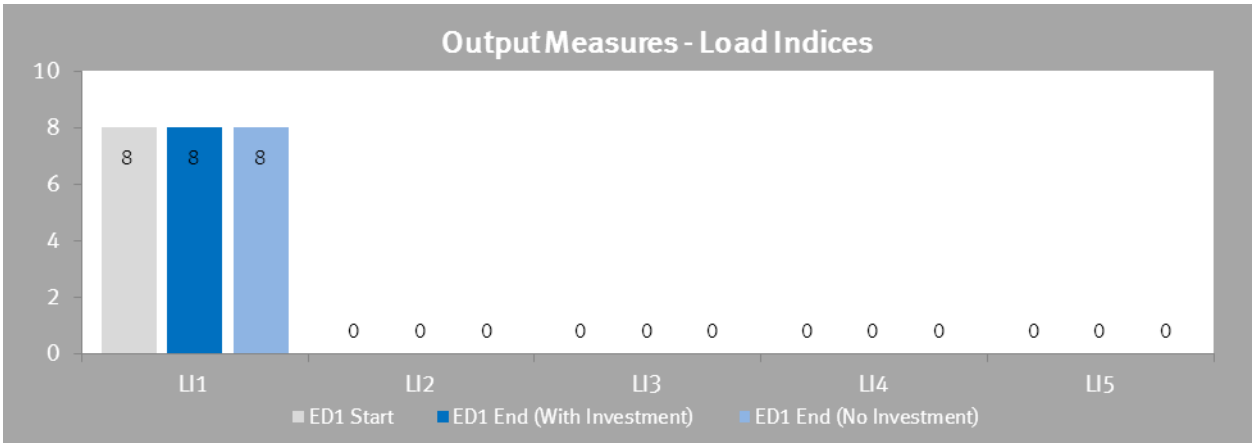
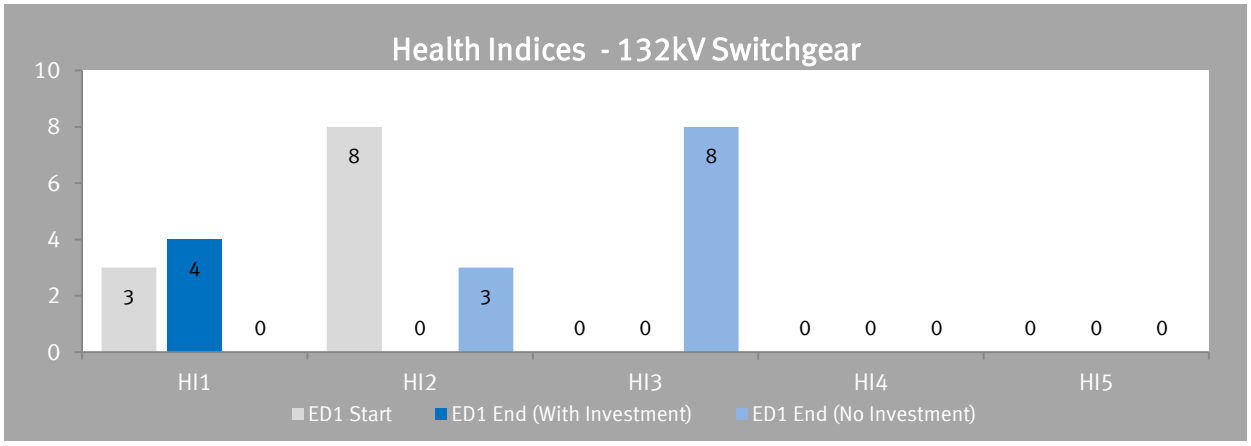


Figure 2. Load Indices (LI)

The figures below provides the projected health index of various assets covered in this RDP at the beginning and end of ED1, with and without interventions as defined in the NAMP under asset replacement.



All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

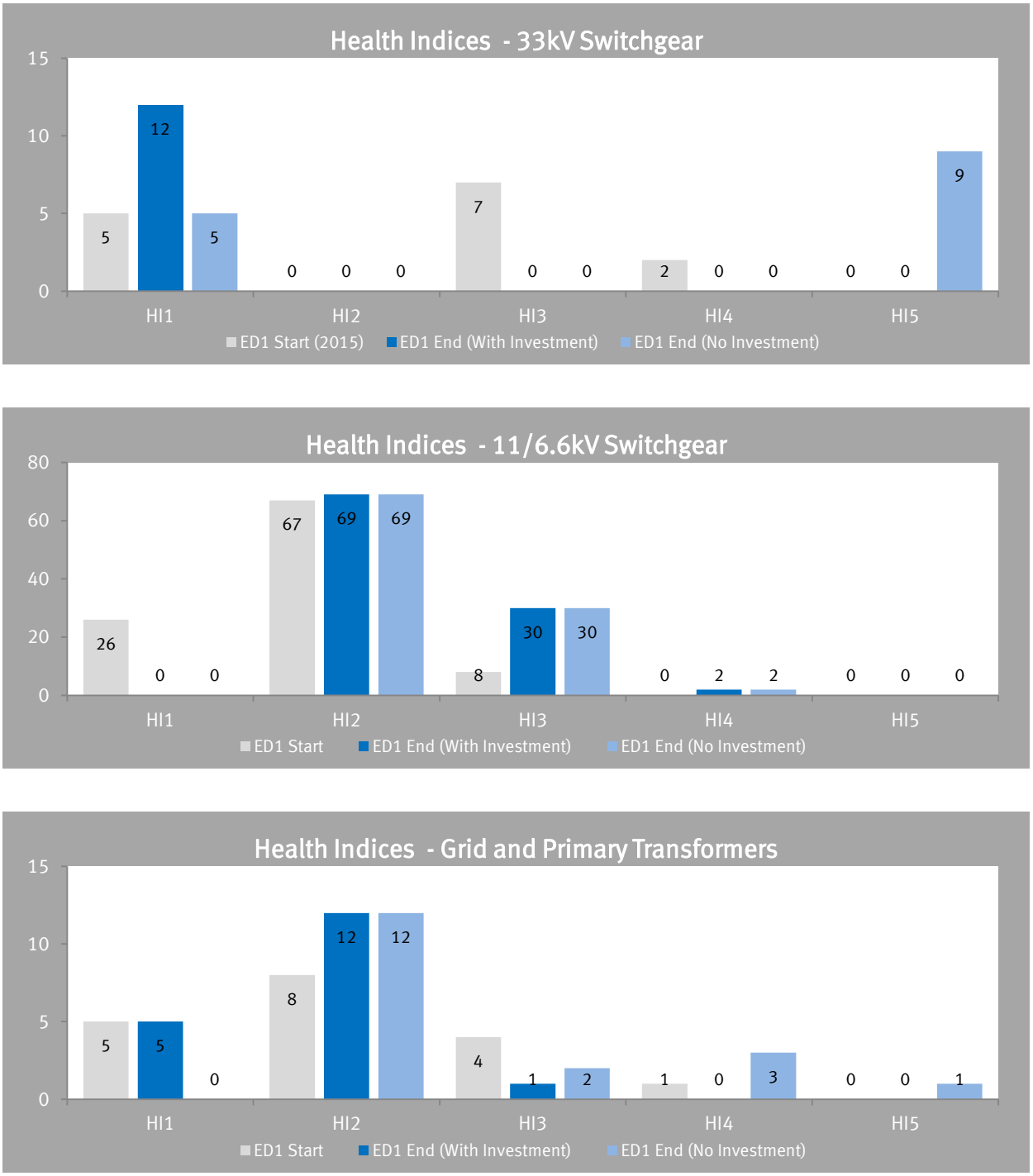


Figure 3. Health Indices by asset category

Scenarios considered

- Demand growth from Planning Load Estimates (PLE's) up to 2023.
- Major Generation sites disconnected.

- Compliance with P2/6 Standard for Security of Supply and operational flexibility of the 132kV network.

RDP Dependencies and Interactions

The 132kV network feeding the area covered by this RDP also feeds two grid substations that form part of the area covered by 'RDP01 – Walpole'. As a result there will be a degree of interaction between the two documents as actions affecting this network could have implications for both areas.

UK Power Networks are presently undertaking the 'Flexible Plug & Play' project that is presently being undertaken with funding from the Ofgem Low Carbon Networks Fund, which is designed to trial options to facilitate the connection of distributed generation to the network. The area chosen for this trial is the network between Peterborough and March, which spans both of the RDP areas and will therefore also introduce interaction between them.

2 Network configuration

2.1 Existing network

This Regional Development Plan covers the city of Peterborough and the immediately surrounding area. The area is supplied at 132kV from Walpole GSP (approximately 35km to the East) by two dual-circuit 132kV overhead lines.

One line runs direct from Walpole to Peterborough Power Station, with a teed connection to Peterborough East. The other line runs from Walpole to Peterborough Central and Peterborough South (via Walsoken and March which are covered by RDP01) with a teed connection to Peterborough Power Station.

From Peterborough Power Station a further dual circuit line runs via Peterborough Central to Peterborough North, with one circuit then continuing into the 'Western Power Distribution – East Midlands' area at Stamford. This network is also supplied from Walpole GSP and the entire 132kV network is presently run interconnected.

The majority of the city area is supplied by 132/11kV transformation (Central, East, South and North substations), with the periphery and surrounding area supplied by 33/11kV substations (Orton, Farcet and Funtham's Lane) which are fed from a 132/33kV installation at Peterborough Central. There are 33kV interconnections to March Grid and Huntingdon Grid, but these cannot support the 33kV demand in the Peterborough area.

There are also two Network Rail traction supplies (feeding the East Coast Main Line). One of these is situated at Peterborough Central and the other is just to the north of Peterborough North. However, although this second site is within the UKPN area it is actually supplied at 132kV from the WPD network.

Geographic diagrams and single line diagrams (SLD) are available in the Appendices.

Embedded Generation

There are a number of existing generators embedded in the network in this area. The most significant ones are listed below.

- Peterborough Power Station (132kV, 390MW)
- Glassmoor Windfarm (33kV, 16MW)
- Red Tile Windfarm (33kV, 10MW)
- McCains Factory (11kV, 9MW embedded in customer's 11kV network)

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2.2 Network changes in progress

The schemes below are either in progress or due to be completed prior to 2015. The expenditure profile for these projects is included in Appendix E.

Orton 33/11kV Primary Substation - ITC (2 x 18/30/40MVA)

The predicted load at Orton substation will exceed the existing firm capacity, including the transfer capacity to Peterborough South substation. It is therefore proposed to replace the existing transformers with larger units. The existing switchgear is not fully rated for this increased load. It is therefore proposed to replace this switchgear. The existing circuits supplying the transformers are not fully rated for the larger units. It is therefore proposed to replace a section of both of these circuits.

Completion of this project will see the two existing transformers replaced with two new transformers, the existing switchboard replaced with a new switchboard comprising eleven circuit breakers and two new 1km underground circuits.

Farcet 33/11kV Primary Substation - ITC (2 x 12/24MVA)

The predicted load at Farcet Primary substation will exceed the existing firm capacity, including transfer capacity, to Peterborough South Substation. It is therefore proposed to replace the existing transformers with larger units. The existing switchgear is fully rated for this increased load. The existing circuits supplying the transformers are fully rated for the larger units.

Completion of this project will see the 2 existing transformers replaced with 2 new transformers.

Peterborough Central 132/33kV Grid Substation - ITC (2x90MVA)

Peterborough Central 33kV is equipped with two 60MVA 132/33kV transformers that were manufactured in 1960. The latest condition assessment of these transformers predicts that they will require replacing circa 2017. As the load is expected to exceed 60MVA in time, it is planned to replace them with new 90MVA units.

Completion of this project will see the 2 existing transformers replaced with 2 new transformers.

Peterborough Central 132/33kV Substation - replace 33kV Switchgear (2000A)

The predicted load at Peterborough Central Grid Substation will exceed the rating of the existing switchgear. It is not possible to lower the load without compromising operational and planning requirements. It is therefore proposed to replace the switchgear.

Completion of this project will see 10 circuit breakers replaced

3 Summary of issues

3.1 Development areas

Load

The City of Peterborough is controlled by Peterborough City Council (PCC), which is a Unitary Authority that covers a larger area than the current city itself, with the northern end extending into the WPD area.

Peterborough City Council is keen to see the City expand and is actively marketing to attract new development to the area. The area also forms part of the government identified 'London – Stansted – Cambridge – Peterborough growth area'.

The South East Region development Strategy issued by the Office of the Deputy Prime minister (ODPM), allocated Peterborough 21,200 additional dwellings over the period 2001 to 2021. There were 65,000 dwellings in Peterborough area in 2001, so these proposals represent a 32% increase in the total number over this period.

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This expansion is also expected to result in an increase in employment, but it is difficult at present to predict how large this increase will be, or its impact on the electrical infrastructure. PCC anticipate that any new employment opportunities within the area will be in the Hi-tech, retail, commercial and warehousing/distribution sectors rather than heavy manufacturing industry.

The view of PCC is that they regard their current growth allocation as “a floor rather than a ceiling” and they are willing to accept additional allocation currently designated to other local authorities in the region that are reluctant to accept additional growth.

The exact location and timing of growth is at present unknown, and as such it is therefore not possible to be prescriptive about what reinforcement this will require. The load details in Appendix E are therefore derived from the Planning Load Estimates.

There are several developments currently underway, which are primarily new housing. The most significant development at present is a proposed new commercial / industrial park to the Southwest of the city. This has an estimated eventual maximum demand of 18MVA and is to be supplied as an ‘inset network’ by an IDNO-owned 33/11kV substation.

Generation

The main existing generation sources in the Peterborough area are listed in section 2 above. However, over the last few years Peterborough Power Station has been operating as a ‘Short Term Operating Reserve’ station and is therefore very sporadic in its operation. Not counting the power station, there are presently 17 generators embedded in the network with a combined capacity of 77MW, and a further 4 sites totalling 34MW have accepted connection offers.

Distributed Generation is going to be one of the major challenges in the area into the future, and the 33kV network therefore forms part of the trial area for the ‘Flexible Plug & Play’ project which is designed to facilitate the connection of generation through the application of active management techniques.

A prime example of the issues that generation creates is the McCains food factory, which is supplied at 11kV from Funtham’s Lane Primary. McCains have circa 9MW of generation installed within their own 11kV network, and whilst we can monitor the overall import/export of the site as a whole, we have no information on the output of the generation. As a result we no longer have any reliable information on what the peak load on Funtham’s Lane Primary would be without their generation in operation.

One of the major challenges with connection of new generation in the area is the prevalence of 132/11kV transformation. Most of these sites run with the 11kV switchboards split to control fault levels, which makes it very difficult to connect generation at 11kV without creating issues with load balance and voltage control on the transformers. As there is little 33kV network, then the only alternative at present is to connect at 132kV which is unpopular with the generation developers due to the high connection costs. Facilitation of generation connections in the vicinity of Peterborough may therefore require a fundamental re-think of the power supply strategy for the city.

Due to the presence of the power station (which has an n-2 connection agreement) the network in this area is also on the verge of the maximum amount of generation that can be accommodated on the 132kV network, which is likely to make the connection of any further significant generation difficult to achieve.

3.2 Asset Replacement

A list of plant recommended for replacement has been included in the ED1 NAMP plan. Dates given are provisional and will change for operational or other reasons such as reinforcement. Costs are generic for the specific plant only and do not take account of any associated equipment which may need replacing at the same time (e.g. structures/bus/line isolators on outdoor CBs).

The following Asset Replacement schemes are proposed.

Farcet 33/11kV Primary Substation - Retrofit 11kV Switchgear

The condition assessment of the 1962 REY LM23T indoor oil insulated switchgear installed at Farcet 33/11kV Primary Substation has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep these assets in use without compromising operational requirements therefore this project recommends its retrofit. Completion of the project will see 4 circuit breakers retrofitted.

Peterborough Central Grid Substation - Replace Grid Transformer (GT3: 132/11kV)

The condition assessment of the 1983 HSP Grid Transformer installed at Peterborough Central 132/33kV Grid Substation has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep these assets in use without compromising operational requirements therefore this project recommends its replacement. Completion of the project will see 1 Grid Transformer replaced with 1 new Grid Transformer.

3.3 Security of Supply analysis

The two 132kV dual-circuit routes from Walpole are normally considered as a 'group' for P2/6 assessment, due to the level of interconnection between them. The existing winter peak 'group' load for winter 2012/13 was just over 345MVA, and hence the group is classified as 'Group E'.

However, the situation is complicated by the presence of the Power Station and the interconnection via the WPD network. When the Power Station is generating, the 'export' to WPD via Stamford tends to increase, which therefore increases the apparent group demand. On the closest day to the peak quoted above when the power station was not generating, the peak load was 316MVA.

As the amount of power that is 'exported' to WPD also tends to reduce slightly following an outage, it is possible that under post-fault conditions with no generation the residual group demand may fall just under the Group E threshold, but it does not seem unreasonable that a conurbation the size of Peterborough should have Group E level security.

For a group E network, P2/6 requires 2/3 of the peak group demand to be supportable for a summer n-2 outage. This gives the load to be supported as 230MVA, but the actual summer peak load was recorded as 260MVA. In such situations it is considered that the higher actual summer peak demand needs to be supportable.

The circuits from Walpole to Peterborough Power Station and Walpole to West March are all 400mm 'Zebra' conductor, rated for 50C operation. The theoretical rating of these in summer is 745A or 170MVA. In the event of an n-2 outage at peak summer load with no generation from the Power Station, this would therefore give a combined capacity of 340MVA compared to the 260MVA demand, giving a theoretical 'headroom' of approximately 80MVA assuming an even load balance between the circuits, which is unlikely, especially as the 132kV switchboard at Walpole currently runs split..

Modelling the 'summer max' scenario on DigSilent for 2013 with no generation from Peterborough Power Station or the existing windfarms, and assuming that the n-2 outage is one circuit from each route (worst case scenario as all load is still connected) gives the loading of the two feeders from Walpole as 114MVA and 140MVA (254MVA total).

Modelling this scenario as above but with 2022 loads gives the feeder loads from Walpole as 152MVA and 163MVA, assuming that Walpole is run solid. This would therefore suggest that additional 132kV network capacity will be needed around this time.

Transferring demand onto the WPD network under such a scenario is not an option as WPD have indicated that they do not have the capacity to support UKPN load and that any significant 'flow' towards UKPN would be disconnected. However, the terms of the interface agreement with WPD are presently under discussion.

P2/6 allows for generation to contribute to the capacity, but during the 12 month period to 30 Nov 2012 the power station was only exporting for just under 3.4% of the year, and did not generate at all for a period of nearly 4 months (2 Feb – 2 August). As a result it is not considered that the power station can be relied on for support.

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3.4 Operational and technical restrictions

PQF 132kV route issues

The PQF 132kV route from Peterborough Power Station to Peterborough Central starts out as a dual circuit overhead line and then splits with one circuit going underground and the other as a single circuit overhead line. Part of this latter line was installed in the early 1980's across a railway marshalling yard under Eastern Electricity's master wayleave agreement with British Rail.

The marshalling yard has since fallen out of use and been sold off and is now the location of a new housing development, which will make access to the masts for maintenance purposes extremely difficult. It is therefore proposed to replace the single circuit overhead section of the route with a second underground cable.

Peterborough's Geography

The geography of the city presents a number of challenges when seeking routes for power cables, as the city is bisected in the north-south direction by the East Coast Main Line Railway and in an east-west direction by the River Nene, the Peterborough – March railway line and the 'Nene Valley' preserved railway.

Fault Levels

The fault levels at both Peterborough North and Peterborough East are above the rating of the 11kV switchgear, which is presently managed by running all bus sections and bus couplers (where fitted) open, with auto-close schemes to maintain security. This overcomes the issue, but means that the load needs to be kept balanced between the busbar sections so that the load on each winding of the dual-wound 132/11kV transformers is reasonably even to avoid creating issues with voltage control. The knock-on issue of this is that connecting 11kV generation becomes problematical, requiring at least dual-circuit connection to maintain the load balance.

N-2 132kV outages – security of supply

Whilst 132kV dual circuit outages have a low probability, the Peterborough network is vulnerable to such events due to the prevalence of 132/11kV transformation. The use of high capacity 132/11kV substations enables the area to be supplied by just a few substations, but the risk that this presents is that each substation feeds a wide area, and it is the 11kV network is not sufficiently robust to enable the load to be recovered in the event of an n-2 132kV outage.

This is exacerbated by the geographical issues referred to above, as there are relatively few connections crossing the rivers and railways which therefore creates further restrictions on the ability to pick up load from another source.

3.5 National Grid

Walpole 132kV Switchgear Replacement

There is an ongoing project to replace the 132kV switchgear at Walpole GSP with a new GIS switchboard. This is primarily driven by the condition of the existing outdoor switchgear, but will also give benefits in terms of increased fault rating.

Bainton

The recommended strategy also includes a proposal for a new GSP to be established in the vicinity of Bainton to the North of Peterborough.

4 Recommended strategy

Whilst the predominance of 132/11kV transformation in the Peterborough area creates some issues, primarily in terms of making the area vulnerable to n-2 132kV outages and being difficult to connect generation, the fact that it is well established means that making any fundamental changes to the network topology is likely to be prohibitive in terms of the cost of works required.

The strategy for the area, as set out below, therefore looks to develop the existing network rather than make any major changes in philosophy.

4.1 Description

The reinforcement works that are already authorised for Orton Primary, Farcet Primary and Peterborough Central 33kV, will deal with the immediate capacity issues at these sites, although in the case of Orton further reinforcement may be required within the ED1 period to overcome the capacity limitations that will be imposed by the 11kV switchgear rating and part of the 33kV cabling to the site. However, it is proposed to defer this work by applying demand side management at Orton Primary.

The 30MVA 132/11kV transformer at Peterborough Central is proposed to be replaced on condition grounds, but it is not currently planned to install a higher capacity unit although the site is well loaded. The majority of the load that is supplied from this site is actually situated around the central area of the city, which is on the opposite side of the River Nene. As a result, the majority of the existing outfeeds already cross the river, and it is therefore felt that installing additional capacity would not be appropriate as it would be extremely difficult to get this extra capacity to where it is needed.

When the Peterborough Central 11kV substation becomes fully loaded, then load will either have to be moved to adjoining substations (North, South or East) if capacity is available, or a new substation will have to be established on the northern side of the river. Serious consideration should therefore be given to the acquisition of a suitable 'reserved' site in the near future to secure this as a future option. If the economy should recover then land availability in central Peterborough is likely to become limited and expensive.

It is also anticipated that another new substation will eventually be required at the northern end of the city to provide additional capacity when Peterborough North becomes fully loaded, and it may therefore also be worth investigating the acquisition of a 'reserved' site in this area.

One of the 132kV circuits that feeds Peterborough Central and North also feeds into the WPD network at Stamford, which at times can feed in the region of 60-70MVA of 'out of area' load. The reinforcement works referred to above will increase the utilisation of these circuits by UK Power Networks, which could cause issues with the provision of capacity to WPD.

The terms of the interface agreement with WPD are presently under discussion, but if it is agreed to continue to provide them with 60-70MVA capacity then as and when UK Power Networks require to connect any additional load to these circuits, then it would be necessary to establish a new Grid Supply Point to the north of Peterborough to provide the required capacity. There is a potential location for such a site near 'Bainton' where the 400kV and 132kV networks run in close proximity. The establishment of this site has therefore been included within the ED1 period. This would also provide additional 132kV capacity to Peterborough, which will be needed to address future P2/6 compliance issues on the network from Walpole.

It is also recommended that additional 132kV isolators are established wherever substations are teed from 'double-ended' 132kV circuits to maximise the flexibility and security of the network, and minimise the possibility of large areas being off supply for an extended period in the event of an n-2 outage. In the main these could be established at substation sites, but it would be advisable to establish a switching compound at the 'Flag Fen' tee point to provide this flexibility to Peterborough East.

Innovation: Demand Side Response

All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

Studies have been undertaken to identify suitable sites for participation in smart demand response to reduce peak load with a view to delay proposed reinforcement work. These studies identified a Demand Side Response intervention as an option to defer the reinforcement of a primary substation in this RDP.

4.2 Financial Appraisal and Benefits

The financial expenditure is shown in Appendix E.

Information regarding Load Indices is available in Appendix F and information regarding Health Indices is available in Appendix G

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5 Alternative Strategies

No alternative strategies have been identified at this time.

6 References

References	Description
Reference 1	Planning Load Estimates EPN Area 2011 - 2023
Reference 2	132kV Network HV Schematic Operating Diagrams East of England
Reference 3	33kV Network HV Schematic Operating Diagrams East of England

6.1 Appendices

Appendix	Description
Appendix A	Geographical diagram
Appendix B	Single Line Diagram – Existing Network
Appendix C	Single Line Diagram – Recommended Strategy
Appendix D	Envisaged future network following installation of Bainton GSP
Appendix E	Detailed costs for recommended strategy
Appendix F	Output Measures – Load Indices (LI)
Appendix G	Output Measures – Health Indices (HI)
Appendix H	Generation Heat Map

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7 Document sign off

Sign-off of this Mandate certifies that the Sponsor has ratified the above and approval is sought to proceed to the development of the necessary PG&C Gate B documentation.

Recommended by:

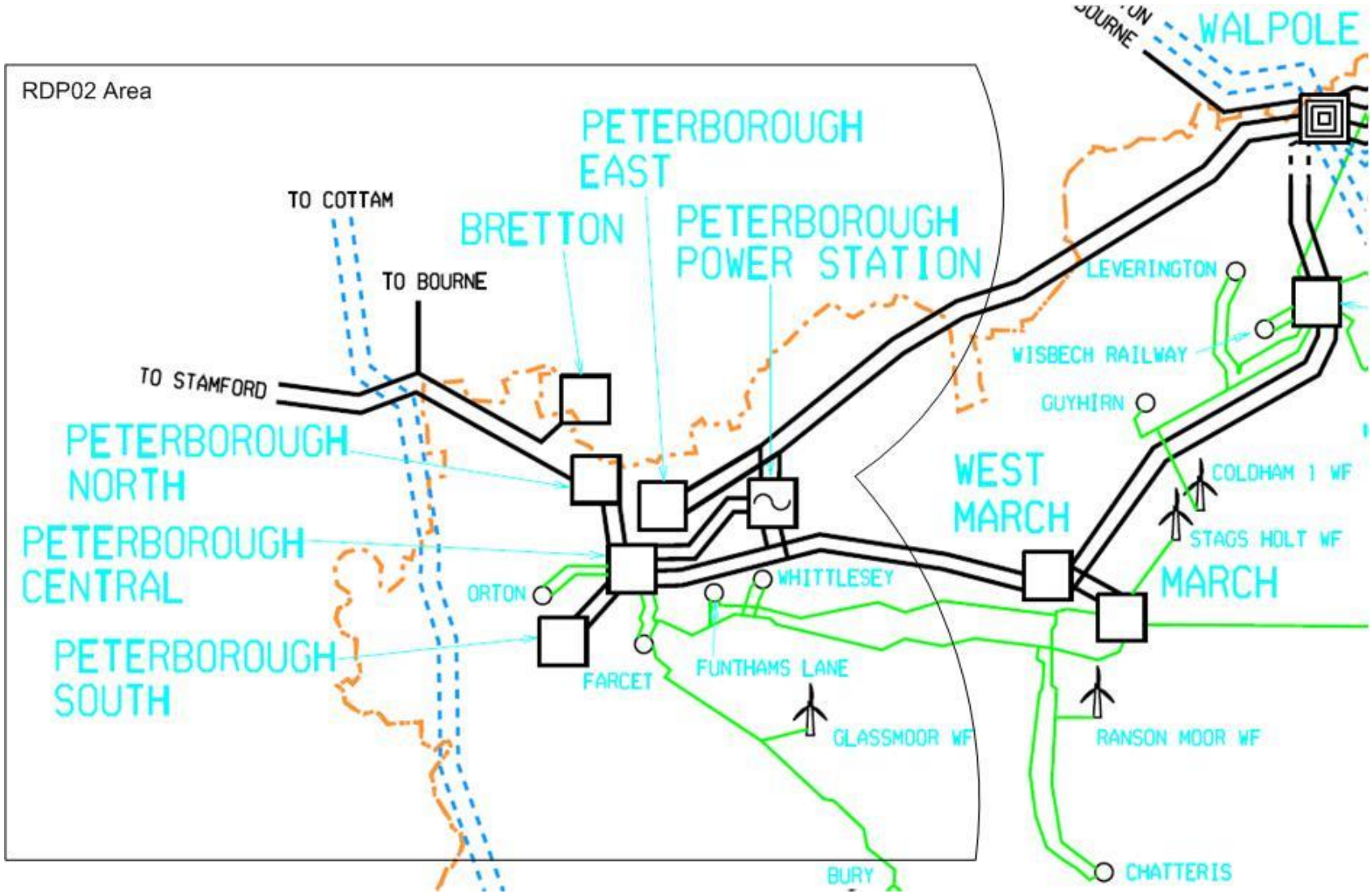
Name	Role	Signature	Date
Peter Rye	Infrastructure Planner		19/03/14
Nuno Da Fonseca	Infrastructure Planning Manager (EPN)		

Approval by:

Name	Role	Signature	Date
Robert Kemp	Head of System Development		20/03/14
Barry Hatton	Director of Asset Management		

Walpole GSP - Peterborough (EPN)

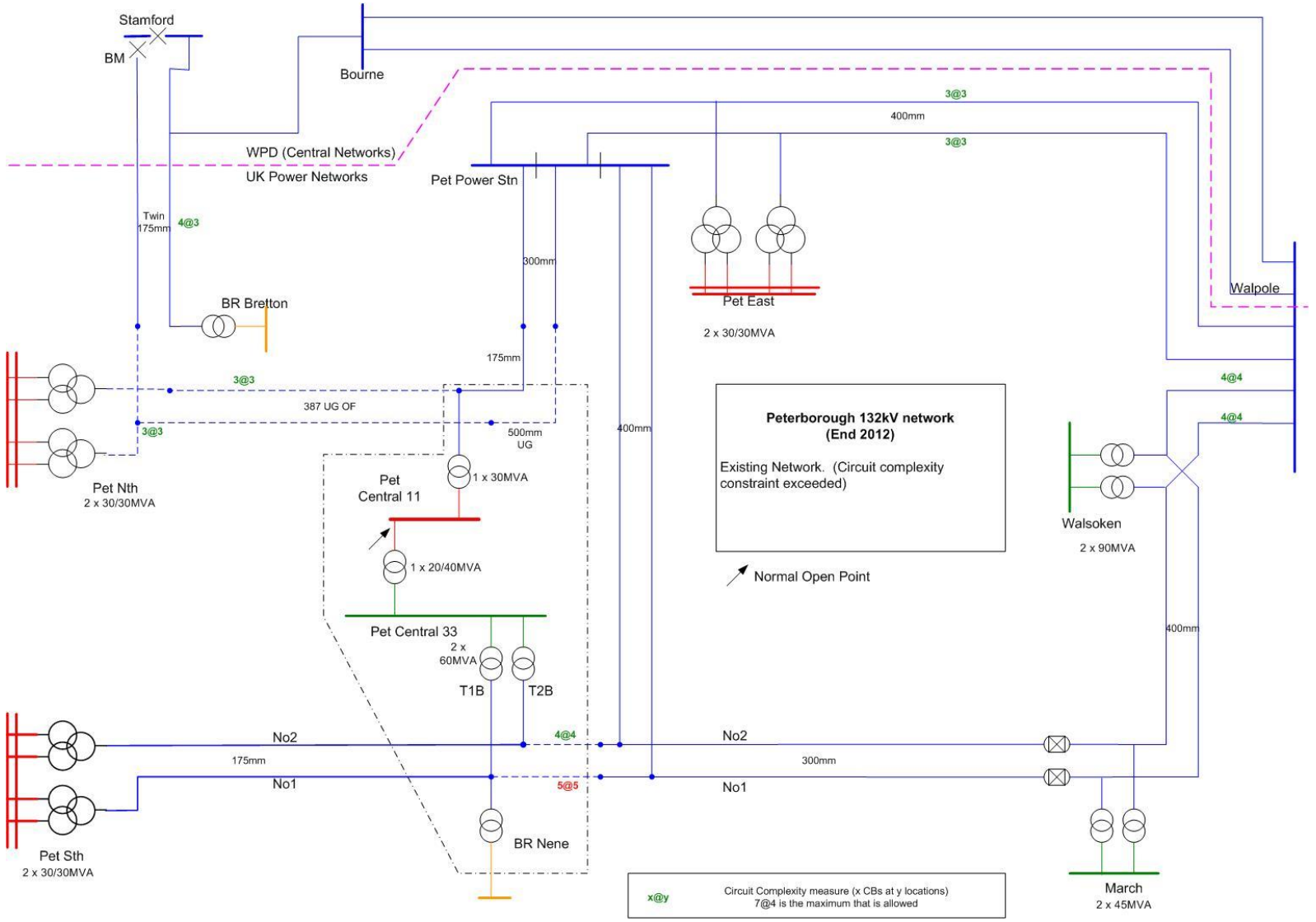
APPENDIX A: GEOGRAPHICAL DIAGRAM



Walpole GSP - Peterborough (EPN)

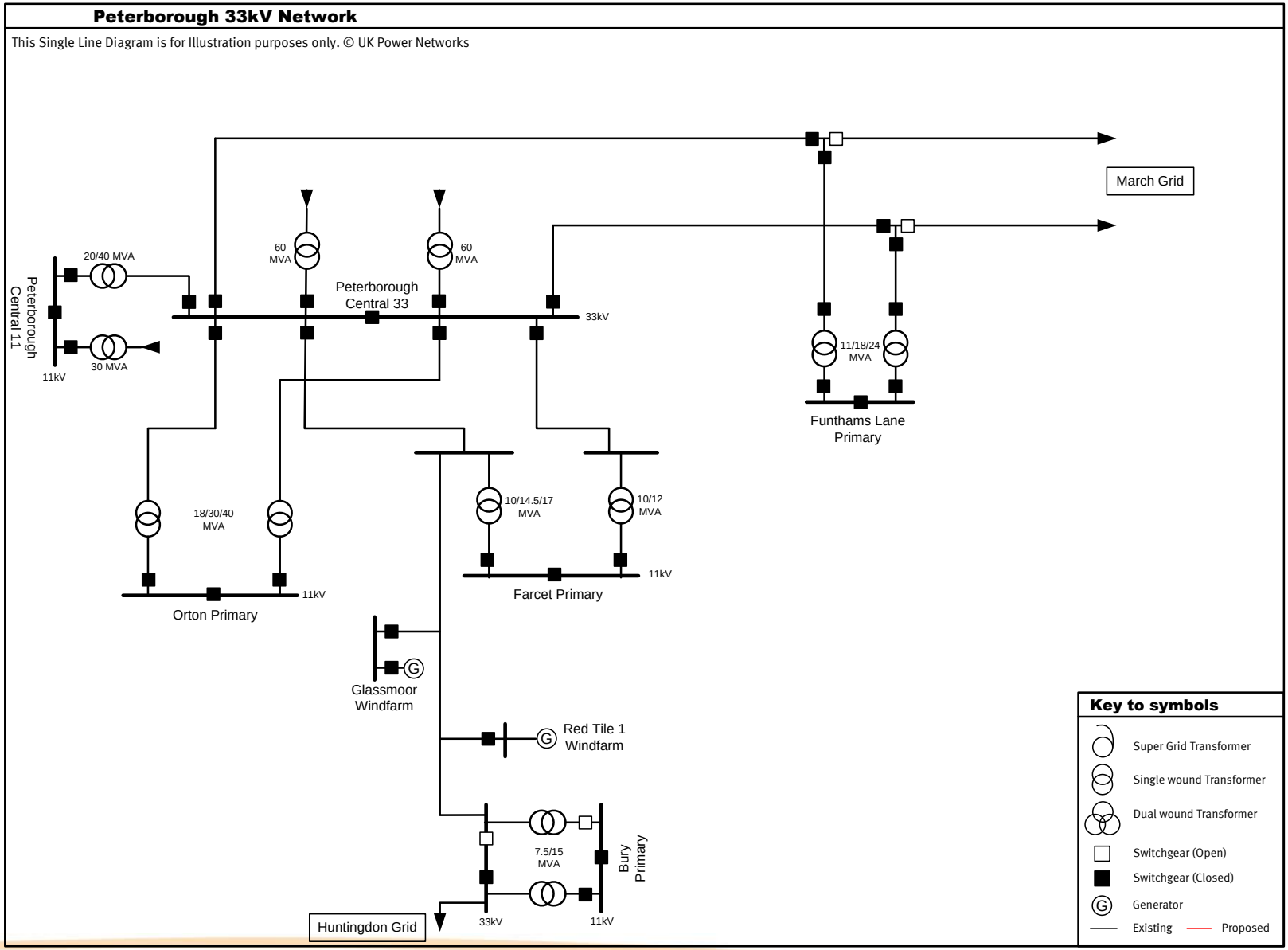
APPENDIX B: SINGLE LINE DIAGRAM – EXISTING NETWORK

Existing 132kV Network



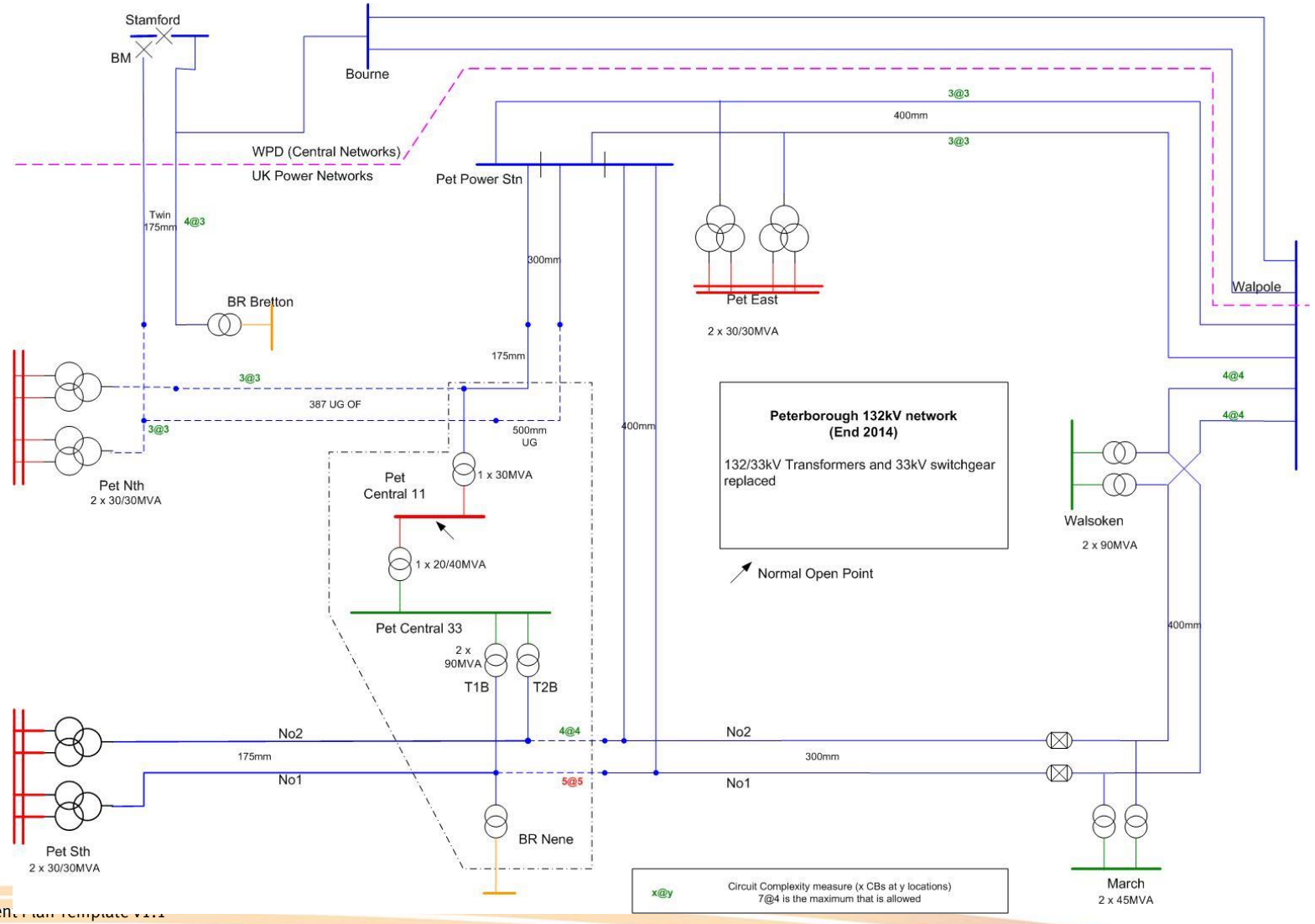
Walpole GSP - Peterborough (EPN)

Existing 33kV Network



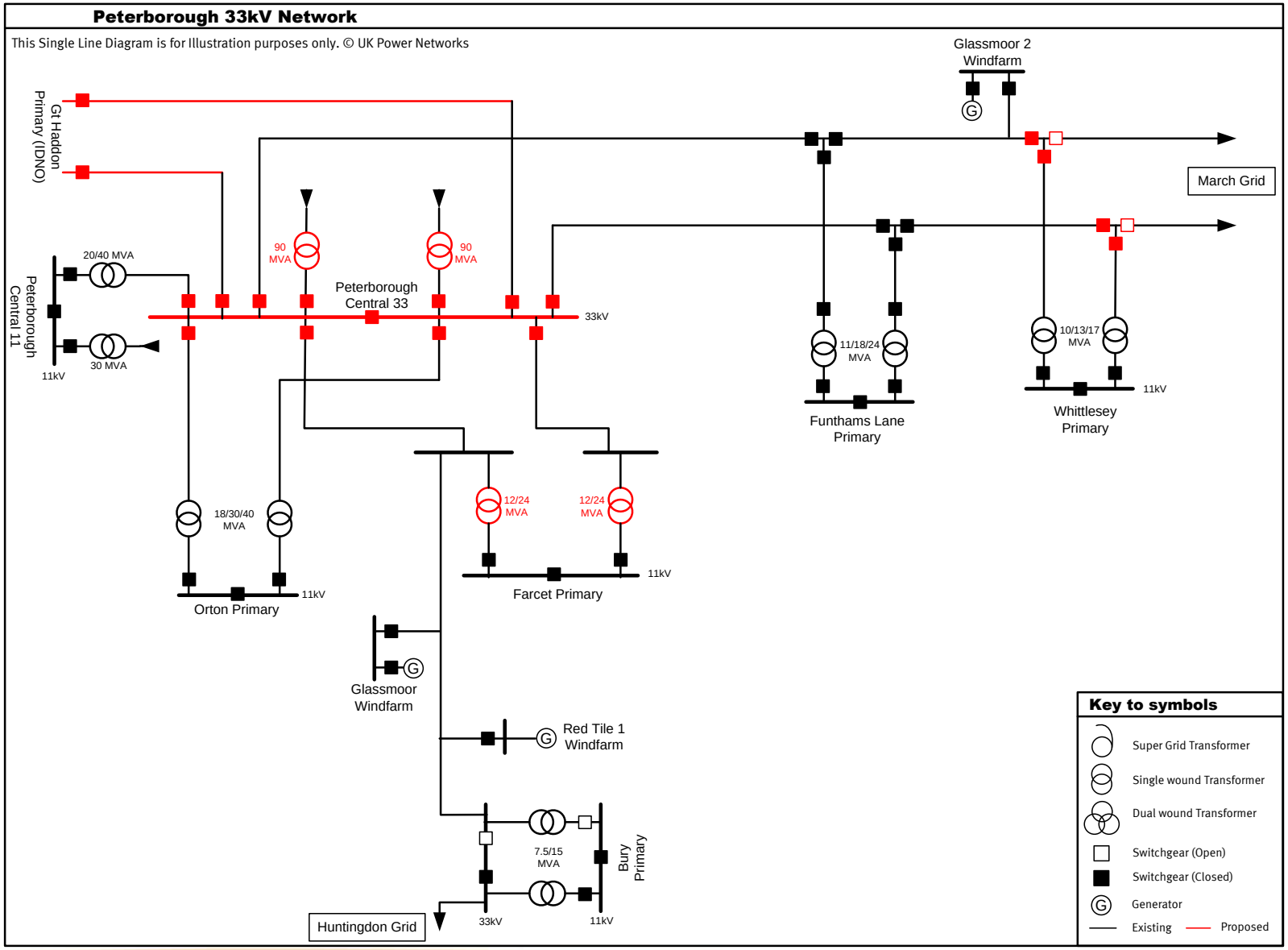
APPENDIX C: SINGLE LINE DIAGRAM – RECOMMENDED STRATEGY

Recommended Strategy (132kV network)

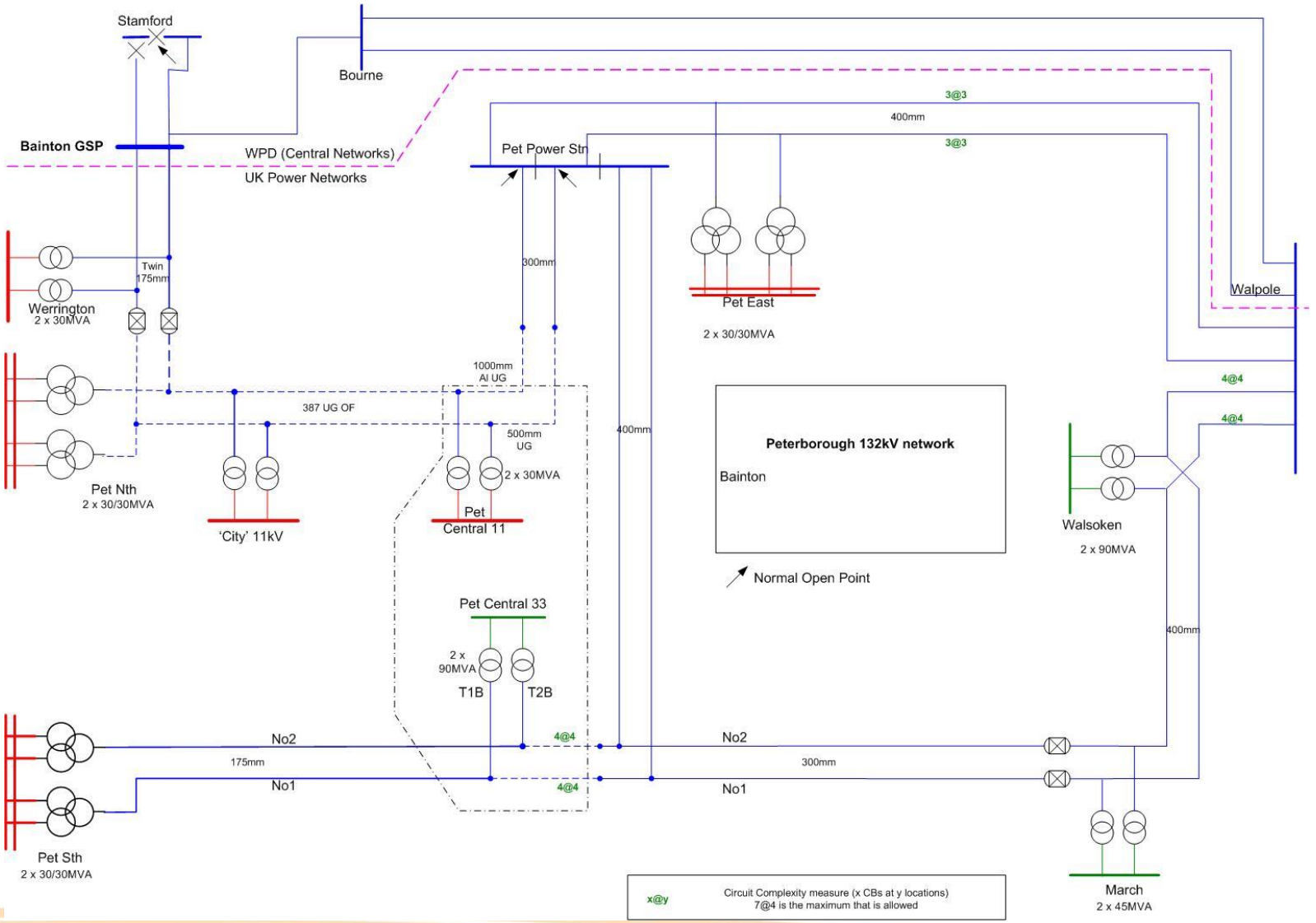


Walpole GSP - Peterborough (EPN)

Recommended Strategy (33kV network)



APPENDIX D: ENVISAGED FUTURE 132KV NETWORK FOLLOWING INSTALLATION OF BAINTON GSP



Walpole GSP - Peterborough (EPN)

APPENDIX E: DETAILED COSTS FOR RECOMMENDED STRATEGY

NAMP version: Table J Less Ind Baseline 05 June 2013

Cat	Project ID	Description	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023
A	7687	Farcet 33/11kV Primary Substation - Retrofit 11kV Switchgear										
A	7724	Peterborough Central Grid Substation - Replace Grid Transformer (GT3: 132/11kV)		404,961	1,074,999							
R	5628	PQF 132kV Route - Underground Due to Southbank Development	119,805	47,922	798,702	798,702	1,310,723					
R	3001	Orton 33/11kV Primary Substation - ITC (2 x 18/30/40MVA)	1,139,191									
R	3900	Whittlesey 33/11kV Primary Substation - Demand Side Response (DSR)				7,425	29,700	29,700	29,700	29,700	29,700	29,700
R	4172	Farcet 33/11kV Primary Substation - ITC (2 x 12/24MVA)	739,014	273,702								
R	3855	Peterborough Central 132/33kV Grid Substation - ITC (2x90MVA)	2,760,565	681,826								
R	3653	Bainton Proposed 400/132kV Exit Point (N-2)						24,825	707,017	2,533,146	1,872,002	
R	3354	Peterborough Central 132/33kV Substation - Replace 33kV Switchgear (2000A)	1,106,379									
R	5555	Peterborough Central/Farcet 33kV OHL Circuit - Reinforcement (575A)			34,602	103,807						
R	3367	Peterborough Central/Funthams Lane Proposed 33kV Circuit	273,203									
R	3698	Peterborough Central/Funthams Lane & Tees 33kV Circuits - Separate Fleet Drove Tee Point	862,641									

Walpole GSP - Peterborough (EPN)

APPENDIX F: OUTPUT MEASURES – LOAD INDICES (LI)

PLE version 27 February 2013 (Element Energy growth forecast)

					DPCR5 Intervention		RIIO-ED1 without intervention				RIIO-ED1 with intervention			P2/6 at end of ED1	
RDP	Substation	Season	First Limitation	FC NOW (MVA)	NAMP	FC ED1 Start (MVA)	2014 (S) 14/15 (w)	2022 (S) 22/23 (W)	2014 (S) 14/15 (w)	2022 (S) 22/23 (W)	NAMP	FC ED1 end (MVA)	2022 (S) 22/23 (W)	P2/6 Class	Comply
RDP02	Farcet	W	Transformer	14.5	4172	22.8	15.1	16.2	LI1	LI1		22.8	LI1	C	Yes
RDP02	Funthams Lane total	S	Circuit Rating	10.0		18.0	8.0	8.1	LI1	LI1		18.0	LI1	B	Yes
RDP02	Orton	W	Aux equipment	21.6	3001	28.9	17.4	18.4	LI1	LI1	5731	30.9	LI1	C	Yes
RDP02	Peterborough Central 11	S	Transformer	30.0		30.0	21.9	22.9	LI1	LI1		30.0	LI1	C	Yes
RDP02	Peterborough Central 33	W	Switchgear	68.5	3855	115.4	54.0	57.2	LI1	LI1		115.4	LI1	C	Yes
RDP02	Peterborough East	S	Transformer	60.0		60.0	35.0	36.7	LI1	LI1		60.0	LI1	C	Yes
RDP02	Peterborough North Grid	W	Switchgear	76.3		76.3	48.7	51.6	LI1	LI1		76.3	LI1	C	Yes
RDP02	Peterborough South					0.0	0.0	0.0				0.0			Yes
RDP02	Peterborough South Grid 11	S	Transformer	60.0		60.0	27.2	27.5	LI1	LI1		60.0	LI1	C	Yes

Note: the real load of Funtham's Lane is unknown as we have no info on output of their generation so do not know how much is being masked. Assuming that the circuit limitation refers to the 33kV network back to March, then this will be resolved by the two Funtham's circuit reinforcement projects due to complete in 2013, which will bring firm up to full Tx rating.

APPENDIX G: OUTPUT MEASURES - HEALTH INDICES (HI)

	132kV Switchgear														
	ED1 Start (2015)					ED1 End (2023) No Investment					End of ED1 (2023) With Investment				
Substation	HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5
BAINTON											4				
PETERBOROUGH POWER STN	3	8					3	8							

	33kV Switchgear														
	ED1 Start (2015)					ED1 End (2023) No Investment					End of ED1 (2023) With Investment				
Substation	HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5
FUNTHAMS LN PRIMARY	2					2					2				
PETERBOROUGH CENTRAL 33	1		7	2		1				9	10				
RED TILE WINDFARM	2					2									

	11/6.6kV Switchgear														
	ED1 Start (2015)					ED1 End (2023) No Investment					End of ED1 (2023) With Investment				
Substation	HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5
FARCET PRIMARY		5	4					7	2				7	2	
FUNTHAMS LN PRIMARY		10					6	4				6	4		
ORTON PRIMARY		12					12					12			
PETERBOROUGH CENTRAL 11		18					18					18			
PETERBOROUGH NORTH GRID	1	22	4				8	19				8	19		
PETERBOROUGH SOUTH GRID	25						25					25			

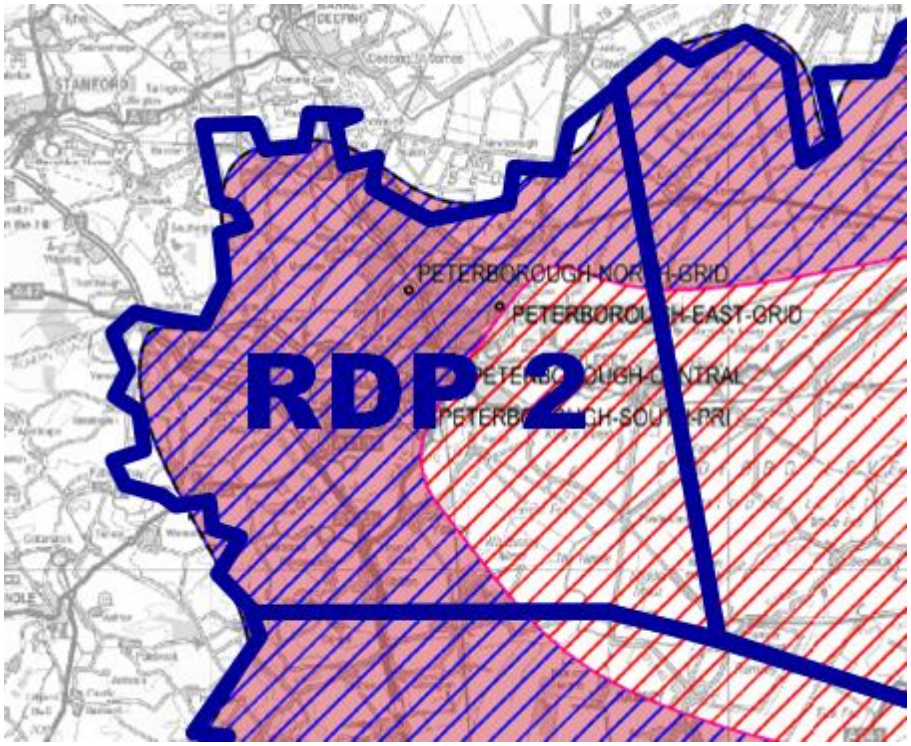
	Grid and Primary Transformers														
	ED1 Start (2015)					End of ED1 (2023) No Investment					End of ED1 (2023) With Investment				
Substation	HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5
BR BRETTON		1					1					1			
FARCET PRIMARY			2					1	1			1	1		
FUNTHAMS LN PRIMARY	2						2					2			
ORTON PRIMARY		2					1	1			2				
PETERBOROUGH CENTRAL 11		1					1					1			
PETERBOROUGH CENTRAL 132		1	2	1			1		2	1	3	1			
PETERBOROUGH EAST GRID	1	1					2					2			
PETERBOROUGH NORTH GRID		2					2					2			
PETERBOROUGH SOUTH GRID	2						2					2			

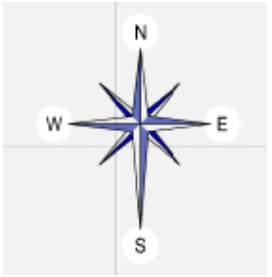
Regional Development Plan

Walpole GSP - Peterborough (EPN)

APPENDIX H: GENERATION HEAT MAP

The heat map presented in this page is indicative of the capability of the high voltage electrical network to accept connection of new generation equipment. The area in red indicates that the network in that area is effectively at saturation point with respect to existing generation connections. The amber and green areas indicate parts of the network that currently have limited and spare capacity to connect new generation equipment at HV or above.





*Flexible Plug and Play Trial area shows the indicative geographical zone of where the project is being trailed. For information on the Flexible Plug and Play project, please visit *www.flexibleplugandplay.co.uk*

KEY:

* FPP TRIAL INNOVATION ZONE AREA
132kV CAPACITY HIGHLY UTILISED
HIGHLY UTILISED
CAPACITY AVAILABLE
SIGNIFICANT CAPACITY AVAILABLE