

**Title: Bolney** 

**SPN** Regional Development Plan

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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
2.0	28/02/2014	Major	M. Jones	1 Executive Summary	Costs and project list updated to reflect Feb 19 <sup>th</sup> NAMP
2.0	28/02/2014	Major	M. Jones	2.3 Projects in Progress	Costs and project list updated to reflect Feb 19 <sup>th</sup> NAMP
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2.0	28/02/2014	Major	M. Jones	4.4 Costs and Phasing	Costs updated to reflect Feb 19 <sup>th</sup> NAMP
2.0	28/02/2014	Minor	M. Jones	All	General amendments to formatting/layout
2.1	10/03/2014	Minor	SJE	2.3.1	8067 Brighton description updated
2.2	23/03/2014	Minor	SJE	4	Description updated
2.3	26/03/2014	Minor	SG	1.3 Costs Profiles	Reference to 19 <sup>th</sup> Feb NAMP added
2.3	26/03/2014	Minor	SG	1.4 Output Measures	"Table 2" changed to "graph below"
2.3	26/03/2014	Minor	SG	2.3 Projects in Progress	Reference changed to 19 <sup>th</sup> Feb NAMP
2.3	26/03/2014	Minor	SG	3.1 Development Areas	Table numbers updated
2.3	26/03/2014	Minor	SG	3.3 Security of Supply and Load Index Analysis	Table Key added
2.3	26/03/2014	Minor	SG	4.4 Costs and Phasing	Reference to 19 <sup>th</sup> Feb NAMP added
2.3	26/03/2014	Minor	SG	4.5.1 Load Indices	Graph and section removed

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#### 1 Introduction

### 1.1 Executive Summary

This Development Plan reviews the SPN network supplied from Bolney Grid Supply Point (GSP) which has an aggregated group winter peak demand of circa 930MW increasing to 1GW by 2023.

The supply area encompasses large conurbations in the southern and central areas including Crawley, Horsham and Haywards Heath, the strategically important Gatwick Airport and southern coastal towns between Littlehampton, Newhaven and the city of Brighton and Hove.

Embedded generation in the area includes the 420MW CCGT Shoreham Power Station and Storrington Generation.

The network is complex comprising thirteen major 132kV substations with interconnection to adjacent groups via Dormansland (Northfleet GSP) and Lewes (Ninfield GSP). The associated 33kV overhead line and cable network supplies over 40 primary 33/11kV substations.

No major redesign or reconfiguration of the network is proposed during ED1 with the strategy formulated to maintain compliance with security of supply criteria and operational reliability with targeted asset replacement.

Reinforcement: 14 Substations have been identified for intervention

Asset Replacement: 33 projects justified on asset condition are proposed.

#### 1.2 Proposed projects >£1M

#### 1.2.1 Reinforcement

Littlehampton	£5.6m
Moulsecoomb	£8.5m
Brighton Town	£1.3m
Capel	£1.0m
North Shoreham	£1.3m

#### 1.2.2 Asset Replacement

Nutfield Primary – Switchgear Replacement	£2.1m
• South Hove Primary – Replacement of 11kV Switchge	ar£2.1m
<ul> <li>Ashington Primary – T1&amp;T2 Replacement</li> </ul>	£1.2m
• Brighton Town 33 kV - Primary T1&T2 Replacement	£1.1m
• Withdean 33 kV - Primary T1&T2 Replacement	£1.1m
• Southern Cross – 132 kV Cable Replacement	£1.1m
Reigate – transformer replacement	£1.6m
• Leigh-Reigate 33kV Gas cable replacement	£2.1m
Steyning-Worthing Gas Cable Replacement	£2.0m
• Fishersgate-Moulescoomb Gas Cable Replacement	£1.5m
Littlehampton ESQC Resolution	£3.0m
• Lewes/Newhaven BT21CN	£1.2m

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Bolney/Steyning BT21CN

£1.5m

Please refer to table 15 (Section 4.1) for timescales and project expenditure.

### 1.3 Costs profile

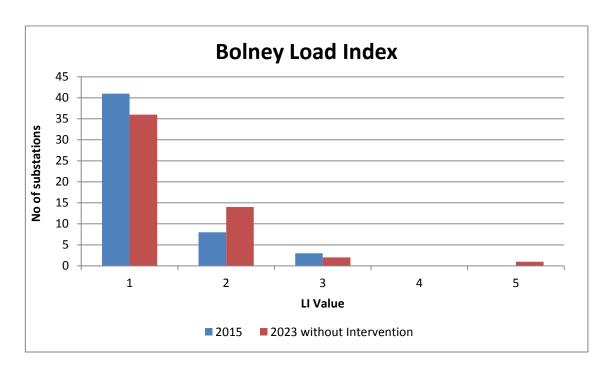
The table below provides the forecast aggregate NAMP cost for the network expenditure under this RDP during the last two years of DPCR5 and the ED1 period subject to project feasibility studies and final approval.

Table 1. Costs Profile - Table J Less Indirects 19th February 2014

	2013/	2014/	2015/	2016/	2017/	2018/	2019/	2020/	2021/	2022/	2023/	
Description	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
NLRE	5,557	2,719	2,241	4,202	2,597	3,171	3,494	5,798	3,521	2,582	1,281	37,164
LRE	1,549	1,304	2,374	2,286	2,892	412	66	1,288	4,448	3,670	459	20,747
Total Expenditure	7,106	4,022	4,615	6,488	5,489	3,583	3,560	7,086	7,969	6,252	1,740	57,911

#### 1.4 Output Measures

The graph below provides the expected Load Indices in 2015 and 2023 without interventions for all substations covered in this RDP. Substations with a projected load index of 4 and 5 (LI4 and LI5) will be specifically targeted for improvement and are discussed in this RDP.



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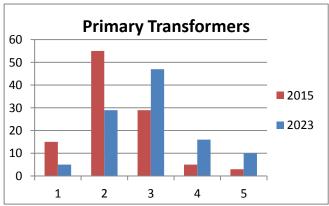


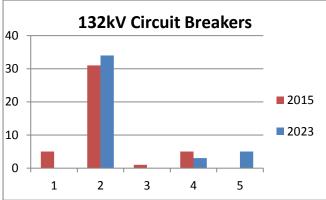
All of the cost numbers displayed in this document are before the application of on-going efficiencies and real price effects.

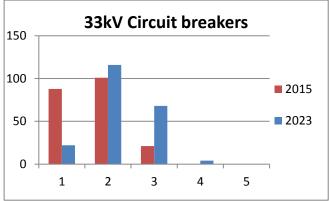
### 1.5 Output Measures Health Index

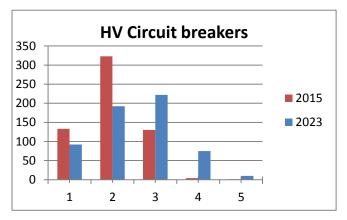
The charts below provide the projected health index status, without intervention, of various assets covered in this RDP by 2023. Eighteen Substations will have switchgear equipment classified as HI5 by 2023, while twenty primary transformers and five grid transformers will have been classified as HI5 by 2024. Moreover, two 33kV FFC cable connections appear to have HI5 by 2023, for which cable replacement interventions have been proposed.











### 1.6 Principal Risks and Dependencies

The timing of most of the projects will be dictated by load growth and/or health/load indices. Other factors such as quality of supply, new connections and sustainability may change the overall priorities and add previously unconsidered priorities.

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#### **Bolney**



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### 2 Network configuration

#### 2.1 Existing Network

This Regional Development Plan reviews the SPN EHV/HV network supplied from Bolney 400/132 kV Grid Supply Point. This includes all UKPN assets within the area which extends to the south west and includes Worthing (West Sussex), south east up to Brighton, and north to Smallfield and Leigh (south-east Surrey).

Geographic diagram in Appendix A and SLD in Appendix B;



Figure 1. Bolney GSP Site Map

#### **Bolney GSP**

Bolney 132kV substation comprises of 5x276MVA 400/132 kV super grid transformers and 10x132 kV outgoing circuits, which include the following 132kV feeders:-

- a. Goddards Green, 2x90 MVA 132/33kV The connection is made via PCG double circuit overhead line. The site has a firm capacity 108.6 MW Winter (W) and 85.5 MW Summer (S). Primary substations fed from Goddards Green include Burges Hill (33/11 kV), Hurstpierpoint (33/11kV) and Haywards Heath (33/11kV).
- **b. Bolney Grid 2x30 MVA, 132/33 kV** The site has a firm capacity 38.2 MW (W) and 29.4 MW (S). Primary substations fed from Bolney Grid include Pulborough (33/11kV), Southwater (33/11kV) and Cowfold (33/11kV).
- c. Three Bridges Main The connection is via PRA 132kV double circuit overhead line.

Three Bridges Main includes the following 132 kV feeders:

- **Smallfield** The connection is via PWB 132kV double circuit overhead line.
- Three Bridges Local 33kV 3x90 MVA, 132/33kV The site has a firm capacity of 179.5 MW (W) and 150.7 MW (S). Primary substations fed from Three Bridges Local include Crawley Industrial East &

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West (33/11kV), Forest Row (33/11kV), West Hoathley (33/11kV), Southgate (33/11kV) and Crawley Town (33/11kV).

- **d. Horsham Grid, 3x30 MVA 132/11kV** The connection is via 132kV PNA double circuit overhead line and 132kV underground cable. The site has firm capacity 45.7MW (W) and 33MW (S).
- **e.** Steyning Grid 33kV 2x45MVA, 132/33kV. The connection is via PBC 132kV double circuit overhead line. The site has a firm capacity of 55.6MW (W) and 42.8MW (S). Primary substations fed from Steyning Grid include Steyning (33/11kV) and Ashington (33/11kV).
- Southern Cross 132kV The connection is via PRB double circuit overhead line.

Southern Cross 132kV includes the following 132kV feeders:

- Worthing Grid, 3x90MVA 132/33kV The connection is via PSA double circuit overhead line. The site has a firm capacity of 208.5 MW (W) and 172.8 MW (S). Primary substations fed from Worthing Grid include Sompting (33/11kV), West/North/South Worthing (33/11kV), Worthing Town (33/11kV), Littlehampton (33/11kV) and Angmering (33/11kV).
- Fishersgate Grid 33kV, 1x90MVA and 2x60MVA, 132/33kV. The connection is via PJH 132kV double circuit overhead line and via a 132kV underground cable. Fishersgate 33kV has a firm capacity of 148.2 MW (W) and 114 MW (S). Primary substations fed from Fishersgate Grid include Lewes Grid (132/33kV), North Shoreham (33/11kV), Hangleton (33/11kV), Droveway (33/11kV), Portslade (33/11kV), Southwick (33/11kV), South Hove (33/11kV) and Withdean (33/11kV).
- **Brighton Local and Moulsecoomb, 3x90MVA 132/33kV** The connection is via two 132kV underground cables. Brighton Local and Moulsecoomb Grid 33kV have a firm capacity of 116.2 MW (W) and 85 MW (S). Primary substations fed from those include Moolsecoomb (33/11kV), Queens Park (33/11kV), Rottingdean (33/11kV), Brighton Town (33/11kV) and Kemp Town (33/11kV).
- 132 kV feeder to Shoreham Power Station
- g. Smallfield Grid 1x60 MVA, 2x45 MVA, 132/33 kV The connection is done via PJC double circuit overhead line. The site has a firm capacity of 92.5 MW (W) and 83.7 MW (S). Primary substations fed from Smallfield Grid include Red Hill (33/11kV), Gatwick Airport (33/11kV), Horley (33/11kV) and Horley Switching Station.

Smallfield 132kV include the following feeders:

- Leigh Grid 33kV 3x60 MVA, 132/33kV The connection is via PTC 132kV double circuit overhead line. The site has a firm capacity of 112.7MW (W&S). Primary substations fed from Leigh Grid include Capel (33/11kV), Cranleigh (33/11kV), Reigate (33/11kV), Nutfield (33/11kV), Capel and Horley switching stations.
- Three Bridges Main 132kV The connection is via PWB 132kV double circuit overhead line.

#### 2.2 Embedded Generation (G59/2-1)

Table 2. Output of generating plants used in the analysis

Site Name	Туре	Mode of Operation	Installed DG (MW)	No. of Generators	Operating Voltage (kV)	Substation Name	Grid Group	GSP/BSP
NFPA	Landfill gas	LONG TERM PARALLEL	0.900	1	11.000	Nutfield 11kV	Leigh Grid	Bolney SGT
PATTESSONS COURT LANDFILL	Landfill gas	LONG TERM PARALLEL	1.985	1	11.000	Nutfield 11kV	Leigh Grid	Bolney SGT
VIRDIS ENERGY (NORGEN) LIMITED	Landfill gas	LONG TERM PARALLEL	4.000	1	11.000	Nutfield 11kV	Leigh Grid	Bolney SGT
LANDFILL GENERATION PHS 2	Landfill gas	LONG TERM PARALLEL	2.000	1	11.000	Horsham 11kV	Horsham Grid	Bolney SGT
LANDFILL GENERATION PHS 1	Landfill gas	LONG TERM PARALLEL	3.000	1	11.000	Horsham 11kV	Horsham Grid	Bolney SGT
BIFFA WASTE SERVICES PHS 1	Landfill gas	LONG TERM PARALLEL	3.000	3	11.000	Horsham 11kV	Horsham Grid	Bolney SGT
WINDMILL QUARRY - GAS TO ENERGY	Landfill gas	LONG TERM PARALLEL	5.125	1	11.000	Ashington 11kV	Steyning Grid	Bolney SGT
REDHILL LANDFILL SITE 3	Landfill gas	LONG TERM PARALLEL	4.000	4	11.000	Nutfield 11kV	Leigh Grid	Bolney SGT
CHESTERFIELD PARK	Diesel	Short Term Parallel	2.400	1	11.000	Reigate 11kV	Leigh Grid	Bolney SGT
BRIGHTON WITHDEAN GRANGE AMC	Diesel	Short Term Parallel	0.500	1	11.000	Withdean 11kV	Brighton Fishersgate	Bolney SGT
EASTBOROUNE DISTRICT GENERAL HOSPITAL	CHP	LONG TERM PARALLEL	2.000	1	11.000	Eastbourne 11kV	Eastbourne Grid	Bolney SGT
GENERATION SITE LANDFILL SITE	Landfill gas	LONG TERM PARALLEL	3.200	1	11.000	Lewes Town 11kV	Lewes Grid	Bolney SGT
HORTON QUARRY	Landfill gas	LONG TERM PARALLEL	2.000	1	11.000	Steyning 11kV	Steyning Grid	Bolney SGT
gional development Plan	Landfill gas	LONG TERM PARALLEL	1.500	2	11.000	Steyning 11kV	Steyning age 8	ofB&ReySGT





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Site Name	Туре	Mode of Operation	Installed DG (MW)	No. of Generators	Operating Voltage (kV)	Substation Name	Grid Group	GSP/BSP
SMOKEJACKS FARM	CHP	LONG TERM PARALLEL	1.600	1	11.000	Capel 11kV	Leigh Grid	Bolney SGT
LOMBARD HOUSE 3	Diesel	Short Term Parallel	1.600	1	11.000	Reigate 11kV	Leigh Grid	Bolney SGT
HARDHAM PS(1106)	Diesel	LONG TERM PARALLEL	3.100	1	11.000	Pulborough 11kV	Bolney Grid	Bolney SGT
SEWAGE TREATMENT WORKS	Biogas	LONG TERM PARALLEL	0.250	1	11.000	Horsham 11kV	Horsham Grid	Bolney SGT
WEST END NURSERIES	CHP	LONG TERM PARALLEL	2.300	1	11.000	Worthing Town 11kV	Worthing Grid B	Bolney SGT
WORTHING HOSPITAL - NEW HV SUPPLY	CHP	LONG TERM PARALLEL	0.225	1	11.000	Worthing Town 11kV	Worthing Grid B	Bolney SGT
SUSSEX WASTE TO ENERGY	Landfill gas	LONG TERM PARALLEL	5.400	1	11.000	Worthing Town 11kV	Worthing Grid B	Bolney SGT
CLOCK HOUSE WORKS	CHP	LONG TERM PARALLEL	1.100	1	11.000	Capel 11kV	Leigh Grid	Bolney SGT
PHASE 1	CHP	LONG TERM PARALLEL	5.000	1	11.000	Worthing Town 11kV	Worthing Grid B	Bolney SGT
UNIVERSITY OF BRIGHTON	PV	LONG TERM PARALLEL	0.035	1	11.000	Moulsecoomb 11kV	Moulsecoomb Grid	Bolney SGT
BROOKHURST WOOD LANDFILL SITE	Landfill gas	LONG TERM PARALLEL	0.330	1	11.000	Horsham 11kV	Horsham Grid	Bolney SGT
PHS 1	CHP	LONG TERM PARALLEL	1.600	1	11.000	Worthing Town 11kV	Worthing Grid B	Bolney SGT
TESCO	CHP	LONG TERM PARALLEL	0.600	1	11.000	North Shoreham 11kV	Brighton Fishersgate	Bolney SGT
SHOREHAM HABOUR	Gas	LONG TERM PARALLEL	400.000	1	132.000	Shoreham Power Station	Southern Cross	Bolney SGT
TESCO HOME SHOPPING CENTRE	CHP	LONG TERM PARALLEL	0.120	1	11.000	Crawley Industrial West 11kV	Three Bridges	Bolney SGT

The total installed capacity of G59/2-1 (generators> 16amps per phase) under this RDP is 452.5 MVA with Shoreham power station contributing 400MVA. Shoreham power station utilizes a gas turbine along with a steam turbine and usually operates at base load.

Note: Smaller generators < 16 amps are connected according to G83/1-1

### 2.3 Projects in progress

Table 3 details asset replacement and reinforcement projects currently in progress based on the 19<sup>th</sup> February 2014 NAMP.

Table 3. NAMP Extract for DPCR5 Projects – Table J Less Indirects 19<sup>th</sup> February 2014

Cat	Namp Line	Project ID	Description	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024
Α	1.02.03	3157	PBC - Bolney-Steyning - Conductor Replacement - BT21 driven	161	277	76	0	0	0	0	0	0	0	0
Α	1.02.03	4129	PJC Bolney-Smallfield 132kV OHL Refurbishment, 1-92 All	103	30	0	0	0	0	0	0	0	0	0
Α	1.02.03	5540	PLB - Lewes/Southern Cross - Tower Refurbishment	147	0	0	0	0	0	0	0	0	0	0
Α	1.02.90	4113	PQA - Three Bridges Main/Three Bridges Local - Conductor Replacement	0	11	46	34	0	0	0	0	0	0	0
Α	1.02.90	5568	PSA - Southern Cross/Worthing - Insulator & Fitting Replacement	16	0	0	0	0	0	0	0	0	0	0
Α	1.03.02	8181	Rottingdean 33/11kV Transformer Noise Attenuation	38	0	0	0	0	0	0	0	0	0	0
Α	1.07.07	3139	Steyning - Worthing No 1 Gas Cable Replacement	2,013	0	0	0	0	0	0	0	0	0	0
Α	1.07.07	4086	Fishersgate - Moulsecoomb 132kV Gas Cable Replacement	1,522	0	0	0	0	0	0	0	0	0	0
Α	1.19.34	8921	Littlehampton ESQC Resolution Strategy	95	592	805	805	703	0	0	0	0	0	0
Α	1.26.01	3017	Bolney 132kV Busbar Protection	77	0	0	0	0	0	0	0	0	0	0
Α	1.26.01	8398	Feeder Protection and T80 Intertrip Replacement (Smallfield, Bolney and Leigh)	160	0	0	0	0	0	0	0	0	0	0
Α	1.26.10	5349	BT21CN Mitigation - Smallfield/Leigh	319	0	0	0	0	0	0	0	0	0	0
Α	1.26.10	5350	BT21CN Mitigation - Southern Cross/Fishersgate	10	0	0	0	0	0	0	0	0	0	0
Α	1.26.10	5366	BT21CN Mitigation - Bolney/Steyning	533	659	324	0	0	0	0	0	0	0	0
Α	1.26.10	7982	BT21CN Mitigation - 33kV Bolney 33kV To Storrington P.Gen	0	60	179	0	0	0	0	0	0	0	0
Α	1.51.03	3188	Ashington Primary - Replace T1/T2 with 12/24MVA Txs	105	1,090	0	0	0	0	0	0	0	0	0
Α	1.51.03	3836	Forest Row - Replace T2	260	0	0	0	0	0	0	0	0	0	0
Α	1.51.03	3864	Brighton Town - Replace T3 and T4	1	0	0	0	0	0	0	0	0	0	0

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Cat	Namp Line	Project ID	Description	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017				2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024
Cat	Lille	שו	Description	2014	2013	2010	2017	2010	2019	2020	2021	2022	2023	2024
R	1.33.01	3722	North Shoreham 33/11kV Reinforcement - Replace T1/T2 with 12/24 MVA Units	959	376	0	0	0	0	0	0	0	0	0
R	1.33.03	3227	Brighton Town - 11 kV Switchgear Uprating	11	0	0	0	0	0	0	0	0	0	0
R	1.33.03	5652	Portslade - Install 11kV Auto Switching Scheme	22	0	0	0	0	0	0	0	0	0	0
R	1.33.03	8067	Brighton Town-Replace 11kV Switchboard	0	43	213	334	334	412	0	0	0	0	0
R	1.37.05	8072	Littlehampton T1/ T2 33kV Group Reinforcement - Reconductor 12 km of DC 33kV OHL and Replace 7 km of DC 33kV UGC	47	488	1,389	1,389	2,242	0	0	0	0	0	0
R	1.37.06	3216	Three Bridges Grid Reinforcement - GT1 132kV Cable Connection	445	0	0	0	0	0	0	0	0	0	0
R	1.37.07	8068	Capel Switching Station 33kV Reinforcement	30	151	248	248	316	0	0	0	0	0	0
Т	3.33.01	3714	Moulsecoomb Local ITC & 33kV Circuit	35	244	524	314	0	0	0	0	0	0	0

#### 2.3.1 Reinforcement

There are currently 10 reinforcement schemes in progress. A summary of the 7 principal projects is detailed below:

**3722 North Shoreham 33/11 kV S/S:** Primary Transformer Capacity increase to meet Load Growth Demand and (N-1).

The predicted load for North Shoreham primary substation will exceed the existing firm capacity. It is therefore planned to replace the existing the existing 15MVA transformers with 12/24MVA units.

**5652 Reinforcement of Portslade S/S:** Install 11kV Auto Switching Scheme to meet Load Growth Demand and (N-1).

The Portslade 11kV substation has three transformers fed from Fishersgate 33kV. The 3rd transformer is running on standby because of the high fault level that would occur should they run solid. However no automatic switching scheme is in place. This scheme will install an autoswitching scheme on the section breaker or transformer breaker for the 11kV switchboard at Portslade.

**8067 Brighton Town 33/11 kV S/S:** The load at Brighton Town 33kV/11kV is predicted to exceed the firm capacity, due to limitations to operational flexibility caused by the 11kV switchboard fault level rating. To maintain fault level compliance, the site is split at the bus section. However the load divides such that loss of one transformer will put sections 3/4 out-of-firm, resulting in at least three transformers running solid to manage the load. It is not possible to lower the load (or reduce the fault levels) without compromising operational requirements. The substation has manual post fault transfers of 6.71MVA (winter) and 5.66MVA (summer) with a switching time which exceeds 3 hours. The calculated fault level at Brighton is predicted to be 20.1kA (phase to ground) and 17.3kA (3 phase), while running solid, being 153% and 132% respectively of the switchboard fault rating of 13.1kA.

**8072** Littlehampton T1/ T2 33kV Group Reinforcement: Reconductor DC 33kV OHL and replace 33kV UGC. The predicted load at Littlehampton T1 T2 group will exceed the existing rating of the associated feeder circuits by 2018. The project is proposed to see 7 km of DC phase conductor replaced and 12 km of underground cable replaced.3216: Three Bridges Grid Reinforcement: GT1 132kV Cable connection. Install new or replace 132kV cable to meet Load Growth Demand. Replace the circuit feeding GT1 (capacity 76MVA) with a new cable that can serve full GT1 utilization (90MVA).

8068 Capel Switching Station 33kV Reinforcement: Firm capacity is exceeded in 2018.

The predicted load at Capel Switching Station 33kV will exceed the existing rating of the associated feeder circuits. It is not possible to lower the load without compromising operational and planning requirements. It is therefore proposed to replace the conductor on the circuit by replacing 10 km of DC 33kV conductor. Completion of this project will see 10 km of DC phase replaced.

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### **3 Network Development Considerations**

#### 3.1 Development areas

According to West Sussex structure plan 2001-2016 a development scheme for new dwellings has been adopted which assumes 2890 (net) new homes a year.

This has been distributed among the different areas as follows:

(Source: <a href="http://www.westsussex.gov.uk/your\_council/plans\_projects\_reports\_and/plans/structure\_plan\_2001-2016.aspx">http://www.westsussex.gov.uk/your\_council/plans\_projects\_reports\_and/plans/structure\_plan\_2001-2016.aspx</a>)

Table 4. West Sussex dwellings development scheme

District	Annual Average	Annual Average Power Increase (MW)	Substation
	Rate (Gross)		
Adur	115	0.29	Steyning
Arun	580	1.45	Littlehampton
Chichester	515	1.29	Angmering
Crawley	300	0.75	Crawley Town
Horsham	620	1.55	Horsham
Mid Sussex	680	1.70	Cowfold/Burges Hill
Worthing	290	0.73	Worthing
Total Gross	3100		
Total Net	2890	7.76	

According to Brighton/ Hove City council provision for at least 11300 new homes to be built over the plan period 2010-2030 has been made, which equates to an annual average rate of 565 dwellings. (Source: <a href="http://www.brighton-hove.gov.uk/downloads/bhcc/ldf/cp\_Draft\_City\_Plan\_FINAL\_May\_2012.pdf">http://www.brighton-hove.gov.uk/downloads/bhcc/ldf/cp\_Draft\_City\_Plan\_FINAL\_May\_2012.pdf</a>)

Table 5. Brighton/Hove dwellings development scheme

District	Annual Average	Annual Average	Substation
	Rate	Power	
	(Gross)	Increase	
		(MW)	
Brighton/Hove	565	1.41	Brighton Town/ South Hove

The geographical locations of the above areas have been included in Appendix A.

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

#### 3.2 Asset Health

It should be noted that HIs presented in the RDP will not align with the RIGS. The HIs presented in the RDP are the outcome of our ARP model on an asset by asset basis. Different rules are applied for the RIGs reporting, as agreed with Ofgem, where assets may be grouped and all assets in the group take the same HI.

The forecast health indices 2015 – 2023 without intervention are detailed below and overleaf:

Table 6. 11kV CIRCUIT BREAKERS

			2015					2023		
Substation	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
ANGMERING 33KV		3	7					8	2	
ASHINGTON 33KV		10						10		
BRIGHTON TOWN 33 KV		32	2				30	4		
BURGESS HILL 33KV		8	4					10	2	
CAPEL 33/11KV		8					8			
COWFOLD 33KV		1	7				-	4	4	
CRANLEIGH 33/11		11					1	10		
CRAWLEY IND EST WEST		6	8					9	5	
CRAWLEY INDUSTRIAL EAST 33/11KV		16					14	2		
CRAWLEY TOWN 33KV		18					13	5		
EAST GRINSTEAD 33KV	4	11				3	11	1		
FOLKESTONE EAST		7						7		
FOREST ROW 33KV		2	6					7	1	
GATWICK AIRPORT 33/11KV (AF)	1	17					17	1		
GODDARDS GREEN 33/11KV	11					11				
HANGLETON 33 KV			10					4	6	
HAYWARDS HEATH 33KV	1	13				1	13			
HORLEY 33KV	15	3	5	2	1		15	6	2	3
HORSHAM GRID 132/11 KV	24						24			
HURSTPIERPOINT 33KV		1	10				1	5	4	1
KEMPTOWN 33KV	14					14				
LITTLEHAMPTON 33KV		12	1				2	8		
MOULSECOOMB 33/11KV	2	3	9			2	1	3	8	
NORTH SHOREHAM 33KV		10						7	3	
NORTH WORTHING 33KV		2	10					4	8	
NUTFIELD 33KV	1	2	8	1		1		4	3	4
PORTSLADE 33KV		5	12					16	1	
PULBOROUGH 33/11KV		8					8			
QUEENS PARK 33/11KV		5	8				1	9	3	
REDHILL PRIMARY	11					11				
REIGATE _A_ 33/11KV	18					18				
ROTTINGDEAN 33KV		7						3	4	
SOMPTING 33KV		7					7			
SOUTH HOVE 33KV		4	15					4	15	
SOUTH WORTHING 33KV		11						11		
SOUTHGATE 33KV	16					16				
SOUTHWATER 33/11KV		13					1	12		
SOUTHWICK 33KV		2	7	1				6	3	1
STEYNING 33KV		5	1					5		1
THE DROVEWAY	15					15				
UCKFIELD 33/11KV		8					7	1		
WEST HOATHLY 33KV		7						7		
WEST WORTHING 33KV		11					3	7	1	
WITHDEAN 33KV		11					11			
WORTHING TOWN 33KV		23					1	22		

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

Table 7. 33kV CIRCUIT BREAKERS

			2015					2023		
Substation	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BOLNEY GRID 132 KV		2	1110	•••	1110		1.112	2		1110
BOLNEY GRID 33 KV		6	2					8		
BRIGHTON LOCAL 132 KV		1	1					2		
BRIGHTON LOCAL 33 KV		4	11					13	2	
CAPEL SW STN (33KV)	9	•	• • •			9				
DORMANSLAND GRID		7	1					8		
DORMANSLAND GRID 132 KV		2	•					2		
EASTBOURNE GRID		8					8			
FISHERSGATE GRID	24					1	23			
FISHERSGATE GRID 132 KV		3	1			•		3	1	
GATWICK (BF)	2	U					2		•	
GODDARDS GREEN GRID	2	7				2	7			
GODDARDS GREEN GRID 132		•								
KV		2					2			
HORLEY SWITCHING STATION	3						3			
LEIGH GRID	12						12			
LEIGH GRID 132 KV	4						4			
LEWES GRID 132 KV	2					2				
MOULSECOOMB GRID		6					1	5		
MOULSECOOMB GRID 132 KV		1					1			
NEWHAVEN GRID		7	2				1	8		
NEWHAVEN GRID 132 KV		2						2		
ROTTINGDEAN SW STN		1					1			
SMALLFIELD GRID	4	7				4	1	6		
SMALLFIELD GRID 132 KV	1	2				1	2			
STEYNING GRID 132 KV		2					2			
STEYNING GRID 33KV		5					5			
STORRINGTON GENERATION	1						1			
THREE BRIDGES LOCAL 33KV	12	16				3	24	1		
WORTHING GRID 132 KV		2						2		
WORTHING GRID A	12	1					13			
WORTHING GRID B 33KV		7	3				3	6	1	

Table 8. 132 kV CIRCUIT BREAKERS

Substation	No. HI1	No. HI2	2015 No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	2023 No. HI3	No. HI4	No. HI5
BOLNEY GRID 132 KV		13					13			
DORMANSLAND GRID 132 KV				1						1
LEWES GRID 132 KV		2	1						3	
SMALLFIELD GRID 132 KV				4						4
SOUTHERN CROSS 132 KV		12					12			
STEYNING GRID 132 KV		1					1			
THREE BRIDGES MAIN 132 KV	5	3					8			

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

# Table 9. PRIMARY TRANSFORMERS

			2015					2023		
Substation	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
ANGMERING 33KV		2						2		
ASHINGTON 33KV				2						2
BRIGHTON TOWN 33 KV	1		1		2		1		1	2
BURGESS HILL 33KV		2					1	1		
CAPEL 33/11KV			2					2		
COWFOLD 33KV		2					2			
CRANLEIGH 33/11		2					2			
CRAWLEY IND EST WEST CRAWLEY INDUSTRIAL EAST		2						2		
33/11KV		1	1		1		1	1		1
CRAWLEY TOWN 33KV	1	3					2	2		
EAST GRINSTEAD 33KV		2	1					2		1
FOLKESTONE EAST		2					1	1		
FOREST ROW 33KV		1		1				1		1
GATWICK AIRPORT 33/11KV (AF)		3					2	1		
GODDARDS GREEN 33/11KV	1	1					2			
HANGLETON 33 KV		2						2		
HAYWARDS HEATH 33KV	1	2					1	2		
HORLEY 33KV	1	1	1				1	2		
HURSTPIERPOINT 33KV		1		1				1		1
KEMPTOWN 33KV			2						2	
LEIGH GRID 132 KV	3	1				2	1	1		
LITTLEHAMPTON 33KV	1	2				1	1			1
MOULSECOOMB 33/11KV			2					2		
NORTH SHOREHAM 33KV		1	1					1	1	
NORTH WORTHING 33KV			2					2		
NUTFIELD 33KV	2						2			
PORTSLADE 33KV			3						3	
PULBOROUGH 33/11KV	2					2				
QUEENS PARK 33/11KV		2						2		
REDHILL PRIMARY		2					2			
REIGATE _A_ 33/11KV			2	1					2	1
ROTTINGDEAN 33KV		2						2		
SOMPTING 33KV			2					2		
SOUTH HOVE 33KV			2						2	
SOUTH WORTHING 33KV		1	1					2		
SOUTHGATE 33KV		3	-				2	 1		
SOUTHWATER 33/11KV		2					2	-		
SOUTHWICK 33KV		2						2		
STEYNING 33KV		2						2		
THE DROVEWAY	2						2			
UCKFIELD 33/11KV		2						2		
WEST HOATHLY 33KV		2					1	1		
WEST WORTHING 33KV		2					-	2		
WITHDEAN 33KV			2						2	
WORTHING TOWN 33KV			3					1	3	

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

Table 10. GRID TRANSFORMERS

	2015							2023		
Substation	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BOLNEY GRID 132 KV			2					2		
BRIGHTON LOCAL 132 KV			2					1	1	
DORMANSLAND GRID 132 KV		1	1				1	1		
FISHERSGATE GRID 132 KV		3					2	1		
GODDARDS GREEN GRID 132 KV		1			1		1			1
HORSHAM GRID 132 KV		1	1	1			1		1	1
LEIGH GRID 132 KV	2	1				1	1	1		
LEWES GRID 132 KV		1	1					1	1	
MOULSECOOMB GRID 132 KV		1					1			
NEWHAVEN GRID 132 KV		2						2		
SMALLFIELD GRID 132 KV	1	2				1	1	1		
STEYNING GRID 132 KV		2					2			
THREE BRIDGES GRID 132/33KV	1	2					2	1		
WORTHING GRID 132 KV			3					3		

# 3.3 Security of supply and load index analysis

The forecast substation demands referenced against the site firm capacity including transfers are detailed below:

Table 11. P 2/6 Assessment Table

Sub-station	P2/6	Secondary Voltage	Firm Capacity (MM)	Transfer (MW)	P.F.	Vinter 12/13 Summer 2012 (MV)	Vinter 13714 Summer 2013 (MV)	Vinter 14/15 Summer 2014 (MV)	Vinter 15/16 Summer 2015 (MV)	Vinter 16/17 Summer 2016 (MV)	Vinter 17/18 Summer 2017 (MV)	Vinter 18/19 Summer 2018 (MV)	Vinter 19/20 Summer 2019 (MV)	Vinter 20/21 Summer 2020 (MV)	Vinter 21/22 Summer 2021 (MV)	Vinter 22/23 Summer 2022 (MV)
▼	~	ν,	ш 🔻	~		,	,		٠ ا	,	,	,	>	>	>	>
Angmering	YES	11 <b>k</b> V	20.58	2.01	1	17.71	17.69	17.81	17.96	18.11	18.13	18.15	18.19	18.22	18.41	18.59
Angmering	YES	11 <b>k</b> V	17.77	0.00	0.92	10.34	10.32	10.39	10.47	10.55	10.56	10.58	10.60	10.62	10.72	10.82
Ashington	YES	11kV	12.48	9.27	1	10.62	10.63	10.68	10.75	10.83	10.87	10.92	10.98	11.03	11.16	1128
Ashington	YES	11kV	9.20	8.75	0.92	8.90	8.90	8.95	9.00	9.07	9.10	9.14	9.18	9.23	9.33	9.43
Betchw orth T1	YES	11kV	7.40	0.00	1	3.53	3.54	3.57	3.61	3.65	3.65	3.66	3.67	3.68	3.71	3.74
Betchw orth T1	YES	11 <b>k</b> V	5.60	0.00	0.97	2.37	2.38	2.40	2.42	2.45	2.45	2.46	2.46	2.47	2.49	2.51
Boliney Grid	YES	33kV	38.22	0.00	1	31.29	3145	3196	32.53	33.04	33.17	33.33	33.51	33.70	34.12	34.56
Boliney Grid	YES	33kV	29.40	0.00	0.98	19.44	19.54	19.87	20.24	20.56	20.64	20.74	20.84	20.96	2122	2148
Boliney SGT	YES	400kV	1271.80	0.00	1	834.76	835.67	84146	849.07	856.54	857.85	859.78	861.91	864.37	872.22	879.75
Bolney SGT	YES	400kV	1123.40	0.00	0.96	590.06	590.70	594.83	600.38	605.83	606.71	608.01	609.45	611.13	616.43	62151
Brighton Fishersgate	YES	33kV	148.20	0.00	1	117.02	116.96	117.60	118.46	119.35	119.59	119.95	120.36	120.83	122.32	123.68
Brighton Fishersgate	YES	33kV	114.00	0.00	0.95	89.58	89.52	89.96	90.56	9119	9136	9162	91.92	92.26	93.32	94.29
Brighton Fishersgate RT	YES	33kV	19.20	0.00	1	15.58	15.58	15.58	15.58	15.58	15.58	15.58	15.58	15.58	15.58	15.58
Brighton Fishersgate RT	YES	33kV	19.20	0.00	0.96	15.65	15.65	15.65	15.65	15.65	15.65	15.65	<b>1</b> 5.65	15.65	15.65	15.65
Brighton Local	YES	33kV	109.70	0.00	1	81.35	8145	82.18	83.04	83.86	84.00	84.25	84.52	84.86	85.88	86.81
Brighton Lecal	YES	33kV	86.40	0.00	0.96	65.06	65.12	65.70	66.37	67.00	67.11	67.30	67.51	67.77	68.55	69.26
Grid	YES	33kV	217.80	0.00	1	110.56	110.60	11136	112.28	113.17	113.33	113.60	113.90	114.27	115.49	116.59
Grid	YES	33kV	172.80	0.00	0.96	83.41	83.42	84.01	84.72	85.41	85.52	85.73	85.96	86.24	87.14	87.96
Brighton Town	YES	11kV	65.20	6.44	1	46.40	46.55	47.17	47.85	48.47	48.56	48.72	48.89	49.11	49.72	50.28
Brighton Town	YES	11kV	48.10	5.21	0.92	40.49	40.61	4113	4170	42.22	42.29	42.42	42.57	42.74	43.25	43.72
Burgess Hill	YES	11kV	21.95	0.00	1	12.58	12.53	12.57	<b>12</b> .65	12.73	12.75	12.77	12.80	12.83	13.00	13.16
Burgess Hill	YES	11kV	18.40	0.00	0.92	9.62	9.58	9.61	9.66	9.73	9.74	9.75	9.77	9.79	9.92	10.04
Capel Switching Station	NO	33kV	21.45	0.00	1	20.03	20.15	20.58	2105	21.47	2153	2161	2171	2182	22.11	22.41
Capel Switching Station	YES	33kV	21.45	0.00	0.96	1146	11.53	1179	12.06	12.31	12.34	12.39	12.45	12.52	12.69	12.86
Capel T1	YES	11 <b>k</b> V	4.75	1.86	1	3.47	3.50	3.61	3.72	3.82	3.83	3.86	3.88	3.91	3.98	4.05
Capel T1	YES	11kV	3.50	1.29	0.95	2.44	2.46	2.53	2.61	2.68	2.69	2.70	2.72	2.74	2.79	2.83
Capel Total	YES	11kV	9.50	2.55	1	9.31	9.34	9.44	9.55	9.65	9.67	9.69	9.72	9.75	9.81	9.88
Capel Total	YES	11kV	7.13	1.95	0.95	5.03	5.05	5.13	5.20	5.27	5.28	5.30	5.32	5.34	5.38	5.43
Regional Development Plan	YES	11kV	12.61	0.00	1	8.67	8.72	8.87	9.04	9.19	9.23	9.28	9.34	9.40	9.52	9.65
Cow fold	YES	11kV	9.70	0.00	0.97	4.84	4.87	4.95	5.04	5.13	5.15	5.18	5.21	5.24	5.31	5.38
Cranleigh	YES	11kV	22.00	1.62	1	17.68	17.77	18.13	18.51	18.85	18.90	18.97	19.04	19.13	19.37	<b>1</b> 9.61
Cranleigh	YES	11kV	16.73	0.87	0.97	10.50	10.56	10.77	1101	1122	11.24	1129	1133	11.38	1153	1168





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

Sub-station ▲	P2/6	Secondary Voltage	Firm Capacity (MW)	Transfer (MW)	P.F.	Vinter 12/13 Summer 2012 (MV)	Vinter 13/14 Summer 2013 (MV)	Vinter 14/15 Summer 2014 (MV)	Vinter 15/16 Summer 2015 (MV)	Vinter 16/17 Summer 2016 (MV)	Vinter 17/18 Summer 2017 (MV)	Vinter 18/19 Summer 2018 (MV)	Vinter 19/20 Summer 2019 (MV)	Vinter 20/21 Summer 2020 (MV)	Vinter 21/22 Summer 2021 (MV)	Vinter 22/23 Summer 2022 (MV)
Forest Row	YES	11kV	9.50	0.00	0.95	4.59	4.63	4.74	4.87	4.98	4.99	5.01	5.03	5.06	5.12	5.19
Getwick Airport A/F	YES	11kV	34.56	0.00	1	13.89	14.01	14.35	14.70	14.99	15.00	15.01	15.03	15.05	15.15	15.26
Gatwick Airport A/F	YES	11kV	33.48	0.00	0.93	16.34	16.47	16.88	17.29	17.63	17.64	17.65	17.67	17.70	17.82	17.94
Gatwick B/F	YES	11kV	31.36	0.00	1	1138	11.38	1138	1138	1138	11.38	1138	1138	11.38	1138	1138
Gatwiick B/F	YES	11kV	23.52	0.00	0.98	1162	11.62	1162	1162	1162	11.62	1162	1162	11.62	1162	1162
Goddards Green	YES	33kV	108.60	0.00	1	69.43	69.98	70.73	72.16	73.67	73.79	73.96	74.15	74.36	75.01	75.63
Goddards Green	YES	33kV	85.50	0.00	0.95	46.46	46.99	47.68	49.03	50.42	50.50	50.61	50.72	50.85	5 <b>12</b> 6	5166
Goddards Green 33/11	YES	11kV	23.04	0.00	1	13.69	14.38	15.07	16.34	17.60	17.60	17.60	17.60	17.60	17.60	17.60
Goddards Green 33/11	YES	11kV	17.28	0.00	0.96	9.65	10.34	1103	12.30	13.56	13.56	13.56	13.56	13.56	13.56	13.56
Hangleton	YES	11kV	20.80	0.00	1	14.66	14.63	14.66	14.72	14.80	14.83	14.88	14.94	15.00	15.20	15.38
Hangleton	YES	11 <b>k</b> V	17.40	0.00	0.90	9.95	9.92	9.94	9.98	10.03	10.06	10.09	10.13	10.17	10.30	10.41
Haywards Heath	YES	11kV	40.10	0.00	1	28.62	28.53	28.48	28.48	28.53	28.59	28.66	28.75	28.84	29.13	29.40
Haywards Heath	YES	11kV	35.72	0.00	0.94	19.35	19.26	19.21	19.21	19.24	19.28	19.33	19.38	19.45	19.63	19.81
Horley	YES	11kV	44.70	3.24	0.9	24.53	24.53	24.67	24.85	25.03	25.08	25.15	25.23	25.32	25.56	25.80
Horley	YES	11kV	35.30	0.00	0.93	17.94	17.94	18.04	18.16	18.29	18.33	18.38	18.44	18.50	18.67	18.84
Horsham 132/11	YES	11kV	75.70	0.00	1	41.96	4196	42.19	42.50	42.84	42.96	43.13	43.31	43.52	44.04	44.55
Horsham 132/11	YES	11kV	58.20	0.00	0.97	32.31	32.31	32.48	32.72	32.97	33.06	33.18	33.32	33.47	33.86	34.25
Hurstpierpoint	YES	11kV	20.30	0.00	1	15.31	15.31	15.39	15.50	15.62	15.68	15.75	15.83	15.91	16.11	16.30
Hurstpierpoint	YES	11kV	16.04	0.00	0.93	9.04	9.04	9.09	9.15	9.22	9.25	9.29	9.33	9.38	9.49	9.60
Kemp Tow n	YES	11kV	23.80	0.00	1	16.99	16.98	17.07	17.18	17.29	17.31	17.34	17.38	17.42	17.58	17.72
Kemp Tow n	YES	11kV	19.80	0.00	0.99	14.44	14.44	14.51	14.59	14.68	14.70	14.72	14.75	14.79	14.92	15.03
Leigh Grid	YES	33kV	112.70	0.00	1	68.08	68.20	68.97	69.87	70.71	70.84	7104	71.27	7153	72.36	73.17
Leigh Grid	YES	33kV	112.70	0.00	0.95	51.82	5188	52.40	53.02	53.60	53.69	53.83	53.99	54.18	54.78	55.37
Littlehampton T1 T2	NO	11kV	13.70	0.00	1	12.88	12.89	13.05	13.23	13.39	13.41	13.44	13.47	13.50	13.65	13.80
Littlehampton T1 T2	YES	11kV	12.30	0.00	0.96	8.64	8.65	8.75	8.87	8.98	8.99	9.00	9.02	9.04	9.14	9.24
Littlehampton T3	YES	11kV	13.70	0.00	1	7.76	7.77	7.85	7.94	8.02	8.03	8.04	8.06	8.07	8.15	8.22
Littlehampton T3	YES	11kV	12.30	0.00	0.96	5.69	5.70	5.75	5.81	5.87	5.88	5.89	5.90	5.91	5.96	6.02
Littlehampton Total	YES	11kV	27.40	0.00	1	20.67	20.69	20.92	21.19	21.44	2147	2151	21.55	2160	2183	22.05
Littlehampton Total	YES	11kV	24.70	0.00	0.96	14.34	14.35	14.51	14.68	14.85	14.87	14.89	14.92	14.95	15.11	15.26
Moulsecoomb Grid	YES	33kV	53.39	0.00	1	27.45	27.40	27.42	27.49	27.56	27.57	27.60	27.63	27.67	27.86	28.04
Moulsecoomb Grid	YES	33kV	43.20	0.00	0.97	18.35	18.30	18.32	18.36	18.41	18.41	18.43	18.45	18.47	18.59	18.71
Moulsecoomb Local	YES	11kV	23.76	6.05	1	22.86	22.82	22.84	22.88	22.94	22.95	22.98	23.01	23.04	23.20	23.34
Moulsecoomb Local	YES	11kV	19.80	0.00	0.99	15.45	15.41	15.42	15.45	15.49	15.49	15.51	15.53	15.55	15.65	15.75
North Shoreham	YES	11kV	18.70	7.15	1	17.12	17.12	17.24	17.38	17.52	17.55	17.58	17.61	17.65	17.81	17.97
North Shoreham	YES	11kV	13.80	5.24	0.92	11.91	1191	1199	12.09	12.19	12.20	12.22	12.24	12.27	12.38	12.48
North Worthing	YES	11kV	22.50	5.15	1	18.47	18.45	18.54	18.67	18.80	18.83	18.87	18.92	18.97	19.17	19.36
North Worthing	YES	11kV	19.20	0.00	0.96	12.46	12.44	12.50	12.58	12.67	12.69	12.71	12.74	12.78	12.91	13.03
Nutfield	YES	11kV	20.90	0.00	1	14.41	14.41	14.56	14.74	14.92	14.95	14.99	15.05	15.11	15.31	15.51
Nutriield	YES	11kV	17.10	0.00	0.95	1140	11.40	11.52	1166	1179	11.82	1185	1189	11.94	12.10	12.25
Portslade	YES	11kV	44.16	0.00	1	15.41	15.42	15.56	15.73	15.90	15.94	16.00	16.07	16.15	16.40	16.62
Portslade	YES	11kV	31.40	0.00	0.91	12.31	12.32	12.42	12.55	12.68	12.71	12.76	12.81	12.87	13.06	13.23
Pulberough	YES	11kV	22.90	0.00	1	13.12	13.13	13.22	13.34	13.46	13.51	13.58	13.65	13.73	13.89	14.05
Pulberough	YES	11kV	16.60	0.00	0.92	7.90	7.91	7.96	8.03	8.10	8.13	8.17	8.21	8.25	8.35	8.45
Queens Park	YES	11kV	22.50	0.00	1	20.00	19.97	20.05	20.17	20.30	20.34	20.42	20.50	20.60	20.89	21.15
Queens Park	YES	11kV	19.00	0.00	0.95	15.22	15.20	15.25	15.34	15.44	15.47	15.52	15.58	15.66	15.87	16.06
Redhill	YES	11kV	36.60	0.00	1	19.26	19.26	19.26	19.26	19.26	19.26	19.26	19.26	19.26	19.26	19.26
Redhill	YES	11kV	28.80	0.00	0.96	16.54	16.54	16.54	16.54	16.54	16.54	16.54	16.54	16.54	16.54	16.54
Reigate	YES	11kV	47.00	1.53	1	3121	3120	3136	3157	31.78	3182	3188	31.95	32.03	32.33	32.62
Reigate	YES	11kV	37.24	0.00	0.98	26.60	26.58	26.71	26.89	27.06	27.09	27.15	27.20	27.27	27.52	27.76
Rottingdean T1	YES	11kV	10.90	0.00	1	4.80	4.78	4.79	4.81	4.83	4.83	4.83	4.83	4.84	4.88	4.91
Rottingdean T1	YES	11kV	9.60	0.00	0.95	3.24	3.23	3.24	3.25	3.26	3.26	3.26	3.26	3.27	3.29	3.32

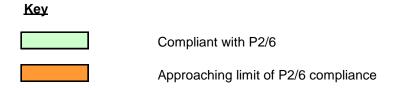
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Sub-station	P2/6	Secondary Voltage	Firm Capacity (MW)	Transfer (MW)	P.F.	Vinter 12/13 Summer 2012 (MV)	Vinter 13/14 Summer 2013 (MV)	Vinter 14/15 Summer 2014 (MV)	Vinter 15/16 Summer 2015 (MV)	Vinter 16/17 Summer 2016 (MV)	Vinter 17/18 Summer 2017 (MV)	Vinter 18/19 Summer 2018 (MV)	Vinter 19/20 Summer 2019 (MV)	Vinter 20/21 Summer 2020 (MV)	Vinter 21/22 Summer 2021 (MV)	Winter 22/23 Summer 2022 (MV)
Rottingdean T2	YES	11kV	10.90	0.00	1	5.51	5.50	5.51	5.52	5.54	5.54	5.55	5.55	5.55	5.59	5.63
Rottingdean T2	YES	11kV	9.60	0.00	0.95	4.01	4.00	4.01	4.02	4.03	4.03	4.03	4.04	4.04	4.07	4.09
Rottingdean Total	YES	11kV	22.60	0.00	1	10.34	10.32	10.33	10.36	10.40	10.40	10.41	10.42	10.42	10.50	10.57
Rottingdean Total	YES	11kV	19.20	0.00	0.95	7.27	7.24	7.25	7.28	7.30	7.30	7.31	7.31	7.32	7.37	7.42
Smallfield Grid	YES	33kV	92.50	0.00	0.9	54.62	54.74	55.20	55.71	56.16	56.22	56.30	56.39	56.50	56.82	57.16
Smallfield Grid	YES	33kV	83.70	0.00	0.93	36.18	36.28	36.64	37.03	37.36	37.39	37.44	37.49	37.56	37.76	37.97
Sompting	YES	11kV	15.85	0.00	1	12.67	12.68	12.77	12.89	13.01	13.03	13.05	13.08	13.11	13.25	13.38
Sompting	YES	11kV	13.95	0.00	0.93	8.10	8.10	8.16	8.23	8.31	8.32	8.34	8.35	8.37	8.45	8.53
Sourith Hove	YES	11kV	21.70	4.00	1	18.38	18.40	18.64	18.93	19.22	19.28	19.40	19.53	19.68	20.12	20.51
Sourth Hove	YES	11kV	19.00	0.00	0.95	13.98	14.00	14.18	14.39	14.60	14.65	14.74	14.83	14.95	15.27	15.56
South Worthing	YES	11kV	22.18	0.00	1	14.55	14.55	14.67	14.81	14.94	14.96	14.99	15.03	15.07	15.22	15.37
South Worthing	YES	11kV	16.73	0.00	0.97	11.73	11.73	11.82	11.93	12.03	12.05	12.07	12.10	12.13	12.25	12.37
Southgate	YES	11kV	44.60	4.31	1	24.20 15.45	24.33	24.95	25.62	26.19	26.22	26.26	26.32	26.39	26.75	27.11
Southgate Contline atom	YES YES	11kV 11kV	32.40 23.52	3.31 0.00	0.94	9.85	15.53 9.94	15.91 10.22	16.32 10.52	16.68	16.70 10.81	16.72	16.76	16.80	17.02 11.11	17.24 11.26
Southwater	YES	11kV	17.64	0.00	0.98	7.86	7.94	8.15	8.38	8.58	8.61	8.64	8.68	8.73	8.84	8.95
Southwater Southwick	YES	11kV	19.10	0.00	1	15.06	15.04	15.11	15.20	15.30	15.31	15.34	15.37	15.40	15.54	15.68
Southwick	YES	11kV	14.10	0.00	0.94	9.32	9.31	9.35	9.40	9.46	9.47	9.49	9.50	9.52	9.61	9.69
Steyning Grid	YES	33kV	55.58	0.00	1	14.81	14.79	14.82	14.88	14.96	15.02	15.08	15.16	15.24	15.41	15.59
Steyning Grid	YES	33kV	42.75	0.00	0.95	11.16	11.14	11.16	1121	1127	11.31	11.36	11.41	11.47	11.60	11.72
Steyning Local	YES	11kV	14.40	0.00	1	5.55	5.52	5.50	5.50	5.51	5.53	5.56	5.58	5.61	5.68	5.75
Steyning Local	YES	11kV	10.60	0.00	0.92	3.84	3.81	3.80	3.79	3.80	3.81	3.83	3.85	3.86	3.91	3.96
The Drovew ay	YES	11kV	36.60	0.00	1	8.47	8.47	8.50	8.55	8.61	8.63	8.67	8.71	8.75	8.87	8.98
The Drovew ay	YES	11kV	28.80	0.00	0.96	10.03	10.03	10.07	10.13	10.20	10.23	10.27	10.32	10.38	10.52	10.65
Three Bridges	YES	33kV	179.50	0.00	0.9	136.94	137.00	137.94	139.07	140.15	140.31	140.54	140.81	141.12	142.24	143.36
Three Bridges	YES	33kV	150.66	0.00	0.93	111.02	111.00	111.59	112.31	113.00	113.10	113.25	113.42	113.62	114.34	115.06
Three Bridges RT	YES	33kV	30.72	0.00	1	20.79	20.79	20.79	20.79	20.79	20.79	20.79	20.79	20.79	20.79	20.79
Three Bridges RT	YES	33kV	30.72	0.00	0.96	20.80	20.80	20.80	20.80	20.80	20.80	20.80	20.80	20.80	20.80	20.80
West Hoathly	YES	11kV	12.90	2.41	1	11.20	11.13	11.17	11.27	1139	11.45	11.53	11.62	11.71	12.01	12.30
West Hoathly	YES	11kV	9.80	1.36	0.98	5.22	5.16	5.18	5.22	5.28	5.30	5.34	5.38	5.43	5.57	5.70
West Hoathly Forest Row Group	YES	kV	21.10	0.00	1	17.21	17.20	17.42	17.70	17.98	18.05	18.16	18.27	18.39	18.77	19.15
West Hoathly Forest Row Group	YES	kV	16.90	0.00	0.96	9.79	9.77	9.90	10.07	10.24	10.28	10.34	10.40	10.46	10.67	10.87
West Worthing	YES	11kV	22.30	4.85	1	21.89	2185	21.92	22.03	22.15	22.18	22.22	22.26	22.31	22.52	22.72
West Worthing	YES	11kV	18.40	3.94	0.92	13.44	13.40	13.44	13.51	13.58	13.60	13.62	13.65	13.68	13.80	13.92
Withdean	YES	11kV	20.40	9.72	1	16.06	16.03	16.06	16.12	16.20	16.23	16.28	16.34	16.40	16.62	16.82
Withdean	YES	11kV	18.40	0.00	0.95	12.66	12.62	12.64	12.69	12.75	12.78	12.81	12.86	12.90	13.07	13.21
Worthing Grid A	YES	33kV	104.30	0.00	1	72.16	72.12	72.53	73.06	73.59	73.69	73.82	73.97	74.14	74.82	75.49
Worthing Grid A	YES	33kV	93.90	0.00	0.96	45.60	45.56	45.80	46.12	46.44	46.50	46.58	46.67	46.77	47.18	47.58
Worthing Grid B	YES	33kV	104.30	0.00	1	65.63	65.63	65.94	66.31	66.69	66.73	66.80	66.88	66.98	67.40	67.80
Worthing Grid B	YES	33kV	93.90	0.00	0.96	40.23	40.22	40.39	40.59	40.79	40.81	40.85	40.90	40.95	41.17	4139
Worthing Grid Total	YES	33kV	208.50	0.00	1	136.39	136.35	137.05	137.95	138.85	138.99	139.20	139.42	139.68	140.78	141.84
Worthing Grid Total	YES	33kV	172.80	0.00	0.96	85.83	85.78	86.19	86.71	87.23	87.31	87.43	87.56	87.71	88.35	88.96
Worthing Town T1 T2 T4	YES	11kV	43.90	0.00	1	24.98	24.98	24.98	24.98	24.98	24.98	24.98	24.98	24.98	24.98	24.98
Worthing Town T1 T2 T4	YES	11kV	33.10	0.00	0.96	22.87	22.87	22.87	22.87	22.87	22.87	22.87	22.87	22.87	22.87	22.87
Worthing Tow n T3	YES	11kV	21.90	0.00	1	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03
Worthing Tow n T3	YES	11kV	16.60	0.00	0.96	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33
Worthing Town Total	YES	11kV	65.80	0.00	1	31.05	3105	31.05	31.05	31.05	31.05	31.05	31.05	31.05	31.05	31.05
Worthing Town Total	YES	11kV	49.68	0.00	0.96	28.20	28.20	28.20	28.20	28.20	28.20	28.20	28.20	28.20	28.20	28.20







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### 3.4 Operational and technical restrictions

The running arrangement at Brighton Town is restricted by the fault level rating of the switchboard, such that the site must remain split on the bus section. This leaves the site un-firm for a N-1 fault, such that the site cannot be made solid.

#### 3.5 National Grid

There are no scheduled National Grid transmission projects affecting this area during the plan period.

Plans for the proposed off shore 700MW Rapion wind farm are at an advanced stage which requires a new 400kV cable connection between Bolney GSP and the Sussex coast. Although not associated with UK Power Networks local environmental groups are contesting the cable route across the South Downs and there is likely to be adverse publicity affecting the electricity industry in this area.



### 3.6 Network Constraints

#### **Worthing Cable Bridge**

Worthing Cable Bridge contains the Steyning number 1 and 2 132kV cables. One of these circuits is to be decommissioned in ED1. The other circuit is being replaced in DR5. Worthing has alternative supplies from Southern Cross via a double circuit 132kV overhead tower line.

#### **Gatwick Stream South, Central and North**

The Smallfield Gatwick Airport numbers 1, 2 and 3 circuits cross Gatwick stream at three points on small cable bridges. The third circuit is on a slightly different route from numbers 1 and 2 circuits providing a degree of

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segregation. Gatwick Airport has an alternative 33kV supply via two cable circuits to the Gatwick Airport B station from Three Brides Local 33kV substation providing an alternative supply.

### 4 Recommended strategy

Bolney Substation area offers both challenges and opportunities for network development. A combination of Asset Replacements and Reinforcements has been proposed that will enhance the network performance. This in brief includes:

- Switchgear replacement that will maintain the integrity of the network and where possible increase the firm capacity due to higher utilization of the incoming circuits.
- Firm capacity increase through transformer replacement.
- Interventions in ancillary equipment which strengthens the available firm capacity.
- Interventions in OHLs and cable circuits.

The following sections describe in detail the above interventions and their effect at the network performance. Some of the projects that require asset replacement, specifically those involving replacement of the switchboard, may be subjected to retrofit replacement. This will be considered further at the investment stage.

#### 4.1 Proposed interventions included in NAMP

Table 12. Proposed Interventions 2013-2023

Substation	Driver	Commissioning Year	Scope of Works	New Firm Capacity
Capel 33/11 kV	Reinforcement	2019	Primary ITC Transformers Replacement	24 MVA (Winter)
West Worthing 33/11 kV	Reinforcement	2022	3 <sup>rd</sup> circuit plus transformer	40 MVA (Winter)
West Hoathly33/11kV	Reinforcement	2021	Re-conductor 33kV line	24MVA (Winter)
New 33/11kV Substation Saxon Road	Reinforcement	2020	DSR	
New 33/11kV Substation St Andrews Road	Reinforcement	2020	DSR	
Brighton Town	Reinforcement	2019	Replacement 11kV Switchgear	
Littlehampton	Reinforcement	2017	Re-conductor 33kV circuit and replace cables	
Moulscoomb	Reinforcement	2022	2 <sup>nd</sup> Transformer and circuit	117MVA
Crawley Industrial East 33/11 kV	Asset Replacement	2018	Transformers Refurbishment	
PQA Three Bridges Main – Three Bridges	Asset Replacement	2016	Replace OHL Conductor Tower Replacement	
PYB Three Bridges Main – Tilgate, 2-6 ALL	Asset Replacement	2022	Refurbish OHL Conductor Tower Replacement	
PNA Bolney – Horsham, 1-20 ALL	Asset Replacement	2022	Refurbish OHL Conductor	
Hangleton 33/11 kV S/S	Asset Replacement	2017	11kV Switchgear Replacement	
Nutfield Primary	Asset Replacement	2016	11kV Switchgear Replacement	
Cowfold Primary	Asset Replacement	2020	Replacement 11 kV Switchgear	
South Hove Primary	Asset Replacement	2017	Transformer T2 Replacement Switchboard Replacement	24 MVA (Winter)
Queens Park Primary	Asset Replacement	2019	Replacement 11 kV Switchgear	24 MVA (Winter)
Southwick 33/11 kV	Asset Replacement	2016	Replacement of T1 and T2	24 MVA (Winter)
Worthing Town 33/11kV	Asset Replacement	2023	Refurbish Transformers	

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Substation	Driver	Commissioning	Scope of Works	New Firm
		Year		Capacity
North Worthing	Asset Replacement	2019	11kV Switchgear	24MVA
33/11kV	Asset Replacement	2019	Replacement	(Winter)
Hurstpierpoint	Asset Replacement	2021	Switchgear	23MVA
33/11kV	Asset Replacement	2021	Replacement	(Winter)
North Shoreham	Asset Banksoment	2023	Switchgear	24MVA
33/11kV	Asset Replacement	2023	Replacement	(Winter)
Portslade	Asset Danis sament	2024	Switchgear	
33/11kV	Asset Replacement	2024	Refurbishment	
Portslade	A 4 D 1 4	0000	Transformers	
33/11kV	Asset Replacement	2022	Refurbishment	
Rottingdean	A 4 D 1 4	0004	Switchgear	
33/11kV	Asset Replacement	2024	Replacement	
Southwick	A 15 1	0017	Switchgear	
33/11kV	Asset Replacement	2017	Replacement	
Forest Row 33kV	Asset Replacement	2022	Retrofit 11kV switchgear	
Moulsecoomb	Asset Replacement	2022	Retrofit 11kV switchgear	
Driebten Legal 400 b)/		2020	Refurbish Grid Transformers	
Brighton Local 132 kV	Asset Replacement	2020	GT1, GT2	
Driebten Teur 2214/	Asset Danis sament	2040	Replace Primary Transformers	
Brighton Town 33kV	Asset Replacement	2018	T1&T2	
Courth Llove 221/1	Accet Depleasers	2020	Refurbish Primary	
South Hove 33kV	Asset Replacement	2020	Transformers T1&T2	
Fishersgate – Withdean	Accet Depleases and	2020	Cable Danlesement	
33kV FFC Cable	Asset Replacement	2020	Cable Replacement	
Southern Cross to Lewes	Asset Replacement	2022	Cable Replacement	
Fishersgate – Brighton Local		2020		
33kV FFC Cable	Asset Replacement	2020	Cable Replacement	
Moulsecoomb Local	Connections	2017	Transformer Penlacement	40 MVA
Modisecoomb Local	LRR	2017	Transformer Replacement	(Winter)

# 4120: PYB Three Bridges Main - Tilgate; Towers 2-6. Refurbish OHL Conductor to comply with Asset Health Requirements

The project requires the conductor refurbishment of towers 2-6 by 2018, however HI indicate that the towers will also need to be refurbished or replaced by 2023 (HI=5). It is therefore recommended to be considered that the conductor replacement would also include tower replacement works.

- Left conductor HI4 in 2023. Asset no: 0309060/9063/9064
- Left fittings HI5 in 2012. Asset no: 0309062
- Right conductor HI4 in 2015. Asset no: 0309063/9064
- Right fittings HI4 in 2015. Asset no: 0309063/9064
- Earth conductor HI4 in 2015. Asset no: 0309060/9063/9064
- Earth fittings HI4 in 2023. Asset no: 0309060/9063/9064
- Tower Steel Work HI4 in 2015 and HI5 in 2023
- Foundations no problem in current period.

# 4121: PNA Bolney - Horsham, 1-20 ALL. Refurbish OHL Conductor to comply with Asset Health Requirements

Conductor replacement is not required during the 2016-2018 period (HI3 by 2023). However HIs show that earthwire and fittings replacement, as well as towers replacement needs to be considered within the period under study.

• Left fittings HI4 in 2023. Asset no: 0304995/4996/5002/5003/5004/5010

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- Right fittings HI4 in 2023. Asset no: 0304995/4996/5002/5003/5004/5010
- Earth conductor HI4 in 2012 and HI5 in 2023
- Earth fittings HI4 in 2023. Asset no: 0304995/4996/5002/5003/5004/5010
- Tower Steel Work HI4 in 2015 and HI5 in 2023
- Foundations no problem in current period.

#### 3258: Hangleton 33/11 kV S/S. 11kV Switchgear Replacement to meet Asset Health Requirements

The 11kV switchboard has been condition assessed and classified as condition 4 in 2023 Therefore this project recommends the replacement of the 11kV switchboard.

#### 4155: Nutfield Primary - Replacement of 11kV Switchgear to meet Asset Health Requirements.

The 11kV switchboard has been condition assessed and classified as condition 4 and 5 in 2023 Therefore this project recommends the replacement of the 11kV switchboard.

#### 4159: Cowfold Primary - Replacement of 11kV Switchgear.

- HI shows 4 breakers with HI4 by 2023.
- Transformers' HIs no problem in current period.

Therefore, this project recommends the replacement of the 11kV switchboard.

#### 4160: Burgess Hill Primary - Retrofit of 11kV Switchgear.

- HI shows 4 breakers with HI3 at 2015 and 2 breakers with HI4 by 2023
- Transformers' HIs no problem in current period

Therefore the retrofit of the switchgear is recommended to improve switchgear's health assessment.

#### 4161: South Hove Primary – Replacement of 11 kV Switchgear and Transformer refurbishment

- HI shows 15 breakers with HI4 2023.
- HI show transformers T2 and T3 at HI4 by 2023

The 19 x Reyrolle C-gear at South Hove Primary were manufactured between 1960 and 1964 and will be replaced at the end of their nominal life based on age-related deterioration and their overall condition (HI5).

Therefore, this project recommends the replacement of the 11kV switchboard to allow higher utilization of the transformers. It is also proposed to include the replacement of T2 which goes out of its nominal life by 2023.

Additionally a new substation could be built at an adjacent site (Saxon Road) which will relieve South Hove substation (project 8076). This is deferred through application of DSR.

#### 4164: Queens Park Primary - Replacement of 11kV Switchgear and DSR.

- HI shows 8 breakers with HI3 at 2015 and 3 breakers with HI4 by 2020.
- Transformers HIs no problem in current period (HI=2 and HI=3 in 2024).

The predicted load at Queens Park Primary will exceed the existing firm capacity by 2020. Currently there are two transformers 2x16/20 MVA with available firm capacity 22.5 MW (winter) (Limiting factor the rating of the secondary switchboard). The existing 11kV switchgear is not fully rated for this increased load. Therefore, it is proposed the replacement of 11kV switchboard to allow higher utilization of the transformers.

It is noted that the 33kV incoming circuits are rated at 24MVA, therefore after replacement of the switchboard; the new firm rating will be 24MVA.

7821: Angmering 33kV - Replacement of 11kV switchgear.

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Switchgears' HIs show eight circuit breakers with HI3 and two with HI4 in 2023. Therefore the replacement of the switchgear is recommended to comply with equipment health asset requirements criteria. This project interacts with project 8064 which concerns further reinforcement of Angmering substation.

# 3701: Capel 33/11 kV Substation Reinforcement. Primary Transformers Capacity Increase to meet Load Growth Demand and (N-1).

Limiting factor: Cyclic rating of transformers.

- Transformers' HIs no problem in current period
- Switchgears' HIs show no problem in current period.
- The demand is supplied with 2.85MW (winter) transfer capacity

Currently there are two transformers of 7.5 MVA installed. With these, the firm capacity of the Substation is expected to be exceeded by 2012/2013 (winter). Therefore it is proposed to replace the existing units with 12/24 MVA units to accommodate for the load increase. After replacement of the two transformers the new firm capacity will be 24MVA.

#### 7901: Reigate 33/11 kV Substation Asset Replacement. Replace Primary Transformers (T1, T2, T3).

It is proposed to replace the existing T3-12/24MVA transformer with a 12/24MVA transformer as well as T1&T2 transformers from 16/20MVA to 12/24MVA units due to their poor health performance by 2023. (Consideration will be given in using higher rating units depending on marginal costs)

#### 7880: Crawley Industrial East 33/11 kV Substation Refurbish Primary Transformer (T1, T2).

The transformers have been condition assessed and classified as one having a health indices of HI5. It is therefore proposed to refurbish T2 (15MVA) to comply with health asset requirements. Primary transformer T1 satisfies health asset requirements and therefore no refurbishment is required.

The firm capacity of the site will remain the same. The incoming 33 kV circuit is rated at 23MVA.

#### 7836: North Worthing 33kV - Retrofit 11kV Switchgear

• Switchgears' health indices appear to be 4 & 5 in 2018

Therefore this project recommends the retrofit of the switchgear to comply with the health asset requirements. The switchgear replacement must be done in conjunction with the uprating of the ancillary equipment so that to allow full utilization of transformers and make the firm capacity equal to 24MVA (winter).

#### 7918: Worthing Town 33kV - Refurbish Primary Transformer (T1/T2/T3/T4).

The transformers present HI4 in 2023.

Therefore the project recommends the refurbishment of the transformers.

#### 8680: Moulsecoomb 132/33kV reinforcement

One of the two 90MVA grid transformers at Brighton Local has to be refurbished in ED1. The extended outage necessary to carry out the scale of refurbishment places the city of Brighton and Hove at significant risk of an n-2 event. The Fishersgate to Brighton Local 132kV circuits are fluid filled cables and have an extended leakage and third party damage history. The Brighton Local sub-station is adjacent to a rehabilitation centre. In 2011, a resident accessed the sub-station from this centre and was killed. The site had security in excess of ESQCR requirements but this proved insufficient to prevent access. Enhanced security measures have been installed on the site. Should such an event occur again, the emergency services would instruct the sub-station to be switched out. The existing Moulsecoomb site is supplied by one 132kV gas compression cable to one grid transformer with three 33kV interconnectors to Brighton Local. These interconnectors have Moulsecoomb primary sub-station teed off one of the circuits. The existing gas compression pipeline cable is being replaced in DPCR5. To mitigate the risk of an n-2 event arising in the city, it is proposed to install a new 132kV in the now redundant gas compression pipeline cable pipe to Southern Cross and install a second 90MVA grid transformer in the available space on the existing Moulsecoomb site within the existing boundary.

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#### 7814: Hurstpierpoint 33/11kV, Switchgear replacement.

The switchgear appears to have 4 circuit breakers with HI4 and 1 circuit breaker with HI5 in 2023. Therefore the project recommends the replacement of the switchgear, to comply with the health assets standards. In addition the new switchgear must be rated so that to allow maximum utilization of transformer capacity (23MVA – winter). Moreover, the uprating of the incoming circuits, if necessary, must be considered.

#### 7816: North Shoreham 33/11kV, Switchgear replacement.

The switchgear appears to have three circuit breakers with HI4 in 2023. Therefore it is proposed to replace the switchgear to comply with the health assets standards. Moreover, the new switchgear must be rated so that to ensure full utilization of new installed 12/24 MVA transformers.

#### 7839: Portslade 33/11kV, Retrofit 11kV Switchgear.

Portslade appears to has1 circuit breaker with HI4 in 2023. Therefore it is proposed to retrofit the switchgear to comply with health assets standards. Moreover, the rating must be capable of utilizing the full rating of the retrofitted transformers (refer to project 7899).

#### 7899: Portslade 33/11kV, Refurbish Primary Transformer T1, T2 & T3.

Primary Transformers reach the end of their life by 2023 (HI4 for T1, T2&T3). Therefore it is proposed to refurbish the units with so as to comply with health assets standards.

### 7818: Rottingdean 33kV - Replacement of 11kV switchgear.

Primary Transformers T1&T2 appear to have no problem in current period

Rottingdean appears to have 4 circuit breakers with HI4 in 2023. Therefore the replacement of the switchgear is proposed to comply with health assets standards.

#### 7845: Southwick 33kV - Replacement 11kV Switchgear.

Primary Transformers T1&T2 appear to have no problem in current period

Southwick appears to have 3 circuit breakers with HI4 and 1 circuit breaker with HI5 in 2023. Therefore the replacement of the switchgear is proposed to comply with health assets standards.

### 7967: Fishersgate Grid - Withdean (Circuit 1-2), 33kV FFC Cable replacement (2019-2021).

The cable section 91198378-1-2 appears to have HI5 in 2021, therefore this projects ensures the replacement in order to comply with reliability standards.

### 7968: Fishersgate Grid - Brighton Local (Circuit 2-2), 33kV FFC Cable replacement (2019-2021).

The cable section 91199107-2-2 appears to have HI5 in 2012, therefore this project ensures the replacement in order to comply with the reliability standards. However, this project has been scheduled for 2019, but it would be recommended to be transferred at an earlier period.

#### 7806: Smallfield Grid - Replace 132kV Switchgear

The condition assessment of the 1968 GEC OFA11 Bulk Oil Switchgear installed at Smallfield Grid has shown that the probability of failure due to degradation will become unacceptable (4 circuit breakers at HI5). 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 4 circuit breakers replaced with 4 new circuit breakers.

#### 7826: Forest Row 33kV - Retrofit 11kV Switchgear

The condition assessment of the 1966 - 67 Reyrolle LMT Oil Switchgear installed at Forest Row 33kV has shown that the probability of failure due to degradation will become unacceptable (HI4). It is not possible to keep these assets in use without compromising operational requirements; therefore this project recommends its Refurbishment. Completion of the project will see 7 circuit breakers replaced with 7 new circuit breakers.

### 7833: Moulsecoomb 33/11kV - Retrofit 11kV Switchgear

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The condition assessment of the 1967 South Wales Switchgear C4X Oil Switchgear installed at Moulsecoomb 33/11kV has shown that the probability of failure due to degradation will become unacceptable (HI5). It is not possible to keep these assets in use without compromising operational requirements, therefore this project recommends its Refurbishment. Completion of the project will see 12 circuit breakers replaced with 12 new circuit breakers.

#### 7876: Brighton Local 132kV - Refurbish Grid Transformer (GT1, GT2)

The condition assessment of the 1963/64 English Electric Grid Transformers with English Electric FDB tap changers installed at has shown that the probability of failure due to degradation will become unacceptable (HI4). It is not possible to keep these assets in use without compromising operational requirements; therefore this project recommends its refurbishment. Completion of the project will see 1 Grid Transformer refurbished.

#### 7877: Brighton Town 33 kV - Replace Primary Transformer (T1, T2)

The condition assessment of the T2 1963 English Electric Primary Transformer with Fuller HS tap changer has shown that the probability of failure due to degradation will become unacceptable (HI4/5). It is not possible to keep these assets in use without compromising operational requirements; therefore this project recommends its replacement. T1 will be replaced due to Load Reinforcement. Completion of the project will see 2 Primary Transformer replaced with 2 new 20/40MVA Primary Transformers. This project has been optimized.

#### 7891: Horsham Grid 132kV - Refurbish Grid Transformer (GT2A, GT3A)

The condition assessment of the 1966 Bonar Long Grid Transformers with Fuller HS tap changers installed at has shown that the probability of failure due to degradation will become unacceptable (HI5). It is not possible to keep these assets in use without compromising operational requirements; therefore this project recommends its refurbishment.

### 7907: South Hove 33kV - Refurbish Primary Transformer (T2, T3)

The condition assessment of the 1964 English Electric Primary Transformers with Fuller HS tap changers installed at has shown that the probability of failure due to degradation will become unacceptable (HI4). It is not possible to keep these assets in use without compromising operational requirements; therefore this project recommends its refurbishment. **8075: Queens Park 33kV/11kV – ITC** 

The predicted load at Queens Park 33kV/11kV will exceed the existing rating of the associated transformer circuits.

It is not possible to lower the load without compromising operational and planning requirements. It is therefore proposed to reduce demand utilising demand side response.

#### 8076: New Saxon Road (South Hove Primary) Demand Side Response

Brighton and Hove City Council has predicted an increase in population of 16% (or 40,000 people) by 2026. The impact on the demand caused by this growth is subjective and is estimated to of the order of 1.2MW on top of the predicted demand by 2023. Reinforcement is expected to be required during ED2.

It is therefore proposed to put contracts in place to provide up to 2.0MVA of DSR in ED1. This is proposed as an alternative to traditional reinforcement and is required to supply the forecast increased peak demands in the area of South Hove.

#### 8079: New St Andrews Road (West Worthing Primary) Demand Side Response

The predicted load at West Worthing 33kV/11kV will exceed the existing winter firm capacity in 2019/20. It is not possible to lower the load without compromising operational and planning requirements.

It is therefore proposed to put contracts in place to provide up to 2.0MVA of DSR in ED1. In ED2, it is proposed that a new substation be constructed at St Andrews Road, fed by 2 x 10km 33kV underground cable circuits from Worthing Grid.

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#### 4.2 Proposed interventions not included in NAMP

There are cases where the Substation includes assets which do not conform with the health assets standards and no actions have been included in the current NAMP. These cases are described below:

#### Steyning 33/11kV - Retrofit of 11kV switchgear (2022-2023).

Steyning appears to have 1 circuit breaker with HI5 in 2023. The S/S has no problem concerning the firm capacity during this period. However, the retrofit of the switchgear is recommended to comply with health assets standards.

#### 4.3 Alternatives Considered

#### 3834: - Southwick - Replace T1 and T2 (2015)

T1 and T2 are 15 MVA units dating from 1956 and 1962 respectively. T1 suffers from poor oil quality due to high acid content, and T2 is suffering from severe oil leaks. Both transformers have been condition assessed and classified as having a health index of 140. Therefore, they are to be replaced with 12/24 MVA units (**to be removed from NAMP**).

3705: Crawley Industrial East Substation 33/11kV. Reinforcement - Increase 11kV Transfer Capability (2021/22).

According to PLE the site has a firm capacity of 36.3MW which is enough to supply the load demand, therefore it is proposed this project to be deferred to the next period, after re-consideration.

3743: West Worthing 33/11 kV Substation Reinforcement. Primary Transformers Capacity Increase to meet Load Growth Demand and (N-1) (2017-2019).

Limiting factor: Rating of ancillary equipment.

- Transformers' HIs no problem in current period
- Switchgears' HIs show no problem in current period.
- West Worthing S/S is expected to exceed its firm capacity in 2020 (the demand is currently supplemented by 4.85 MW transfer capability).

The switchgear firm capacity is limited to 22.3 MW (winter) while two transformers of 16/20 MVA are currently installed. The incoming 33kV circuits have a winter rating of 23.2MVA and the transformer having a cyclic rating of 24MVA which is not enough to satisfy the demand without the transferred capacity. Since the transformers appear to have good HIs, it is proposed to add a new 16/20MVA unit and lay a new 33kV cable. This will trigger the replacement of 11kV switchboard which is not fully rated for the increased load.

Additionally, a new substation is planned to be built at St. Andrews Road (subjected to planning permission – project: 8079) which will further relive the load demand at West Worthing. This can be deferred out of ED1 with demand side response.

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# 4.4 Costs and phasing

**Table 13.** NAMP proposed actions – Table J Less Indirect 19<sup>th</sup> February 2014

Cat	Namp Line	Project ID	Description	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024
Α	1.02.03	3157	PBC - Bolney-Steyning - Conductor Replacement - BT21 driven	161	277	76	0	0	0	0	0	0	0	0
Α	1.02.03	4120	PYB - Three Bridges Main -Tilgate - Conductor Replacement	0	0	0	0	0	0	0	0	0	50	0
Α	1.02.03	4121	PNA - Bolney - Horsham - Conductor Replacement	0	0	0	0	0	0	0	0	85	217	0
Α	1.02.03	4129	PJC Bolney-Smallfield 132kV OHL Refurbishment, 1-92 All	103	30	0	0	0	0	0	0	0	0	0
Α	1.02.03	5540	PLB - Lewes/Southern Cross - Tower Refurbishment	147	0	0	0	0	0	0	0	0	0	0
Α	1.02.03	7963	PLB - Lewes - Southern Cross - Insulator and Fittings Replacement	0	0	0	0	0	104	164	0	0	0	0
Α	1.02.90	4113	PQA - Three Bridges Main/Three Bridges Local - Conductor Replacement	0	11	46	34	0	0	0	0	0	0	0
Α	1.02.90	5568	PSA - Southern Cross/Worthing - Insulator & Fitting Replacement	16	0	0	0	0	0	0	0	0	0	0
Α	1.03.02	8181	Rottingdean 33/11kV Transformer Noise Attenuation	38	0	0	0	0	0	0	0	0	0	0
Α	1.07.07	3139	Steyning - Worthing No 1 Gas Cable Replacement	2,013	0	0	0	0	0	0	0	0	0	0
Α	1.07.07	4086	Fishersgate - Moulsecoomb 132kV Gas Cable Replacement	1,522	0	0	0	0	0	0	0	0	0	0
Α	1.07.07	8399	Southern Cross to Lewes 132kV: Replace 132kV Gas Cable Section Between Southern Cross-Mile Oak	0	0	0	0	0	0	139	555	416	0	0
Α	1.07.07	8643	Decomissioning of Steyning-Worthing Gas Cable Circuit 4	0	0	0	0	0	0	0	0	18	53	0
Α	1.07.90	4087	Leigh - Reigate 33kV IP Gas Cable Replacement	0	0	0	0	0	0	53	369	897	791	0
Α	1.09.01	8172	100913013 - 33kV Lewes Grid/Lewes Town No2 - OHLReplacement	0	0	0	0	24	44	0	0	0	0	0
Α	1.09.01	8174	100913012 - 33kV Lewes Grid/Lewes Town No1 - OHLReplacement	0	0	54	14	0	0	0	0	0	0	0
Α	1.19.34	8921	Littlehampton ESQC Resolution Strategy	95	592	805	805	703	0	0	0	0	0	0
Α	1.26.01	3017	Bolney 132kV Busbar Protection	77	0	0	0	0	0	0	0	0	0	0
Α	1.26.01	8398	Feeder Protection and T80 Intertrip Replacement (Smallfield, Bolney and Leigh)	160	0	0	0	0	0	0	0	0	0	0
Α	1.26.10	5295	BT21CN Mitigation - Lewes/Newhaven	0	0	124	1,112	0	0	0	0	0	0	0
Α	1.26.10	5349	BT21CN Mitigation - Smallfield/Leigh	319	0	0	0	0	0	0	0	0	0	0
Α	1.26.10	5350	BT21CN Mitigation - Southern Cross/Fishersgate	10	0	0	0	0	0	0	0	0	0	0
Α	1.26.10	5366	BT21CN Mitigation - Bolney/Steyning	533	659	324	0	0	0	0	0	0	0	0
Α	1.26.10	7982	BT21CN Mitigation - 33kV Bolney 33kV To Storrington P.Gen	0	60	179	0	0	0	0	0	0	0	0
Α	1.26.10	7990	BT21CN Mitigation - 33kV Reigate 33kV To Biffa Redhill	0	0	60	179	0	0	0	0	0	0	0
Α	1.26.10	7999	BT21CN Mitigation - 33kV Little Chart to Harrietsham	0	0	0	60	179	0	0	0	0	0	0
Α	1.48.01	7806	Smallfield Grid - Replace 132kV Switchgear	0	0	0	0	0	0	257	626	0	0	0
Α	1.50.01	3258	Hangleton 33/11kV S/S - Retrofit 11kV Switchgear	0	0	0	0	0	0	78	81	0	0	0
Α	1.50.01	4155	Nutfield Primary - Replace 11kV Switchgear	0	0	574	1,571	0	0	0	0	0	0	0
Α	1.50.01	4159	Cowfold Primary - Replace 11kV Switchgear	0	0	0	0	0	226	570	0	0	0	0
Α	1.50.01	4160	Burgess Hill Primary - Retrofit 11kV Switchgear	0	0	0	0	0	0	57	30	0	0	0
Α	1.50.01	4161	South Hove Primary - Replace 11kV Switchgear	0	0	0	0	0	0	573	1,570	0	0	0
Α	1.50.01	4164	Queens Park Primary - Replace 11kV Switchgear	0	0	0	0	0	92	594	0	0	0	0
Α	1.50.01	7814	Hurstpierpoint 33kV - Replace 11kV Switchgear	0	0	0	0	0	0	239	597	0	0	0
Α	1.50.01	7816	North Shoreham 33kV/11kV - Replace 10 Panel GEC VMX Switchgear	0	0	0	0	0	0	0	0	235	583	0
Α	1.50.01	7818	Rottingdean 33kV - Replace 11kV Switchgear	0	0	0	0	0	0	0	0	0	221	543
Α	1.50.01	7821	Angmering 33kV - Replace 11kV Switchgear	0	0	0	0	0	0	0	234	584	0	0

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Cat	Namp Line	Project ID	Description	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022	2022/ 2023	2023/ 2024
Α	1.50.01	7824	Crawley Ind Est West - Retrofit 11kV Switchgear	0	0	0	0	0	0	91	124	0	0	0
Α	1.50.01	7826	Forest Row 33kV - Retrofit 11kV Switchgear	0	0	0	0	0	0	0	66	54	0	0
Α	1.50.01	7833	Moulsecoomb 33/11kV - Retrofit 11kV Switchgear	0	0	0	0	0	0	0	82	100	0	0
Α	1.50.01	7836	North Worthing 33kV - Replace 11kV Switchgear	0	0	0	0	243	611	0	0	0	0	0
Α	1.50.01	7839	Portslade 33kV - Retrofit 11kV Switchgear	0	0	0	0	0	0	0	0	0	103	160
Α	1.50.01	7845	Southwick 33kV - Replace 11kV Switchgear	0	0	0	234	584	0	0	0	0	0	0
Α	1.51.03	3188	Ashington Primary - Replace T1/T2 with 12/24MVA Txs	105	1,090	0	0	0	0	0	0	0	0	0
Α	1.51.03	3836	Forest Row - Replace T2	260	0	0	0	0	0	0	0	0	0	0
Α	1.51.03	3864	Brighton Town - Replace T3 and T4	1	0	0	0	0	0	0	0	0	0	0
Α	1.51.03	7877	Brighton Town 33 kV - Replace Primary Transformer (T1,T2)	0	0	0	0	158	942	0	0	0	0	0
Α	1.51.03	7901	Reigate _A_ 33/11kV - Replace Primary Transformer (T1, T2, T3)	0	0	0	78	519	1,037	0	0	0	0	0
Α	1.51.03	7916	Withdean 33kV - Replace Primary Transformer (T1, T2)	0	0	0	0	0	0	0	0	135	357	579
Α	1.51.11	7876	Brighton Local 132kV - Refurbish Grid Transformer (GT1, GT2)	0	0	0	0	0	0	0	176	125	0	0
Α	1.51.11	7880	Crawley Industrial East 33/11kV - Refurbish Primary Transformer (T1, T2)	0	0	0	114	188	0	0	0	0	0	0
Α	1.51.11	7891	Horsham Grid 132kV - Refurbish Grid Transformer (GT2A, GT3A)	0	0	0	0	0	114	188	0	0	0	0
Α	1.51.11	7899	Portslade 33kV - Refurbish Primary Transformer (T1, T2, T3)	0	0	0	0	0	0	0	149	297	0	0
Α	1.51.11	7907	South Hove 33kV - Refurbish Primary Transformer (T2, T3)	0	0	0	0	0	0	114	188	0	0	0
Α	1.51.11	7918	Worthing Town 33kV - Refurbish Primary Transformer (T1, T2, T3, T4)	0	0	0	0	0	0	0	120	276	207	0
Α	1.51.11	8668	Haywards Heath 33/11kV - Refurbish Primary Transformers (T1, T2)	0	0	0	0	0	0	0	0	300	0	0
Н	1.29.01	7967	Fishersgate-Withdean 33kV (Circuit 1-2) - 33kV FFC Replacement	0	0	0	0	0	0	185	402	0	0	0
Н	1.29.01	7968	Fishergate Grid-Brighton Local (Circuit 2-2) - 33kV FFC Replacement	0	0	0	0	0	0	194	428	0	0	0
R	1.33.01	3701	Capel 33/11kV Substation Reinforcement - Replace T1/T2 with 12/24 MVA Units	0	0	0	0	0	0	0	23	185	461	369
R	1.33.01	3722	North Shoreham 33/11kV Reinforcement - Replace T1/T2 with 12/24 MVA Units	959	376	0	0	0	0	0	0	0	0	0
R	1.33.01	8075	Queens Park Primary Demand Side Response	0	0	0	0	0	0	7	30	30	30	30
R	1.33.01	8076	New Saxon Road (South Hove Primary) Demand Side Response	0	0	0	0	0	0	7	30	30	30	30
R	1.33.01	8079	New St Andrews Road (West Worthing Primary) Demand Side Response	0	0	0	0	0	0	7	30	30	30	30
R	1.33.03	3227	Brighton Town - 11 kV Switchgear Uprating	11	0	0	0	0	0	0	0	0	0	0
R	1.33.03	5652	Portslade - Install 11kV Auto Switching Scheme	22	0	0	0	0	0	0	0	0	0	0
R	1.33.03	8067	Brighton Town-Replace 11kV Switchboard	0	43	213	334	334	412	0	0	0	0	0
R	1.37.05	8072	Littlehampton T1/ T2 33kV Group Reinforcement - Reconductor 12 km of DC 33kV OHL and Replace 7 km of DC 33kV UGC	47	488	1,389	1,389	2,242	0	0	0	0	0	0
R	1.37.06	3216	Three Bridges Grid Reinforcement - GT1 132kV Cable Connection	445	0	0	0	0	0	0	0	0	0	0
R	1.37.06	8680	Moulsecoomb 132/33kV Reinforcement - Install a 2nd 9km 132kV Circuit and 90 MVA GT2	0	0	0	0	0	0	44	1,174	4,173	3,119	0
R	1.37.07	8068	Capel Switching Station 33kV Reinforcement	30	151	248	248	316	0	0	0	0	0	0
Т	3.33.01	3714	Moulsecoomb Local ITC & 33kV Circuit	35	244	524	314	0	0	0	0	0	0	0

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# 4.5 HI / LI Improvement

Table 14. 11kV Circuit breakers

			2015				2023 v	vith Interv	ention	
Substation	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
ANGMERING 33KV	HI1	<b>HI2</b>	<b>HI3</b>	HI4	HI5	<b>HI1</b>	HI2	HI3	HI4	HI5
ASHINGTON 33KV		10	,			10		10		
BRIGHTON TOWN 33 KV		32	2				30	4		
BURGESS HILL 33KV		8	4			12	30	4		
CAPEL 33/11KV		8	4			12	8			
COWFOLD 33KV		1	7			8	0			
CRANLEIGH 33/11		11	ı			0	1	10		
CRAWLEY IND EST WEST		6	8			1.1	ı	10		
CRAWLEY INDUSTRIAL EAST		0	0			14				
33/11KV		16					14	2		
CRAWLEY TOWN 33KV		18					13	5		
EAST GRINSTEAD 33KV	4	11				3	11	1		
FOLKESTONE EAST		7						7		
FOREST ROW 33KV		2	6			8				
GATWICK AIRPORT 33/11KV (AF)	1	17					17	1		
GODDARDS GREEN 33/11KV	11					11				
HANGLETON 33 KV			10			10				
HAYWARDS HEATH 33KV	1	13				1	13			
HORLEY 33KV	15	3	5	2	1		15	6	2	3
HORSHAM GRID 132/11 KV	24						24			
HURSTPIERPOINT 33KV		1	10			11				
KEMPTOWN 33KV	14					14				
LITTLEHAMPTON 33KV		12	1				5	8		
MOULSECOOMB 33/11KV	2	3	9			14				
NORTH SHOREHAM 33KV		10				10				
NORTH WORTHING 33KV		2	10			12				
NUTFIELD 33KV	1	2	8	1		12				
PORTSLADE 33KV		5	12			17				
PULBOROUGH 33/11KV		8					8			
QUEENS PARK 33/11KV		5	8			13				
REDHILL PRIMARY	11					11				
REIGATE _A_ 33/11KV	18					18				
ROTTINGDEAN 33KV		7				7				
SOMPTING 33KV		7					7			
SOUTH HOVE 33KV		4	15			19				
SOUTH WORTHING 33KV		11						11		
SOUTHGATE 33KV	16					16		-		
SOUTHWATER 33/11KV		13					1	12		
SOUTHWICK 33KV		2	7	1		10	•			
STEYNING 33KV		5	1	•				5		1
THE DROVEWAY	15		-			15				-
UCKFIELD 33/11KV	1	8					7	1		
WEST HOATHLY 33KV		7					•	7		
WEST WORTHING 33KV		11					3	7	1	
WITHDEAN 33KV		11					11	•	•	
WORTHING TOWN 33KV		23					1	22		

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

### Table 15. 33kV CIRCUIT BREAKERS

	2015						2023 v	with Interv	ention	
Substation	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
BOLNEY GRID 132 KV	HI1	<b>HI2</b> 2	HI3	HI4	HI5	HI1	HI2	<b>HI3</b>	HI4	HI5
BOLNEY GRID 33 KV		6	2					8		
BRIGHTON LOCAL 132 KV		1	1					2		
BRIGHTON LOCAL 132 KV		4	11					13	2	
CAPEL SW STN (33KV)	9	4	11			9		13		
DORMANSLAND GRID	9	7	1			9		8		
			I							
DORMANSLAND GRID 132 KV		2						2		
EASTBOURNE GRID		8					8			
FISHERSGATE GRID	24					1	23			
FISHERSGATE GRID 132 KV		3	1					3	1	
GATWICK (BF)	2						2			
GODDARDS GREEN GRID	2	7				2	7			
GODDARDS GREEN GRID 132 KV		2					2			
HORLEY SWITCHING STATION	3						3			
LEIGH GRID	12						12			
LEIGH GRID 132 KV	4						4			
LEWES GRID 132 KV	2					2				
MOULSECOOMB GRID		6					1	5		
MOULSECOOMB GRID 132 KV		1					1			
NEWHAVEN GRID		7	2				1	8		
NEWHAVEN GRID 132 KV		2						2		
ROTTINGDEAN SW STN		1					1			
SMALLFIELD GRID	4	7				4	1	6		
SMALLFIELD GRID 132 KV	1	2				1	2			
STEYNING GRID 132 KV		2					2			
STEYNING GRID 33KV		5					5			
STORRINGTON GENERATION	1						1			
THREE BRIDGES LOCAL 33KV	12	16				3	24	1		
WORTHING GRID 132 KV		2						2		
WORTHING GRID A	12	1					13			
WORTHING GRID B 33KV		7	3				3	6	1	

# Table 16. 132 kV CIRCUIT BREAKERS

	2015					2023 with Intervention				
Substation	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BOLNEY GRID 132 KV		13					13			
DORMANSLAND GRID 132 KV				1						1
LEWES GRID 132 KV		2	1						3	
SMALLFIELD GRID 132 KV				4		4				
SOUTHERN CROSS 132 KV		12					12			
STEYNING GRID 132 KV		1					1			
THREE BRIDGES MAIN 132 KV	5	3					8			

### **Table 17. PRIMARY TRANSFORMERS**

	2015				2023 with Intervention					
Substation	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
	HI1	HI2	HI3	HI4	HI5	HI1	HI2	HI3	HI4	HI5

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

	2015				2023 v	vith Interv	ention			
Substation	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
ANGMERING 33KV		2						2		
ASHINGTON 33KV				2						2
BRIGHTON TOWN 33 KV	1		1		2	2	1		1	
BURGESS HILL 33KV		2					1	1		
CAPEL 33/11KV			2			2				
COWFOLD 33KV		2					2			
CRANLEIGH 33/11		2					2			
CRAWLEY IND EST WEST		2						2		
CRAWLEY INDUSTRIAL EAST 33/11KV		1	1		1	2		1		
CRAWLEY TOWN 33KV	1	3					2	2		
EAST GRINSTEAD 33KV		2	1					2		1
FOLKESTONE EAST		2					1	1		
FOREST ROW 33KV		1		1				1		1
GATWICK AIRPORT 33/11KV (AF)		3					2	1		
GODDARDS GREEN 33/11KV	1	1					2			
HANGLETON 33 KV		2						2		
HAYWARDS HEATH 33KV	1	2				2	1			
HORLEY 33KV	1	1	1				1	2		
HURSTPIERPOINT 33KV		1		1				1		1
KEMPTOWN 33KV			2						2	
LEIGH GRID 132 KV	3	1				2	1	1		
LITTLEHAMPTON 33KV	1	2				1	1			1
MOULSECOOMB 33/11KV			2					2		
NORTH SHOREHAM 33KV		1	1			2				
NORTH WORTHING 33KV			2					2		
NUTFIELD 33KV	2						2			
PORTSLADE 33KV			3			3				
PULBOROUGH 33/11KV	2					2				
QUEENS PARK 33/11KV		2				2				
REDHILL PRIMARY		2					2			
REIGATE A 33/11KV			2	1		3				
ROTTINGDEAN 33KV		2						2		
SOMPTING 33KV			2					2		
SOUTH HOVE 33KV			2			2				
SOUTH WORTHING 33KV		1	1					2		
SOUTHGATE 33KV		3					2	1		
SOUTHWATER 33/11KV		2					2			
SOUTHWICK 33KV		2						2		
STEYNING 33KV		2						2		
THE DROVEWAY	2						2			
UCKFIELD 33/11KV		2						2		
WEST HOATHLY 33KV		2				2				
WEST WORTHING 33KV		2						2		
WITHDEAN 33KV			2			2				
WORTHING TOWN 33KV			4			4				
						1				

# Table 18. GRID TRANSFORMERS

	2015				2023 with Intervention					
Substation	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BOLNEY GRID 132 KV		2						2		

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

	2015				2023 with Intervention					
Substation	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BRIGHTON LOCAL 132 KV			2			2				
DORMANSLAND GRID 132 KV		1	1				1	1		
FISHERSGATE GRID 132 KV		3					2	1		
GODDARDS GREEN GRID 132 KV		1			1		1			1
HORSHAM GRID 132 KV		1	1	1		2	1			
LEIGH GRID 132 KV	2	1				1	1	1		
LEWES GRID 132 KV		1	1					1	1	
MOULSECOOMB GRID 132 KV		1					1			
NEWHAVEN GRID 132 KV		2						2		
SMALLFIELD GRID 132 KV	1	2				1	1	1		
STEYNING GRID 132 KV		2					2			
THREE BRIDGES GRID 132/33KV	1	2					2	1		
WORTHING GRID 132 KV			3					3		

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

# **5 References**

References	Description
Reference 1	Planning Load Estimates SPN Area 2011 – 2023 (27 February 2013) Element Energy
Reference 2	SPN 132kV System Diagram East
Reference 3	SPN 132kV System Diagram West
Reference 4	SPN LTDS Network Schematics
Reference 5	NAMP SPN Table J Less Ind 19 February 2014
Reference 6	ED1 Update September 2012 v10.3.1

# **5.1 Appendices**

Appendix	Description
Appendix A	Geographical diagrams
Appendix B	Single Line Diagram – Existing Network
Appendix C	SPN area
Appendix D	Geo-Physical Network Diagram

# **5.2 Document History**

Version	Date of Issue	Author	Details
1.0	01/11/13	URS / CW	
2.0	28/02/14	MJ	
2.1	10/03/14	SJE	
2.2	23/03/14	SJE	
2.3	26/03/14	SG	

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

# 6 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
URS	Infrastructure Planner	URS	
Tendai Matiringe	IDP Coordinator (EPN/LPN/SPN)	Tendai Matiringe	
Chris Winch	Planning Manager (North / South)	Chris Winch	

# Approval by:

Name	Role	Signature	Date
Robert Kemp	Head of System Development	Robert Kemp	
Barry Hatton	Director of Asset Management	Barry Hatton	

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# **Area Covered**

**APPENDIX A:** GEOGRAPHICAL DIAGRAM

WEST SUSSEX

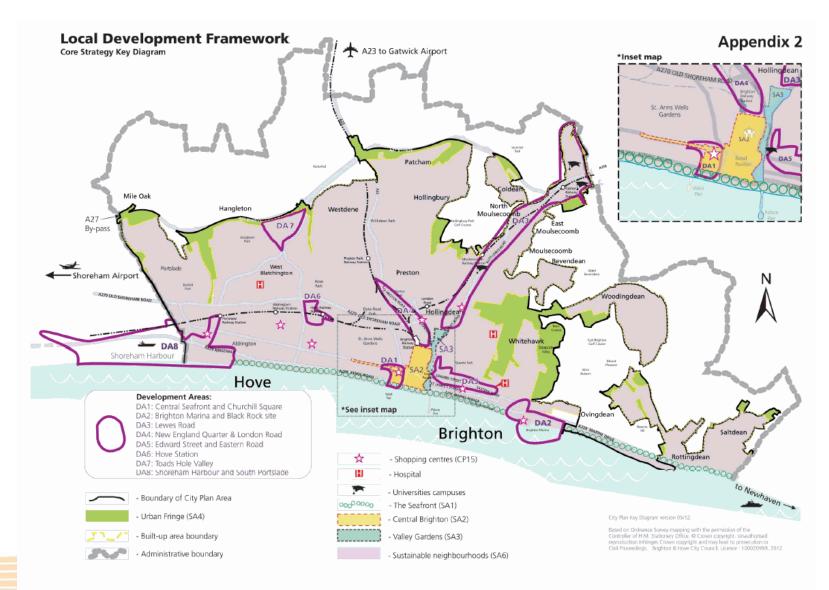




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#### **Area Covered**

# **BRIGHTON AREA**

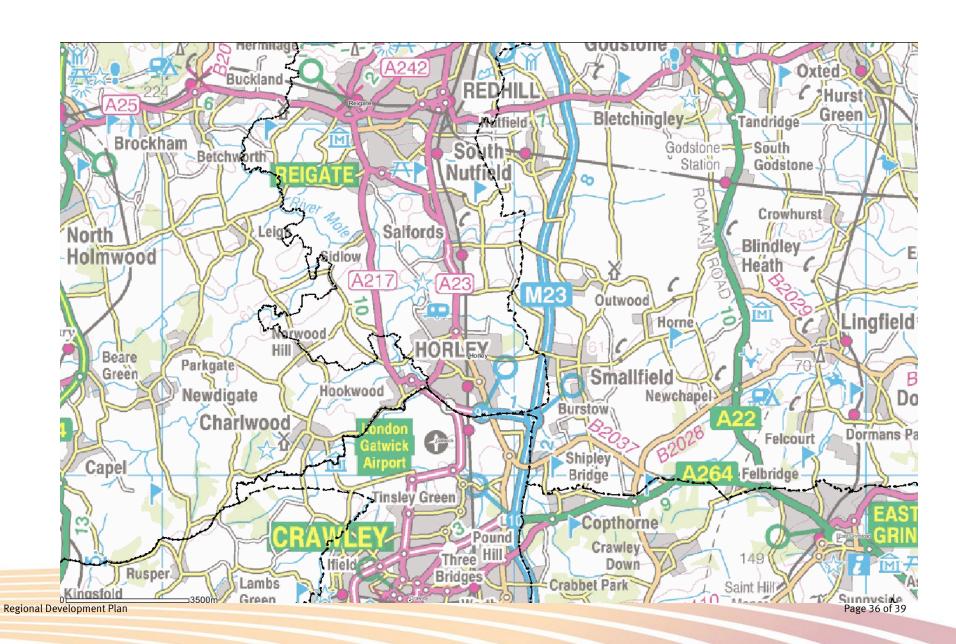


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**Area Covered** 

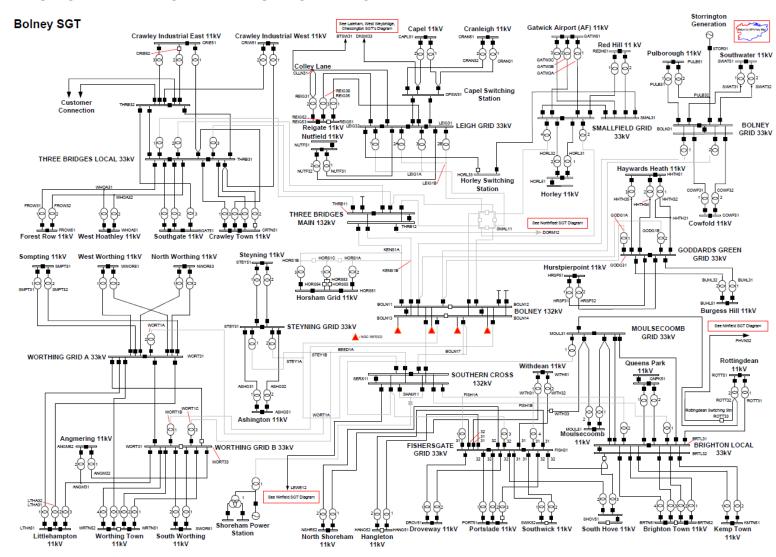
**SOUTH WEST SURREY** 



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#### **Area Covered**

### **APPENDIX B:** SINGLE LINE DIAGRAM – EXISTING NETWORK

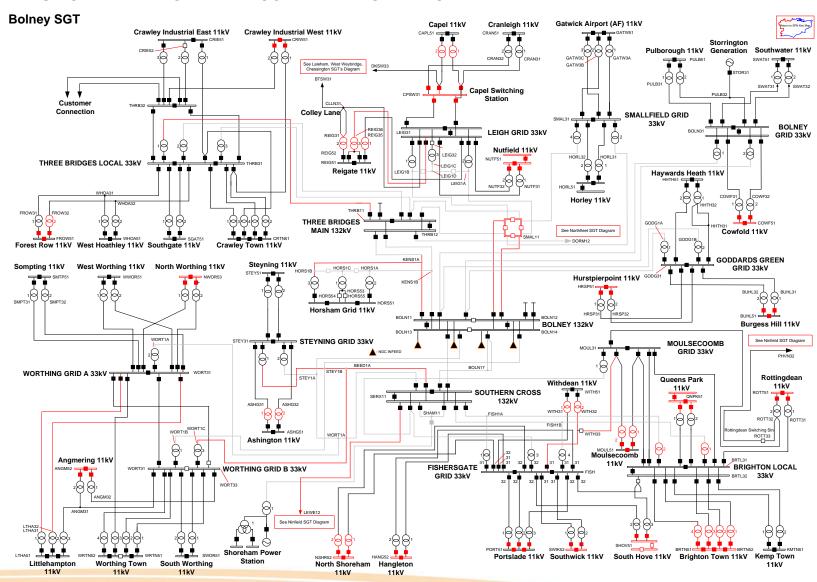


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#### **Area Covered**

### **APPENDIX C:** SINGLE LINE DIAGRAM – RECOMMENDED STRATEGY



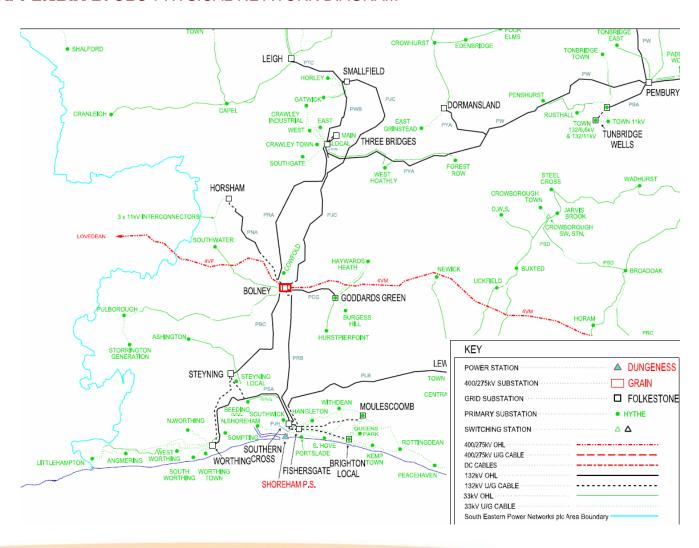
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#### **Area Covered**

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# **APPENDIX D: GEO-PHYSICAL NETWORK DIAGRAM**



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