



Title: Wimbledon

LPN Regional Development Plan

Version: 3.2

Date: March 2014

Wimbledon

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
1.0	September 2012		Roy Kelly		Draft
2.1	June 2013		Sophie Motte		Review of LI and HI data, new NAMP version and Element Energy PLEs
2.2	June 2013		Sophie Motte		Amendments following review of document
3.0	25/02/14	Major	Martin Jones	1 Executive Summary	Updated costs and scheme list according to 19 th Feb NAMP
3.0	25/02/14	Major	Martin Jones	2.3 Projects in Progress	Updated costs and scheme list according to 19 th Feb NAMP
3.0	25/02/14	Major	Martin Jones	4.1 Asset Replacement	Updated scheme list according to 19 th Feb NAMP
3.0	25/02/14	Major	Martin Jones	4.2 Reinforcement	Updated scheme list according to 19 th Feb NAMP
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3.1	21/03/14	Minor	Panagiotis Xenos	Contents	Updated table of contents
3.1	21/03/14	Minor	Panagiotis Xenos	1 Executive Summary	Revised and edited the text/content/wording
3.1	21/03/14	Major	Panagiotis Xenos	1 Executive Summary	Updated NAMP costs summary table
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3.1	21/03/14	Minor	Panagiotis Xenos	3 Network Development Considerations	Revised and edited the text/content/wording
3.1	21/03/14	Major	Panagiotis Xenos	3.2 Asset Health	Updated HI tables pre-intervention
3.1	21/03/14	Major	Panagiotis Xenos	3.3 Security of Supply Analysis	Updated P2/6 analysis table and LI table pre-intervention
3.1	21/03/14	Major	Panagiotis Xenos	3.6 Pinch Points	Removed section and transferred content in section 3.4

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1 Executive Summary

The Wimbledon Regional Development Plan includes a total of two exit points, two grid substations and thirteen primary substations (fourteen at the end of DPCR5 following the commissioning of Kingsgate House). The aggregated peak group demand is circa 594MVA (Winter) and 477MVA (Summer).

Forecast natural load growth in this region has an average compound growth rate of approximately 1.9% across the network substations.

As well as natural load growth, new developments in the network footprint create reinforcement challenges for the ED1 price control period. Current and prospective levels of connection applications attributed to the Vauxhall, Nine Elms and Battersea (VNEB) development and the Victoria Circle development are expected to significantly increase the peak group demand. The VNEB development is in an area where the distribution network has limited spare capacity or few 11kV panels available to connect new customers, so establishment of a new VNEB substation is proposed.

Major works are planned for Wimbledon Grid Supply Point, as National Grid begin to upgrade the 275kV network to 400kV. This upgrade will affect the 132kV assets located on the shared site. In conjunction with the upgrade, UK Power Networks will be replacing all of the 132kV switchgear at Wimbledon with new Gas Insulated Switchgear. This replacement will be done as a unified switchboard which will result in increased network resilience and available 132kV positions.

Asset replacement due to condition will also require a considerable investment to maintain the reliability of switchgear and transformers. A large number of fluid-filled and gas pressure cable sections have been identified as requiring replacement with solid type cables.

Proposed Projects >£1M

Reinforcement Schemes

• VNEB - New 132/11kV Substation	£31.5M (incl. £10M land purchase; £25.8M in ED1)
• Wimbledon 132kV switchgear replacement	£13.4M (£13M in ED1)
• Wandsworth Grid 132/66kV group reinforcement	£10.4M
• Wimbledon Grid C 33kV	£6.6M
• Wandsworth Central reinforcement	£3.0M

Asset Replacement Schemes

• Durnsford Road 11kV switchboard replacement	£1.9M
• Merton 11kV switchboard replacement	£1.8M
• Gorrings Park 11kV switchboard replacement	£1.9M
• Moreton Street 11kV switchboard replacement	£2.4M
• Lots Road - Replace Grid Transformer (GT1)	£1.6M (£1.5M in ED1)
• Wimbledon C - Replace Grid Transformer (GT2B)	£1.4M
• Norroy Rd Tee Point - Barnes 66kV gas cable replacement	£4.5M
• Wandsworth Grid – Norroy Rd Tee Point 66kV gas cable replacement	£3.3M (£2.9M in ED1)
• Wimbledon Grid - Trinity Crescent (Circuit 2-A) - 33kV FFC replacement	£1.0M
• Wimbledon - Merton (Circuit 3-A) - 33kV FFC replacement	£1.2M
• Wandsworth 66kV - Carslake (Circuit 3-B) - 66kV FFC replacement	£2.0M
• Wandsworth 66kV - Lombard (Circuit 2-B) - 66kV FFC replacement	£1.2M
• Wimbledon 132kV SEC 1&2 - Kingston 132kV (Circuit 1-B, Circuit 2-B & Circuit 2-C) - 132kV FFC replacement	£15.4M
• Wimbledon 132kV SEC 1&2 - Bengeworth Road 33 (Circuit 2-J) – 132kV FFC Replacement	£5.0M

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Costs Profile

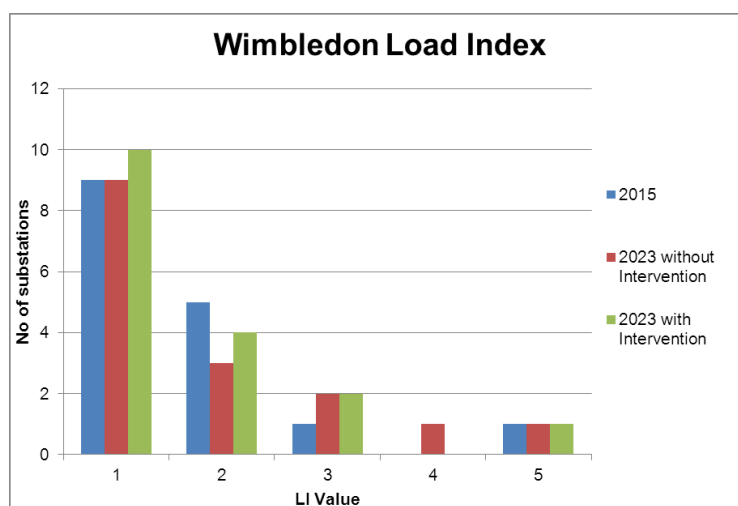
Table 1. NAMP Costs Summary (2013-2023)

Cat.	Description	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
A & H	Total Asset Replacement	0	494,049	3,811,249	6,719,409	4,473,007	3,285,902	4,690,357	6,553,099	9,165,938	6,660,440
R	Total Reinforcement	275,609	5,570,312	8,785,751	6,551,434	10,753,326	9,175,430	1,516,801	2,067,465	5,461,366	2,239,322
	Grand Total	275,609	6,064,361	12,597,000	13,270,843	15,226,333	12,461,331	6,207,158	8,620,564	14,627,304	8,899,762

Table 1 above provides the forecast aggregate NAMP cost for network expenditure under this RDP during the last two years of DPCR5 and the ED1 period subject to project feasibility studies and final approval. These costs do not include work in progress, listed in paragraph 2.3.

Output Measures - Load Index

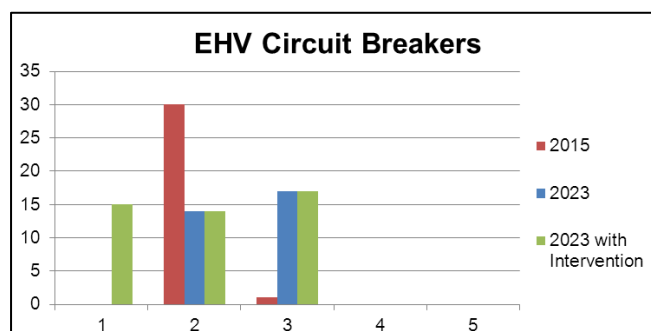
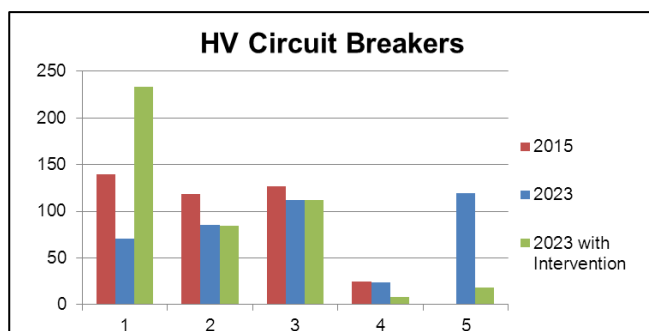
The forecast load indices for 2023, with and without intervention, are detailed below:



The 2023 with intervention figures in the chart above include the proposed new VNEB substation which is forecast to reach LI2 at the end of ED1.

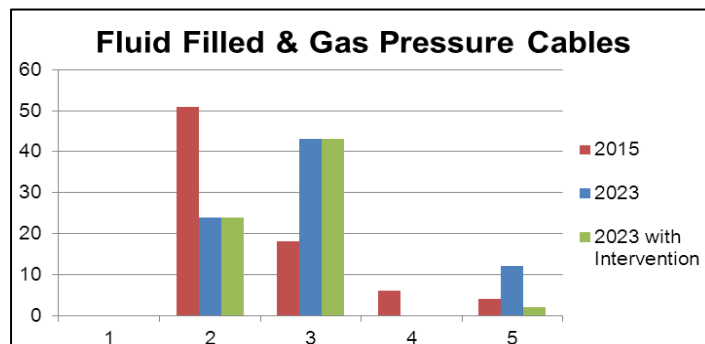
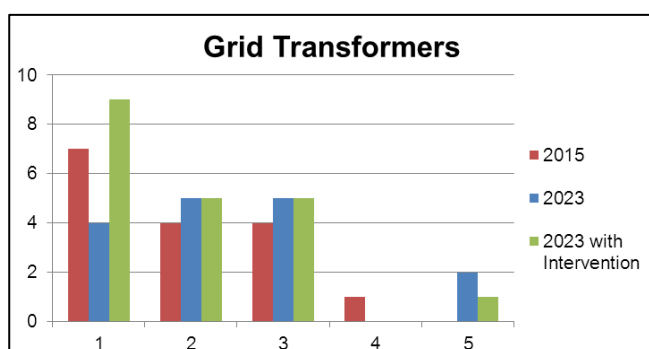
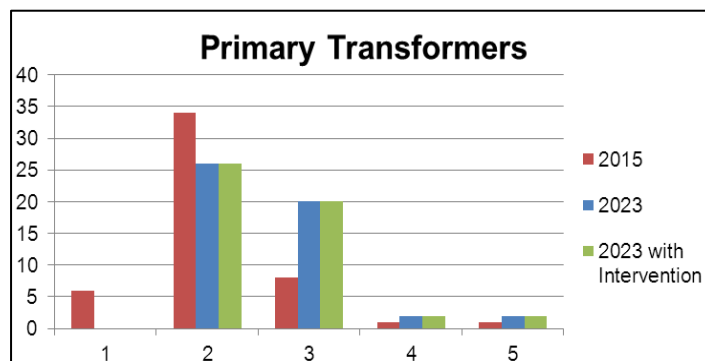
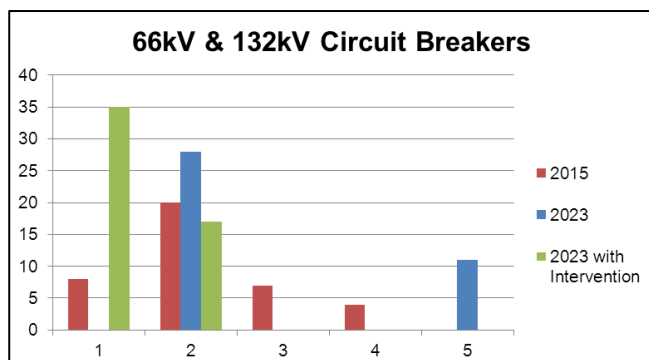
Output Measures - Health Index

The forecast health indices for 2015 and 2023, with and without intervention, for each plant category are detailed below:



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Principal Risks and Dependencies

The schemes covered in this RDP have been planned based on the Planning Load Estimates (February 2013) taking into account the 2011/12 maximum demand figures. The load forecasts are based on the Element Energy model. If the economic situation improves there is a risk that there will be shortfall of reinforcement schemes in the plan.

The load forecasts also include an assumed level of embedded generation being connected to the network. Should this generation not materialise, then a larger than forecast load growth could be realised.

Where Demand Site Response (DSR) has been included at a substation, this is based on an assumption that customers will be willing to accept the scheme. In most cases these customers have not as yet been identified.

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2 Network Configuration

2.1 Existing Network

Wimbledon Grid 132kV consists of two independent 132kV double busbar switchboards.

The Wimbledon Grid North switchboard comprises sections 1 & 2 while the Wimbledon Grid South switchboard is formed of sections 3 & 4. There is no interconnection between the two 132kV switchboards.

Physically the site is split into a North and South compound.

Switchboard sections 1 & 2 are located primarily in the North compound, although three circuit breakers from section 2 are situated in the South compound. The double busbars of Section 2 in the North compound are connected via 132kV overhead lines to the busbars of Section 2 in the South compound. The three bays are currently being transferred into the North compound which will allow the decommissioning and removal of the aerials. This constitutes the preliminary works to clear part of the site for NG to replant the 275kV substation at 400kV.

Sections 3 and 4 are located in the South compound only.

North - Sections 1 and 2

The switchboard is supplied by two 275/132kV 180MVA Super Grid Transformers (SGT's). Section 1 is normally supplied by one SGT and section 2 is supplied by two infeeds from Chessington. The two sections are normally connected through two 90MVA reactors. The purpose of the reactors is to limit the fault level on the Wimbledon – New Cross 132kV network. One of the SGT's (SGT1B) is run on open standby. This running arrangement again limits the prospective fault level on the 132kV network while allowing the transformer to contribute to the firm capacity of the substation.

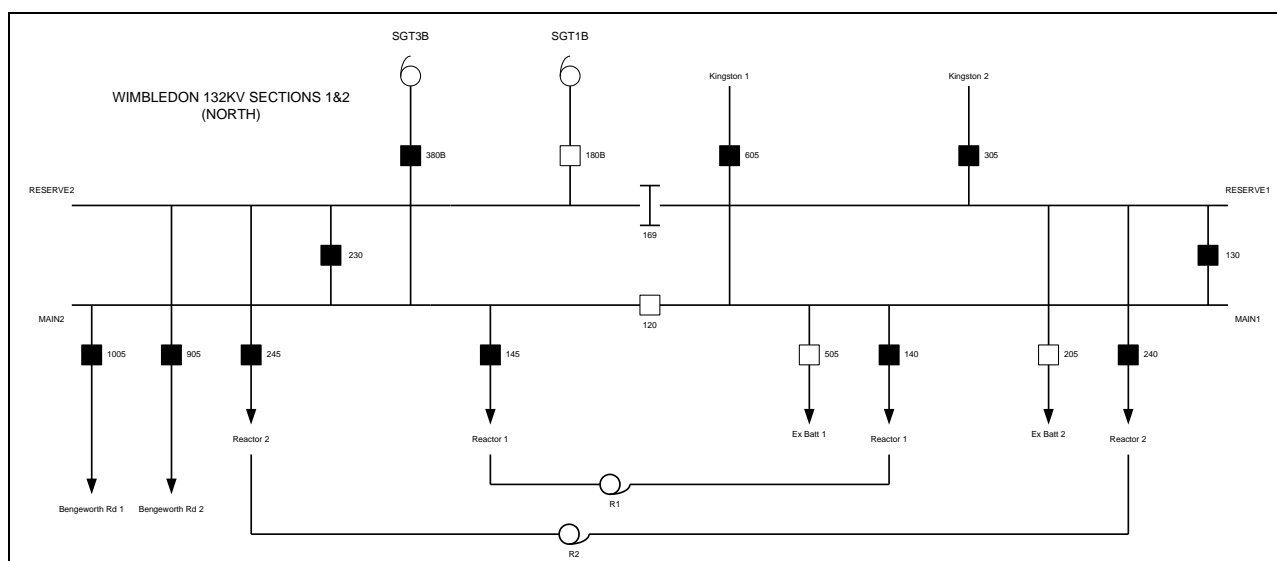


Figure 1. Wimbledon Grid North 132kV

Wimbledon Grid North has a group demand which lies between 60MW – 300MW and is therefore a Class D supply under security of supply requirements.

The downstream network is shown in Appendix B. The strategy and projects for the Bengeworth Rd network are covered in the New Cross RDP.

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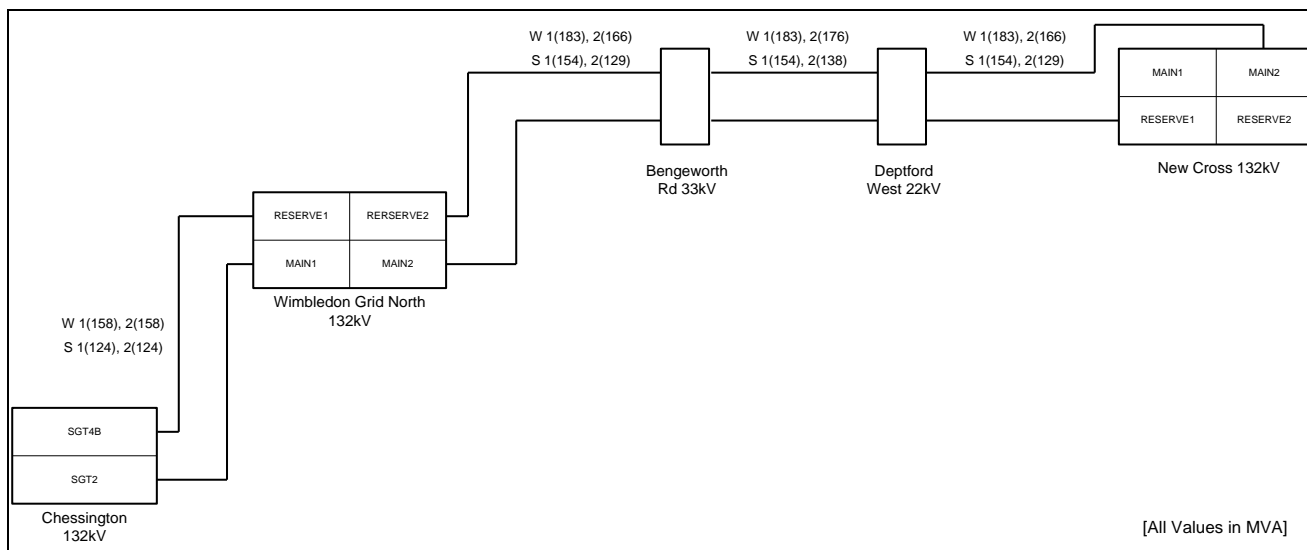


Figure 2. Wimbledon Grid North 132kV network

South - Sections 3 and 4

Sections 3 and 4 are supplied by four 275/132kV 240MVA Super Grid Transformers. The switchboard is normally run with two transformers supplying the main busbar and two supplying the reserve busbar. The bus coupler circuit breakers are normally open and so the main busbar and reserve busbar are electrically isolated when Wimbledon South is intact.

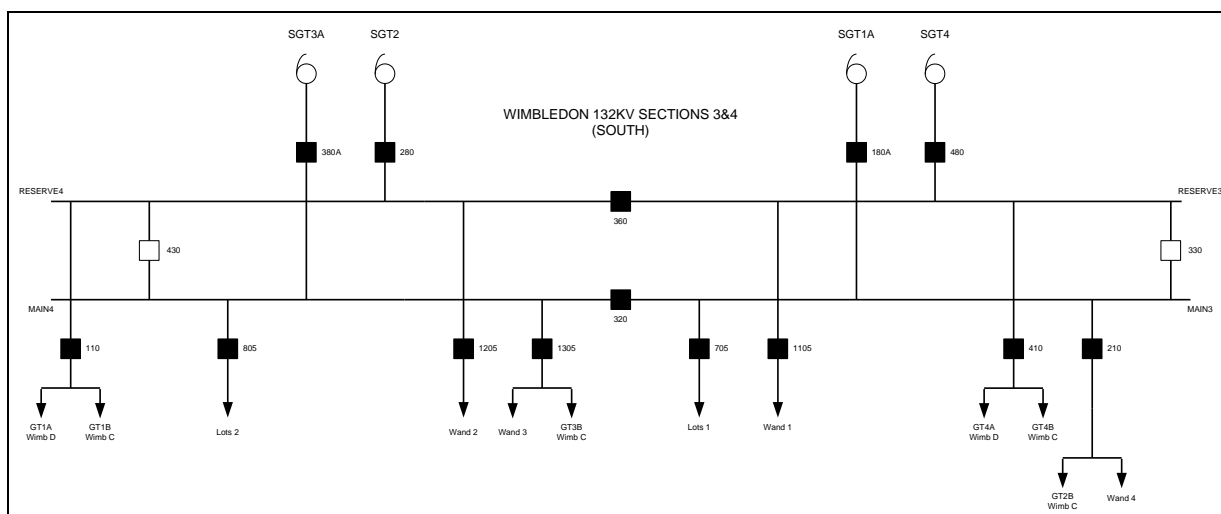


Figure 3. Wimbledon Grid South 132kV

The downstream network is shown in Appendix B.

Wimbledon Grid South has a group demand which lies between 300MW – 1500MW and is therefore a Class E supply under security of supply requirements.

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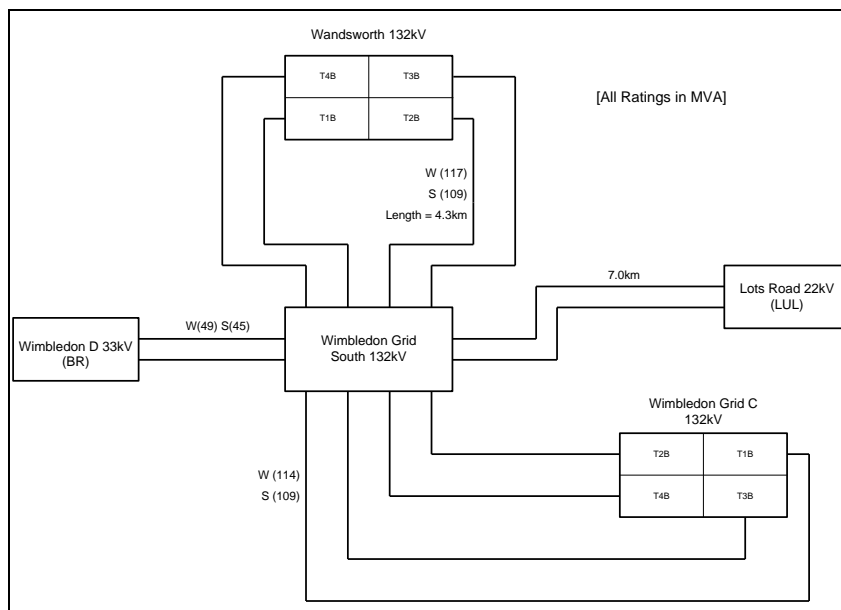


Figure 4. Wimbledon Grid South 132kV network

2.2 Embedded Generation

Table 2. Embedded Generation

GSP	Main Substation	Site Name	Type	Installed DG (MVA)	Operating Voltage (kV)	Mode of Operation
Wimbledon Grid South 3/4	Moreton Street	THAMES HOUSE	Diesel	5.700	11.000	Standby
Wimbledon Grid South 3/4	Barnes B 6.6kV	KEW SEWAGE TREATMENT WORKS	Diesel	0.800	6.600	Long Term Parallel
Wimbledon Grid South 3/4	Lombard Road B	MARCO POLO HOUSE	Diesel	1.000	11.000	Standby
Wimbledon Grid South 3/4	Durnsford Road	ST GEORGE'S HOSPITAL	CHP	5.000	11.000	Long Term Parallel
Wimbledon Grid South 3/4	Moreton Street	IMPERIAL CHEMICAL HOUSE	CHP	0.206	11.000	Long Term Parallel
Wimbledon Grid South 3/4	Lots Road LUL 22kV	LUL GREENWICH POWER STATION	Diesel	44.250	11.000	Long Term Parallel
Wimbledon Grid South 3/4	Moreton Street	MOD	CHP	7.000	11.000	Long Term Parallel
Wimbledon Grid South 3/4	Wandsworth	1008312 TOWN HALL	PV	0.012	11.000	Long Term Parallel
Wimbledon Grid South 3/4	Merton	MERTON FIRE CONTROL CENTRE	Wind	0.044	11.000	Long Term Parallel
Wimbledon Grid South 3/4	Merton	MERTON FIRE CONTROL CENTRE	PV	0.077	11.000	Long Term Parallel

Table 2 above details the generating plants used in the analysis for the Wimbledon Network. The total installed capacity of G59/2 embedded generation at 11kV and 6.6kV under this RDP is 64.1MVA.

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2.3 Projects in Progress

Table 3. Ongoing Projects (19th February 2014 NAMP)

Cat.	Reference	Description	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
A	1.51.11.8507	Gorrington Park - Refurbish Primary Transformer (T3)	256,803	0	0	0	0	0	0
A	1.55.02.6328	Replacement of Oil-Filled Through Bushings at Carslake Road	37,340	0	0	0	0	0	0
R	1.33.01.4346	Montford Place: Transformer Asset Replacement	143,063	0	0	0	0	0	0
R	1.34.02.5026	Moreton Street: 11kV Network Reconfiguration	249,998	0	0	0	0	0	0
R	1.35.01.2610	Moreton St: Install 2x66MVA 132/11kV Transformers	2,193,890	0	0	0	0	0	0
R	1.36.01.3730	Wimbledon 132kV GSP - 132kV Circuit Breaker Replacement	59,021	387,325	2,616,208	6,635,844	3,832,346	-86,030	0

Ongoing works:

8507: Gorrington Park – Refurbish primary transformer (T3)

Following a winding fault it has been determined that this transformer cannot be repaired on site. This project allows for removal from site to the manufacturer factory for full refurbishment including a new core and windings.

6328: Replacement of oil-filled through bushings at Carslake Road

Following a fault on the oil-filled bushings feeding FT4 at Carslake Road, the transformer and associated bus bars were disconnected. The bushings need to be replaced due to condition. The bushings feeding the other transformers need to be changed as they are of the same vintage and present a high risk of failure.

4346: Montford Place: Transformer asset replacement

Condition assessment has identified that the 2 spare transformers originally intended for installation are unsuitable for re-use. The requirement for the new units is unchanged from the justification detailed in the original scheme and it is therefore necessary to procure replacement transformers to complete the site works.

5026: Moreton Street 11kV network reconfiguration

In order to remove the derogation at Ebury Bridge, it is necessary to transfer the West Group and East Group to Moreton C. In addition, for the St John's Wood Outage, the Old Brompton Road SE group needs to be transferred to Moreton C and the four feeders need to be reused to transfer approximately 24MVA from OBR to Moreton C.

2610: Moreton Street: Install 2x66MVA 132/11kV transformers

The project is to establish a new Moreton Street 'C' substation comprising two 66MVA 132/11kV transformers and associated 11kV switchboard. The substation will be supplied via two new 132kV cables installed in the existing Wandsworth-Pimlico deep cable tunnel. The circuits will be teed off two of the Wimbledon-Wandsworth 132kV circuits at Wandsworth Grid.

The reinforcement is required to relieve the adjacent Ebury Bridge substation which is operating at the limit of the firm capacity with no scope for reinforcement.

The new capacity will additionally support 11kV interconnection with Old Brompton Road and Ebury Bridge during outages at St. John's Wood 132kV.

3730: Wimbledon 132kV GSP - 132kV circuit breaker replacement

Wimbledon Grid 132kV is a sensitive grid supply point as it supplies the whole of South West London (over 382,000 customers) including strategic government buildings. Due to its radial nature, it has minimum load transfers and no interconnection to other GSPs. Because of loading, fault level and asset condition issues, it is proposed to replant the Air Insulated Switchgear on site as an indoor Gas Insulated Switchboard combining both Wimbledon 3&4 and Wimbledon 1&2. The new switchboard will be installed in a new switch house to be built after the decommissioning of three of the 132kV breakers on the South compound.

This project, linked to the National Grid project to upgrade the Wimbledon 275kV substation at 400kV, will increase the capacity and the resilience at Wimbledon Grid 132kV.

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3 Network Development Considerations

3.1 Development Areas

Kingsgate House, Victoria

Land Securities are redeveloping the former Kingsgate House on Victoria Street, SW1, as part of its transformation of Victoria. The scheme comprises two new buildings: The Zig Zag Building, a 190,000 sq. ft. office building over 14 floors with a staggered façade; and Kings Gate, a 12 storey residential building comprising 100 apartments. Both buildings will provide a new and enhanced retail offer with 45,000 sq. ft. of space, together with considerable improvements to the public realm benefitting the wider Victoria area. The buildings are planned to complete in summer 2015 having supported an estimated 2,500 jobs throughout the construction phase.

In addition, the development provides for an affordable housing contribution of £11.6m which will be directed towards the provision of much needed affordable development in the Westminster area.



Figure 5. The proposed development at Kingsgate House, Victoria

Victoria Circle

In February 2009, the Council granted conditional approval to the Land Securities development scheme known as 'VT12'. Now known as 'Victoria Circle', this scheme provides for the comprehensive redevelopment and regeneration of a 2.5 hectare site bounded by Victoria Street, Buckingham Palace Road, Bressenden Place and Allington Street, and will incorporate a new station entrance, as part of the Victoria Station Upgrade (VSU) scheme. Victoria Circle scheme will be constructed in 3 phases to allow for completion of the VSU works to the east of the site. Work on Victoria Circle commenced in October 2012. Land Securities have applied for a 16MVA connection which will be supplied from Kingsgate House.

Vauxhall, Nine Elms & Battersea

Vauxhall Nine Elms Battersea (VNEB) is a Mayor of London supported opportunity area located along the south bank of the River Thames between Vauxhall and Chelsea Bridges. The adopted planning framework contains proposals for 16,000 homes, an extension to the Northern underground line from Kennington to Battersea Power Station and support for a tall building strategy. The area includes the new Covent Garden Market, Battersea Dogs Home and construction has commenced on the new United States Embassy and regeneration of Battersea Power Station.

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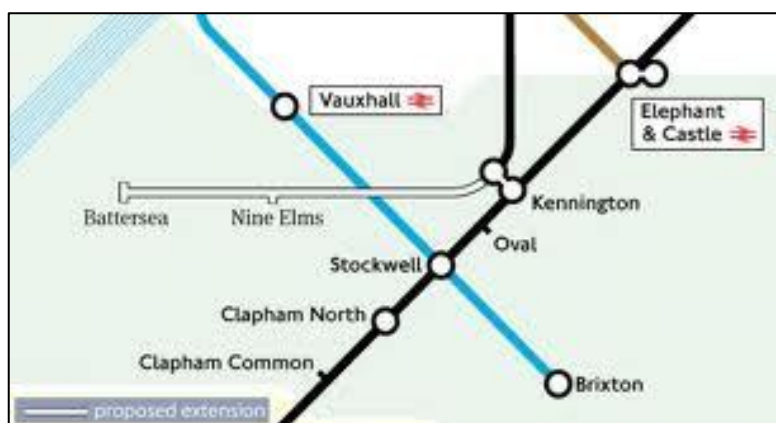


Figure 6. Maps of VNEB development area and extension to the Northern Line

This proposed extension to the Northern Line has now been approved and TFL have now sent out the compulsory purchase orders (CPO).

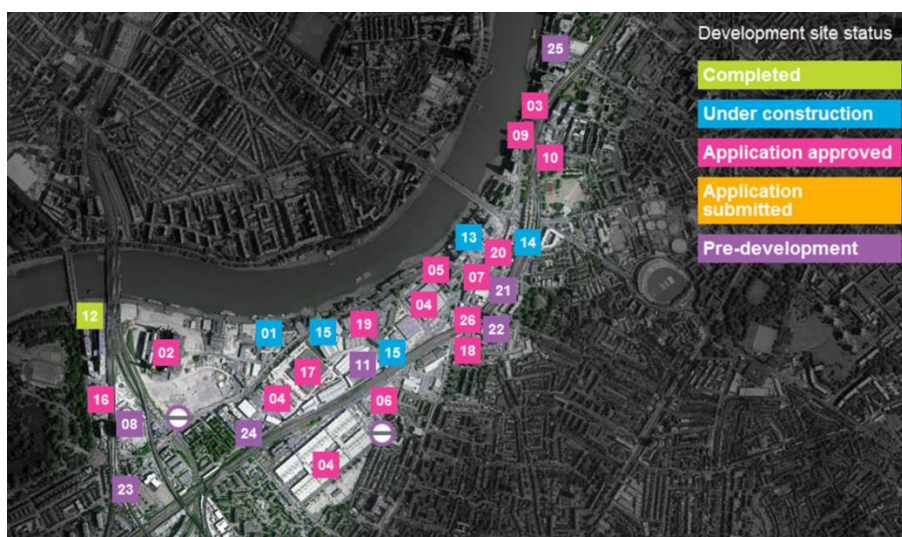


Figure 7. Latest development site status

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3.2 Asset Health

Health indices (HI's) for all network equipment covered in this RDP before any further ED1 investment are listed in Table 4 to 9 below. The equipment groups covered include HV circuit breakers (6.6kV and 11kV), EHV circuit breakers (33kV), 66kV&132kV circuit breakers, primary transformers (22/11kV and 33/11kV), grid transformers (132/11kV, 132/33kV and 132/22kV) and underground cables (33kV and 132kV).

Note: N/A refers to the sites that will be established within ED1 as part of the Wimbledon RDP reinforcement strategy.

Table 4. HV Circuit Breakers

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BARNES B 6.6KV	31					31				
BURLINGTON RD			18	5	1				6	18
CARSLAKE RD		18	6					24		
DUKES AVE	1	19	3			1	22			
DURNSFORD RD			28							28
GORRINGE PARK			28						5	23
LOMBARD RD B 11KV	37	3				40				
MERTON			23	3					3	23
MORETON ST 11KV		1	18	17		1			8	27
TRINITY CRESCENT		25	3					26	2	
WANDSWORTH CENTRAL A		26				8		18		
WEST NORWOOD		26				4		22		
MORETON ST C 11KV	33					33				
KINGSGATE HOUSE	38					38				
VNEB			N/A					N/A		

Table 5. EHV Circuit Breakers

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
LOTS ROAD (LUL) 22KV		1					1			
WIMBLEDON D 33KV BR		7					7			
WIMBLEDON GRID C 33KV		22	1			6		17		

Table 6. 66 and 132kV Circuit Breakers

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
WANDSWORTH 66KV		17					17			
WANDSWORTH 132KV			N/A					N/A		
WIMBLEDON 132KV 1,2,3&4	8	3	7	4		11				11
WIMBLEDON GRID 132KV			N/A					N/A		

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Table 7. **Primary Transformers**

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BARNES B 6.6KV	2	1					3			
BURLINGTON RD		4					4			
CARSLAKE RD		3	1					4		
DUKES AVE		2		1			2			1
DURNSFORD RD			3		1			3		1
GORRINGE PARK		4						4		
LOMBARD RD B 11KV	4						4			
MERTON		4						4		
MONTFORD PL B 11KV		3	1					4		
MORETON ST 11KV		1	3				1	1	2	
TRINITY CRESCENT		4					4			
WANDSWORTH CENTRAL A		4					4			
WEST NORWOOD		4					4			

Table 8. **Grid Transformers**

Substation	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
LOTS ROAD (LUL) 22KV		1		1			1			1
WANDSWORTH 66KV	1	1	2				1	3		
WIMBLEDON D 33KV BR	2						2			
WIMBLEDON GRID C 33KV		2	2				1	2		1
MORETON ST C 11KV	2					2				
KINGSGATE HOUSE	2					2				
VNEB			N/A					N/A		

Wimbledon

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Table 9. Gas Pressure and Fluid Filled Cables

Cable Route	2015					2023				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
CARSLAKE RD-BARNES 6.6KV		1	3					3		1
CARSLAKE RD-NORROY RD TPT 66KV			2					2		
WANDSWORTH 66KV-CARSLAKE RD		3			1		1	2		1
WANDSWORTH 66KV-LOMBARD RD		3	4	1			3	4		1
WANDSW 66KV-WANDSW CTL A		4					3	1		
WIMBLE 132KV 3&4-LOTS RD 22KV		4					4			
WIMBLE 132KV 3&4-WANDSW 66KV		2	1				1	2		
WIMBLE 132KV SEC 1&2-BENGE RD 33		2	3		1			5		1
WIMBLE 132KV SEC 1&2-KINGSTON 33		5		3			2	3		3
WIMBLE 132KV SEC 1&2-REACTOR 1		1						1		
WIMBLE 132KV SEC 1&2-REACTOR 2			1							1
WIMBLE GRID C 33KV-BURL RD		7	1				7	1		
WIMBLE GRID C 33KV-DUKES AVE		10	2					12		
WIMBLE GRID C 33KV-MERTON		3			1			3		1
WIMBLE GRID C 33KV-TRINITY CST		2	1		1			3		1
WIMBLE GRID C 33KV-W. NORWOOD		4					3	1		
NORROY RD TPT-BARNES 66KV GAS CABLE*				1						1
WANDSWORTH GRID-NORROY RD TPT 66KV GAS CABLE**				1						1

Note: HI's for FFC's refer to the number of cable sections per circuit.

* HI refers to 3.5km of gas pressure cable.

** HI refers to 2.5km of gas pressure cable.

Wimbledon

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

3.3 Security of Supply Analysis

Table 10 show the forecast load growth at all the substations fed from Wimbledon Grid Supply Point. Highlighted in orange are any loads that exceed the substation firm capacity plus any post fault transfer capability.

Table 10. P2/6 Assessment Table Wimbledon Grid 132kV (see Appendix C)

Sub-station	P2/6	Secondary Voltage	Firm Capacity (MW)	Transfer (MW)	P. F.	Winter 13/14 Summer 2013 (M W)	Winter 14/15 Summer 2014 (M W)	Winter 15/16 Summer 2015 (M W)	Winter 16/17 Summer 2016 (M W)	Winter 17/18 Summer 2017 (M W)	Winter 18/19 Summer 2018 (M W)	Winter 19/20 Summer 2019 (M W)	Winter 20/21 Summer 2020 (M W)	Winter 21/22 Summer 2021 (M W)	Winter 22/23 Summer 2022 (M W)
Barnes B 6.6kV	YES	6.6kV	59.90		0.96	28.75	29.10	29.51	29.89	30.30	30.74	31.21	31.70	32.35	33.02
Barnes B 6.6kV	YES	6.6kV	46.08		0.96	19.02	19.24	19.50	19.74	20.00	20.29	20.59	20.90	21.32	21.74
Burlington Road	YES	11kV	51.90		0.98	30.89	31.19	31.53	31.84	32.18	32.53	32.91	33.30	33.85	34.41
Burlington Road	YES	11kV	40.20		0.97	22.77	22.99	23.25	23.49	23.75	24.02	24.31	24.61	25.03	25.45
Carslake	YES	11kV	57.33		0.98	39.51	39.85	40.25	40.62	41.03	41.47	41.94	42.42	43.11	43.81
Carslake	YES	11kV	43.20		0.96	28.94	29.18	29.46	29.72	30.01	30.32	30.64	30.98	31.47	31.95
Dukes Avenue	YES	11kV	36.30		0.98	29.87	30.18	30.53	30.86	31.21	31.58	31.97	32.38	32.92	33.48
Dukes Avenue	YES	11kV	26.83		0.97	15.85	16.00	16.19	16.35	16.53	16.72	16.92	17.13	17.41	17.70
Durnsford	YES	11kV	49.55	14.78	0.96	40.18	40.74	41.35	41.90	42.50	43.14	43.81	44.51	45.39	46.29
Durnsford	YES	11kV	42.75	14.63	0.95	27.05	27.44	27.86	28.23	28.65	29.09	29.55	30.03	30.64	31.26
Gorringe Park	YES	11kV	57.33		0.98	39.03	39.49	40.00	40.43	40.91	41.41	41.92	42.44	43.17	43.91
Gorringe Park	YES	11kV	43.65		0.97	25.61	25.90	26.22	26.49	26.80	27.12	27.44	27.78	28.24	28.71
Kingsgate House	YES	11kV	83.00		0.96	0.00	0.00	5.04	13.44	16.80	16.80	16.80	16.80	16.80	16.80
Kingsgate House	YES	11kV	83.00		0.96	0.00	0.00	5.04	13.44	16.80	16.80	16.80	16.80	16.80	16.80
Lombard Road B	YES	11kV	92.63		0.95	57.46	57.91	58.42	58.85	59.34	59.87	60.42	60.98	61.81	62.63
Lombard Road B	YES	11kV	72.00		0.96	40.36	40.67	41.01	41.30	41.62	41.98	42.34	42.72	43.28	43.82
Lots Road 22kV LUL	NO	22kV	81.60		0.96	55.90	55.90	55.90	55.90	55.90	55.90	55.90	55.90	55.90	55.90
Lots Road 22kV LUL	NO	22kV	81.60		0.96	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42
Merton	YES	11kV	47.57	32.26	0.95	52.69	53.31	53.99	54.59	55.25	55.94	56.66	57.41	58.38	59.38
Merton	YES	11kV	37.53	29.42	0.96	38.62	39.06	39.54	39.96	40.42	40.91	41.41	41.94	42.62	43.32
Moreton St / Kingsgate House Total	YES	kV	288.00		0.96	0.00	38.80	43.84	52.24	55.60	55.60	55.60	55.60	55.60	55.60
Moreton St / Kingsgate House Total	YES	kV	266.90		0.96	0.00	39.41	44.45	52.85	56.21	56.21	56.21	56.21	56.21	56.21
Moreton Street	YES	11kV	85.12	23.68	0.97	58.94	59.16	59.38	59.56	59.77	59.99	60.21	60.44	60.72	61.00
Moreton Street	YES	11kV	64.13	22.90	0.95	63.41	63.64	63.88	64.07	64.29	64.52	64.75	64.99	65.29	65.58
Moreton Street C	YES	11kV	83.23		0.97	0.00	38.80	38.80	38.80	38.80	38.80	38.80	38.80	38.80	38.80
Moreton Street C	YES	11kV	62.70		0.95	0.00	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41
Trinity Crescent	YES	11kV	57.33		0.98	50.52	50.95	51.42	51.83	52.28	52.77	53.28	53.80	54.56	55.31
Trinity Crescent	YES	11kV	43.65		0.97	27.98	28.21	28.46	28.68	28.93	29.19	29.46	29.74	30.15	30.55
Wandsworth	YES	11kV	57.33		0.98	44.45	44.86	45.31	45.72	46.16	46.65	47.16	47.70	48.46	49.21
Wandsworth	YES	11kV	43.65		0.97	31.22	31.50	31.81	32.08	32.39	32.72	33.06	33.42	33.94	34.45
Wandsworth Grid 66kV	YES	66kV	340.47		0.97	223.49	225.23	227.18	228.91	230.84	232.91	235.08	237.34	240.49	243.64
Wandsworth Grid 66kV	YES	66kV	248.40		0.92	182.72	183.99	185.41	186.66	188.06	189.57	191.13	192.77	195.03	197.29
West Norwood	YES	11kV	57.92		0.99	39.22	39.70	40.24	40.70	41.21	41.75	42.29	42.86	43.64	44.43
West Norwood	YES	11kV	44.10		0.98	24.30	24.59	24.90	25.17	25.48	25.79	26.11	26.45	26.91	27.38
Wimbledon D 33kV BR	YES	33kV	68.60		0.96	23.68	23.68	23.68	23.68	23.68	23.68	23.68	23.68	23.68	23.68
Wimbledon D 33kV BR	YES	33kV	68.60		0.96	26.54	26.54	26.54	26.54	26.54	26.54	26.54	26.54	26.54	26.54
Wimbledon Grid C 33kV	YES	33kV	329.20		0.96	268.70	271.78	275.20	278.19	281.52	285.02	288.65	292.42	297.50	302.66
Wimbledon Grid C 33kV	YES	33kV	259.20		0.96	180.95	182.95	185.17	187.12	189.28	191.55	193.91	196.36	199.65	203.00
Wimbledon Grid South 3/4	YES	132kV	788.00		0.96	555.73	598.89	608.31	620.19	628.00	633.04	638.28	643.75	651.20	658.72
Wimbledon Grid South 3/4	YES	132kV	732.70		0.96	420.87	463.38	471.63	482.65	489.23	492.82	496.54	500.43	505.70	511.04

Class of supply E (Group demand over 300MW and up to 1500MW)

Two load groups within the Wimbledon Grid South network have maximum demands exceeding 300MW during the ED1 period. In accordance with Engineering Recommendation P2/6, for groups of this size a Second Circuit Outage assessment is required.

Class E (Over 300MW and up to 1500MW)			<i>all figures in MW</i>
Substation/Group Name	Summer 2022 M.D.	SCO Capacity	Load at Risk
Wimbledon Grid South	511.0	366.4	144.6
Wimbledon Grid C	203.0	194.4	8.6

Table 11. P2/6 security assessment – Class E

Wimbledon

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

LI Table Without Intervention

Substation	Voltage kV	Load Index	
		2015	2023
Barnes B 6.6kV	66/6.6	1	1
Burlington Road	33/11	1	1
Carslake	66/11	1	1
Dukes Avenue	33/11	2	2
Durnsford	33/11	2	2
Gorrington Park	33/11	1	1
Lombard Road B	66/11	1	1
Merton	33/11	5	5
Moreton Street	66/11	3	4
Trinity Crescent	33/11	2	3
Wandsworth	66/11	2	3
Wandsworth Grid 66kV	132/66	1	1
West Norwood	33/11	1	1
Wimbledon Grid C 33kV	132/33	2	2
Moreton Street C	132/11	1	1
Kingsgate House	132/11	1	1
VNEB	132/11	N/A	N/A

Note: Merton 33/11kV substation is showing as an LI5 from 2015. The site is maintained compliant by 11kV post-fault transfers to adjacent substations. With the low forecast load growth in the area, the transfers are sufficient to maintain P2/6 compliance through ED1. Therefore no reinforcement scheme is proposed for Merton substation.

3.4 Operational and Technical Constraints

The Wimbledon to New Cross 132kV network is run as an interconnected network and as a result, the prospective fault level can become an issue for certain running conditions.

The following is a list of critical operational points in the Wimbledon Grid 132kV network area:

Wandsworth

Bell Lane Creek
Cable Bridge 0040
TQ2550675077

Wandsworth

Causeway Box Girder Bridge
Cable Bridge 0043
TQ2561074989

Wandsworth

Causeway Narrow Girder Bridge
Cable Bridge 0051
TQ2556375101

Wandsworth

Causeway Broad Girder Bridge
Cable Bridge 0052
TQ2556675091

Wimbledon

Plough Lane over Wandle (small)
Cable Bridge 0053
TQ2609271503

Wimbledon

Over river Wandle by Wimbledon Grid
Cable Bridge 0055
TQ2595371760

Wimbledon

Plough Lane over Wandle (large)
Cable Bridge 0067
TQ2609271502

Wandsworth

Wimbledon

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

Causeway Lattice Bridge

TQ2557075082

3.5 National Grid

National Grid are upgrading their 275kV Wimbledon substation to 400kV by laying new 400kV cables in a new tunnel between Kensal Green and Wimbledon. All 275/132kV SGTs on site will be replaced by 400/132kV units. As part of this work it is necessary to divert a number of UK Power Networks 132kV and 33kV cables all within the site boundary of Wimbledon North 132kV substation.

3.6 Smart Demand Response

Two sites have been identified as suitable for implementation of Demand Side Response (DSR) in ED1:

- Wimbledon Grid (or any site fed from Wimbledon Grid 132kV): 5MVA of DSR will be used to mitigate the impact during replanting of the Wimbledon substation by reducing loading (project 8557).
- Wandsworth Grid (or any site fed from Wandsworth 66kV): 5MVA of DSR will be used to mitigate the impact until the 132kV switchgear and the new 132kV circuits between Wimbledon and Wandsworth are commissioned at the Wandsworth substation by reducing loading (project 8558).

Wimbledon

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

4 Recommended Strategy

The network strategy for the Wimbledon network is designed to ensure:

- Appropriate contribution to the necessary addition of network capacity in London, to meet growth in load from existing customers and to enable new connections in relevant areas
- Continued adherence to the security of supply criteria defined in Engineering Recommendation P2/6
- Maintaining reliable network operation by asset replacement, or refurbishment, of poorly performing equipment identified through asset condition monitoring (HI) techniques

The proposals are summarised below.

4.1 Asset Replacement

The following projects are identified in this RDP as interventions to address assets with poor health indices.

4400: Merton 11kV - Replace 11kV Switchboard

An asset condition assessment has confirmed the requirement to replace the poorly performing 11kV switchboard. Due to the congested nature of the site, it will be necessary to construct a building extension at level+1 to accommodate the new switchboard.

7798: Gorrington Park - Replace 11kV Switchgear

The condition assessment of the 1995 GEC VMX Vacuum Switchgear installed at Gorrington Park has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep this asset in use without compromising operational requirements; therefore this project recommends its replacement. Completion of the project will see 28 circuit breakers replaced with 28 new circuit breakers.

7803: Moreton Street 11kV - Replace 11kV Switchgear

The Moreton Street 11kV circuit breakers will be HI3 and HI4 at the beginning of ED1, becoming HI4 and HI5 at the end of ED1. It is proposed to replace the 36-panel double busbar switchboard.

7937: Durnsford Road - Replace 11kV Switchgear

The condition assessment of the 1995 GEC VMX Vacuum circuit breakers installed at Gorrington Park 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 their replacement. Completion of the project will see 28 circuit breakers replaced with 28 new circuit breakers.

7856: Lots Road (LUL) 22kV - Replace Grid Transformer (GT1)

The condition assessment of the 1989 Hawker Siddeley 85MVA Grid Transformer with ATL AMD319 tapchanger installed at Lots Road 132/22kV Substation has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep this asset 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 85MVA Grid Transformer.

7857: Wimbledon Grid C 33kV - Replace Grid Transformer (GT2B)

The condition assessment of the 1964 C.A. Parsons 90MVA Grid Transformer with Fuller HS tapchanger installed at Wimbledon C 132/33kV Substation has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep this asset 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 90MVA Grid Transformer.

7864: Dukes Avenue - Replace Primary Transformer (T4)

The condition assessment of the 1959 BTH 15MVA Primary Transformer with BTH ATC313 tap changer installed at Dukes Avenue 33/11kV Substation has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep this assets in use without compromising operational requirements; therefore this project recommends its replacement. Completion of the project will see 1 Primary Transformer replaced with 1 new 15MVA Primary Transformer.

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7865: Durnsford Road - Replace Primary Transformers (T1)

The condition assessment of the 1951 Yorkshire Electric 15MVA Primary Transformer with Fuller HM tap changer installed at Durnsford Road 33/11kV Substation has shown that the probability of failure due to degradation will become unacceptable. It is not possible to keep this asset in use without compromising operational requirements, therefore this project recommends its replacement. Completion of the project will see 1 Primary Transformer replaced with 1 new 15MVA Primary Transformer.

Gas Pressure Cable Replacement Schemes

8303: Norroy Road Tee Point - Barnes 66kV (3.5km)

8304: Wandsworth Grid - Norroy Road Tee Point 66kV (2.5km)

The condition assessment of these cables 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 CI and CML performance, therefore this project recommends their replacement.

Fluid Filled Cable Replacement Schemes

7940: Wimbledon Grid - Trinity Crescent 33kV Circuit 2-A (2.9km)

7941: Wimbledon - Merton 33kV Circuit 3-A (3.4km)

7949: Wandsworth - Carslake 66kV Circuit 3-B (1.6km)

7956: Wandsworth - Lombard 66kV Circuit 2-B (0.9km)

7939: Wimbledon 132kV 1&2 - Kingston 132kV Circuit 1-B, Circuit 2-B and Circuit 2-C (11km)

7948: Wimbledon 132kV SEC 1&2 - Bengeworth Road, 132kV Circuit 2-J (3.6km)

The condition assessment of these fluid filled cables 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 CI and CML performance, therefore this project recommends their replacement.

4.2 Reinforcement

8496: Wandsworth Central 66/11kV - ITC (add 2x15MVA)

The demand at Wandsworth Central 66/11kV substation (also known as Wandsworth) is expected to reach the limit of the site's winter firm capacity at the end of ED1. As it is not possible to further increase the rating of the existing transformers, additional capacity is required to maintain compliance under N-1 conditions. This project therefore proposes installing 2 additional 15MVA 66/11kV transformers at Wandsworth Central supplied by 2 new 1.5km 132kV circuits (run at 66kV) from Wandsworth Grid 66kV rated to match the new transformers' cyclic rating and extend the existing 11kV switchboard by 15 panels to accept the new transformers and allow for additional 11kV feeders.

Completion of this project will see 2 new transformers along with associated circuits and switchgear being commissioned at the beginning of ED2.

5815: VNEB New 132/11kV Substation - (2x66.6MVA)

The area around the old Battersea Power Station is currently supplied from two main substations, Lombard Road and Montford Place, which are expected to reach their firm capacity in ED1. They cannot undergo reinforcement due to space constraints.

In addition, the declaration of this area as a new development and the recent commitments to develop the old Battersea Power Station site is leading to high interest. Based on stakeholder consultations and connection applications the new developments are expected to increase peak demand (over and above organic growth for the area) by between 63MVA and 115MVA.

The growth of demand in the area and the potential development – with the corresponding rise in load-density to what we typically see in central London areas – a substantial increase will be required in the capacity and capability to distribute power in this highly active area.

This forecast demand increase exceeds the supply capacity of adjacent primary substations and it is therefore recommended to establish a new 2x66MVA 132/11kV main substation within the 'opportunity area'. It is proposed to supply the new substation from Wandsworth Grid new 132kV switchboard (project 3667) with new 132kV cables installed in the existing Wimbledon to Pimlico deep cable tunnel which is routed beneath Nine

Wimbledon

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

Elms Lane. The substation is to be designed with space for installation of a 3rd transformer to cater for future demand increases.

6333: Wimbledon Grid C 132/33kV - ITC (2x90MVA) (N-2)

The forecast demand at Wimbledon Grid C 132/33kV substation will exceed the 300MW threshold in 2022, which will move the substation to a class E site under P2/6 recommendation. This requires compliance with N-2 considerations. For a second circuit outage in summer, the substation would be non-compliant. It is proposed to reinforce Wimbledon Grid C.

Completion of this project will see the addition of two 90MVA 132/33kV transformers and a new section of 33kV switchboard. The new transformers will be supplied from the new Wimbledon Grid 132kV switchboard. Following the replacement of Wimbledon Grid South 132kV switchgear, there will be space on site to accommodate the additional plant.

5717: Wandsworth 66kV: Feeder Circuit Reconfiguration

This scheme is designed to reduce circuit complexity on the Wandsworth - Moreton Street T2B / Norroy Road Tee-Point / Barnes / Carslake connection.

With the current configuration, during planned or unplanned work, there are significant switching constraints. By reconfiguring the connections the switching operations required will be greatly simplified. In addition, during a fault, the impact on high profile customers in Victoria SW1, including New Scotland Yard and Parliament Offices, will be significantly reduced.

The project involves equipping a spare bay at Wandsworth Grid 66kV with a dead tank circuit breaker and feeder reconfigurations to separate the heavily loaded Moreton Street T2B transformer from Norroy Tee Point.

Completion of this project will see the installation of 1x66kV dead tank circuit breaker and the reconfiguration will see the Moreton Street T2B 66kV circuit and the Norroy Road Tee-Point 66kV circuit being supplied via separate circuit breakers at Wandsworth Grid 66kV substation.

3667: Wandsworth Grid 132/66kV Group Reinforcement

Wandsworth Grid 66kV is supplied from Wimbledon Grid 132kV via four 132kV circuits. Due to the increasing demand at the primary sites fed from Wandsworth and the commissioning of the new Moreton Street C and Kingsgate House substations, the load on the four circuits is expected to reach 300MW by winter 2014/15. This will make the circuits a Class E group under P2/6 recommendation, thereby requiring compliance with N-2 requirements in summer. It is proposed to install 3 new 132kV circuits from Wimbledon in the Wimbledon-Wandsworth tunnel, supplying a new 132kV gas insulated switchboard, on the Wandsworth site, which will feed Moreton Street, Kingsgate House and the future substation at Battersea. This will split the network and keep the load on the four initial circuits below 300MW.

Completion of the scheme will see a new 9 panel gas insulated switchboard and 3x132kV circuits from Wimbledon. The 132kV circuit breakers at Wimbledon are to be installed as part of the replacement of the air insulated switchgear by a new 31-panel switchboard (project 3730).

Wimbledon

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

4.3 Costs and Phasing

Table 12. NAMP (2013-2023; 19th February 2014)

Cat.	Reference	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
A	1.07.90.8303 Norroy Rd Tee Point-Barnes 66kV Gas Cable Replacement	0	0	0	0	0	2,239,942	2,239,942	0	0	0
A	1.07.90.8304 Wandsworth Grid-Norroy Rd Tee Point 66kV Gas Cable Replacement	0	415,989	1,663,957	1,247,968	0	0	0	0	0	0
A	1.50.01.4400 Merton 11kV: Replace 11kV Switchboard	0	0	264,859	904,021	678,016	0	0	0	0	0
A	1.50.01.7798 Gorrington Park - Replace 11kV Switchgear	0	0	275,173	945,413	709,060	0	0	0	0	0
A	1.50.01.7803 Moreton St 11kV - Replace 11kV Switchgear	0	0	0	0	0	336,899	1,192,953	894,715	0	0
A	1.50.01.7937 Durnsford Road - Replace 11kV Switchgear	0	0	0	275,173	945,413	709,060	0	0	0	0
A	1.51.01.7856 Lots Road (LUL) 22kV - Replace Grid Transformer (GT1)	0	78,060	1,524,695	0	0	0	0	0	0	0
A	1.51.01.7857 Wimbledon Grid C 33kV - Replace Grid Transformer (GT2B)	0	0	0	0	0	0	0	78,284	1,363,165	0
A	1.51.03.7864 Dukes Ave - Replace Primary Transformer (T4)	0	0	0	0	0	0	0	0	328,968	246,405
A	1.51.03.7865 Durnsford Rd - Replace Primary Transformers (T1)	0	0	82,565	492,809	0	0	0	0	0	0
H	1.29.01.7940 Wimbledon Grid-Trinity Crescent (Circuit 2-A) - 33kV FFC Replacement	0	0	0	0	0	0	0	0	288,435	712,245
H	1.29.01.7941 Wimbledon-Merton (Circuit 3-A) - 33kV FFC Replacement	0	0	0	0	0	0	0	0	331,568	841,644
H	1.29.01.7949 Wandsworth 66kV-Carslake (Circuit 3-B) - 66kV FFC Replacement	0	0	0	0	0	0	0	550,252	1,497,695	0
H	1.29.01.7956 Wandsworth 66kV-Lombard (Circuit 2-B) - 66kV FFC Replacement	0	0	0	0	0	0	0	0	326,258	825,713
H	1.29.02.7939 Wimbledon 132kV SEC 1&2-Kingston 132kV (Circuit 1-B, Circuit 2-B & Circuit 2-C) - 132kV FFC Replacement	0	0	0	0	0	0	1,257,462	5,029,849	5,029,849	4,034,433
H	1.29.02.7948 Wimbledon 132kV SEC 1&2-Bengeworth Rd 33 (Circuit 2-J) - 132kV FFC Replacement	0	0	0	2,854,025	2,140,519	0	0	0	0	0
R	1.33.01.8496 Wandsworth Central 66/11kV - ITC (add 2x15MVA)	0	0	0	0	0	0	0	99,432	1,491,477	1,372,159
R	1.35.05.8557 Demand Side Response at Wimbledon Grid	0	75,000	75,000	75,000	75,000	75,000	0	0	0	0
R	1.35.05.8558 Demand Side Response at Wandsworth Grid	0	75,000	75,000	75,000	75,000	0	0	0	0	0
R	1.35.07.5815 VNEB New 132/11kV Substation - (2x66.6MVA)	275,609	5,420,312	8,635,751	6,201,204	5,397,344	4,294,908	1,286,176	0	0	0
R	1.35.07.6333 Wimbledon Grid C 132/33kV - ITC (2x90MVA) (N-2)	0	0	0	0	0	0	13,692	1,766,274	3,925,053	867,163
R	1.36.03.5717 Wandsworth 66kV: Feeder Circuit Reconfiguration	0	0	0	0	0	0	0	201,760	44,836	0
R	1.37.06.3667 Wandsworth Grid 132/66kV Group Reinforcement	0	0	0	200,230	5,205,982	4,805,522	216,933	0	0	0

4.4 HI / LI Improvement

Projected Asset Health Indices (With Investment)

Health indices for all network equipment covered in this RDP with investments are listed in red font in Table 13 to Table 18 below. The equipment groups covered include HV circuit breakers (6.6kV and 11kV), EHV circuit breakers (22 and 33kV), 66kV&132kV circuit breakers, primary transformers (EHV/11kV and EHV/6.6kV), grid transformers (132/33kV) and underground cables (33kV, 66kV and 132kV).

Red numbers indicate changes due to ED1 projects.

Table 13. HV Circuit Breakers

Substation	2015					2023 with Intervention				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BARNES B 6.6KV	31					31				
BURLINGTON RD			18	5	1				6	18
CARSLAKE RD		18	6					24		
DUKES AVE	1	19	3			1	22			
DURNSFORD RD			28			28				
GORRINGTON PARK			28			28				
LOMBARD RD B 11KV	37	3				40				

Wimbledon

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

MERTON		23	3	26
MORETON ST 11KV	1	18	17	36
TRINITY CRESCENT	25	3		26 2
WANDSWORTH CENTRAL A	26			8 18
WEST NORWOOD	26			4 22
MORETON ST C 11KV	33			33
KINGSGATE HOUSE	38			38
VNEB		N/A		44

Table 14. **EHV Circuit Breakers**

Substation	2015					2023 with Intervention				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
LOTS ROAD (LUL) 22KV		1					1			
WIMBLEDON D 33KV BR		7					7			
WIMBLEDON GRID C 33KV		22	1			15	6	17		

Table 15. **66 and 132kV Circuit Breakers**

Substation	2015					2023 with Intervention				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
WANDSWORTH 66KV		17				1	17			
WANDSWORTH 132KV			N/A			9				
WIMBLEDON 132KV 1,2,3&4	8	3	7	4				N/A		
WIMBLEDON GRID 132KV			N/A			25				

Table 16. **Primary Transformers**

Substation	2015					2023 with Intervention				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
BARNES B 6.6KV	2	1					3			
BURLINGTON RD		4					4			
CARSLAKE RD		3	1					4		
DUKES AVE		2		1			2			1
DURNSFORD RD			3		1			3		1
GORRINGE PARK		4						4		
LOMBARD RD B 11KV	4						4			
MERTON		4						4		
MONTFORD PL B 11KV		3	1					4		
MORETON ST 11KV		1	3				1	1	2	
TRINITY CRESCENT		4					4			
WANDSWORTH CENTRAL A		4					4			
WEST NORWOOD		4					4			

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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 17. **Grid Transformers**

Substation	2015					2023 with Intervention				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
LOTS ROAD (LUL) 22KV		1		1			1			1
WANDSWORTH 66KV	1	1	2				1	3		
WIMBLEDON D 33KV BR	2						2			
WIMBLEDON GRID C 33KV		2	2			3	1	2		
MORETON ST C 11KV	2					2				
KINGSGATE HOUSE	2					2				
VNEB			N/A			2				

Table 18. **Gas Pressure and Fluid Filled Cables**

Cable Route	2015					2023 with Intervention				
	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5	No. HI1	No. HI2	No. HI3	No. HI4	No. HI5
CARSLAKE RD-BARNES 6.6KV		1	3					3		1
CARSLAKE RD-NORROY RD TPT 66KV			2					2		
WANDSWORTH 66KV-CARSLAKE RD		3			1		1	2		N/A
WANDSWORTH 66KV-LOMBARD RD		3	4	1			3	4		N/A
WANDSW 66KV-WANDSW CTL A		4					3	1		
WIMBLE 132KV 3&4-LOTS RD 22KV		4					4			
WIMBLE 132KV 3&4-WANDSW 66KV		2	1				1	2		
WIMBLE 132KV SEC 1&2-BENGE RD 33		2	3		1			5		N/A
WIMBLE 132KV SEC 1&2-KINGSTON 33		5		3			2	3		N/A
WIMBLE 132KV SEC 1&2-REACTOR 1		1						1		
WIMBLE 132KV SEC 1&2-REACTOR 2			1							1
WIMBLE GRID C 33KV-BURL RD		7	1				7	1		
WIMBLE GRID C 33KV-DUKES AVE		10	2					12		
WIMBLE GRID C 33KV-MERTON		3			1			3		N/A
WIMBLE GRID C 33KV-TRINITY CST		2	1		1			3		N/A
WIMBLE GRID C 33KV-W. NORWOOD		4					3	1		
NORROY RD TPT-BARNES 66KV GAS CABLE				1						N/A
WANDSWORTH GRID-NORROY RD TPT 66KV GAS CABLE				1						N/A

Note: There are no HI's for solid cables which will replace the existing gas pressure and fluid filled cables.

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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.

Projected Load Indices (With Investment)

Substation	Voltage kV	2023 Load Index	
		Without Investment	With Investment
Barnes B 6.6kV	66/6.6	1	1
Burlington Road	33/11	1	1
Carslake	66/11	1	1
Dukes Avenue	33/11	2	2
Durnsford	33/11	2	2
Gorringe Park	33/11	1	1
Lombard Road B	66/11	1	1
Merton	33/11	5	5
Moreton Street	66/11	4	2
Trinity Crescent	33/11	3	3
Wandsworth	66/11	3	3
Wandsworth Grid 66kV	132/66	1	1
West Norwood	33/11	1	1
Wimbledon Grid C 33kV	132/33	2	1
Moreton Street C	132/11	1	1
Kingsgate House	132/11	1	1
VNEB	132/11	N/A	2

Wimbledon

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 LPN Area 2012 – 2023 (February 2013, Element Energy)
Reference 2	Primary Distribution Systems Standard Running Arrangements 2012 Overview Diagrams
Reference 3	NAMP LPN Table J Less Ind (19 th February 2014)
Reference 4	Vauxhall Nine Elms Battersea Opportunity Area Planning Framework - Appendices and Technical Appendices
Reference 5	Asset Condition Reports June 2013

5.1 Appendices

Appendix	Description
Appendix A	Geographical Diagram
Appendix B	Single Line Diagram – Existing Network
Appendix C	P2/6 Analysis

5.2 Document History

Version	Date of Issue	Author	Details
1.0	September 2012	Roy Kelly	Draft
2.1	June 2013	Sophie Motte	Review of LI and HI data, new NAMP version and Element Energy PLEs
2.2	June 2013	Sophie Motte	Amendments following review of document
3.0	February 2014	Martin Jones	Amendments for February 2014 NAMP
3.1	March 2014	Panagiotis Xenos	ED1 Plan Resubmission

Wimbledon

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
Panagiotis Xenos	Infrastructure Planning Engineer		
Sophie Motte	IDP Coordinator		
Chris Winch	Planning Manager		

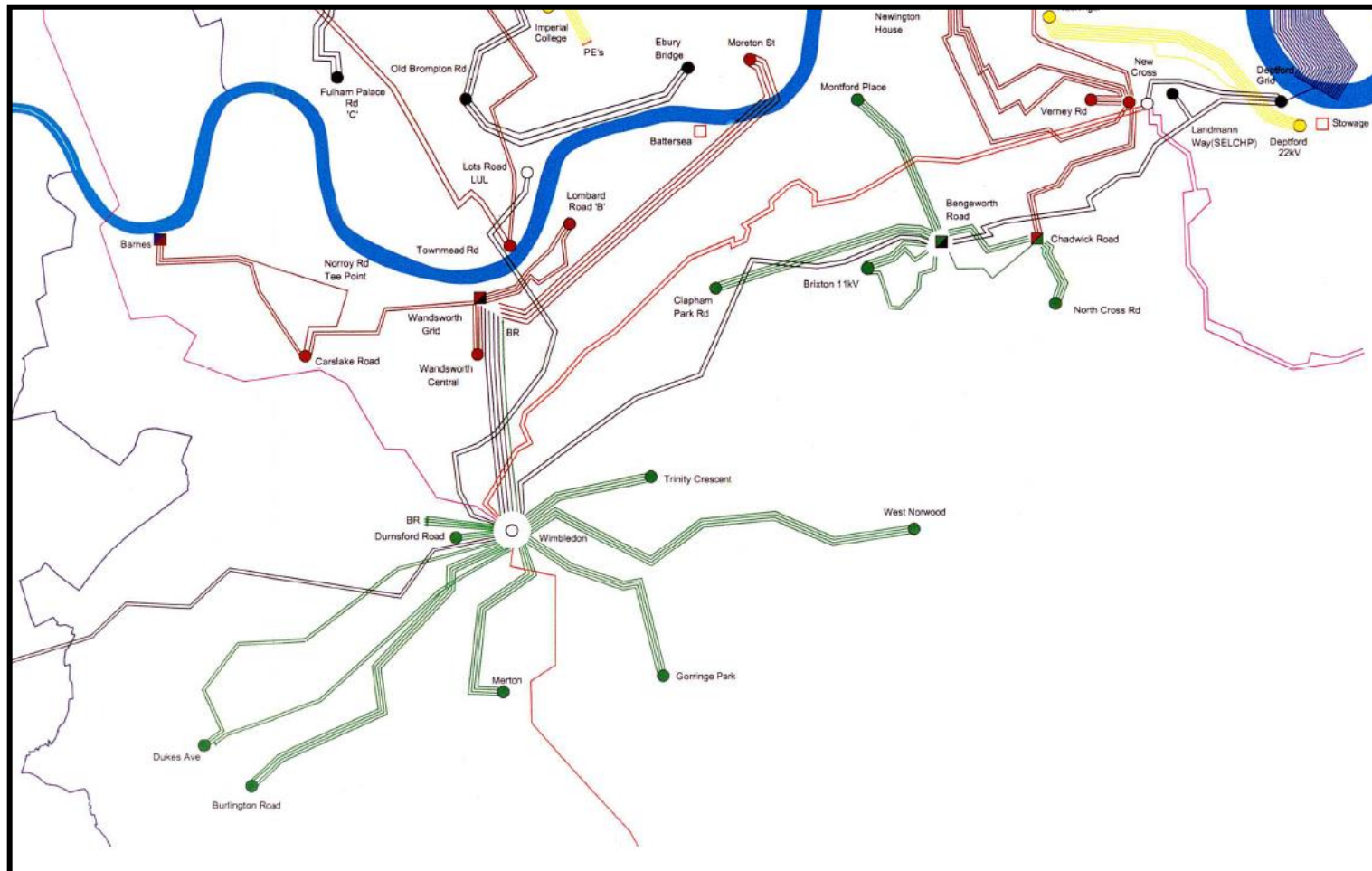
Approval by:

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

Regional Development Plan

Wimbledon

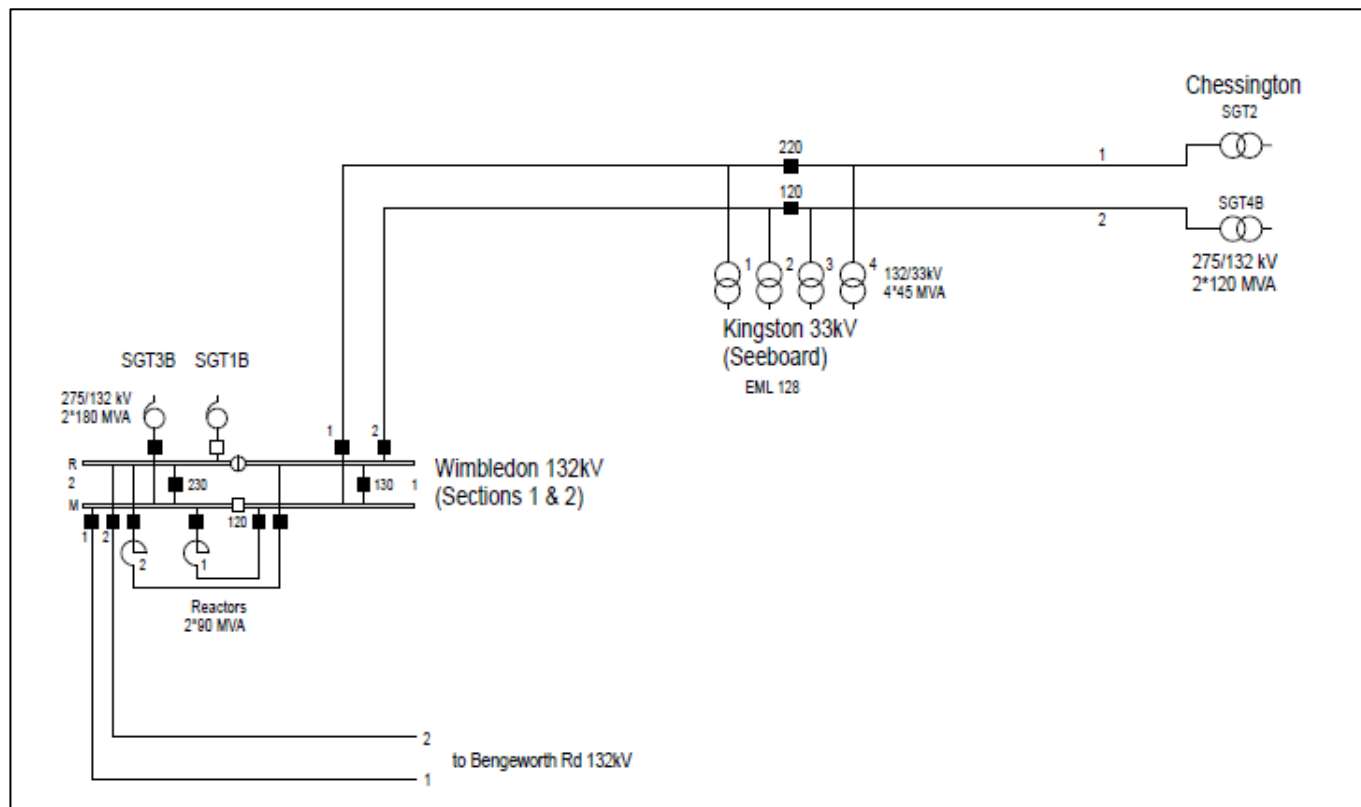
APPENDIX A: Geographical Diagram



Wimbledon

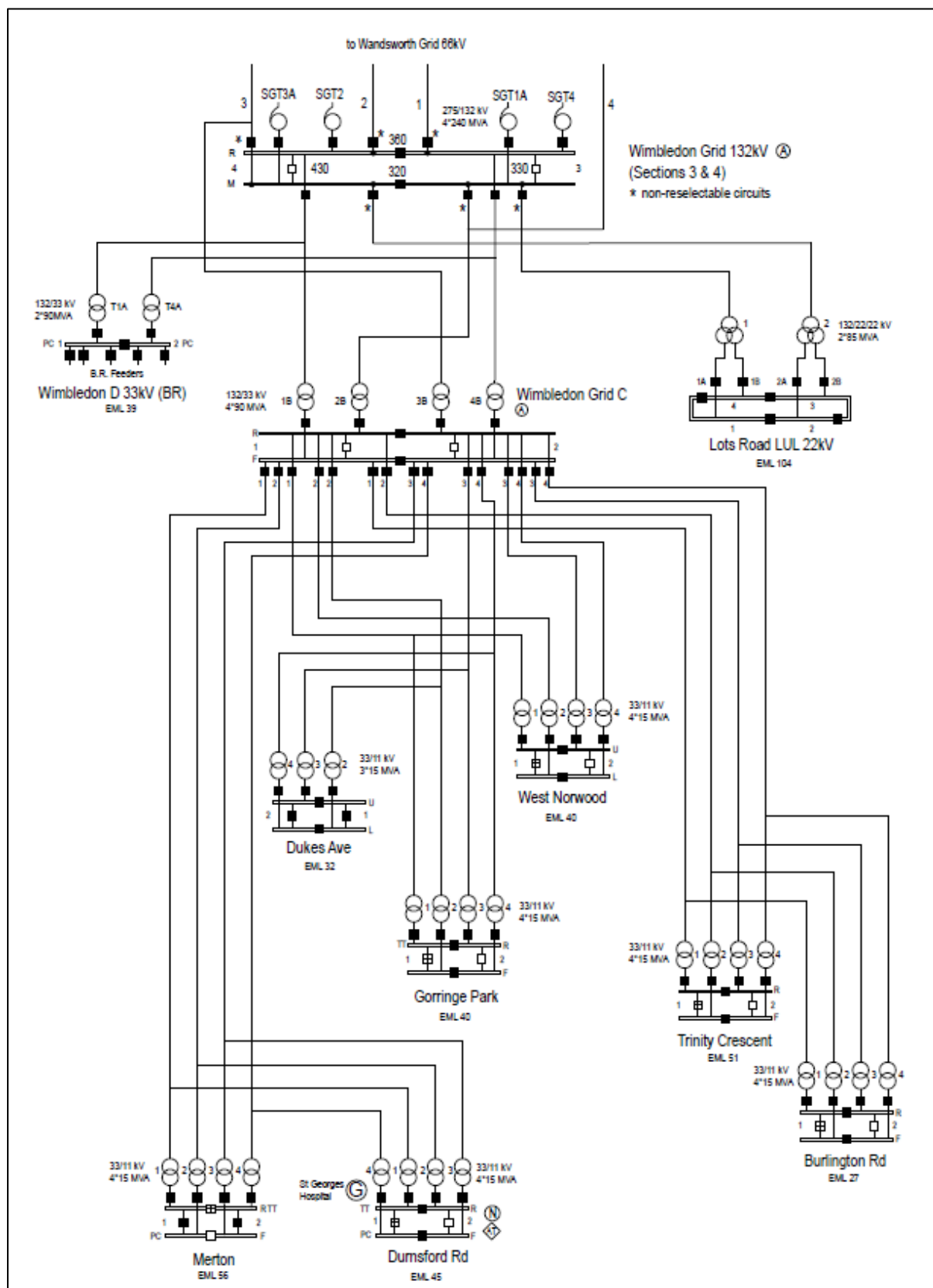
APPENDIX B: Single Line Diagram – Existing Network

Part 1: Wimbledon Sections 1 & 2 (North)



Wimbledon

Part 2: Wimbledon Sections 3 & 4 (South)



Part 3: Wimbledon Sections 3 & 4 (South) Continued



Regional Development Plan



Wimbledon

APPENDIX C: P2/6 ANALYSIS

Sub-station	P2/6	Secondary Voltage	Firm Capacity (MW)	Transfer (MW)	P. F.	Winter 13/14 Summer 2013 (M W)	Winter 14/15 Summer 2014 (M W)	Winter 15/16 Summer 2015 (M W)	Winter 16/17 Summer 2016 (M W)	Winter 17/18 Summer 2017 (M W)	Winter 18/19 Summer 2018 (M W)	Winter 19/20 Summer 2019 (M W)	Winter 20/21 Summer 2020 (M W)	Winter 21/22 Summer 2021 (M W)	Winter 22/23 Summer 2022 (M W)
Barnes B 6.6kV	YES	6.6kV	59.90		0.96	28.75	29.10	29.51	29.89	30.30	30.74	31.21	31.70	32.35	33.02
Barnes B 6.6kV	YES	6.6kV	46.08		0.96	19.02	19.24	19.50	19.74	20.00	20.29	20.59	20.90	21.32	21.74
Burlington Road	YES	11kV	51.90		0.98	30.89	31.19	31.53	31.84	32.18	32.53	32.91	33.30	33.85	34.41
Burlington Road	YES	11kV	40.20		0.97	22.77	22.99	23.25	23.49	23.75	24.02	24.31	24.61	25.03	25.45
Carslake	YES	11kV	57.33		0.98	39.51	39.85	40.25	40.62	41.03	41.47	41.94	42.42	43.11	43.81
Carslake	YES	11kV	43.20		0.96	28.94	29.18	29.46	29.72	30.01	30.32	30.64	30.98	31.47	31.95
Dukes Avenue	YES	11kV	36.30		0.98	29.87	30.18	30.53	30.86	31.21	31.58	31.97	32.38	32.92	33.48
Dukes Avenue	YES	11kV	26.83		0.97	16.85	16.00	16.19	16.35	16.53	16.72	16.92	17.13	17.41	17.70
Durnsford	YES	11kV	49.55	14.78	0.96	40.18	40.74	41.35	41.90	42.50	43.14	43.81	44.51	45.39	46.29
Durnsford	YES	11kV	42.75	14.63	0.95	27.05	27.44	27.86	28.23	28.65	29.09	29.55	30.03	30.64	31.26
Gorringe Park	YES	11kV	57.33		0.98	39.03	39.49	40.00	40.43	40.91	41.41	41.92	42.44	43.17	43.91
Gorringe Park	YES	11kV	43.65		0.97	25.61	25.90	26.22	26.49	26.80	27.12	27.44	27.78	28.24	28.71
Kingsgate House	YES	11kV	83.00		0.96	0.00	0.00	5.04	13.44	16.80	16.80	16.80	16.80	16.80	16.80
Kingsgate House	YES	11kV	83.00		0.96	0.00	0.00	5.04	13.44	16.80	16.80	16.80	16.80	16.80	16.80
Lombard Road B	YES	11kV	92.63		0.95	57.46	57.91	58.42	58.85	59.34	59.87	60.42	60.98	61.81	62.63
Lombard Road B	YES	11kV	72.00		0.96	40.36	40.67	41.01	41.30	41.62	41.98	42.34	42.72	43.28	43.82
Lots Road 22kV LUL	NO	22kV	81.60		0.96	55.90	55.90	55.90	55.90	55.90	55.90	55.90	55.90	55.90	55.90
Lots Road 22kV LUL	NO	22kV	81.60		0.96	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42
Merton	YES	11kV	47.57	32.26	0.95	52.69	53.31	53.99	54.59	55.25	55.94	56.66	57.41	58.38	59.38
Merton	YES	11kV	37.53	29.42	0.96	38.62	39.06	39.54	39.96	40.42	40.91	41.41	41.94	42.62	43.32
Moreton St / Kingsgate House Total	YES	kV	288.00		0.96	0.00	38.80	43.84	52.24	55.60	55.60	55.60	55.60	55.60	55.60
Moreton St / Kingsgate House Total	YES	kV	266.90		0.96	0.00	39.41	44.45	52.85	56.21	56.21	56.21	56.21	56.21	56.21
Moreton Street	YES	11kV	85.12	23.68	0.97	58.94	59.16	59.38	59.56	59.77	59.99	60.21	60.44	60.72	61.00
Moreton Street	YES	11kV	64.13	22.90	0.95	63.41	63.64	63.88	64.07	64.29	64.52	64.75	64.99	65.29	65.58
Moreton Street C	YES	11kV	83.23		0.97	0.00	38.80	38.80	38.80	38.80	38.80	38.80	38.80	38.80	38.80
Moreton Street C	YES	11kV	62.70		0.95	0.00	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41	39.41
Trinity Crescent	YES	11kV	57.33		0.98	50.52	50.95	51.42	51.83	52.28	52.77	53.28	53.80	54.56	55.31
Trinity Crescent	YES	11kV	43.65		0.97	27.98	28.21	28.46	28.68	28.93	29.19	29.46	29.74	30.15	30.55
Wandswoorth	YES	11kV	57.33		0.98	44.45	44.86	45.31	45.72	46.16	46.65	47.16	47.70	48.46	49.21
Wandswoorth	YES	11kV	43.65		0.97	31.22	31.50	31.81	32.08	32.39	32.72	33.06	33.42	33.94	34.45
Wandswoorth Grid 66kV	YES	66kV	340.47		0.97	223.49	225.23	227.18	228.91	230.84	232.91	235.08	237.34	240.49	243.64
Wandswoorth Grid 66kV	YES	66kV	248.40		0.92	182.72	183.99	185.41	186.66	188.06	189.57	191.13	192.77	195.03	197.29
West Norwood	YES	11kV	57.92		0.99	39.22	39.70	40.24	40.70	41.21	41.75	42.29	42.86	43.64	44.43
West Norwood	YES	11kV	44.10		0.98	24.30	24.59	24.90	25.17	25.48	25.79	26.11	26.45	26.91	27.38
Wimbledon D 33kV BR	YES	33kV	68.60		0.96	23.68	23.68	23.68	23.68	23.68	23.68	23.68	23.68	23.68	23.68
Wimbledon D 33kV BR	YES	33kV	68.60		0.96	26.54	26.54	26.54	26.54	26.54	26.54	26.54	26.54	26.54	26.54
Wimbledon Grid C 33kV	YES	33kV	329.20		0.96	268.70	271.78	275.20	278.19	281.52	285.02	288.65	292.42	297.50	302.66
Wimbledon Grid C 33kV	YES	33kV	259.20		0.96	180.95	182.95	185.17	187.12	189.28	191.55	193.91	196.36	199.65	203.00
Wimbledon Grid South 3/4	YES	132kV	788.00		0.96	555.73	598.89	608.31	620.19	628.00	633.04	638.28	643.75	651.20	658.72
Wimbledon Grid South 3/4	YES	132kV	732.70		0.96	420.87	463.38	471.63	482.65	489.23	492.82	496.54	500.43	505.70	511.04