Existing Line Survey Report

Brechfa Forest Connection Project

January 2014

CYSWLLT COEDWIG Brechfa FOREST CONNECTION

WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

Document Details

Document prepared by:

LS Transmission Company Ltd

Western Power Distribution

Contents

Glossary of Terms

Term	Description
AAAC	All Aluminium Alloy Conductor
ACSR	Aluminium Conductor Steel Reinforced
Cable	Underground cables
Conductor	Overhead wire
D10 E10	Tower with 10^{o} angle deflection to the overhead alignment and a height extension section of 10 feet (approx. 3 meters)
Horse	$70mm^2$ diameter aluminium conductor
kV	Kilovolts (thousand volts)
LV	Low voltage
Lynx	$175mm^2$ diameter aluminium conductor
OHL	Overhead line
Pylon	Steel lattice tower for suspending overhead lines
Span	Overhead wires between two towers
Tight bar	Datum point taken from top of OHL to provide a theoretical horizontal level for conductor between poles, without conductor sag
Tower	Steel lattice tower for suspending overhead lines
UPAS	$300mm^2$ diameter aluminium conductor
ZEBRA	$400mm^2$ diameter aluminium conductor

Executive summary

1.0.1 Western Power Distribution (WPD) is proposing to use existing overhead lines on the distribution network (in connection with new overhead lines) to carry the power generated at the three proposed Brechfa Forest wind farms to the Swansea North Grid Substation. From here it will be distributed to consumers in the South Wales area.

1.0.2 This report updates and supersedes the Existing Line Survey published in June 2013.

1.0.3 The existing overhead lines are carried on existing steel lattice towers, also called pylons, and will operate at 132,000 volts (132kV). These towers all carry two circuits, a set of three overhead wires, one set on each side of the tower. Overhead wires are also called conductors.

1.0.4 Each of the overhead line circuits has an alphabetical identification reference and the four circuits that run from near Llandyfaelog, south of Carmarthen, to the Swansea North Substation are designated as follows; the EE-route, the C-route, the V-route and the W-route.

1.0.5 The process adopted for this study involved surveying the line to record the topographical tower positions, conductor attachments points and current conductor profile. Data on the electrical load and weather conditions at the time of the survey was also recorded to allow the original sagging basis for the conductors to be determined. Where the existing conductors were retained, the line profiles were redrawn for the new operating temperature of 75^{o}C.

1.0.6 The EE-route has no clearance to ground infringements but will require replacement conductors.

1.0.7 The V-route has no significant clearance infringement issues. Proposals are presented for the rectification of the four minor infringements that were

encountered using semi-tension sets and undergrounding two low voltage (LV) crossings.

1.0.8 On the C-route there are clearance infringements at five locations and proposals for rectification are presented. These include replacing suspension insulator strings with semi-tension insulator sets and the possible diversion of a LV line underground.

1.0.9 The W-route has no clearance infringements.

1.0.10 For network protection in fault scenarios WPD will install a circuit breaker at the New Lodge Substation at Burry Port.

1.0.11 The configuration of the existing 132kV circuits adjacent to the New Lodge Substation will need to be changed from the existing arrangement. Based on the need for the circuit breaker WPD has decided that this will be connected using a new underground cable in and out of New Lodge Substation. Towers W38 and C6 are the most appropriate for underground cable sealing ends.

1.0.12 An overhead interconnector at 132kV will be required, also using towers W38 and C6, to replace the existing conductors between towers W40 and C4, which is on the circuit from Carmarthen to Llanelli and separate to the Brechfa Forest Connection.

Introduction

2.0.1 The three proposed wind farms in the Brechfa Forest area (Brechfa Forest West, Brechfa Forest East and Bryn Llywelyn) will be connected to the existing distribution network by a single circuit 132kV overhead line constructed on twin wooden poles which, depending upon the final alignment chosen, could be approximately 32km in length. The point of connection will be at either tower EE46 or EE42 of the EE route near Llandyfaelog, approximately 10 kilometres south of Carmarthen.

2.0.2 From there the generated power will be routed to the Swansea North Grid Substation via existing overhead lines, which will be upgraded accordingly, and then distributed across South Wales. Each of the overhead line circuits has an alphabetical identification reference and the four circuits that run from near Llandyfaelog to Swansea North Substation are designated as follows; the EE-route, the C-route, the V-route and the W-route.

2.0.3 Survey work was conducted on the existing overhead lines to capture the tower positions, conductor attachment point locations, existing conductor profile and topographical features along the route. Data on the electrical load and weather conditions at the time of the survey was also recorded to allow the original sagging basis for the conductors to be determined. Where the existing conductors were retained, the line profiles were redrawn for the new operating temperature.

2.0.4 Where necessary, fitting new conductors was recommended, and a strength and capability assessment was carried out in accordance with the requirements of the BS EN 50341 general approach. The radial ice thickness was capped at 46.5 mm in accordance with National Grid practice, but where necessary a further reduction in ice thickness may be adopted, with the agreement of the client and only if such a reduction was justified by local, historical experience of conductor icing.

2.0.5 This report updates and supersedes the Existing Line Survey, June 2013.

V-route

3.0.1 The Brechfa Forest Connection Project will utilise a section of the V-route running between Swansea North and Carmarthen Bay. The affected section of the line consists of 60 structures, a mixture of tower type PL1b PL16 and L4(M) construction, currently strung with two circuits of UPAS conductor operating at 50°C. WPD proposes to upgrade this line to UPAS conductors operating at 75°C.

3.0.2 LSTC, a survey, design and engineering consultancy, have undertaken a full line survey of the V-route in order to determine the tower locations, conductor attachment point locations, conductor profile and topographical features along the route. The weather conditions and electrical load at the time of the survey were also recorded to allow the original sagging basis to be estimated for the existing conductor.

3.0.3 Back analysis concluded that the original conductor sag matched most closely with a profile drawn for UPAS (9.5mm Ice) at 50°C.

3.0.4 Based on the survey data, a series of line profiles and a clearance infringement report were prepared, as shown in Appendix A. Four clearance infringements have been identified as noted below.

3.0.5 A ground clearance infringement with a maximum magnitude of 0.18m was identified in span 76-77. The span is supported on D2 standard height suspension towers. Three options for clearance rectification are possible, as follows:

- Insulator disc removal, which will raise the conductor by approximately 0.1m per disc subject to verifying the performance of the insulator string.
- Fitting semi-tension sets, which will raise the conductor by approximately 2.0m.
- Increase tower height or new tower.

3.0.6 The magnitude of the infringement is small and fitting semi-tension sets will provide sufficient clearance.

3.0.7 Two vertical clearance infringements to low voltage lines were identified in spans 80-81 and 107-108, under bar tight conditions. Three options are available to rectify clearance infringements to low voltage (LV) line crossings, as follows:

- Redesign shorter bottom insulator strings, which is likely to raise the conductor by 0.1m per insulator disc removed. There is a need to check that adequate insulation to the structure is still provided as well as ensuring that electrical performance requirements are satisfied and wire clearance(s) are adequate.
- Replace the suspension insulator set with a semi-tension set. For standard 132kV suspension set this may raise the conductor by 1.5 to 2.0m.
- Divert the LV line via an underground cable. This avoids further scaffolding work or LV shutdown for maintenance of the 132kV line.

3.0.8 The infringement in span 80-81 has a magnitude of 0.32m. As this infringement relates to the bar tight condition it is likely that the actual LV conductor is much lower than assumed.

3.0.9 Based on the current assessment of the clearances and given that towers V80 and V81 are both D2 suspension towers, all of the options for clearance rectification given above are viable. Diverting the LV line to an underground cable on this scheme is the preferred option because removing the crossing removes the hazard for construction and future maintenance.

3.0.10 In span 107-108 the clearance infringement relates to the pole as well as the conductor of the LV line. In this case, the magnitude of the clearance infringement is 0.94m. As tower V107 is a tension structure and given the magnitude of the infringement insulator removal is not a viable option. This infringement may be rectified by replacing suspension insulators with semi-tension sets although this can only be achieved at tower V108. This means that the magnitude of the clearance improvement at mid span is likely to be around 1.0m and will be subject

to adequate tower wire clearances being achieved. A site specific design assessment of tower V108 will be required to verify structural integrity or strengthening that may be required. Diverting the LV line to an underground cable is the preferred option because removing the crossing removes the hazard for construction and future maintenance and is not subject to clearance and structural requirements being satisfied.

3.0.11 An infringement to buildings with a maximum magnitude of 0.94m was found in span 91-92. Two options are available for rectifying this infringement:

- Increase the height of the towers by modifying the existing structures or constructing new towers:
- Replace the suspension strings with semi-tension sets, which will be subject to wire clearance requirements and structural checks.

3.0.12 This infringement may be rectified by replacing suspension insulators with semi-tension sets. This solution will be subject to adequate tower wire clearances being achieved and a site specific design assessment of towers V91 and V92 will be required to verify structural integrity and to confirm the limits of approach to buildings.

3.0.13 Increasing the height of the towers is an expensive option and it may also require tower heights that fall outside the requirements of with Section 37 consent. The location of the new tower will require extensive negotiations with landowners and grantors and therefore this is considered the least preferred option.

C-route

4.0.1 The C-route consisted of two 132 kV circuits strung with 300mm^2 AAAC UPAS conductors between towers C4 and C6 and with 400mm^2 ACSR ZEBRA conductors between towers C6 and C21A.

4.0.2 LSTC have undertaken a survey of the C-route, to identify the location of the tower positions, conductor attachment points and the topographical features along the route. In order to allow the original sagging basis to be estimated the conductor profile was recorded along with weather conditions and the electrical load at the time of the survey.

4.0.3 The C-route towers C6 to C21A were profiled based on the use of a ZEBRA conductor operated at 60°C.

4.0.4 Based on the survey data a series of line profiles and a clearance infringement report were prepared, as shown in Appendix A. Of the five identified, four ground clearance infringements were identified as noted below.

4.0.5 A ground clearance infringement with a maximum magnitude of 1.022m was identified in span 7-8. Three options for clearance rectification are possible, as follows:

- Redesign the bottom insulator strings, this will raise conductor by approximately 0.1m per insulator disc removed, subject to verifying the performance of insulator string, the electrical performance requirements and the wire clearance.
- Replacing suspension insulators with semi-tension sets will raise the conductor by approximately 2.0m. This is subject to satisfactory wire clearance.
- Increase the height of the supporting towers by constructing new taller structures or modifying the existing towers with parallel body extensions.

4.0.6 Given the magnitude of the infringement, shorter insulator strings could not present a viable solution to achieve the required clearance.

4.0.7 Substituting the suspension strings at tower C7 for semi-tension sets was identified as a more feasible option.

4.0.8 For the reasons provided in paragraph 3.1.13 above, increasing the tower height is the least preferred option.

4.0.9 Another ground clearance infringement was identified in span 15-16 between tower C15, a tension structure and tower C16 a suspension structure. The maximum magnitude of the infringement is 0.029m and three options for clearance rectification were identified, as follows:

- Use of shorter bottom insulator strings. This potentially raises the conductor by approximately 0.1m per disc removed but is subject to verifying the performance of insulator string, the electrical performance requirements and providing adequate wire clearance.
- Fitting semi-tension sets will raise conductor by approximately 2.0m, subject to wire clearance requirements and structural checks.
- Increased tower height.

4.0.10 Considering the magnitude of the infringement, all of the above options were considered to be viable solutions to achieve the required clearances. A site specific design assessment of tower C8 will be required to verify structural integrity or strengthening that may be required clearance. Semi-tension sets are likely to be the most cost effective solution.

4.0.11 In span 17-18 a ground clearance infringement with a maximum magnitude of 0.944m was identified. Towers C17 and C18 are both tension structures. Therefore, the options for clearance rectification are limited to increasing the tower height, adjusting conductor tension or earthworks. The preferred solution is to add a further extension to tower C17. This is a type D10 E10’ tower constructed to

specification CEB L132 (0.4 sq in conductors), and adding a standard 3.04m (10ft) extension to make the tower an E20' will rectify the clearance problem.

4.0.12 The final ground clearance infringement occurs in span 19-20 between suspension towers C19 and C20. The maximum magnitude of the infringement is 1.184m. Two options are available to rectify clearance infringements to line crossings, as follows.

- Replace suspension insulator set with a semi-tension set. For standard 132kV suspension set this may raise the conductor by 1.5 to 2.0m.
- Increase the height of the towers.

4.0.13 Substituting the suspension strings for semi-tension sets at towers C19 and C20 would appear to be the most cost-effective option to raise the level of the conductor, subject to wire clearance requirements and structural checks.

4.0.14 A vertical clearance infringement to a 33kV line was identified in span 18-19, under bar tight conditions. Three options are available to rectify clearance infringements to line crossings, as follows:

- Use shorter bottom insulator strings, likely to raise the conductor by 0.1m per disc removed. It will be necessary to check that adequate insulation and wire clearance is still provided.
- Replace suspension insulator set with a semi-tension set. For standard 132kV suspension set this may raise the conductor by 1.5 to 2.0m.
- Divert the 33kV line via an underground cable.

4.0.15 The infringement in span 18-19 has a magnitude of 2.59m. As this infringement relates to the bar tight condition it is likely that the actual 33kV conductor is much lower that assumed. Using the measured conductor height the clearance was found to be sufficient.

4.0.16 To avoid future issues during maintenance of the 132kV line, an underground

diversion of the LV lines is the preferred option.

EE-route

5.0.1 The EE-route was constructed to a 275kV specification by the former Central Electricity Generating Board (CEGB) with L3 towers and it operates with Lynx conductors and a Horse earthwire. WPD proposes replacing the existing conductors with UPAS conductors operating at 132kV and at 75°C on one circuit of the route.

5.0.2 A survey was conducted on this line to determine the locations of the towers and conductor connection points. Using this information the line was profiled for the new conductor type, which would be strung to replace the existing Lynx conductor on one side of the tower only.

5.0.3 No clearance issues were identified.

W-route

6.0.1 The W-route consists of two circuits strung with 300mm2 AAAC UPAS conductors. The northern most circuit of the W-route (Llanelli/Carmarthen) is operated at 132kV and the south circuit operated at 33kV.

6.0.2 LSTC has investigated the feasibility of locations for an interconnector between the 132kV 'W' and 'C' routes for WPD.

6.0.3 WPD has decided that it requires a circuit breaker as part of the Brechfa Forest Connection and that this will be situated at New Lodge Substation. The engineering solution will therefore comprise a new underground cable in and out of New Lodge Substation. Towers W38 and C6 are the most appropriate for underground cable sealing ends.

6.0.4 An overhead interconnector at 132kV will be required, also using towers W38 and C6, to replace the existing conductors between towers W40 and C4, which is on the circuit from Carmarthen to Llanelli and separate to the Brechfa Forest Connection.

Conclusion

7.0.1 Clearance infringements were identified on the V and C routes and proposals for rectification have been presented.

7.0.2 Replacing the existing conductors on the EE-route with UPAS conductors operating at 132kV and 75°C on one circuit of the route does not cause clearance issues, as the EE-route was designed to operate at 275kV.

7.0.3 Where preferred options for clearance mitigation have been proposed, WPD will consider all options from a technical and environmental perspective to confirm the best solution particularly where tower strengthening may be required for construction and maintenance operations.

7.0.4 The configuration of the existing 132kV circuits adjacent to the New Lodge Substation will need to be changed from the existing arrangement. Based on the need for the circuit breaker, WPD has decided that this will be connected using a new underground cable in and out of New Lodge Substation. Towers W38 and C6 are the most appropriate for underground cable sealing ends.

7.0.5 An overhead interconnector at 132kV will be required, also using towers W38 and C6, to replace the existing conductors between towers W40 and C4. This is on the circuit from Carmarthen to Llanelli and separate to the Brechfa Forest Connection.

Appendix 1
Clearance Infringement – V-route

	Western Power Distribution				Issue	A
	Clearance Infringement Report Sheet				Date	May-13
	OHL Surveys At Brechfa				Compiled	S.H.
	V Route 52 - 109				Approved	M.W.
					Doc No.	35-13144-01
					Pages	1 of 2

Section	Span	Type of Infringement	Maximum Operating Temperature used	Notes	Perferred Rectification Option
			Proposed Upas 300mm		
52 - 55					
	52-53	No infringements recorded	75°C		
	53-54	No infringements recorded	75°C		
	54-55	No infringements recorded	75°C		
55 - 58					
	55-56	No infringements recorded	75°C		
	56-57	No infringements recorded	75°C		
	57-58	No infringements recorded	75°C		
58 - 60					
	58-59	No infringements recorded	75°C		
	59-60	No infringements recorded	75°C		
60 - 67					
	60-61	No infringements recorded	75°C		
	61-62	No infringements recorded	75°C		
	62-63	No infringements recorded	75°C		
	63-64	No infringements recorded	75°C		
	64-65	No infringements recorded	75°C		
	65-66	No infringements recorded	75°C		
	66-67	No infringements recorded	75°C		
67 - 69					
	67-68	No infringements recorded	75°C		
	68-69	No infringements recorded	75°C		
69 - 70					
	69-70	No infringements recorded	75°C		
70 - 70a					
	70-70a	No infringements recorded	75°C		
70a - 78					
	70a-71	No infringements recorded	75°C		
	71-72	No infringements recorded	75°C		
	72-73	No infringements recorded	75°C		
	73-74	No infringements recorded	75°C		
	74-75	No infringements recorded	75°C		
	75-76	No infringements recorded	75°C		
	76-77	Ground clearance infringment	75°C	Infringes by 0.18m	Install shorter suspension sets
	77-78	No infringements recorded	75°C		
78 - 84					
	78-79	No infringements recorded	75°C		
	79-80	No infringements recorded	75°C		
	80-81	Infringement to LV Conductors of undercrossing	75°C	Infringement using bar tight condition (See Note 1) infringes by 0.32m	Underground LV line
	81-82	No infringements recorded	75°C		
	82-83	No infringements recorded	75°C		
	83-84	No infringements recorded	75°C		
84 - 89					
	84-85	No infringements recorded	75°C		
	85-86	No infringements recorded	75°C		
	86-87	No infringements recorded	75°C		
	87-88	No infringements recorded	75°C		
	88-89	No infringements recorded	75°C		

Note 1 : Infringement is shown at a bar tight condition, the actual LV conductor is significantly lower than this. If details of the conductor could be provided this can be checked and verified clearance is achieved

	Western Power Distribution			Issue	A
	Clearance Infringement Report Sheet			Date	May-13
	OHL Surveys At Brechfa			Compiled	S.H.
	V Route 52 - 109			Approved	M.W.
				Doc No.	35-13144-01
				Pages	2

Section	Span	Type of Infringement	Maximum Operating Temperature used	Notes	Perferred Rectification Option
89 - 90					
	89-90	No infringements recorded	75°C		
90 - 97					
	90-91	No infringements recorded	75°C		
	91-92	infringement to houses	75°C	infringes by 0.94m (swing clearance needed to confirm)	Semi-tension sets
	92-93	No infringements recorded	75°C		
	93-94	No infringements recorded	75°C		
	94-95	No infringements recorded	75°C		
	95-96	No infringements recorded	75°C		
	96-97	No infringements recorded	75°C		
97 - 98					
	97-98	No infringements recorded	75°C		
98 - 101					
	98-99	No infringements recorded	75°C		
	99-100	No infringements recorded	75°C		
	100-101	No infringements recorded	75°C		
101 - 107					
	101-102	No infringements recorded	75°C		
	102-103	No infringements recorded	75°C		
	103-104	No infringements recorded	75°C		
	104-105	No infringements recorded	75°C		
	105-106	No infringements recorded	75°C		
	106-107	No infringements recorded	75°C		
107 - 109					
	107-108	Infringement to 11kV Conductors and pole of undercrossing	75°C	infringes by 0.94m (swing clearance needed to confirm)	Underground LV line
	108-109	No infringements recorded	75°C		

Note 1 : Infringement is shown at a bar tight condition, the actual LV conductor is significantly lower than this. If details of the conductor could be provided this can be checked and verified clearance is achieved

Appendix 2
Clearance Infringement – C-route

	Western Power Distribution				Issue	A
	Clearance Infringement Report Sheet				Date	Jun-13
	OHL Surveys At Brechfa				Compiled	S.H.
	C Route 4 - 21A				Approved	M.W.
					Doc No.	35-13144-04
					Pages	1

Section	Span	Type of Infringement	Maximum Operating Temperature used	Notes	Perferred Rectification option
			Proposed Upas 300mm		
4 - 6					
	4-5	No infringements recorded	75°C		
	5-6	No infringements recorded	75°C		
			Existing Zebra 400MM		
6 - 8					
	6-7	No infringements recorded	60°C		
	7-8	Ground clearance infringment	60°C	Infringes by 1.022m	Semi-tension sets
8 - 11					
	8-9	No infringements recorded	60°C		
	9-10	No infringements recorded	60°C		
	10-11	No infringements recorded	60°C		
11 - 15					
	11-12	No infringements recorded	60°C		
	12-13	No infringements recorded	60°C		
	13-14	No infringements recorded	60°C		
	14-15	No infringements recorded	60°C		
15 - 17					
	15-16	Ground clearance infringment	60°C	Infringes by 0.029m	Semi-tension sets
	16-17	No infringements recorded	60°C		
17 - 18					
	17-18	Ground clearance infringment	60°C	Infringes by 0.944m	Increase tower height
18 - 21A					
	18-19	OHL clearance infringement	60°C	Infringement to 33kv OHL	Underground LV line
	19-20	Ground clearance infringment	60°C	Infringes by 1.184m	Semi-tension sets
	20-21	No infringements recorded	60°C		
	21-21A	No infringements recorded	60°C		

Note 1 : Infringement is shown at a bar tight condition, the actual LV conductor is significantly lower than this. If details of the conductor could be provided this can be checked and verified clearance is achieved

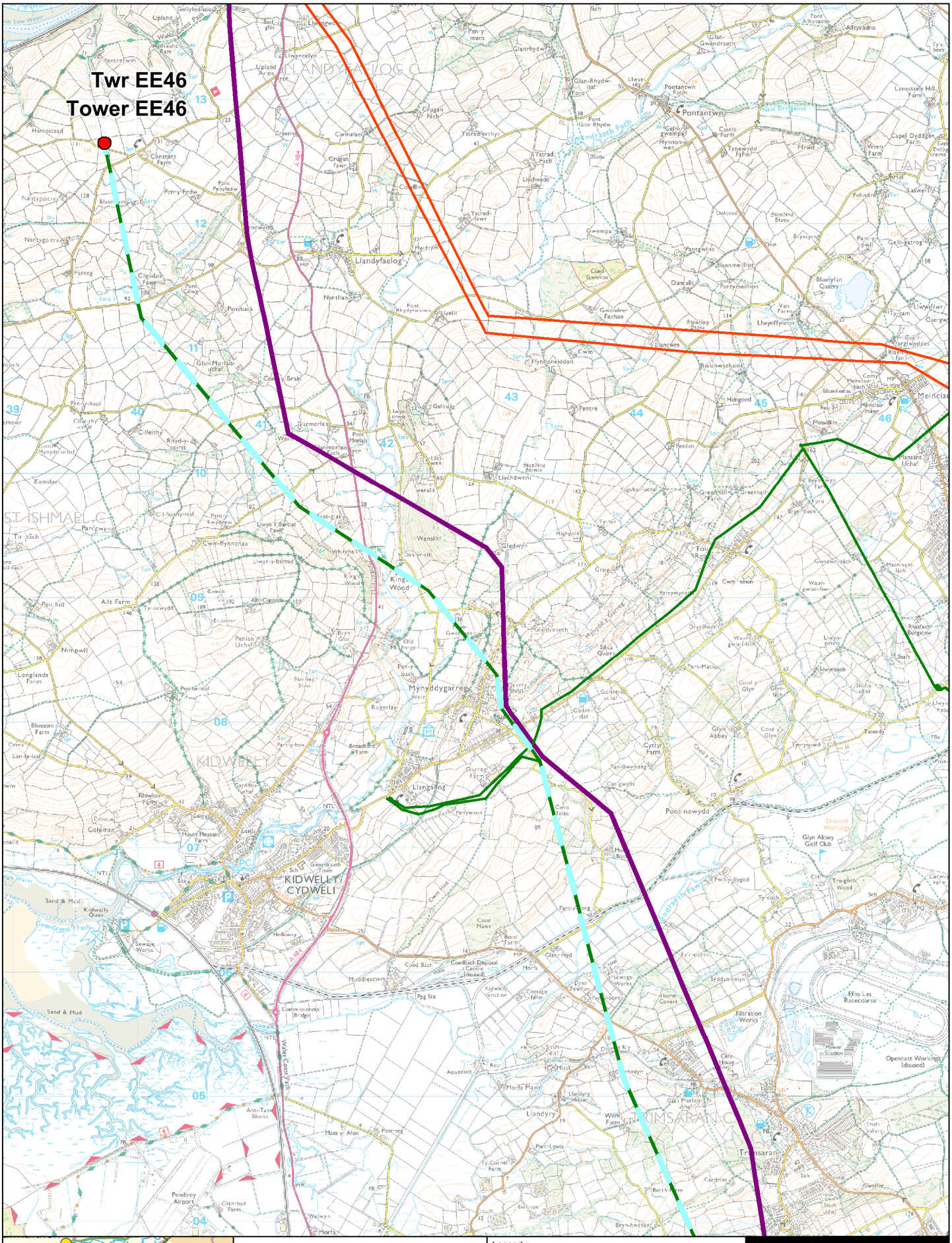
Appendix 3
Clearance Infringement – EE-route

Western Power Distribution		Issue	A
Clearance Infringement Report Sheet		Date	Jul-13
OHL Surveys At Brechfa		Compiled	S.H.
EE Route W40 - EE46		Approved	M.W.
		Doc No.	35-13144-06
		Pages	1

Section	Span	Type of Infringement	Maximum Operating Temperature used		Notes
			UPAS 300mm AAAC	**LYNX 36KN 175 ACSR**	
W40 - EE7					
	40-6	No infringement recorded	75°C	50°C	
	6-7	No infringement recorded	75°C	50°C	
EE7 - 13					
	7-8	No infringement recorded	75°C	50°C	
	8-9	No infringement recorded	75°C	50°C	
	9-10	No infringement recorded	75°C	50°C	
	10-11	No infringement recorded	75°C	50°C	
	11-12	No infringement recorded	75°C	50°C	
	12-13	No infringement recorded	75°C	50°C	
EE13 - 15					
	13-14	No infringement recorded	75°C	50°C	
	14-15	No infringement recorded	75°C	50°C	
EE15 - 19					
	15-16	No infringement recorded	75°C	50°C	
	16-17	No infringement recorded	75°C	50°C	
	17-18	No infringement recorded	75°C	50°C	
	18-19	No infringement recorded	75°C	50°C	
EE19 - 26					
	19-20	No infringement recorded	75°C	50°C	
	20-21	No infringement recorded	75°C	50°C	
	21-22	No infringement recorded	75°C	50°C	
	22-23	No infringement recorded	75°C	50°C	
	23-24	No infringement recorded	75°C	50°C	
	24-25	No infringement recorded	75°C	50°C	
	25-26	No infringement recorded	75°C	50°C	
EE26 - 28					
	26-27	No infringement recorded	75°C	50°C	
	27-28	No infringement recorded	75°C	50°C	
EE28 - 29					
	28-29	No infringement recorded	75°C	50°C	
EE29 - 32					
	29-30	No infringement recorded	75°C	50°C	
	30-31	No infringement recorded	75°C	50°C	
	31-32	No infringement recorded	75°C	50°C	
EE32 - 36					
	32-33	No infringement recorded	75°C	50°C	
	33-34	No infringement recorded	75°C	50°C	
	34-35	No infringement recorded	75°C	50°C	
	35-36	No infringement recorded	75°C	50°C	
EE36 - 42					
	36-37	No infringement recorded	75°C	50°C	
	37-38	No infringement recorded	75°C	50°C	
	38-39	No infringement recorded	75°C	50°C	
	39-40	No infringement recorded	75°C	50°C	
	40-41	No infringement recorded	75°C	50°C	
	41-42	No infringement recorded	75°C	50°C	
EE42 - 46					
	42-43	No infringement recorded	75°C	50°C	
	43-44	No infringement recorded	75°C	50°C	
	44-45	No infringement recorded	75°C	50°C	
	45-46	No infringement recorded	75°C	50°C	

Note 1 : Infringement is shown at a bar tight condition, the actual LV conductor is significantly lower than this. If details of the conductor could be provided this can be checked and verified clearance is achieved

Appendix 4
Route Maps



RSK

WESTERN POWER DISTRIBUTION

Rev	Date	Description	Drn	Chk	App
00	29.01.14	First Draft	JG	DW	VR

Legend :

- Tower EE46 / Twr EE46
- EE line (WPD) / Llinell EE (WPD)
- V line (WPD) / Llinell V (WPD)
- 33kV line (WPD) / Llinell 33kV (WPD)
- 132kV line (WPD) / Llinell 132kV (WPD)
- 275kV line (WPD) / Llinell 275kV (WPD)
- 400kV line (WPD) / Llinell 400kV (WPD)

Brechfa Forest

Title: Figure 1
Existing Network

Ffigur 1
Y Rhwydwaith Presennol

0 0.5 1
Kilometres
Scale = 1:40,000 @ A4

N W E S

REV 00

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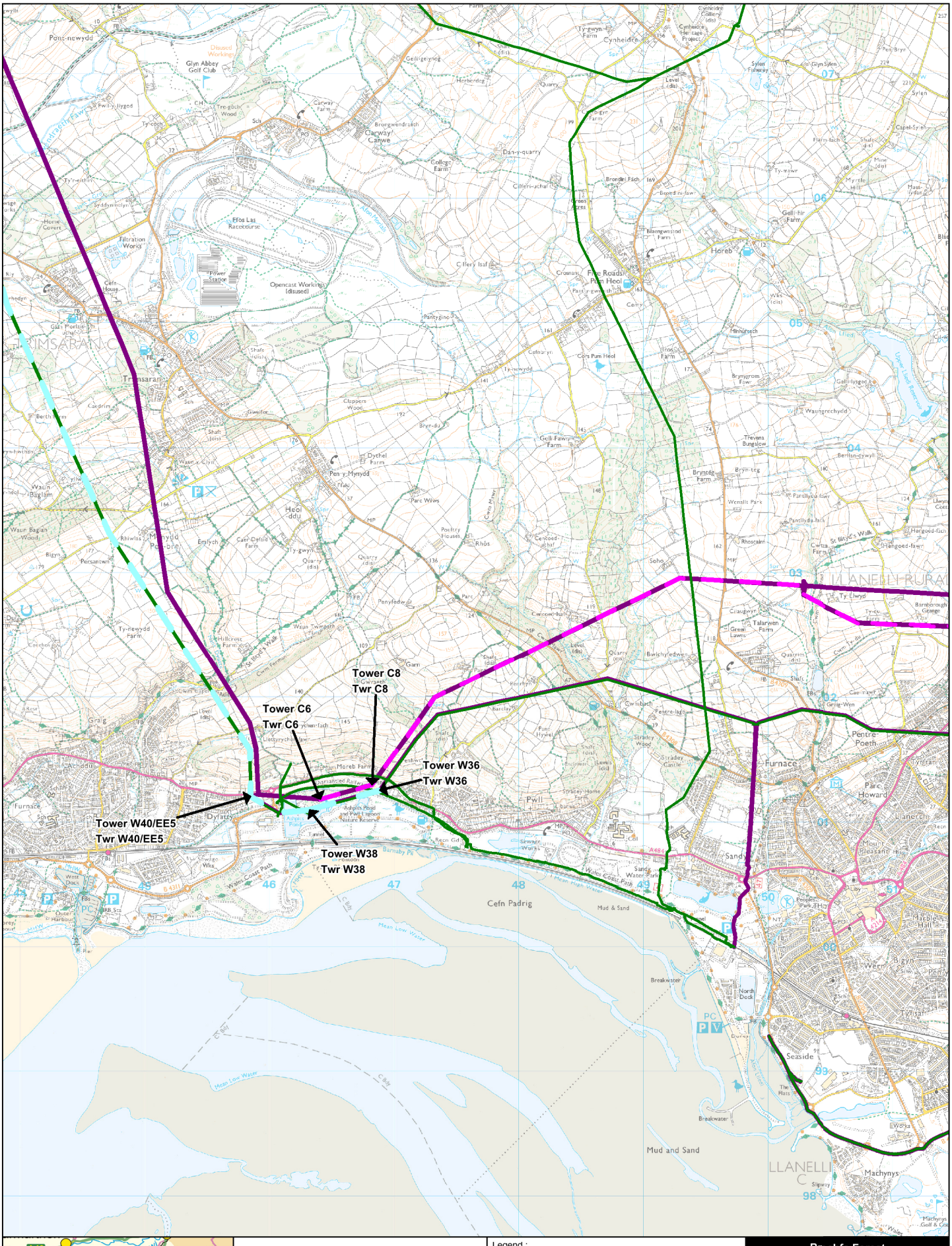
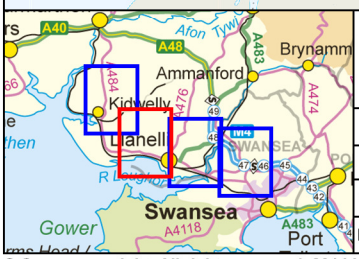




RSK

WESTERN POWER DISTRIBUTION

Rev	Date	Description	Drn	Chk	App
00	29.01.14	First Draft	JG	DW	VR

Legend :

- Tower EE46 / Twr EE46
- EE line (WPD) / Llinell EE (WPD)
- V line (WPD) / Llinell V (WPD)
- 33kV line (WPD) / Llinell 33kV (WPD)
- 132kV line (WPD) / Llinell 132kV (WPD)
- 275kV line (WPD) / Llinell 275 kV (WPD)
- 400kV line (WPD) / Llinell 400kV (WPD)

Brechfa Forest

Title: Figure 2
Existing Network

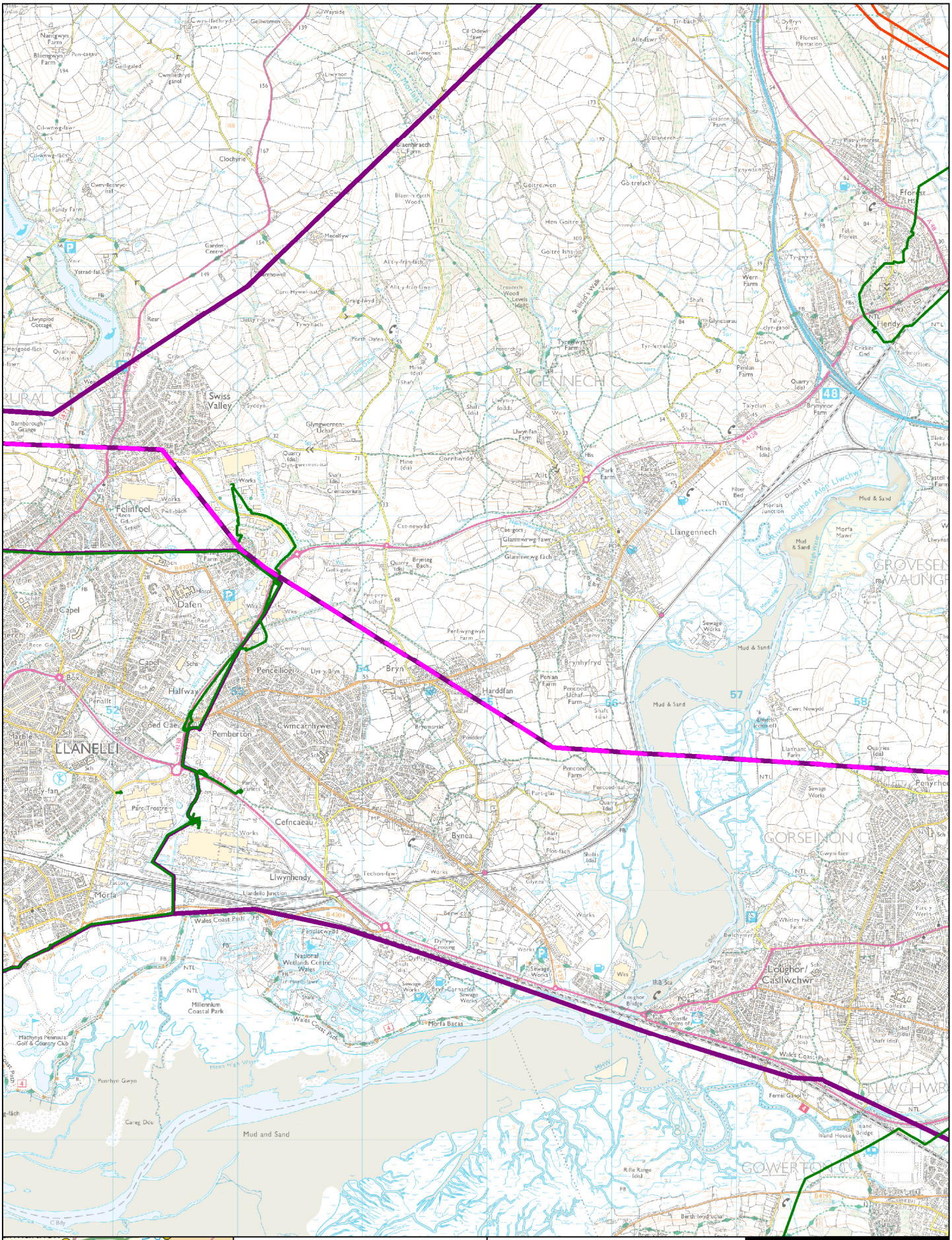
Ffigur 2
Y Rhwydwaith Presennol

0 0.5 1
Kilometres
Scale = 1:40,000 @ A4

N
W E
S

REV 00

File Name : P:\EIA\110000 - EPD South Projects\110516 - Brechfa Forest\01 GIS\Existing_Network_Llandyfaelog_to_Swansea_Map2.wor



RSK

WESTERN POWER DISTRIBUTION

Rev	Date	Description	Drn	Chk	App
00	29.01.14	First Draft	JG	DW	VR

Legend :

- Tower EE46 / Twr EE46
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- V line (WPD) / Llinell V (WPD)
- 33kV line (WPD) / Llinell 33kV (WPD)
- 132kV line (WPD)
- 275kV line (WPD) / Llinell 275kV (WPD)
- 400kV line (WPD) / Llinell 400kV (WPD)

Brechfa Forest

Title: Figure 3
Existing Network

Ffigur 3
Y Rhwydwaith Presennol

0 0.5 1
Kilometres
Scale = 1:40,000 @ A4

N W E S

REV 00

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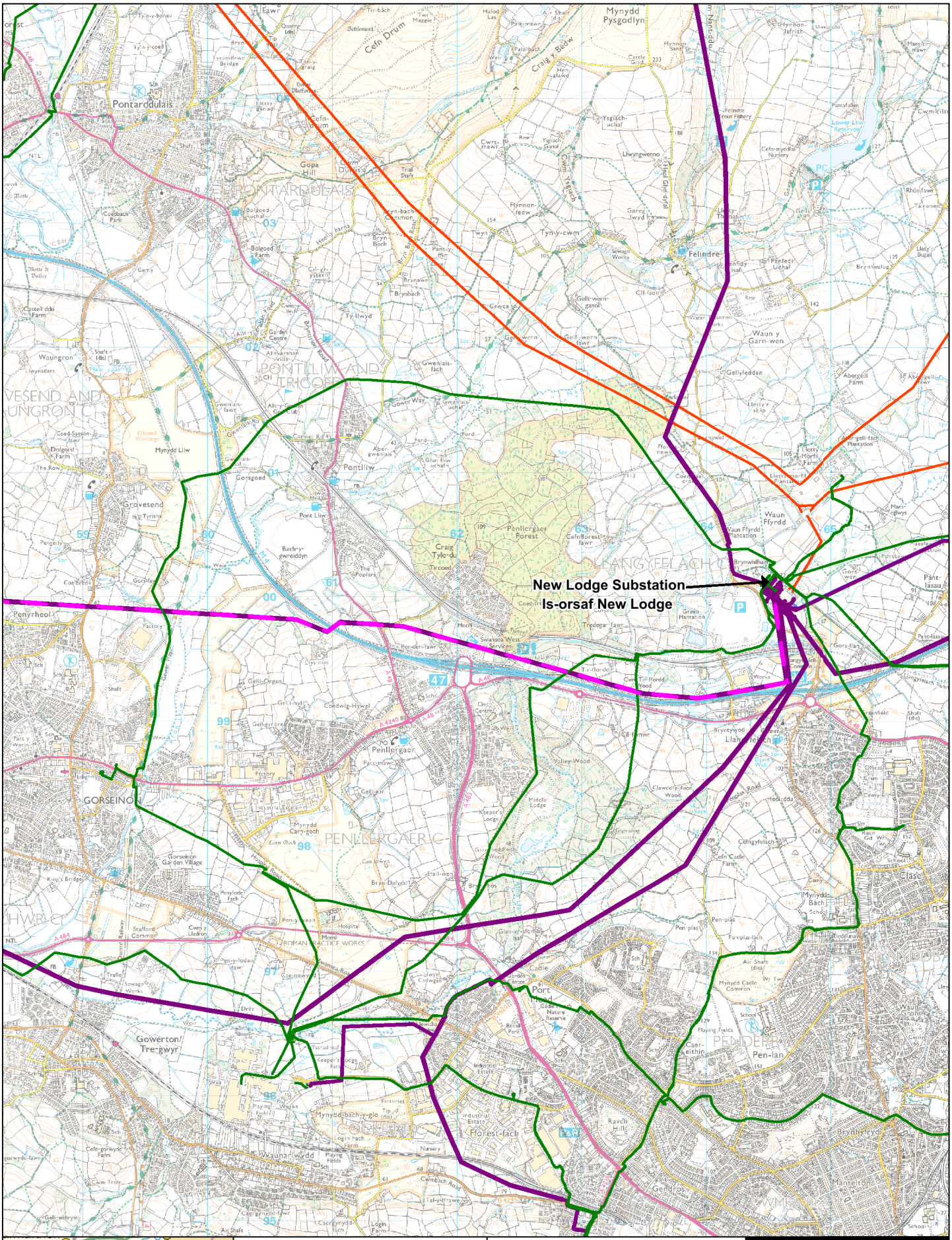

RSK

WESTERN POWER DISTRIBUTION

Rev	Date	Description	Drn	Chk	App
00	29.01.14	First Draft	JG	DW	VR

Legend :

- Tower EE46 / Twr EE46
- EE line (WPD) / Llinell EE (WPD)
- V line (WPD) / Llinell V (WPD)
- 33kV line (WPD) / Llinell 33kV (WPD)
- 132kV line (WPD) / Llinell 132kV (WPD)
- 275kV line (WPD) / Llinell 275kV (WPD)
- 400kV line (WPD) / Llinell 400kV (WPD)

Brechfa Forest

Title: Figure 4
Existing Network

Ffigur 4
Y Rhwydwaith Presennol

0 0.5 1
Kilometres
Scale = 1:40,000 @ A4

N W E S

REV 00

File Name : P:\EIA\110000 - EPD South Projects\110516 - Brechfa Forest\01 GIS\Existing_Network_Llandyfaelog_to_Swansea_Map4.wor