TATA STEEL

TATA

Appendix 5.2: Methodology Supporting Tables

Table 5.15 Discrete Receptor Details			
Ref	**Name**	**OS Location**	
		X	**Y**
1	Talbot Court Nursing Home, Talbot Road	276923	189479
2	25 Lower West End Road	277067	189006
3	21 Duke Street	277614	188396
5	40 Byass Street	278238	187110
6	1 Ten Acre Wood	279563	186315
8	26 Curt Ucha Terrace (Talbot Road)	277098	189213
11	Port Talbot Fire Station	277388	188733
14	Theodore Road	277328	189385
15	Talbot Road	276833	189567
17	Port Talbot Docks	276346	189446
18	Prince St.	277689	188235
23	12 Lower West End Road	277139	188901
24	Woodfield Street	277461	188673
27	91 Talbot Road	277020	189291
28	74 Talbot Road	277035	189297
29	44 Abbey Road	277179	189345
30	9 Abbey Road	277275	189444
31	1 Abbey Road	277329	189527
32	Glen Afan Comprehensive School	276715	189941
33	Dyffryn Comprehensive School	277079	189508
34	Residential, 1 Castle Street	276241	190110

Table 5.16 Traffic Data Used in the Assessment of Local Air Quality

Link Ref	2013 Base Year		2018 Base Flows		2018 With Option 1 & Option 2 Phase 1		Change (2018 With – 2018 Base)		2028 WO*		2028 With Option 2 Phase 2		Change (2028 With – 2028 Base)		Speed (km/h)
	AADT	HDV	AADT	HDV	AADT	HDV	AADT	HDV	AADT	HDV	AADT	HDV	AADT	HDV	
Link 1	11018	496	11412	514	11466	514	54	0	12199	549	12253	549	54	0	48
Link 2	11912	476	12338	494	12392	494	54	0	13189	528	13243	528	54	0	48
Link 3	16154	646	16731	669	16785	669	54	0	17885	715	17939	715	54	0	48
Link 4	12184	548	12619	568	12943	568	324	0	13489	607	13813	607	324	0	64
Link 5	9968	797	10324	826	10590	855	265	29	11036	883	11302	912	265	29	64
Link 6	9968	1196	10324	1239	10590	1268	265	29	11036	1324	11302	1354	265	29	80
Link 7	12922	1034	13384	1071	13649	1100	265	29	14307	1145	14572	1174	265	29	80
Link 8	11684	701	12101	726	12128	726	27	0	12936	776	12963	776	27	0	48
Link 9	21306	852	22067	883	22175	883	108	0	23589	944	23697	944	108	0	48
Link 10	7384	332	7648	344	7810	344	162	0	8175	368	8337	368	162	0	48
Link 11	7384	332	7648	344	7810	344	162	0	8175	368	8337	368	162	0	48
Link 12	12922	581	13384	602	13708	602	324	0	14307	644	14631	644	324	0	64

* Option 2 Phase 1 will not alter baseline traffic once the construction is completed as there are no additional vehicle movements associated with the operation of the boiler.

Table 5.19 Blast Furnace Gas Consumption						
Unit	**With existing boiler plant**		**With Option 1 or Option 2 second installation**		**With Option 2 first installation**	
	tonnes/hr	**MWth**	**tonnes/hr**	**MWth**	**tonnes/hr**	**MWth**
Margam C, boiler 6	130	101	130	101	130	101
Margam C, boiler 7	130	101	130	101	130	101
No. 3 boiler	100	78	100	78	100	78
Margam A, boiler 5	40	31	-	-	40	31
Margam B, Mitchell boiler	90	70	-	-	90	70
Service boiler 4	50	39	-		30	23
Service boiler 5	50	39	-	-	30	23
New boiler 8 [b]	-	-	189	148	189	148
New boiler 9 [b]	-	-	189	148	--	-
Average BFG flare	166	129	17	13	17	13
Total	*756*	*589*	*756*	*589*	*756*	*589*

Notes: [a] Based on gross calorific value of 3.75 MJ/Nm³. [b] The new boilers are rated at 164 MWth, but will not always be fully fired with only BFG. The most common situation is that the boilers will be fired with blast furnace gas that may be enhanced by mixing small proportions of coke oven gas, BOS gas or natural gas to increase the calorific value as required, though over 85% of the thermal input will come from the blast furnace gas alone. The final split of gas will be determined on

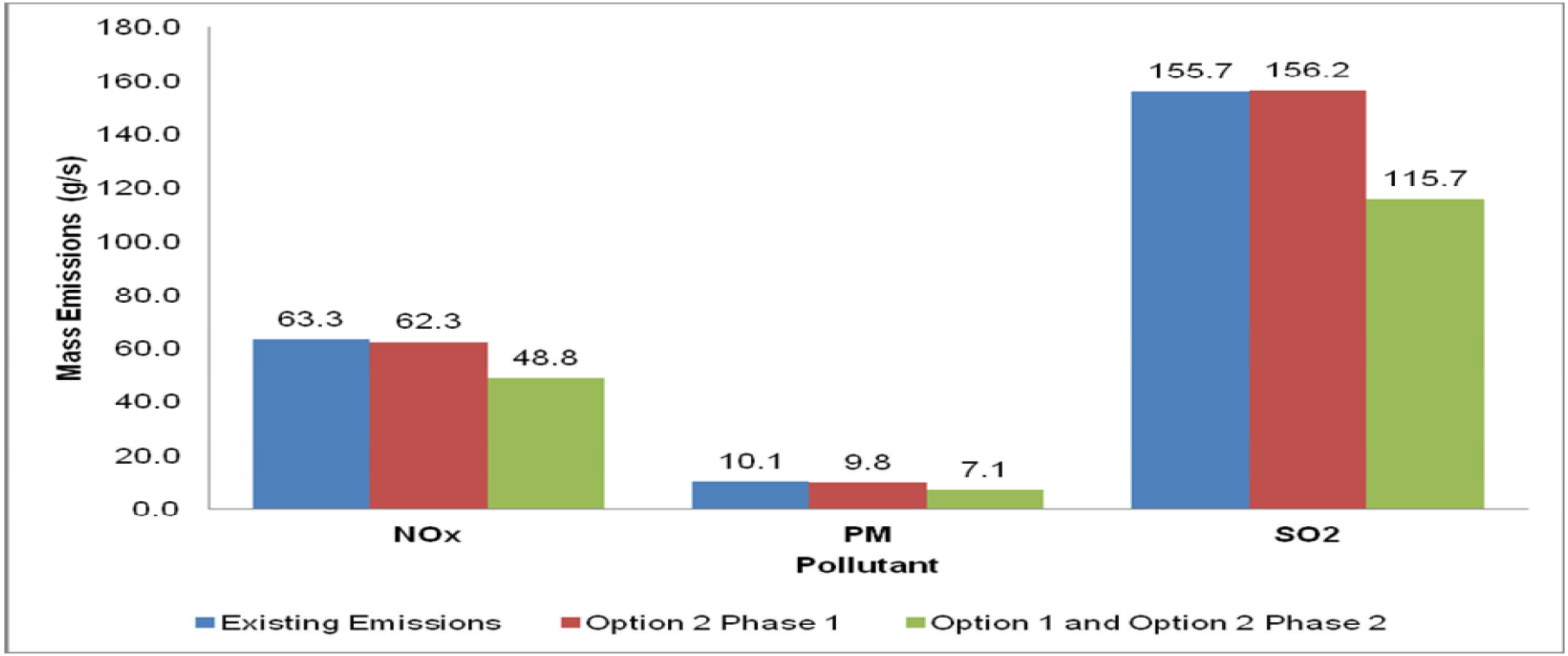
an operational basis related to the gas availability a. It is anticipated that any gas sent to the new power station would otherwise have been sent to flare and as such the relative effects will be the same. In case of reduced availability of blast furnace gas, and in order to ensure the necessary supply of steam, natural gas can be used to supplement the BFG and the boilers will have the capacity to fire with only natural gas in case of a complete loss of BFG, however, the use of natural gas is uneconomic, and would only be used as a temporary measure if other gases were not available in sufficient quantity

Table 5.20 Emission Limit Values

Scenario	Unit	Waste gas flow (Nm³/h @ 3% O2, dry)	ELV (mg/Nm³ @ 3% O_2, dry)			Pollutant emission rates (g/s)		
			NO_x	PM	SO_2	NO_x	PM	SO_2
With Existing Boilers	Margam C, boiler 6	166,807	300	50	800	13.9	2.32	37.1
	Margam C, boiler 7	166,807	300	50	800	13.9	2.32	37.1
	No. 3 boiler	128,313	200	30	400	7.13	1.07	14.3
	Margam A, boiler 5	51,325	300	50	800	4.28	0.71	11.4
	Margam B, Mitchell boiler	115,482	300	50	800	9.62	1.60	25.7
	Service boilers 4&5	128,313	300	50	800	10.7	1.78	28.5
	Flare	N/A	N/A	N/A	N/A	3.79	0.32	1.62
	Total with existing boiler plant					63.3	10.1	155.6
With Option 1 or Option 2 second installation	Margam C, boiler 6	166,807	300	50	800	13.9	2.32	37.1
	Margam C, boiler 7	166,807	300	50	800	13.9	2.32	37.1
	No. 3 boiler	128,313	200	30	400	7.13	1.07	14.3
	New boiler 8	243,016	100	10	200[a]	6.75	0.68	13.5
	New boiler 9	243,016	100	10	200[a]	6.75	0.68	13.5
	Flare	N/A	N/A	N/A	N/A	0.39	0.03	0.17
	Total with Option 1					48.8	7.09	115.6
With Option 2 first installation	Margam C, boiler 6	166,807	300	50	800	13.9	2.32	37.1
	Margam C, boiler 7	166,807	300	50	800	13.9	2.32	37.1
	No. 3 boiler	128,313	200	30	400	7.13	1.07	14.3
	Margam A, boiler 5	51,325	300	50	800	4.28	0.71	11.4
	Margam B, Mitchell boiler	115,482	300	50	800	9.62	1.60	25.7
	Service boilers 4&5	76,209	300	50	800	6.35	1.06	16.9
	New boiler 8	243,016	100	10	200[a]	6.75	0.68	13.5
	Flare	N/A	N/A	N/A	N/A	0.39	0.03	0.17
	Total with Option 2 first installation					62.3	9.79	156.2

Notes ELV = Emission Limit Value. [a] Values have been based on the ELV for firing blast furnace gas as set out in the IED.

Graph 5.1: Graph of Total Pollutant Emission Rates from the Tata Site Based on Emission Limit Values for each Assessment Scenario



Note: Mass emissions of SO_2 appear to increase with Option 2 Phase 1 relative to the Existing Case. This is due to the way that SO_2 emission from the flare, which does not have an Emission Limit Value, has been calculated in the existing scenario. In reality SO_2 emission can not increase above their existing levels as SO_2 is determined by the amount of sulphur in the fuel being burned which will not be altered by the proposed development. In reality SO_2 emission are likely to decrease in Option 2 Phase 2 due to acid gas control systems which are inherent to the boilers along with controlled combustion in the boilers which will reduce SO_2 formation.

Table 5.21 Measured Emissions from Existing Boilers

Unit	Waste gas flow (Nm^3/h @ 3% O_2, dry)	Pollutant concentrations (mg/Nm^3 at 3% O_2, dry)						Actual oxygen (%, dry)	
		NO_x		CO		PM			
		Average	Range	Average	Range	Average	Range	Average	Range
Margam C, boiler 6	166,807	104	52 – 167	2	1 – 3	6.9	4.1 - 10.9	4.3	3.2 - 6.4
Margam C, boiler 7	166,807	81	51 – 103	7	0 – 17	4.9	1.0 – 10.0	4.6	4.0 – 5.5
No. 3 boiler	128,313	23	11 – 51	38	18 – 68	2.6	1.6 – 3.4	11.1	10.0 – 12.2
Margam A, boiler 5	51,325	38	19 – 54	723	9 – 9,418	2.1	0.6 – 2.7	9.5	7.8 – 11.7
Margam B, Mitchell boiler	115,482	28	12 – 56	389	2 – 4,319	4.6	0.5 – 8.0	11.5	9.7 – 13.6
Service boilers 4&5	128,313	159	32 - 266	1,565	0 – 6,347	8.7	5.4 – 12.7	11.4	8.6 – 15.5

Table 5.22 Estimated Pollutant Emissions from Boilers Without New Power Plant									
Unit	**Waste gas flow (Nm^3/h @ 3% O_2, dry)**	**Pollutant emission Waste gas flow rates (g/s)**							
		Long-term				**Max Short-term**			
		NO_x	**CO**	**PM**	**SO_2**	**NO_x**	**CO**	**PM**	**SO_2**
Margam C, boiler 6	166,807	4.81	0.08	0.32	1.27	7.72	0.15	0.51	1.27
Margam C, boiler 7	166,807	3.73	0.32	0.23	1.27	4.77	0.77	0.46	1.27
No. 3 boiler	128,313	0.82	1.34	0.09	0.98	1.81	2.43	0.12	0.98
Margam A, boiler 5	51,325	0.55	10.3	0.03	0.39	0.77	134	0.04	0.39
Margam B, Mitchell boiler	115,482	0.89	12.5	0.15	0.88	1.8	139	0.26	0.88
Service boilers 4&5	128,313	5.67	55.8	0.31	0.98	9.48	226	0.45	0.98
Flare	-	3.79	20.6	0.32	1.62	-	-	-	-
Total	-	20.2	101	1.44	7.38	-	-	-	-

Table 5.24 Estimated Pollutant Emissions from Boilers With Option 1									
Unit	**Waste gas flow (Nm^3/h @ 3% O_2, dry)**	**Pollutant emission Waste gas flow rates (g/s)**							
		Long-term				**Max Short-term**			
		NO_x	**CO**	**PM**	**SO_2**	**NO_x**	**CO**	**PM**	**SO_2**
Margam C, boiler 6	166,807	4.81	0.08	0.32	1.27	7.72	0.15	0.51	1.27
Margam C, boiler 7	166,807	3.73	0.32	0.23	1.27	4.77	0.77	0.46	1.27
No. 3 boiler	128,313	0.82	1.34	0.09	0.98	1.81	2.43	0.12	0.98
New boiler 8	243,016	6.22	0.29	0.4	1.85	11.25	1.12	0.74	1.85
New boiler 9	243,016	6.22	0.29	0.4	1.85	11.25	1.12	0.74	1.85
Flare	-	0.39	2.15	0.03	0.17	-	-	-	-
Total	-	22.2	4.47	1.47	7.38	-	-	-	-

Table 5.23 Estimated Pollutant Emissions from Boilers With Option 2 Phase 1									
Unit	**Waste gas flow (Nm^3/h @ 3% O_2, dry)**	**Pollutant emission Waste gas flow rates (g/s)**							
		Long-term				**Max Short-term**			
		NO_x	**CO**	**PM**	**SO_2**	**NO_x**	**CO**	**PM**	**SO_2**
Margam C, boiler 6	166,807	4.81	0.08	0.32	1.27	7.72	0.15	0.51	1.27
Margam C, boiler 7	166,807	3.73	0.32	0.23	1.27	4.77	0.77	0.46	1.27
No. 3 boiler	128,313	0.82	1.34	0.09	0.98	1.81	2.43	0.12	0.98
Margam A, boiler 5	51,325	0.55	10.3	0.03	0.39	0.77	134	0.04	0.39
Margam B, Mitchell boiler	115,482	0.89	12.5	0.15	0.88	1.8	139	0.26	0.88
Service boilers 4&5	76,209	3.37	33.1	0.18	0.58	5.63	134	0.27	0.58
Additional boiler 8	243,016	6.22	0.29	0.4	1.85	11.25	1.12	0.74	1.85
Flare	-	0.39	2.15	0.03	0.17	-	-	-	-
Total	-	20.8	60.1	1.43	7.38	-	-	-	-

Table 5.25 Stack/Emission Characteristics

Unit/ Stack	OS Location	Height (m)	Diameter (m)	Actual O_2 (%, dry)	Waste gas flow [a] (Nm^3/h, actual O_2, wet)	Mean molecular mass (kg/kmol)	Specific heat capacity (J/°C/kg)	Temperature (°C)
Margam C, boilers 6 & 7	277149, 188448	135	3.89 [b]	4.5	380,303	31.7	984	215
No. 3 boiler	276980, 188470	33	2.8	11.1	240,845	30.6	990	150
Margam A, boiler 5	277052, 188526	32	2.4	9.5	83,456	30.9	989	180
Margam B, Mitchell boiler	277164, 188185	37	2.7	11.5	225,461	30.6	991	200
Service boilers 4 & 5	277851, 186608	68	2.5	11.4	247,682	30.6	991	200
New boiler 8	277198, 188433	40 - 120[c]	2.5	3.0	255,283	31.9	982	125
New boiler 9	277202, 188463	40 - 120[c]	2.5	3.0	255,283	31.9	982	125
Average for BFG flare					Momentum flux (m^4/s^2)		Buoyancy flux [d] (MW)	
Without new boilers	277142, 187509	54	1.2	-	1,208		116	
With new boiler(s)				-	13.1		12.1	

Notes:

[a] Calculated from BFG firing rate and actual waste gas oxygen content.

[b] Two flues, each with a diameter of 2.75 metres

[c] Range of potential stack heights - see text

[d] Assuming 90% of the heat input becomes sensible heat of the flare

1.1.1 It should be noted that the pollutant concentrations (both measured and ELVs) Table 5.20 and Table 5.24 are expressed at reference conditions of 3% oxygen and dry gas, however, the numbers presented in Table 5.25 are based on actual conditions for the purposes of calculating efflux momentum, buoyancy and hence plume rise. These values are expressed at actual oxygen and for wet gas and as such differ to those presented in the previous tables.

1.1.2 The following calculation sets out the methodology used to calculate emission for No. 3 boiler and has been included as an example. The BFG flow to the boiler is 100 tonnes per hour (Table 5.19) and density is 1.3386 kg/Nm³ (see paragraph 5.4.49), this equates to 74,705 Nm³/hour. Combustion with sufficient air to leave 3% waste gas oxygen yields 1.7176 Nm³ dry waste gas per Nm³ BFG (see paragraph 5.4.50), so the waste gas flow expressed at 3% oxygen, dry gas is 74,705 x 1.7176 = 128,313 Nm³/hour, as stated in Table 5.20, Table 5.22, Table 5,23 and Table 5.24. The mass emission rates then use this flow rate - so a NO_x ELV of 200 mg/Nm³ (expressed at 3% oxygen, dry gas) equates to a NO_x emission rate of 128,313/3,600 x 200/1,000 = 7.13 g/s and an average measured NO_x concentration of 23 mg/Nm³ (expressed at 3% oxygen, dry gas) equates to a NO_x emission rate of 128,313/3,600 x 23/1,000 = 0.82 g/s. Since the mean waste gas oxygen for this boiler is 11.1% (Table 5.21), the flow rate would be 128,313 x (20.9-3)/(20.9-11.1) = 234,368 Nm³/hour expressed at actual oxygen and for dry gas. The moisture content is the difference between the wet and dry waste gas volumes from paragraph 5.4.50 (1.8043-1.7176 = 0.0867 Nm³ H_2O per Nm³ BFG), so for a BFG rate of 74,705 Nm³/hour, there is 6,477 Nm³/hour water vapour. Adding this to the dry waste gas flow gives 234,368 + 6,477 = 240,845 Nm³/hour expressed at actual oxygen and for wet gas as stated in Table 5.25.

Table 5.26 Building characteristics					
Unit/Stack	**Stack Height (m)**	**Relevant Building**	**Building Characteristics**		
			Height (m)	**Length (m)**	**Width (m)**
Margam C, boilers 6 & 7	121	Margam C boiler house	25	45	32
No. 3 boiler	33	Margam A boiler house	25	91	20
Margam A, boiler 5	32	Margam A boiler house	25	91	20
Margam B, Mitchell boiler	37	Margam B boiler house	25	43	17
Service boilers 4 & 5	68	Hot Mill	20	980	110
New boiler 8	40 - 120	New boiler house	32	45	23.3
New boiler 9	40 - 120	New boiler house	32	45	23.3
BFG flare stack	54	No relevant building	-	-	-

Table 5.27 Example of Where Air Quality Objectives Apply		
Averaging Period	**Objectives should apply at:**	**Objectives should generally not apply at:**
Annual mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc.	Building façades or offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the buildings façades), or any other location where public exposure is expected to be short-term.
24 hour mean	All locations where the annual-mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the buildings façade), or any other location where public exposure is expect to be short-term.
1 hour mean	All locations where the annual and 24-hour mean would apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations to which the public might reasonably be expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access

Table 5.28 Discrete Receptor Details - Human			
Ref	**Name**	**OS Location**	
		X	**Y**
1	Talbot Court Nursing Home, Talbot Road	276923	189479
2	25 Lower West End Road	277067	189006
3	21 Duke Street	277614	188396
4	Groeswen Park	277938	188212
5	40 Byass Street	278238	187110
6	1 Ten Acre Wood	279563	186315
7	1 Conduit Place	277541	189321
8	26 Curt Ucha Terrace (Talbot Road)	277098	189213
9	20 Kings Street	277092	190174
10	130a Water Street	276063	189898
11	Port Talbot Fire Station	277388	188733
12	Dyffryn School	278700	187387
13	Twll-yn-y Wal Park	278196	187891
14	Theodore Road	277328	189385
15	Talbot Road	276833	189567
16	Port Talbot Little Warren	275313	188879
17	Port Talbot Docks	276346	189446
18	Prince St.	277689	188235
19	Victoria Gardens	275471	197183
20	Pontardawe Post Office	272031	203950
21	Old Fire Station, Water Street, Port Talbot	276131	189926
22	11 College Green Margam	278794	187237
23	12 Lower West End Road	277139	188901
24	Woodfield Street	277461	188673
25	Eastern Primary School	277606	188848
26	Groes Primary School	278590	187407
27	91 Talbot Road	277020	189291

Table 5.28 Discrete Receptor Details - Human			
Ref	**Name**	**OS Location**	
		X	**Y**
28	74 Talbot Road	277035	189297
29	44 Abbey Road	277179	189345
30	9 Abbey Road	277275	189444
31	1 Abbey Road	277329	189527
32	Glen Afan Comprehensive School	276715	189941
33	Dyffryn Comprehensive School	277079	189508

Table 5.29 Discrete Receptor Details – Ecological				
Ref	**Name**	**Designation**	**OS Location**	
			X	**Y**
1	Bishops Wood	SSSI	259258	188025
2	Blackmill Woodlands	SAC, SSSI	292964	185912
3	Blackpill, Swansea	SSSI	262700	189841
4	Bracelet Bay	SSSI	262927	187120
5	Bryn-Bach, Cefn Cribwr	SSSI	287053	183095
6	Caeau Cefn Cribwr	SSSI	285769	183080
7	Caswell Bay	SSSI	258177	187248
8	Cefn Cribwr Grasslands (Glaswelltiroedd)	SAC	287096	183083
9	Cefn Cribwr Grasslands (Glaswelltiroedd)	SAC	285573	183308
10	Cefn Cribwr Grasslands Glaswelltiroedd)	SAC	285541	181873
11	Cefn Cribwr Grasslands (Glaswelltiroedd)	SAC	284278	181903
12	Clemenstone Meadows, Wick	SSSI	291985	173900
13	Cors Crymlyn / Crymlyn Bog	SSSI	270782	193803
14	Craig Y Parciau Woodland	LNR	289683	179112
15	Crymlyn Bog / Cors Crymlyn	SAC	271598	194216
16	Crymlyn Bog And Pant Y Sais	NNR	271598	194216
17	Crymlyn Bog And Pant Y Sais	NNR	269686	194539
18	Crymlyn Bog	RAMSAR	271598	194216
19	Crymlyn Bog	RAMSAR	269360	194712
20	Crymlyn Bog	SAC, SSSI	269426	194750
21	Crymlyn Burrows	SSSI	271446	192471
22	Cwm Cyffog	SSSI	292134	190365
23	Cwm Du Woodlands	SSSI	287589	190090
24	Cwm Risca Meadow	SSSI	287431	184476
25	Cynffig/Kenfig	SSSI	277910	183346
26	Dunraven Bay	SAC	288636	172752

Table 5.29 Discrete Receptor Details – Ecological				
Ref	**Name**	**Designation**	**OS Location**	
			X	**Y**
27	Eaglesbush Valley	LNR	275526	195844
28	Eaglesbush Valley	LNR	275125	196161
29	Eglwys Nunydd Reservoir	SSSI	279205	185527
30	Eglwys Nunydd Reservoir	SSSI	279463	184876
31	Ewenny And Pant Quarries	SSSI	290474	176683
32	Fforest Goch Bog	SSSI	273840	202025
33	Frog Pond Wood	LNR	284057	181946
34	Glais Moraine	SSSI	269472	200466
35	Kenfig	SAC	279053	181378
36	Kenfig / Cynffig	SAC	284477	177438
37	Kenfig / Cynffig	SAC	285694	176828
38	Kenfig / Cynffig	SAC	277910	183346
39	Kenfig Pool And Dunes	LNR	277910	183346
40	Kenfig Pool And Dunes	LNR	279052	181635
41	Kenfig Pool And Dunes	NNR	277910	183346
42	Kenfig Pool And Dunes	NNR	279300	181797
43	Kenfig	SSSI	279053	181378
44	Langland Bay (Rotherslade)	SSSI	261289	187070
45	Locks Common	LNR	280558	177637
46	Locks Common	LNR	280363	178265
47	Margam Moors	SSSI	278076	185023
48	Margam Moors	SSSI	278284	184606
49	Merthyr Mawr	SSSI	284477	177438
50	Merthyr Mawr	SSSI	285694	176828
51	Merthyr Mawr Warren	NNR	284457	177228
52	Merthyr Mawr Warren	NNR	286004	176900
53	Mumbles Hill	LNR	262656	187375

Table 5.29 Discrete Receptor Details – Ecological				
Ref	**Name**	**Designation**	**OS Location**	
			X	**Y**
54	Old Castle Down	SSSI	290300	175738
55	Pant Y Sais	SSSI, LNR	271598	194216
56	Penplas Grasslands	SSSI	263455	197938
57	Penycastell, Cefn Cribwr	SSSI	284253	181958
58	Southerndown Coast	SSSI	288425	172927
59	Tremains Wood	LNR	292114	180155
60	Waun Cimla	SSSI	284698	183119
61	Waun Fawr, Cefn Cribwr	SSSI	285669	181774