OTTERPOOL PARK

Environmental Statement Appendix 8.1 - Carbon Calculations Appendix

MARCH 2022

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TABLES

1 Introduction

1.1.1 This appendix sets out in detail the calculations presented in the main Climate Change chapter. Section 2: Construction (Capital) Carbon demonstrates the calculations of the GHG emissions associated with the construction of the proposed development, Section 3: Operational Carbon demonstrates the calculations associated with the operation of the project, Section 4: Sensitivity Test presents detailed calculations of Scenario 2: Quantum for approval 2044 + Framework Masterplan.

1.1.2 Section 5: Total Carbon Assessment presents the model for projected carbon emissions over the construction period from 2024 to 2046.

2 Construction (Capital) Carbon

2.1.1 Construction carbon consists of the embodied carbon in the construction materials, which includes the manufacturing, maintenance and replacement of design life and end-of-life associated emissions. Construction carbon also includes emissions associated with transportation of materials to site and waste from site. These calculations are presented in table 1.

2.1.2 Construction carbon also includes construction site energy use, water use and transportation of workers to and from site during the construction period. These calculations are presented in Table 2.

Table 1: Carbon emissions during construction as result of materials use: embodied carbon, transport of materials to site, and transport of waste from site

Materials Stream	Estimated Quantities of materials (tonnes)	Conversion Factor (kgCO2e/kg)	Embodied Carbon (Tonnes)	Wastage Rate (%)	Waste Arisings (tonnes)	Carbon Emissions of Materials Transport (TCO2e)	Carbon Emissions of Waste Transport (TCO2e)	Total Transport Emissions of materials and waste (TCO2e)	Total Emissions
Bricks	59,007	0.24	14,162	10	11,801	1061.8	20.8	1082.6	16,327
Tiles and ceramics	9,816	0.7	6,871	5	785	132.6	1.6	134.2	7,139
Concrete	469,213	0.107	50,206	2.5	18,769	8206.6	36.7	8243.3	66,693
Inert	443,270	0.0052	2,305	5	44,327	7974.4	86.6	8061.0	18,427
Insulation materials (non-hazardous)	5,223	1.86	9,714	5	783	1912.2	382.2	2294.4	14,303
Metals	76,892	2.03	156,091	5	2,307	1383.5	9.4	1392.8	158,877
Packaging materials	15,794	2.015	31,825	100	3,949	213.2	32.6	245.8	32,317
Plasterboard / gypsum	21,826	0.39	8,512	2.5	4,911	392.7	47.1	439.8	9,392
Binders	3,267	0.74	2,418	2.5	163	44.2	0.7	44.9	2,508
Plastic (excluding packaging waste)	26,309	3.31	87,083	2	2,631	355.3	28.4	383.7	87,850

Materials Stream	Estimated Quantities of materials (tonnes)	Conversion Factor (kgCO2e/kg)	Embodied Carbon (Tonnes)	Wastage Rate (%)	Waste Arisings (tonnes)	Carbon Emissions of Materials Transport (TCO2e)	Carbon Emissions of Waste Transport (TCO2e)	Total Transport Emissions of materials and waste (TCO2e)	Total Emissions
Timber	127,325	0.72	91,674	5	12,733	1718.0	322.6	2040.6	95,755
Floor coverings (soft)	1,231	3.9	4,802	10	123	16.7	0.5	17.2	4,836
Electrical and electronic equipment (non-hazardous)	2,020	1	2,020	-	61	27.5	0.3	27.8	2,076
Furniture	2,946	1.75	5,155	-	29	39.8	0.2	39.9	5,235
Canteen / office / ad-hoc waste	6,135	2.1	12,884	100	1,534	83.0	6.2	89.2	13,062
Liquids	2,489	0.8	1,991	2.5	124	33.7	0.8	34.5	2,060
Oils	207	3.47844	722	2.5	10	3.1	0.2	3.3	729
Bituminous mixtures (Non-hazardous (e.g. asphalt))	27,376	0.086	2,354	2.5	1,369	369.6	5.6	375.1	3,104
Hazardous waste	11,811	1.33	15,765	7.3	1,063	159.5	4.4	163.9	16,093
Other waste	45,794	1.39	63,653	7.3	4,121	618.1	19.5	637.7	64,928

Materials Stream	Estimated Quantities of materials (tonnes)	Conversion Factor (kgCO2e/kg)	Embodied Carbon (Tonnes)	Wastage Rate (%)	Waste Arisings (tonnes)	Carbon Emissions of Materials Transport (TCO2e)	Carbon Emissions of Waste Transport (TCO2e)	Total Transport Emissions of materials and waste (TCO2e)	Total Emissions
Mixed construction and/or demolition waste	481,099	1.39	668,727	7.3	43,299	6491.3	129.2	6620.5	681,968
TOTAL	**1,839,051**		**1,238,935**		**154,893**	**31236.5**	**1135.6**	**32372.0**	**1,303,679**

Table 2: Carbon emissions during construction as result of: (1) Onsite Energy Usage, (2) Onsite Water Usage, (3) Transport of workers to/from site

Onsite energy usage	370.6	kg CO2 per £100k		Construction period (years)	25
Project estimated value	1,630,000,000	£ GBP		Construction period (weeks)	1300
Total CO2	6040.78	tonnes		kgCO2e/week	1879
total CO2e (Energy Use)	**7,458**	**tonnes**		**tCO2e**	**2,433**
Water usage	18.4	m3 per £100k		Source: EA Embodied Carbon Calculator - Personal Travel (method 1)	
Estimated water usage	299,920	m3			
	0.344	kg CO2e per m3			
Total CO2e (Water Use)	**103**	**tonnes**	Source: UK Industry Performance Report (2018)		

3 Operational Carbon

3.1.1 Operational carbon consists mainly of additional private vehicles trips in the region that are attributed to the proposed Development, based on the transportation model in the Transport Assessment. Additional trips calculations and their respective carbon emissions are presented in Table 3. Total annual transport carbon emissions for the year 2037 and 2044 are presented in Table 4

3.1.2 Operational carbon also includes energy use such as electricity and gas in the operation of buildings in the proposed Development, energy data is based on the Energy Strategy and is presented in Table 5.

Table 3: Additional trips attributed to the proposed Development in 2037 and 2044

Link Name	2037				2044			
	Without proposed Development	With proposed Development	Additional Trips	Carbon Emissions	Without proposed Development	With proposed Development	Additional Trips	Carbon Emissions
B2067 Otterpool Lane	2,210	966	-1,244	-770	2,378	1,786	-592	-769
A20 Ashford Road b/w Otterpool Lane & Newingreen	2,216	1,489	-727	-450	4,383	7,492	3,109	4039
old A20 Ashford Road at Newingreen	0	2,114	2,114	1309	2,358	2,787	429	557
A20 Ashford Road b/w Newingreen & M20	2,334	1,587	-747	-463	1,685	1,356	-329	-427
A20 Ashford Road at Barrow Hill	4,271	6,746	2,475	1533	732	1,337	605	786
Aldington Road b/w Otterpool Lane & Stone Street	2,383	2,316	-67	-41	518	547	29	38
Stone Street	1,685	998	-687	-425	1,102	1,807	705	916
B2067 Aldington Road west of Otterpool Lane	772	1,148	376	233	1,925	2,047	122	158
Lympne Hill	513	530	17	11	12,821	15,551	2,730	3546
B2068 Stone Street	1,090	1,499	409	253	12,725	13,795	1,070	1390
M20 east of J11	1,904	1,982	78	48	2,779	3,561	782	1016
M20 west of J11	12,457	14,104	1,647	1020	2,204	3,579	1,375	1786
Cheriton Road	12,220	13,274	1,054	653	2,831	2,890	59	77
A261 Hythe Road	2,716	3,157	441	273	3,286	3,448	162	210
A259 Military Road	2,110	3,409	1,299	804	678	717	39	51
A259 Prospect Road	2,802	2,723	-79	-49	2,302	2,705	403	523
Swan Lane	3,251	3,332	81	50	4,601	4,764	163	212
A20 Hythe Road west of Swan Lane	672	694	22	14	2,686	2,819	133	173

Link Name	2037				2044			
	Without proposed Development	With proposed Development	Additional Trips	Carbon Emissions	Without proposed Development	With proposed Development	Additional Trips	Carbon Emissions
A2070 Kennington Road	2,316	2,226	-90	-56	3,887	3,933	46	60
A262 Hythe Road	4,425	4,523	98	61	4,684	4,930	246	320
A260 Spitfire Way	2,568	2,649	81	50	2,821	2,944	123	160
A260 Canterbury Road	3,854	3,879	25	15	2,378	1,786	-592	-769
Alkham Valley Road	4,630	4,757	127	79	4,383	7,492	3,109	4039
Nackington Road	2,021	2,077	56	35	2,135	2,223	88	114
Old Dover Road	2,323	2,345	22	14	2,429	2,463	34	44
Total				4,199				18,247

Table 5: Carbon emissions arising from additional trip attributed to the proposed Development in 2037 and 2044

Year	Estimated Carbon Emissions (tonnes CO_2e per year)		
	Without proposed Development	With proposed Development	Increase in Transport GHG attributed to development
2017	187,257	-	-
2037	202,072	202,450	4,199
2044	229,619	247,866	18,247

Table 4: Carbon emissions arising from operational energy use

TCO2/Year	Carbon emissions from energy use including Unregulated Energy
Building Regulations	42,960
Be Lean (After Energy Efficiency)	33,715
Be Clean (After District Heating)	33,715
Be Green (After renewables)	31,089

4 Sensitivity Test

4.1.1 Following is calculations done from the figures presented in the Transport Assessment, Table 101, and is presented in the Climate Change chapter at page 8-32.

Table 6: Sensitivity Test of Scenario 2: Quantum for approval 2044 + Framework Masterplan

Junction Number	Core Scenario	Scenario 2 (2044,10k)	Change in Trips	Change in Carbon emissions	Junction Number	Core Scenario	Scenario 2 (2044,10k)	Change in Trips	Change in Carbon emissions
1	11604	11600	-0.03%	0.04%	**20**	7943	7992	0.61%	3.31%
2	10868	11112	2.20%	9.98%	**21A**	9625	9662	0.38%	0.60%
3	3020	3000	-0.67%	2.87%	**21B**	4097	4095	-0.05%	-0.06%
4	2896	2865	-1.08%	2.49%	**23**	16224	16242	0.11%	0.52%
5	3788	3752	-0.96%	-0.86%	**24**	6354	6398	0.69%	0.76%
6	4424	4381	-0.98%	-1.94%	**25**	4150	4161	0.26%	0.64%
7A	4977	4981	0.08%	0.12%	**26**	6265	6300	0.56%	0.96%
7B	3948	3930	-0.46%	-0.90%	**27**	2826	2807	-0.68%	-0.87%
8	3645	3624	-0.58%	-1.10%	**SH18**	6720	6740	0.30%	2.08%
9	1565	1523	-2.76%	-2.48%	**SH19**	4192	4193	0.02%	0.07%
10	2161	2168	0.32%	0.42%	**SH16**	5889	5892	0.05%	0.12%
11	5890	5815	-1.29%	-1.47%	**32**	2223	2234	0.49%	2.12%
12	2001	2032	1.53%	2.74%	**33**	2795	2990	6.52%	29.02%
13	4007	4016	0.22%	0.37%	**34**	2241	2328	3.74%	6.46%
14	4590	4600	0.22%	0.43%	**35**	7543	6936	-8.75%	20.13%
15	7502	7521	0.25%	3.54%	**36**	8577	8710	1.53%	3.82%
16	4318	4329	0.25%	0.48%	**38**	2102	2093	-0.43%	-0.65%
17	5219	5329	2.06%	4.22%	**39**	2195	2225	1.35%	2.31%
18	1779	1798	1.06%	4.23%	**42**	11533	11535	0.02%	0.15%
19	2891	2897	0.21%	0.40%	**43**	8583	8849	3.01%	14.13%

Table 7: Sensitivity Test Results

Scenario	Illustrative Masterplan (TCO2/annum)	Sensitivity Test (TCO2/annum)	Increase (%)
Scenario 2 (2044, 10k)	213,502	219,487	2.73%

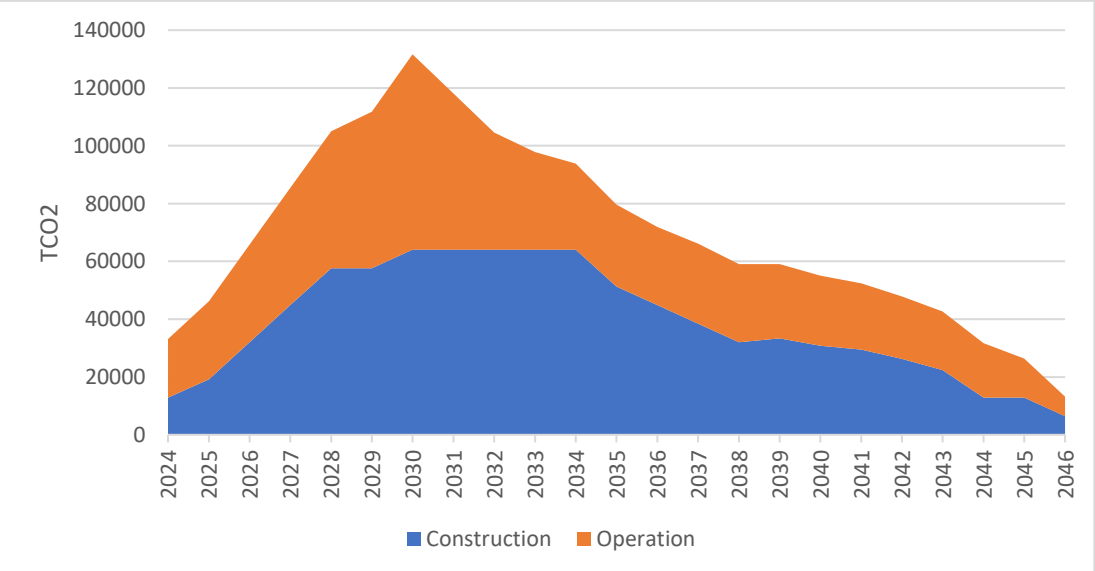
5 Total Carbon Assessment

5.1.1 A model was designed to assess total carbon emissions over time, from commence of construction at 2024, to peak construction at 2030 and to completion and full operation. These model takes into account energy and transport decarbonisation assumptions by DEFRA (Energy and emissions projections: Net Zero Strategy baseline (partial interim update December 2021))

Table 8: Modelled carbon emissions from the proposed Development over time (TCO2)

Year	Construction	Operation	Total	Year	Construction	Operation	Total
2024	12813	20275	33088	**2035**	51252	28385	79,637
2025	19220	27033	46253	**2036**	44846	27033	71,879
2026	32033	33792	65824	**2037**	38439	27709	66,148
2027	44846	40550	85395	**2038**	32033	27033	59,066
2028	57659	47308	104967	**2039**	33314	25682	58,995
2029	57659	54066	111725	**2040**	30751	24330	55,081
2030	64065	67583	131,648	**2041**	29470	22978	52,448
2031	64065	54066	118,131	**2042**	26267	21627	47,893
2032	64065	40550	104,615	**2043**	22423	20275	42,698
2033	64065	33792	97,857	**2044**	12813	18923	31,736
2034	64065	29737	93,802	**2045**	12813	13517	26,330
				2046	6407	6758	13,165

Figure 1: Projected carbon emissions over life time of the project



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