Appendix C

APPENDIX C - CARBON DATA

The content of this document is draft and relates to material [or data] which is still in the course of completion in travel to Gate 2 and should not be relied upon at this early stage of development. We continue to develop our thinking and our approach to the issues raised in the document in preparation for Gate 2.

1 CARBON STRATEGY EMISSIONS FACTORS:

Item		Unit	kg CO_2e /unit	Emission factor source: (Chemicals: EcoInvent 3.5/SimaPro): EcoInvent tags)
Earth Works	Earth	m3	4.84	Oneclick
Electricity	Electricity	kWh	0.23	Oneclick
Treatment chemicals	Sulphuric Acid	Kg	0.0781	1 kg Sulphuric acid {RER}| production | Cut-off, U
	Liquid Oxygen	Kg	0.6007	1 kg Oxygen/NItrogen, liquid {RER}| air separation, cryogenic | Cut-off, U
	Sodium Hypochlorite (bulk)	Kg	0.1810	1 kg Sodium hypochlorite, without water, in 15% solution state {RER}| sodium hypochlorite production, product in 15% solution state | Cut-off, U
	Sodium Hypochlorite (bulk)	Kg	0.1810	1 kg Sodium hypochlorite, without water, in 15% solution state {RER}| sodium hypochlorite production, product in 15% solution state | Cut-off, U
	Citric Acid	Kg	1.4112	1 kg Citric acid {RER}| production | Cut-off, U
	Sodium Hypochlorite (bulk)	Kg	0.1810	1 kg Sodium hypochlorite, without water, in 15% solution state {RER}| sodium hypochlorite production, product in 15% solution state | Cut-off, U
	Orthophosphoric Acid	Kg	1.3438	1 kg Phosphoric acid, industrial grade, without water, in 85% solution state

				{RER}| purification of wet-process phosphoric acid to industrial grade, product in 85% solution state | Cut-off, U
	Caustic soda liquor 25%	Kg	0.5899	1 kg Sodium hydroxide, without water, in 50% solution state {RER}| chlor-alkali electrolysis, mercury cell | Cut-off, U
	Caustic soda liquor 25%	Kg	0.5899	1 kg Sodium hydroxide, without water, in 50% solution state {RER}| chlor-alkali electrolysis, mercury cell | Cut-off, U
	Liquid aluminum sulfate	Kg	0.6618	1 kg Aluminium sulfate, without water, in 4.33% aluminium solution state {RoW}| production | Cut-off, U
	Magnafloc LT25 (Mechanical thickening)	Kg	2.6710	1 kg Polyacrylamide {GLO}| production | Cut-off, U
	Activated carbon	Kg	2.61	Activated carbon from wood product – source Winnepig.
Steel	Stainless Steel (pumps & screens)	m3	22831	Oneclick
	Steel Pipes (structural steel and ready-mix concrete)	m3 kg	270.88 2.12	Oneclick
	Steel Reinforcing bar (within concrete)	kg	3.79	Oneclick
Plastic	High density polyethylene (HDPE) plastic pipe, 0% recycled content	kg	2.91	Oneclick
Concrete	Concrete (Pre-cast) - 20% GGBS.	• m3 • kg • kg	• 0.3 • 0.83 • 0.0416	Oneclick

	• Water for concrete mixes (concrete ingredient / adhesive) • Portland cement • Blast furnace slag (GGBS) • General Aggregate for concrete • Concrete admixtures - plasticisers	• kg • kg	• 0.0067 • 1.88	
	Concrete Precast for TBM segments, C40/50, 20% GGBS. • Water for concrete mixes (concrete ingredient / adhesive) • Portland cement • Blast furnace slag (GGBS) • General Aggregate for concrete • Concrete admixtures - plasticisers	• m3 • kg • kg • kg • kg	• 0.3 • 0.83 • 0.0416 • 0.0067 • 1.88	Oneclick
	Concrete C40/50, 0% GGBS • Water for concrete mixes (concrete ingredient / adhesive) • Portland cement • General Aggregate for concrete	• m3 • kg • kg	• 0.3 • 0.83 • 0.0067	Oneclick
Asphalt	Asphalt	m3	171.55	Oneclick
	Low temperature asphalt (-10 to 40 degC)	m3	154.56	Oneclick
Aggregate	Crushed Rock subbase	m3	4.04	Oneclick
Copper	Copper	m3	79357.66	Oneclick

2 CARBON ASSESSMENT - SITE ASSUMPTIONS AND EXCLUSIONS

Area	Asset	Percentage of materials	Assumptions and exclusions
Intake	Canal screen	Concrete – 0%	Standard rebar, 25 mm diameter x 4 bars
		Steel – 90%	
		Copper– 10%	
	Intake structure	Concrete – 100%	19m long, 10m wide and 6 walls of 0.25m thickness approximately
	Band screens	Concrete – 0%	4m wide, 2m deep, 0.5m depth Assumed steel
		Steel – 90%	
		Copper– 10%	
	Pump sump	Concrete – 30%	25-30m^3 sump volume collecting abstracted water post-grit removal
		Steel – 65%	
		Copper– 5%	
	Transfer pumps	Concrete – 30%	500kg steel x 4 units

		Steel – 65%	
		Copper– 5%	
Rising main	Ductile Iron Cement Lined DN1000	Cast Iron – 100%	1000mm diameter, cement is 6mm thickness, 10mm steel pipe thickness. Assumed weight per m of 334kg
Raw Water Storage	Earth embankment	Earth – 100%	8m internal depth and 6m external depth - slopes 1:3. 3m embankment crest width. Top of embankment diameter 217m. Base of embankment 229m diameter. 200,000 m^3
	Storage transfer pumps	Concrete – 30%	500kg steel x 4 units
		Steel – 65%	
		Copper– 5%	
Treatment	Ozone contactors	Concrete – 30%	3No. 684 m^3 Ozone Contactor tanks - assumed to be RC concrete structure of 20.5mx20.5mx7m height, with 0.4m wall thickness +20% volume for foundations
		Steel – 65%	
		Copper– 5%	
	High-rate clarifiers	Concrete – 30%	Settlement area required in total - 8No. Clarifiers (120 m^2 settlement area per unit) All sites 960 m^2
		Steel – 65%	

		Copper– 5%	
	Filters feed pumps	Concrete – 30%	300kg x 8 units Assumed Steel
		Steel – 65%	
		Copper– 5%	
	UF membranes backwash pumps	Concrete – 30%	250kg x 3 units Assumed Steel
		Steel – 65%	
		Copper– 5%	
	UF membranes backwash tanks	Concrete – 30%	Assuming size 25m x 10m x 5m depth (4m water level + 1 m freeboard)
		Steel – 65%	
		Copper– 5%	
	Foundations for UF membranes (concrete pad)	Concrete – 100%	Assuming membrane system footprint dims are 60m x 36m and foundations 0.5m deep
	Interstage pumping station	Concrete – 30%	300kg x 3 units Assumed Steel
		Steel – 65%	

		Copper– 5%	
	GAC filter	Concrete – 30%	12No. 50m^2 per GAC unit, 3m carbon depth - assume reactor total height of 5m, wall thickness 0.25m and 20% joints concrete
		Steel – 65%	
		Copper– 5%	
	GAC Backwash pumps	Concrete – 30%	300kg x 3 units Assumed Steel
		Steel – 65%	
		Copper– 5%	
	GAC Blowers	Concrete – 30%	250kg x 3 units Assumed Steel
		Steel – 65%	
		Copper– 5%	
	GAC backwash tank	Concrete – 30%	16m x 10m x 5m depth (4m water level). Assumed Steel
		Steel – 65%	
		Copper– 5%	
	Chlorine contact tanks	Concrete – 50%	All sites 1390m^3

		Steel – 45%	Assume RC concrete
		Copper– 5%	
	High-lift pumping station	Concrete – 30%	500kg x 5 units Assumed Steel
		Steel – 65%	
		Copper– 5%	
	Sludge thickeners	Concrete – 30%	Spiral separator, 2No. Units 11.3m diam. And 4m height structure - expected power requirement 5kW per unit. Assumed 0.25m wall thickness plus 20% foundations
		Steel – 65%	
		Copper– 5%	
Others	Access road	Hot road asphalt – 100%	7.3m width, 100mm asphalt
		Aggregate- 100%	7.3m width, 450mm base
	Fencing	Steel -100%	3m high, 10mm thickness Assumed steel
	Fencing Foundation	Concrete – 100%	371 x 0.5m x 0.5m x 0.4m concrete in situ (not reinforce)
		Soil – 93%	

	2x Mabey Bridge for Tring	Aggregate – 3% Concrete – 4%	The bridge deck is excluded due to lack of dimensions or carbon information from the supplier Soil – 506m^3 Concrete Pad – 20.7m^3 Aggregate - 16 m^3
	HDPE Plastic rising main	Plastic – 100%	Assumed weight per meter is 104.91 kg

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