AtkinsRéalis

Appendix 12-1 – Purpose-built LCA Tool Assumptions

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BALLINA AND LOUGH TALT WATER SUPPLY UPGRADE

Appendix 12-1 Purpose-built LCA Tool Assumptions

0. Front Sheet	
0.1	Asset name based on Maximo code
0.2	Current energy usage taken from previous 5 years meter readings with anomalous readings removed.
0.3	Energy demand for above ground projects will increase based on the increase of megalitres per day (MLD) values over the design horizon. For below ground projects the energy demand will increase over the construction duration to its maximum value
0.4	Assumes Energy Balance Assessment Value does not include reduction from renewable energy sources!
0.5	
1. Asset A1 - A5, B2 - B4	
1.1	Asset lifecycle stages are assigned based on inclusions and exclusions.
1.2	For A1-A3 Assets A4 is calculated based on a single delivery. Default transportation distances based off of Royal Institute of Chartered Surveyors (RICS) recommendations (table 17)
1.3	For A1-A5 Assets, A4 is calculated as per 1.2 or as 1% of A1-A5 if the value of 1.2 is greater than 10% of the A1-A5 emissions.
1.4	A5 is assumed to be 2% of A1-A3 for Civils Assets and 1% for M and E and Combined Assets.
1.5	B2 - 3 values are assumed to be 2% of A1-A5 for each period. Period duration is defined under the whole life carbon sheet.
1.6	B4 is assumed to be a total replacement each period. The periods are defined under the whole life carbon sheet.
1.7	Some Carbon Curves that can be seen in the 'Factors and Profiles' Tab starting row 805 have their embodied carbon emissions updated until these curves are updated inside Copperleaf

2. Adjustments A1 - A5, B2 - B4	
2.1	Where Adjustment Items are physical assets, A1-A3 is estimated through approximate volumes of concrete, steel/metal, aggregate and asphalt used if value is not available through datasheets
2.2	A4 for ad-hoc items is calculated as per 1.2. Equipment is assumed to be rented locally (20km)
2.3	A5 for Ad-hoc items is calculated as per 1.4
2.4	B2 - B3 for Ad-hoc items is calculated as per 1.5
2.5	B4 for Ad-hoc items is calculated as per 1.6
3. Water Mains A1 - A5	
3.1	Assumptions for HDD: Excavated Area = (pipe dia. / 2 + 50 mm extra)^2 * PI
3.2	Assumptions for HDD: Topsoil excavated volume = 0
3.3	A5 Pipelaying emissions: Assumed 6 days needed to install 1km of pipe for both open trench and HDD (See Factors & Profiles)
3.4	Assumed same life-time for all pipe material and is the same as for other civil assets
3.5	Barrier pipe is assumed to be a HDPE pipe with an aluminium sheet and with a polypropylene layer. It is assumed that these added materials do not change the pipe weight for the same diameter compared to regular HDPE pipe.
4. Construction Works A1 - A5	
4.1	Assumed emissions for landfilled organic material, ex. Wood, occur in the year the waste is disposed of.
4.2	Assumed waste occurs primarily during A1-A5 or in the C project phases
4.3	Energy usage for installation and excavation of pipework is already accounted for in Sheet 3. Watermains
4.4	Portable Cabins assumptions based on sources outlined in "Factors & Profiles" but are not based on any UÉ example. Portable cabins only include energy emissions and electricity usage should be included in the "Energy Use during Construction" section.

5. Water Reservoir A1 - A4	
5.1	Pre-cast concrete walls: 15m flat bed = 45 transportations for pre-cast concrete tank delivery
5.2	Excavation volumes include 500mm over over excavation on base. Sidewall over excavation is same as tank depth at 30 deg slope
5.3	Excavation A4 module emissions account for export of excavated material and import of virgin backfill (accounting for reduced volume of virgin backfill)
5.4	Pipework included within pipework section: allowance for 1100mm DN overflow pipe (inlet and outlet only)
5.5	Access covers = 1.2m x 1.2m
5.6	T joints for pillars of large reservoirs >100ML: Requires 0.226 m3 of concrete per m2 of internal area (Based on Saggart design)
6. Chemical Emissions - B8	
6.1	Constant dosing rater per l of water treated.
6.2	Assumes Emission factors based on UKWIR Carbon Accounting Workbook v16
6.3	Without user input default percentages for the active ingredient of the chemicals are assumed.
7. Water Sludge - B8	
7.1	Treated water output = 95% of plant capacity
7.2	Sludge transportation distance assumed as 50km (unless overwritten)
7.3	Sludge uplift volume assumed as $30m^3$ (unless overwritten)
Note -	$V = M \div (\rho s P)$ The water sludge calculations and assumptions listed below are taken from IW-TEC-900-07-FM and IW-TEC-900-07-FM-02 Treatment and Disposal of Water Treatment Plant Residuals
7.4	The volume of sludge is calculated using the following formula - For sludge with less than 1% DS content, for the purposes of calculating volumes, the density of wet sludge can be assumed at 1000 kg/m3. The volume can therefore be estimated as follows -

7.5	Clarification calculations - The volume of sludge produced in a typical sludge clarifier will be at least: - 2.2% of treated water output where alum is used as the coagulant - 1.8% of treated water output where ferric sulphate is used as the coagulant - 0.7% of treated water output in the DAF process
7.6	Clarification calculations - the dry solids content can be assumed as: - 0.2% DS content - Low colour lake (<50 Hazen) - 0.35% DS content - High colour lake/river (50-120 Hazen) - 0.5% DS content - Flashy River (Turbidity 5NTU, Colour >100 Hazen)
7.7	1st Stage Filtration calculations - first stage filter backwash shall not represent volumes less than 4.5% of daily treatment plant output for ground water, lake, or river raw water sources
7.8	1st Stage Filtration calculations - filter backwash dry solids content will be no less than 0.04% DS content
7.9	Under most circumstances, residuals from filter and membrane backwash processes will be equalised and settled prior to discharge and prior to further thickening of settled solids.
7.10	The discharge from the UWWEST tank shall have a maximum settled dry solids content of 0.75%
7.11	Sludge shall be thickened to a thickened sludge dry solids content of 3%
7.12	Sludge is generally dewatered to the following standards: - 16%-18% DS content - for plants to this specification, centrifuges or plate presses may be employed to dewater solid residuals - 19%-25% DS content or greater - for plants to this specification, plate presses shall be employed to dewater solid residuals For the calculation, a minimum value of 16%DS was assumed
7.13	The solid material in waterworks sludge has a specific gravity of about 2.5
8. Renewables Solar	
8.1	Renewable energy target is 10% of annual energy demand
8.2	Recommended solar PV size to meet 10% target is based on an average of 750 kWh/kWp/yr
8.3	Area requirement calculated using a solar PV sizing factor of 0.2 kWp/m^2 (Jacobs)

9. Waste Material A5, C1 - C4	
9.1	Assumed emissions for landfilled organic material, ex. Wood, occur in the year the waste is disposed of.
9.2	Assumed all pipes installed during the project will be disposed of depending on material alone. Ex. All Ductile Iron pipes will be recycled or all PVC pipes will be abandoned. It is not possible to have a fraction of all Ductile iron pipes to be recycled.
Uncertainty Factors	
U.1	Uncertainties based on the current project phase and reliability of emission factors for materials
U.2	Currently all material uncertainties are weighted equally.
Whole Life Carbon	
W.1	Construction profile assumed to be sigmoidal, with most works undertaken during the middle of the construction period
W.2	MLD increase modelled as a linear increase between the end of construction and the design horizon.
W.3	B6 Energy Emissions are factored by the SEAI emissions factors until 2053. Post 2053 it is assumed the grid is decarbonised and the emission factor for 2053 is used
W.4	B6 Energy Emissions is factored by the percentage of construction during the construction phase representing assets coming online.
W.5	B8 Chemical Emissions are factored by the MLD increase, reaching total at the design year.
W.6	Shadow price of carbon taken from '*Revising the Shadow Price of Carbon used in Public Sector Economic Appraisal*' published March 2024 by Department of Public Expenditure, NDP Delivery, and Reform up to 2055
W.7	From 2055 onwards, shadow price of carbon for 2055 is used.
W.8	Scenario Analysis: Assumed three different grid decarbonisation scenarios. With Additional Measures (WAM), With Existing Measures (WEM), Risk. The WEM and Risk scenario are assumed to have 20% and 40% higher carbon emissions per kWh of grid electricity produced.