METROLINK

Integrated Transport. Integrated Life.

A5.11 Water Management

Contents

List of Figures and Tables

1. Introduction

This appendix supports the EIAR Metrolink Construction Phase Chapter (Chapter 5) and describes how water supply, usage and wastewater arisings will be managed during the construction stages of the proposed Project. Specifically, it details:

- Activities requiring water;
- Peak water usage requirements at each construction compound;
- Where water for each site could be sourced from;
- Strategies for minimising water use;
- Strategies for conserving water;
- Treatment of wastewater; and
- Means of disposal of wastewater.

This appendix should also be read in conjunction with Chapter 18 (Hydrology).

2. Water Requirements and Demand Estimate

Table 2.1: Typical Areas and Activities Requiring a Supply of Water lists the typical construction activities requiring a supply of water and the locations at which these activities will take place.

Table 2.1: Typical Areas and Activities Requiring a Supply of Water

Activity	Station Main Compounds	Satellite Compounds	Tunnels Worksites
Offices	X	X	X
Welfare	X	X	X
Wheel washing	X	X	X
Surface washing down	X	X	X
Underground washing down	X		X
Dust suppression	X	X	X
Concrete mixing	X		
Bentonite mixing	X		X
Grout mixing	X		X
Sprayed Concrete Lining mixing			X
TBM conditioning			X
TBM cooling			X

Table 2.2: Estimated Peak Daily Water Requirementshows the estimated peak daily water requirement for these activities at each compound.

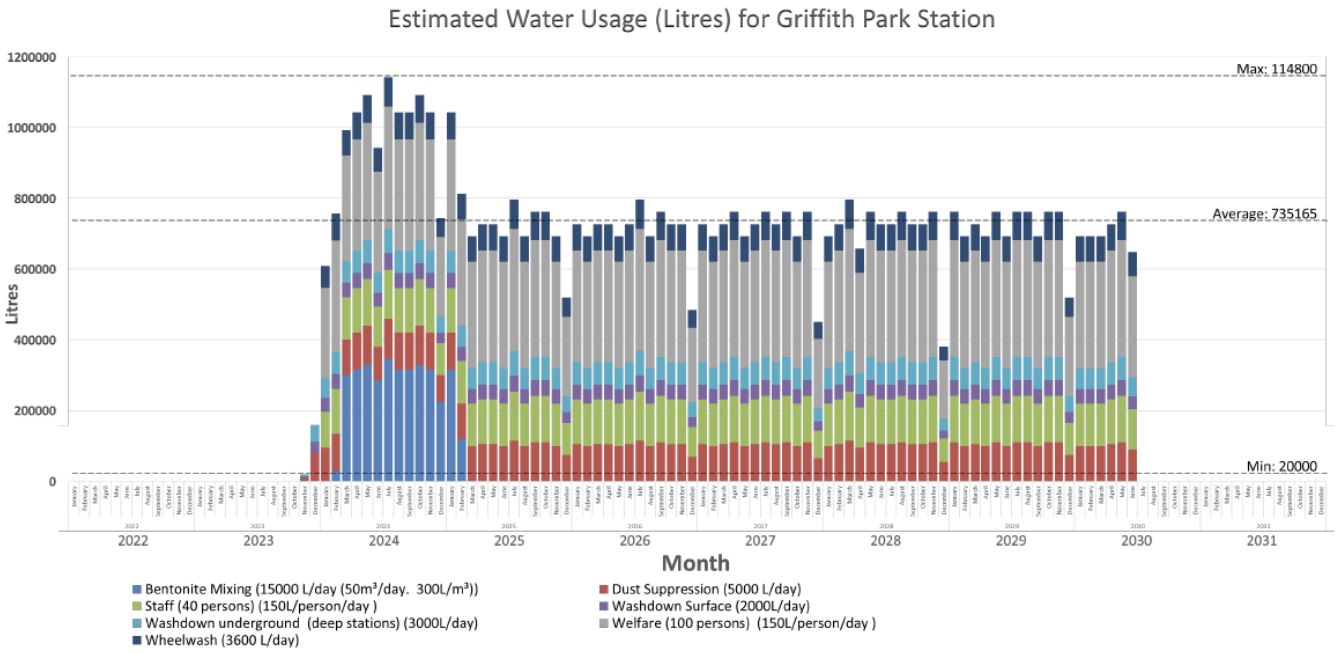
Table 2.2: Estimated Peak Daily Water Requirement

Compound Location	Compound Type					Peak Daily Requirement - Litres / Day
	Surface station	Surface satellite	Tunnel	Portal	Deep Station	
Estuary Station	x					103,600
Seatown West		x				13,390
Estuary Court		x				30,850
Fingallian's		x				5,750
Seatown Station	x					32,800
Woodies		x				9,350
Mantua Park		x				9,350
North Dublin Corporate Park		x				32,350
Chapel Lane		x				12,850
Pavilions Shopping Centre		x				9,350
Swords Station	x					33,400
Pinnock Hill		x				9,350
Fostertown Station	x					25,200
Nevistown Lane		x				32,350
Boland		x				32,350
DANP				x		320,50
Dublin Airport Station					x	68,050

Compound Location	Compound Type					Peak Daily Requirement - Litres / Day
	Surface station	Surface satellite	Tunnel	Portal	Deep Station	
DANP			x	x		274,500
Dardistown Station					x	43,600
Dardistown Depot					x	120,100
M50 Bridge		x				40,300
Northwood Station and Portal			x	x	x	302,400
Ballymun Station					x	127,600
Collins Avenue Station					x	67,600
Albert College Park Shaft						29,700
Griffith Park Station					x	229,600
Glasnevin Station					x	76,000
Mater Station					x	70,000
O' Connell Street Station						46,300
Tara Station					x	82,600
St Stephens Green Station					x	68,500
Charlemont Station					x	68,500

Water usage will vary from site to site and as the construction programme evolves. At peak, the most significant use of water will be at sites where on-site batching of concrete is proposed; currently at Estuary, the Dublin Airport South Portal (DASP), Dardistown Depot, Northwood Station and Portal, Ballymun and Griffith Park Stations.

Diagram 2.1 shows a graphical representation of the expected peak daily water demand for Griffith Park, with anticipated minimum, average and peak levels depicted. This site is proposed for batching and supply of trackbed concrete to the main tunnel drive from the Northwood Portal to Charlemont Station and is expected to use greater quantities of water than other station sites.



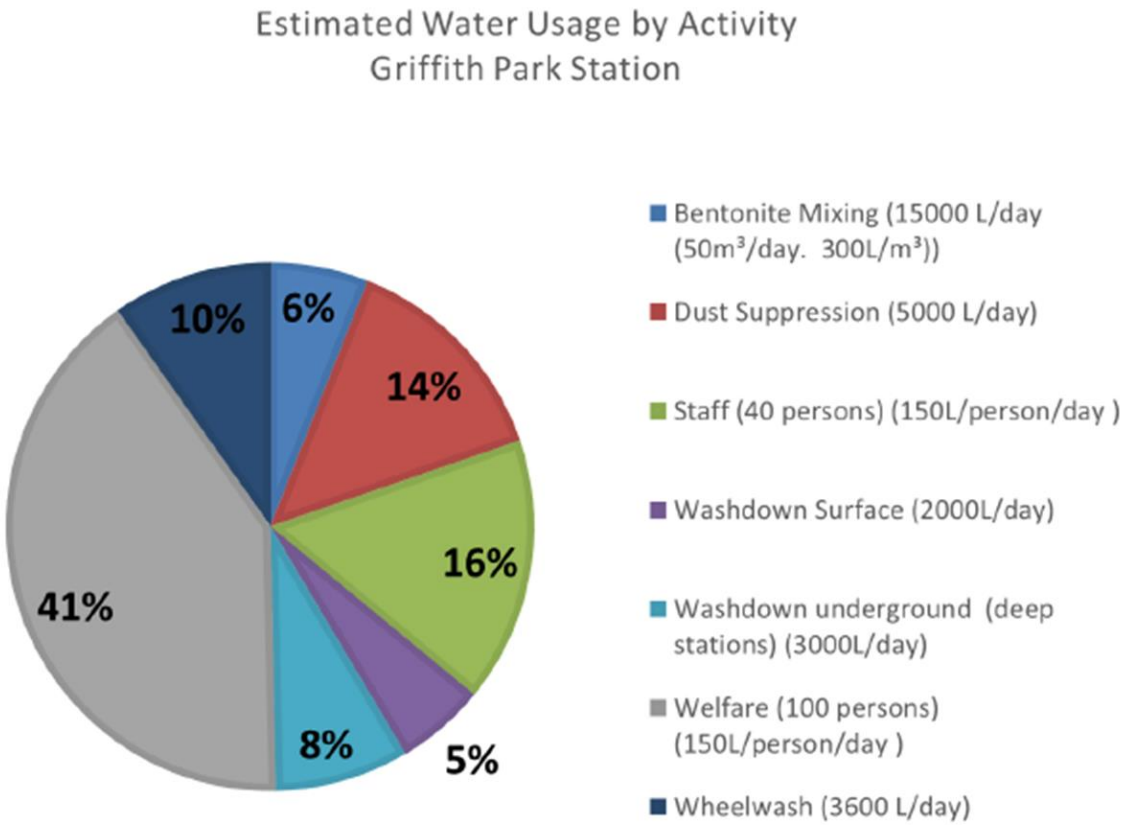


Diagram 2.1: Estimated Peak Water Demand for Griffith Park Station

3. Sources of Water

A supply of water will be required at all compounds, the locations of which are shown in Figure 5.1.

It is anticipated that a mains supply will be available at all station, shaft and tunnel worksites. Satellite sites which are located in or adjacent to existing urban facilities would also be expected to benefit from a mains supply. However, for worksites in the northern section in particular, it is likely that tankers will be used to supply water to sites which are remote to mains supply or other sources.

Whilst potable water is required for drinking and welfare, a source for general site use is expected to be a combination of potable (mains) water, and water recycled from other sources on site. For example:

- Groundwater from dewatering activities;
- Rainwater harvesting from buildings; and
- Water filtered from bentonite recycling during diaphragm wall and piling construction.

Requirements for dewatering installations at deep station, tunnel portals, shafts and shallow sub surface works can provide a valuable source of water for general site use.

It is anticipated that methods of collecting (harvesting) rainwater, and recycling and treatment of wastewater for general site use, will be adopted wherever practical to do so.

Water filtered from bentonite slurry, as part of the recirculation process during diaphragm wall construction, can be treated and recycled in the operation.

With the exception of drinking water for office and welfare supplies, many of the construction activities listed in Table 2.1: Typical Areas and Activities Requiring a Supply of Watercould utilise all or part water from a grey water source, where testing and/or treatment deems it suitable for use e.g. wheel washing, surface and underground washing down, bentonite and concrete production.

Opportunities to conserve and minimise water consumption is discussed in Section 4, whilst management for the disposal of residual wastewater is discussed in Section 5.

Table 3.1: Availability of Mains Water and Sewer Connections at Main Station and Satellite Compounds represents an overview of the review carried out to assess potential availability for potable water connection and foul water disposal at each of the worksites. The review also identified and provided an estimate of how far infrastructure would need to be laid to provide a connection into site from an existing supply. All the potential connections identified will need to be consented with each utility provider (please refer to Chapter 22, Infrastructure and Utilities, Volume 5 of this EIAR for further information).

Table 3.1: Availability of Mains Water and Sewer Connections at Main Station and Satellite Compounds

Compound Location	Compound Type	Utility	Requirement	Availability	Location
Estuary	Surface Station	Water	Y	Y	Local supply on south boundary of site, part of planned diversion works. 80mm
		Foul	Y	N	New services currently part of the design for the new station and park and side
Fingallians	Surface Satellite	Water	Y	Y	Within 200m of site approx. 2No 150mm mains
		Foul	N	Y	Within 200m of site approx. 900mm to 120mm sewer as part of diversion works TBC
Seatown West	Surface Satellite	Water	Y	Y	Within 100m of site approx. 2No 150mm mains
		Foul	N	-	-
Estuary Court	Surface Satellite	Water	Y	Y	Within 200m of site approx. 150mm main
		Foul	N	-	-
Woodies	Surface Satellite	Water	Y	Y	Within 100m of site approx. 150mm main
		Foul	N	-	
Mantua	Surface Satellite	Water	Y		Within 200m of site approx. 150mm main
		Foul	N	-	-
FCC	Surface Satellite	Water	Y		Within 100m of site approx. 150mm main
		Foul	N	-	-
Seatown	Surface Station	Water	Y	Y	Currently within station footprint, to be diverted as part of the works, 150mm
		Foul	Y	Y	Currently within station footprint, to be diverted as part of the works, 900mm to 1200mm
NDC	Surface Satellite	Water	Y	Y	Within 100m of site approx. Will be diverted. 150mm main
		Foul	N	-	-
Chapel Town	Surface Satellite	Water	Y	Y	50m away, local housing estate supply, size unknown
		Foul	N	-	-
Pavillions	Surface Satellite	Water	Y	Y	100m away, 150mm and 100mm mains
		Foul	N	-	-
Swords Central	Surface Station	Water	Y	Y	300m away, 150mm main
		Foul	Y	Y	300m away, 600mm sewer. Will be temp overpumped during construction works
Pinnock Hill	Surface Satellite	Water	Y		200m away, 100mm main
		Foul	N	-	-
Fostertown	Surface Station	Water	Y	Y	Within compound footprint, 200mm main
		Foul	Y	N	None within local area
Nevistown Lane	Surface Satellite	Water	Y	Y	Within 50m, 10mm main
		Foul	N	-	-
Boland	Surface Satellite	Water	Y	Y	Within 100m, 200mm, 225mm, 4" mains
		Foul	N	-	-
North Portal	Portal	Water	Y	Y	Within 200m, size unknown
		Foul	N	-	-
Dublin Airport	Deep Station	Water	Y	Y	Within 200m, size unknown
		Foul	Y	N	None within local area
South Portal	Portal / Tunnel	Water	Y	N	None within local area
		Foul	Y	N	None within local area
Dardistown	Surface Station	Water	Y	Y	To be confirmed
		Foul	Y	Y	To be confirmed
Northwood Portal	Portal / Tunnel	Water	Y	Y	To be confirmed

Compound Location	Compound Type	Utility	Requirement	Availability	Location
		Foul	Y	Y	To be confirmed
Ballymun	Deep Station	Water	Y	Y	Various diameters
		Foul	Y	Y	To be confirmed
Collins Avenue	Deep Station	Water	Y	Y	Various diameters
		Foul	Y	Y	To be confirmed
Albert College Park Shaft	Deep Station	Water	Y	Y	To be confirmed
		Foul	Y	Y	To be confirmed
Griffith Park	Deep Station	Water	Y	Y	100mm.
		Foul	Y	Y	450mm
Glasnevin	Deep Station	Water	Y	Y	Various diameters
		Foul	Y	Y	To be confirmed
Mater	Deep Station	Water	Y	Y	150mm CI and 400mm CI Berkley Road. 100mm CI Eccles Street
		Foul	Y	Y	300mm VC combined Eccles Street. 795mm brick combined Berkley Road
O'Connell Street	Deep Station	Water	Y	Y	100mm CI Moore Lane.
		Foul	Y	Y	Combined 300mm VC Moore Lane
Tara	Deep Station	Water	Y	Y	150mm CI Luke Street / Townsend Street. 250mm Townsend Street. 600mm trunk Townsend Street
		Foul	Y	Y	2440mm brick and 1200mm concrete in Townsend Street.
St Stephen's Green	Deep Station	Water	Y	Y	450mm and 150mm in St Stephens Green East.
		Foul	Y	Y	1830mm x 930mm in St Stephens Green East.
Charlemont	Deep Station	Water	Y	Y	225mm combined in Dartmouth Road. 2170 x 1760 combined in Grand Parade. New 450mm proposed in Grand Parade
		Foul	Y	Y	150mm in Dartmouth Road. 100mm in Grand Parade

4. Management During Construction

All contractors will prepare a Water Management Plan. Such a plan will apply commitments made within the proposed Project contract towards the minimisation of water use, conservation of water and water efficiency measures on the proposed Project worksites..

To ensure that the Water Management Plan remains relevant, adequate and effective as the works progress it should be reviewed and updated as necessary:

- following any change that has a significant impact on water usage.
- as instructed by the Metrolink Project Manager, and
- at least every six months.

4.1 Objectives

The Water Management Plan should set out a number of key objectives and targets towards conserving and minimising water use, for example:

Eliminate - eliminate water use by identifying if the water-using process or activity is really necessary and/or if there is a cost-effective alternative to using water.

Substitute - identify and use alternative 'non-potable' sources and eliminate inappropriate use of drinking (potable) water. Assess whether rainwater or grey water can be used for the activity/process.

Reduce - explore options that improve efficiency, e.g., by regular maintenance of water-using equipment (to ensure they are working to maximum efficiency), installing metering and monitoring supplies, and updating fittings and/or processes on a regular basis.

Reuse – identify whether wastewater can be reused in a process or activity, e.g., wheel washing. This would include surplus water extracted from ground dewatering activities which would normally require filtering through settlement or flocculation tanks prior to discharge to sewers and/or water courses. This source could be tankered to other sites for general use.

Disposal - dispose of excess water legally and responsibly to ensure prevention of flooding, pollution or inconvenience to stakeholders.

4.2 Minimising Water Consumption

Minimisation of the use of mains water should be considered during planning for each stage of the works, incorporated into relevant procedures and method statements, and with steps to eliminate or minimise water usage incorporated and utilised where possible.

Mains water connections will be fitted with meters such that potable water usage is monitored and managed. Where practical and possible, water should be reused on site.

Construction activities on the project identified as having the potential for high water use should be specifically targeted against opportunities to reduce water use, utilising the hierarchy of objectives listed in Section 4.1 above.

Specific examples of these are provided below.

4.2.1 Piling and Diaphragm Wall Construction

The mixing of bentonite to form a slurry required for piling and diaphragm wall construction is a process which consumes large volumes of water. De-sanding equipment and (potentially) a filter press to separate water from excavated materials is likely to be standard equipment at sites during diaphragm wall and piling construction. Where practical, this water will be treated for re-use on site.

Mixing of grout for injection at the “toe” of diaphragm walls and secant piles to provide a water cut off will form a part of this overall process.

At the start of diaphragm wall operations, the equivalent volume for at least one full depth panel will be mixed and stored in tanks or silos on site. At peak production it is then estimated that the diaphragm wall process will require mixing of up to 50m³ of fresh bentonite each day, requiring 300 litres of water per cubic metre, a total of 15,000 litres per day. How much this volume can be reduced by is dependent on the ground conditions encountered during the Hydrofraise milling operation. As the bentonite fluid is circulated through the desanding/separation plant, excavated material is separated and clean bentonite recirculated into the excavation. Fine particles remaining suspended after the separation process will, over time, increase the density/viscosity of the fluid such that it will need to be replaced by a fresh mix.

Recycling of water drawn off from the separation process could be expected to reduce the use of mains water by between 10% and 20%.

Subject to testing, the use of water extracted for dewatering could potentially reduce reliance on mains water to zero for this operation. However, dewatering installations are unlikely to commence until diaphragm wall and piling construction is well advanced.

4.2.2 Tunnelling

Large volumes of water are required during the tunnelling process for a variety of activities including mixing of grout for the tunnelling annulus, Tunnel Boring Machine (TBM) cutter head conditioning, TBM cooling and frequent washing down along the length of the TBM.

Water used for mixing grout and for generating foam for TBM cutterhead conditioning is carefully controlled, and use is proportional to tunnelling production rates. At peak production, up to 40,000 litres per day of potable water could be required for grout mixing. Subject to testing, water yielded from dewatering could be expected to be used for this process, reducing the use of mains water by at least 50%.

Water used to cool the TBM cutterhead is circulated within a closed system and topped up to compensate for some evaporation and the extension of the cooling main as the TBM advances. Water may be tapped off this main at the TBM, for washdown in the ring build area, and at set locations along the tunnel for general cleaning down.

It is estimated that 3,600 litres of water per day will be added to the circulation system to compensate for extending the main as the TBM advances and also to compensate for evaporation. In addition, 5,000 litres per day could be drawn off the main for washing down at the TBM. It is unlikely that an alternative source such as dewatering would be used for this process.

All wastewater from underground activities will be pumped to the surface, passed through holding tanks to settle out suspended solids, and treated if necessary, to meet any requirements prior to discharge to sewers or watercourses. Ideally this wastewater source should be reused, and settlement tanks equipped such that water can be drawn off as and when required.

4.2.3 Dust Suppression

Dust suppression on site will regularly use large volumes of water.

During any demolition works, equipment fitted to demolition plant and at sensitive locations will capture dust while minimising water usage.

Dust suppression on haul roads will likely utilise a water bowser towed behind a tractor unit. The use of wastewater pumped from tunnels and underground, collected and passed through settlement tanks could be used for this process, along with surplus water from dewatering and harvested rainwater, reducing the reliance on mains water by potentially 50% to 100%. However, distribution to surface sites (in particular) will require tanker vehicles to operate between sites.

Where practical, hard standing areas should be regularly cleaned using equipment fitted with dust bags and vacuums to capture dust at source rather than use water.

Local roads used for access to the sites should be swept on a frequent basis during normal working hours with well-maintained mechanical sweepers fitted with active controlled sprinklers.

4.2.4 Surface Activities

At peak, surface activities could consume up to 2,000 litres of water per day.

It is expected that hard standing areas will be created on all worksites, using drainage to collect surface water runoff and discharge to sewers and/or watercourses via interception chambers to settle out any suspended solids.

Key activities on site which have the potential to consume large volumes of water include vehicle and wheel washing, cleaning of equipment used during and after major concrete pours, and washing down on the associated worksite areas.

For wheel washing, use of waterless wheel cleaning systems or systems which can collect and recirculate dirty water should be considered.

Jet washers used for cleaning equipment and work areas should have the ability to switch water off at point of use i.e., trigger guns. Harvested rainwater stored in tanks could be adapted for this purpose, as could surplus water from dewatering operations.

4.2.5 Site Accommodation

For office and welfare accommodation, typical water saving measures that should be implemented include:

- Dual flush toilets;
- Timed flow urinals;
- Non-concussive taps;
- Push or spray, or low flow taps to all cold water supplies; and
- Passive infrared (PIR) sensors, or waterless options on urinals.

Externally, boot washing facilities should use patent systems which combine high power jets and brushes to minimise water use and trap “mud and muck” for easy removal.

It would not be expected that rainwater harvested from the worksite could be used in site accommodation without a treatment such as chlorine. However, at locations where volumes are likely to be of significance and where it is practical to store large volumes, rainwater run-off from site buildings should be collected and stored for use on site.

4.2.6 Dewatering

It is anticipated that dewatering activities will be required at the majority of sites. For sites where volumes and discharge rates are expected to be high, then these could provide an additional valuable source of supply for general site use such as dust suppression, general cleaning and surface washdown.

Also, and where practical, surplus water from sites being actively dewatered, should be transported to sites where dewatering is not being carried out in order to minimise use of potable water at these locations.

From a study carried out to assess water ingress at the deep station sites, a nominal flow rate of 0.5litres/second (i.e. 43,200litres/day) is assumed at the following station sites for the purpose of assessing the number of tankers per day to transport discharged groundwater off site:

- Northwood;
- Ballymun;

- Collins Avenue;
- Griffith Park;
- Glasnevin;
- Mater;
- O'Connell Street;
- Tara;
- St Stephen's Green; and
- Charlemont.

An assessment for water infiltration for the surface works in the northern section is yet to be concluded, though it is anticipated that dewatering/depressurisation activities will be required for sections of the alignment where retained cut and cut/cover construction is carried out.

Activities which could utilise discharge from dewatering installations would include:

- Surface washdown;
- (Stations) underground washdown;
- Dust suppression;
- Wheel wash;
- Bentonite mixing (subject to quality testing and phasing of installation);
- Grout mixing (subject to quality testing); and
- Sprayed Concrete Lining batching (subject to quality testing).

4.2.7 Rainwater "harvesting"

The average rainfall in the east of Ireland is in the order of 750 to 1,000mm per year.

A rainwater harvesting system, such as those that are now commonplace for schools, hotels, farms, commercial premises, petrol stations/car wash, could be installed on each site to collect run off from all site temporary accommodation. This could potentially provide an alternative source for a number of activities on site.

5. Wastewater Management

5.1 Wastewater Disposal

The most significant volumes of waste from mains water use on site is likely to be from the office and welfare accommodation. On average, each employee creates 50 litres of wastewater per day, which equates to 30% of an expected daily demand of 150 litres per person.

Foul water drainage will be installed at the construction sites to collect discharges from office and welfare accommodation. Where possible, this will be connected to mains sewers, or alternatively to a septic tank for emptying by road tanker. Pre-application enquiries for foul discharge connection have been submitted to Irish Water for each station and consultation is on-going.

Construction wastewater will principally be generated from the following activities: groundwater dewatering, washing down (surface, underground (deep stations) and tunnels), dust suppression, concrete batching, wheel washing, TBM cooling and TBM conditioning. Wastewater will be recycled where possible (e.g. for wheel washing and boot washing) or reused (e.g. for dust suppression or grout mixing). Water that cannot be recycled or reused will require disposal by discharge to sewer.

Wastewater will be classed as trade effluent and will require a Trade Effluent Licence from Irish Water. A Trade Effluent Licence sets out conditions that businesses must comply with. These may include:

- The nature, composition and volume of the trade effluent discharge;
- The method of treatment, the location of discharge and the periods during which discharge may be made; and
- The taking and analysis of trade effluent samples and the trade effluent records that must be kept.

As water usage will vary from site to site, then the volume of wastewater to be disposed of will vary. It is assumed that wastewater from construction activities at all the main station and tunnel worksites can be discharged to main sewers subject to a level of treatment to ensure compliance with the conditions set out on the licence.

Where there is no main sewer in close proximity to a worksite, or if the conditions for disposal to the sewer network cannot be met then it is likely that wastewater will need to be removed by tanker for disposal at a licenced site. Similarly, and for the purpose of assessing peak daily vehicle numbers, it is currently assumed that the volume of water extracted from dewatering installations will not be recycled, and surplus water will be removed by tanker either to other sites (as discussed in Section 4.2.6) or to a licenced disposal site.

An approximation of the daily peak volumes of wastewater that could be required to be discharged to sewer from each construction compound is provided in Appendix A. An example of the breakdown of wastewater generated per activity for Dublin Airport South Portal is also presented in graphical form in Appendix A, with predicted minimum, average and maximum volumes depicted.

5.2 Drainage

Foul water drainage will be installed to collect discharge from office and welfare accommodation, and either connected to mains sewers in local highways, or to a septic tank.

Generally, the construction sites will be pervious, as they are overlain in stone, which will permit the percolation of surface water through to the underlying subsoil. Surface water drainage will be installed to collect and contain surface water runoff from hardstanding areas. Where possible, surface water run-off will be discharged to watercourses or to surface water sewers.

All surface water discharges from construction site areas are initially likely to be high in sediment, with potentially elevated alkalinity where cement works is on-going and will require adequate attenuation and treatment prior to approved discharge to the respective, defined watercourse or surface water sewer.

Discharging to the environment requires a wastewater discharge licence or certificate of authorisation from the Environmental Protection Agency (EPA). There are stringent conditions attached to wastewater discharge licences to ensure the water is of good quality and does not negatively impact on the receiving waterbody.

The lead contractor(s) will be required to provide a Water Management Plan for disposal of construction run-off water for approval. Monitoring of the discharge will be in accordance with EPA discharge requirements and any discharge water which exceeds approved discharge limits will be re-circulated at the site and further treated or will be disposed off-site to an appropriate disposal facility. Based on the typical nature of construction related water, it is likely that discharge water will require [recorded] daily inspection and monitoring for key parameters including pH, suspended solids and mineral oils.

Where discharge to surface waters is not possible, then an alternative discharge to foul sewer will be sought from Irish Water.

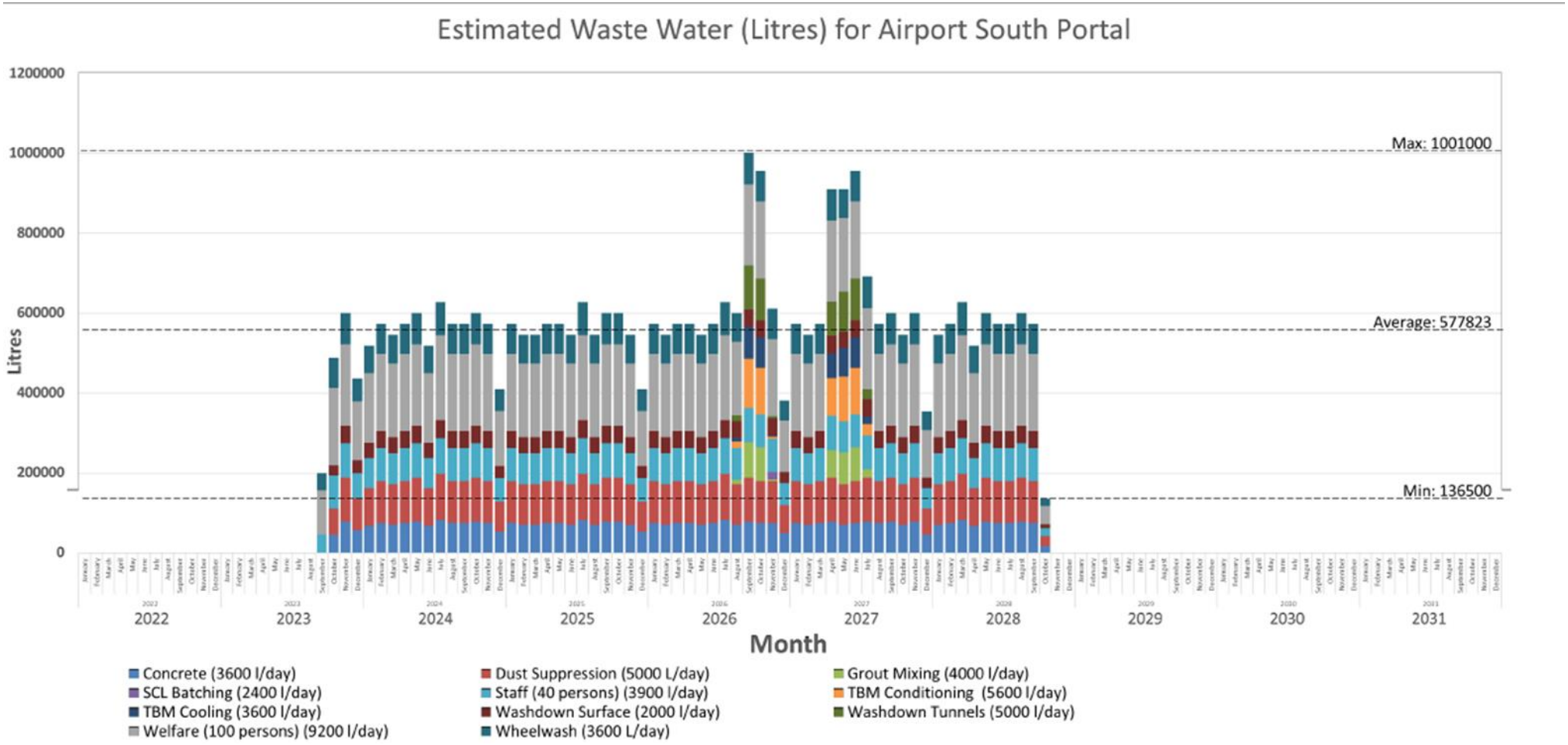
An indicative layout for how wastewater and water run off could be managed on MetroLink construction sites is shown in Appendix B. Griffith Park station is used for this example, but the principles can be applied to any of the worksites.

Water will be treated by pumping through a temporary construction site attenuation/ settlement tank prior to discharging through a series of treatment tanks with storage as required. Chemical dosing may be required for water with high sand/silt content to promote coagulation/ flocculation and achieve the required level of settlement of suspended sediment. Photographs of typical treatment equipment are contained in Appendix C.

The lead contractor(s) will be required to implement a Sediment Erosion and Pollution Control Plan for all construction works. This will include measures to manage soil and silt-laden water on site and accidental leaks / spills to ground and water.

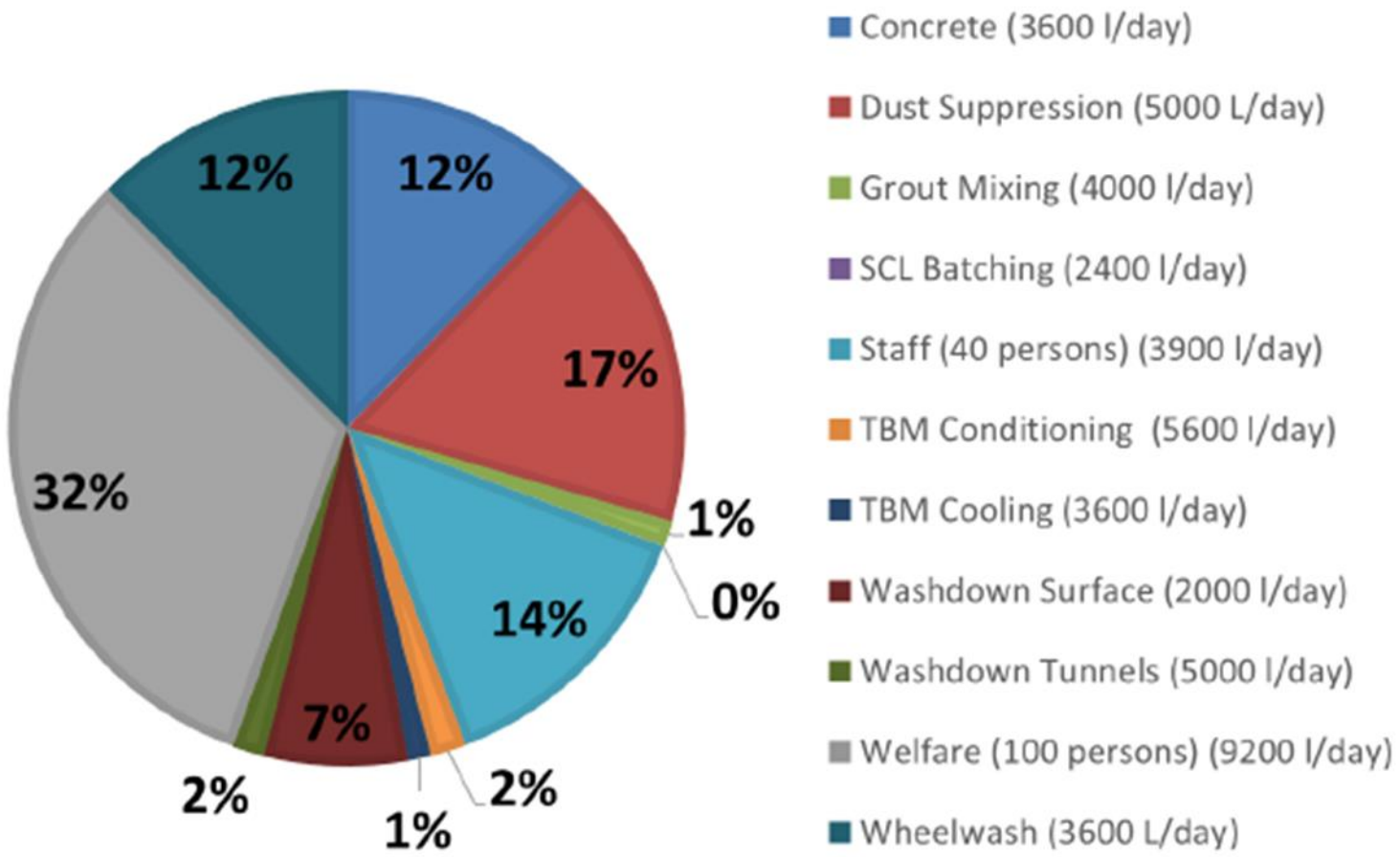
Appendix A. – Estimated Peak Daily Wastewater Volumes

	Staff 150L/person/day	wsate water	Welfare 150L/person/day	wsate water	Washdown Surface 2000L/day	wsate water	Washdown underground (deep stations) 3000L/day	wsate water	Dust Suppression 5000 L/day	wsate water	Concrete Batching 200m³/day. 300L/m³ 1st Stage trackbed = 600m³/day 2nd stage trackbed = 250m³/day	wsate water	Wheelwash 3600 L/day	wsate water	TBM Cooling	wsate water	Washdown Tunnels 5000 L/day	wsate water	TBM Conditioning	wsate water	Bentonite Mixing 50m³/day. 300L/m³	wsate water	Grout Mixing 200m³/day. 200L/m³	wsate water	SCL Batching 120m³/day, 200L/m³	wsate water	Peak Daily Requirement	Estimated Peak Daily Wastewater Litres/day
Estimated % as waste water	30%		30%		100%		100%		100%		20%		50%		100%		100%		10%		10%		10%		10%			
Compound Reference																												
Estuary Station Main Compound	3300	1100	21600	7200	4000	4000	0	0	10000	10000	75000	15000	3600	1800							15000	1500					117,500	53,800
Fingallian's Satellite Site (bridge demo)	750	250	1500	500	1000	1000			2500	2500																	5,750	4,250
Seatown West Satellite Site	1500	500	1290	430	2000	2000			5000	5000			3600	1800													13,390	7,930
Estuary Court Satellite Site	1500	500	3750	1250	2000	2000			5000	5000			3600	1800							15000	1500					30,850	10,250
Woodie's Satellite Site	750	250	1500	500	1000	1000			2500	2500			3600	1800													9,350	4,250
Mantua Satellite Site (bridge demo)	750	250	1500	500	1000	1000			2500	2500			3600	1800													9,350	4,250
Seatown Station Main Compound	900	300	6300	2100	2000	2000			5000	5000			3600	1800							15000	1500					32,800	10,900
North Dublin Corporate Business Park Compound Satellite Site	2250	750	4500	1500	2000	2000			5000	5000			3600	1800							15000	1500					32,350	10,750
Chapel Lane Site (bridge demo)	750	250	1500	500	2000	2000			5000	5000			3600	1800													12,850	2,550
Pavillion's Shopping Centre compound	750	250	1500	500	1000	1000			2500	2500			3600	1800													9,350	6,050
Swords Central Station Main Compound	900	300	6900	2300	2000	2000			5000	5000			3600	1800							15000	1500	46300				33,400	12,900
Pinnock Hill Roundabout Satellite Site	750	250	1500	500	1000	1000			2500	2500			3600	1800													9,350	6,050
Fosterstown Station Main Compound	900	300	5700	1900									3600	1800							15000	1500					25,200	5,500
Nevinstown Lane Site	2250	750	4500	1500	2000	2000			5000	5000			3600	1800							15000	1500					32,350	12,550
Boland Satellite Site	2250	750	4500	1500	2000	2000			5000	5000			3600	1800							15000	1500					32,350	12,550
North Portal Satellite Site	2550	750	3900	1300	2000	2000			5000	5000			3600	1800							15000	1500					32,050	12,550
Dublin Airport North Portal Main Compound	13800	4600	25650	8550	2000	2000	3000	3000	5000	5000			3600	1800							15000	1500					68,050	26,450
Dublin Airport Station Main Compound	11700	3900	27600	9200	2000	2000			5000	5000	180000	36000	3600	1800	3600	3600	5000	5000	56000	5600			40000	4000	24000	2400	274,500	162,500
Dublin Airport South Portal Main Compound	7500	2500	10500	3500	2000	2000			5000	5000			3600	1800							15000	1500					43,600	16,300
Dardistown Station & Depot Main Compound	2700	900	16800	5600	2000	2000			5000	5000	75000	15000	3600	1800							15000	1500					120,100	15,300
M50 Crossing Satellite Compound 1	1500	500	5850	1950	1000	1000	0	0	2500	2500			1800	900							7500	750					20,150	15,200
M50 Crossing Satellite Compound 2	1500	500	5850	1950	1000	1000	0	0	2500	2500			1800	900							7500	750					20,150	7,600
Northwood Station & Portal Main Compound	21300	710	45900	15300	2000	2000			5000	5000	180000	36000	3600	1800	3600	3600	5000	5000	56000	5600	15000	1500	40000	4000	24000	2400	302,400	181,910
Ballymun Station Main Compound	11850	3950	27150	9050	2000	2000	3000	3000	5000	5000	60000	12000	3600	1800							15000	1500					127,600	21,800
Collins Avenue Station Main Compound	11850	3950	27150	9050	2000	2000	3000	3000	5000	5000			3600	1800							15000	1500					67,600	26,300
Albert College Vent Shaft	2400	800	4200	1400	1000	1000	1000	1000	2500	2500			3600	1800							15000	1500			24000	2400	29,700	34,000
Griffith Park Station Main Compound	6000	2000	15000	5000	2000	2000	3000	3000	5000	5000	180000	36000	3600	1800							15000	1500					229,600	56,300
Glasnevin Station Main Compound	18900	6300	28500	9500	2000	2000	3000	3000	5000	5000			3600	1800							15000	1500					76,000	29,100
Mater Station Main Compound	13800	4600	27600	9200	2000	2000	3000	3000	5000	5000			3600	1800							15000	1500					70,000	27,100
O'Connell Street Station Main Compound	3300	1100	14400	4800	2000	2000	3000	3000	5000	5000			3600	1800							15000	1500					46,300	19,200
Tara Station Main Compound	18000	6000	36000	12000	2000	2000	3000	3000	5000	5000			3600	1800							15000	1500					82,600	31,300
St Stephen's Green Station Main Compound	13650	4550	26250	8750	2000	2000	3000	3000	5000	5000			3600	1800							15000	1500					68,500	26,600
Charlemont Station Main Compound	13650	4550	26250	8750	2000	2000	3000	3000	5000	5000			3600	1800							15000	1500			24000	2400	68,500	53,000

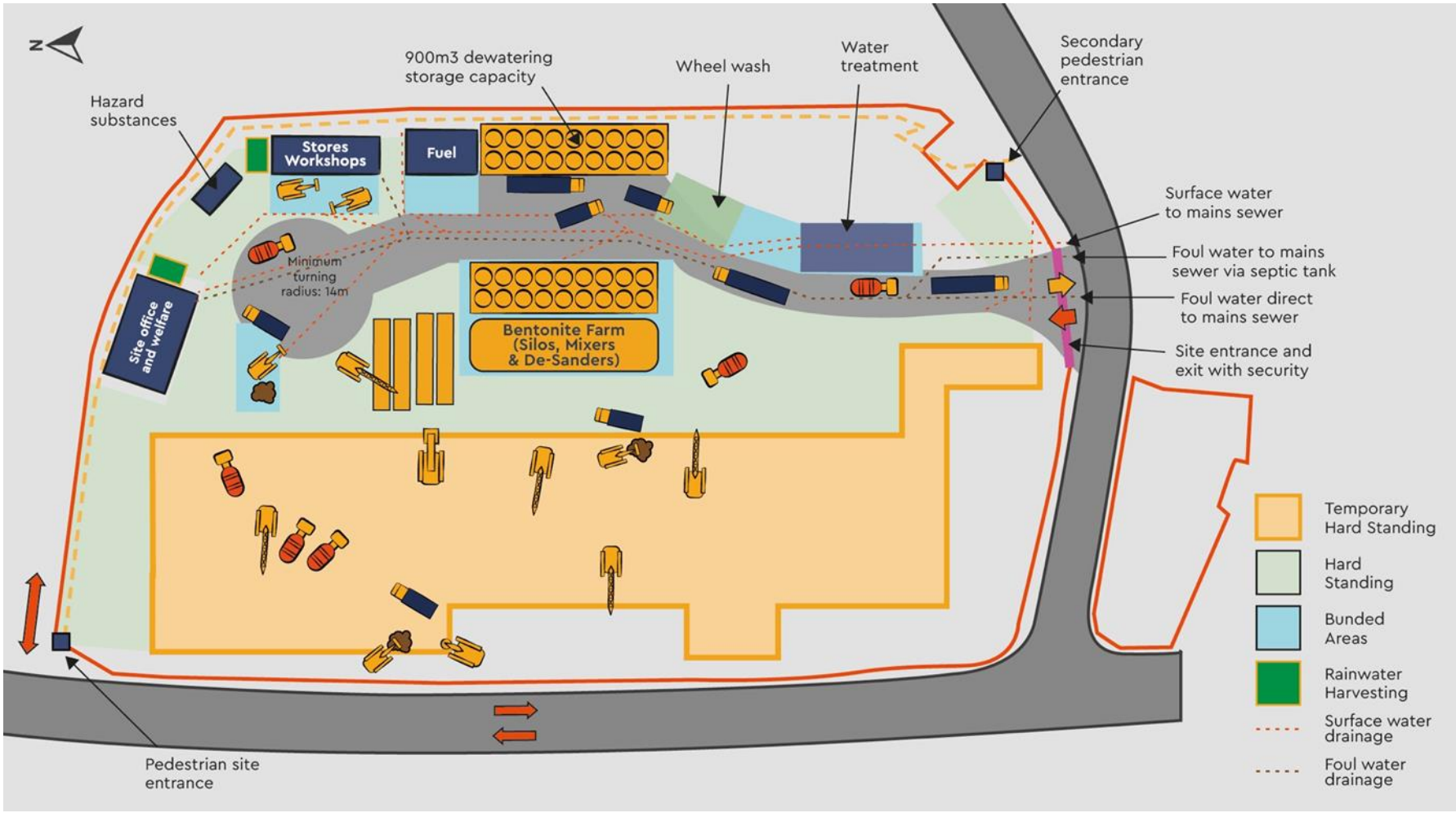

Estimated Waste Water (Litres) for Airport South Portal
1200000
1000000
800000
600000
400000
200000
0
Litres
Max: 1001000
Average: 577823
Min: 136500
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
Month
Concrete (3600 l/day)
SCL Batching (2400 l/day)
TBM Cooling (3600 l/day)
Welfare (100 persons) (9200 l/day)
Dust Suppression (5000 L/day)
Staff (40 persons) (3900 l/day)
Washdown Surface (2000 l/day)
Wheelwash (3600 L/day)
Grout Mixing (4000 l/day)
TBM Conditioning (5600 l/day)
Washdown Tunnels (5000 l/day)

JACOBS
IDOM

Estimated Waste Water by Activity
Airport South Portal



Appendix B. Indicative Layout for Surface and Wastewater Management at Construction Compound



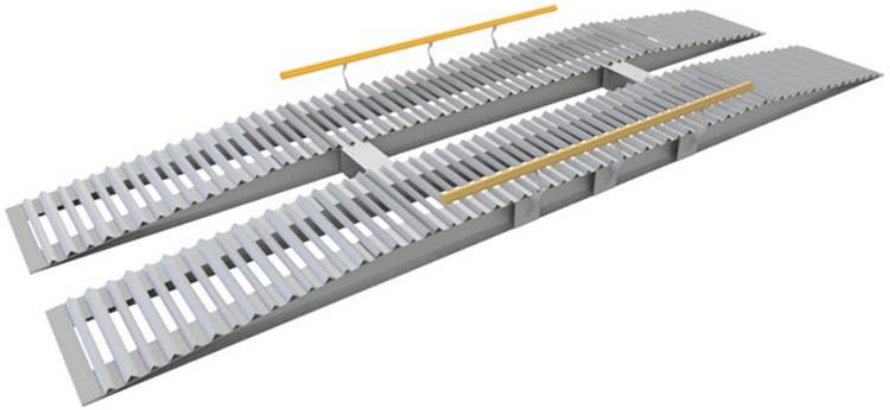
Appendix C. Equipment Types

Water Treatment

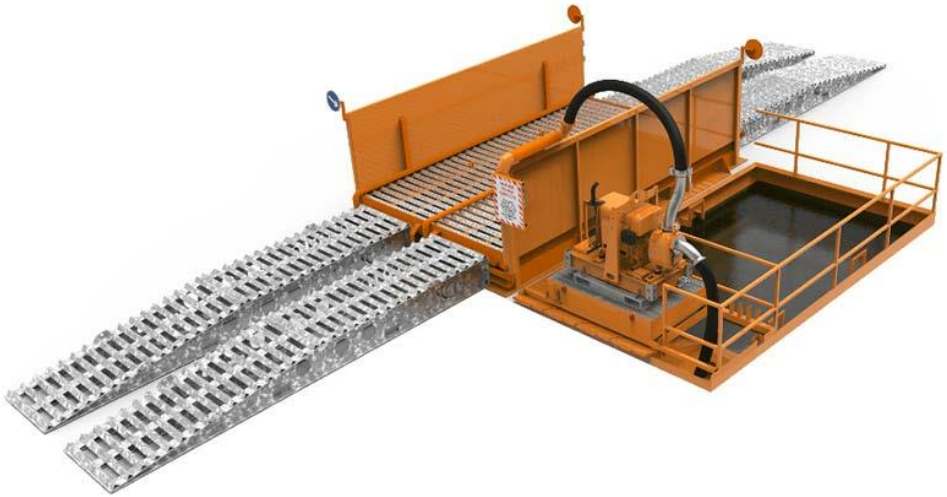
Settlement tanks

Chemical dosing / flocculation

Wheel Washing



Waterless / Rumble grid cleaner



Recycling wheelwash system

Boot Washing

Manual boot washer

Automatic boot washer