

Muse Developments Ltd
New Victoria Development
Attenuation Tank Specification

VIC-ARUP-ZZ-XX-SP-CD-0001

P02 | 17 July 2019

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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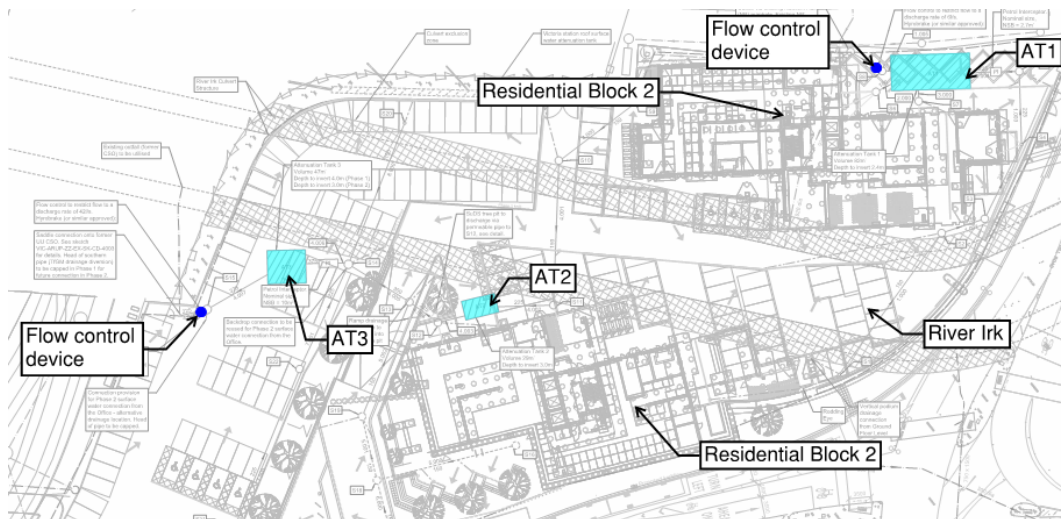
1 Introduction

This specification has been written to describe the performance criteria required for:

- Storm water attenuation tanks (3 No.)
- Flow Control Devices (2 No.)

The current design assumes that the tanks will comprise of a system of geocellular units, connected together to form a tank system. Each tank is to be completely surrounded in a suitable geomembrane so that rainwater entering will be held within the tank. The systems should not be designed for infiltration into the surrounding ground.

Figure 1 - Tank Locations



1.1 Surface water design

The proposed surface water drainage system to be installed as part of the New Victoria Development comprises an underground piped gravity system, as shown on Drawing VIC-ARUP-P1-EX-DR-CD-2001. The system comprises of the following principal components:

- Provision of surface water drainage for Residential Block 1 and the northern carpark area. This will drain to the River Irk culvert via Network Rail's outfall pipe. A rainwater attenuation tank (AT1) shall be constructed at the downstream end of this system, prior to connecting to Network Rail's network.
- Provision of surface water drainage for Residential Block 2 and the remaining southern car park areas. This drainage will discharge to the River Irk culvert via the existing, to be declassified, UU Combined Sewer Overflow (CSO). This system will comprise of two rainwater attenuation

tanks, (AT2) to the west of Block 2 mid drainage run and another (AT3) at the downstream end of the system prior to connecting to the UU network.

- The scheme has been designed to accommodate a minimum 30% restriction in runoff rate for storm events. Due to the design of the network this equates to a >50% reduction for the 1 in 100year +20% Climate Change (CC) storm event.

1.2 Purpose of this document

The term ‘Manufacturer/Supplier’ has been used collectively throughout this document to refer to the designer and tank manufacturer of the attenuation tanks.

This performance specification sets out the criteria to be satisfied for the rainwater attenuation tanks infrastructure as follows: -

- Existing and proposed site constraints that shall be taken into consideration during the design;
- Design responsibility
- Structural design
- Hydraulic design
- Layout and dimensional requirements
- Access and detail criteria
- Fabrication detail, construction details and calculations to be provided
- Inspection and testing

Contractual (conditions, access routes, attendance, payment, maintenance period, defects liability etc.) and programme requirements are not covered by this specification. These are specified by the Main Contractor.

It is intended that a design and supply order is placed by the Main Contractor for the attenuation tanks, and all associated units, connections, lining material, shafts, chambers, covers and connections using this specification.

This performance specification has been used to enable the Main Contractor to take advantage of alternative materials, construction methods, costs and Manufacturers/Suppliers.

2 Criteria

2.1 Existing and proposed site constraints

Constraint	Drawing/Document Ref.
Proposed site layout	Refer to Landscape Masterplan Drawing PL1487-VW-114 and PL1487-VW-115.
Summary of ground conditions	Refer to Work Stage 3 Report VIC-ARUP-ZZ-XX-RP-Z-0003.
Underground utilities and services, both within highways and crossing the site.	Refer to Drawing VIC-ARUP-P1-EX-DR-CU-2015.

2.2 Design responsibility

These are as stated below:-

- Structural design - Manufacturer/Supplier.
- Temporary works design – Manufacturer/Supplier.
- Fabrication and construction drawings - Manufacturer/Supplier.
- Review of layout and levels to comply with drainage design – Main Contractor's Designer (Arup).
- Requirements for approval of tank – Manufacturer/Supplier.
- Acceptance and approval for construction – Main Contractor.
- Approval of testing regime – Main Contractor.

2.3 Design Standards

The following design standards shall be considered in the design:-

- CIRIA documents C753 and C737.
- Specification for Highway Works and Design Manual for Roads and Bridges published by the Department of Transport.
- Civil Engineering Specification for the Water Industry 7th Edition published by the Water Services Association.
- Sewers for Adoption 7th Edition published by the Water Services Association
- BS EN 752:2008: Drains and Sewer Systems Outside Buildings.
- BS EN 12056: Gravity Drainage Systems Inside Buildings

- BS EN 124: Gully tops and Manhole tops for Vehicular and Pedestrian areas – Design requirements, Type testing, Marking, Quality control.

2.4 Tank structural design

The minimum cover to the tanks shall be 1.2m.

Ground levels given in the Landscape Masterplan are the current proposed finished paving levels for the area above the proposed tank. Due account should be taken of depth of cover and traffic loading during construction.

The design shall consider dead and imposed environmental characteristic loads due to: -

- backfill;
- construction methods and construction load;
- transportation and handling;
- permanent vehicle loading;
- weight of stored water and water pressure.

These characteristic loadings are to have partial factors applied to provide design loadings in accordance with CIRIA C737 Table 5.9.

The product/system shall comprise units which are interlocking both horizontally and vertically, and are able to transfer loading from one unit to the adjacent units.

The Manufacturer/Supplier shall be able to demonstrate by calculation the load transfer capability between adjacent units.

The complete tank system shall comprise only of components from one particular product system from one particular Manufacturer.

The Manufacturer/Supplier shall confirm that a complete set of independent tests has been carried out for the particular product/system, giving as a minimum, stress/strain curves for vertical and lateral compression, and creep tests under sustained long-term loading. This should clearly demonstrate the ultimate compressive strength and deflection performance of the product/system. The calculations should be based on the requirements of the CIRIA C753 document and shall follow the methods and guidance set out in CIRIA C737. The results should demonstrate the following minimum standards;

- Compressive test requirement¹ – 475 KN/m²
- Lateral test requirement – 120 KN/m²
- Long-term creep test requirement – 140 KN/m². Creep and fatigue results should not be extrapolated in time more than two orders (200 days tests required for 50 years design life)

¹ N.B. test requirements calculated to CIRIA C697.

Where the system incorporates an open internal void, an analysis of the bending stresses of the walls/columns/roofs should be provided.

The tank shall be designed to take into account the effects of external pressures and buoyancy due to ground water where considered appropriate. Information on ground conditions shall be taken from the Work Stage 3 Report, and from the Main Contractor's knowledge of the site conditions and Proposed Remediation Strategy.

The type of backfill around and above the tank should be in accordance with the tank Manufacturer's recommendations.

The tanks should be required to have a 50 year design life. They should also conform to all current legislation and regulations in accordance with the Manufacturer's chosen specified material.

The tanks shall have a guarantee of sufficient durability against chemical attack from aggressive ground conditions or from surface water runoff to achieve the required life expectancy.

The Manufacturer/Supplier shall provide a warranty to ensure the product/system will achieve the required design standards for the full period of the design life.

The Main Contractor shall provide a flat and uniform base for the tank units. This should have a CBR value no less than 3%. Where base ground conditions show CBR values less than this, the Main Contractor shall excavate below tank base level and fill with capping material so as to be able to demonstrate a base CBR value not less than 3%. The tank units shall be bedded as recommended by the Manufacturer/Supplier.

The surrounding geomembrane shall be the product recommended by the tank unit Manufacturer/Supplier. As a minimum, **Table 1** denotes the following physical properties required;

Table 1 - Membrane requirements

Impermeable Membrane Physical Properties		
Tear Resistance	Tear Strength (N)	>20
	Tear Strength (N/mm)	>40
Tensile Strength	Tensile Strength (MPa)	>14.4
Elongation at Break	Unaged	>500%
	Accelerated Aging (56 days at 80 °C)	>250%
Density (kg/m ³)		920

Joints should have a minimum lap of 300mm and should be welded.

2.5 Tank Layouts and Dimensions

For the purposes of the hydraulic design of the drainage system, the following tank dimensions and layouts are required, as per **Tables 2** below.

The Main Contractor may propose an alternative system or layout which satisfies the general requirement of the drainage system. Arup is to carry out a hydraulic assessment of the alternative drainage system to ensure the arrangement does not alter the overall hydraulic performance. A period of four weeks should be allowed for this assessment to be carried out and a maximum of one alternative will be considered.

2.6 Rainwater Attenuation Tanks

Table 2 – Tank Layout & Dimension Requirements

Parameter/Tank	Stormwater Attenuation Tank AT1	Stormwater Attenuation Tank AT2	Stormwater Attenuation Tank AT3
Tank Invert Level (mAOD)*	30.500	30.150	29.250
Final Ground Level (mAOD)*	32.900	33.150	33.250 (Phase 1) 32.250 (Phase 2)
Incoming Pipe Invert Level (m AOD) / Diameter (mm)*	31.197 / 225mm 31.309 / 150mm 31.295 / 150mm	31.624 / 225mm	29.815 / 375mm
Outgoing Pipe Invert Level (m AOD) / Diameter (mm)*	30.500 / 150mm	30.150 / 225mm	29.250 / 375mm
Tank Gradient	1 in 500 max	1 in 500 max	1 in 500 max
Min. Useable Storage Volume (m ³)	78	27	45
Indicative tank layout	Geocellular units as shown in drawing		
Indicative tank depth (m)	1.20	1.80	1.80
Requirements for Flow Control Unit	Hydrobrake (or similar) – refer to layout.	None required.	Hydrobrake (or similar) – refer to layout.

Vent pipe requirements	Vented manhole cover on access shaft.
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*Final levels to be confirmed following Landscape Architects final levels design.

De-silting regimes - the tank shall be designed to avoid excessive silting and should incorporate adequate provisions for cleaning and maintenance. The Manufacturer/Supplier should provide adequate details regarding the de-silting of the tanks, if deemed necessary.

Maintenance regimes - the Manufacturer/Supplier should provide information regarding the maintenance regime of the tanks and the time interval at which maintenance should take place. Adequate information needs to be available for accessing and repairing inlet and outlet areas. Unless stated in design, no silt traps have been included. Therefore, maintenance regimes should accommodate for silt removal.

The tank will not be adopted by a drainage Statutory Undertaker (United Utilities).

2.7 Flow Control Device

A flow control device shall be provided for both AT 1 and AT 3. For AT1, this may be located at the tank outlet if the chosen geocellular system includes specialised units for the purpose. Otherwise the control should be located in a chamber downstream of the tank, as shown on the drainage layout Drawing VIC-ARUP-P1-EX-DR-CD-2001. The details of the chamber shall be compatible with the chosen flow control unit.

The flow control unit shall operate for rainwater only.

The flow control unit shall incorporate an alternative means of emptying the tank, should the outlet become blocked. This alternative gate or valve shall be able to be operated by a person from ground level, without them having to enter the chamber.

An alternative flow control device may be proposed so long as it satisfies all the criteria of this specification. However, for any appropriate alternative arrangement, Arup are to carry out a review of the proposed alternative calculations (to be supplied) to ensure the arrangement does not adversely alter the overall hydraulic performance (max of 1 alternative). Four weeks shall be allowed for this review (if required).

2.8 Tank Access and detail criteria

Adequate access shall be provided to inlet and outlet areas for maintenance and clearance of blockages.

The minimum size of access shaft should be sufficient to allow observation of the water levels within the base of the tank and the means of inspection and cleaning

as recommended by the Manufacturer/Supplier. Where man entry/access is required, it shall be by the means of a winch in addition to the provision of a ladder.

Where person access is required, a suitable landing area within the tank below the access shaft should be provided. The area immediately surrounding the access cover should be flat to allow for safe use of a winch. The access cover should also be in close proximity to vehicle access routes to aid transfer to emergency vehicles.

Covers and frames shall be class D400 to BS EN 124 and recessed, unless stated otherwise on the drawings or drainage schedules.

Ventilation of the tanks shall be via ventilated covers or other ventilation feature (such as ventilation cowl) and in accordance with the Manufacturer's guidance.

2.9 Fabrication detail, construction details and calculations

The Manufacturer/Supplier shall provide: -

- full structural and hydraulic design calculations, checked internally by the Manufacturer's organisation;
- fabrication and construction drawings including plans,
- sections and details;
- bedding and backfill requirements
- handling requirements;
- method statements as required by the Main Contractor.
- warranty for the required design life
- Statement of maintenance requirements

2.10 Protection of the Tanks during Construction

Once constructed, the Main Contractor shall take precautions to protect the tank systems from excessive loading or impact from subsequent construction activities. Haul roads, plant standing areas and materials storage areas should not be located over or in the vicinity of the tank. Any subsequent excavation activities necessary close to the tanks (drainage connections, utilities etc) should be carried out carefully so as to avoid damage to the tank systems. Any damage caused should be repaired using only components compatible with the tank system and to a standard compatible with the Manufacturer's guidance, at the Main Contractor's own expense.

2.11 Other information to be provided

The Manufacturer/Supplier shall provide the following;

- Design information and independent testing data.
- CDM risk assessments and residual risks.
- Operation and Maintenance Information for inclusion in the Health and Safety file.
- Recommendations for safe demolition or abandonment of the tanks.

2.12 Inspection and testing

A water test shall be carried out on each tank (by the Main Contractor) to demonstrate it is water-tight. This shall be in accordance with CESWI 7th Edition Cl 7.18.

Where appropriate, a CCTV examination shall be used on all parts of the tanks to demonstrate and record the internal integrity of the tanks.

Any deficiencies in the tanks identified by the CCTV survey or which result the water tests not reaching the required standard shall be rectified at the Manufacturer/Supplier's expense. The tests shall be repeated to demonstrate compliance.

Visual inspection shall be undertaken before backfilling by the Main Contractor.

Testing shall be carried out immediately prior to the completion of the final finished surfacing/paving/landscaping over the tank. The testing regime should be to Manufacturer/Suppliers requirements/specification. The Main Contractor shall self-certify this compliance.