METROLINK

Integrated Transport. Integrated Life.

A18.5 Flood Risk Assessment

Contents

1. Introduction & Background

1.1 Project Background

The population of Dublin is projected to increase to 1.4 million by 2040. In terms of employment, the city centre has maintained its position as the pre-eminent location for jobs and at the highest levels of intensity. Aligned to this, Fingal is the fastest growing region in Ireland including Dublin Airport and supports 117,300 jobs in the Irish economy.

MetroLink is one of three major transport infrastructure projects along with BusConnects and the DART expansion that are included in Project Ireland 2040. Together, they will enable the development of reliable, sustainable, affordable, integrated public transport that will support the Greater Dublin and wider Irish economy, help Ireland meet its climate change targets and make Dublin a better place to live, work, shop or visit. The proposed new MetroLink is critical to the future growth and development of Dublin as it integrates between domestic and international transport hubs, such as Dublin Airport, Iarnród Éireann Infrastructure and the DART.

The extents of the proposed MetroLink scheme are presented in Figure 1.1. The proposed scheme extends from Lissenhall to the north of Swords. The scheme follows a route in a southerly direction, running in close proximity to the R132. The proposed metro passes beneath Dublin Airport before emerging to pass over the M50. At Northwood, just south of the M50, the metro enters and tunnel and follows a southerly direction to the city centre. The metro passes beneath the city centre to terminate at the Luas – Green Line in Ranelagh, to the south of the city centre

The objective of this report is to assess the level of flood risk to and arising from the proposed development. The assessment complies with Stages 1 to 3 Flood Risk Assessment as set out in 'The Planning System and Flood Risk Management, Guidelines for Planning Authorities' (Office of Public Works, 2009).

Figure 1.1 MetroLink Preferred Route

1.2 Works Description

The MetroLink scheme (hereafter after called the Proposed Scheme) is a combination of an overground (at grade and on embankment), and underground (open-cut and tunnelled) metro (rail) network. The overground section commences to the north of Swords at Lissenhall and extends to Northwood, just to the south of the M50. The route runs in a southerly direction from Lissenhall close to the R132 past Seatown, Swords, Fosterstown and the Airside Retail Park. The route then turns away from the R132 to enter a tunnelled section just north to Naul Road and pass, in tunnel, beneath Dublin Airport. The Proposed Scheme emerges to the south of Dublin Airport and continues in southerly direction, crossing over the M50 to Northwood. The overground section comprises a mixture of at-grade and on-embankment network. Parts of this section are also open cut and cut and cover to pass beneath/accommodate existing infrastructure.

At Northwood, the Proposed Scheme enters a tunnelled section and then continues in a southerly direction beneath Ballymun, Santry, Glasnevin, Phibsborough, Dublin city centre and St. Stephen's Green. The scheme terminates in Ranelagh where it meets the Luas Green Line.

The Proposed Scheme is described in greater detail below, refer to **Figure 1.2**. It is split into the following four sections:

- Section 1: Lissenhall to Fosterstown Station.
- Section 2: Fosterstown Station to Dublin Airport.
- Section 3: Dublin Airport to Northwood Station.
- Section 4: Northwood Station to Charlemont (Passed).

Figure 1.2 MetroLink Scheme. Sections

1.2.1 Section 1: Lissenhall to Fosterstown Station

The MetroLink scheme will begin at ground level at Lissenhall, where an open-air station (Estuary Station) and a 3000-vehicle, multi-storey park-and-ride facility are proposed. The Proposed Scheme then continues south on a viaduct to cross the Broadmeadow and Ward Rivers (Ch. 1 + 500 and Ch. 1 + 760). Downstream of the Broadmeadow and Ward, the Proposed Scheme continues in a southerly adjacent to the R132. For part of this section, the Proposed Scheme is constructed in an Open Cut. This means that the MetroLink scheme will run below the road level along the R132 to mitigate concerns about its visual impact. Three further open-air stations will be constructed as part of this section namely:

- **Seatown Station (Ch. 2 + 850)** - Open-air station to be located between the Estuary and Seatown roundabouts, east of the 132 in cutting.
- **Swords Central Station (Ch. 3 + 800)** - Open-air station to be located across the road from the Pavilions Shopping Centre, east to the R132. A footbridge will provide better and safer connection to the shopping centre, bus stops and Swords town centre.
- **Fosterstown Station (Ch. 4 + 800)** - Open-air station to be located north to Airside Retail Park, east to the R132. A footbridge for pedestrians and cyclists will be constructed to facilitate access to Boroimhe.

1.2.2 Section 2: Fosterstown Station to Dublin Airport Station

To the south of Fosterstown Station, the Proposed Scheme will run alongside the R132, passing beneath the road at Nevistown Lane junction and a Texaco Service Station. The MetroLink scheme turns away from the R132 to head towards Dublin Airport. Within this section it crosses the Sluice River Ch. 5 + 963 and an associated tributary (Ch. 5 + 765). New culverts are provided in both locations to maintain flows along both watercourses beneath the Proposed Scheme. To the north of Naul Road, it enters a tunnel that will take it under Dublin Airport. Dublin Airport Station will be located at Ch. 7 + 050. All elements of the Proposed Scheme are located below ground where it passes the airport to minimise impact on the airport operations.

1.2.3 Section 3: Dublin Airport to Northwood Station

The Proposed Scheme emerges from the tunnel section at Dardistown, to the south of Dublin Airport. This location has been proposed as the site of the main train depot. The area has been zoned for employment in the Local Development Plan and will comprise sidings, storage, cleaning and other operational facilities. Within the section, the Turnapin Stream, which is a tributary of the Mayne River is diverted to accommodate the new depot. The proposed diversion includes a 15m wide riparian buffer, in accordance with the Local Development Plan, to improve connectivity between the river and floodplain.

The Proposed Scheme leaves the Dardistown depot site to the south and then crosses over the M50 on a new viaduct (Ch. 9 + 650 – Ch. 9 + 750). It then continues in a southerly direction towards the proposed Northwood Station.

Just downstream of the M50, the Proposed Scheme crosses the Santry River. The Proposed Scheme is designed to pass over the Santry River where it is contained in an existing culvert. No works will be undertaken to modify the culvert. The Proposed Scheme reaches Northwood Station (Ch. 10 + 300), which will be located underground at the junction of the R108 and Northwood Avenue. This will allow passengers to access the station (development entrance to be located on Northwood Avenue) from either side of the R108 without having to cross a busy road.

1.2.4 Section 4: Northwood Station to Charlemont Station (Passed)

The MetroLink scheme will be underground between Northwood and Charlemont Stations. Nine further underground Stations will be constructed as part of this section:

- **Ballymun Station (Ch. 11 + 250)** - This Station will lie adjacent to the R108, partly under the site of the old shopping centre.
- **Collins Avenue (Ch. 12 + 250)** - This Station will lie east to Ballymun Road, close to Our Lady of Victories Church and Our Lady of Victories National School.
- **Griffith Park (Ch. 13 + 850)** - This Station will lie under the Home Farm FC soccer pitch. An emergency intervention shaft for the tunnel will be located in the grounds of Albert College Park.
- **Glasnevin (Ch. 14 + 900)** - This Station will lie northwest of the junction of the R108 and Royal Canal Way. This Station is key to the proposed scheme as it is where the MetroLink scheme will interchange with Iarnród Éireann services.
- **Mater (Ch. 15 + 600)** - This Station will lie under the Four Masters Park which will provide convenient access to the Mather Hospital, St. Joseph's Church and Berkely Street.
- **Tara (Ch. 17 + 400)** - This Station is proposed to the west of Tara Street DART Station, on lands between Tara Street and Poolbeg Street. This station will be an interchange with Iarnród Éireann services. The station includes flood resilience measures as it is potentially at risk of flooding from the River Liffey.
- **St. Stephen's Green (Ch. 18 + 500)** - This Station will be located under St. Stephen's Green East.

To the south of Charlemont, the MetroLink scheme will in tunnel for approximately 650 m and will terminate underground, south of the Ranelagh LUAS stop (Green Line). This terminating tunnel section will be used to construct cross-over arrangements, so trains can cross lines and turn-back in service. This final tunnel section will be aligned to enable its potential connection to the LUAS Green Line in the future.

1.3 Report Structure

The flood risk assessment is structured as follows:

- Chapter 2 sets out the Plan Guidelines considered.
- Chapter 3 sets out the Flood Risk Assessment Methodology.
- Chapter 4 outlines the findings of the Stage 1 Flood Risk Assessment.
- Chapter 5 presents the findings of the Stage 2 Flood Risk Assessment.
- Chapter 6 details the potential flood risk implications arising from the work and the proposed mitigation measures.
- Chapter 7 presents the findings of the Stage 3 Flood Risk Assessment.
- Chapter 8 assesses the proposed works in accordance with the Justification Test.
- Chapter 9 presents the conclusions and recommendations.

2. Planning Guidelines

2.1 The Planning System and Flood Risk management Guidelines for Planning Authorities

The Planning System and Flood Risk Management Guidelines for Planning Authorities introduce comprehensive mechanisms for the incorporation of flood risk identification, assessment and management into the planning process.

The Guidelines set out the methodology to be used for the Flood Risk Assessment, which require the planning system at national, regional and local levels to:

- Avoid development in areas at risk from flooding, particularly floodplains, unless there are proven wider sustainability grounds that justify development. Where this is the case, development must be appropriate and flood risks must be effectively managed to reduce the level of risk.
- Adopt a Sequential Approach to Flood Risk Management when assessing the locations for new development based on avoidance, reduction, and mitigation of flood risk.
- Incorporate Flood Risk Assessment into planning application decisions and appeals.

2.2 Fingal County Council Development Plan – Strategic Flood Risk Assessment (2017-2023)

The Strategic Flood Risk Assessment (SFRA) provides *'an area wide assessment of all types of significant flood risk to inform strategic land use planning decisions'*.

The assessment presents the key flood management policies and objectives that must be followed by all new developments. It identifies 18 sites within flood zones A and B and covers acceptable grounds for Justification Tests for development plans within each site. Where the Proposed Scheme is within or proximate to these sites, further detail is provided within this report.

The Proposed Scheme will need to demonstrate compliance with the objective set out in sections 4.4.3 and 5.8.2 of the SFRA. FCC states that no proposals for highly vulnerable developments should be considered in flood risk areas and that for most development, the Medium Range Future Scenario (MRFS) is an appropriate consideration. Any applications should be supplemented by an appropriately detailed FRA and meets the criteria of the Development Management Justification Test.

The Proposed Scheme will need to demonstrate compliance with the overarching objectives and recommendations of the SFRA stated in Table 2.1.

Table 2.1 Objectives and recommendations of the SFRA

Fingal County Development Plan SFRA Objective	Proposed Scheme Approach to Compliance
Section 4.4.3 of the SFRA covers highly vulnerable development in Flood Zone A and B. It states that "Compensatory storage for development that results in a loss of floodplain within Flood Zone A must be provided on a level for level basis."	The Stage 3 FRA results showed that the design of the proposed viaduct over Broadmeadow and Ward Rivers and the construction of the proposed culverts on Sluice River and its tributary will have will not increase flood risk. **The Proposed Scheme therefore meets this objective**
Section 5.8.2 of the SFRA covers climate change. It states that "For most development…the medium-range future scenario (20% increase in flows and/or 0.35 m increase in sea level and 100% increase in urbanisation) is an appropriate consideration."	The impacts to and arising from the Proposed Scheme are assessed against the Medium Range Future Scenario (MRFS) for climate change. The proposed new viaduct over Broadmeadow and Ward Rivers, culverts over Sluice River and its tributary and the diversions of a tributary of Staffordstown watercourse and Turnapin watercourse also allow for the effects of future climate change. All new drainage is designed to accommodate the effects of the medium range future climate change scenario. **The Proposed Scheme therefore meets this objective**

2.3 Dublin City Development Plan – Strategic Flood Risk Assessment (2016-2022)

The Strategic Flood Risk Assessment (SFRA) provides '*an area wide assessment of all types of significant flood risk to inform strategic land use planning decisions*'.

The assessment presents the key flood management policies and objectives that must be followed by all new developments. It identifies 30 sites within flood zones A and B and covers acceptable grounds for justification tests for development plans within each site. Where the Proposed Scheme is within or proximate to these sites, further detail is provided within this report.

The Proposed Scheme will need to demonstrate compliance with the overarching objectives and recommendations of the SFRA stated in Table 2.2.

Table 2.2 Objectives and recommendations of the SFRA

Dublin City Development Plan SFRA Objective	Proposed Scheme Approach to Compliance
Section 4.5 of the SFRA covers major developments within flood zone A and B. It is not appropriate for new highly vulnerable development to be located on greenfield land within flood zone A or B. Regeneration of already urbanised areas within zones A and B may be justified.	The Proposed Scheme comprises the construction of the metro line for the city of Dublin. No works are proposed on greenfield lands covered by the SFRA. Tara Street Station is located within Flood Zone B. This is justified owing to its strategic importance in connecting to DART and Iarnród Éireann services. **The Proposed Scheme therefore meets this objective**
Section 4.6 of the SFRA covers highly vulnerable development in Flood Zone A and B. It states that "Proposals for development that results in a loss of fluvial floodplain within undefended flood zone A must also demonstrate that compensatory storage can be provided on a level for level basis."	The Stage 3 FRA results showed that the construction of the proposed Tara Station will have no impact on the coastal flood risk (current and HEF scenarios) and on fluvial flood risk (HEFS). There will be no flood risk impacts from the construction of this station. **The Proposed Scheme therefore meets this objective**
Section 4.10 of the SFRA covers climate change. It states that "For most development…the medium-range future scenario (20% increase in flows and/or 0.5m increase in sea level and/or 20% increase in rainfall depth) is an appropriate consideration."	The impacts to and arising from the Proposed Scheme are assessed against the High-End Future Scenario (HEFS) for climate change. The proposed new Tara Street Station allows for the effects of future climate change. All new drainage is also designed to accommodate the effects of the High-End Future climate change Scenario. **The Proposed Scheme therefore meets this objective**

2.4 Greater Dublin Strategic Drainage Study (April 2005)

The Greater Dublin Strategic Drainage Study (GDSDS) was commissioned in 2001 to analyse existing foul and surface water drainage systems in the local authority areas of Dublin City, Fingal, South Dublin and Dun Laoghaire – Rathdown and the adjacent catchments in Counties Meath, Kildare and Wicklow. With respect to the Proposed Scheme, the applicable objectives of the study can be summarised as follows:

- To develop an environmentally sustainable drainage strategy for the region consistent with the EU Water Framework Directive.
- To provide a consistent policy framework and standards which will apply throughout the region.
- To develop tools for the effective management of the drainage systems including Geographical Information Systems (GIS), network models and digital mapping.
- To develop the optimum drainage solution from a range of alternative scenarios having regard to the whole-life cost and environmental performance, the solution to be broken down into a set of implementation projects which can be prioritised and put in place.

An overarching Drainage Strategy was developed for the MetroLink scheme which was applied to the design. This incorporated the recommendations of the GDSDS specifically in relation to the design of sustainable drainage measures and minimum drainage design standards.

2.5 Fingal County Council – Planning & Strategic Infrastructure Department Green/Blue Infrastructure for Development (December 2020)

The guidance document will set out the need for Sustainable Urban Drainage Systems (SuDS) in developments, typical SuDS features that we would expect to be included in schemes, a selection of tools that have been incorporated to assist with the implementation of these, and finally items that shall be submitted as part of future planning applications in county Fingal. With respect to the Proposed Scheme, the applicable objectives of the study can be summarised as follows:

- To use of sustainable drainage systems (SuDS) to minimise and limit the extent of hard surfacing and paving and require the use of sustainable drainage techniques where appropriate, for new development or for extensions to existing developments, in order to reduce the potential impact of existing and predicted flooding risks.

- Discourage the use of hard non-porous surfacing and pavements within the boundaries of rural housing sites.

- Integrate provision for biodiversity with public open space provision and sustainable water management measures (including SuDS) where possible and appropriate.

- Seek the creation of new wetlands and/or enhancement of existing wetlands through provision for Sustainable Drainage Systems (SuDS).

An overarching Drainage Strategy was developed for the MetroLink scheme which was applied to the design. This incorporated the recommendations of the Fingal Drainage Design Strategy specifically in relation to the design of sustainable drainage measures and minimum drainage design standards.

3. Flood Risk Assessment Methodology

The document *Planning System and Flood Risk Management: Guidelines for Planning Authorities* published by the OPW (referred to hereafter as the FRM Guidelines) outlines the key principles that should be used for assessing flood risk to proposed development sites. It recommends that a staged approach should be adopted. The stages of appraisal and assessment are as follows:

- **Stage 1: Flood risk identification** – This stage identifies any issues (flooding or surface water management) related to the proposed MetroLink scheme.

- **Stage 2: Initial flood risk assessment** – This stage seeks to confirm the sources of flooding identified in Stage 1. All existing information is reviewed in detail and extent of the flood risk associated with the MetroLink scheme established.

- **Stage 3: Detailed flood risk assessment** – Where required, this stage will assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development, of its potential impacts on flood risk elsewhere and of the effectiveness of any proposed mitigation measures. This will typically involve use of an existing or construction of a hydraulic model across a wide enough area to appreciate the catchment wide impacts and hydrological process involved.

Following the Stage 1 and 2 assessments, Stage 3 level analysis was completed for the following scheme elements:

- Proposed new diversion of a tributary/ditch located in the Staffordstown Watercourse catchment to accommodate construction of the Park & Ride facilities at Estuary Station (around Ch. 1 + 100).

- Proposed new viaduct crossing of the Broadmeadow and Ward Rivers (Ch. 1 + 500 – Ch. 1 + 760).

- Proposed new culvert crossing of Sluice River and a nearby tributary (Ch. 5 + 765 and Ch. 5 + 963).

- Proposed new diversion of Turnapin Stream to accommodate construction of the MetroLink Depot (around Ch. 8 + 600).

- Flood resilience measures associated with the proposed Tara Street Station (Ch. 17 + 400).

3.1 Flood Zones

The FRM Guidelines define the following three flood zones:

- **Flood Zone A** – Where the probability of flooding from rivers and the sea is highest (greater than 1% annually or 1 in 100 years for river flooding or 0.5% annually or 1 in 200 years for coastal flooding).

- **Flood Zone B** - 'Where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 years and 1% annually or 1 in 100 for river flooding and between 0.1% annually or 1 in 1000 years and 0.5% annually or 1 in 200 for coastal flooding).

- **Flood Zone C** – Where the probability of flooding from rivers and the sea is low (less than 0.1% annually or 1 in 100 years for both river and coastal flooding (Flood Zone C covers all areas of the plan that are not in zones A or B).

These flood zones are used to assess the suitability of the location for a proposed development with respect to its vulnerability to flooding.

3.2 Vulnerability of the MetroLink scheme

With reference to Figure 1.1 and the discussion in Section 1.2 above, the Proposed Scheme will accommodate overground tracks between:

- Lissenhall (Ch. 1 + 000) and the Northern Portal which is located north to Naul Road (Ch. 6 + 100);
- The Southern Portal which is located in the Dardistown area at Ch. 8 + 400 and Northwood (Ch. 10 + 000).

The remainder of the MetroLink line i.e. beneath Dublin Airport and from Northwood to its terminus in Ranelagh will be tunnelled underground.

The Proposed Scheme also includes the following above ground elements:

- Open air stations. Access points to all underground stations will be located at ground level.
- A train depot at Dardistown comprising cleaning, storage and other operational facilities.
- A Park & Ride with 3,000 parking spaces associated with Estuary Station.

Watercourses that are crossed by the scheme are maintained by a combination of new and existing bridge/culvert crossings (as appropriate) depending on the impact of the scheme, size of the watercourse and scale of the crossing.

With reference to Table 3.1 of the Planning System and Flood Risk Management Guidelines for Planning Authorities, the MetroLink scheme works are assessed as "essential infrastructure such as primary transport" and therefore classed as a "highly vulnerable development". Whilst the Proposed Scheme will principally serve areas in Fingal CC and Dublin CC; its strategic importance with links to domestic and international transport hubs and potential catchment area are assessed to elevate it above the criteria of local transport infrastructure.

The FRM Guidelines require that a Justification Test be completed for any highly vulnerable developments that are located within Flood Zone A or Flood Zone B.

4. Stage 1 Flood Risk Identification

4.1 General

The Stage 1 Flood Risk Assessment assesses the existing flood risk to the Proposed Scheme. This is carried out as a desktop study using existing information from a number of sources. The objective was to identify whether there are potential flooding or surface water management issues for the Proposed Scheme that require further investigation.

Refer to Table 4.1 for the data sources considered during the Stage 1 Flood Risk Assessment.

Table 4.1 Data sources

Data Type	Source	Coverage	Report Section
Historic Flood Information	www.floodinfo.ie	Full Scheme	4.2
National CFRAM Mapping - Fluvial & Coastal Flood Risk (as applicable)	www.floodinfo.ie	Proposed Scheme crossings of and works adjacent to the: ▪ Broadmeadow River ▪ Ward River ▪ Sluice River ▪ Mayne River ▪ Santry River ▪ Gaybrook Stream ▪ River Liffey	4.3
National Indicative Flood Mapping – Fluvial only	www.floodinfo.ie	Proposed scheme crossing and works adjacent to the River Tolka	4.4
Areas Benefitting from Defences	www.floodinfo.ie	River Liffey & River Tolka. No other flood relief schemes are present along the Proposed Scheme	4.5
Minor watercourses and ditches	OSi Mapping	Applicable to the Park & Ride and Depot parts of the Proposed Scheme only.	4.6
Canals & Waterways	OSi Mapping	Proposed Scheme crossings of and works adjacent to the: ▪ Grand Canal ▪ Royal Canal	4.7
		Proposed Scheme crossings of and works adjacent to the: ▪ Broadmeadow River	

Irish Coastal Protection Study – coastal flood risk extents	www.floodinfo.ie	▪ Ward River ▪ River Liffey	4.8

Figure 4.1 shows the locations of the watercourses that are crossed by or where works are completed in close proximity for the Proposed Scheme. Sections 4.3 to 4.8 summarise the flood risk information available for each of these locations.

Figure 4.1 MetroLink Scheme Watercourse Interfaces

4.2 Historic Flood Events

The OPW National Flood Hazard Mapping website (www.floodinfo.ie) was used to identify historical flooding along the route of the proposed overground works of the Proposed Scheme, refer to Figure 4.2 and Figure 4.3.

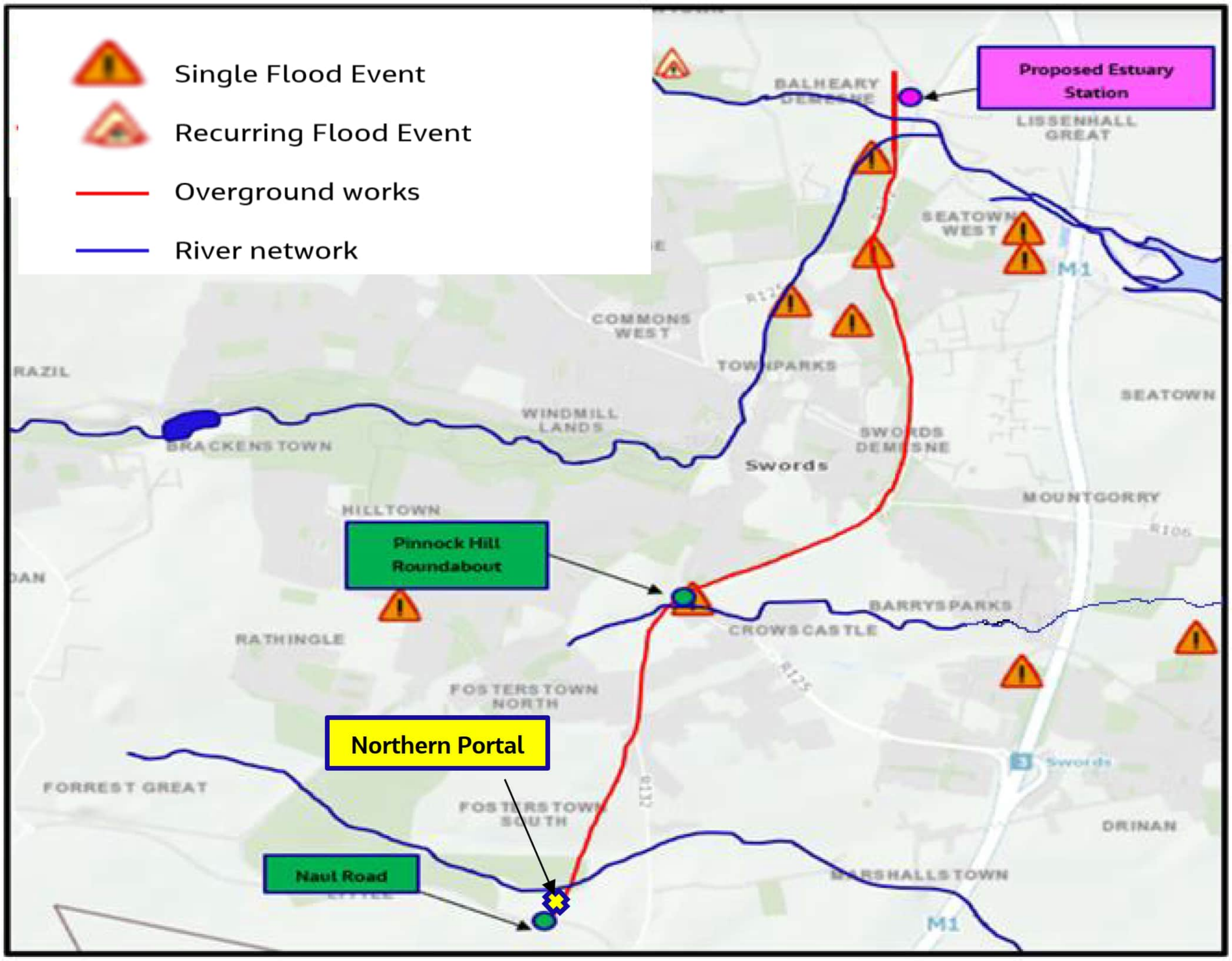


Figure 4.2 Past flood events between Lissenhall and Northern Portal (north to Naul Road)

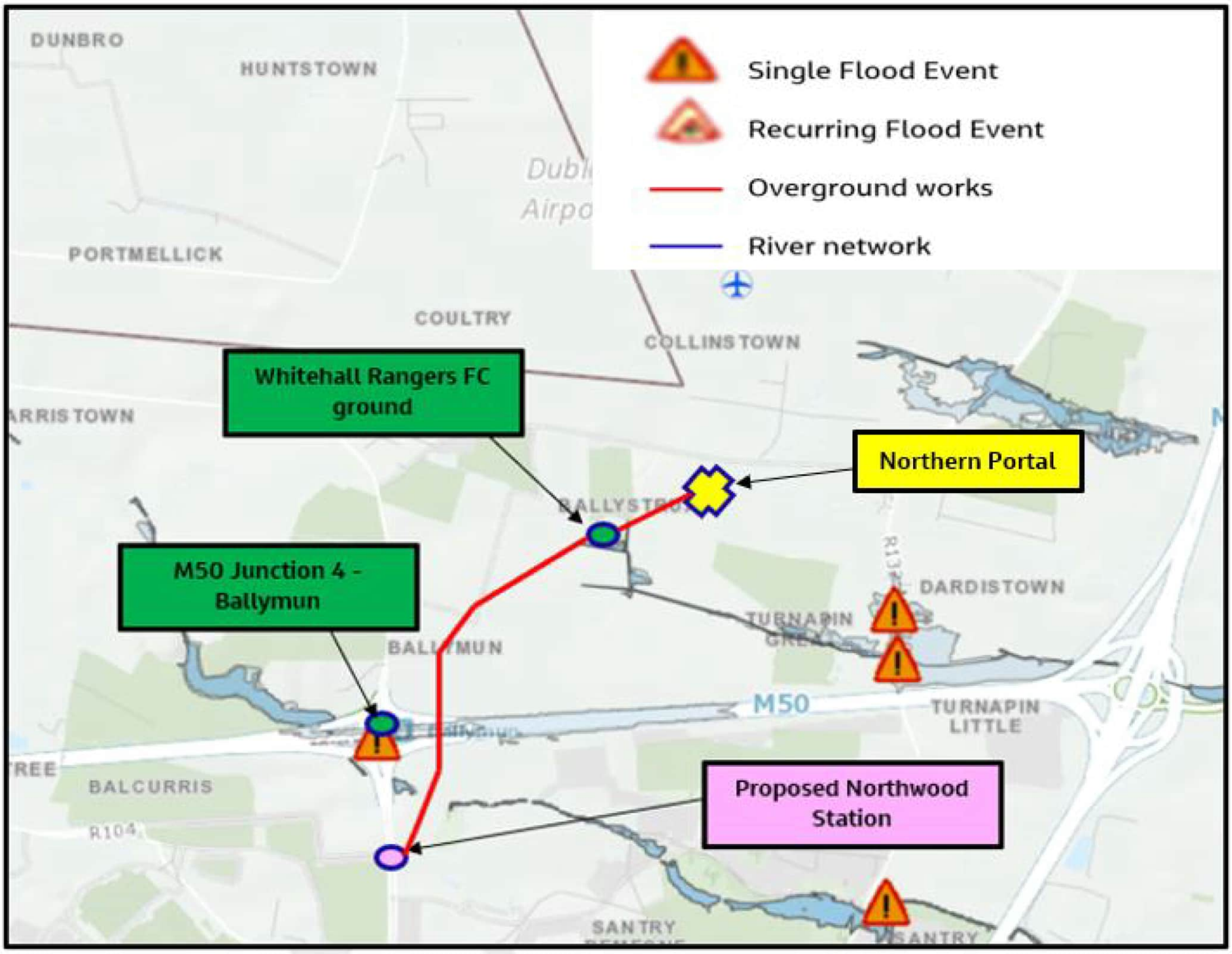


Figure 4.3 Past flood events between Southern Portal and Northwood Station

Seven flood events were identified on or immediately adjacent to the MetroLink scheme. Further details of these flood events are provided in Table 4.2 and Figure 4.4, Figure 4.5, Figure 4.6 and Figure 4.7 below.

Table 4.2 Flood events identified on or immediately adjacent to the MetroLink route

Location	Type	Date	Description
Lissenhall (North to Swords)	Fluvial – Broadmeadow River	9th and 10th August 2008	Refer to Figure 4.3. Flooding occurred in several parts of the Greater Dublin region due to a very heavy and prolonged rainfall. The Broadmeadow River recorded a water level of 1.62m (AD) at the OPW automatic recording hydrometric station (Stn. No. 08008) in the morning of 10th August 2008.
Estuary Roundabout (Swords)	Fluvial – Ward River	13th -15th November 2002	Refer to Figure 4.4. A total rainfall depth of 86.8 mm fell over the three-day period event and flooded Estuary Roundabout due to failure of the Surface Water network. A temporary contraflow emergency measure operated successfully and ensured that the R132 remained open to traffic.
Seatown Villas (Swords)	Pluvial / Artificial Drainage	6th and 7th November 1982	Refer to Figure 4.4. Widespread flooding occurred as a result of the extremely heavy rainfall on the 5th, 6th and 7th November 1982. Garden flooding affecting 25 properties, but flood waters did not actually enter any house. The problem arose due to blockage of a trunk sewer.
Pinnock Hill Roundabout (Swords)	Pluvial	April 2011/ Recurring	Refer to Figure 4.4. Flooding of N1 near the Travelodge hotel as the surface water system was overwhelmed. In times of very heavy rainfall, the surface water system floods affecting lands near the hotel. Council staff have implemented emergency works to divert flood waters onto the roundabout and reduce the risk of flooding to the nearby properties.
M50 at Junction 4 (Ballymun exit)	Pluvial	13th -15th November 2002	Refer to Figure 4.5. A total rainfall of 86.8 mm fell in the three-day period event and flooded the M50 at Ballymun Exit. Remedial measures to road drainage were undertaken at this location to reduce the risk of flooding.
Ballymun Road (proposed Collins Avenue Station)	Fluvial – Wad River	8th December 1954	Refer to Figure 4.6. The River Wad is culverted alongside Ballymun Road (short length of 36″ diameter concrete pipes) and at Wad Bridge on Ballymun Road (3′9″ x 4′6″ high stone arch). This flooding was due to blockage of the Wad Bridge, which caused the Wad River to flow down Ballymun Road with subsequent flooding on the Claremont Stream. The flooding was also due to insufficient capacity of the surface water drainage system of Ballymun Road

Location	Type	Date	Description
Deans Swift Bridge (proposed Griffith Park Station)	Fluvial – River Tolka	15th November 2002/ Recurring	Refer to Figure 4.7. This flood followed 2 days of very heavy rainfall. A previous rainfall event on 8th – 10th November had resulted in a very wet catchment which, combined with winter vegetation conditions, meant that a very high level of run-off took place on the 15th November, with little, if any infiltration/soakage into the ground.

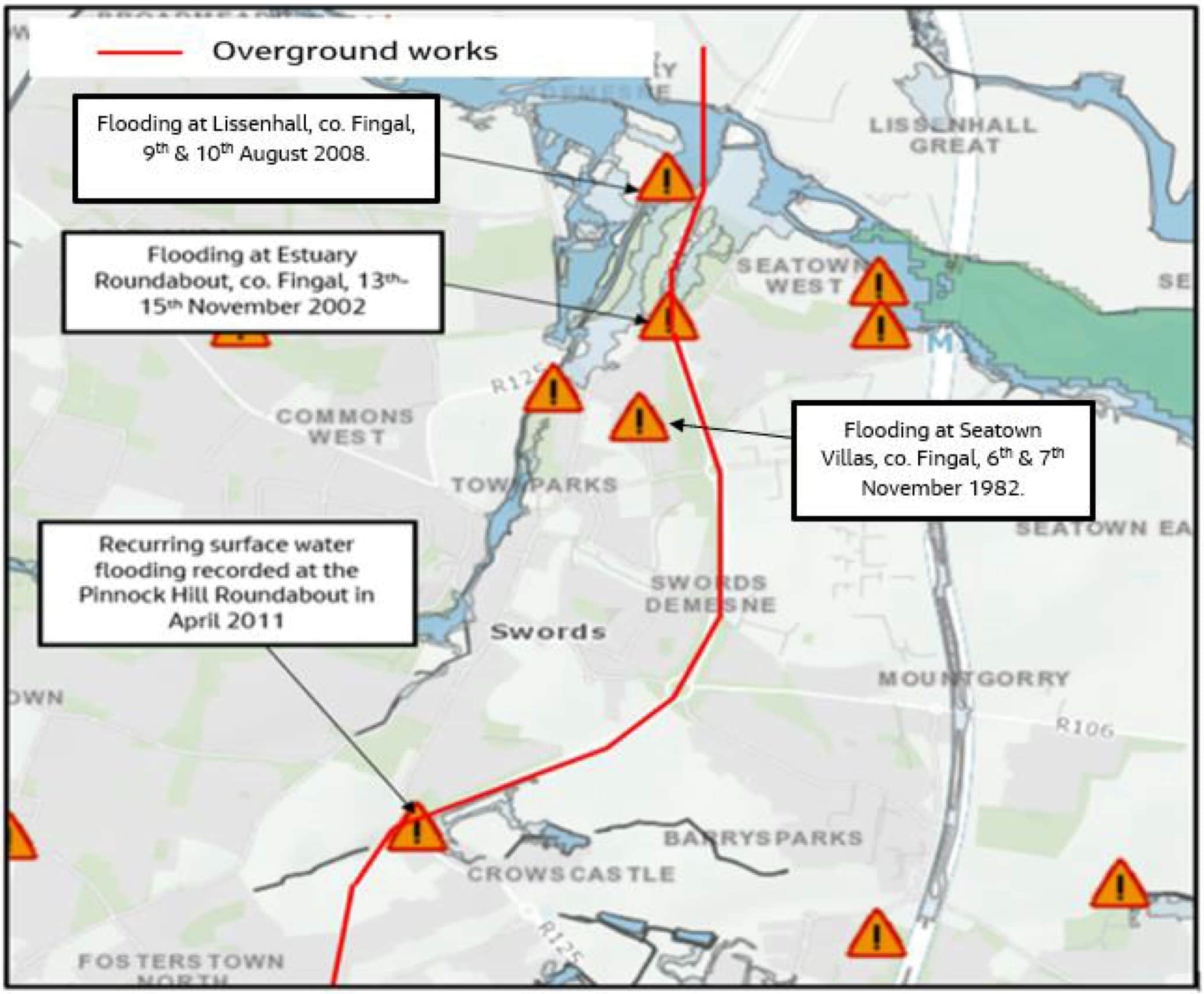


Figure 4.4 Locations of historic flooding near R132 (Swords).

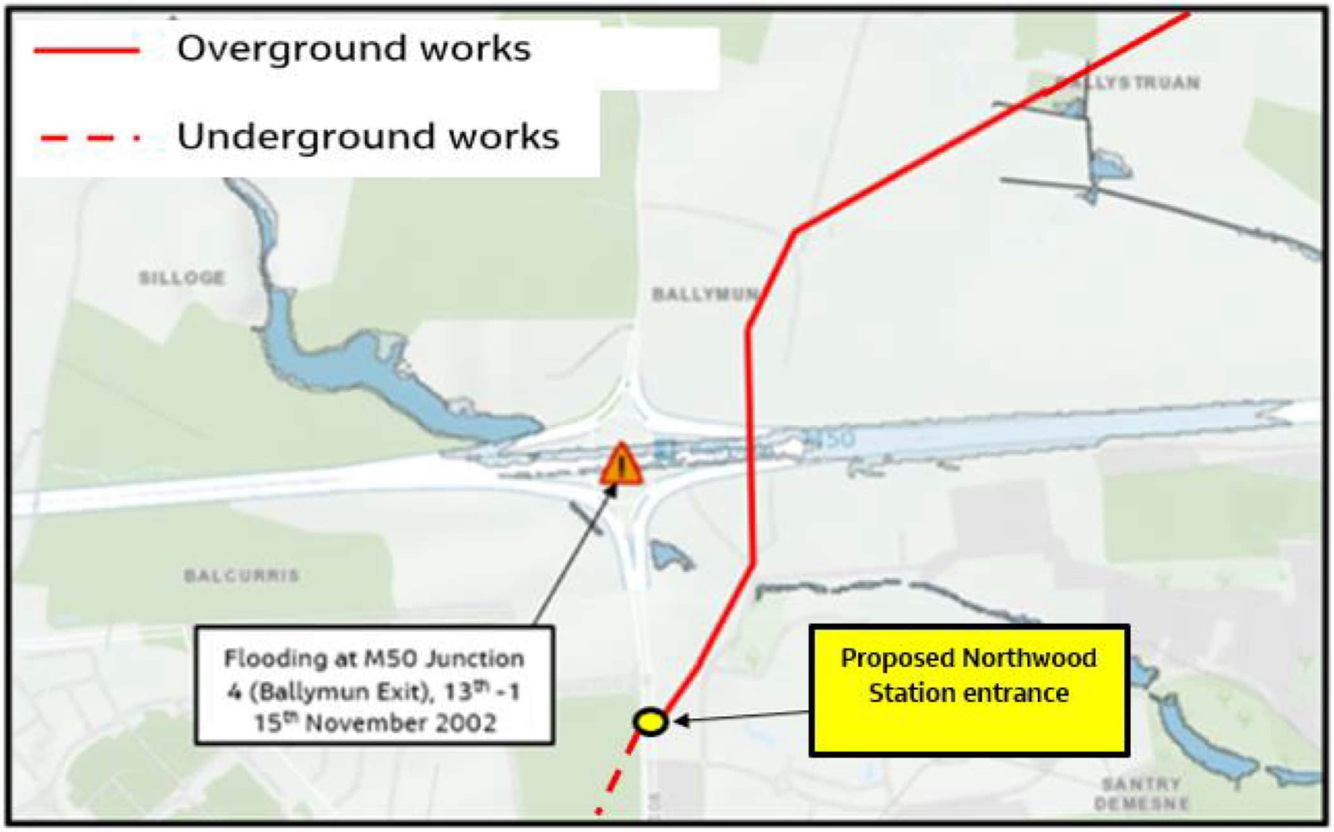


Figure 4.5 Locations of historic flooding near M50 Junction 4 - Ballymun

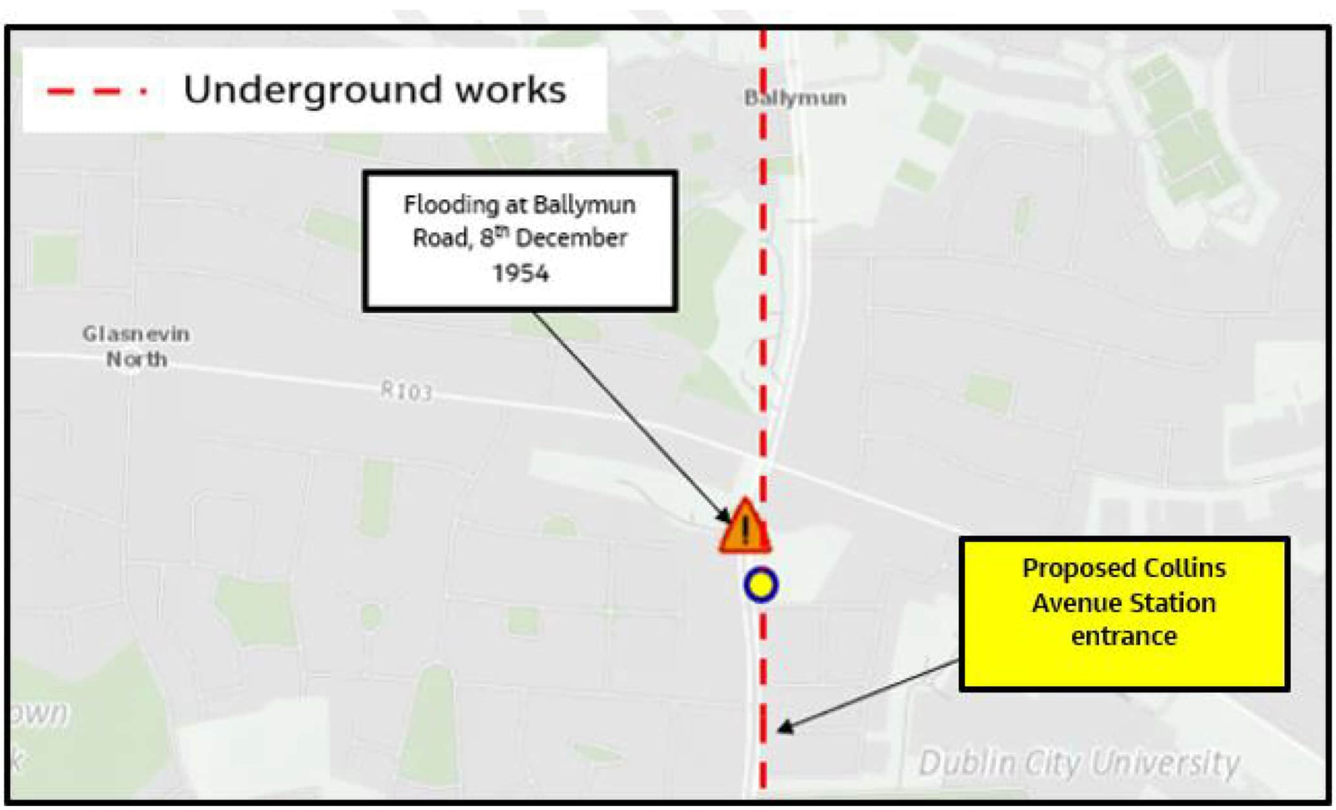


Figure 4.6 Locations of historic flooding near proposed Collins Avenue Station entrance

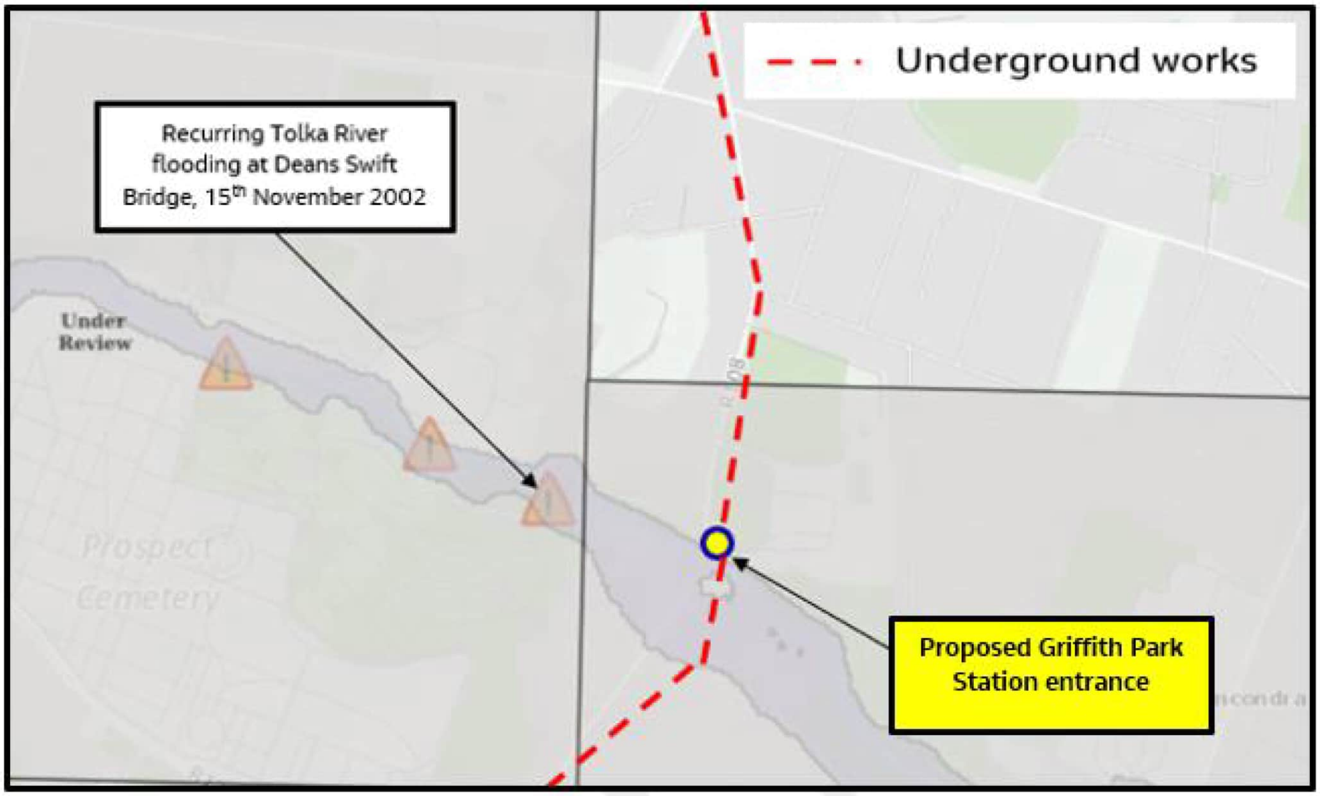


Figure 4.7 Locations of historic flooding near proposed Griffith Park Station entrance

4.3 OPW CFRAM Study Mapping

Flood risk along the Proposed Scheme was assessed against the outputs from the OPW Eastern Catchment Flood Risk Assessment and Management (CFRAM) Study. The applicable predicted flood extents for Broadmeadow River, Ward River, Gaybrook Watercourse, Sluice River, Mayne River, Santry River and River Liffey from the CFRAM study are presented in full in Appendix B, with extracts showing the predicted fluvial flood extents affecting the Proposed Scheme in Figure 4.8, Figure 4.10, Figure 4.11, Figure 4.12, Figure 4.13 and Figure 4.14.

The extracts showing the predicted coastal flood extents for the Proposed Scheme are represented in Figure 4.9 and Figure 4.15.

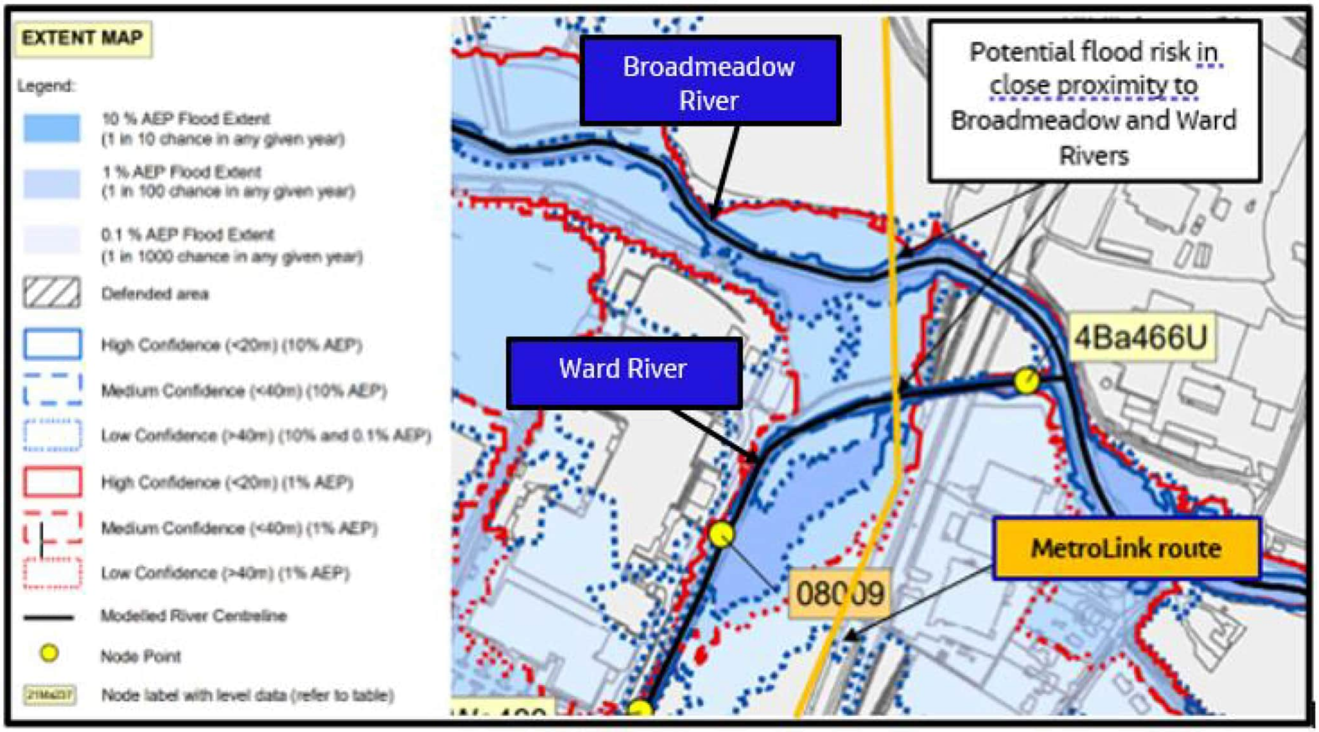


Figure 4.8 Extract of fluvial flood mapping from Eastern CFRAM study for the MetroLink at the crossing with Broadmeadow and Ward Rivers.

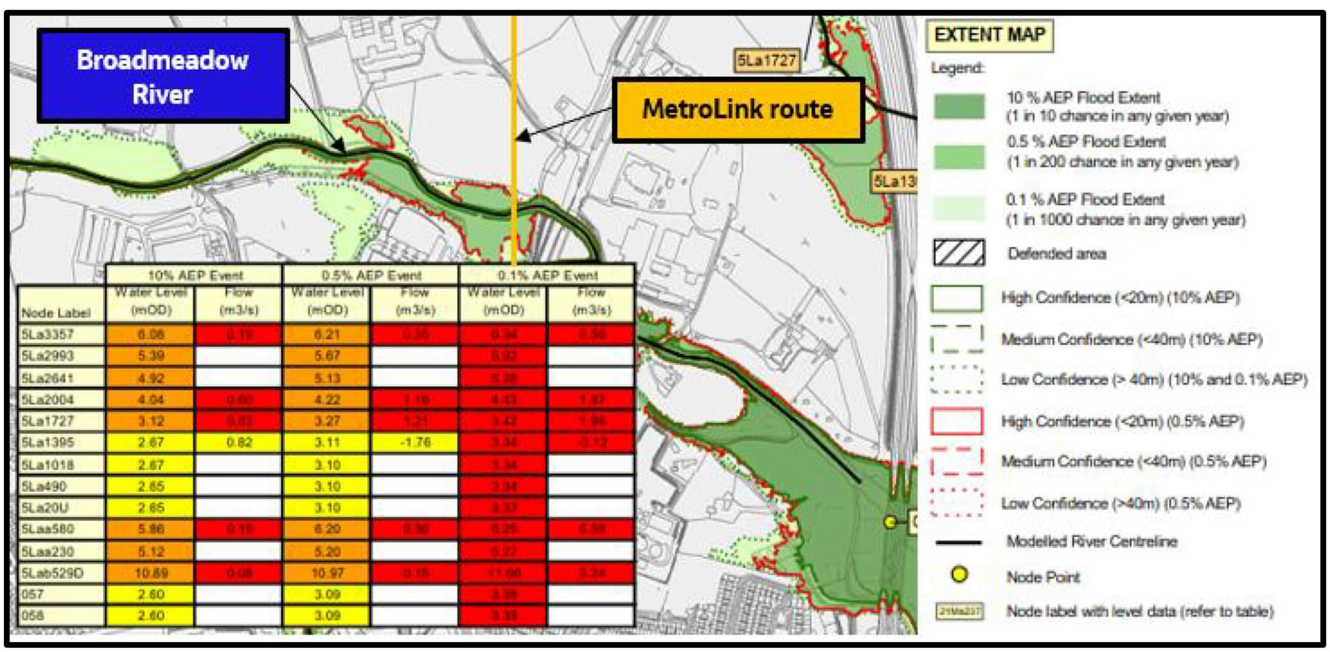


Figure 4.9 Extract of coastal flood mapping from Eastern CFRAM study for the MetroLink at the crossing with Broadmeadow and Ward Rivers.

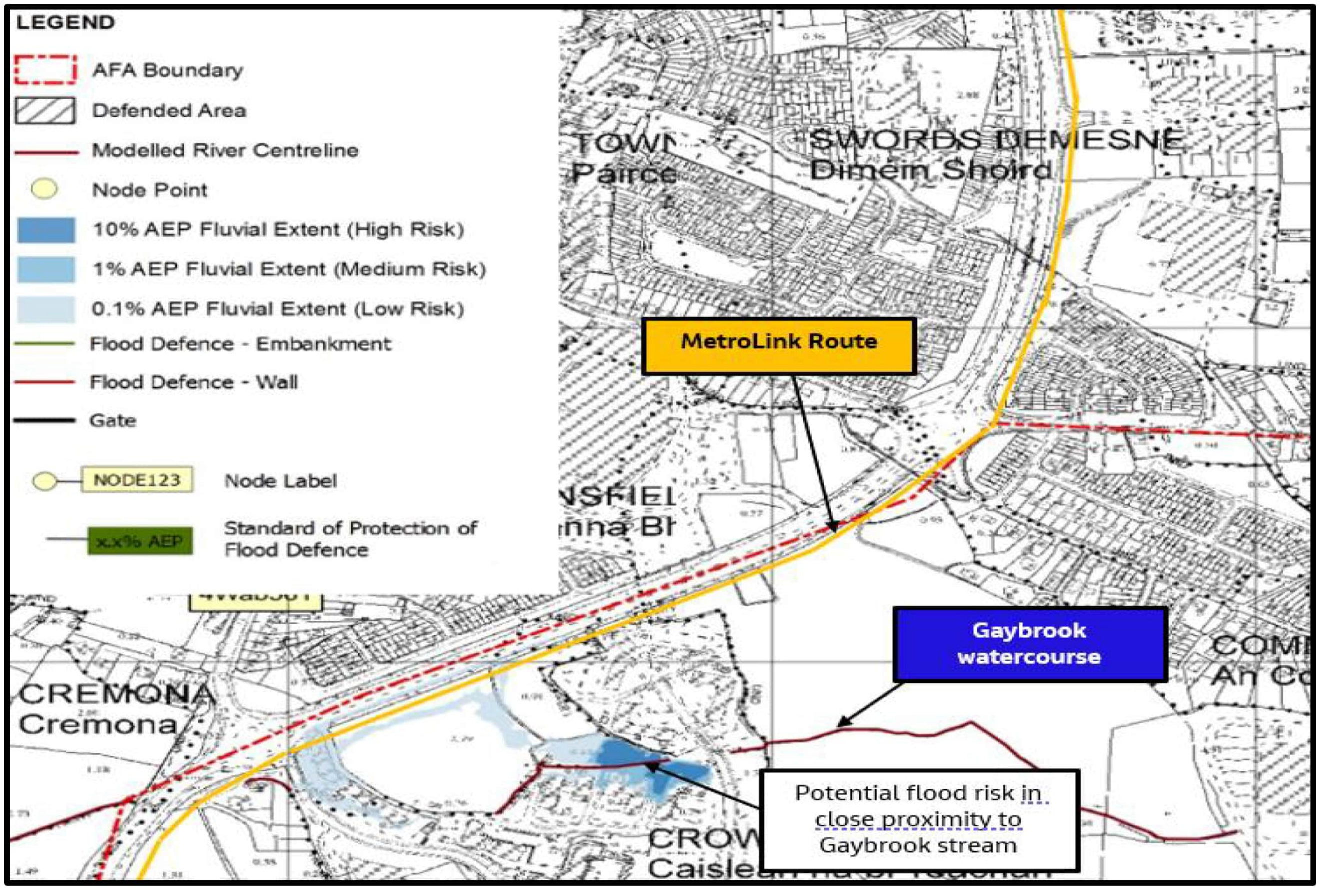


Figure 4.10 Extract of fluvial flood mapping from Eastern CFRAM study for the MetroLink at the crossing with Gaybrook stream.

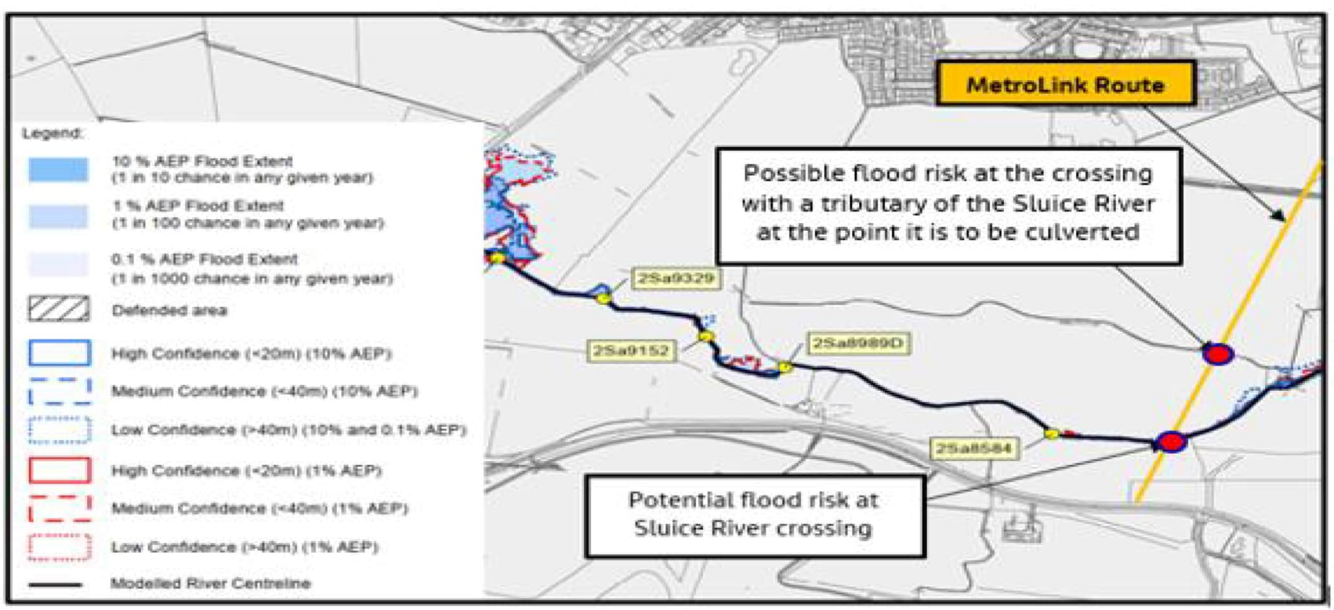


Figure 4.11 Extract of fluvial flood mapping from Eastern CFRAM study for the MetroLink at the crossing with Sluice River and one of its tributaries.

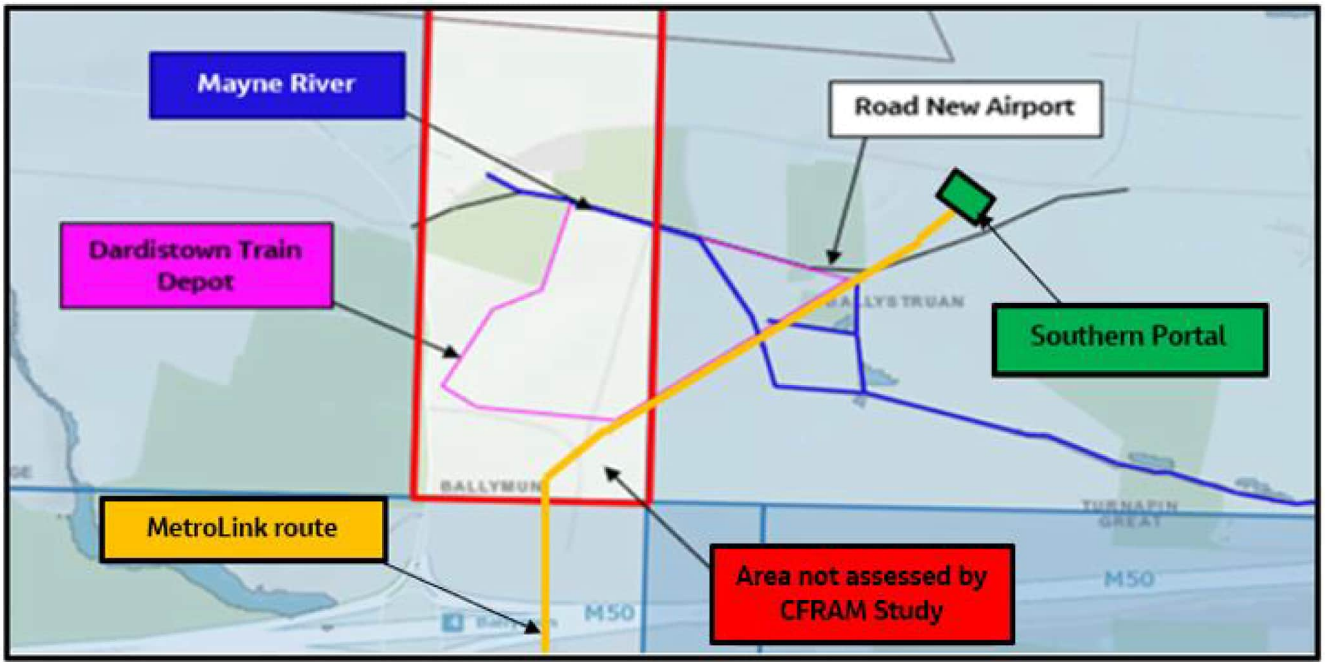


Figure 4.12 Extract of fluvial flood mapping from Eastern CFRAM study for the MetroLink at the crossing with Mayne River.

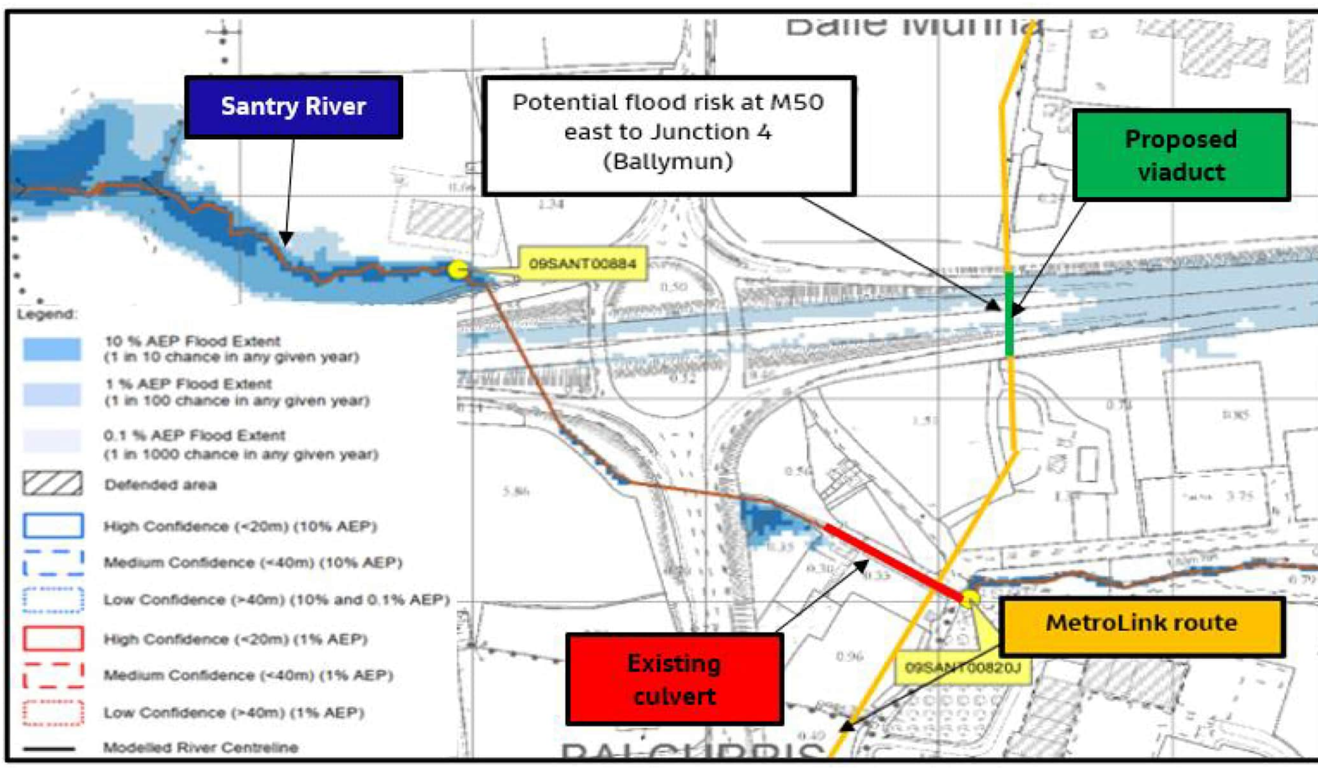


Figure 4.13 Extract of fluvial flood mapping from Eastern CFRAM study for the MetroLink scheme at the crossing with Santry River.

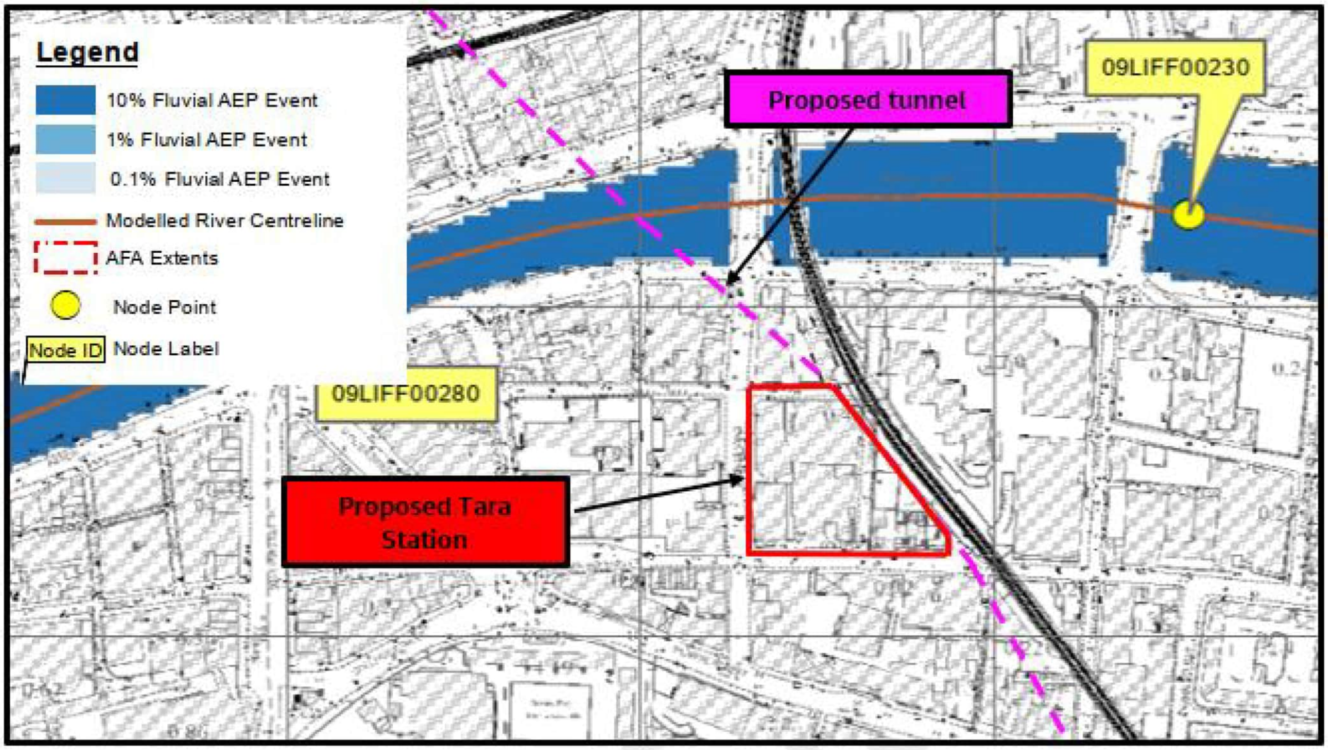


Figure 4.14 Extract of fluvial flood mapping from Eastern CFRAM study for the MetroLink scheme at the proposed Tara Station entrances

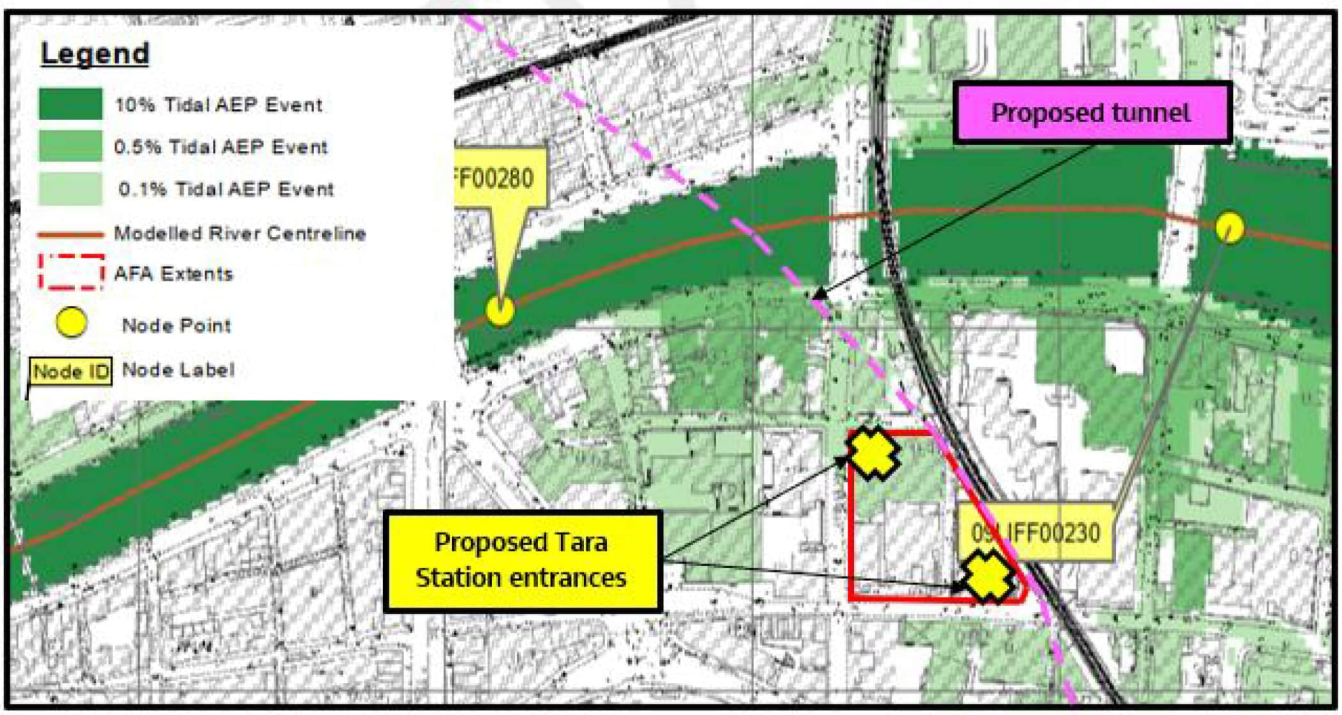


Figure 4.15 Extract of coastal flood mapping from Eastern CFRAM study for the MetroLink scheme at the proposed Tara Station entrances

The results from the CFRAM outputs for the Proposed Scheme can be summarised as follows:

- **Figures 4.8 & 4.9: Ward & Broadmeadow Rivers** – the Proposed Scheme runs through the floodplain near to the confluence of the two rivers. Parts of the lands crossed by the Proposed Scheme at risk from the 10% AEP Fluvial Flood with much of the scheme in this location located within the 1% AEP fluvial flood extent.

  The Proposed Scheme is also at risk of flooding from coastal sources within this reach. Based on the location and predicted flood extents however, fluvial flooding would appear to be the dominant source.

- **Figure 4.10: Gaybrook** - the Proposed Scheme crosses lands at risk of flooding in the 0.1% AEP flood extent associated with the Gaybrook.

  There is no risk of coastal flooding associated with the Gaybrook identified for the Proposed Scheme.

- **Figure 4.11: Sluice River** – the Proposed Scheme crosses the Sluice River. There appears to be little natural floodplain with flows contained in bank at the scheme crossing.

  There is no risk of coastal flooding associated with the Sluice River identified for the Proposed Scheme.

- **Figure 4.12: Turnapin Stream (Mayne River) -** the Proposed Scheme crosses the Turnapin Stream, which is a tributary of the Mayne River. There appears to be little natural floodplain with flows contained in bank at the scheme crossing.

  There is no risk of coastal flooding associated with the Turnapin Stream identified for the Proposed Scheme.

- **Figure 4.13: Santry River** – the Proposed Scheme crosses the Santry River. The Santry is in culvert where it is crossed by the Proposed Scheme.

  There is no risk of coastal flooding associated with the Santry River identified for the Proposed Scheme.

- **Figures 4.14 & 4.15: River Liffey** - the Proposed Scheme crosses beneath the River Liffey. The Proposed Scheme is in-tunnel where it passes beneath the Liffey so does not affect river flows.

  The CFRAM mapping shows that there is no risk of fluvial flooding to the Proposed Scheme as all flows are contained in-bank. Tara Street Station which forms part of the proposed scheme is located in lands shown to be at risk of coastal flooding from the Liffey.

4.4 National Indicative Flood Mapping (NIFM)

The National Indicative Flood Mapping (NIFM) data was produced for all catchments greater than 5km^2 that were not covered by the National CFRAM Programme. All major watercourses that are crossed by the Proposed Scheme were covered by the CFRAM programme with the exception of the River Tolka.

Figure 4.16 below shows the predicted flood extent for the River Tolka where it is crossed by the proposed scheme. The Proposed Scheme is in tunnel, passing beneath the River Tolka so does not affect river flow. Griffith Park Station, which is part of the Proposed Scheme, is located outside of the 0.1% AEP flood extent.

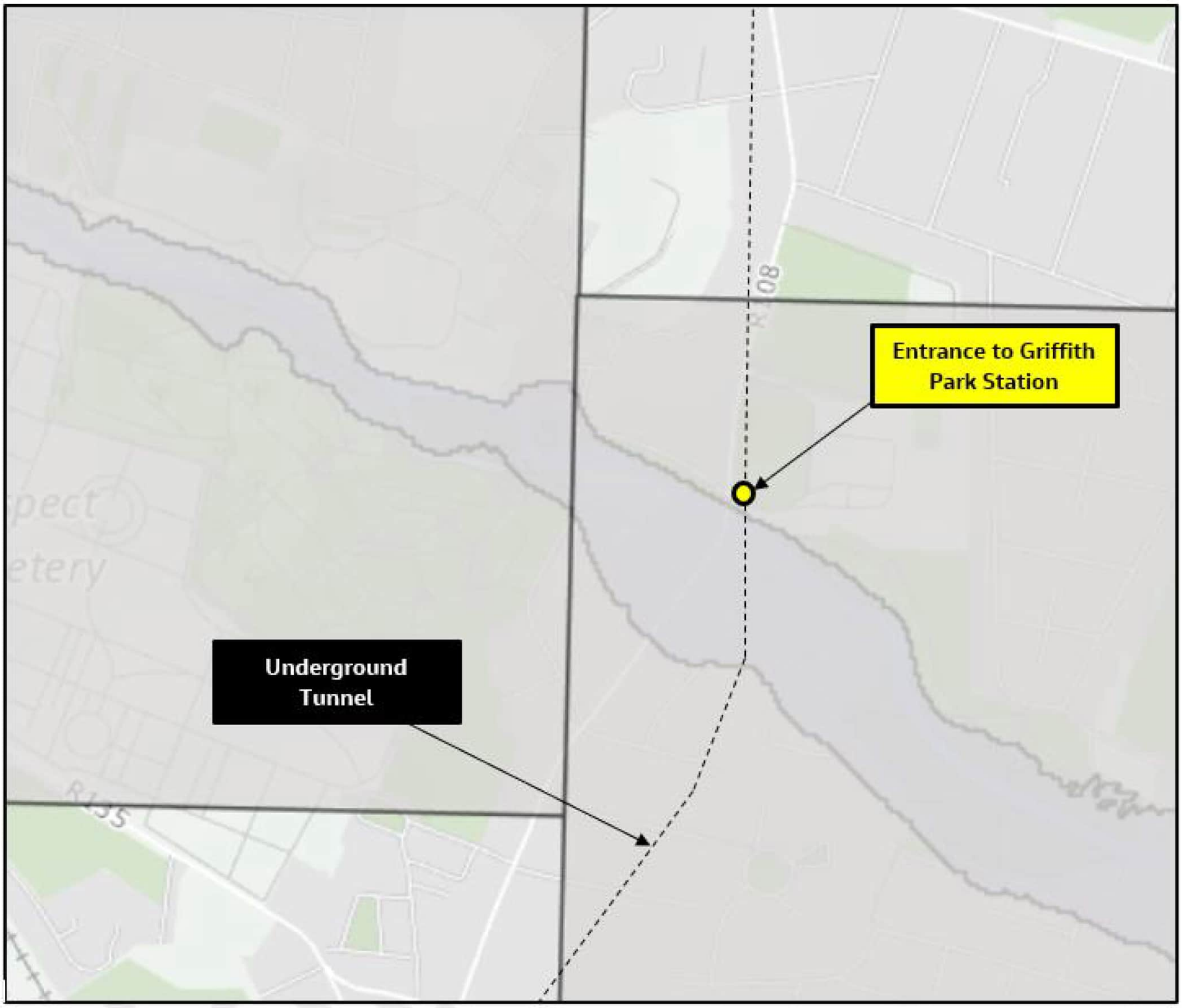


Figure 4.16 Extract of the 0.1 AEP fluvial flood extents for River Tolka (NIFM)

4.5 Benefitting Areas

Existing flood relief schemes (FRS) are present along the Rivers Tolka and Liffey where it is crossed by the Proposed Scheme.

Figure 4.17 shows the Area Benefitting from Defences (ABD) associated with the River Tolka FRS. The defences are stated as providing a 1% AEP standard of flood protection. Griffith Park Station, which forms part of the Proposed Scheme, is located outside of the Area Benefitting from Defences.

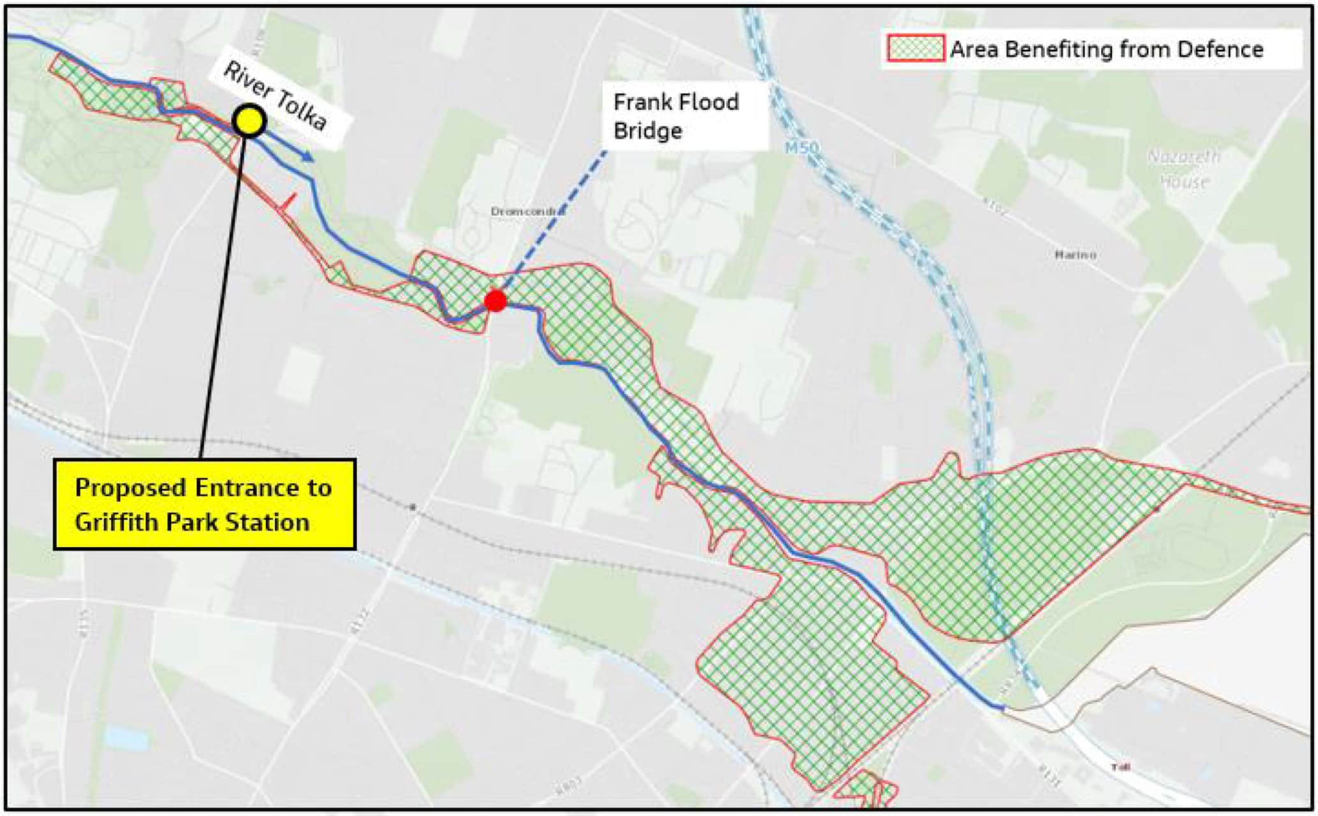


Figure 4.17 River Tolka FRS Area Benefitting from Defence

The remained of the Proposed Scheme is in tunnel where it passes beneath the River Tolka FRS Area Benefitting from Defence. The Proposed Scheme will have no impact on the performance of the River Tolka FRS.

Figure 4.18 shows the Area Benefitting from Defences for the River Liffey associated with the Spencer Dock FRS and River Dodder FRS. The Spencer Dock FRS provides a 0.5% AEP standard of protection, and the River Dodder FRS provides a 1% AEP standard of protection. The Proposed Scheme is in tunnel and will not affect the performance of either FRS.

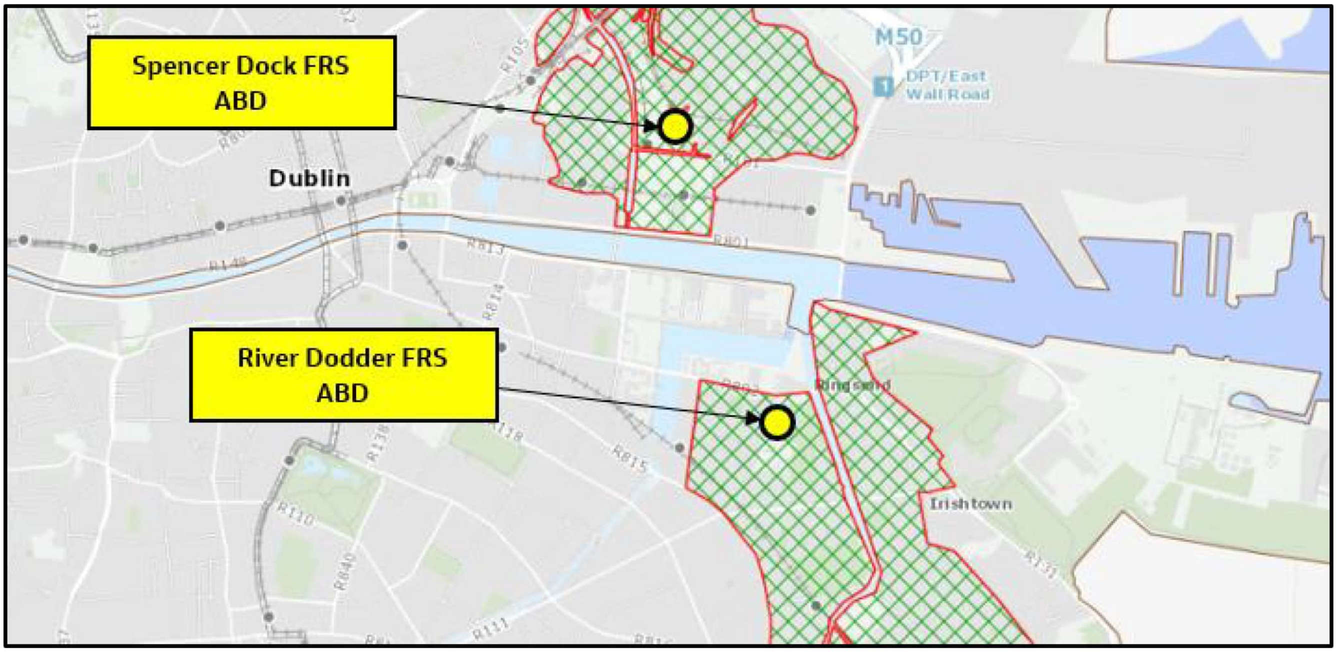


Figure 4.18 Spencer Dock FRS and River Dodder FRS Area Benefitting from Defence (ABD)

4.6 Minor Watercourses & Ditches

4.6.1 Park & Ride

The Proposed Scheme includes the construction of a Park & Ride at Lissenhall (around Ch. 1 + 100). Figures 4.19 and 4.20 show the proposed Park & Ride, which will impact on field drains that are part of the Staffordstown River Catchment. These ditches will be diverted as part of the Proposed Scheme.

There is no published flood risk information of any of these ditches. No historic records of flooding were identified for either ditch.

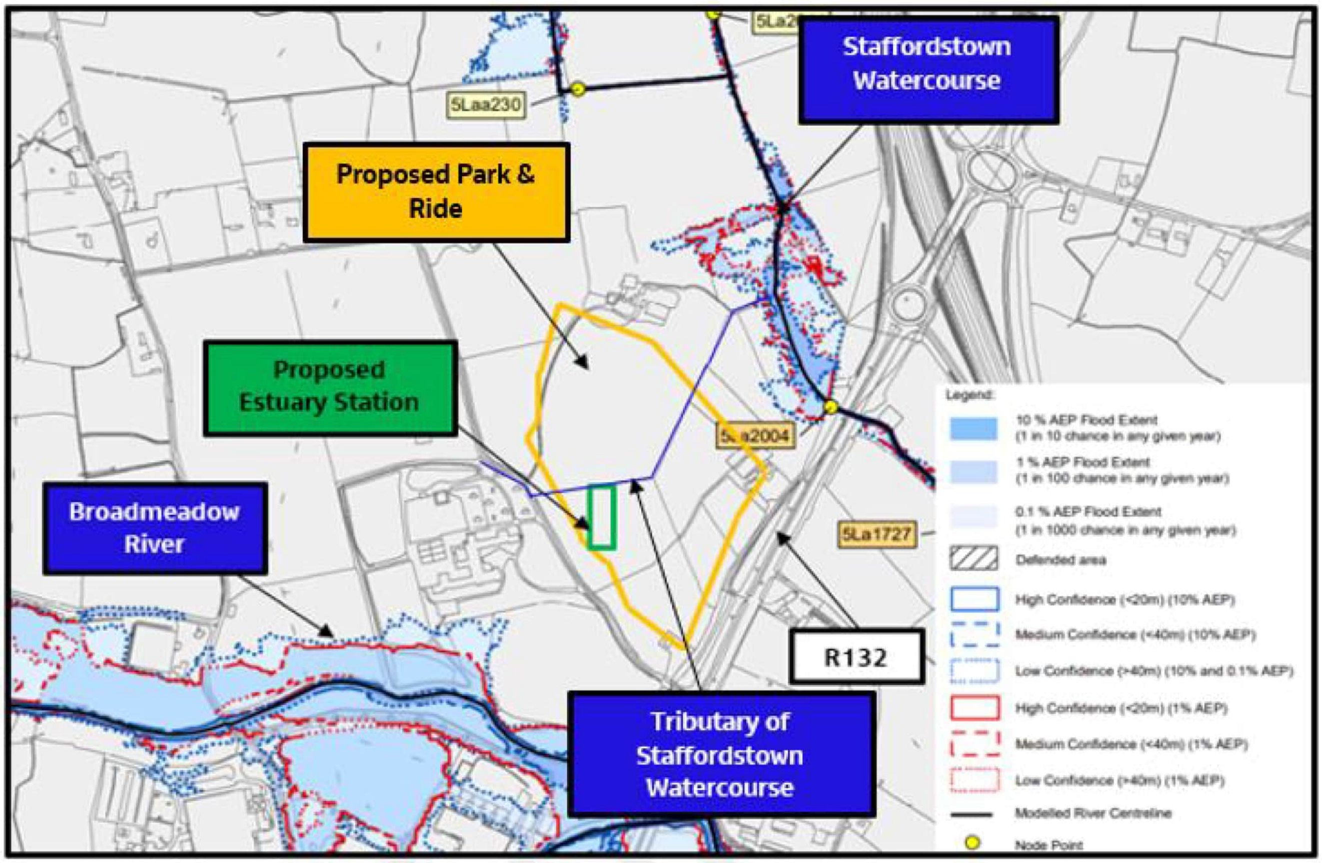


Figure 4.19 Extract of fluvial flood mapping from CFRAM study around the proposed watercourse diversion (around Ch. 1 + 100).

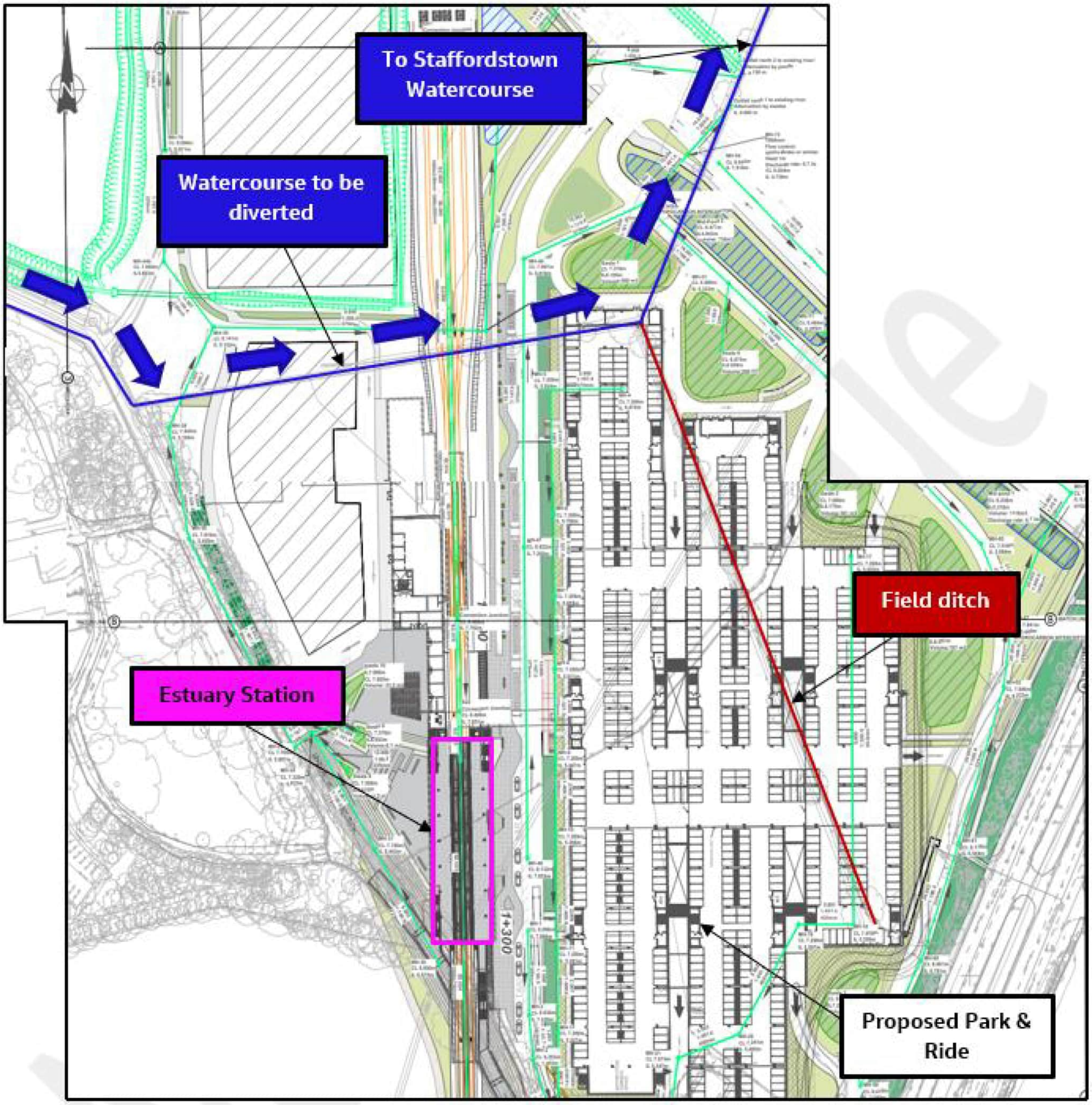


Figure 4.20 Proposed works for the MetroLink scheme at Lissenhall

4.6.2 Dardistown Depot

A Depot is proposed as part of the Proposed Scheme in Dardistown, to the south of Dublin Airport (around Ch. 6 + 800). Figure 4.21 shows the proposed Dardistown Depot and Station, which will impact on the Turnapin Stream and a number of minor ditches and drains that form part of the Mayne River catchment. These watercourses will be diverted as part of the Proposed Scheme.

There is no published flood risk information of any of these ditches. No historic records of flooding were identified for any of the ditches.

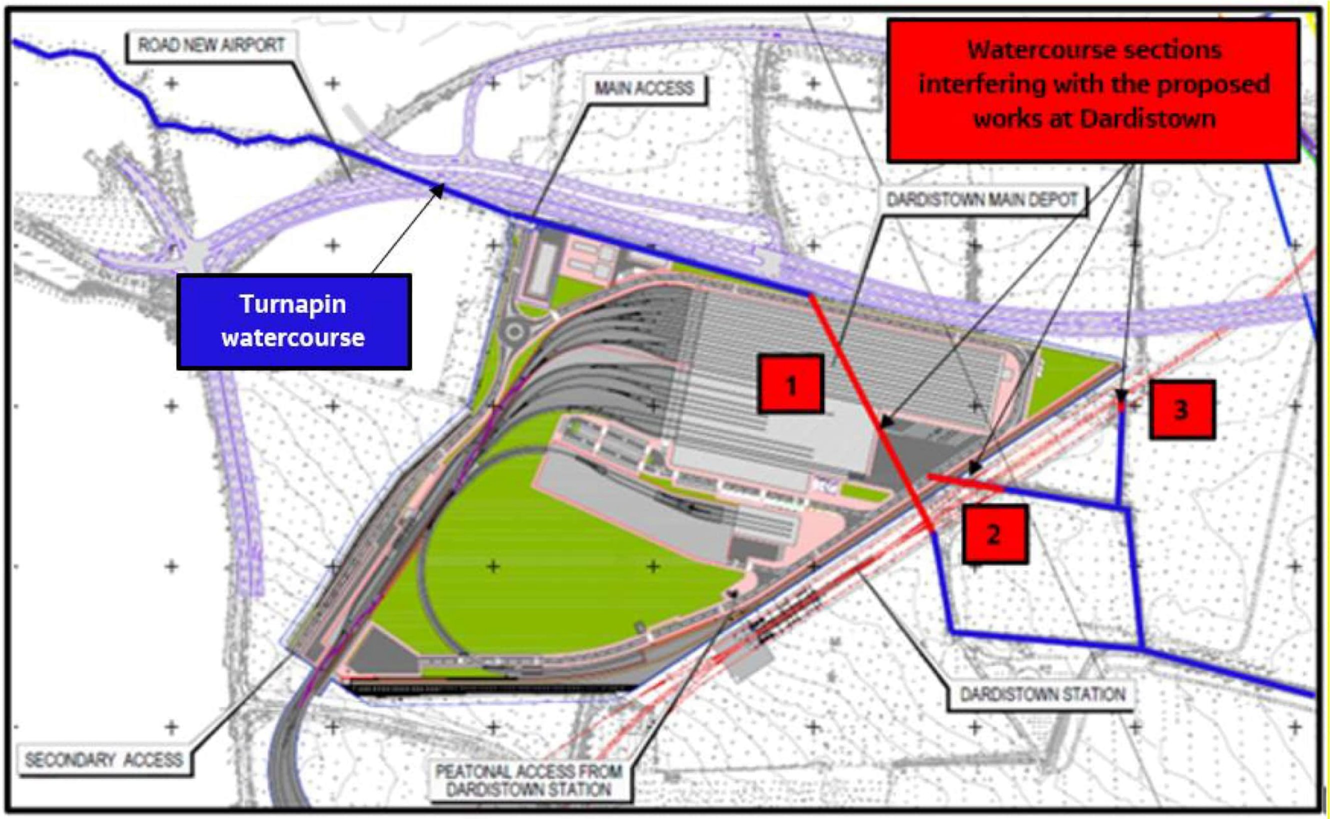


Figure 4.21 Proposed works for the MetroLink scheme at Dardistown

4.7 Canals & Waterways

4.7.1.1 Royal Canal on Prospect Road (Ch. 14 + 900)

The Proposed Scheme passes beneath the Royal Canal. Glasnevin Station, which forms part of the Proposed Scheme is proposed to be constructed in close proximity to the canal; refer to Figures 4.22 and 4.23.

Water levels along the canal are regulated by a series of lock gates and waste-weirs. It is thought that there are insufficient flows in the canal to pose a flood risk to the proposed MetroLink scheme including Glasnevin Station. There are no records of flooding from the Royal Canal in this location.

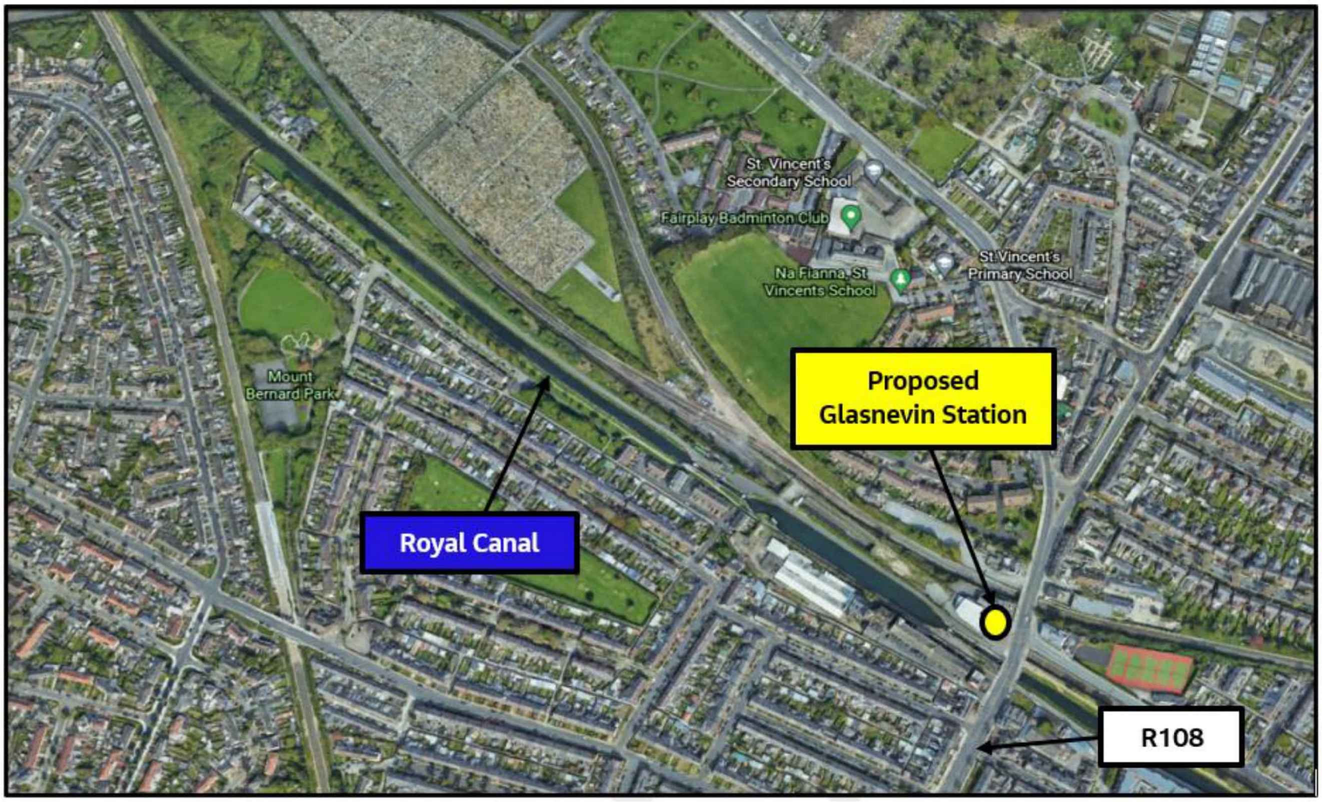


Figure 4.22 Location of the proposed Glasnevin Station

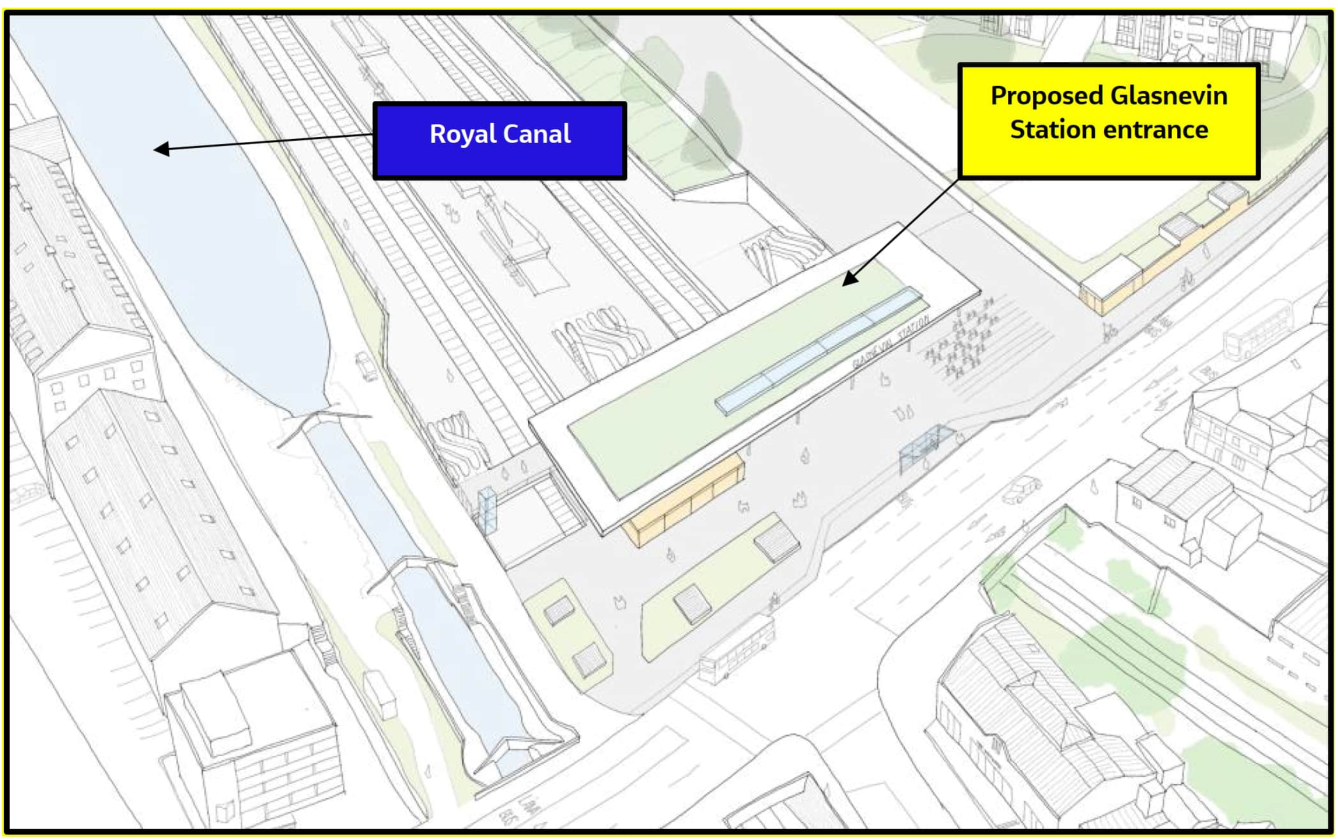


Figure 4.23 Location of the proposed Glasnevin Station entrance

4.7.1.2 Grand Canal, on Grand Parade, Ch. 19 + 300.

The Proposed Scheme passes beneath the Royal Canal. Charlemont Station, which forms part of the Proposed Scheme is proposed to be constructed in close proximity to the canal; refer to Figures 4.24 and 4.25.

It is thought that there are insufficient flows in the canal to pose a flood risk to the proposed MetroLink scheme including Charlemont Station. There are no records of flooding from the Grand Canal in this location.

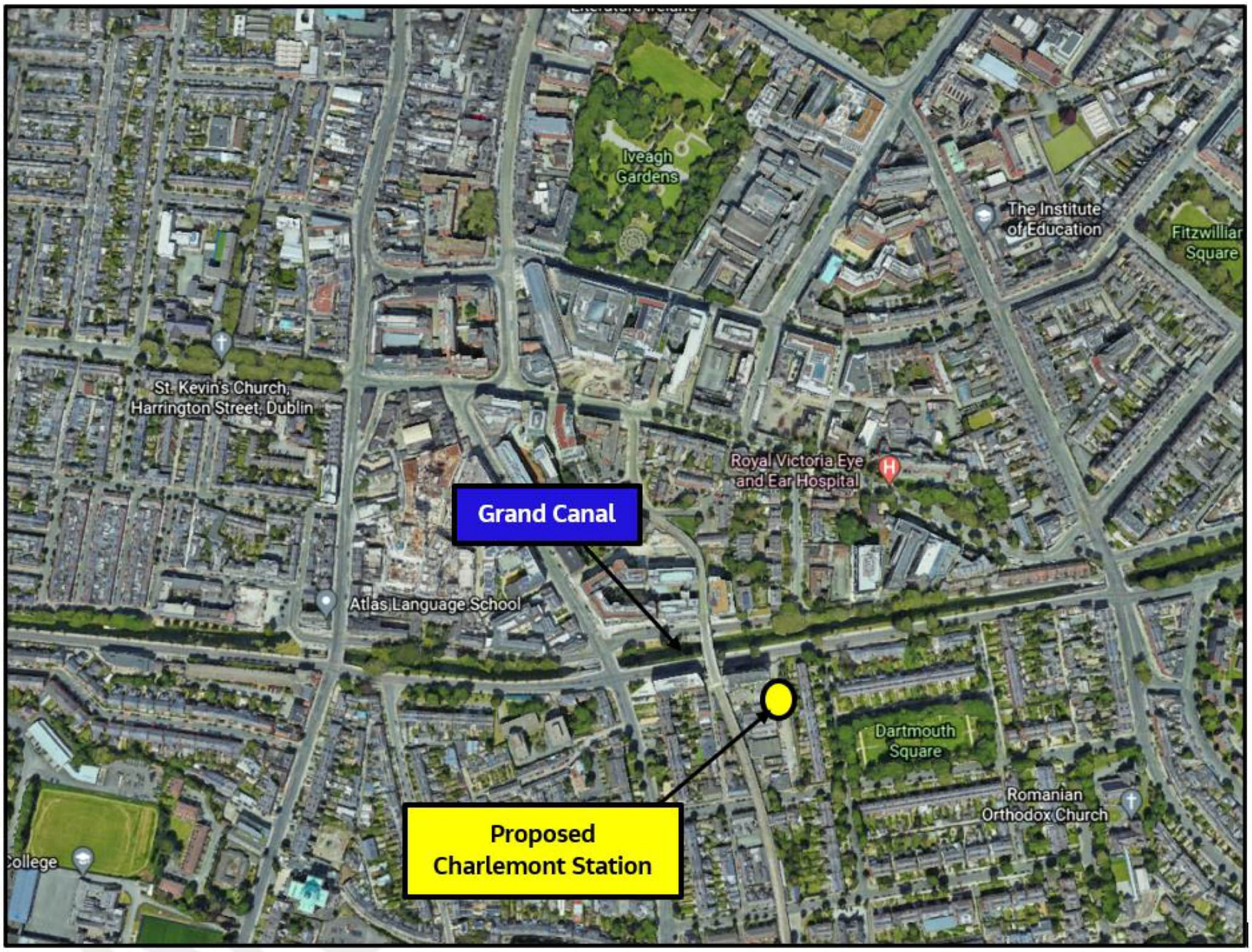


Figure 4.24 Location of the proposed Charlemont Station

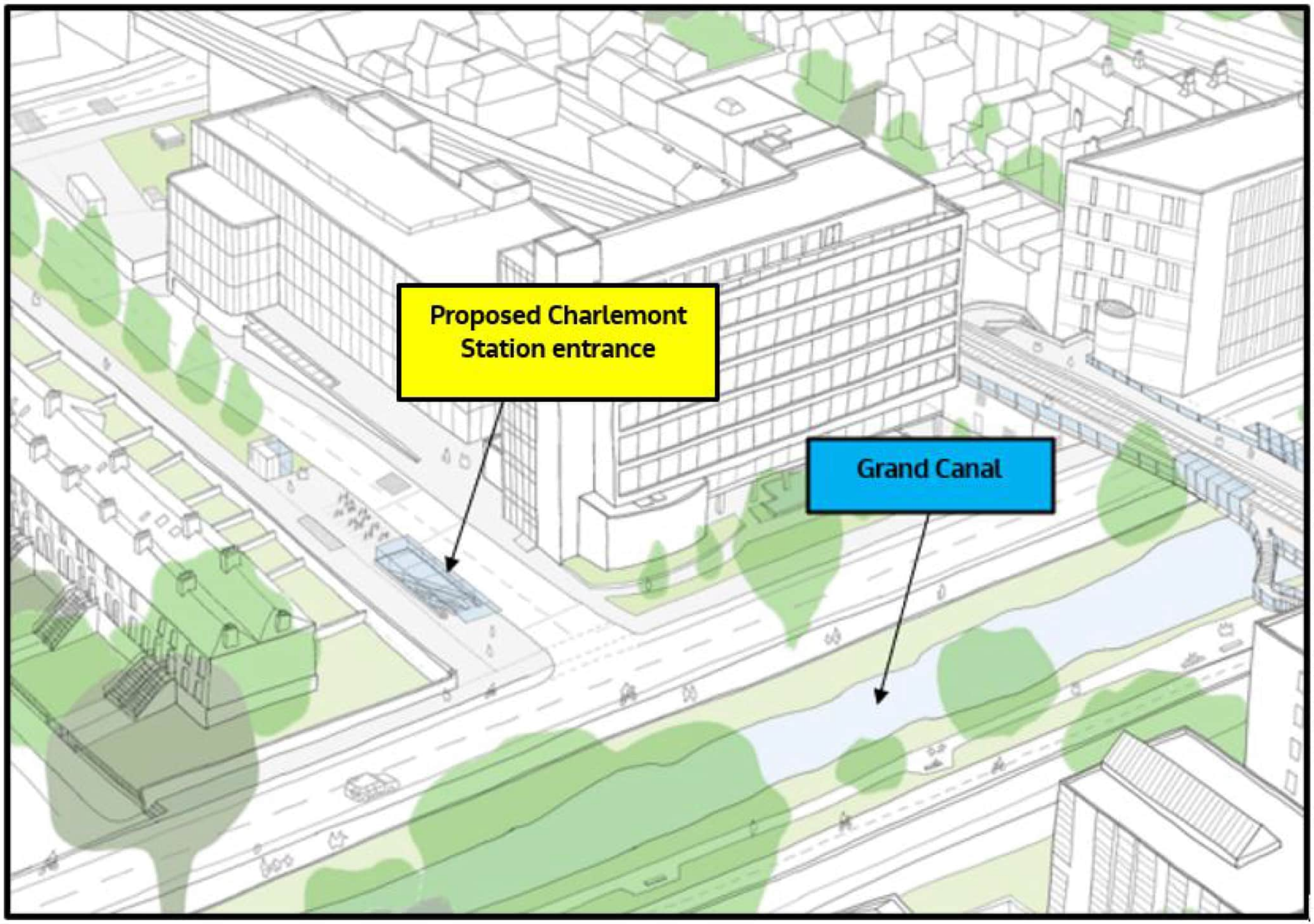


Figure 4.25 Location of the proposed Charlemont Station entrance

4.8 Irish Coastal Protection Strategy Study (ICPSS)

The Irish Coastal Protection Strategy Study (ICPSS) produced for the OPW in 2013 provides an overview of coastal flood hazard and risk in Ireland. Flood maps were produced for the 0.5% and 0.1% AEP flood events. A volume of maps is also available which represent a projected future scenario for the year 2100 and include allowances for projected future changes in climate. Specifically, these represent the Mid-Range Future Scenario and allow for 500mm rise in Mean Sea Level.

Flood mapping for the 0.5% and 0.1% AEP present day flood extent for the Proposed Scheme are illustrated Figure 4.26 and Figure 4.27.

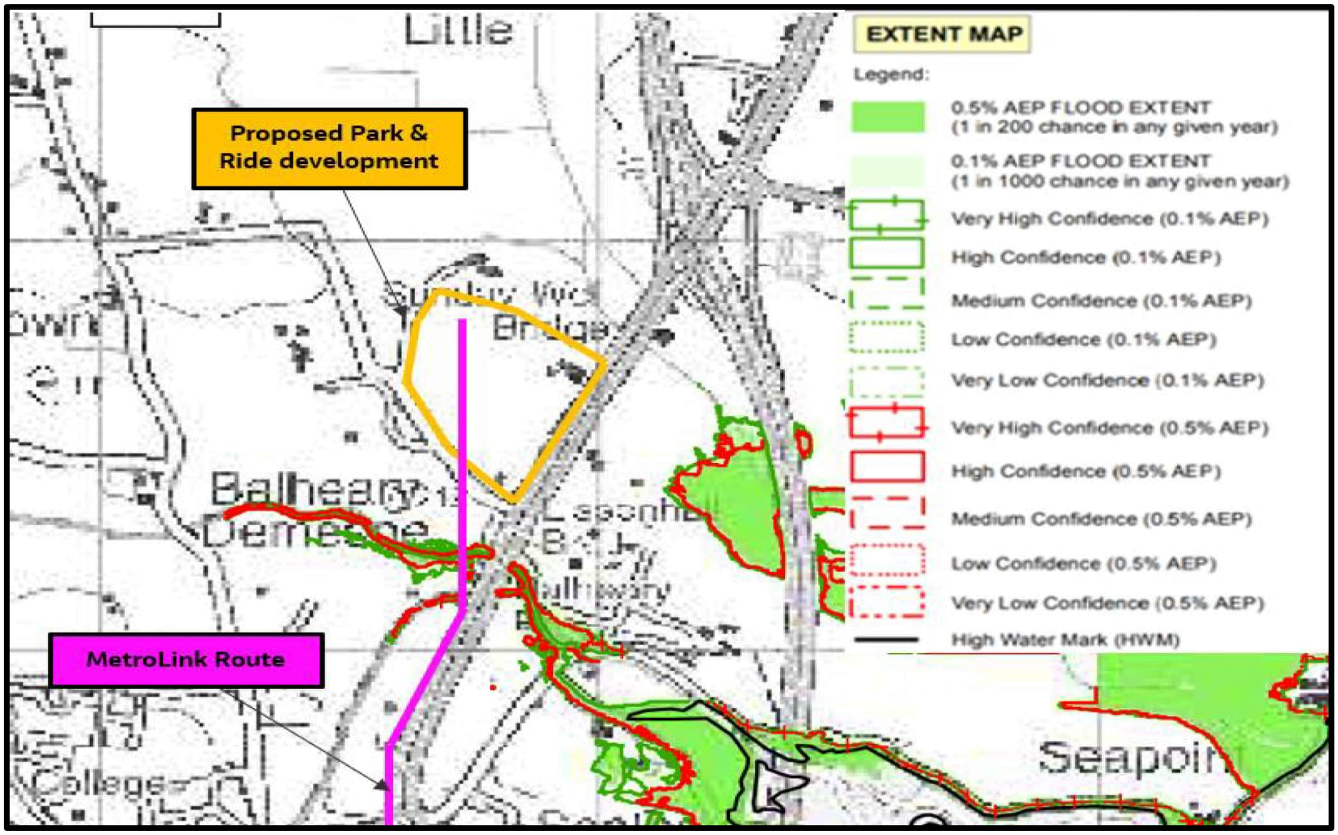


Figure 4.26 ICPSS Coastal Mapping – Ward & Broadmeadow Rivers at Lissenhall

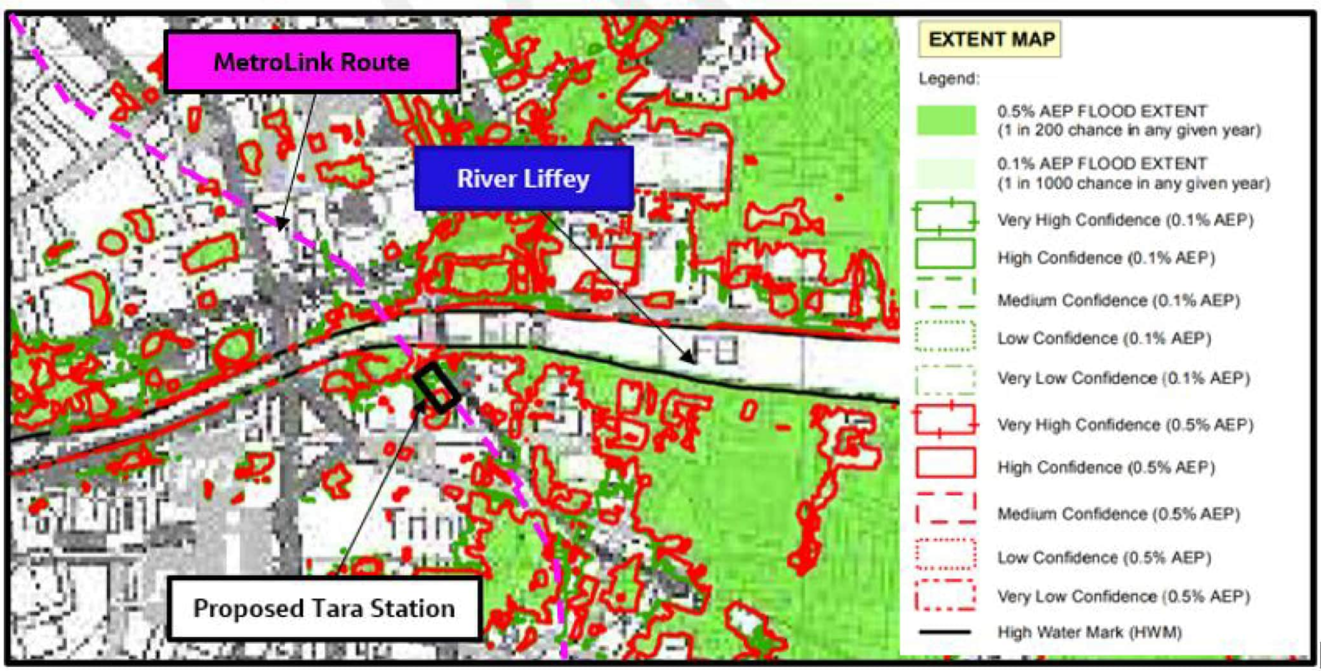


Figure 4.27 ICPSS Coastal Mapping River Liffey

ICPSS flood mapping shows that there is a risk of coastal flooding at Lissenhall due to tidal flows backing-up the Ward and Broadmeadow Rivers. As noted however, the predicted extent of coastal flooding is not as extensive as from fluvial flooding.

that the proposed Tara Station and the proposed works at the crossing with Broadmeadow and Ward Rivers are potentially at risk of coastal flooding in a 0.5% Tidal AEP event.

There are several flood defence schemes in place to mitigate against the risk at Tara Station. Quay walls on both sides of the River Liffey from East Wall Road Bridge to the Sean Heuston Bridge protect the majority of Dublin City Centre from coastal flooding. There are also ongoing works at South Campshires area from Butt Bridge to Cardiff Lane that will protect the area from an estimated 0.5% AEP (200-year) flood event plus climate change. Therefore, it can be concluded that the wall should provide adequate protection against current and future coastal flood risks.

4.9 Fluvial & Coastal Flood Risk Summary

4.9.1 Major River & Watercourse Crossings

Six locations have been identified where the MetroLink Scheme crosses a major watercourse. These locations and an outlined of the nature of the crossing made by the Proposed Scheme at these locations are summarised below in Table 4.3. Further details of the flood risk associated with each crossing are provided in Section 5.

Table 4.3 MetroLink Scheme Watercourse Crossings with Potential Flood Risk Impact

Watercourse	Chainage	Flood Risk Source		Crossing details
		Fluvial	Coastal	
Broadmeadow and Ward Rivers	1 + 540 & 1 + 625	✓	✓	The Proposed Scheme includes a Viaduct crossing of the two rivers.
Gaybrook Stream	4 + 450	✓		The existing culvert crossing retained and not modified by construction of the Proposed Scheme.
Unnamed Tributary of Sluice River	5 + 765	✓		The tributary is placed in a new culvert where it is crossed by the Proposed Scheme.
Sluice River	5 + 963	✓		The Sluice River is placed in a new culvert where it is crossed by the Proposed Scheme.
Santry River	10 + 000	✓		The Proposed Scheme crosses the Santry River where the watercourse is in culvert. This existing culvert crossing retained underneath the proposed tracks and is not modified.

Table 4.4 lists the watercourses that are crossed but not impacted by the proposed scheme as it is in tunnel. For completeness, this also includes the Royal Canal and Grand Canal. As there are no flood risk implications arising from these crossings, they are not considered any further in this report.

Table 4.4 MetroLink Scheme Watercourse Crossing with no Potential Flood Risk Impact

Watercourse	Chainage	Flood Risk Source		Crossing details
		Fluvial	Coastal	
River Tolka	13 + 930	✓		The Proposed Scheme is underground in-tunnel where it passes beneath the River Tolka. The scheme has no interface with the Tolka at the crossing.
River Liffey	17 + 150 – 17 + 250	✓	✓	The Proposed Scheme is underground in-tunnel where it passes beneath the River Liffey. The scheme has no interface with the Liffey at the crossing.
Royal Canal	14 + 950	N/A	N/A	The Proposed Scheme is underground in-tunnel where it passes beneath the Royal Canal. The scheme has no interface with the Royal Canal at the crossing.
Grand Canal	19 + 260	N/A	N/A	The Proposed Scheme is underground in-tunnel where it passes beneath the Grand Canal. The scheme has no interface with the Grand Canal at the crossing.

4.9.2 Minor Watercourses

Table 4.5 lists the minor watercourses that are not identified by CFRAM, NFIM or other flood risk mapping but are potentially impacted by the Proposed Scheme. Further details of the flood risk associated with the proposed works along each watercourse are provided in Section 5.

Table 4.5 MetroLink Scheme Minor Watercourses with Potential Flood Risk Impact

Watercourse	Chainage	Flood Risk Source		Crossing details
		Fluvial	Coastal	
Ditch within the catchment of the Staffordstown River	1 + 100	✓		Ditch is located beneath the footprint of the proposed Park & Ride at Estuary Station. The ditch is to be diverted to allow for the construction of the Proposed Scheme.
Turnapin Stream	8 + 600	✓		The Turnapin Stream is a tributary of Mayne River. The stream is to be diverted to allow for the construction of the proposed Dardistown train depot.

4.9.3 Stations & Indirect Impacts

In addition to the direct crossings or impacts on the watercourses listed in Sections 4.9.1 and 4.9.2 above, the Proposed Scheme includes 2 No. proposed underground stations that are located in close proximity to a watercourse and/or associated floodplain. The entrances to the stations are at ground level so could provide a potential route for floodwaters to affect Proposed Scheme. Further details are provided in Table 4.6 below with a more detailed flood risk assessment in Section 5.

Table 4.6 Proposed MetroLink Stations at Potential Flood Risk

MetroLink Station	Chainage	Flood Risk Source		Crossing details
		Fluvial	Coastal	
Griffith Park	13 + 875	✓		Proposed entrance to Griffith Park station to be located in close proximity to River Tolka.
Tara Street	17 + 400		✓	Proposed entrance and station located within the floodplain of the River Liffey

4.10 Rainfall Flood Extents

Pluvial flooding occurs during periods of heavy rainfall, when the rainfall rate is greater than the infiltration capacity. It is usually associated with high intensity rainfall events (typically > 30mm/h) resulting in overland flow and ponding in depressions in the topography. In urban situations underground sewerage/drainage systems and surface watercourses may be completely overwhelmed.

Pluvial flood extents are available for areas of Dublin and provide an indication of the level of risk. It should be noted that this mapping should be used to identify potential risk but is not appropriate for a site-specific flood risk assessment.

Pluvial mapping extends along the Proposed Scheme from the City Centre as far as the M50 overpass. The 10% flood extents are illustrated in Figure 4.28, Figure 4.29, Figure 4.30 and Figure 4.31.

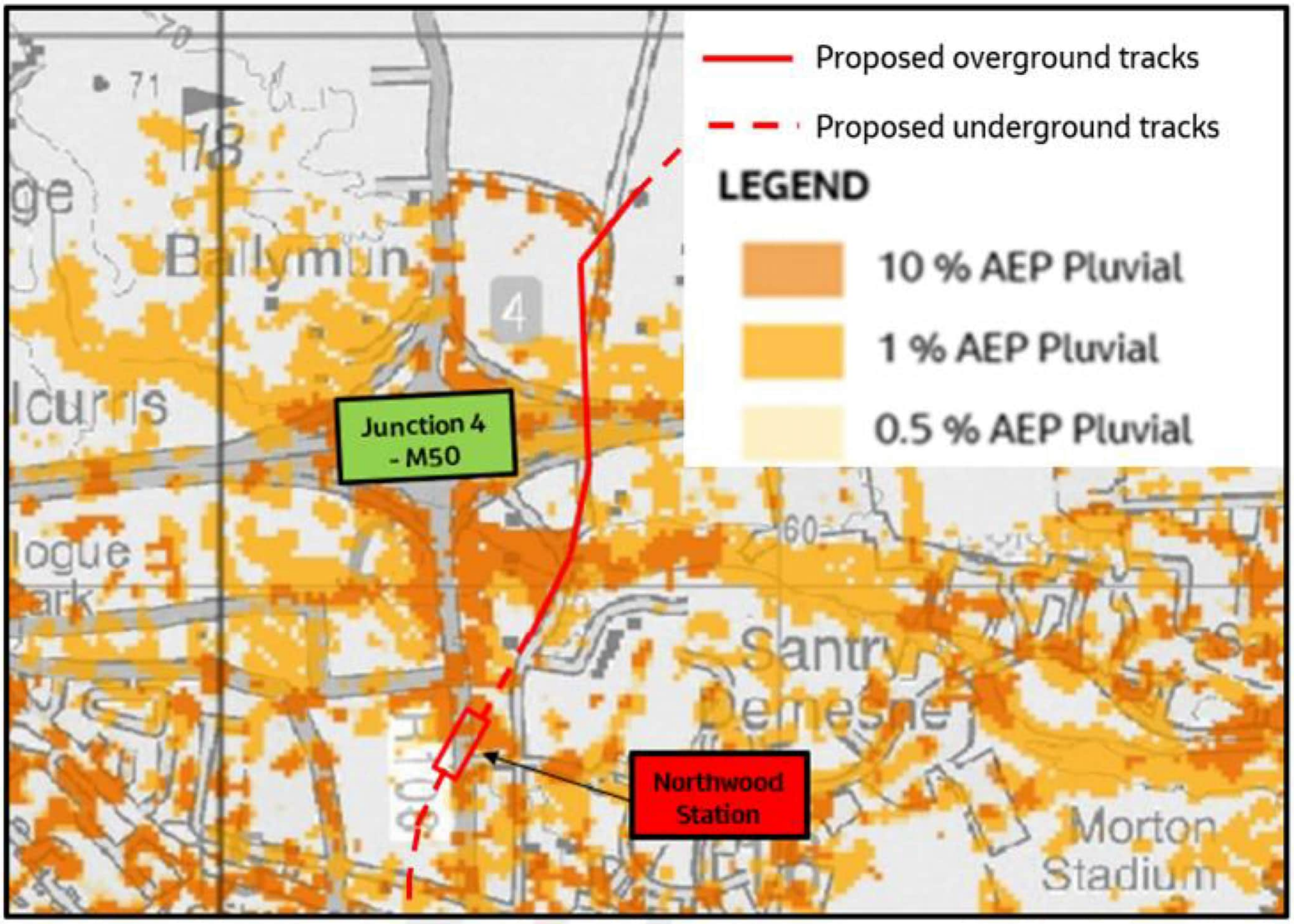


Figure 4.28 Extract of pluvial flood mapping on the MetroLink scheme southeast to Junction 4 (M50).

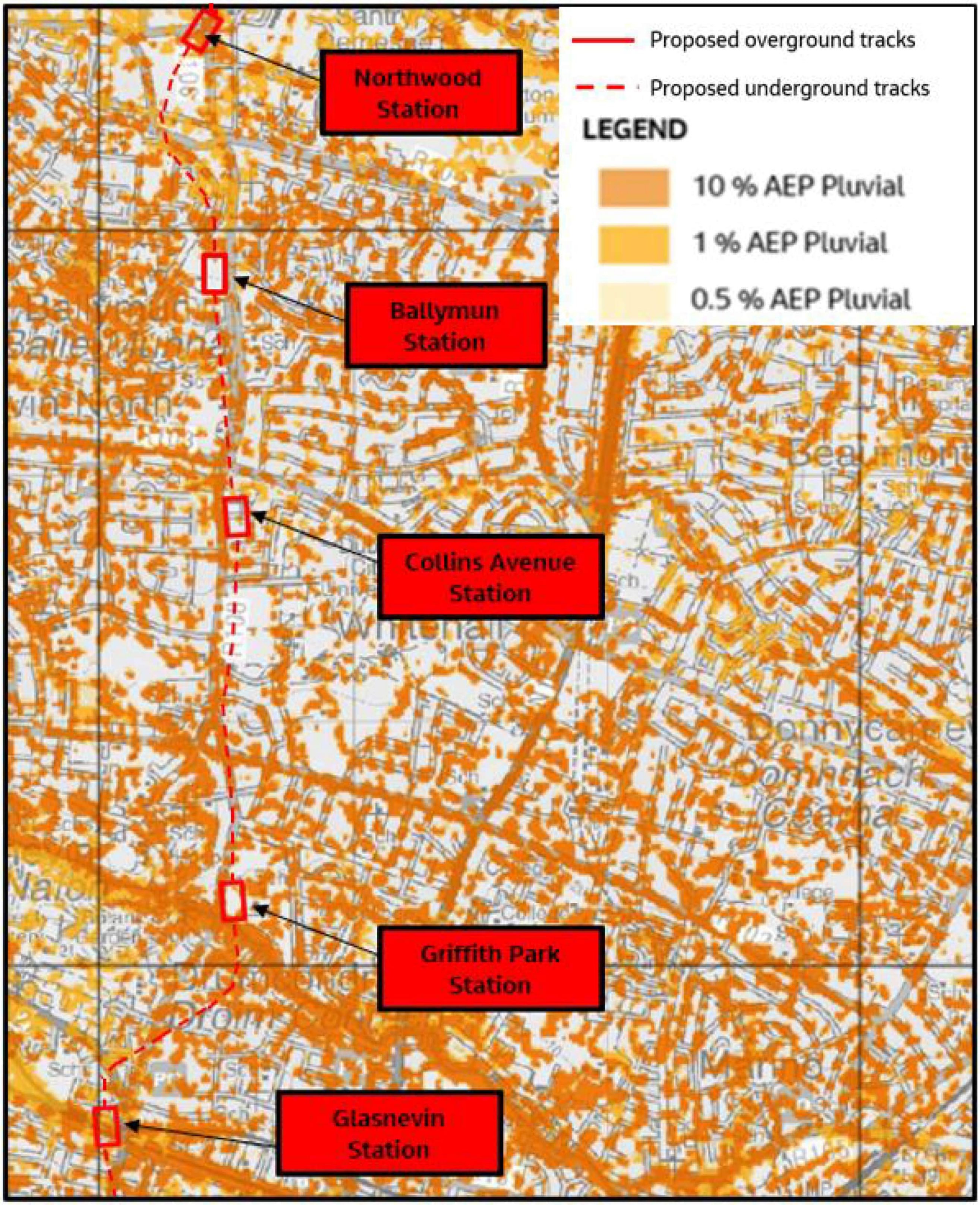


Figure 4.29 Extract of pluvial flood mapping on the MetroLink scheme between Northwood and Glasnevin Stations

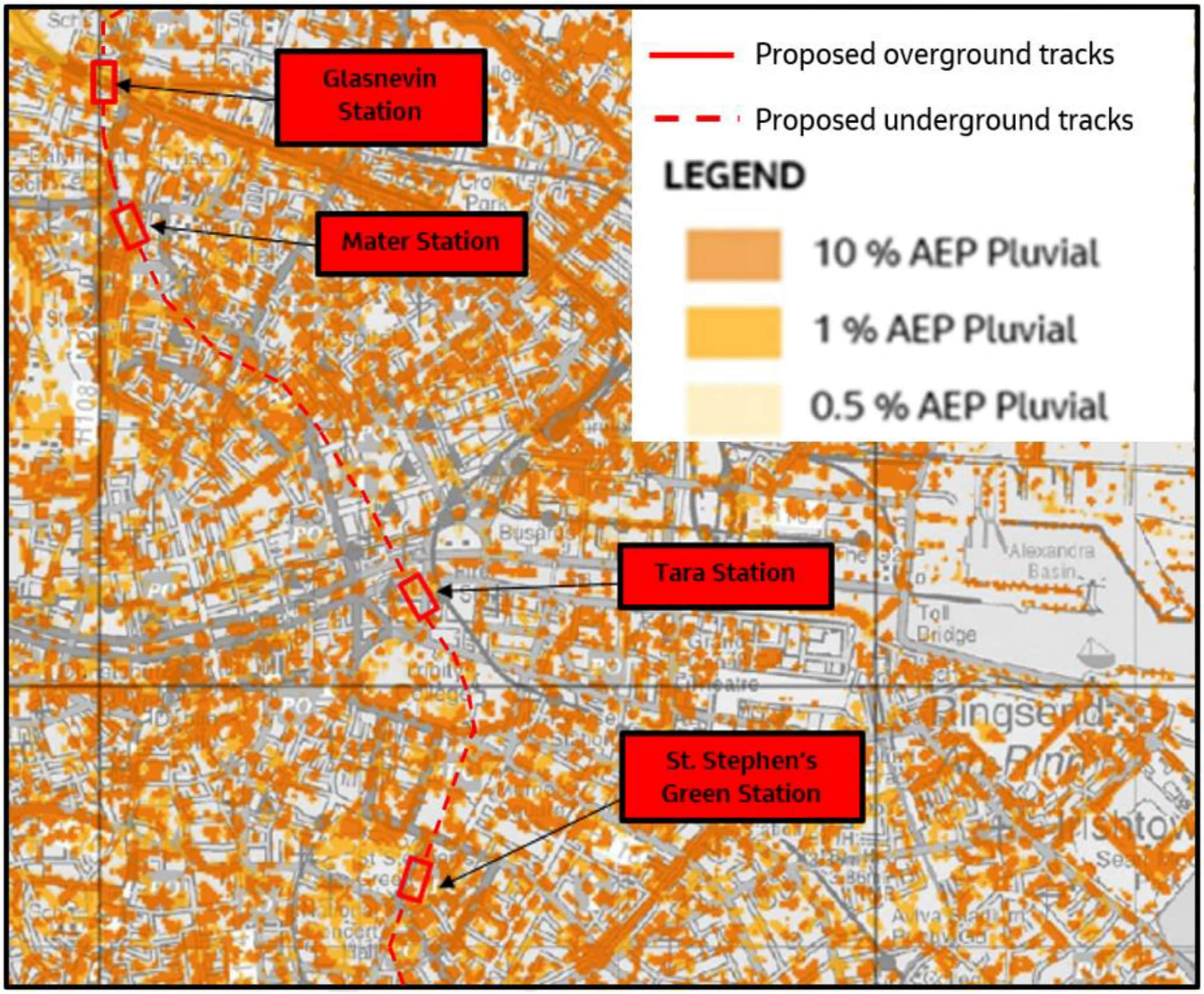


Figure 4.30 Extract of pluvial flood mapping on the MetroLink scheme between Glasnevin and St. Stephen's Green Stations

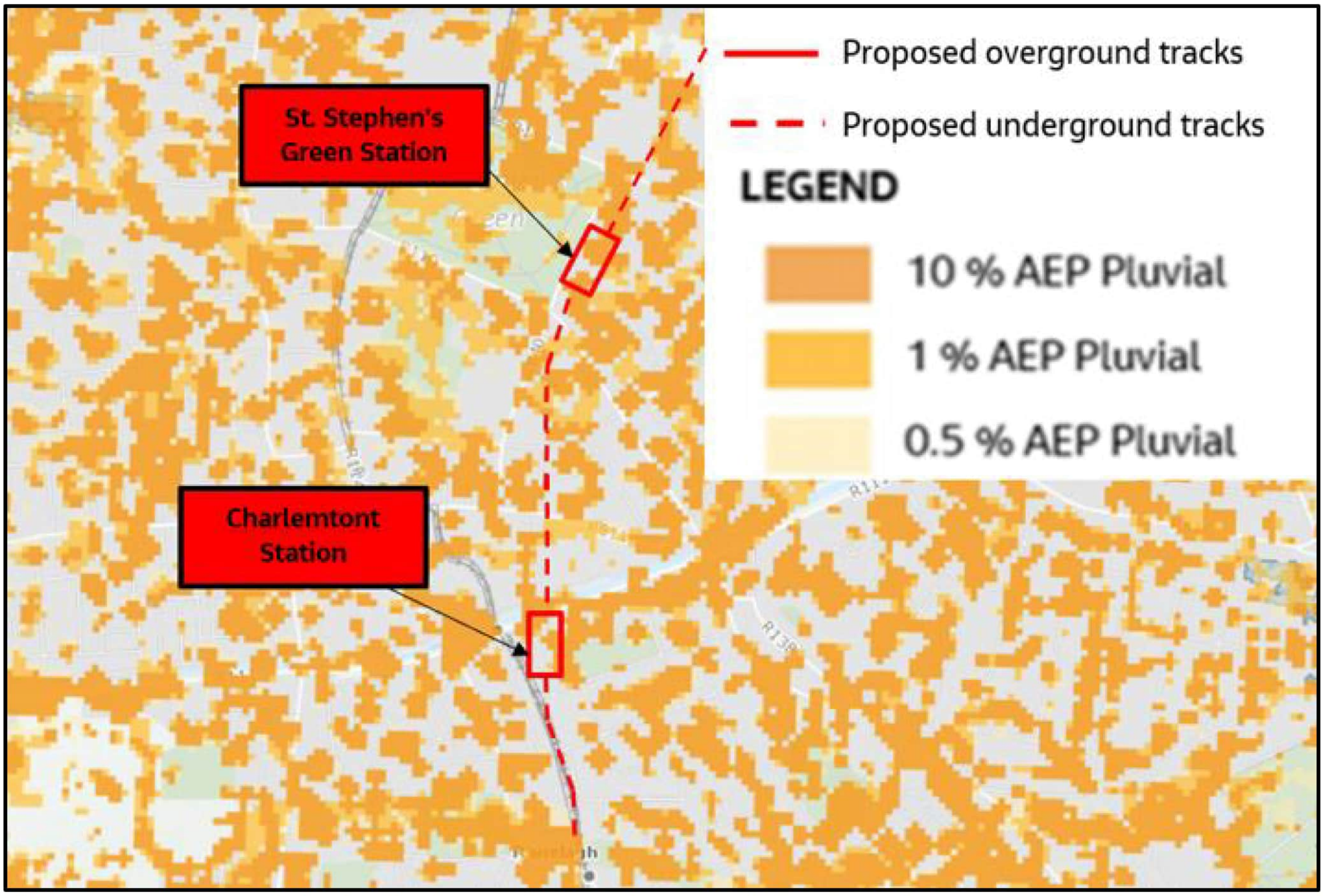


Figure 4.31 Extract of pluvial flood mapping on the MetroLink scheme between St. Stephen's Green and Charlemont Stations

As shown, there are numerous potential pluvial flood risk areas along the length of the Proposed Scheme. This is because much of the surface water drainage system within Dublin is undersized meaning a high potential for pluvial flooding following heavy rainfall. It should be noted that extending south from Northwood Station, the scheme is in tunnel or cut and cover then it is not affected by pluvial flooding. The proposed stations located along the tunnelled sections of the Proposed Scheme could however be affected by pluvial flooding.

It is reasonable to assume that the remainder of the Proposed Scheme i.e. from Lissenhall to the M50 is exposed to a similar level of pluvial flood risk due to the nature of the surface water drainage network through Dublin.

Section 5 considers the Pluvial flood risk to the scheme in further detail.

4.11 Strategic Flood Risk Assessments (SFRA)

4.11.1 Fingal County Council Development Plan

A Strategic Flood Risk Assessment and Management Plan was prepared as part of the Fingal County Council Development Plan 2017-2023. Reference to the information contained in this document shows that parts of the Proposed Scheme would be located within Flood Zones A and B. With reference to Figure 4.32, Figure 4.33 and Figure 4.34, this relates particularly to works along the R132 where the Proposed Scheme crosses the Ward and Broad Meadow Rivers. The Proposed Scheme also crosses Flood Zone B lands associated with the Santry River.

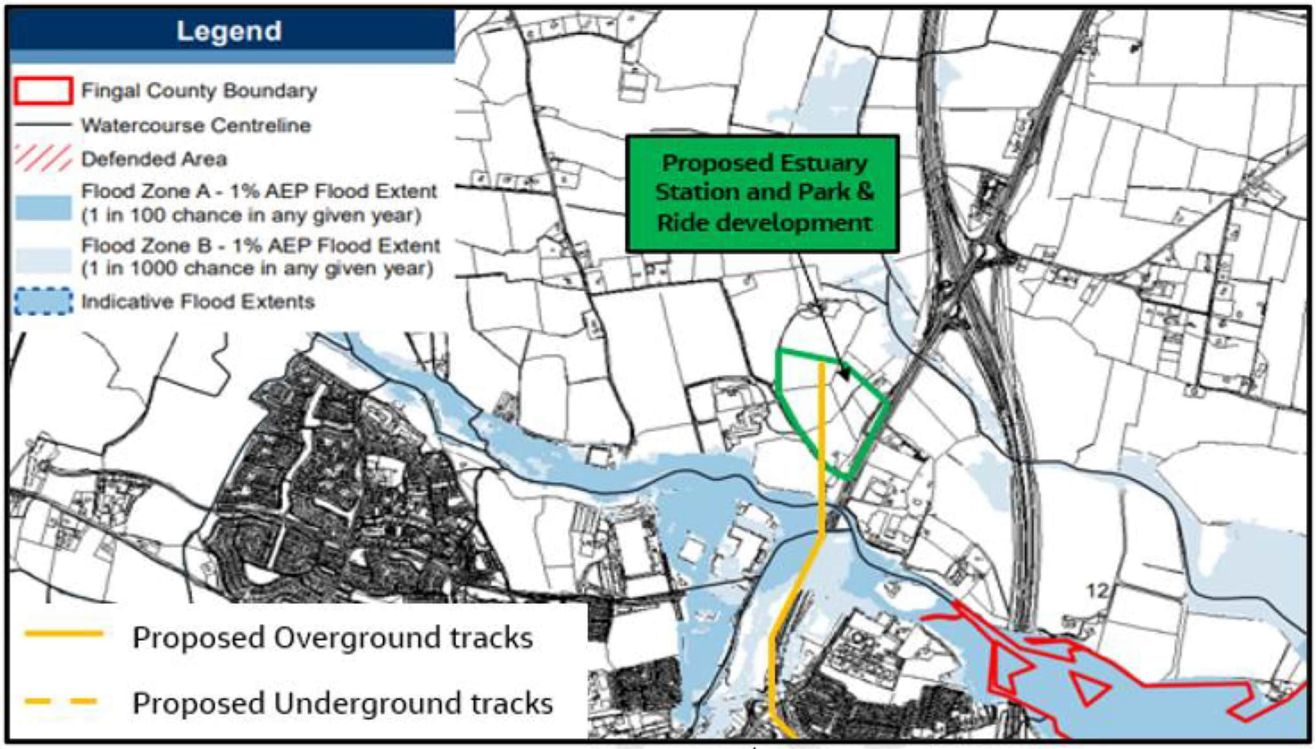


Figure 4.32 Fingal County Council Composite Flood Map. Lissenhall.

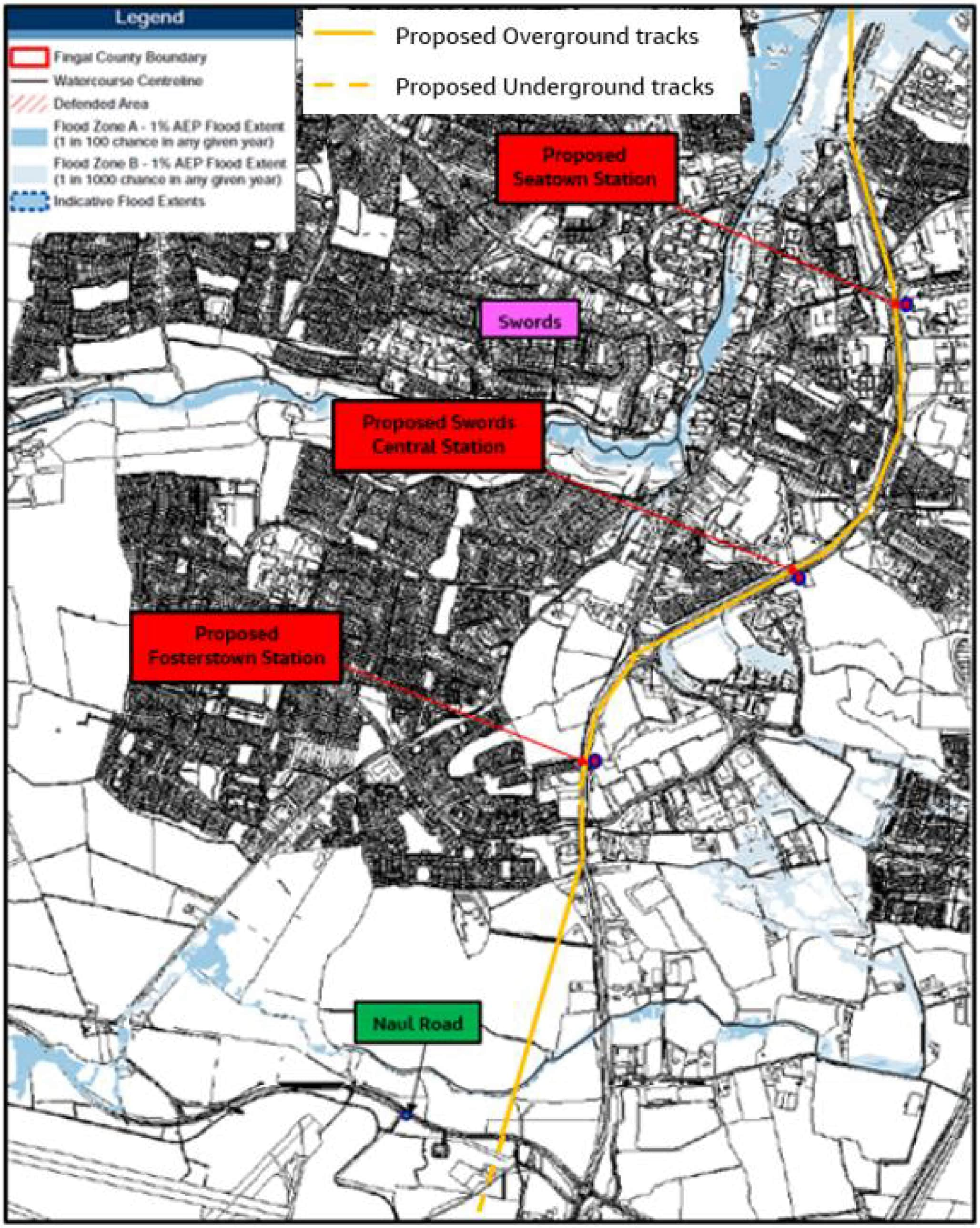


Figure 4.33 Fingal County Council Composite Flood Map. Between Lissenhall and Naul Road.

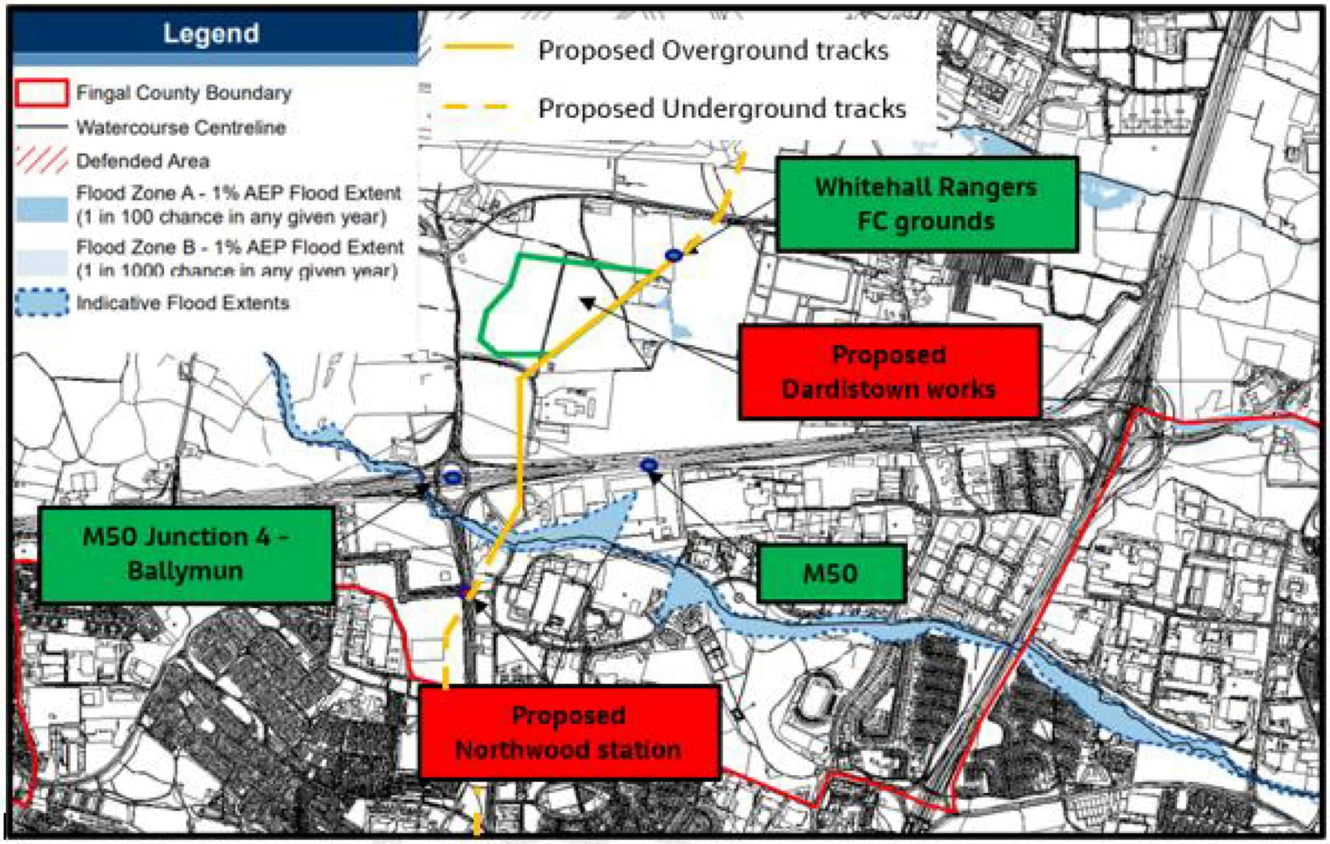


Figure 4.34 Fingal County Council Composite Flood Map. Dardistown and Ballymun areas.

4.11.2 Dublin City Development Plan

A Strategic Flood Risk Assessment and Management Plan was prepared as part of the Dublin Town Development Plan 2016-2022. Reference to this document shows that part of the proposed Tara Station would be located within Flood Zone A associated with the River Liffey, refer to Figure 4.35. It should be noted that the proposed line is in tunnel where it passes beneath the Liffey and its associated floodplain.

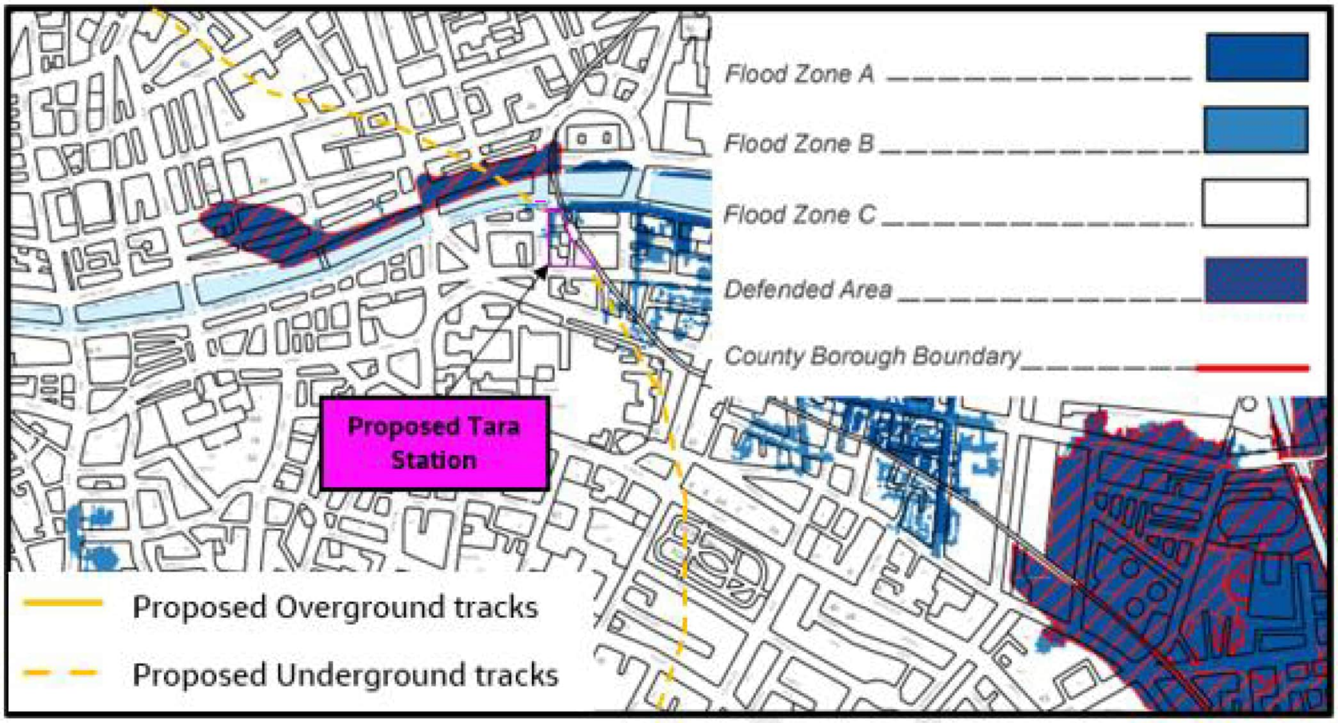


Figure 4.35 Dublin City Council Composite Flood Map.

A moderate risk of pluvial risk has been reported along much of the Proposed Scheme, except for the proposed location for Glasnevin Station where the risk of pluvial flooding has been reported as extreme. This is not unexpected as much of the existing surface water drainage network was designed to provide a low standard of protection (typically 20% AEP or less), refer to Figure 4.36.

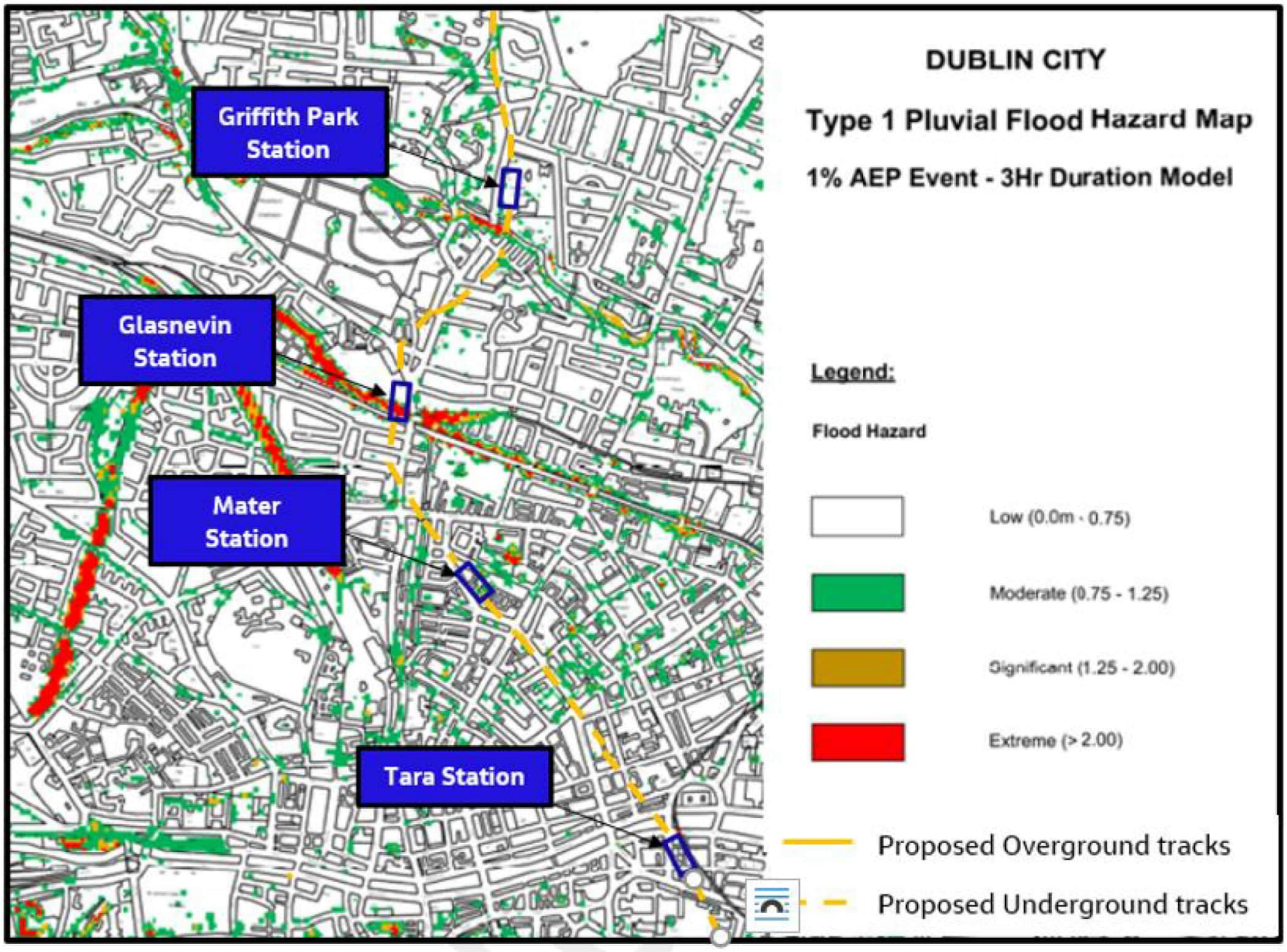


Figure 4.36 Dublin City Council Pluvial Flood Hazard Map.

5. Stage 2 Initial Flood Risk Assessment

This section assesses the risk of flooding to the Proposed Scheme site once the works are complete from a range of different sources, which is then used to develop a broader understanding of the risk characteristics to the Proposed Scheme.

5.1 Potential Sources of Flooding

Further to the Stage 1 assessment, the potential sources of flooding are listed below:

- **Fluvial (Major Rivers)** – Five locations along the Proposed Scheme are at risk of fluvial flooding due to crossing a major watercourse:
  - Lissenhall (Swords) crossing of the Broadmeadow and Ward Rivers (Ch. 1 + 490 – Ch. 2 + 200).
  - Crossing of the Gaybrook
  - Crossing of the Sluice River and nearby tributary (Ch. 5 + 765 – Ch. 5 + 963).
  - Crossing of the Santry River (Ch. 10 + 000).
- **Fluvial (Minor Watercourses)** – Two locations along the Proposed Scheme are at risk of fluvial flooding due to crossing/affecting a minor watercourse:
  - Lissenhall (Swords), from the proposed diversion of a tributary of Staffordstown watercourse around Ch. 1 + 100.
  - Dardistown, from the proposed diversion of the Turnapin watercourse around Ch. 8 + 600.
- **Fluvial (Stations)** – Griffith Park Station which forms part of the proposed scheme is potentially at risk of fluvial flooding due to its proximity to the River Tolka. No other stations that are proposed as part of the scheme are at risk of fluvial flooding.
- **Coastal** – Two locations along the Proposed Scheme are at risk of coastal flooding due to crossing a major watercourse:
  - Lissenhall (Swords) from Broadmeadow and Ward Rivers (Ch. 1 + 490 – Ch. 2 + 200).
  - Tara Station, on Tara Street, Ch. 17 + 400.
- **Coastal (Stations)** – Tara Station which forms part of the proposed scheme is potentially at risk of coastal flooding from the River Liffey. No other stations that are proposed as part of the scheme are at risk of coastal flooding
- **Pluvial** – OPW records show the risk of pluvial flooding is prevalent along the Proposed Scheme due to the limited capacity of the existing surface water drainage network across Dublin. Pluvial flooding poses the greatest risk to the stations that are proposed as part of the Scheme as they are typically located in heavily urbanised areas that are reliant on the existing surface water network for drainage. Where the scheme is in a tunnel or constructed on an embankment, there is no risk of pluvial flooding to the scheme.

The below ground elements of the scheme including tunnelled sections of the track and stations, by their nature, could be at risk from groundwater flooding. The design of all below ground scheme elements will ensure sufficient resilience to groundwater flooding with all below ground structures appropriately lined to prevent the ingress of groundwater during operation.

Groundwater flooding is therefore not considered any further in this assessment.

As noted in Section 4, flood risk to the Proposed Scheme from the Royal and Grand Canals is not considered further. This is because the Proposed Scheme passes beneath both waterways in a tunnel.

5.2 Major Rivers Fluvial Flood Risk Assessment

The five locations along the Proposed Scheme that are at risk of fluvial flooding due to crossing a major watercourse are:

- Lissenhall (Swords) crossing of the Broadmeadow and Ward Rivers (Ch. 1 + 490 – Ch. 2 + 200).
- Crossing of the Gaybrook
- Crossing of the Sluice River and nearby tributary (Ch. 5 + 765 – Ch. 5 + 963).
- Crossing of the Santry River (Ch. 10 + 000).

Further details including the level of flood risk at each location are provided in the paragraphs below.

5.2.1 Lissenhall (Swords), Ch. 1 + 490 – Ch. 2 + 200, associated with Broadmeadow and Ward Rivers

The Stage 1 Flood Risk Assessment indicated that the Proposed Scheme is at risk of fluvial flooding where it crosses the Broadmeadow and Ward Rivers at Lissenhall (Swords). The Proposed Scheme can be split into two sections in this location:

- Section 1 (Ch. 1 + 500 and Ch. 1. + 760) where the Proposed Scheme crosses the Broadmeadow and Ward Rivers on and embankment and viaduct.
- Section 2 (Ch. 1 + 760 and Ch. 2 + 200) where the Proposed Scheme comprises an open cut section of track running parallel to the Ward River.

The Eastern CFRAM study outputs for the Broadmeadow and Ward Rivers were compared against the Proposed Scheme. As shown in Figure 5.1, the Proposed Scheme passes through lands that are at risk of flooding in the 10%, 1% and 0.1% AEP floods.

Peak water levels from the Eastern CFRAM study are compared against the proposed track levels for the scheme for Sections 1 and 2 as outlined above.

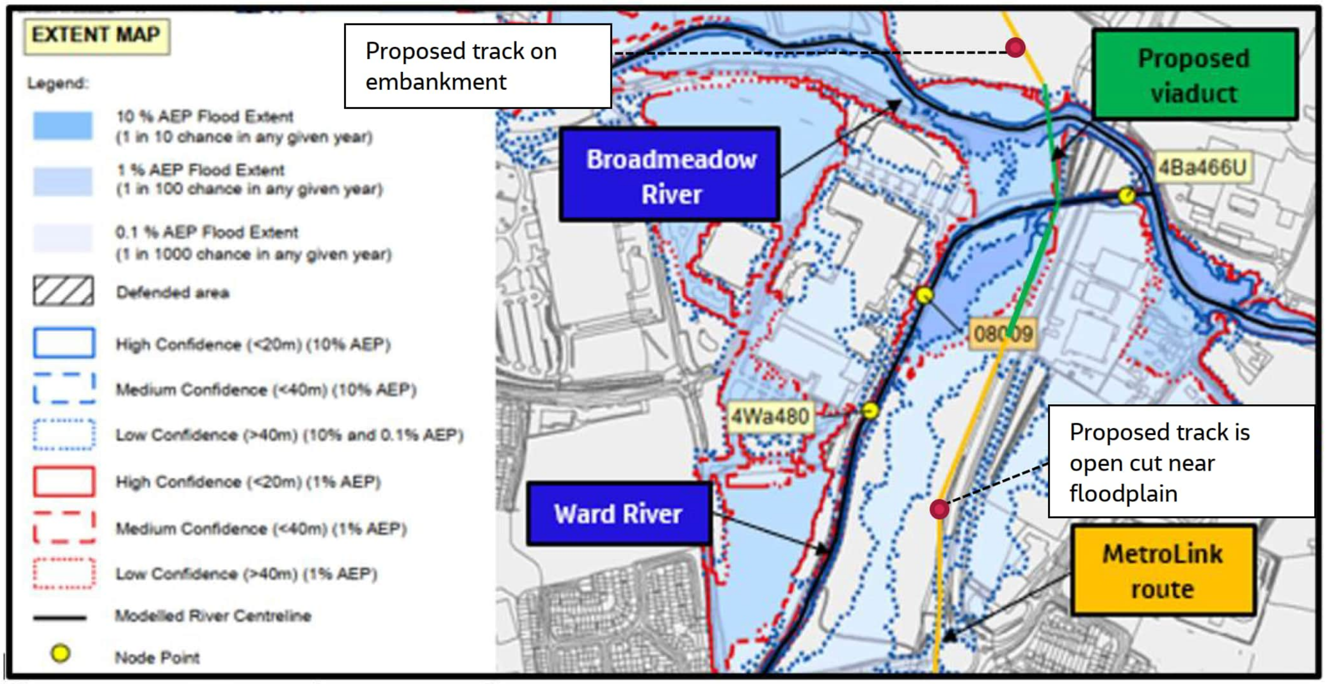


Figure 5.1 Extract of fluvial flood mapping from CFRAM study around the Broadmeadow and Ward Rivers crossing (Ch. 1+ 500 – Ch. 1 + 760)

The predicted flood levels between Ch. 1 + 490 and Ch. 1 + 760 have been obtained from the OPW CFRAM Study maps (See Appendix B) for the 10%, 1% and 0.1% AEP flood events and have been compared against the minimum top of rail level for the MetroLink scheme in this section; refer to Table 5.1.

Table 5.1 Design Broadmeadow and Ward Rivers Fluvial Flood Levels for the Lissenhall (Swords) Section 1, Ch. 1 + 490 – Ch. 1 + 760

AEP Event	Flood Level at Proposed Scheme Crossing (mAOD	Minimum Top Of Rail (TOR) level (mAOD)	Difference / Freeboard Allowance (m)
10% (1 in 10)	4.81*	7.70	+2.89
1% (1 in 100)	5.10*		+2.60
0.1% (1 in 1000)	5.62*		+2.08

* Calculated level obtained from node 08009.

As shown, the Proposed Scheme is not at risk of flooding in the 0.1% AEP flood at the proposed crossing of the Broadmeadow and Ward Rivers as the level of the track significantly exceeds the design flood level. The Proposed Scheme does however traverse a significant area of floodplain and mitigation will be required to ensure no increase in flood risk as a consequence of the works. The measures that have been designed as part of the scheme are detailed in Section 6.

The predicted flood level for Ch. 1 + 760 and Ch. 2 + 200 have been from the OPW CFRAM Study maps have been compared against the minimum top of rail level for the MetroLink scheme in this section; refer to Table 5.2. As noted, this section of the line is in Open Cut and located below existing ground levels.

Table 5.2 Design Broadmeadow and Ward Rivers Fluvial Flood Levels for the Lissenhall (Swords) Section 2, Ch. 1 + 760 – Ch. 2 + 200

AEP Event	Calculated Flood Level (mAOD)	Minimum Top Of Rail (TOR) level (mAOD)	Difference / Freeboard Allowance (m)
10% (1 in 10)	4.81*	0.62	- 4.19
1% (1 in 100)	5.10*		- 4.48
0.1% (1 in 1000)	5.62*		- 5.00

* Calculated level obtained from node 08009.

Section 2, Ch. 1 + 800 and Ch. 2 + 200 of the Proposed Scheme is constructed in Open Cut and runs close to the Ward River and its associated floodplain. Based on the available information it is considered to be at risk of flooding from the Ward. Were flood waters from the Ward to enter the open cut section of the track, this would result in significant flood depths along the Proposed Scheme, as shown in Table 5.2 above.

A Stage 3 Flood Risk Assessment has therefore been completed for the Scheme where it crosses the Broadmeadow and the Ward to ensure the scheme is sufficiently resilient to flooding and will not increase the risk of flooding to other receptors.

Ch. 1 + 490 – Ch. 2 + 200 Broadmeadow & Ward Fluvial Flood Risk Assessment Summary:

- Between Ch. 1 + 490 and Ch. 2 + 200, the MetroLink scheme is located in Flood Zone A.
- The elevated part of track where it crosses the Broadmeadow and Wards Rivers is not at risk of flooding during the 0.1% AEP flood. The construction of the proposed crossing over Broadmeadow and Ward Rivers might affect their predicted extents of fluvial flooding and requires further assessment.
- Part of this Section is constructed below ground in Open Cut and runs parallel to the Ward River floodplain. This section could be at significant risk of fluvial flooding.
- A Stage 3 FRA is required as the construction of the proposed crossing might change in flood risk arising from the MetroLink project from the Broadmeadow and Ward Rivers. Mitigation for the Open Cut section of the line also requires further consideration to ensure the scheme is resilient to flooding.

5.2.1.1 Gaybrook around Pinnock Hill Roundabout (R132), Ch. 4 + 025 – Ch. 4 + 400.

The proposed MetroLink scheme runs parallel to the R132 in open cut and cover sections, prior to passing beneath the Gaybrook. Figure 5.2 shows the route of the proposed scheme, the extent of open cut and covered sections and the location of the Gaybrook crossing.

The Gaybrook stream will pass above the Proposed Scheme in its existing culvert (located at Ch. 4 + 500).

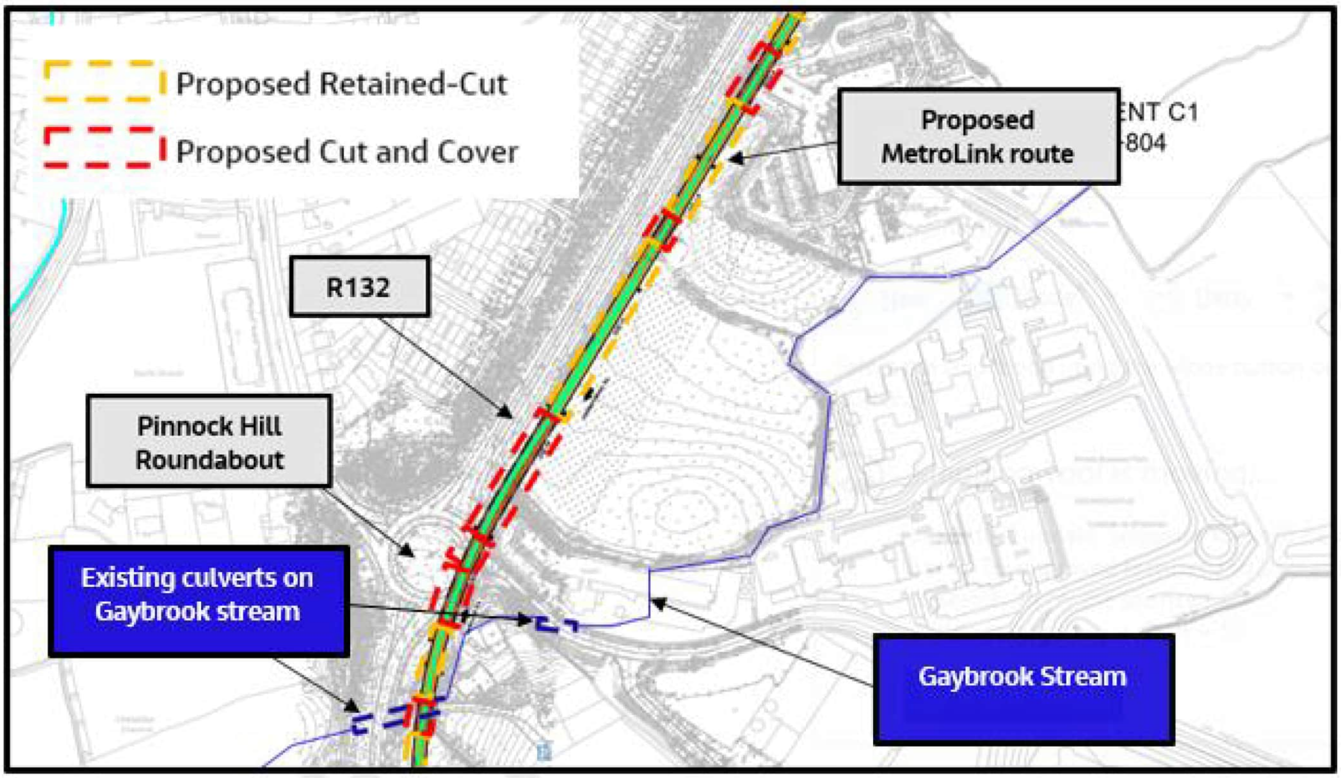


Figure 5.23 Existing culvert crossing on Gaybrook watercourse (Ch. 4 + 500).

The CFRAM study map for the Gaybrook is presented in Figure 5.3. This shows the Proposed Scheme would be located in the 0.1% AEP flood extent.

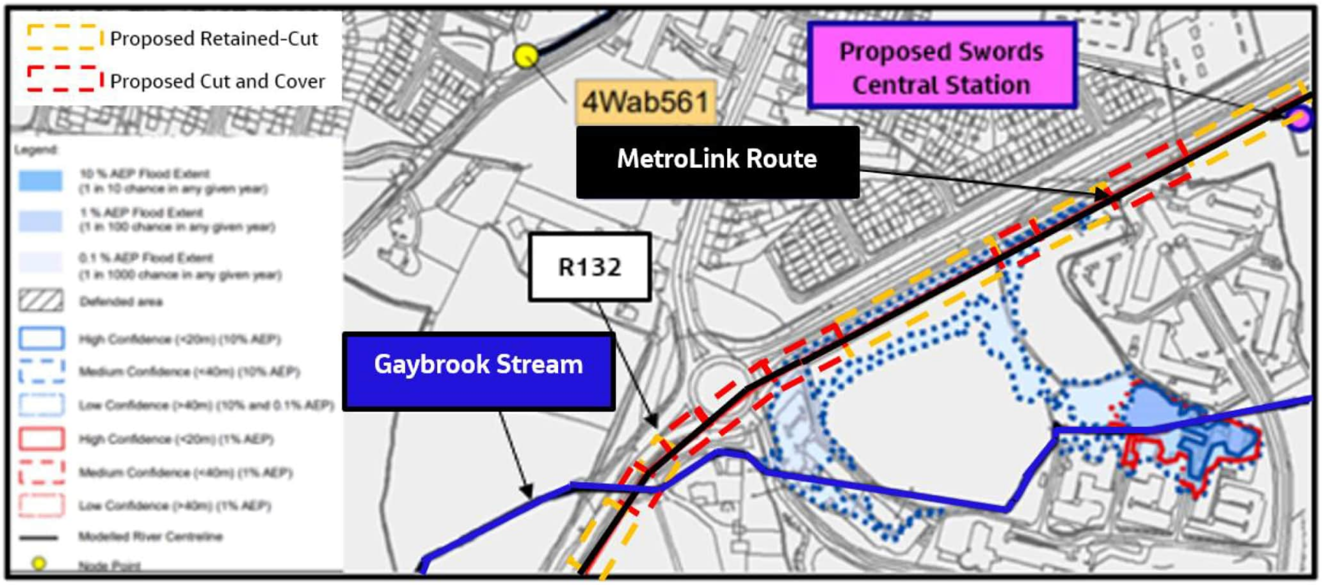


Figure 5.3 Extract of fluvial flood mapping from CFRAM study along R132, between Ch. 04 + 025 – Ch. 04 + 400.

It was understood that works had been completed following historic flooding in this location raised questions around the accuracy of the CFRAM mapping.

In the CFRAM model, all flows in the Gaybrook are assumed to pass beneath the R132 in a culvert and continue in an easterly direction downstream. A from site investigation was completed and found that a 900mm concrete pipe intercepts the Gaybrook watercourse to the west to the R132 and diverts this water to the Ward River, refer to Figure 5.4.

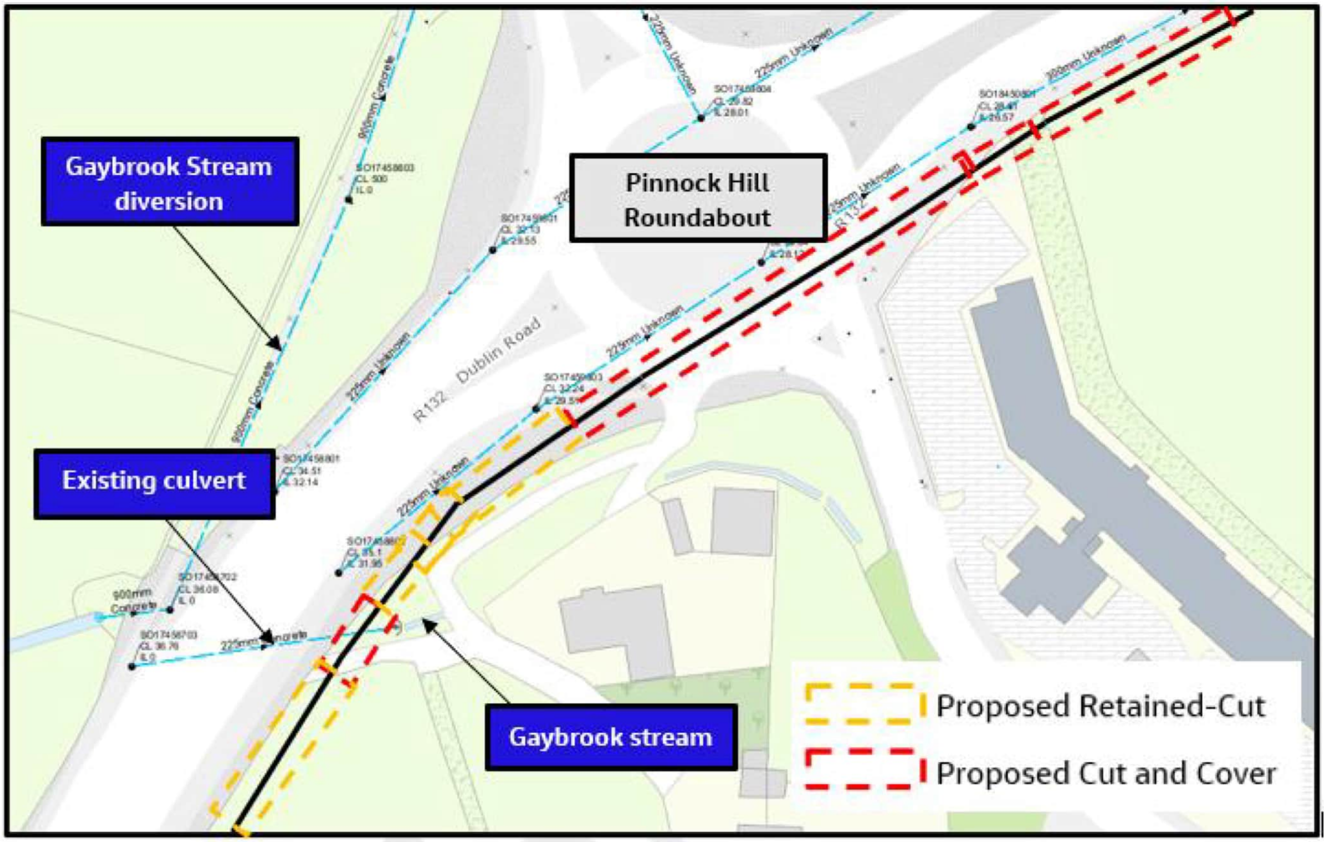


Figure 5.4 Existing Gaybrook watercourse diversion west to R132.

Based on the visual inspection, it was estimated that 95% of flows from Gaybrook watercourse are being diverted to the new route with a small sweetening flow is conveyed in the existing culvert crossing underneath the R132. The CFRAM mapping therefore overestimates the extent of flooding from the Gaybrook as it does not include the 900mm diversion culvert that conveys most of the flows to the Ward River.

Owing to the extent of the track that is covered in the this reach and the diversion of the Gaybrook into a 900mm culvert, it is therefore considered that there is no risk of fluvial flooding from Gaybrook to the Proposed Scheme. Therefore, a Stage 3 Flood Risk Assessment is not required to confirm the extent of the flood risk associated with the MetroLink scheme established at this location. The Proposed Scheme will have no impact on flows along the Gaybrook as all existing culverts are maintained and not modified as part of the works.

5.2.2 North to Naul Road, Ch. 5 + 765 – Ch. 5 + 963, associated with Sluice River and a tributary.

The Stage 1 Flood Risk Assessment indicated that the MetroLink scheme is at risk of fluvial flooding from Sluice River (at Ch. 5 + 963), refer to Figure 5.5. The Proposed Scheme also crosses a tributary of the Sluice River at Ch. 5 + 765.

The predicted flood levels have been obtained from the OPW CFRAM Study (See Appendix B) for the 10%, 1% and 0.1% AEP flood event and has been compared against the minimum Top of Rail (TOR) level at the crossing of the Sluice River (Ch. 5 +963), refer to Table 5.3.

It should be noted that the OPW CFRAM maps did not include outputs for the Sluice River tributary crossing at Ch. 5 + 765. For the purposes of this stage of the assessment, it is assumed that the flood levels at Ch. 5 + 963 shall also apply with further assessment completed at Stage 3 to verify the flood risk for this crossing.

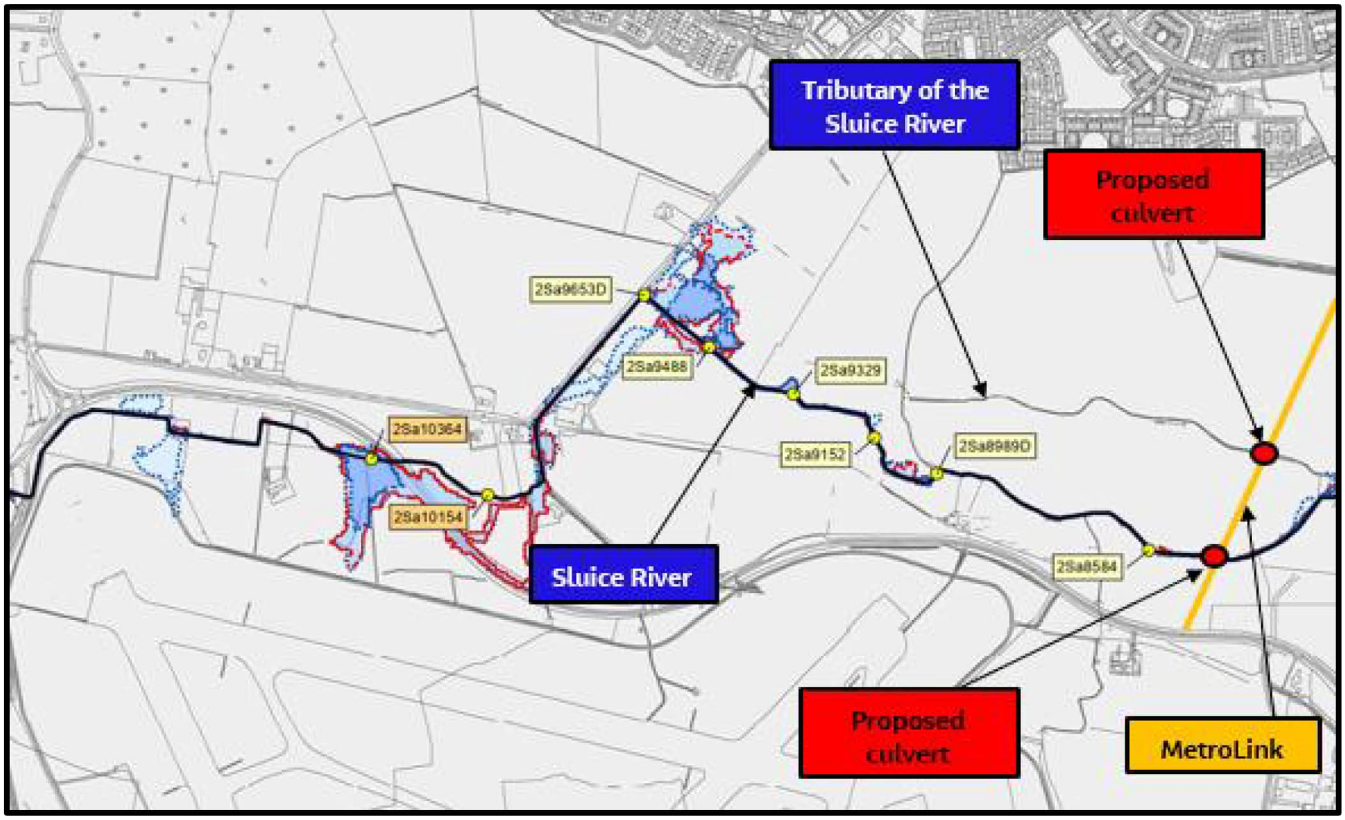


Figure 5.5 Extract of fluvial flood mapping from CFRAM study around the Sluice River crossing (Ch. 5 + 963)

Table 5.3 Sluice River and tributary Fluvial Flood Levels for the MetroLink scheme. North to Naul Road, Ch. 5 + 765 – Ch. 5 + 963

AEP Event	Sluice River Flood Level (mAOD)	Minimum Top Of Rail (TOR) level (mAOD)	Difference / Freeboard Allowance (m)
10% (1 in 10)	42.35*	46.81	+4.46
1% (1 in 100)	42.62*		+4.19
0.1% (1 in 1000)	42.82*		+3.99

* Values obtained from node 2Sa8584.

The nearest model node '2Sa8584' is upstream of the culvert crossing underneath R132 meaning the reported water levels are likely to slightly overestimate potential flood depths at the crossing with the MetroLink scheme.

As shown, the proposed MetroLink scheme would not be at risk of fluvial flooding from Sluice River. However, a Stage 3 Flood Risk Assessment is required at this location as the construction of the proposed culverts over Sluice River and its tributary might affect the hydraulic capacity of the watercourses and therefore, their predicted extents of flooding.

Ch. 5 + 765 – Ch. 5 + 963 Sluice River Fluvial Flood Risk Assessment Summary:

- There little natural floodplain where the proposed scheme crosses the Sluice River with flows contained in bank. The proposed elevation of the MetroLink Scheme mean it will not be at risk of flooding from the Sluice River.
- The construction of the proposed new culvert crossings on Sluice River and its tributary as part of the MetroLink Scheme might affect flood risk along these watercourses.
- A Stage 3 FRA to demonstrate that the Proposed Scheme will not increase flood risk on either watercourse.

5.2.3 East and southeast to Junction 4 (M50), Ch. 9 + 650 – Ch. 10 + 000, associated with Santry River.

The Stage 1 assessment indicated that the M50 is at risk of fluvial flooding east to Junction 4 – Ballymun, Ch. 9 + 650 – Ch. 9 + 750). The predicted flood extent is shown in Figure 5.6.

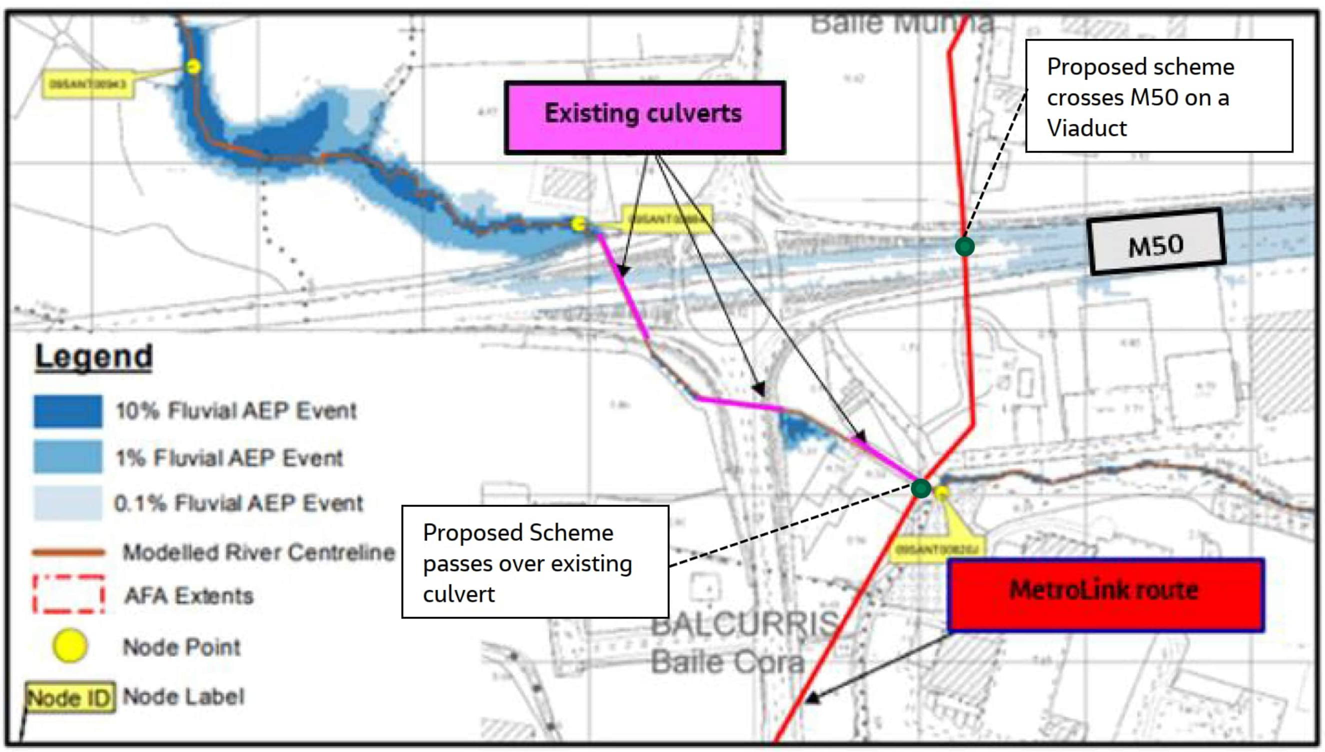


Figure 5.6 Extract of fluvial flood mapping from CFRAM study around the Santry River (Ch. 9 + 650 – Ch.10 + 000)

The Proposed Scheme crosses the M50 on a viaduct (between Ch. 9 + 650 and Ch. 9 + 750). The track in this location will be approximately 67.55 m above existing ground levels and, therefore, is not at risk of flooding. Existing flooding of the M50 will continue to occur as flood flows will pass beneath the MetroLink Viaduct.

Downstream, the Proposed Scheme passes over the Santry River when it is in culvert. The Proposed Scheme has been designed so that the existing culvert on the Santry can be retained without modification.

The predicted flood levels have been obtained from the OPW CFRAM Study (See Appendix B) for the 10%, 1% and 0.1% AEP flood events and have been compared against the minimum Top of Rail (TOR) level of the rail tracks where it crosses the Santry River, refer to Table 5.4.

Table 5.4 Design Santry River Fluvial Flood Levels for the MetroLink scheme at the Culvert Crossing (Ch. 9 + 650 – Ch. 9 + 750).

AEP Event	Flood Level (mAOD)	Minimum Top Of Rail (TOR) level (mAOD)	Difference / Freeboard Allowance (m)
10% (1 in 10)	54.33*	56.67	+ 2.34
1% (1 in 100)	54.53*		+ 2.14
0.1% (1 in 1000)	54.63*		+ 2.04

* Values obtained from node 09SANT00820J.

The nearest model node to the area at risk of flooding (09SANT008820J) is located just downstream of the Proposed Scheme where the Santry River emerges from its existing culvert. As shown, the Proposed Scheme is not at risk from flooding from the Santry River.

As the proposed scheme does not amend the capacity of the existing culverts on Santry River there will therefore be no impact on the existing risk or extent of flooding in this location. The Proposed Scheme is also not at risk from flooding from the Santry River as it is elevated above the floodplain. A Stage 3 Flood Risk Assessment will therefore not be required at this location.

Ch. 9 + 650 – Ch. 10 + 000 Santry River Fluvial Flood Risk Assessment Summary:

- There is no change in flood risk to or arising from the MetroLink scheme from the Santry River as no modifications are undertaken to the existing culvert structure over the Santry River.
- The Proposed Scheme is not at risk of flooding from the Santry River
- A Stage 3 FRA is not required as the works will not affect the hydraulic capacity of the existing culverted crossing of the Santry River.

5.3 Minor Watercourses Fluvial Flood Risk Assessment

5.3.1 Lissenhall (Swords). Associated with the diversion of a tributary of the Staffordstown watercourse around Ch.1 + 100.

The proposed Park & Ride at Lissenhall, refer to Figure 5.7, is at risk of fluvial flooding from a ditch that crosses the site and is a tributary of Staffordstown watercourse. The ditch will need to be diverted to allow for the construction of the proposed works.

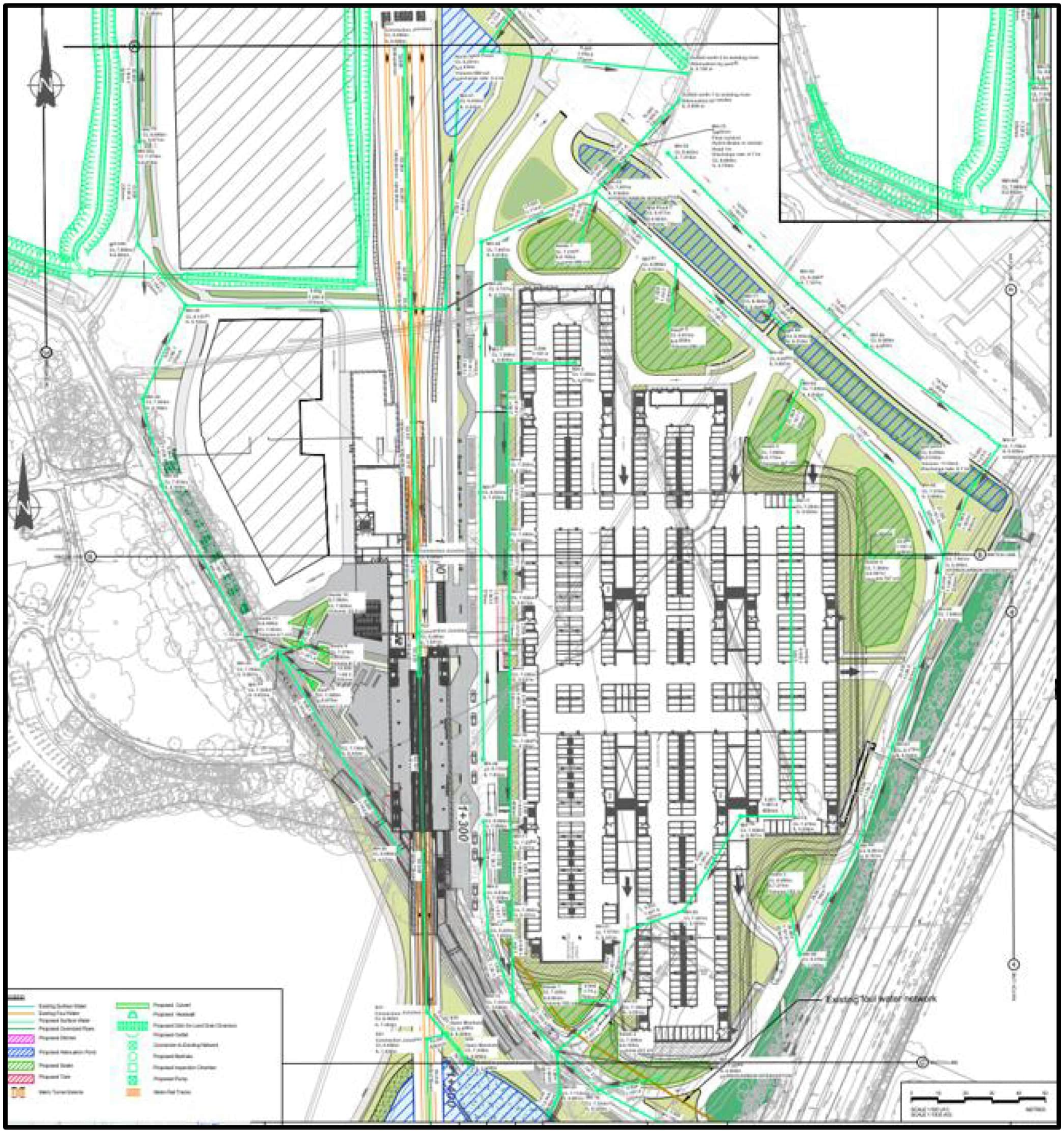


Figure 5.7 Proposed Estuary Station and Park & Ride development (Ch. 1 + 000 – Ch. 1 + 400).

A Stage 3 Flood Risk Assessment will therefore be completed for the watercourse diversion at this location to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development, of its potential impacts on flood risk elsewhere and of the effectiveness of any proposed mitigation measures. This assessment is described in Section 7 below.

5.3.2 Dardistown. Associated with the diversion of the Turnapin watercourse, around Ch. 8 + 600.

The proposed Depot and Station at Dardistown, refer to Figure 5.8, is at risk of fluvial flooding from the Turnapin Stream and other minor ditches that cross the site and are tributaries of the Mayne River. The ditches and stream will need to be diverted to allow for the construction of the proposed works.

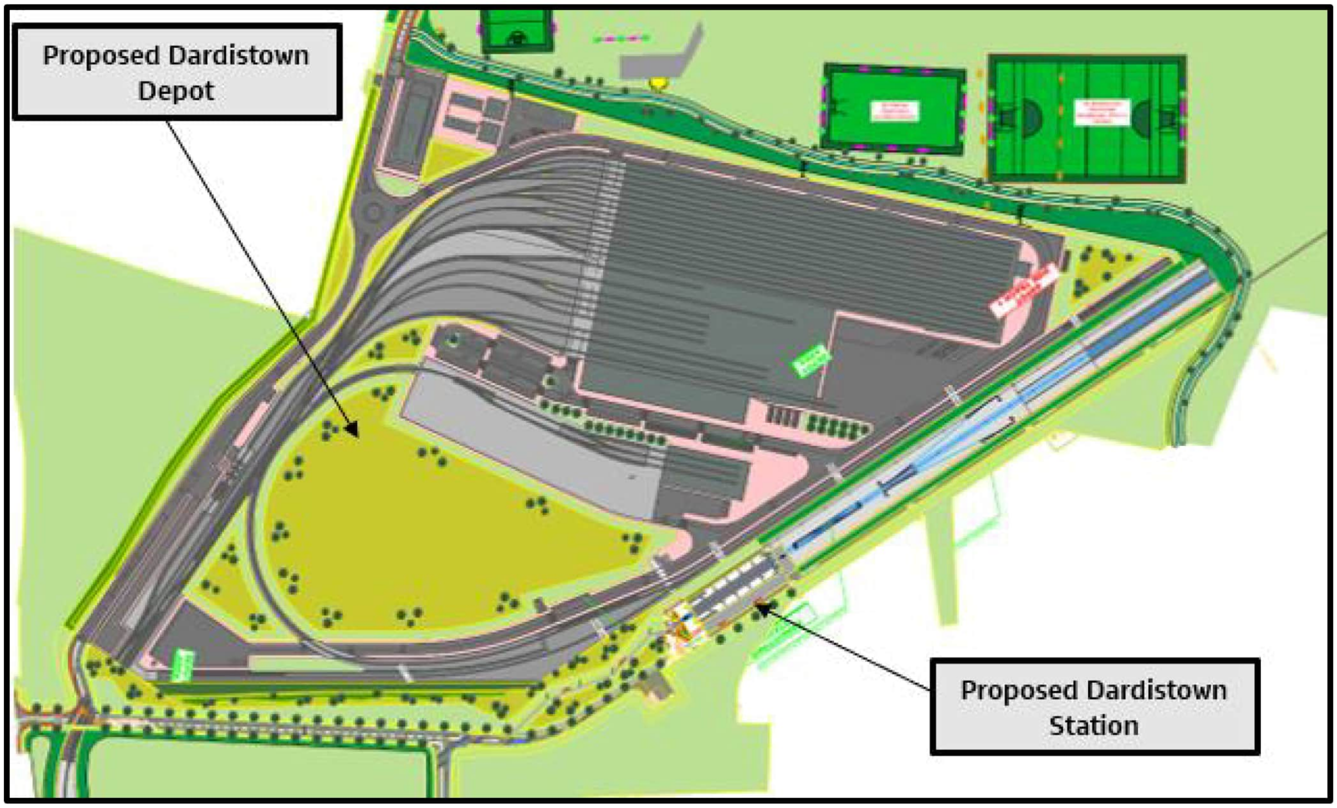


Figure 5.8 Proposed Dardistown Station and Train Depot (Ch. 8 + 650 – Ch. 9 + 420).

A Stage 3 Flood Risk Assessment will therefore be completed for the watercourse diversion at this location to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development, of its potential impacts on flood risk elsewhere and of the effectiveness of any proposed mitigation measures. This assessment is described in Section 7 below.

5.4 Stations Fluvial Flood Risk Assessment

The Stage 1 assessment found that Griffith Park Station could be at risk of fluvial flooding from the River Tolka. The Stage 1 assessment did not confirm if Griffith Park Station (Ch. 13 + 875) is at risk of fluvial flooding from River Tolka as the OPW is currently updating the modelling and mapping for the area of interest. NIFM mapping is available for the site however no flood levels are provided as part of this dataset.

The Stage 1 assessment showed that Griffith Park Station could be benefit from the defences that were constructed as part of the River Tolka FRS.

OPW topographical survey was obtained and shows a Flood Defence Wall runs along the northern bank of River Tolka, east to St Mobhi Road (Ch. 13 + 900), refer to Figure 5.9. This flood defence is stated as providing a 1% AEP standard of protection. The proposed Griffith Park Station would be located landward of this defence

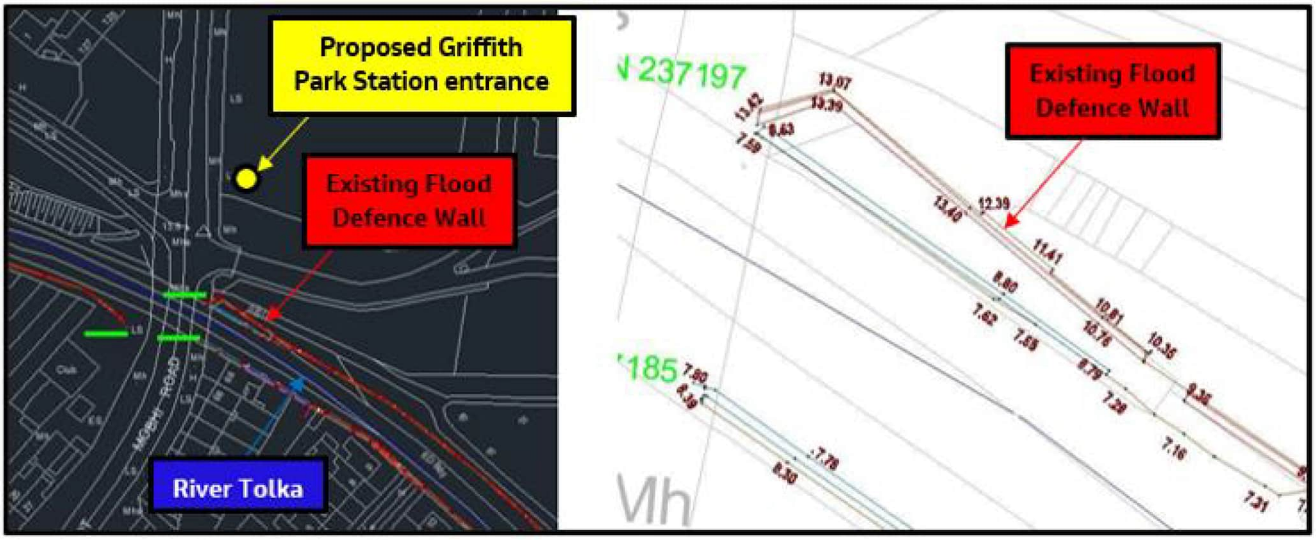


Figure 5.9 Location of the existing Flood Defence Wall north to River Tolka (Ch. 13 + 875) and top of wall levels.

Any flooding of Griffith Park Station would be from flows passing through the station entrance. The proposed location of the Griffith Park Station entrance is shown in Figure 5.5. The threshold for the entrance will will be 17.50mOD. The top level of the River Tolka FRS in this location is 13.40mOD. This means that for the River Tolka to inundate Griffith Park Station, flood depths would need to exceed the top of the flood defences by 3.1m. Given that the defences are stated as providing a 1% AEP standard of protection this is highly unlikely. It is therefore reasonable to assume that Griffith Park Station is not at risk of flooding from the River Tolka.

Ch. 13 + 875 River Tolka Fluvial Flood Risk Assessment Summary:

- At Ch. 13 + 875, the proposed Griffith Park Station is likely located in Flood Zone C as it does not appear to be at risk of flooding from the Tolka;
- There is no change in flood risk to or arising from the MetroLink scheme from the River Tolka as no modifications are which affect channel capacity.
- A Stage 3 FRA is not required.

5.5 Major River Coastal Flood Risk Assessment

The Stage 1 Flood Risk Assessment identified the following two coastal flood risk areas identified for the Proposed Scheme:

- Lissenhall (Swords), Ch. 1 + 490 – Ch. 2 + 200, associated with Broadmeadow and Ward Rivers.
- Proposed Tara Station, Ch. 17 + 400, associated with River Liffey.

Further details including the level of flood risk are provided in the paragraphs below.

5.5.1 Lissenhall (Swords), Ch. 1 + 490 – Ch. 2 + 200, associated with Broadmeadow and Ward Rivers

The Stage 1 Flood Risk Assessment indicated that the Proposed Scheme at Lissenhall (Swords) between Ch. 1 + 500 and Ch. 1 + 760 is at risk of coastal flooding where in crosses the Ward and Broadmeadow Rivers, refer to

Figure 5.10. Peak water levels from the Eastern CFRAM study have been compared against the proposed Top of Rail (ToR) level for the MetroLink Scheme; refer to Table 5.5.

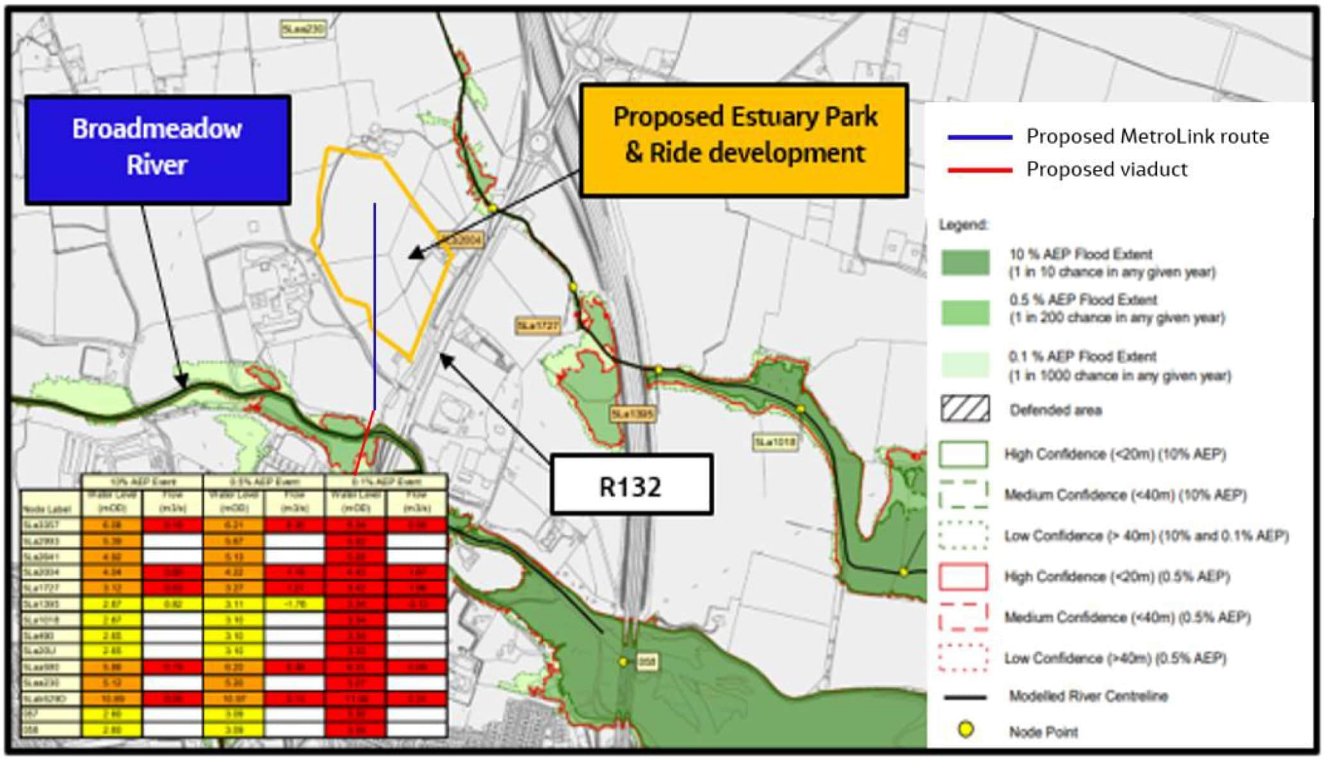


Figure 5.10 Extract of coastal flood risk from the Broadmeadow and Ward Rivers (source: Lissenhall model flood extent maps)

Table 5.5 Design Broadmeadow and Ward Rivers Coastal Flood Levels for the MetroLink scheme. Lissenhall (Swords), Ch. 1 + 490 – Ch. 1 + 760

AEP Event	Flood Level (mAOD)	Minimum Top Of Rail (TOR) level (mAOD)	Difference / Freeboard Allowance (m)
10% (1 in 10)	2.60*	7.70	+5.10
0.5% (1 in 200)	3.09*		+4.61
0.1% (1 in 1000)	3.39*		+4.31

As shown, the Proposed Scheme is not at risk of coastal flooding at the crossing of the Broadmeadow and Ward Rivers.

Figure 5.11 shows the predicted extent of Coastal Flooding from the IPCSS. As shown, the predicted extent of flooding is not as large as that from the Eastern CFRAM suggesting lower peak water levels were used for the IPCSS.

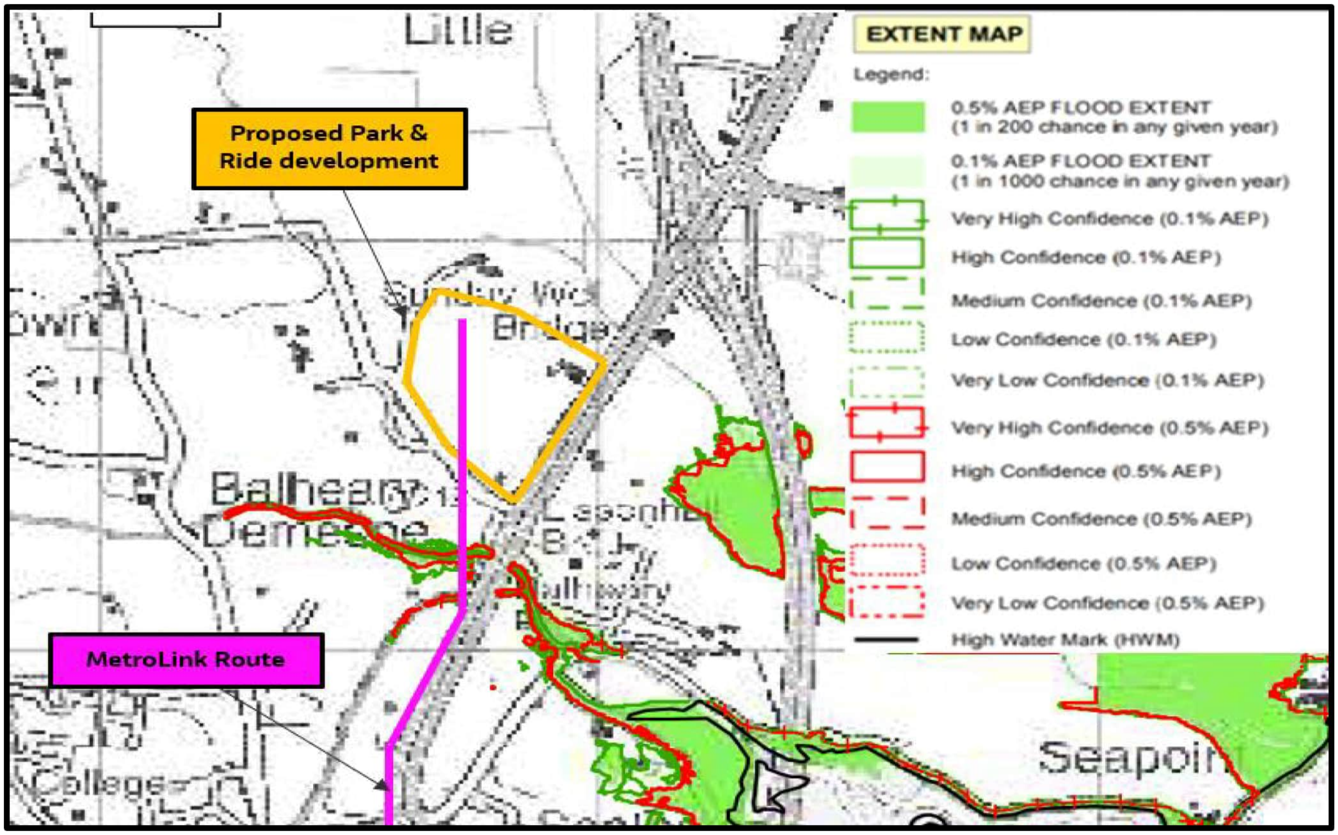


Figure 5.11 ICPSS coastal mapping Lissenhall

Table 5.6 compares the equivalent peak water levels for fluvial and coastal floods at the proposed crossing of the Ward and Broadmeadow Rivers. This confirms that the dominant source of flooding to the Proposed Scheme will come from fluvial sources. Any design mitigation therefore that adequately allows for fluvial flooding in this location can also be considered to satisfactorily address any coastal flood risk.

Table 5.6 Design Broadmeadow and Ward Rivers Fluvial and Coastal Flood Levels for the MetroLink scheme. Lissenhall (Swords), Ch. 1 + 490 – Ch. 1 + 760

AEP Event	Coastal Flood Level (mAOD)	Fluvial Flood Level (mAOD)	Difference (m)
10% (1 in 10)	2.60	4.81	2.21*
0.1% (1 in 1000)	3.39	5.62	2.23*

**A positive difference indicates that the fluvial flood level exceeds the coastal flood level*

Ch. 1 + 490 – Ch. 1 + 760 Ward & Broadmeadow Coastal Risk Assessment Summary:

- The dominant source of flooding to the MetroLink scheme is fluvial as the predicted fluvial flood levels and extents exceed the equivalent coastal outputs.
- A Stage 3 Flood Risk Assessment is required however this will focus solely on Fluvial flood risk. This is because any mitigation that adequately addresses fluvial flood risk will also address any coastal flood risk.

5.5.2 Tara Station, on Tara Street, Ch. 17 + 400, associated with River Liffey

The Stage 1 assessment indicated that proposed Tara Station (Ch. 17 + 400) is at risk of coastal flooding from River Liffey. The footprint of the proposed Tara Station is shown in Figure 5.12 and compared against the predicted coastal flood extent for the River Liffey. Flooding of the station could occur via the station entrances and lead to wider inundation of the MetroLink line.

The remainder of the Proposed Scheme where it passes beneath the Liffey and its floodplain is in a sealed tunnel below ground so should not be at risk of flooding.

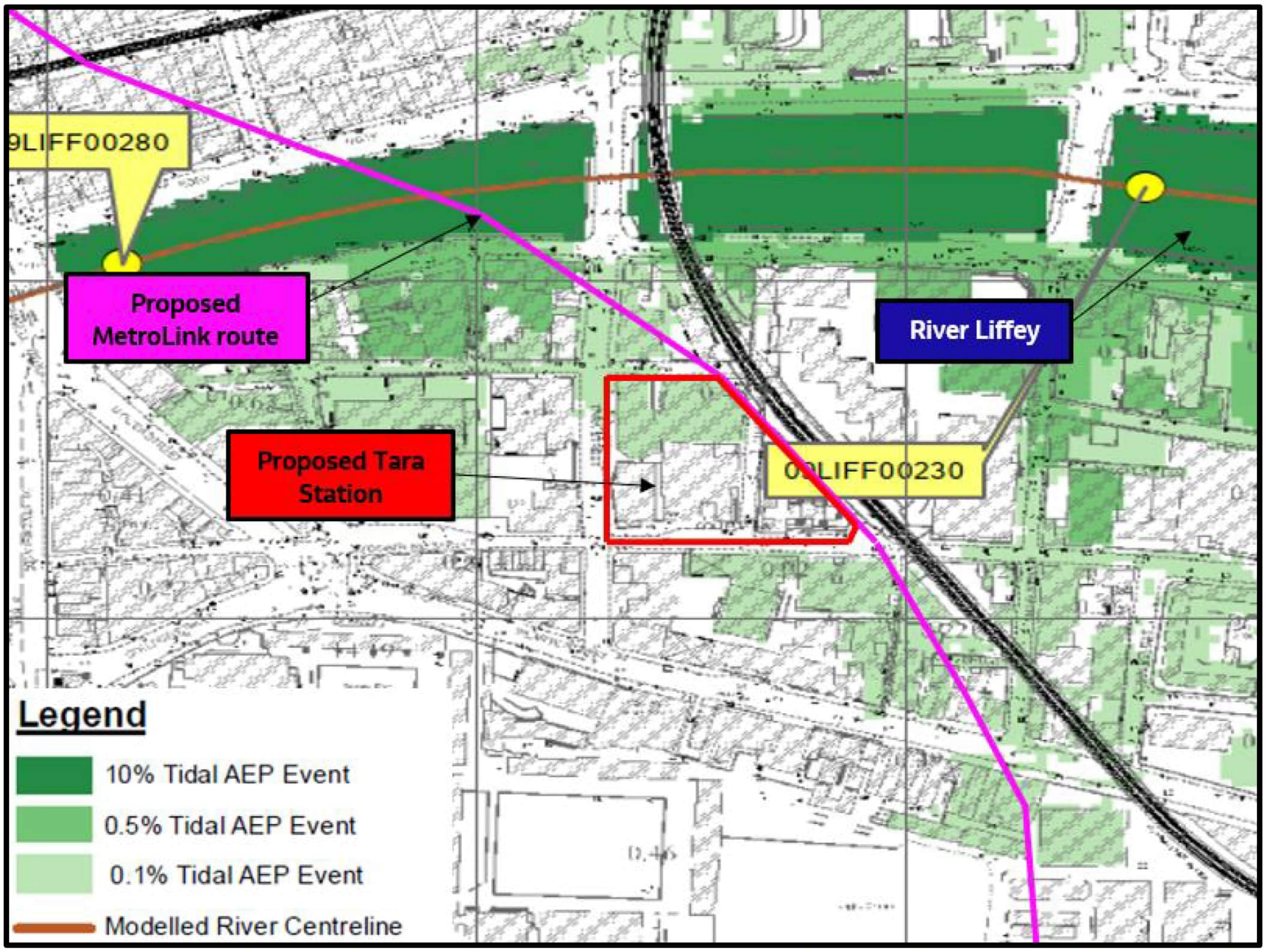


Figure 5.12 Extract of coastal flood mapping from CFRAM study around proposed Tara Station (Ch. 17 + 400)

Tara is an important station as MetroLink will interconnect with DART and Irish Rail services here, one of the major strategies behind the new alignment. Figures 5.13 and 5.14 show the proposed layout and longitudinal section for Tara Station. (Drawings 'ML1-JAI-ARC-MS14_GF-DR-Y-00203' and 'ML1-JAI-ARC-MS14_ZZ-DR-Y-00210' in Appendix C). The threshold for flooding of the station is 3.40mAOD which is the minimum level at each station entrance.

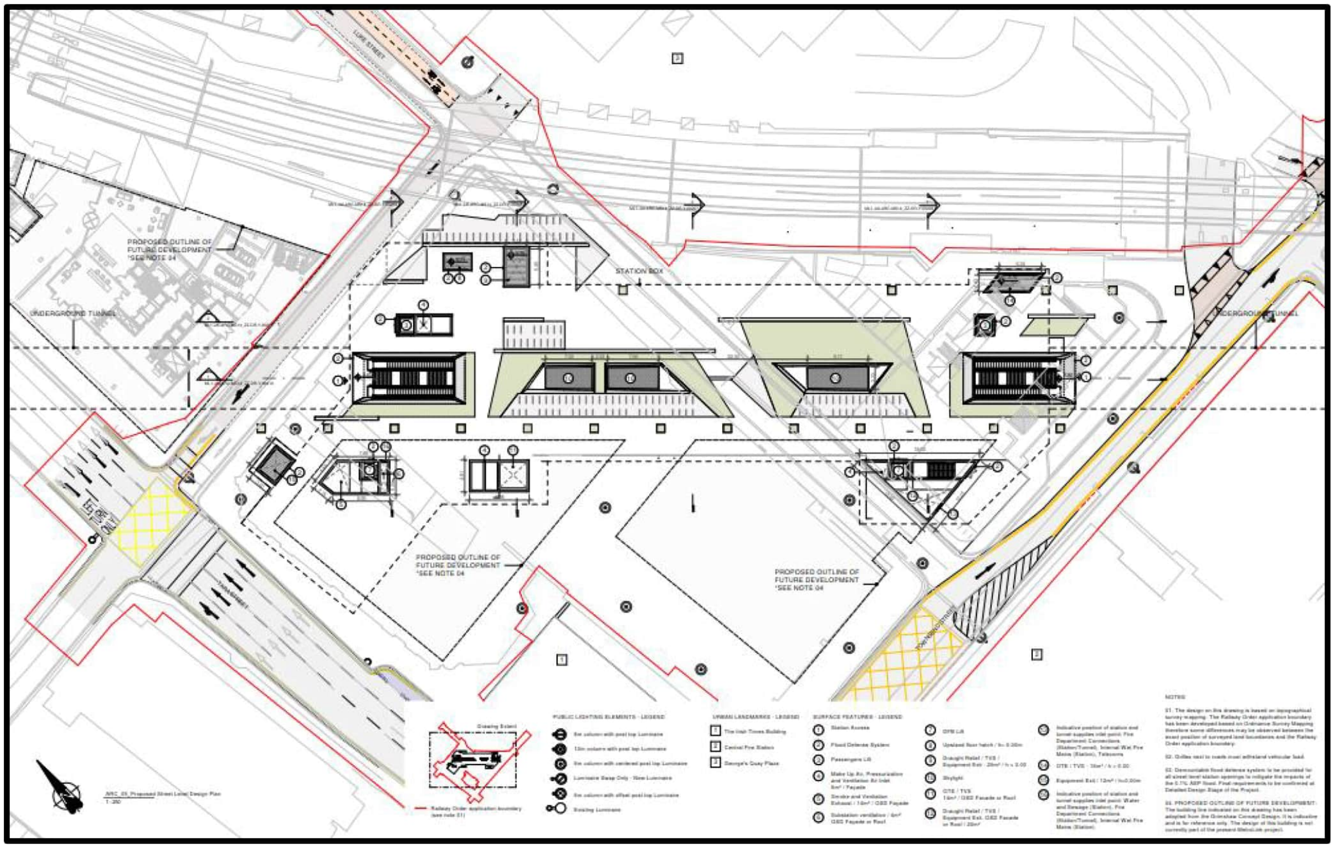


Figure 5.13 Proposed Street Level Design Plan of Tara Station

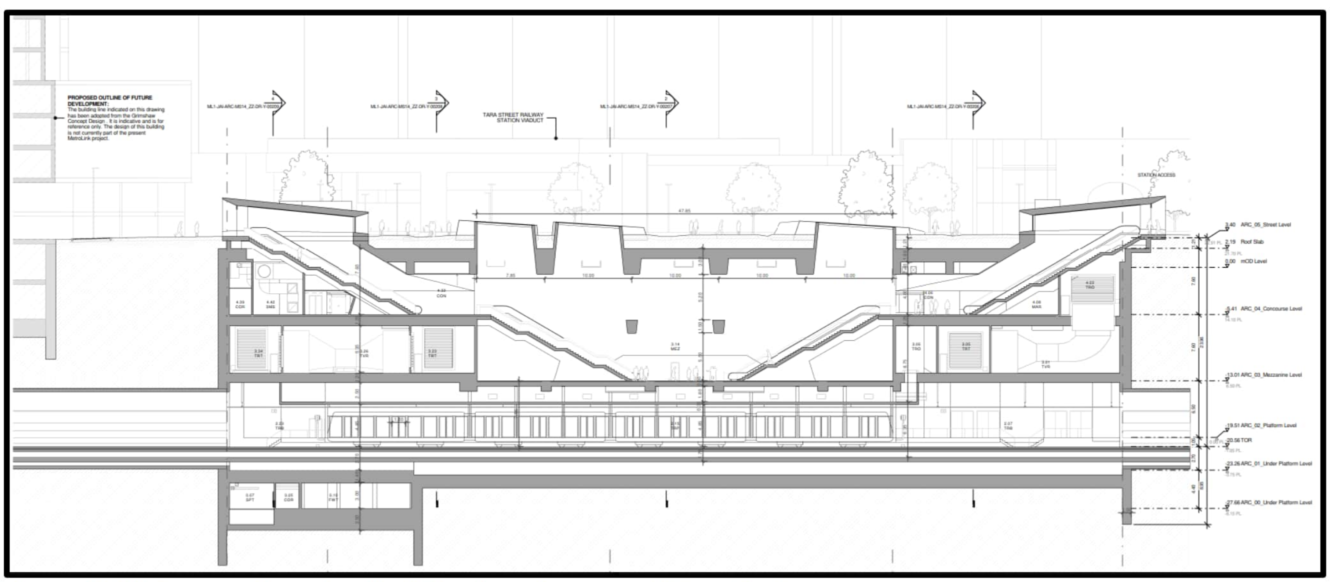


Figure 5.14 Proposed Longitudinal Section of proposed Tara Station

The predicted flood levels have been obtained from the OPW CFRAM Study (See Appendix B) for the 10%, 0.5% and 0.1% AEP flood event and has been compared against the proposed street level of the Tara Station entrances, refer to Table 5.7.

Table 5.7 Current River Liffey Coastal Flood Levels for the proposed MetroLink scheme (Tara Station, Ch. 17 + 400)

AEP Event	Flood Level (mAOD)	Minimum Station Threshold Level (mAOD)	Difference / Freeboard Allowance (m)
10% (1 in 10)	2.68*	3.40	+0.72
0.5% (1 in 200)	3.12*		+0.28
0.1% (1 in 1000)	3.35*		+0.05

* Values obtained from node 09LIFF00280

As shown, the proposed threshold levels around Tara Station mean it is currently not at risk of flooding in the 10%, 0.5% and 0.1 % AEP floods.

Table 5.8 compares the equivalent peak water levels for fluvial and coastal floods at Tara Station. This confirms that the dominant source of flooding to the Proposed Scheme will come from coastal sources. Any design mitigation therefore that adequately allows for coastal flooding in this location can also be considered to satisfactorily address any coastal flood risk.

Table 5.8 Design River Liffey Fluvial and Coastal Flood Levels for the MetroLink scheme. Ch. 17 + 400

AEP Event	Coastal Flood Level (mAOD)	Fluvial Flood Level (mOD)	Difference (m)
10% (1 in 10)	2.68	2.46	-0.22*
0.1% (1 in 1000)	3.35	2.49	-1.22*

**A negative difference indicates that the coastal flood level exceeds the fluvial flood level*

Whilst Tara Station is not at risk of flooding from the 0.1% AEP flood, a Stage 3 Flood Risk Assessment is required at this location to demonstrate if the construction of Tara Station will increase flood risk to other receptors due to potential floodplain displacement. As noted below, Tara Station will be at risk allowing for the effects of future climate change.

Ch. 17 + 400 Fluvial Flood Risk Assessment Summary:

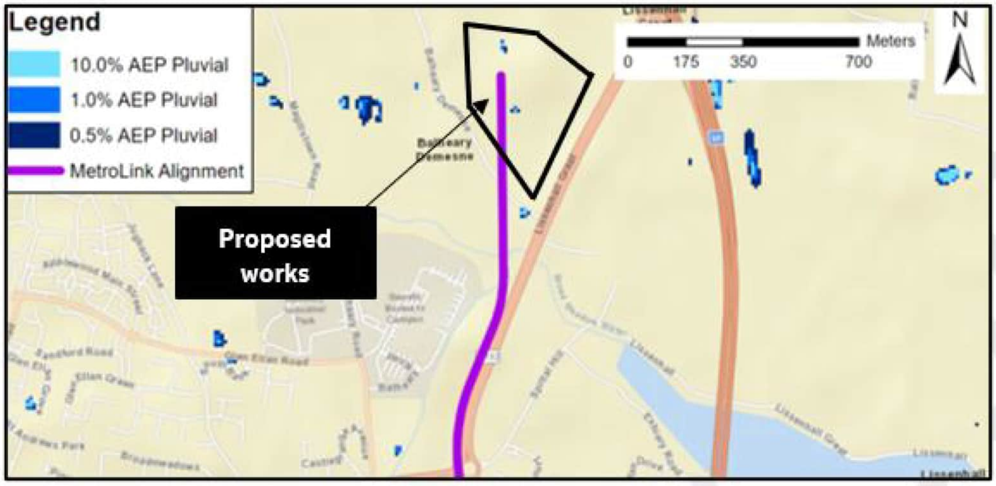
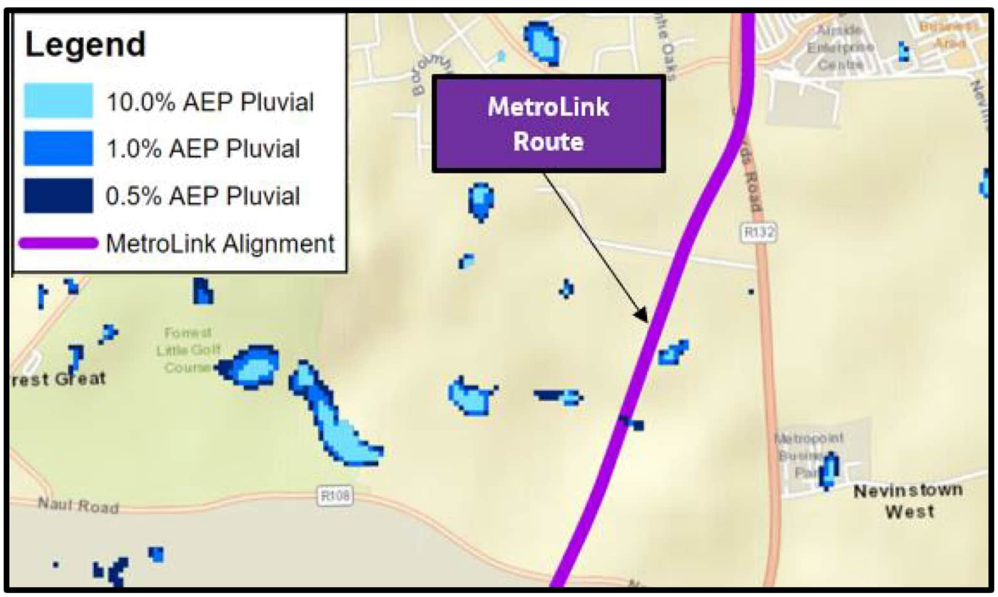
- At Ch. 17 + 400, Tara Station is located in Flood Zone B.
- The construction of the proposed new Tara Station might affect the predicted coastal flood extents of River Liffey due to floodplain displacement, therefore a Stage 3 FRA is required.

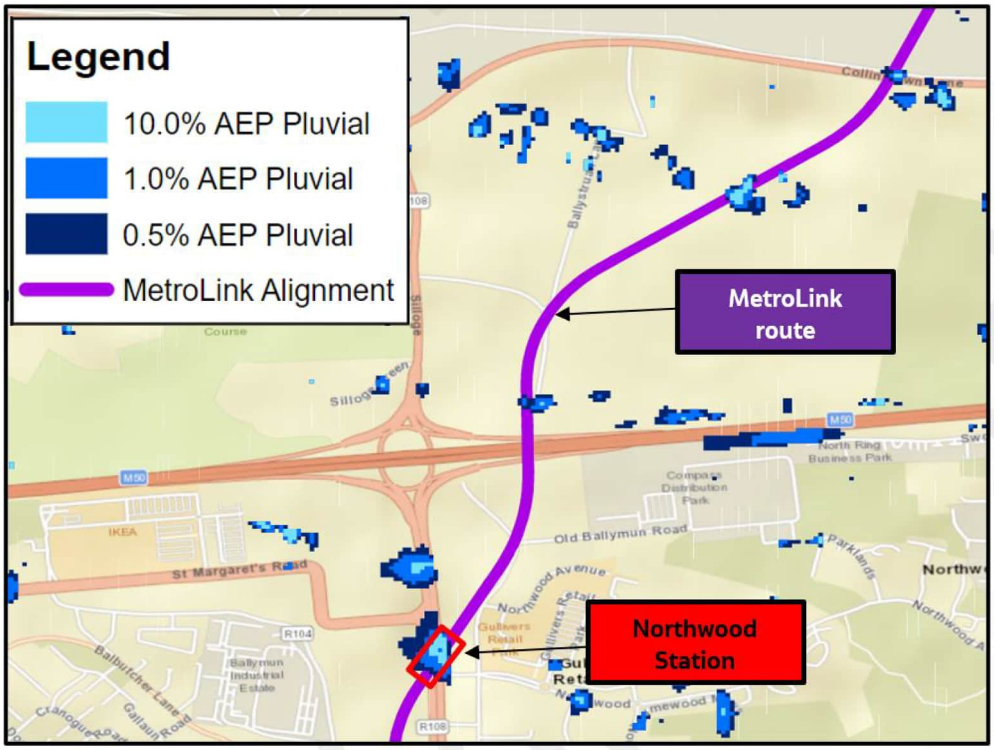
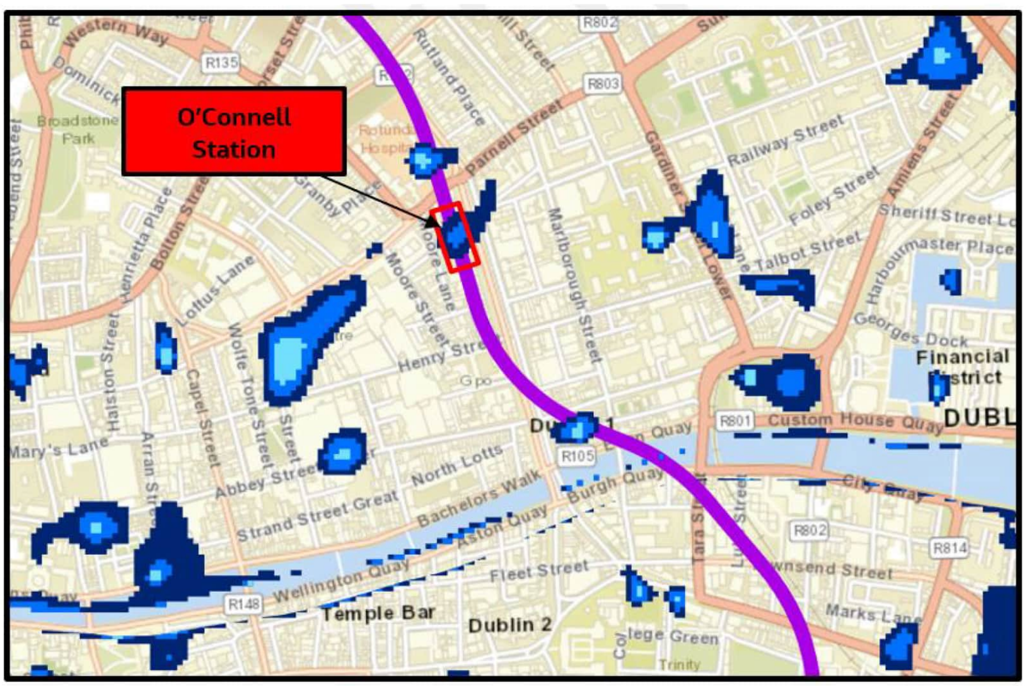
5.6 Initial Pluvial Flood Risk Assessment

Pluvial flooding occurs during periods of heavy rainfall, when the rainfall rate is greater than the infiltration capacity. It is usually associated with high intensity rainfall events (typically > 30mm/h) resulting in overland flow and ponding in depressions in the topography. In urban situations underground sewerage/drainage systems and surface watercourses may be overwhelmed. The Stage 1 Flood Risk Assessment identified numerous potential locations along the proposed scheme that could be subject to pluvial flooding.

Table 5.9 shows sections of the Proposed Scheme which are at risk of pluvial flooding. It should be noted that for much of the scheme, this only affects proposed stations as the track is constructed in a sealed tunnel below ground.

Table 5.9 Pluvial Flood Risk Areas

Location	Comments
	**Lissenhall**
	**North to Naul Road**

Location	Comments
	**Dardistown and Ballymun areas**
	**O'Connell Street**

To reduce the risk of pluvial flooding would require extensive replacement and upgrade of the existing drainage network along the full extent and probably external to the Proposed Scheme. This is beyond the scope of the project.

In line with the Dublin City Development Plan SFRA and GDSDS, drainage from any new impermeable surfaces that are created by the scheme will be attenuated using Sustainable Drainage Systems (SuDS), based on guidance stated in *The SuDS Manual CIRIA 753*. These measures will ensure no net increase in run off from the MetroLink Scheme or additional flows being discharged to the existing drainage networks.

New drainage networks have been developed for all new stations, the track and all associated infrastructure for the MetroLink Scheme. Further details of the Proposed Scheme's surface water design is provided in Section 6 of this report.

5.7 Groundwater Flooding

This type of flooding occurs when the level of water within the soil makes up the land surface (known as the water table) and rises due to periods of abnormally high rainfall.

The proposed scheme includes the construction of tunnelled sections of track and numerous below ground elements associated with the stations. All below ground structures will be designed to be appropriately lined to prevent the ingress of ground water during operation.

During construction, temporary pumping of groundwater will be undertaken to permit construction of underground scheme elements. The discharge of any groundwater to surface water receptors will be subject to consent and controlled to ensure no adverse impact on flood risk. For further details, refer to the Environmental Impact Assessment Report, which this FRA accompanies.

The elevation of the proposed overground infrastructure across the scheme and nature of surface strata as impermeable clay, means the above ground emergence of groundwater is highly unlikely. There are also no reports of groundwater flooding across the Proposed Scheme.

The risk of groundwater flooding to the scheme is therefore considered to be low and is not considered further in this assessment.

5.8 Estuarine flooding

The ICPSS in Section 4.6 of this report identifies two potential sources of coastal flooding to the Proposed Scheme, namely Broadmeadow and Ward Rivers and River Liffey. When combined with fluvial flooding, this could lead to an elevated flood risk. It should be noted that where there is potential risk of coastal and fluvial flooding to a particular location, it does not automatically follow that combined estuarine flooding will lead to an elevated risk. This is because it is quite common for one type to be the dominant flood risk source.

Table 5.10 below compares peak coastal and fluvial flood levels for the Ward and Broadmeadow Rivers. As shown, and confirmed by the predicted flood extents presented previously, fluvial flooding is the dominant flood risk source. Peak fluvial flood levels exceed the peak costal flood levels by 2.2m for the 10% AEP and 0.1% AEP floods. It can therefore be concluded that if the Proposed Scheme is designed to be resilient to the 0.1% AEP fluvial flood then it will also be resilient to all forms of coastal and estuarine flooding.

Table 5.10 – Comparison between Peak Coastal and Fluvial Flood Levels for the Ward & Broadmeadow Rivers

AEP Event	Coastal Flood Level (mAOD)	Fluvial Flood Level (mOD)	Difference (m)
10% (1 in 10)	2.60	4.81	2.21
0.1% (1 in 1000)	3.39	5.62	2.23

A positive difference indicates that the fluvial flood level exceeds the coastal flood level

Table 5.11 below compares peak coastal and fluvial flood levels for the River Liffey. As shown, and confirmed by the predicted flood extents presented previously, coastal flooding is the dominant flood risk source. Peak coastal flood levels exceed the peak fluvial flood levels by 1.2 m for the 0.1% AEP flood. It can therefore be concluded that if the Proposed Scheme is designed to be resilient to the 0.1% AEP coastal flood, then it will also be resilient to all forms of fluvial and estuarine flooding.

Table 5.11 – Comparison between Peak Coastal and Fluvial Flood Levels for the Ward & Broadmeadow Rivers

AEP Event	Coastal Flood Level (mAOD)	Fluvial Flood Level (mOD)	Difference (m)
10% (1 in 10)	2.68	2.46	-0.22
0.1% (1 in 1000)	3.35	2.49	-1.22

A negative difference indicates that the coastal flood level exceeds the fluvial flood level

5.9 Flood Risk due to Climate Change

Future climate change is predicted to give rise to an increased risk of flooding through rising sea levels, an increase in river flows and the frequency and intensity of extreme rainfall. The OPW has identified two potential scenarios for the impacts of climate change that are known as the Mid-Range Future Scenario (MRFS) and High-End Future Scenario (HEFS). Table 5.12 summarises the predicted impacts of both scenarios on predicted sea levels, river flows and rainfall depths over the next 100 years.

Table 5.12 Climate Change Forecast

Parameter	Mid-range Future Scenario (MRFS)	High-End Future Scenario (HEFS)
Mean Sea Level Rise	+500mm	+1000mm
River Flows	+20%	+30%
Extreme Rainfall Depths	+20%	+30%

The Mid-Range Future Scenario (MRFS) scenario is intended to represent the 'likely' future scenario based on a range of forecasts. The High-End Future Scenario (HEFS) represents a more extreme forecast that is at the upper end of accepted projections.

For the purposes of this Flood Risk Assessment, the potential impact of climate change on flood risk to the proposed development has been made relative to the MRFS scenario as specified in *Document Circular PL 2/2014* issued by the Department of Housing, Local Government and Heritage.

5.9.1 Coastal Impacts

The following two parts of the scheme are at risk from coastal flooding:

- Ward & Broadmeadow Rivers where it crossed by the Proposed Scheme.
- River Liffey and specifically the proposed Tara Station.

Table 5.13 below compares the peak coastal flood levels for the Ward & Broadmeadow Rivers with the MRFS effects of climate change against the Proposed Scheme track levels. As shown, the proposed track level still significantly exceeds the peak coastal flood level. The current 0.1% AEP peak fluvial level (5.62m OD) also exceeds the 0.1% coastal flood level with the effects of climate change. This confirms that fluvial flooding from the Ward & Broadmeadow Rivers will remain the dominant flood risk source to the Proposed Scheme with the effects of future climate change.

Table 5.13 Design Broadmeadow and Ward Rivers Coastal Flood Levels with Climate Change for the MetroLink scheme. Lissenhall (Swords), Ch. 1 + 490 – Ch. 1 + 760

AEP Event	Flood Level (mAOD)	Minimum Top Of Rail (TOR) level (mAOD)	Difference / Freeboard Allowance (m)
10% (1 in 10)	3.10	7.70	+4.60
0.5% (1 in 200)	3.59		+4.11
0.1% (1 in 1000)	3.89		+3.81

Table 5.14 below compares the peak coastal flood levels for the River Liffey with the MRFS effects of climate change against the proposed threshold level for Tara Station. As shown, the proposed station threshold level is exceeded by the peak coastal flood level for the 0.5% and 0.1% AEP floods. Mitigation measures are therefore proposed for Tara Station to account for the effects of climate change. Further details of these measures are contained in Section 7.

Table 5.14 River Liffey Coastal Flood Levels for the proposed MetroLink scheme with the effects of Climate Change (Tara Station, Ch. 17 + 400)

AEP Event	Flood Level (mAOD)	Minimum Station Threshold Level (mAOD)	Difference / Freeboard Allowance (m)
10% (1 in 10)	3.28*	3.40	+0.22
0.5% (1 in 200)	3.62*		-0.28
0.1% (1 in 1000)	3.85*		-0.45

* Values obtained from node 09LIFF00280

The track is in tunnel where it passes beneath the Liffey and its floodplain so is not impacted by the effects of climate change.

5.9.2 Fluvial Impacts

Increased river flows from the effects of climate change could impact on all river crossings that are made by the Proposed Scheme. Section 7 describes the mitigation measures that are made as part of the Proposed Scheme where it crosses the following rivers and watercourses:

- Ditches and minor tributaries of the Staffordstown Stream catchment associated with the Park & Ride.
- Ward & Broadmeadow Rivers.
- Sluice River.
- Turnapin Stream associated with the construction of Dardistown Depot.

The impacts of climate change on the other watercourses that are crossed by the Proposed Scheme are summarised in the paragraphs below.

5.9.2.1 Gaybrook

As noted previously, the predicted flood extent for the Gaybrook is overestimated due to the presence of a flood relief culvert that diverts the majority of the stream flow to the Ward River. The track is also covered where it crosses the Gaybrook so would not be affected by any increased flow in the watercourse

5.9.2.2 Santry River

The Proposed Scheme crosses the Santry River where the watercourse is contained in a culvert. Table 5.15 below compares the peak flood levels with the effects of climate change for the Santry River where it is crossed by the Proposed Scheme against the designed track levels.

Table 5.15 Design Santry River Fluvial Flood Levels with Climate Change for the MetroLink scheme at the Culvert Crossing (Ch. 9 + 650 – Ch. 9 + 750).

AEP Event	Flood Level (mAOD)	Minimum Top Of Rail (TOR) level (mAOD)	Difference / Freeboard Allowance (m)
10% (1 in 10)	54.41*	56.67	2.26
1% (1 in 100)	54.64*		2.03
0.1% (1 in 1000)	54.77*		1.90

* Values obtained from node 09SANT00820J.

As shown even with the effects of climate change, the Proposed Scheme track level still significantly exceeds the 0.1% AEP flood level. The Proposed Scheme is therefore resilient to the effects of climate change at its crossing of the Santry River. No modifications are made by the Proposed Scheme to the existing culvert that will convey the Santry beneath the Proposed Scheme therefore there would be no impact on the extent of flooding.

5.9.2.3 River Liffey

Tara Station, which is part of the Proposed Scheme is located in close proximity to the River Liffey. Table 5.16 below compares the peak flood levels with the effects of climate change for the River Liffey against the proposed threshold for Tara Station.

Table 5.16 River Liffey Fluvial Flood Levels with Climate Change for the proposed MetroLink scheme (Tara Station, Ch. 17 + 400)

AEP Event	Flood Level (mAOD)	Minimum Station Threshold Level (mAOD)	Difference / Freeboard Allowance (m)
10% (1 in 10)	2.48	3.40	0.92
1% (1 in 100)	2.50		0.90
0.1% (1 in 1000)	2.52		0.88

* Values obtained from node 09LIFF00280

As shown even with the effects of climate change, the Proposed Scheme threshold level for Tara Station still significantly exceeds the 0.1% AEP flood level. The Proposed Scheme is therefore resilient to the effects of climate change on fluvial flooding associated with the River Liffey.

The track is in tunnel where it passes beneath the Liffey and its floodplain so is not impacted by the effects of climate change.

5.9.2.4 River Tolka

Section 5.4 showed that whilst Griffith Park Station is located close to the River Tolka, it is not at risk of flooding as it is located outside of the floodplain. This conclusion will not be changed by the effects of climate change.

5.9.3 Pluvial Flood Risk

Future climate change will result in increased rainfall depths over the Proposed Scheme. This has the potential to affect the design capacity of drainage systems that are installed for the proposed stations, Park & Ride, Depot and sections of the track that are not covered. Details of how the scheme has allowed for the effects of future climate change within its drainage design are provided in Section 6.

5.9.4 Groundwater Flooding

The Proposed Scheme, in operation, will not be at risk from groundwater flooding. This conclusion is not affected by the impacts of climate change.

5.10 Summary of Flood Risk

The flood risk to the Proposed Scheme is summarised in Sections 5.10.1 to 5.10.3 below.

5.10.1 Major River & Watercourse Crossings

Six locations were identified where the MetroLink Scheme crosses a major watercourse. These locations a summary of the flood risk to the Proposed Scheme is provided in Table 5.17 below.

Table 5.17 MetroLink Scheme Watercourse Crossings Potential Flood Risk

Watercourse	Chainage	Flood Risk Source		Crossing details
		Fluvial	Coastal	
Broadmeadow and Ward Rivers	1 + 540 & 1 + 625	✓	✓	Fluvial flooding is the dominant risk to the Proposed Scheme. The elevation of the Proposed Scheme means it is resilient to fluvial flooding from both watercourses. Further details of the design of the crossing are provided in Section 7. Whilst there is also a risk of coastal flooding to the Proposed Scheme from the Broadmeadow and Ward Rivers, fluvial flooding is the dominant risk. The peak 0.1AEP fluvial flood level exceeds the equivalent tidal flood level by more than 2m. This conclusion is not affected by the impacts of climate change.
Gaybrook Stream	4 + 450	✓		The Proposed Scheme is covered where it passes the Gaybrook. It is therefore not risk of flooding from this watercourse. This conclusion is not affected by the impacts of climate change.
Unnamed Tributary of Sluice River	5 + 765	✓		The elevation of the Proposed Scheme means it is resilient to flooding from both watercourses. Further details of the design of the crossing are provided in Section 7.
Sluice River	5 + 963	✓		
Santry River	10 + 000	✓		The Proposed Scheme crosses the Santry River where the watercourse is in culvert. The elevation of the Proposed Scheme means it is resilient to flooding from the Santry River and has no impact on the watercourse. This conclusion is not affected by the impacts of climate change.

5.10.2 Minor Watercourses

Table 5.18 lists the minor watercourses that are not identified by CFRAM, NFIM or other flood risk mapping but are impacted by the Proposed Scheme for the Park & Ride and Depot. The design for the Proposed Scheme to accommodate these watercourses are detailed in Section 7.

Table 5.18 MetroLink Scheme Minor Watercourses with Potential Flood Risk Impact

Watercourse	Chainage	Flood Risk Source		Crossing details
		Fluvial	Coastal	
Ditch within the catchment of the Staffordstown River	1 + 100	✓		Ditch is located beneath the footprint of the proposed Park & Ride at Estuary Station. The ditch is to be diverted to allow for the construction of the Proposed Scheme.
Turnapin Stream	8 + 600	✓		The Turnapin Stream is a tributary of Mayne River. The stream is to be diverted to allow for the construction of the proposed Dardistown train depot.

5.10.3 Stations & Indirect Impacts

In addition to the direct crossings or impacts on the watercourses listed above, the Proposed Scheme includes 2 No. proposed underground stations that are located in close proximity to a watercourse and/or associated floodplain. The entrances to the stations are at ground level so could provide a potential route for floodwaters to affect Proposed Scheme. The flood risk impacts to the Proposed Scheme are summarised in Table 5.19 below.

Table 5.19 Proposed MetroLink Stations at Potential Flood Risk

MetroLink Station	Chainage	Flood Risk Source		Crossing details
		Fluvial	Coastal	
Griffith Park	13 + 875	✓		Proposed entrance to Griffith Park Station is elevated 4m above the top of the flood defences along the River Tolka. Owing to this difference in elevation, it is reasonable to assume that the station entrance is not vulnerable to flooding from the River Tolka
Tara Street	17 + 400		✓	Proposed Tara Station entrance is located within the floodplain of the River Liffey. Presently, the threshold for the station exceeds the 0.1% (coastal) flood level. The station would however be vulnerable to flooding from the Liffey with the effects of future climate change. Tara Station is not at risk of fluvial flooding from the River Liffey.

6. Stage 3: Detailed Assessment – Pluvial Flooding & Surface Water Drainage

Section 5 considered the flood risk to the proposed MetroLink scheme. This section considers in detail the impacts of the Proposed Scheme on Surface Water flooding, with specific reference to the scheme's surface water drainage design.

6.1 Impacts on Pluvial Flooding & Artificial Drainage Networks

The MetroLink scheme will result in an increase in the area of impermeable surfaces due to the construction of the track bed, new stations, park & ride, depot and other associated infrastructure. To ensure no associated increase in flood risk, the scheme developed an overarching Drainage Strategy[1] to ensure the implementation of sustainable Drainage Measures (SuDS). These measures, which will be further developed through detailed design, are in line with CIRIA SuDS manual C753 (2015), Great Dublin Regional Code of Practice and associated GDSDS Technical Documents and Fingal CC Blue/Green infrastructure for Development Guidance Note. The proposed measures are designed to ensure no increase in existing runoff rates throughout the proposed new development as consequence of the works.

As necessary, additional stormwater infrastructure has been incorporated into the scheme to runoff will not compromise the existing system. This is to ensure no change in the risk of flooding arising from surface water sources.

6.2 Surface Water Design Methodology

The methodology to design the additional stormwater network and associated SuDS measures is set out in the project's overarching Drainage Strategy[2]. The MetroLink scheme was split into catchments based upon infrastructure type and then gradient, topography and outfall location. The additional impermeable area within each catchment was then identified and new storm water infrastructure provided. Prior to discharge to the existing network or outfall to a watercourse, SuDS measures are applied to ensure no increase in existing runoff rates within or being discharged to the existing drainage network.

SuDS measures were selected following a hierarchy which favoured source type solutions close to the new impermeable areas e.g. tree pits as opposed to tanks and other regional type solutions at the downstream end of the network. A conceptual model is presented in Table 6.1.

[1] MetroLink Drainage Design Basis, Rev 0, November 2021
[2] MetroLink Drainage Design Basis, Rev 0, November 2021

Table 6.1 The SuDS Management Train. Source: produced by Jacobs from CIRIA SuDS Manual 2015

Scale		SuDS Management Train
Less Preferred Approach	Source	**Rainwater Harvesting** – capture and reuse within the local environment
		Pervious Surfacing Systems – structural surfaces that allow water to penetrate into the ground reducing discharge to a drainage system e.g. pervious pavement, tree pits
	Site	**Infiltration Systems** – structures which encourage infiltration into the ground e.g. Bioretention Basins
		Conveyance Systems – components that convey and control the discharge of flows to downstream storage components e.g. Swales
	Regional	**Storage Systems** – components that control the flows before discharge e.g. attenuation ponds, tanks, oversized pipes or basins

It should be noted that the selection of a SuDS measure was conditioned by local factors as, in some instances, private land ownership prevented the use of source or site solutions, with the only available option to oversize new pipes beneath the road surface to attenuate any additional flow. In all instances however, SuDS measures are implemented to ensure no increase in the net rate of runoff from any new impermeable areas.

Full details of the proposed drainage design for the MetroLink scheme are presented in Appendix F showing new impermeable areas and their associated SuDS measures. Sections 6.3 and 6.4 below summarise the drainage approach and designs for the Proposed Scheme's stations, Park & Ride and Depot and track respectively.

6.3 Station Drainage Design

6.3.1 Introduction

The WINDES MicroDrainage software was used to design the drainage network and associated SuDS measures for the Proposed Scheme's stations, Park & Ride and Depot.

The permeability rates across the Proposed Scheme are generally low therefore, existing infiltration rates were not considered as part of the hydraulic calculations. This ensures a conservative approach meaning all proposed drainage network infrastructure and associated SuDS measures will be oversized.

Refer to Table 6.2 presents the design parameters used for the drainage design[3].

Table 6.2 Station Drainage Design - Parameters

	Parameter	Design Value
Hydraulic modelling	Region	Scotland/Ireland
	MADD Factor	2
	M5-60	16.3
	R	0.279
	Maximum Time of Concentration	30

[3] Parameters provided by Met Éireann and the Greater Dublin Strategic Drainage Study (GDSDS) volume 2.

	Parameter	Design Value
	Design Depth for Optimisation	1.2
	Minimum Velocity for Auto Design	1
	Minimum Slope for Optimisation	500
	Minimum Full-Bore Velocity	Surface Water Sewer 1.0m/s
	Maximum Pipework Velocity	5m/s
	Maximum Outfall Velocity	2.5m/s
	Return period	1-in-1 year: No surcharge 1-in-5 year: No network flooding 1-in-100 year: No flooding in the attenuation system
Run-off coefficient	Impermeable Area	1.0
	Grassed Verges	0
	Roughness Carrier Drain	0.6mm
	Roughness Filter Drain	1.5mm
	Summer Volumetric Runoff, '*Cv*'	0.75
	Winter Volumetric Runoff, '*Cv*'	0.84
Time of entry	Time of entry	4 min
Chambers	Catchpits to be used throughout, otherwise manholes where multiple connections are required.	
	Minimum Catchpit Size	1050mm
	Minimum Manhole Size	1200mm
	Maximum Spacing Outlets	100m
Pipes	Minimum Surface Water	225mm
	Filter Drainage	150mm
Carrier Drains	Minimum Cover - Trafficked	0.9m
	Minimum Cover – Non trafficked	0.6m
	Vertical Clearance (absolute minimum)	150mm
Discharge Rates	Greenfield Allowable Discharge Rate	Minimum discharge based on flow structure greater than 75 mm to avoid blockage risk (2.5 l/s)
	Existing Allowable Discharge Rate	Current run-off rate from existing surface, either paved or unpaved (see greenfield) For existing paved areas, it has been used the modified rational method applying the Wallingford procedures
Storage volume and basin	Return Period	100 years
	Climate Change Design	20%

Drainage designs have been developed, where required for each of the stations shown in Figure 6.1 below. Section 6.3 contains summary schematics for each station catchment along the with the attenuation measures that are implemented as part of the Proposed Scheme to ensure no net increase in runoff. The information is intentionally provided in summary format for brevity. For further details the reader is referred to the following:

- Appendix E which contains all surface water calculations.
- Appendix F which contains all surface water design drawings.

All station drainage is designed to ensure that there is no net increase in runoff as a consequence of the Proposed Scheme.

Figure 6.1 MetroLink Scheme Station Locations

6.3.2 Estuary Station

The Proposed Scheme at Estuary Station includes an open-air station and 3000-vehicle, multi-storey park-and-ride facility. Figure 6.2 summarises how the area affected by the works was split into sub-catchments.

Figure 6.2 Proposed Estuary Station and Park & Ride works and catchment division of the development

A drainage scheme was designed for each sub-catchment based on the parameters stated in Table 6.2. Summarises of the sub-catchment drainage and SuDS measures are as follows:

Green catchment:

- This 0.25 ha catchment discharges into a proposed ditch diversion via a 525 mm outfall ditch.
- Oversized pipes will attenuate the flows prior to outfall. The permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar flow control.

Purple catchment:

- This 0.11 ha catchment discharges into a proposed ditch diversion.
- Oversized pipes will attenuate the flows and discharge into the ditch diversion. The permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar flow control.

Red catchment:

- This 0.79 ha catchment drains the proposed paved area west to Estuary station and discharges into the diverted ditch.

- Four swales with capacities of 1.5 m^3, 4.1 m^3, 6.7 m^3 and 23.5 m^3 will attenuate the run-off created by the new paving. This run-off will be conveyed to the proposed Northwest Pond via storm water pipes

- The proposed Northwest Pond (909.00 m^3 capacity) will also attenuate the flows from the paved area at the west and north of Estuary station. The permissible outflow from the pond will be limited to 2.5 l/s via a Hydro-Brake® or similar type control.

- A proposed 375 mm pipe will convey the attenuated flows from Northwest Pond to a ditch which eventually discharges to the Staffordstown River.

Magenta catchment:

- This 2.7 ha catchment drains runoff created by the Park & Ride Building and discharges into Broadmeadow River. Two swales (183 m^3 and 221 m^3 capacity) will attenuate the run-off created by the proposed Park & Ride area.

- Storm water pipes will convey water runoff created by the additional impermeable areas from the works and attenuated flows from the swales to a proposed pond.

- The proposed pond (1,740.00 m^3) will also attenuate the flows from the proposed Park & Ride area.

- A proposed 300 mm pipe will convey the attenuated flows from the pond to the Broadmeadow River. The permissible outflow for the pond system will be limited to 14.0 l/s via a Hydro-Brake® or similar at flow control manhole.

Blue catchment:

- This 1.5 ha catchment receives runoff from the road and station and discharges into a diverted ditch.

- Two swales (588.00 m^3 and 589.00 m^3 capacity) will attenuate some of the run-off created by the new impermeable area northwest of the proposed Park & Ride.

- Three swales (192.00 m^3, 361.00 m^3 and 767.00 m^3 capacity) will attenuate the run-off created by the impermeable areas northeast and southeast of the proposed Park & Ride.

- Surface water pipes will convey this attenuated runoff to a network of attenuation ponds. The permissible pond outflow will be limited to 6.7 l/s via a Hydro-Brake® or similar flow control.

Drawings 'ML1-JAI-URD-ROUT_XX-DR-Y-02001', 'ML1-JAI-URD-ROUT_XX-DR-Y-02002', 'ML1-JAI-URD-ROUT_XX-DR-Y-02003' and 'ML1-JAI-URD-ROUT_XX-DR-Y-02004' presented in Appendix F contain full details of the drainage proposals. These drawings combine the drainage design and landscape proposal at the proposed new Estuary Station and Park & Ride development and provides an insight into the distribution of the proposed SuDS at this location and the proposed additional impermeable areas.

6.3.3 Seatown Station

The Proposed Scheme at Seatown Station includes an open-air station and connections to drain park of the track. Figure 6.3 summarises how the area affected by the works was split into sub-catchments.

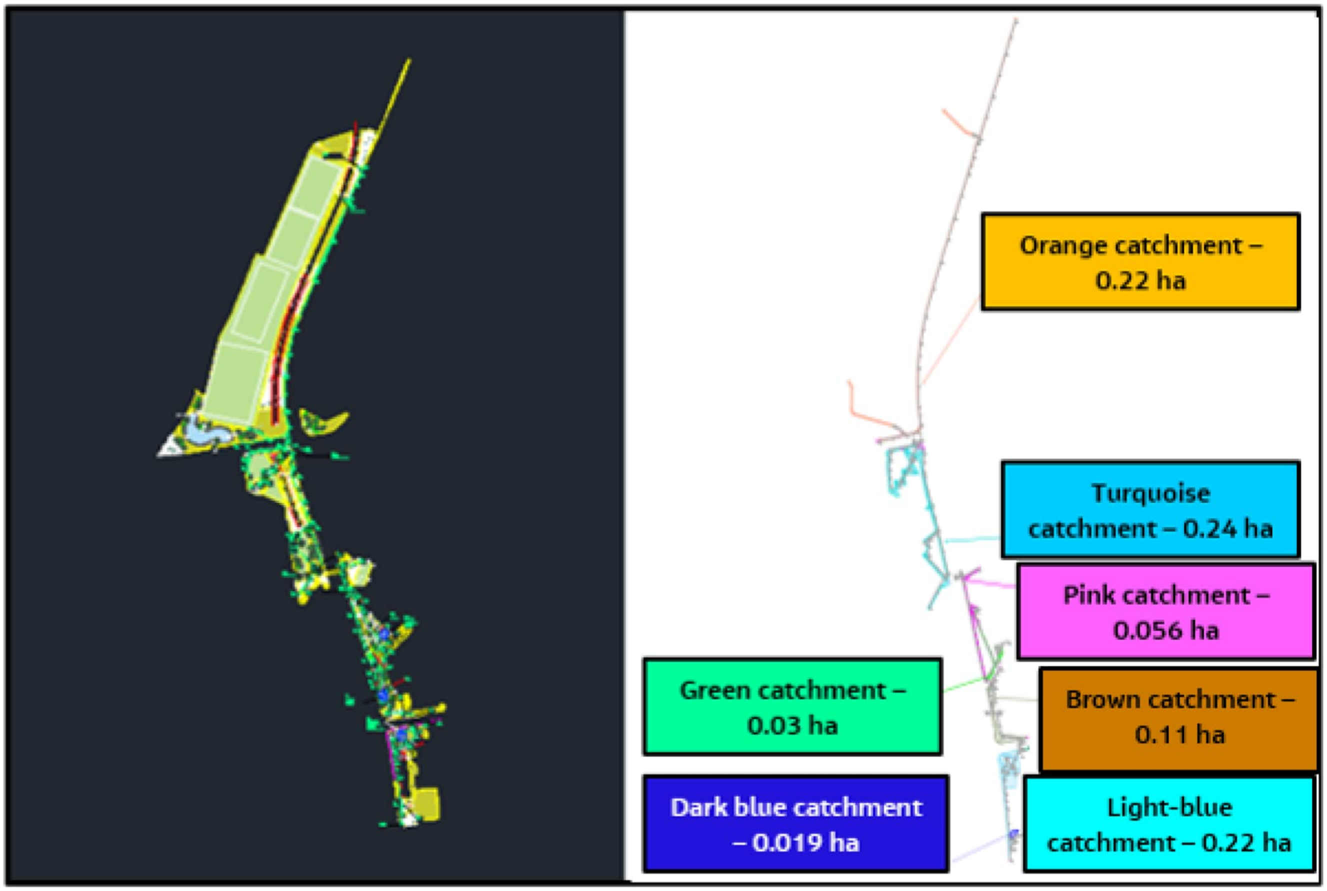


Figure 6.3 Catchment division at proposed Seatown Station

A drainage scheme was designed for each sub-catchment. Summaries of the sub-catchment drainage and SuDS measures are as follows:

Orange catchment:

- This 0.22 ha catchment discharges into the existing surface network.
- Oversized pipes will attenuate the flows and discharge into the existing surface network. The permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar flow control.

Turquoise catchment:

- This 0.24 ha catchment discharges into the existing surface network.
- One storage tank (90.00 m^3) has been proposed to attenuate run-off created by new impermeable areas to be drained by this catchment. An 0.10 m orifice will be proposed at the outlet of this tank to ensure the permissible outflow is limited.

Pink catchment:

- This 0.056 ha catchment discharges into the existing surface network.
- A new swale is proposed (8.50 m^3). This swale will attenuate the flows and the permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar control.

Green catchment:

- This 0.03 ha catchment discharges into the existing surface network.
- A new swale is proposed (113.00 m^3 capacity). This swale will attenuate the flows and the permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar.

Brown catchment:

- This 0.11 ha catchment discharges into the existing surface network.
- A new swale is proposed (87.00 m^3 capacity). This swale will attenuate the flows and the permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar downstream of the proposed swale.

Light-blue catchment:

- This 0.22 ha catchment discharges into the existing surface network.
- A new tank is proposed, (35.00 m^3) which will attenuate the flows from the proposed new impermeable areas.
- Three new swales are also proposed (8.40 m^3, 47.10 m^3 and 4.90 m^3 capacity). These swales will also attenuate run-off created by proposed impermeable areas in the works.
- New proposed storm water pipes will convey attenuated surface water from the proposed swales and the run-off created by the impermeable areas within this catchment to the existing surface network. The discharge rate will be limited to 2.5 l/s via a Hydro-Brake® or similar flow control.

Dark-blue catchment:

- This 0.019 ha catchment discharges into the existing surface network.
- A proposed swale (8.40 m^3 capacity) will attenuate the flows and the permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar flow control.
- A proposed 150 mm pipe will convey the attenuated flows from the proposed swale to the existing surface network.

Drawing 'ML1-JAI-URD-ROUT_XX-DR-Y-02014' in Appendix F contains full details of the proposed drainage scheme. This drawing combines the drainage design and landscape proposal at the proposed new Seatown Station and provides an insight into the distribution of the proposed SuDS at this location and the proposed additional impermeable areas.

6.3.4 Swords Central Station

The Proposed Scheme at Swords Central Station includes an open-air station and connections to drain associated landscaping and infrastructure. Figure 6.4 summarises how the area affected by the works was split into sub-catchments.

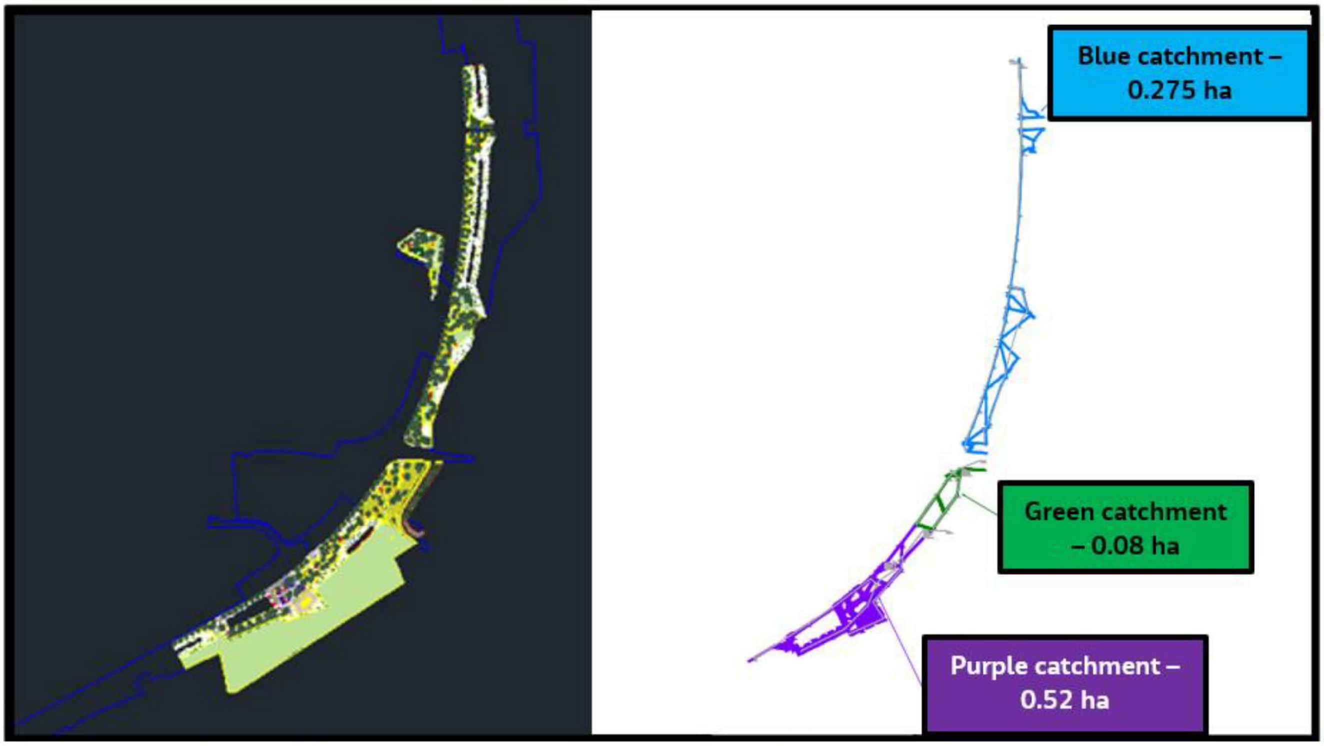


Figure 6.45 Catchment division at proposed Swords Central Station

A drainage scheme was designed for each sub-catchment. Summaries of the sub-catchment drainage and SuDS measures are as follows:

Blue catchment:

- This 0.275 ha catchment discharges into the existing surface network.
- 150 mm, 225 mm, 300 mm, 450 mm, 600 mm and 750 mm oversized pipes will attenuate the flows. The permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar flow control.
- A proposed 300 mm pipe will convey the attenuated flows from proposed over-sized pipes to the existing surface network.

Green catchment:

- This 0.08 ha catchment discharges into the existing surface network.
- A proposed Pond (43.30 m^3 capacity) will attenuate the flows and the permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar.
- A proposed 225 mm pipe will convey the attenuated flows from the proposed pond to the existing surface network.

Purple catchment:

- This 0.52 ha catchment discharges into the existing surface network.
- 150 mm, 225 mm and 300 mm pipes will convey water runoff created by the additional impermeable areas from the works to an attenuation pond.
- The proposed Pond (253.60 m^3 capacity) will attenuate the flows and the permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar.

Drawing ''ML1-JAI-URD-ROUT_XX-DR-Y-02019' in Appendix F contains full details of the drainage scheme.

6.3.5 Fosterstown Station

The Proposed Scheme at Fostertown Station includes an open-air station and connections to drain associated landscaping and infrastructure. Figure 6.5 summarises how the area affected by the works was split into sub-catchments.

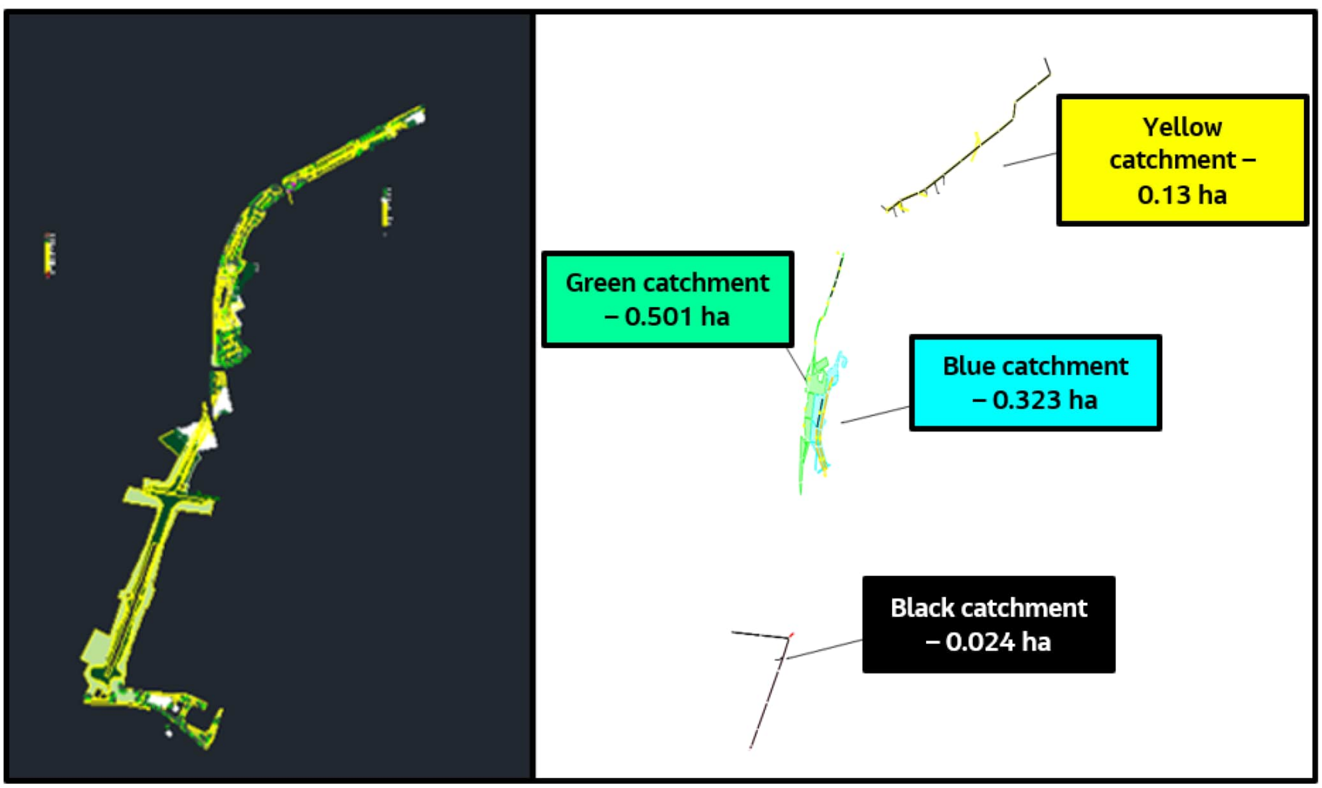


Figure 6.5 6 Catchment division at proposed Fosterstown Station

A drainage scheme was designed for each sub-catchment. Summaries of the sub-catchment drainage and SuDS measures are as follows:

Yellow catchment:

- This 0.13 ha catchment discharges into the existing network.

- 225 mm, 300 mm and 450 mm oversized pipes will attenuate the run-off created by proposed new impermeable areas and convey it to the existing network. The permissible outflow will be limited to 2.50 l/s via a Hydro-Brake® or similar.

Green catchment:

- This 0.501 ha catchment discharges into the existing surface water network.
- Five proposed swales (32.00 m^3, 33.00 m^3, 49.00 m^3, 103.00 m^3 and 103.00 m^3 capacity) will attenuate the flows from the proposed impermeable areas. An 0.075 m orifice is proposed at the outlet of each swale to ensure the permissible outflow is limited.
- 225 mm proposed pipes will convey attenuated water from the swales to proposed new 600 mm and 750 mm oversized pipes. The combine permissible outflow will be limited to 10.00 l/s via a Hydro-Brake® or similar.
- A proposed 300 mm pipe will convey the attenuated flows from proposed over-sized pipes to the existing surface network.

Blue catchment:

- This 0.323 ha catchment discharges into the existing surface network.
- 600mm oversized pipes will attenuate the run-off created by proposed new impermeable areas. The permissible outflow will be limited to 2.50 l/s via a Hydro-Brake® or similar.
- A proposed 600 mm pipe will convey the attenuated flows from the proposed over-sized pipes to the existing surface network.

Black catchment:

- This 0.024 ha catchment discharges into an existing ditch.
- 225 mm oversized pipes attenuate the run-off created by proposed new impermeable areas and convey it to the existing ditch. The permissible outflow will be limited to 2.50 l/s via a Hydro-Brake® or similar.

Drawing ‘ML1-JAI-URD-ROUT_XX-DR-Y-02023’ in Appendix F contains full details of the drainage scheme.

6.3.6 Dublin Airport Station

Dublin Airport is to be an underground station and does not require a drainage scheme. However, works will be required above ground to replace a parking area provide a new pedestrian area to facilitate the access to the station. Figure 6.6 shows that the area affected by the works was treated as a single catchment.

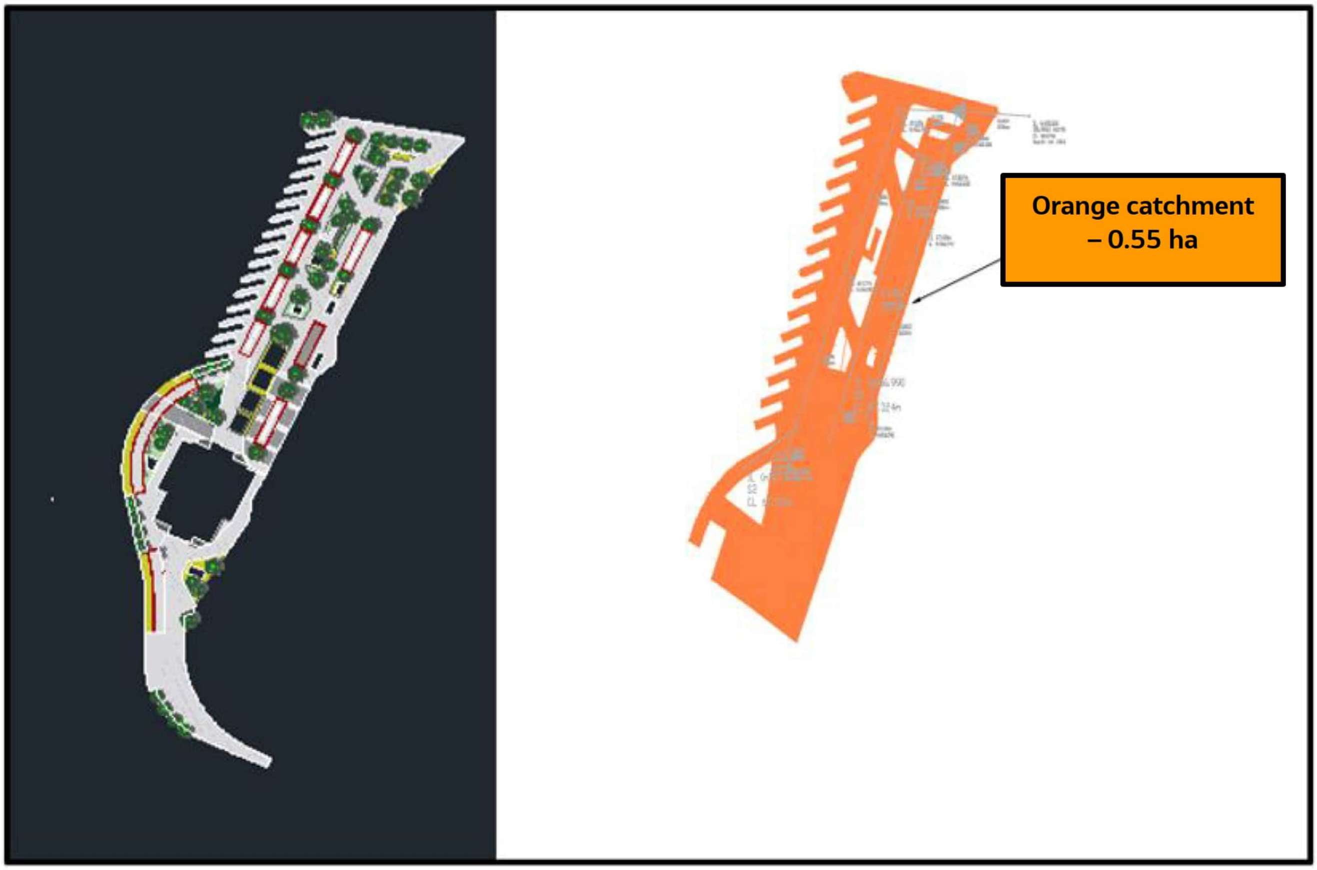


Figure 6.6 7 Catchment division at proposed Dublin Airport Station

A drainage scheme was designed for the catchment, which comprises the following:

- This 0.55 ha catchment discharges into the existing surface network.
- One storage Geocellular tank (480.00 m^3 capacity) has been proposed to attenuate run-off created by new impermeable areas to be drained by this catchment. The permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar.
- 225 mm and 300 mm linear drain pipes will attenuate and convey the run-off created by proposed impermeable areas to the proposed storage tank.
- A 375 mm storm water pipe will convey the attenuated flows from the tank to the existing surface network.

Drawing 'ML1-JAI-URD-ROUT_XX-DR-Y-02032' in Appendix F contains full details of the catchment drainage scheme.

6.3.7 Dardistown Station

Works will be required over the ground to construct Dardistown Station (open-air station) and the main train depot. The proposed works at the depot will include new roads, railway tracks, buildings and new green areas. Figure 6.7 shows the sub-catchments of the proposed new depot at Dardistown Station.

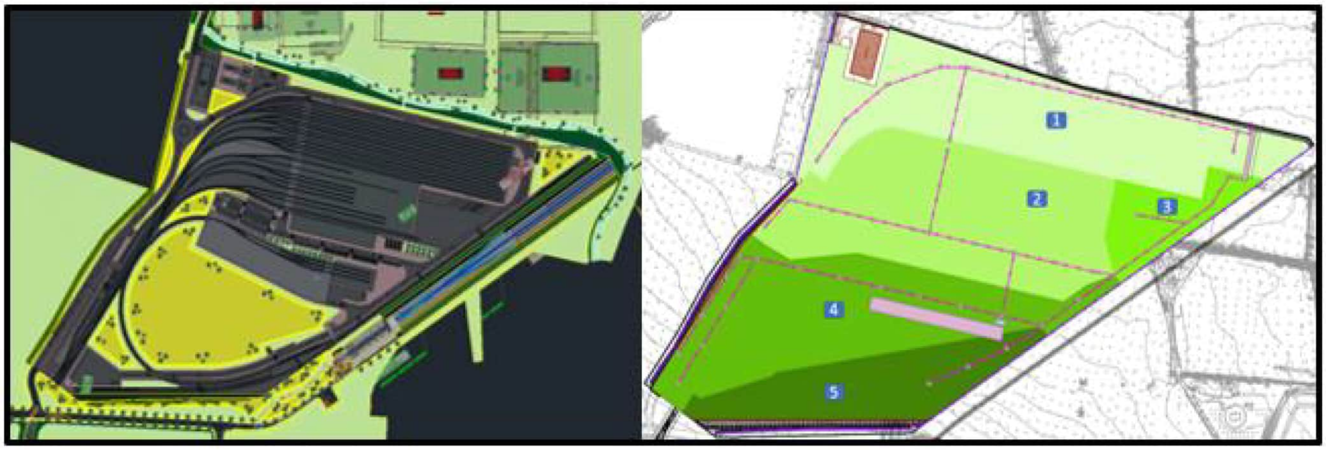


Figure 6.7 Catchment division at proposed Dardistown Station (inside of the depot)

A drainage scheme was designed for each sub-catchment. Summaries of the sub-catchment drainage and SuDS measures are as follows:

- This 17.45 ha catchment discharges into the proposed Turnapin watercourse diversion.
- One proposed irrigation tank (170 m³ capacity) will capture rainwater from the proposed new buildings r.
- Two proposed Geocellular Tanks (486.00 m³ and 2,485.00 m³ capacity) will attenuate the flows from the proposed new impermeable road areas.
- Filter strips will also intercept road run-off from the development to provide opportunities for slow conveyance and infiltration (where appropriate).
- Pervious pavements will also be provided to allow rainwater to pass into the ground below.
- A proposed 1,350 mm pipe will ultimately convey the attenuated flows from attenuation features to the proposed Turnapin watercourse diversion.

Figure 6.8 shows the location of the following SuDS features: (1) Irrigation tank, (2) Storage tanks, (3) Filter strips and (4) pervious pavement.

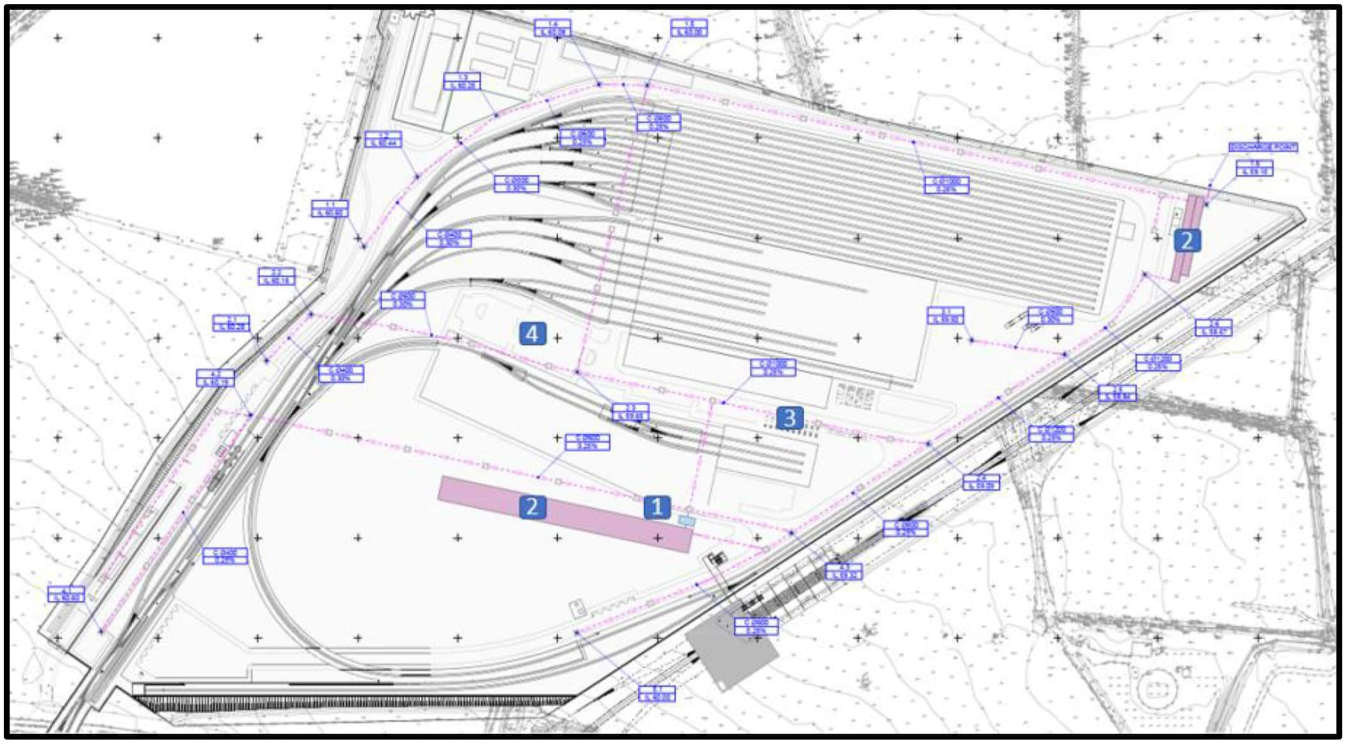


Figure 6.8 Location of the proposed SuDS features

The proposed works also include a new primary and secondary access roads to Dardistown depot and new roads surrounding the proposed depot. Figure 6.9 shows the proposed sub-catchments for the new road network. These works have been developed in line with the Dardistown Local Area Plan 2013-2019 to ensure a 10-15-metre-wide riparian corridor is maintained along both sides of the Turnapin Stream.

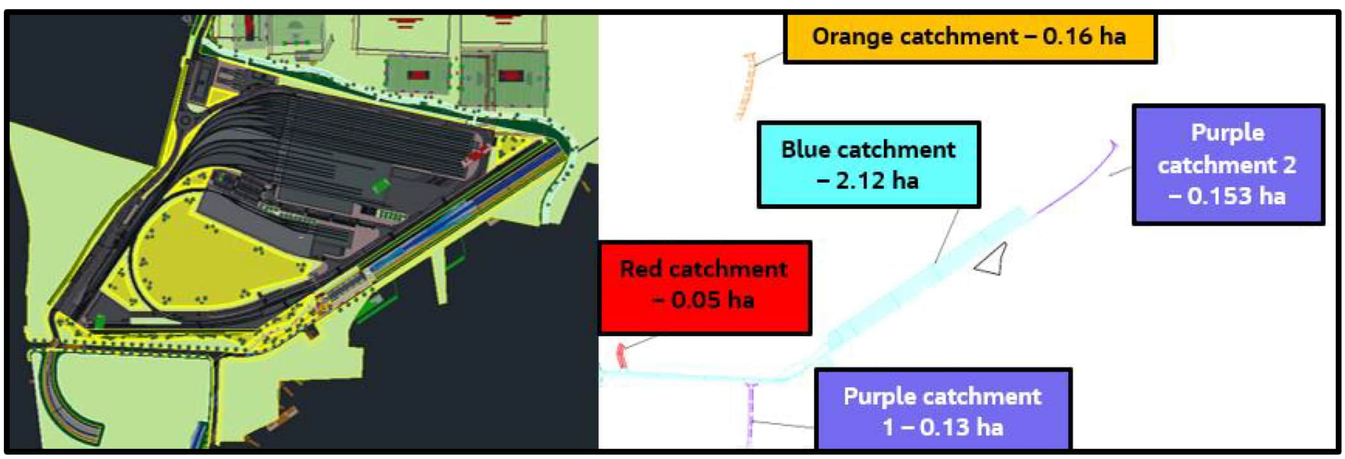


Figure 6.9 Catchment division at proposed Dardistown Station (surrounding the depot)

A drainage scheme was designed for each sub-catchment. Summaries of the sub-catchment drainage and SuDS measures are as follows:

Orange catchment:

- This 0.16 ha catchment discharges into the proposed Turnapin watercourse diversion.

- Grass channels will attenuate and provide treatment to the run-off created by the proposed main access road to Dardistown depot. The permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar.
- A proposed 300 mm pipe will convey the attenuated flows from the channel to the proposed Turnapin Stream diversion.

<u>Blue catchment:</u>

- This 2.12 ha catchment discharges into the proposed Turnapin Stream diversion.
- Swales (470.00 m^3 capacity) and a proposed Storage Tank (1,700.00 m^3 capacity) will attenuate the additional run-off created by this catchment. The permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar.
- A proposed 450 mm pipe will convey the attenuated flows from the tank to the proposed Turnapin Stream diversion.

<u>Red catchment:</u>

- This 0.05 ha catchment discharges into and is attenuated by the proposed drainage network within the depot.

<u>Purple catchment - 1:</u>

- This 0.13 ha catchment discharges into the existing surface network.
- Grass channels will attenuate the flows prior to discharge. The permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar.

<u>Purple catchment - 2:</u>

- This 0.153 ha catchment discharges into the proposed Turnapin watercourse diversion.
- Grass channels will attenuate the flows prior to discharge. The permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar.

Drawings 'ML1-JAI-URD-ROUT_XX-DR-Y-02042', 'ML1-JAI-URD-ROUT_XX-DR-Y-02043', 'ML1-JAI-URD-ROUT_XX-DR-Y-02044', 'ML1-JAI-URD-ROUT_XX-DR-Y-02045', 'ML1-JAI-URD-ROUT_XX-DR-Y-02046', 'ML1-JAI-URD-ROUT_XX-DR-Y-02047', 'ML1-JAI-URD-ROUT_XX-DR-Y-02048' and 'ML1-JAI-DRN-DEPM_XX-DR-Y-50101-1250' in Appendix F provide full details of the proposed drainage scheme.

6.3.8 Northwood Station

Northwood is to be an underground station. A drainage scheme is however required to facilitate the proposed access to the station. Figure 6.10 shows the different catchments of the proposed new Northwood Station drainage network.

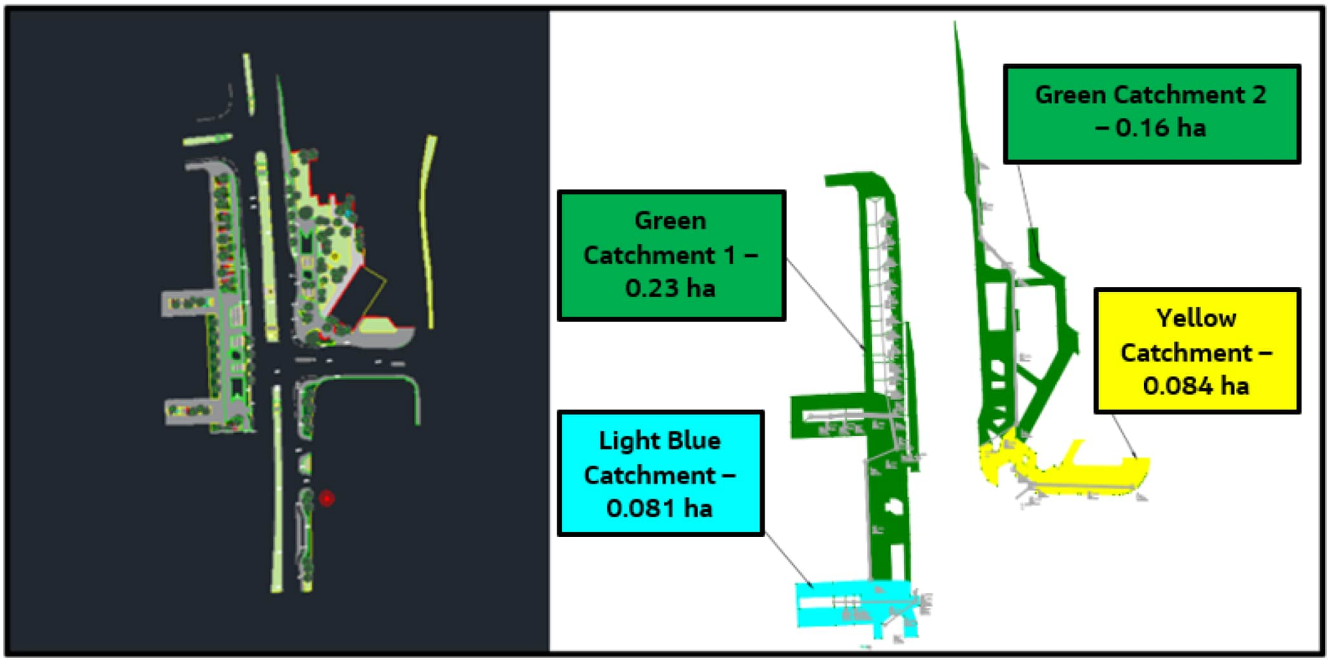


Figure 6.10 Catchment division at proposed Northwood Station

A drainage scheme was designed for each sub-catchment. Summaries of the sub-catchment drainage and SuDS measures are as follows:

Green catchment 1:

- This 0.23 ha catchment discharges into the existing surface network.
- Fifteen swales (4.6 m^3, 7.2 m^3, 5.5 m^3, 5.3 m^3, 3.1 m^3, 3.3 m^3, 3.2 m^3, 1.6 m^3, 1.6 m^3, 1.6 m^3, 1.6 m^3, 3.5 m^3, 1.4 m^3, 2.7 m^3, 15.3 m^3) will attenuate the additional run-off created by the proposed new impermeable areas.
- 300 mm, 375 mm, 450 mm and 525 mm pipes will convey attenuated water from the proposed swales and impermeable areas to a proposed 300 mm pipe which will discharge into the existing surface network. The permissible outflow will be limited to 2.50 l/s via a Hydro-Brake® or similar.

Green catchment 2:

- This 0.16 ha catchment discharges into the existing surface network.
- 450 mm oversized pipes will attenuate the flows. The permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar.
- A 300 mm pipe will discharge the attenuated water from the proposed oversized pipes into the existing surface network.

Yellow catchment:

- This 0.084 ha catchment discharges into the existing network.
- 750 mm and 825 mm oversized pipes will attenuate the flows. The permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar.
- An 825 mm pipe will discharge the attenuated water from the proposed oversized pipes into the existing network.

Light-blue catchment:

- This 0.081 ha catchment discharges into the existing surface network.
- Four swales (0.9 m^3, 4.6 m^3, 5.6 m^3 and 42.2 m^3) will attenuate the run-off created by proposed new impermeable area.
- 375 mm and 525 mm storm water pipes will convey water from the proposed swales to the existing surface network. The permissible outflow will be limited to 2.5 l/s via a Hydro-brake® or similar.

Drawings 'ML1-JAI-URD-ROUT_XX-DR-Y-02057' and 'ML1-JAI-URD-ROUT_XX-DR-Y-02058' in Appendix F contain full details of the proposed drainage scheme.

6.3.9 Ballymun Station

Ballymun is to be an underground station. A drainage scheme is however required to facilitate the proposed access to the station. Figure 6.11 shows the proposed sub-catchments of the proposed new Ballymun Station drainage network.

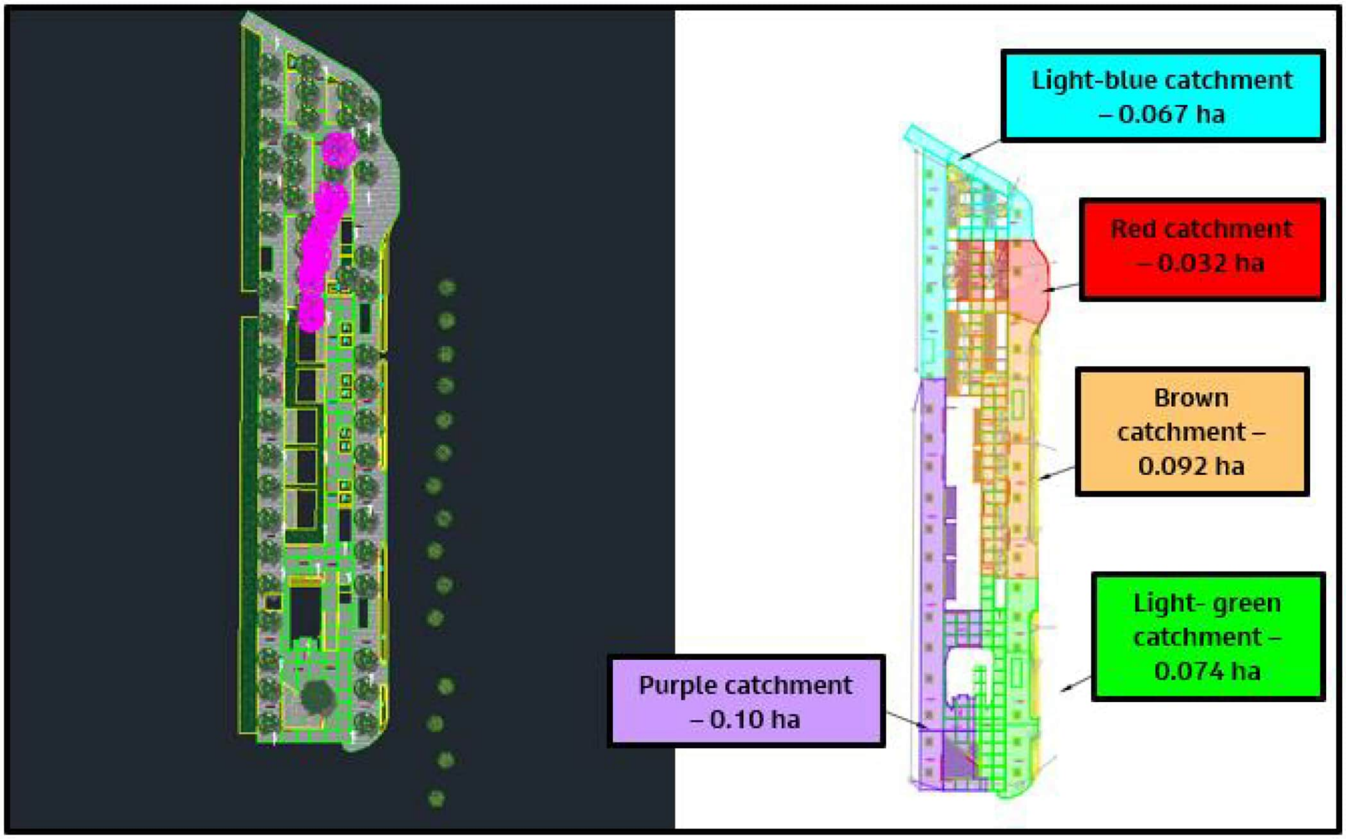


Figure 6.11 Catchment division at proposed Ballymun Station

A drainage scheme was designed for each sub-catchment. Summaries of the sub-catchment drainage and SuDS measures are as follows:

Light-blue catchment:

- This 0.067 ha catchment discharges into the existing surface network.
- Five swales (0.70 m^3, 1.20 m^3 and 2.70 m^3) will attenuate the run-off created by the proposed new impermeable area.
- 150 mm and 300 mm storm water pipes will convey attenuated run-off from swales to the existing surface network. The permissible outflow will be limited to 2.50 l/s via a Hydro-Brake® or similar.

Red catchment:

- This 0.032 ha catchment discharges into the existing surface network.
- Four swales (1.20 m^3) will attenuate the run-off created by the proposed new impermeable area.

- 150 mm and 300 mm storm water pipes will convey attenuated run-off from swales to the existing surface network. The permissible outflow will be limited to 2.50 l/s via a Hydro-Brake® or similar.

<u>Brown catchment:</u>

- This 0.092 ha catchment discharges into the existing surface network.

- Fourteen swales (1.20 m^3, 2.90 m^3 and 9.10 m^3) will the run-off created by the proposed new impermeable area.

- 150 mm, 225 mm and 375 mm storm water pipes will convey attenuated run-off from swales to the existing surface network. The permissible outflow will be limited to 2.50 l/s via a Hydro-Brake® or similar.

<u>Light-green catchment:</u>

- This 0.074 ha catchment discharges into the existing surface network.

- Two swales (3.70 m^3 and 10.30 m^3) will attenuate the run-off created by the proposed new impermeable area.

- 300 mm storm water pipes will convey the attenuated run-off from swales to the existing surface network. The permissible outflow will be limited to 2.50 l/s via a Hydro-Brake® or similar.

<u>Purple catchment:</u>

- This 0.10 ha catchment discharges into the existing surface network.

- 225 mm and 525 mm oversized pipes will attenuate the flows. The permissible outflow will be limited to 2.5 l/s via a Hydro-Brake® or similar.

- A proposed 225 mm pipe will convey the attenuated flows from proposed over-sized pipes to the existing surface network.

Drawing 'ML1-JAI-URD-ROUT_XX-DR-Y-02065' in Appendix F shows full details of the proposed drainage scheme.

6.3.10 Collins Avenue Station

Collins Avenue is to be an underground station. A drainage scheme is required to facilitate the proposed access to the station. Figure 6.12 shows the proposed sub-catchments of the proposed new Collins Avenue Station drainage network.

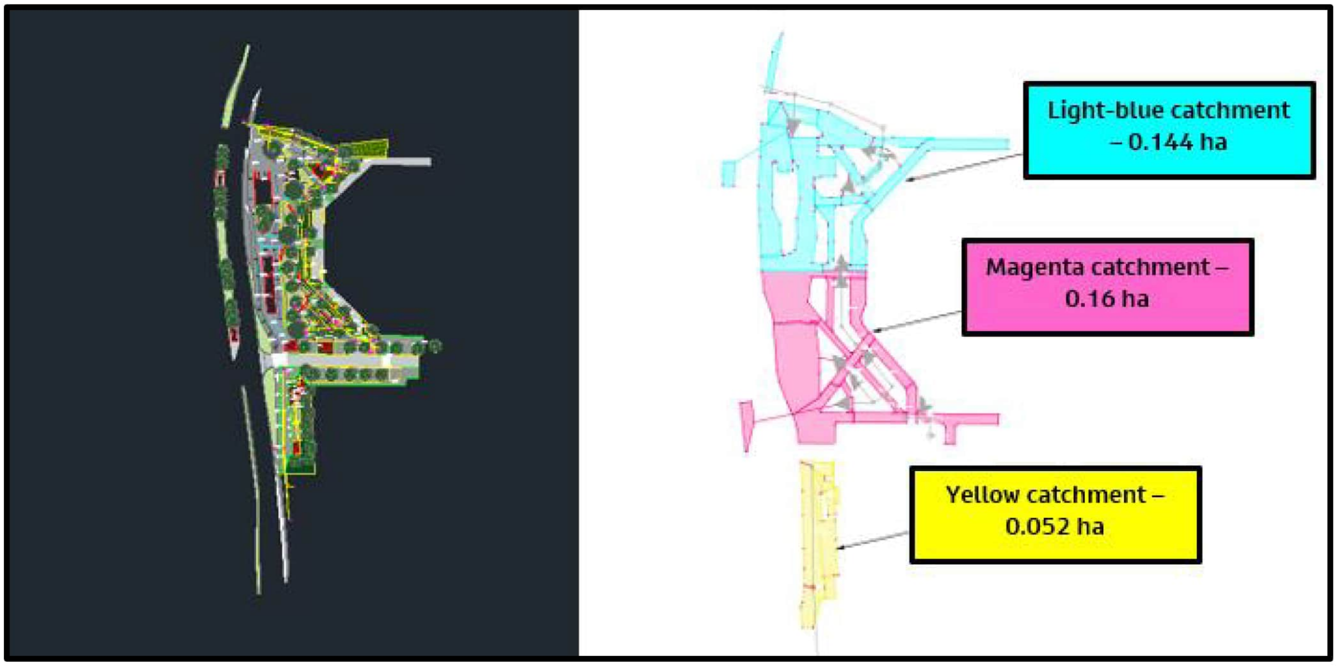


Figure 6.12 Catchment division at proposed Collins Avenue Station

A drainage scheme was designed for each sub-catchment. Summaries of the sub-catchment drainage and SuDS measures are as follows:

<u>Light-blue catchment:</u>

- This 0.144 ha catchment discharges into the existing surface network.
- Four swales (7.30 m^3, 9.60 m^3, 16.50 m^3 and 16.70 m^3) will attenuate the run-off created by the proposed new impermeable area.
- 225 mm and 375 mm storm water pipes will convey attenuated run-off from the swales to the existing surface network. The permissible outflow will be limited to 2.50 l/s via a Hydro-Brake® or similar.

<u>Magenta catchment:</u>

- This 0.16 ha catchment discharges into the existing surface network.
- Seven swales (4.90 m^3, 8.00 m^3, 13.70 m^3, 23.00 m^3, 27.60 m^3, 33.80 m^3 and 37.10 m^3) will the run-off created by the proposed new impermeable area.
- 225 mm and 525 mm storm water pipes will convey attenuated run-off from the swales to the existing surface network. The permissible outflow will be limited to 2.50 l/s via a Hydro-Brake® or similar.

Yellow catchment:

- This 0.052 ha catchment discharges into the existing surface network.
- 225 mm linear drainage pipes will convey and attenuate the run-off created by the proposed new impermeable areas. The permissible outflow will be limited to 2.50 l/s via a Hydro-Brake® or similar.

Drawing 'ML1-JAI-URD-ROUT_XX-DR-Y-02068' in Appendix F contains full details of the proposed drainage scheme.

6.3.11 Griffith Park Station

Griffith Park Station is to be an underground station. A drainage scheme is required to facilitate the proposed access to the station. Figure 6.13 shows the proposed sub-catchments of the proposed Griffith Park Station drainage network.

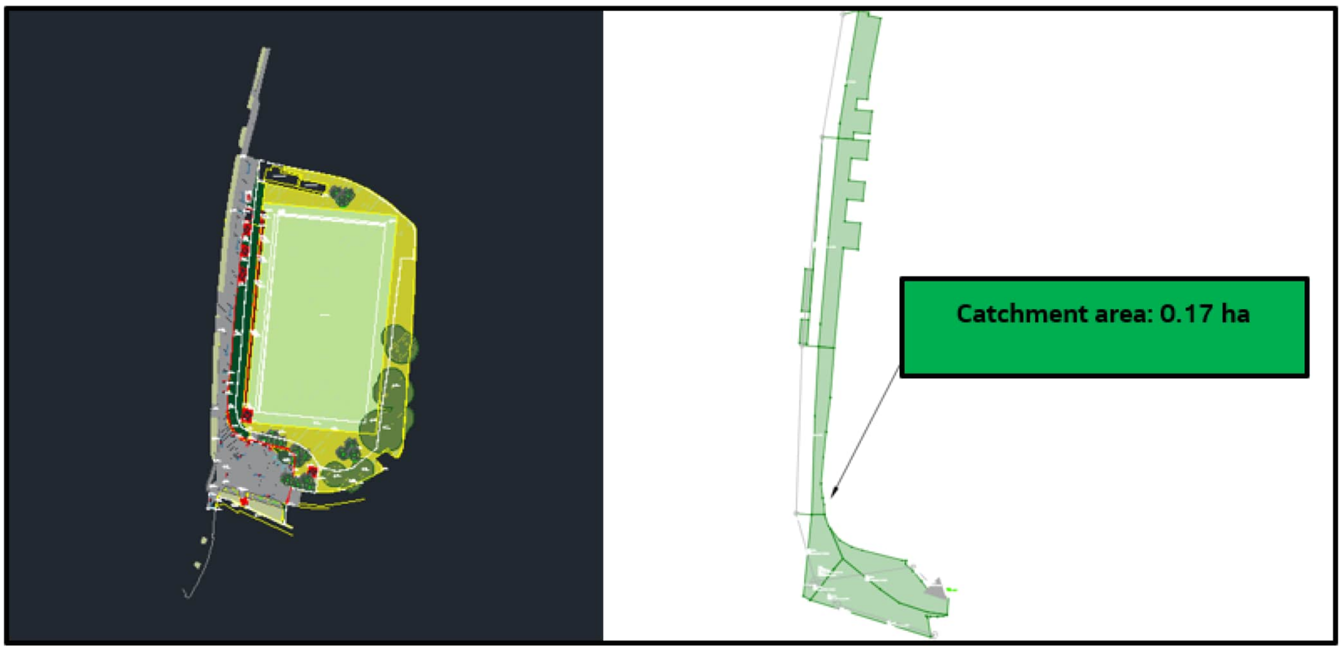


Figure 6.13 Catchment division at proposed Griffith Park Station

The proposed catchment drainage measures are as follows:

- This 0.17 ha catchment discharges into the existing surface network.
- A proposed swale (6.70 m³) will attenuate the flow created by the proposed impermeable areas.
- 225 mm, 300 mm and 375 mm oversized pipes will further attenuate the flows and discharge it into the existing surface network. The permissible outflow will be limited to 2.50 l/s via a Hydro-Brake® or similar.

Drawing 'ML1-JAI-URD-ROUT_XX-DR-Y-02073' in Appendix F contains full details of the proposed drainage scheme.

6.3.12 Glasnevin Station

Glasnevin Station is to be an underground station. A drainage scheme is required to facilitate the proposed access to the station. Figure 6.14 shows the proposed sub-catchments of the proposed Glasnevin Station drainage network.

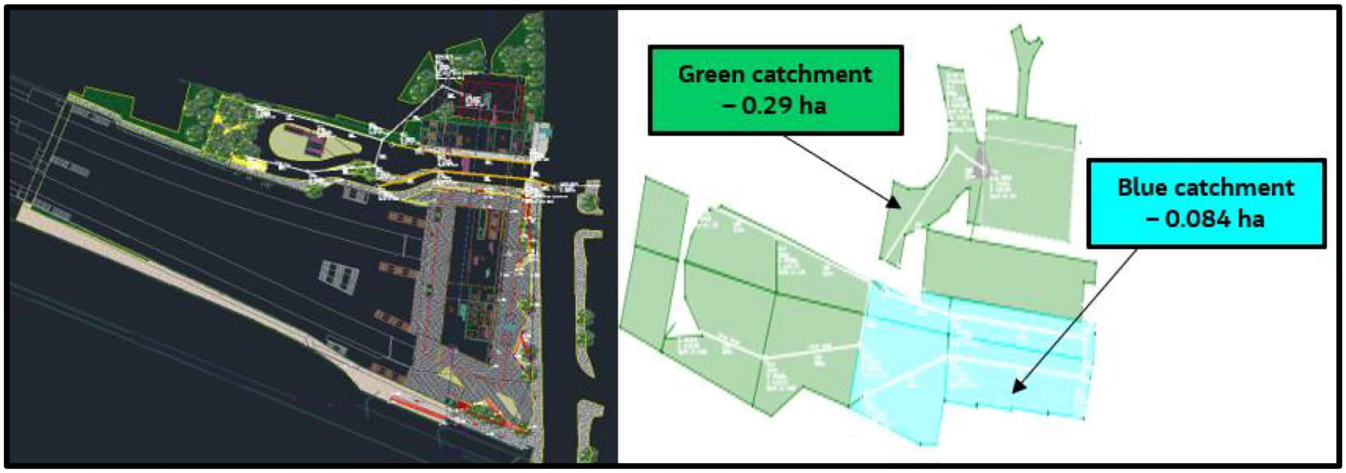


Figure 6.14 Catchment division at proposed Glasnevin Station

The proposed catchment drainage measures are as follows:

<u>**Green catchment:**</u>

- This 0.29 ha catchment discharges into the existing surface network.
- An offline storage tank (100.00 m³) will be proposed to attenuate the run-off from the proposed new impermeable areas and discharge it into the existing surface network.
- 225 mm storm water pipes will convey water runoff from the proposed tank to the existing surface network. The permissible outflow will be limited to 2.50 l/s via a Hydro-Brake® or similar.

<u>**Blue catchment:**</u>

- This 0.084 ha catchment discharges into the existing network.
- 450 mm oversized pipes will attenuate and convey the run-off created by the proposed new impermeable areas to the existing network. The permissible outflow will be limited to 2.50 l/s via a Hydro-Brake® or similar.

Drawing 'ML1-JAI-URD-ROUT_XX-DR-Y-02076' in Appendix F shows full details of the proposed drainage scheme.

6.3.13 Mater Station

Mater Station is to be an underground station. A drainage scheme is required to facilitate the proposed access to the station. Figure 6.15 shows the proposed sub-catchments of the proposed Mater Station drainage network.

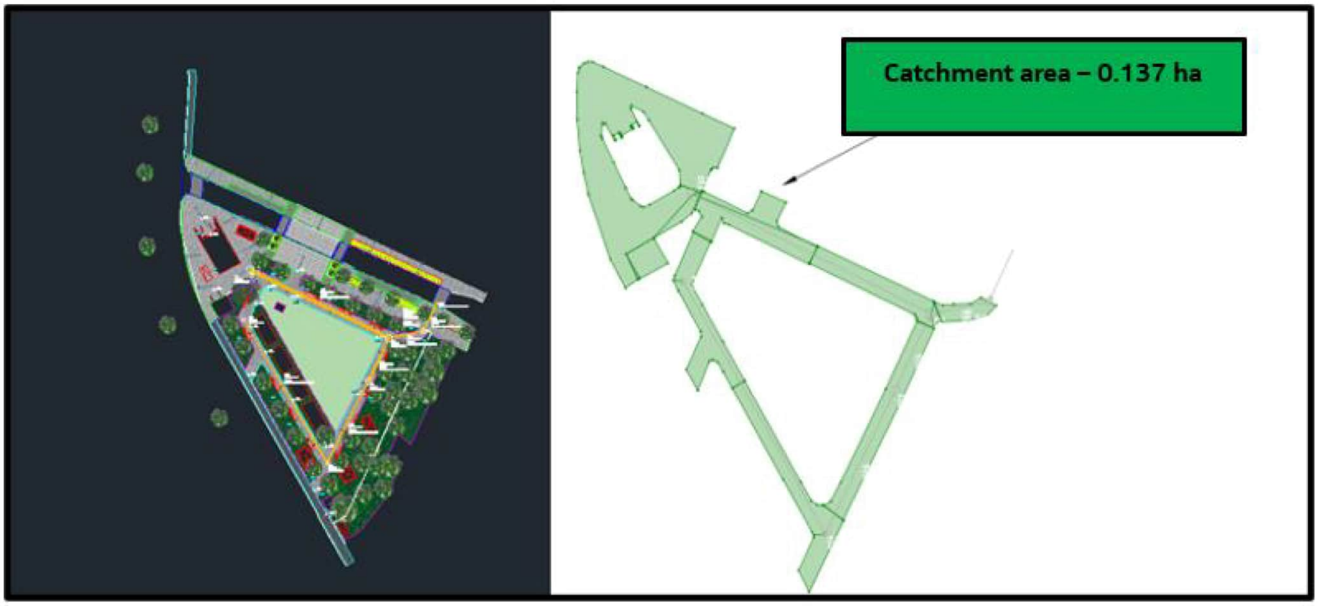


Figure 6.15 Catchment division at proposed Mater Station

The proposed catchment drainage measures are as follows:

- This 0.137 ha catchment discharges into the existing network.
- 300 mm and 450 mm oversized pipes will attenuate and convey the run-off created by the proposed new impermeable areas to the existing network. The permissible outflow will be limited to 2.50 l/s via a Hydro-Brake® or similar.

Drawing 'ML1-JAI-URD-ROUT_XX-DR-Y-02084' in Appendix F contains full details of the proposed drainage scheme.

6.3.14 Tara Station

Tara Station is to be an underground station. A drainage scheme is required to facilitate the proposed access to the station. Figure 6.16 shows the proposed sub-catchments of the proposed Tara Station drainage network.

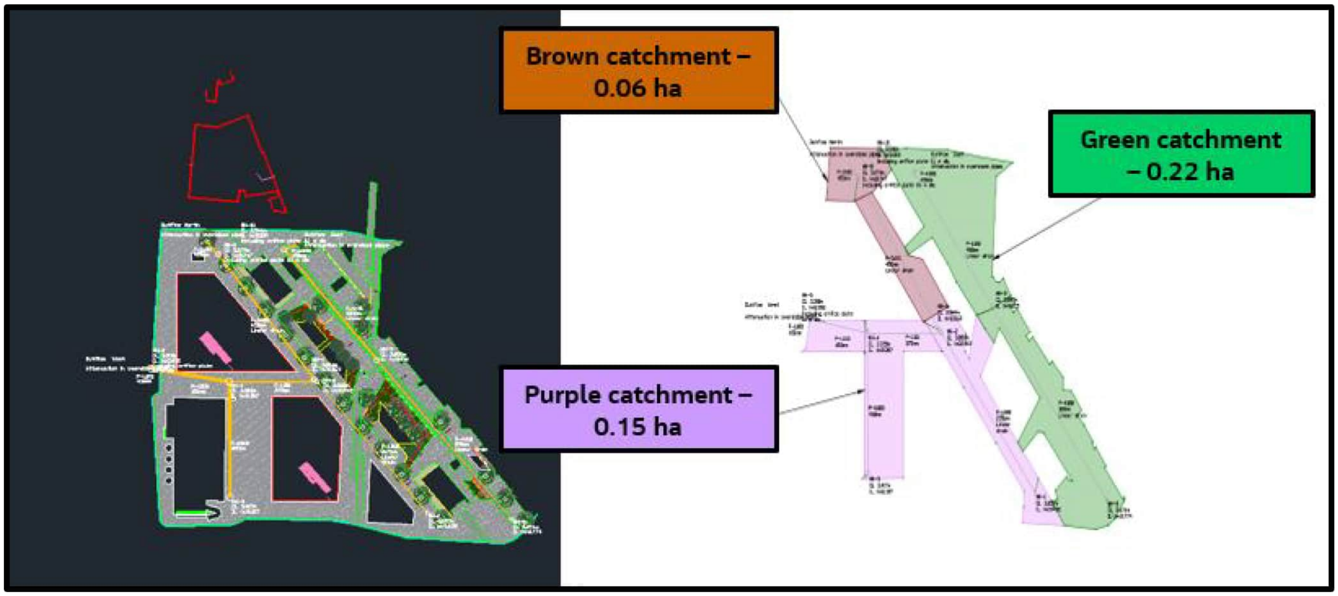


Figure 6.16 Catchment division at proposed Tara Station

The proposed catchment drainage measures are as follows:

Green catchment:

- This 0.22 ha catchment discharges into the existing surface network.
- 300 mm and 450 mm oversized pipes will attenuate and convey the run-off created by the proposed new impermeable areas to the existing surface network. The permissible outflow will be limited to 22.50 l/s by an orifice plate.

Purple catchment:

- This 0.15 ha catchment discharges into the existing network.
- A 225 mm linear drain and 375 mm and 450 mm oversized pipes will attenuate and convey the run-off created by the proposed new impermeable areas to the existing network. The permissible outflow will be limited to 15.10 l/s by an orifice plate.

Brown catchment:

- This 0.06 ha catchment discharges into the existing surface network.
- 450 mm linear pipes will attenuate and convey the run-off created by the proposed new impermeable areas to the existing surface network. The permissible outflow will be limited to 10.70 l/s by an orifice plate.

Drawing 'ML1-JAI-URD-ROUT_XX-DR-Y-02090' in Appendix F contains full details of the proposed drainage scheme.

6.3.15 Stephen's Green Station

Stephen's Green Station is to be an underground station. A drainage scheme is required to facilitate the proposed access to the station. Figure 6.17 shows the proposed sub-catchments of the proposed Stephen's Green Station drainage network.

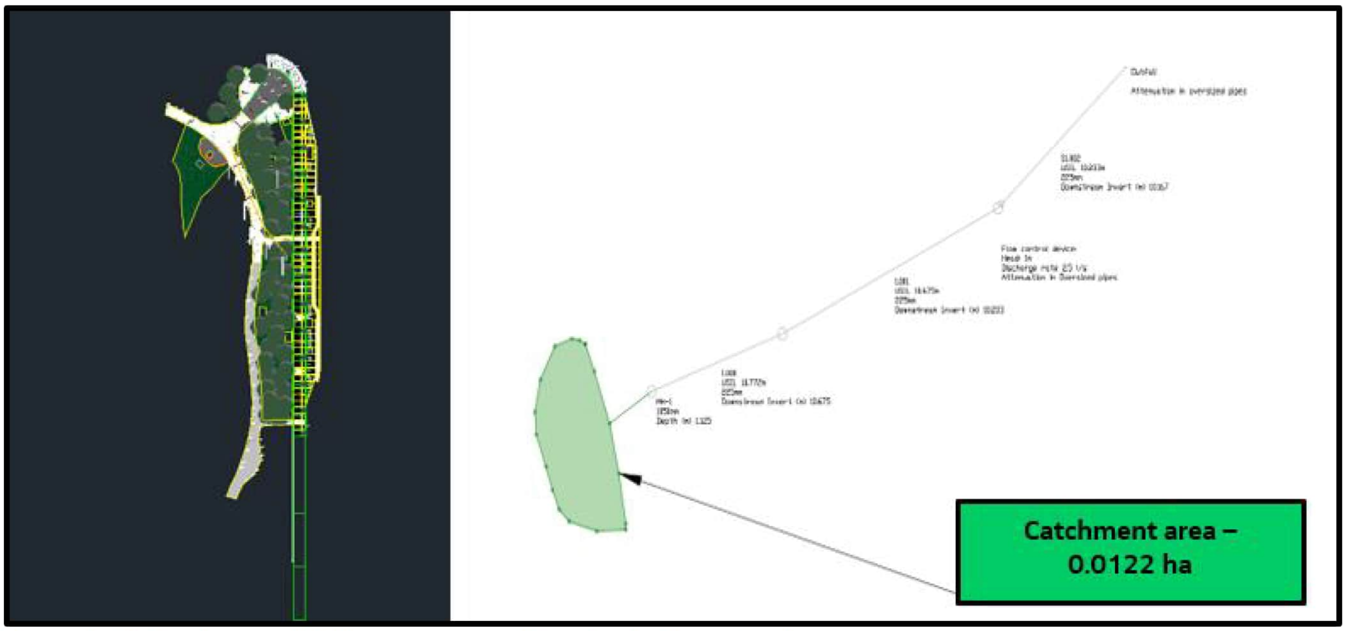


Figure 6.17 Catchment division at proposed Stephen's Green Station

The proposed catchment drainage measures are as follows:

- This 0.0122 ha catchment discharges into the existing network.
- 225 mm oversized pipes will attenuate and convey the run-off created by the proposed new impermeable areas to the existing network. The permissible outflow will be limited to 2.50 l/s by a Hydro-brake® or similar.

Drawing 'ML1-JAI-URD-ROUT_XX-DR-Y-02093' in Appendix F contains full details of the proposed Drainage scheme.

6.4 Track Drainage Design System

6.4.1 Introduction

A surface water system has been developed to drain rainfall that falls directly on overground (at grade and open cut) sections of the track. The systems have been designed to convey rainfall to a point of discharge. Prior to discharge, it is attenuated to ensure no net increase in runoff as a consequence of the works.

The surface water system will also be required to convey firewater. The system was designed to convey, discharge and attenuate the greater of rainfall generated surface water flows or firewater flows. Firewater would be released to the foul network or tankered away for treatment when the receiving network and associated plant has capacity to do so. The discharge of firewater to the foul network or tanker for treatment would also be controlled under a discharge licence.

Drainage systems of the tunnelled sections are designed to convey and discharge firewater flows only as they will not receive surface water flows. These sections are not considered in this FRA, as there would be no increase in flood risk.

6.4.2 General Design Criteria

The following design criteria was applied to the design of drainage systems for the overground track sections:

- All track drainage is directed to the centre of the track where a main channel is located to convey the flow to the assigned discharge point. In most cases, the slope of the channel will follow the gradient of the track. When the track grade is flat, for example at stations, the channel will have a built-in minimum slope to achieve a minimum velocity of 0.50 m/s.

- The central drainage channel is 1.00 m wide and up to 1.00 m deep. An enlarged channel section is used to maximise potential online storage and reduce the required size of the attenuation tanks or ponds that are required prior to discharge.

- No more than 80% of the potential channel capacity is used to convey 1% AEP plus climate change design storm. The 'spare' 20% is to allow for potential uncertainty in the runoff calculations and to mitigate the impact of over-design event on the track drainage.

- At pumped discharge points, the central channels are joined in a main collector pipe or channel, which directs the water towards the pumping well.

- The drainage at track crossover locations is achieved with PVC drainage pipes of the same capacity as the main drainage channel (rectangular shape) through the crossing. This pipe continues to run along the crossing to discharge in the next breaking load box.

6.4.3 Surface Water Attenuation and Outfall – General Approach

Discharge of the track drainage to the surface water network was not considered at it was assumed that the existing drainage networks would not have the capacity to receive it. The Environmental Protection Agency Maps (https://gis.epa.ie/EPAMaps/) and OSi mapping were therefore used to identify potential watercourses that could be used to receive the surface water runoff from each catchment.

For all track drainage catchments, the objective was to identify a receiving watercourse that would allow for gravity discharge from the track. Where this was not practicable due to the design depth of the track in cut, an underground pumping station was provided.

Prior to discharge to the receiving watercourse, surface flows from each track drainage catchment are attenuated to the existing greenfield runoff rate. This means the following:

- Attenuation is provided for areas where the track results in the creation of new impermeable surfaces in areas that are currently permeable (i.e. greenfield);

- Attenuation is not provided for areas the track crosses which are currently impermeable.

Potential attenuation storage options for the MetroLink catchments were assessed using The SuDS Manual (C753), CIRIA, March 2015. Whilst attenuation via soakaway or similar would have been preferred for the MetroLink catchments, this is not possible due to the cohesive soils which underlay much of the scheme. Attenuation storage for the various catchments was provided by either ponds or storage tanks.

The required volume of the attenuation storage for each catchment was based on the surface water runoff rate from the catchment for the design storm and as noted the permitted greenfield outflow rate to the receiving watercourse.

Attenuation storage for each catchment was sized to contain the 1% AEP storm plus 20% for climate change plus 300mm freeboard allowance.

All track drainage is designed to ensure that there is no net increase in runoff as a consequence of the Proposed Scheme.

6.4.4 Catchments

The identified sub-catchments for drainage of the track are presented in Figure 6.18. The MicroDrainage software package was used to confirm the size of the track drainage and attenuation storage for each of the Surface Water Catchments. Sub-catchment models were not developed for tunnelled sections of the track as these stretches will only be required to convey firewater.

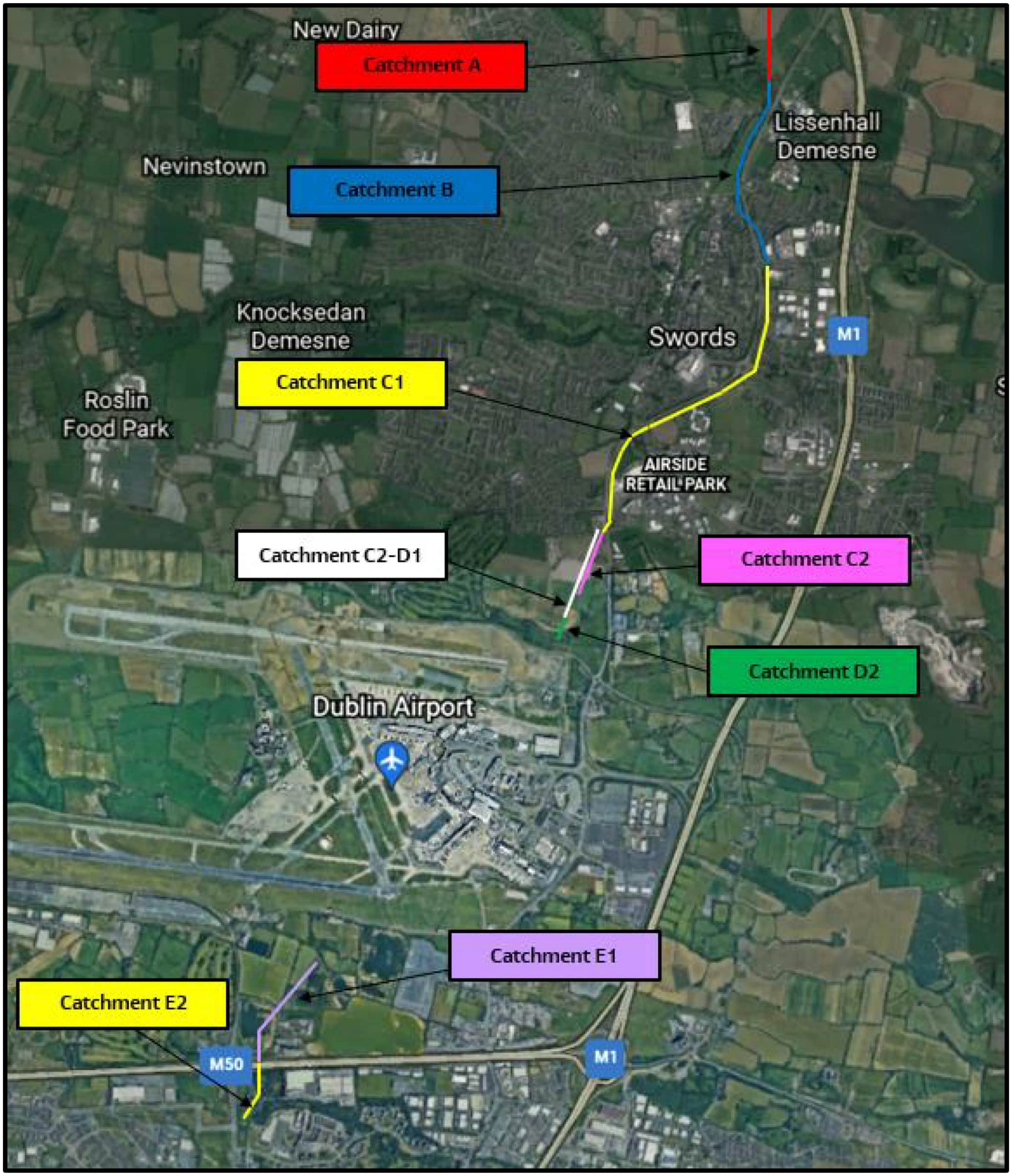


Figure 6.18 Surface water catchment extents (track drainage)

Further details of the model build and outputs from each Catchment are provided below.

6.4.4.1 Catchment A

Drawing 'ML1-JAI-URD-ROUT_XX-DR-Y-02099' in Appendix I shows the proposed track drainage design features in Catchment A. This catchment runs from Ch. 1 + 000 down to Ch. 1 + 479, a total track length of 480.00 m

Catchment A is a gravity system, with the track outfall located at Ch. 1 + 400). The central drain depth will range from 0.20 m to 0.75m deep to achieve minimum flow velocities. A sensitivity analysis was undertaken to verify the channel dimensions. Results showed that the worst-case design storms for the track drainage design were the 1% AEP 15-minute and 30-minute winter storms.

Flows from the catchment will be attenuated by two interconnected wetland ponds. The capacity of the ponds was determined using a sensitivity analysis which showed the 2880-minute (48 hour) winter storm to be the worst-case design storm. The ponds are designed to attenuate both, the surface water from the track drainage network in Catchment A and the magenta catchment from Estuary Station. To contain the 1% AEP (plus climate change) design storm, the ponds have a total design volume of a 4,579.00 m^3. This includes a 300mm freeboard allowance on the maximum water level.

A design summary for Catchment A is presented in Table 6.3.

Table 6.34 Catchment A summary

Feature Description	Feature Detail
Catchment Extent	Ch. 1+ 000 to Ch. 1 + 479
Drained area from tracks [ha]	0.06
Drained area from Estuary Station Park & Ride [ha]	3.08 (Station 2.80 + Tracks 0.28)
Track Channel Dimensions - Width - Depth	 1.00 m 0.20 m to 0.75 m
System Type	Gravity
Maximum Permitted Catchment Outflow	14.00 /s
Attenuation Storage Method	Wetland Ponds
Pond South A - Volume - Depth - Minimum Crest Level - Operating Storage Level - Outlet Control Pond South B - Volume - Depth - Minimum Crest Level - Operating Storage Level	 2,839 m^3 1.80 m 3.70 mAOD 5.50 mAOD Flow Control Device (Hydro-brake® or similar) 1,740 m^3 1.80 m 3.70 mAOD 5.50 mAOD

- Outlet Control	Flow Control Device (Hydro-brake® or similar)
Outfall Watercourse	Broadmeadow River

6.4.4.2 Catchment B

Drawing 'ML1-JAI-URD-ROUT_XX-DR-Y-02100' in Appendix I shows the proposed track drainage design in Catchment B. This catchment runs from Ch. 1 + 479 down to Ch. 2 + 804, a total track length of 1,325 m. Catchment B is a pumped system, with the track outfall located at Ch. 2 + 020.

A sensitivity analysis was undertaken to verify the channel dimensions. Results showed that the worst-case design storms for the track drainage design were the 1% AEP 15-minute and 30-minute winter storms.

Surface water from the tracks will gravitate flows to a pump (Ch. 2 + 300). The pumped flows (maximum pump rate of 110.00 l/s) will be attenuated by two Stormtech® tanks (or similar) in series. The size of these tanks was determined by using a sensitivity analysis which showed the 1% AEP 4320-minute (72 hour) winter storm to be their worst-case design storm. The two tanks have volumes of 190.00 m^3 and 310.00 m^3 respectively and the flow discharge rate will be limited to 2.50 l/s at the outflow of the second tank via a Hydro-Brake® or similar.

A 3,288 m^3 capacity attenuation pond is proposed downstream of the attenuation tanks and discharges to Ward River. The discharge rate will be limited to 2.00 l/s downstream of the proposed pond via a Hydro-Brake® or similar.

A design summary for Catchment B is presented in Table 6.4.

Table 6.4 5 Catchment B summary

Feature Description	Feature Detail
Catchment Extents	Ch. 1+479 to Ch. 2+804
Drained area from tracks [ha]	0.62
Drained area from Existing Roads [ha]	0.33
Track Channel Dimensions - Width - Depth	 1.00 m 0.30 m to 0.75m
System Type	Pumped
Maximum Permitted Catchment Outflow	2.00 l/s
1st Stormtech® Tank (or similar) - Volume - Depth - Minimum Crest Level - Operating Storage Level - Outlet Control	 190.00 m^3 0.91 m 7.85 mAOD 8.76 mAOD N/A
2nd Stormtech® Tank (or similar) - Volume - Depth - Minimum Crest Level - Operating Storage Level - Outlet Control	 310.00 m^3 0.91 m 7.7 mAOD 8.61 mAOD 2.50 l/s (Hydro-Brake® or similar)
Attenuation Pond - Volume - Depth - Invert Level - Operating Storage Level - Outlet Control	 3,288.00 m^3 1.50 m 5.16 mAOD 6.66 mAOD 2.00 l/s (Hydro-Brake® or similar)
Outfall Watercourse	Ward River

6.4.4.3 Catchment C1

Drawing 'ML1-JAI-URD-ROUT_XX-DR-Y-02101' in Appendix I shows the proposed track drainage design for Catchment C1. This catchment runs from Ch. 2 + 804 down to Ch. 5 + 200, a total track length of 2,396 m.

Catchment C1 is a pumped system with the track outfall is located at Ch. 2 + 930 (outfalls to an existing watercourse). The central drain depth will range from 0.375m to 1.00 m deep to keep flow velocities within an acceptable range.

A sensitivity analysis was undertaken to verify the channel dimensions and showed that the worst-case design storms were the 1% AEP 15-minute, 30-minute and 60-minute winter storms.

Flows will be pumped (at a maximum pump rate of 146.00 l/s) to a Stormtech® tank (or similar). In order to store the 1% AEP (plus climate change allowance) design storm, the tank has a total volume of 400.00 m^3. The flow discharge rate at the outfall will be limited to 2.00 l/s via a Hydro-Brake® or similar.

A design summary for the Catchment C1 Drainage is presented in Table 6.5.

Table 6.5 Catchment C1 summary

Feature Description	Feature Detail
Catchment Extents	Ch. 2 + 804 to Ch. 5 + 200
Drained area from tracks [ha]	1.08
Track Channel Dimensions - Width - Depth	 1.00 m 0.38 m to 1.00 m
System Type	Pumped
Maximum Permitted Catchment Outflow	2.00 l/s
Attenuation Storage Method	Stormtech® Tank or similar
Stormtech® Tank (or similar) - Volume - Depth - Invert Level - Operating Storage Level - Outlet Control	 400.00 m^3 1.00 m 14.10 mAOD 15.10 mAOD Hydro-Brake® or similar
Outfall Watercourse	Existing watercourse

6.4.4.4 Catchment C2-D1

Drawing 'ML1-JAI-URD-ROUT_XX-DR-Y-02102' in Appendix I shows the proposed track drainage design for Catchment C2-D1. This catchment runs from Ch. 5 + 200 down to Ch. 5 + 880, a total track length of 600.00 m.

Catchment C2-D1 is a gravity system, with the track outfall located at Ch. 5 + 750. The central drain depth will range from 0.45 m to 0.90 m to keep flow velocities within an acceptable range. Eight orifices are proposed at regular intervals along the track length. These orifices and a Hydro-Brake® (or similar) will allow the network to store attenuate surface water.

A sensitivity analysis was undertaken to verify the channel dimensions and showed that the worst-case design storms for the tracks were the 1% AEP 15-minute and the 480-minute winter storms.

A design summary for the Catchment C2-D1 Drainage is presented in Table 6.6.

Table 6.6 6 Catchment C2-D1 summary

Feature Description	Feature Detail
Catchment Extents	Ch. 5 + 200 to Ch. 5 + 880
Drained area from tracks [ha]	0.44
Track Channel Dimensions - Width - Depth	 1.0 m 0.45 m to 0.90 m
System Type	Gravity
Maximum Permitted Catchment Outflow	2.80 l/s
Attenuation Storage Method	Orifices and Hydro-Brake® (or similar)
Outfall Watercourse	Sluice River Tributary

6.4.4.5 Catchment D2

Drawing 'ML1-JAI-URD-ROUT_XX-DR-Y-02103' in Appendix I shows the proposed track drainage design for Catchment D2. This catchment runs from Ch. 5 + 880 down to Ch. 6 + 022.

Catchment D2 is a gravity system, with the track outfall located Ch. 5 + 950. The central drain depth will range from 0.90 m to 1.00 m to achieve the minimum flow velocities. Two orifices and a Hydro-Brake® (or similar) will allow the network to store the surface water online.

A sensitivity analysis was undertaken to verify the channel dimensions and showed that the worst-case design storm would be the 1% AEP 15-minute winter storm.

A design summary for the Catchment D2 Drainage is presented in Table 6.7.

Table 6.7 7 Catchment D2 summary

Feature Description	Feature Detail
Catchment Extents	Ch. 5 + 880 to Ch. 6 +022
Drained area from tracks [ha]	0.11
Track Channel Dimensions - Width - Depth	 1m 0.90 m to 1.00 m
Model System Type	Gravity
Maximum Permitted Catchment Outflow (Greenfield Rate)	2.00 l/s
Attenuation Storage Method	Orifices and Hydro-Brake® (or similar)
Outfall Watercourse	Sluice River

6.4.4.6 Catchment E1

Drawing 'ML1-JAI-URD-ROUT_XX-DR-Y-02104' in Appendix I shows the proposed track drainage design for Catchment E1. This catchment runs from Ch. 8 + 477 down to Ch. 9 + 690.

Catchment E1 is a pumped system, with the track outfall located at Ch. 8 + 650 (outfalls to the Turnapin Stream). The central drain depth was designed to be 0.75m deep. Ten orifices are proposed at regular intervals along the track length within this catchment to provide online storage.

A sensitivity analysis was undertaken to verify the channel dimensions. Results showed that the worst-case design storms for the track were the 1% AEP 15-minute, 60-minute, 120-minute, 180-minute, 2160-minute and 10080-minute winter storms, depending on location.

Flows will be pumped (maximum pump rate of 20.00 l/s) to a Stormtech® tank (or similar). In order to store the 1% AEP (plus climate change allowance) design storm, the tank will have a total volume of 750.00 m^3. The flow discharge rate will be limited to 2.00 l/s at the outflow of the tank via a Hydro-Brake® (or similar).

A design summary for the Catchment E1 Drainage Model is presented in Table 6.8.

Table 6.88 Catchment E1 summary

Feature Description	Feature Detail
Catchment Extents	Ch. 8 + 477 to Ch. 9 + 690
Drained area from tracks [ha]	1.62
Track Channel Dimensions - Width - Depth	 1.00 m 0.75 m
System Type	Pumped
Maximum Permitted Catchment Outflow	2.00 l/s
Attenuation Storage Method	Stormtech® Tank (or similar).
Stormtech® Tank - Volume - Depth - Invert Level - Operating Storage Level - Outlet Control	 750.00 m^3 1.50 m 57.50 mAOD 59.00 mAOD Hydro-Brake® (or similar).
Outfall Watercourse	Turnapin watercourse diversion

6.4.4.7 Catchment E2

Drawing 'ML1-JAI-URD-ROUT_XX-DR-Y-02105' in Appendix I shows the proposed track drainage design features in Catchment E2. This catchment runs from Ch. 9 + 690 down to Ch. 10 + 250.

Catchment E2 is a pumped system, with the track outfall located at Ch. 9 + 970. Due to the steepness of this section of the track, the central drain depth will range from 0.45 m to 0.75 m. Five orifices are proposed at regular intervals along the track length within this catchment to provide online storage.

A sensitivity analysis was undertaken to verify the channel dimensions. Results showed that the worst-case design storms for the track were the 1% AEP 15-minute and 10080-minute winter storms depending on location.

Flows will be pumped (maximum pump rate of 3.50 l/s) to an attenuation pond. This attenuation pond is linked to another attenuation pond downstream of it. In order to store the 1% AEP (plus climate change allowance) design storm, both ponds will have a total volume of 203.00 and 160.00 m^3 respectively. The size of the ponds were determined using a sensitivity analysis which showed the 8640-minute and 10080-minute winter storms to be the worst-case design storms across the two ponds. The flow discharge rate will be limited to 2.00 l/s downstream of these ponds via a Hydro-Brake® or similar.

A design summary for the Catchment E2 Drainage Model is presented in Table 6.9.

Table 6.99 Catchment E2 summary

Feature Description	Feature Detail
Catchment Extents	Ch. 9 + 690 to Ch. 10 + 250
Drained area from tracks [ha]	0.301
Track Channel Dimensions - Width - Depth	 1.0 m 0.45 – 0.75 m
Model System Type	Pumped
Maximum Permitted Catchment Outflow (Greenfield Rate)	2.00 l/s
Attenuation Storage Method	Attenuation ponds and orifices
1st Attenuation Pond - Volume - Depth - Minimum Crest Level - Operating Storage Level - Outlet Control	 203.00 m^3 1.00 m 56.88 mAOD 57.88 mAOD Orifice
2nd Attenuation Pond - Volume - Depth - Minimum Crest Level - Operating Storage Level Outlet Control	 160.00 m^3 0.82 m 56.68 mAOD 57.50 mAOD Hydro-Brake® or similar
Outfall Watercourse	Santry River

7. Stage 3: Detailed Assessment – Fluvial flooding and Coastal Flooding

7.1 Lissenhall (Swords), around (Ch. 1 + 100) associated with the diversion of a tributary of Staffordstown watercourse.

7.1.1 Introduction

This section follows on from the findings in the Stage 1 and Stage 2 Flood Risk Assessments, where it was noted that construction of the proposed Park & Ride would require diversion of a number of drainage ditches which are located within the Staffordstown Stream catchment.

7.1.2 Summary of the Proposed Works

Figure 7.1 shows the extents of the Proposed Park & Ride and the ditches requiring diversion. The Park & Ride is located at the head of the ditch catchment meaning the diversions are required largely, to convey runoff to ensure adequate drainage of the site.

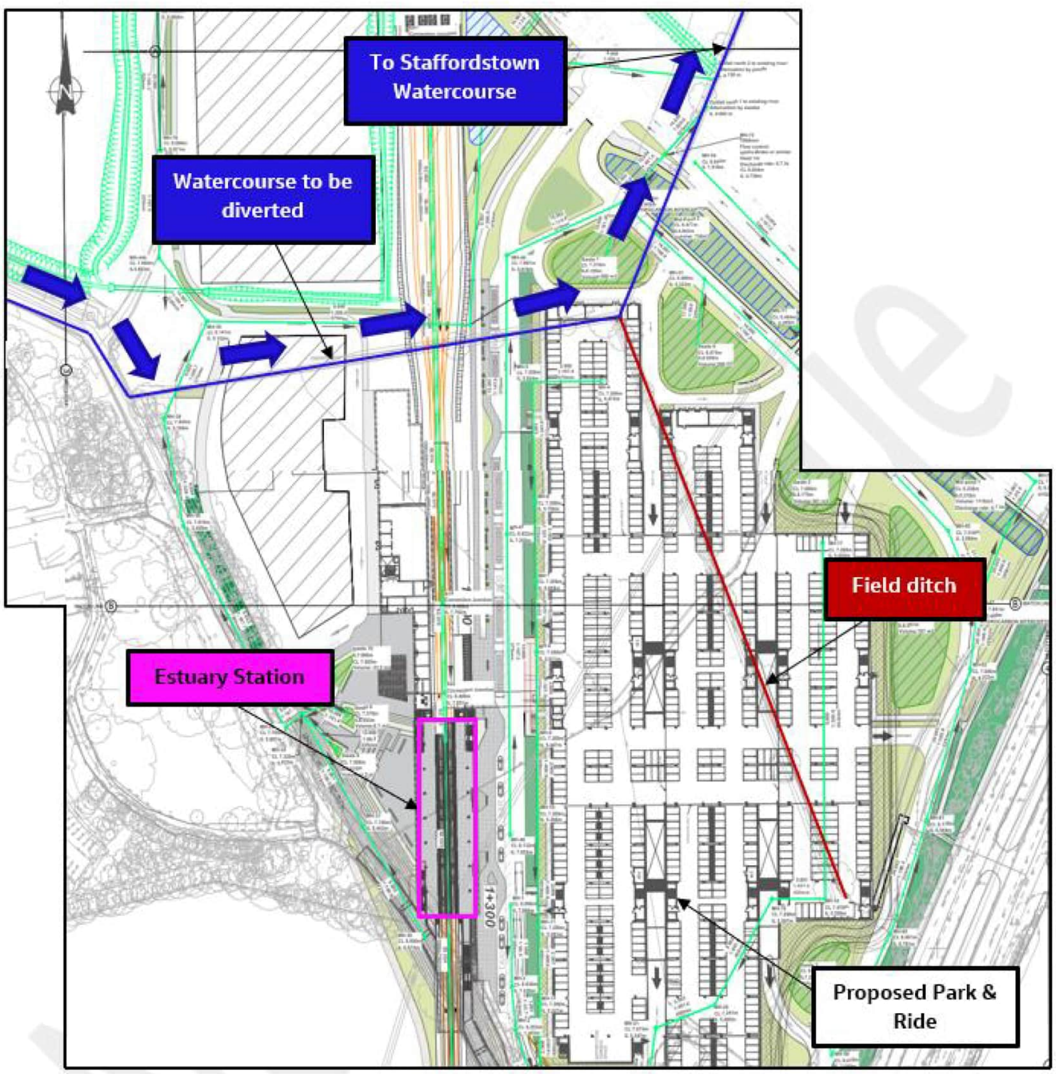


Figure 7.1 Proposed works for the MetroLink scheme at Lissenhall

Figure 7.2 shows how the ditches will be diverted to convey flows around and drain the proposed Park and Ride site. Where the ditches are required to pass underneath new roads, culverts are provided to maintain continuity of flow.

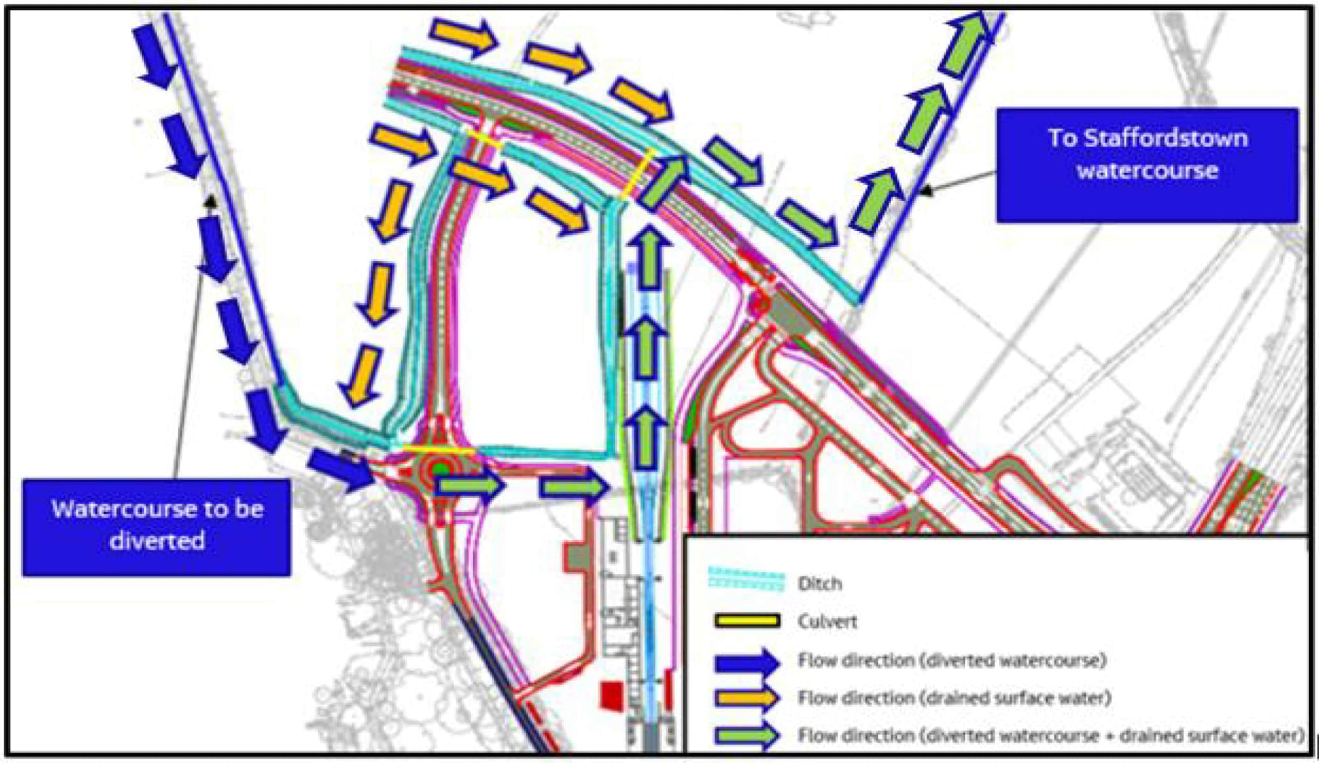


Figure 7.2 Park Ride Proposed Diversion Scheme

7.1.3 Analysis of Scheme Design

As noted, the works are located at the head of the catchment and the ditches are largely required to drain the Park Ride site itself. Using the IHS124 small catchments method, a 0.1% AEP flood design flow of $0.5m^3/s$ was determined.

Figure 7.3 shows the proposed cross-section for the ditch diversion to ensure sufficient capacity to convey the channel design flow of 0.5 m^3/s. The proposed minimal cross-section follows the TII standard design for interceptor drains consisting of a trapezoidal channel measuring 0.5m deep and 2.0m wide with 1:1 bank slope.

At an average longitudinal slope of 0.006, the design flow would reach a depth of 400mm with an average velocity of 0.91 m/s. A 100mm freeboard allowance would be maintained on the diverted ditches capacity.

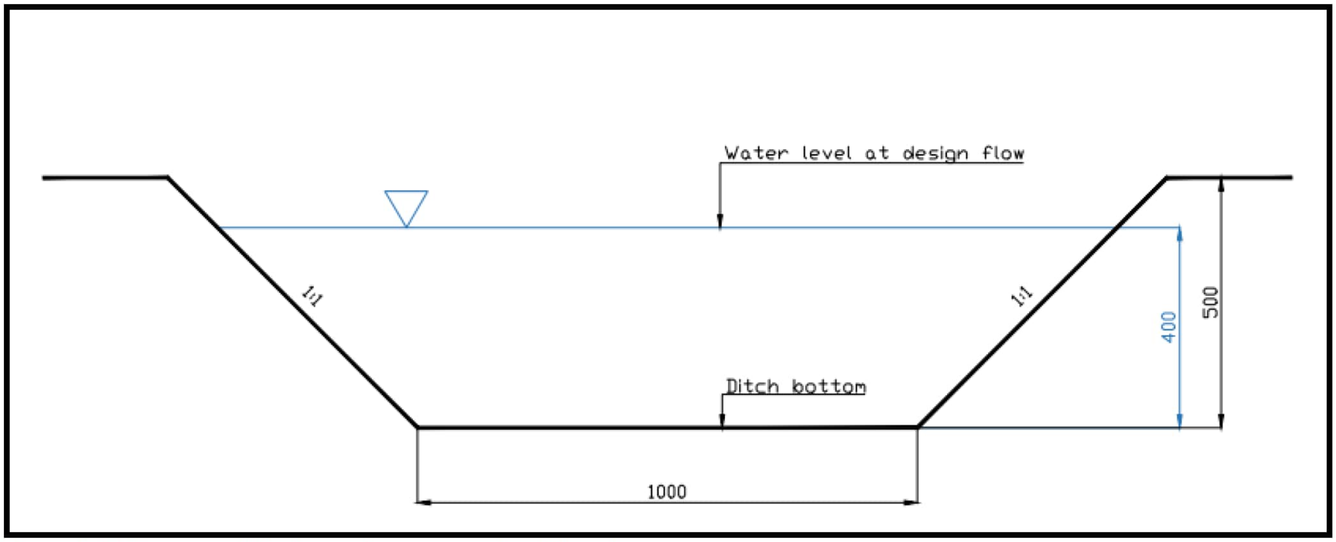


Figure 7.3 Proposed ditch section across the diversion

The three proposed culverts required along the diversion will be rectangular, measuring 1200 mm wide by 1000 mm high. These will be made of concrete and there will be a 300mm ground/gravel layer at their bottom to imitate a natural bed (Manning coefficient equals 0.023). Figure 7.4 shows the proposed culvert cross section.

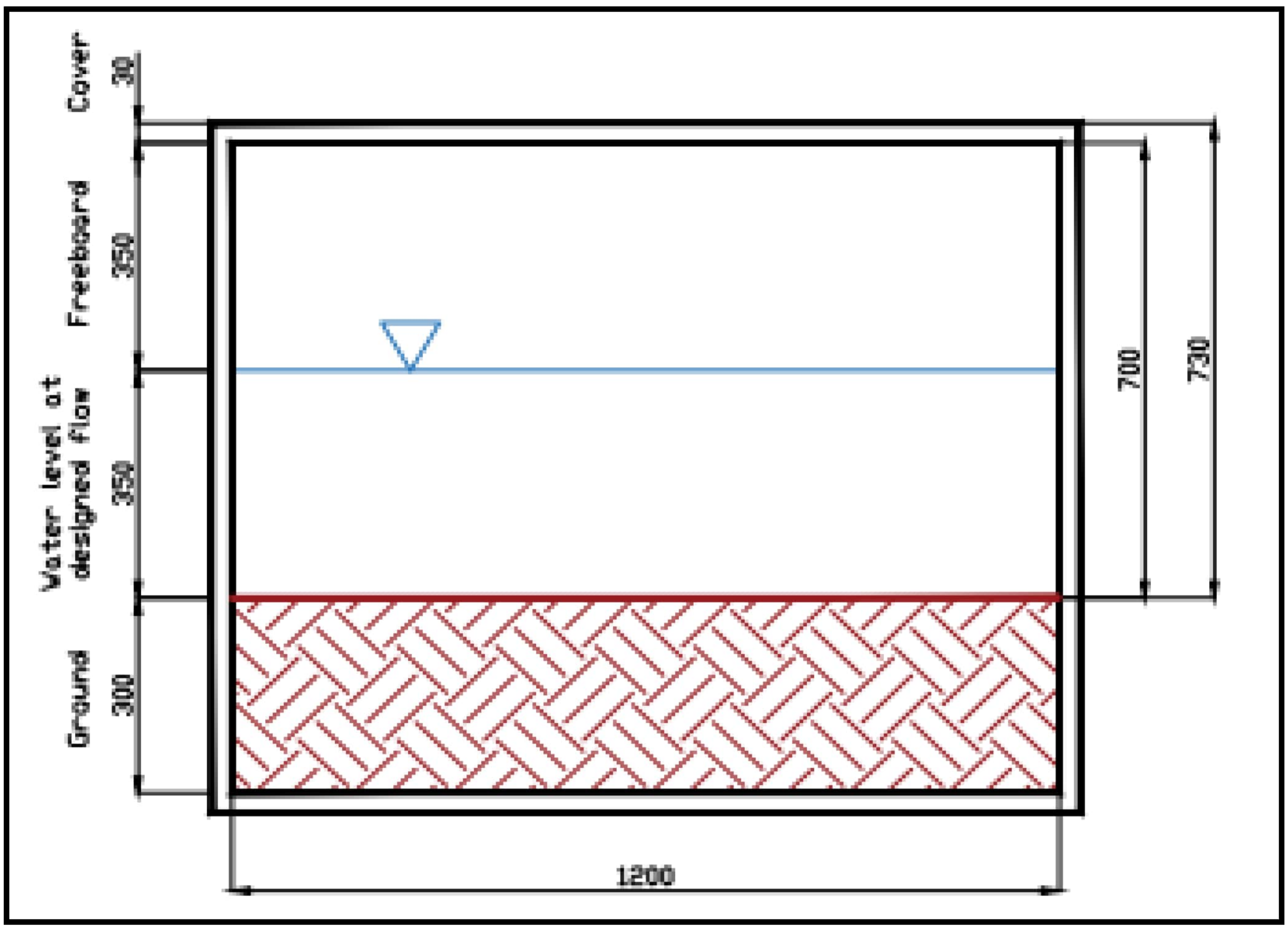


Figure 7.4 Cross-section of each culvert

The longitudinal slope value through the culverts will be 0.0035 to 0.004. The capacity of the culverts will be (0.47- 0.50 m^3/s), with a 350 mm freeboard allowance from the maximum water level to the culvert soffit. Figure 7.5 shows the longitudinal section of a ditch-to-culvert connection.

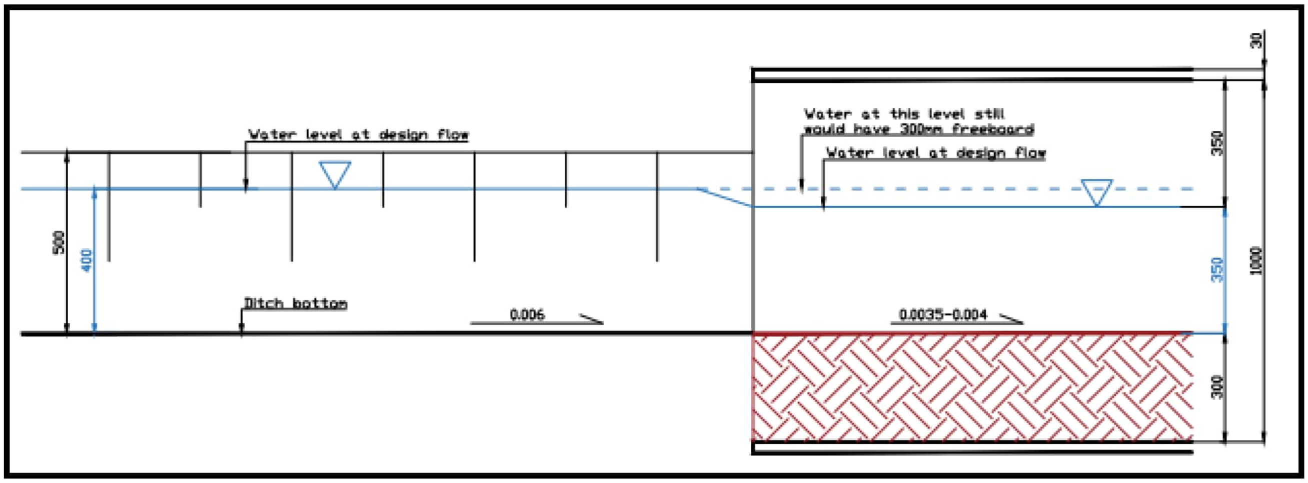


Figure 7.5 Longitudinal section of ditch-to-culvert connection

Further details of the proposed scheme are contained in Appendix J as follows:

- Drawing 'ML1-JAI-VUT-MS01_XX-DR-Y-00198'. Proposed diversion scheme at Estuary Station and Park & Ride development.
- Drawing 'ML1-JAI-PLD-MS01_XX-DR-Y-00001'. The proposed minimal cross-section ditch and culvert design in the Estuary diversion.

7.1.4 Conclusion

The works associated with the Park & Ride require diversion of ditches at the head of the catchment to ensure drainage largely, of just the Park & Ride site. A ditch channel form and associated culverts have been designed to convey a 0.1% AEP design flow of $0.5m^3/s$, with a freeboard allowance. The proposed ditches will therefore not pose a fluvial flood risk to the proposed scheme.

7.2 Lissenhall (Swords), Ch. 1 + 490 – Ch. 2 + 200, associated with Broadmeadow and Ward Rivers.

7.2.1 Introduction

This section follows on from the findings in the Stage 1 & Stage 2 Flood Risk Assessments that showed that the proposed crossing of the Broadmeadow and Ward Rivers had to be incorporated into the scheme design. Whilst the Scheme is resilient to flooding where it crosses both watercourses, owing to the width of floodplain, it could increase upstream water levels from disrupting floodplain conveyance.

The Proposed weeks are therefore subject to a Stage 3 Detailed Flood Risk Assessment to assess the fluvial flood risk at the site and identify any requirement for any further mitigation measures.

The proposed works comprise the construction of a 216.61 m viaduct which comprises 13 spans between Ch. 1 + 500 and Ch. 1 + 760 crossing Broadmeadow and Ward Rivers. These spans range from 19.05 m to 28.10 m in width, refer to Figure 7.6 and drawing 'ML1-JAI-SGN-SC01_XX-DR-Y-00002' in Appendix C. The minimum soffit level for the viaduct is 5.90mOD

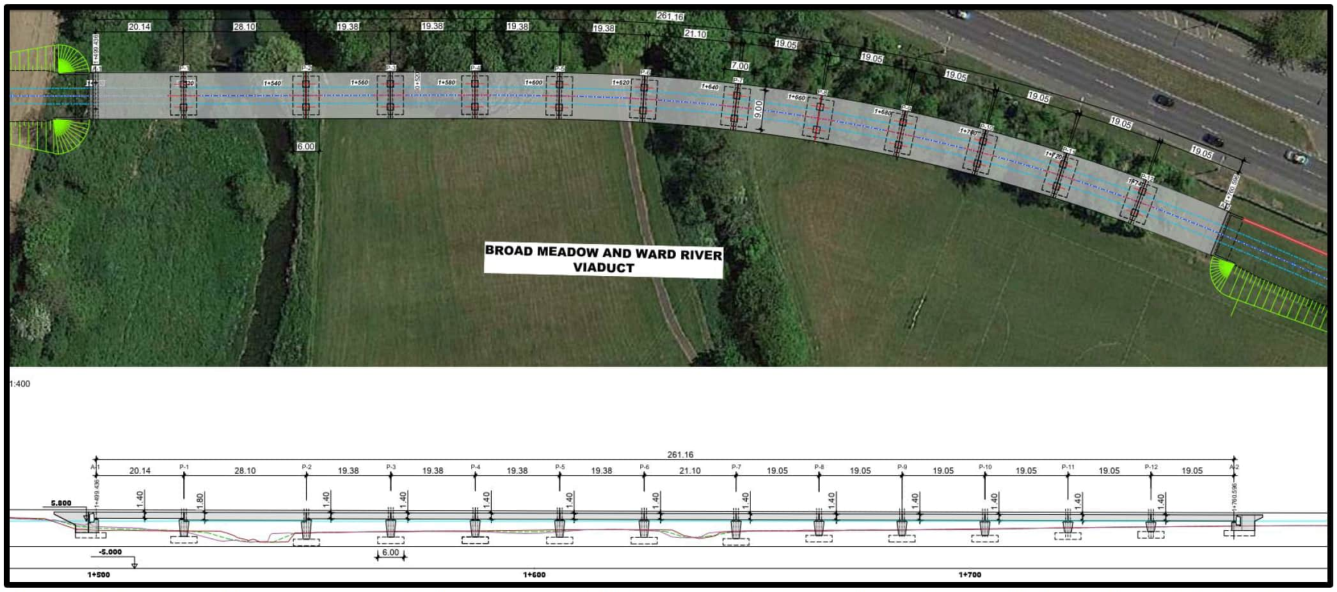


Figure 7.6 General Arrangement of the proposed viaduct crossing Broadmeadow and Ward Rivers (Ch. 1+ 500 – Ch. 1 + 760)

Downstream of the Viaduct, the track section enters an open cut and fall below the existing ground level. A reinforced concrete floodwall with stone cladding up to 0.85m in height, refer to Figure 7.7, is provided to prevent the ingress of flood water in the open track section. Refer to Figure 7.8 for the extents of the proposed wall. Further details are provided in drawing 'ML1 – JAI -SRD-ROUT-XX-DR-Y-07002' in Appendix C.

Both the wall and viaduct have been designed to accommodate the 0.1% AEP design flow.

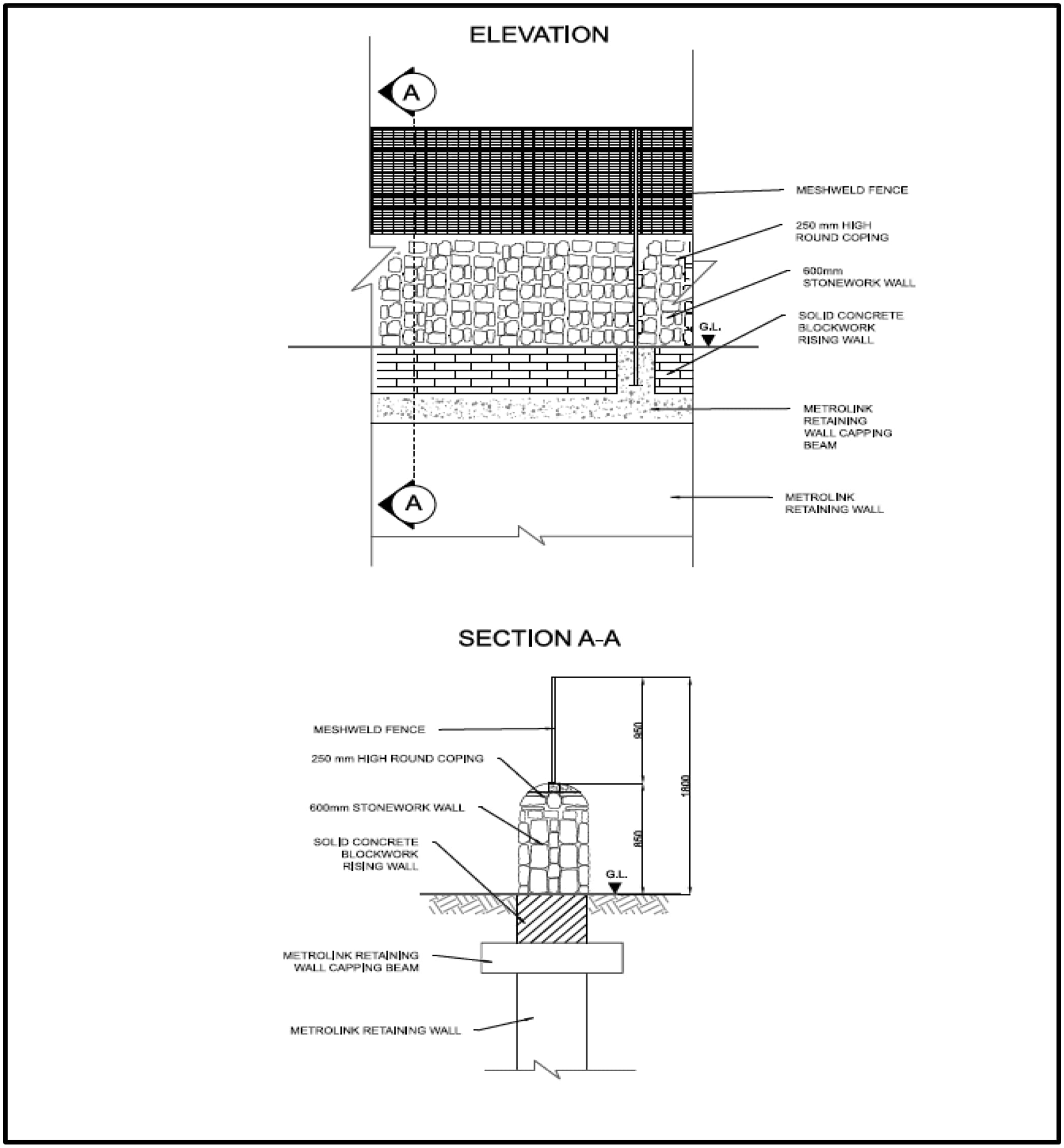


Figure 7.7 Typical detail of the proposed stonework wall between Ward River and the MetroLink scheme (Ch. 1+ 875 – Ch. 2 + 200)

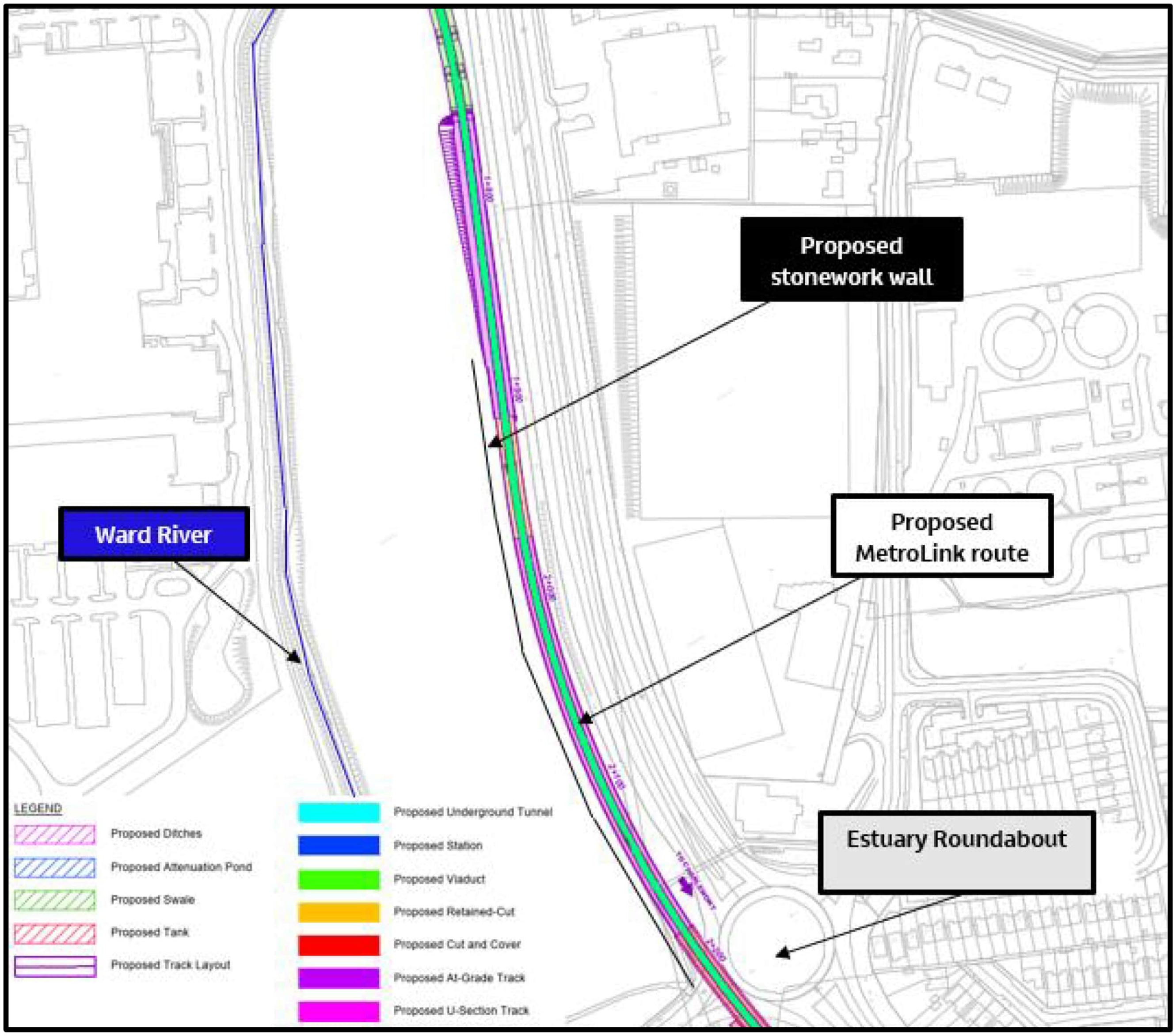


Figure 7.8 Extents of the proposed stonework wall between Ward River and the MetroLink scheme (Ch. 1+ 875 – Ch. 2 + 200)

A quantitative appraisal of the potential flood risk to the proposed development is provided below, assessing its potential impacts on flood risk elsewhere and of the effectiveness of the proposed mitigation measures. This was undertaken using a hydraulic model of the study area to assess the catchment wide impacts of the proposed works.

7.2.2 Hydraulic Model

A fluvial hydraulic model was developed as part of the FEM FRAM Study, to determine design and potential future flood levels, depths, velocities and extents for the Broadmeadow River and Ward River. The model was built using the ISIS 2-D modelling package and comprises a 1-D representation of the river channel and 2-D representation of the floodplain.

The model includes Malahide Estuary, which has a tidal influence. The tidal boundary conditions were calculated at an offshore location near the mouth of the estuary. The eastern side of the Malahide Estuary is partly controlled by the Malahide viaduct constriction. Therefore, a 50% AEP fluvial base flow from the other rivers discharging into the western side of the Malahide estuary, i.e. the Lissenhall and Gaybrook streams were considered negligible and therefore not included in this model.

Hydraulic roughness (or friction) is represented by Manning's coefficient 'n' in the hydraulic model. The value of 'n' accounts for a range of factors that influence the overall roughness either in the channel or across the floodplain. Factors included within the overall evaluation of Manning's coefficient include bed materials and size, vegetation, surface irregularities, channel bed forms, erosional and depositional features, channel sinuosity and obstructions.

The Manning's coefficient for the Broadmeadow River ranges from 0.025 to 0.04 in the river channel and between 0.05 and 0.15 in the floodplain. Culverts are considered to have a Manning's coefficient of 0.002. The Manning's coefficient for the Ward River ranges from 0.025 to 0.06 for the river channel, from 0.03 to 0.085 for the floodplain and 0.002 for culverts.

7.2.2.1 Analysis of the Proposed Scheme

The FEM FRAM model of the Ward and Broadmeadow Rivers was used to assess the impact of the Proposed Viaduct crossing of the Ward and Broadmeadow Rivers in flood risk. The model was run for the baseline and with scheme conditions for the 1%, 1% & climate change and 0.1% AEP floods.

The with scheme scenario includes the proposed Viaduct which comprises a 260m long crossing of the Ward and Broadmeadow Rivers and part of the floodplain; refer to Figure 7.9. The model represented 1.5m box piers every 20m and the clear span openings of the Ward and Broadmeadow Rivers.

The proposed viaduct was designed in accordance with the Hydraulic Design contained in Section 50 consent guidance from the OPW including:

- The bridge must be capable of passing a fluvial flood flow with a 1% annual exceedance probability (AEP) or 1 in 100-year flow with climate change without significantly changing the hydraulic characteristics of the watercourse.
- A bridge must be capable of operating under the above design conditions while maintaining a freeboard of at least 300 mm.
- If the land potentially affected includes dwellings and infrastructure, it must be demonstrated that those dwellings and/or infrastructure are not adversely affected by constructing the bridge or culvert.
- The use of piers is minimized, in order to maintain the characteristics of the existing channel.
- Bridges are designed to operate with a freeboard between the flood level and the bridge deck.
- The encroachment of bridges abutments into the channel are minimized.
- The bridge abutments and piers are parallel with the existing direction of flow.
- The number of barrels for culverts in minimized to reduce the likelihood of debris blockage.

The results from the model runs are tabulated below.

Figure 7.9 Cross-sections along Broadmeadow and Ward Rivers, upstream and downstream of the proposed viaduct

7.2.2.2 Assessment of impact of fluvial flood risk

Tables 7.1 to 7.3 compare the flood levels for the baseline conditions and with the proposed scheme. As shown, the proposed scheme including the viaduct and flood wall to protect the open cut section of the line, has a no impact on peak water levels along the Broadmeadow and Ward Rivers. This is because the Viaduct openings maintain the existing floodplain flow paths beneath the Proposed Scheme and over the R132.

Table 7.1 Comparison between the baseline and with scheme 1% AEP peak levels

Watercourse	Location - Model Cross Section	1% AEP Peak Water Level (mAOD)		Difference in Peak Water Levels (m)
		Existing Situation	With Scheme	
Broadmeadow	4Ba1260 (Upstream of proposed viaduct)	5.17	5.17	0.00
	4Ba982 (Upstream of proposed viaduct)	5.03	5.03	0.00
	4Ba484 (At the crossing with the proposed viaduct)	4.92	4.92	0.00
	4Ba415 (Downstream of proposed viaduct)	4.10	4.10	0.00
	4Ba318 (Downstream of proposed viaduct)	4.07	4.07	0.00
Ward	4Wa816 (Upstream of proposed viaduct)	7.75	7.75	0.00
	4Wa480 (Upstream of proposed viaduct)	5.39	5.39	0.00
	4Wa188 (At the crossing with the proposed viaduct)	4.91	4.91	0.00

Note: Cross Section Locations are provided in Figure 7.9.

Table 7.2 Comparison between the baseline and with scheme 1% AEP & climate change peak levels

Watercourse	Location - Model Cross Section	1% AEP & Climate Change Peak Water Level (mAOD)		Difference in Peak Water Levels (m)
		Existing Situation	With Scheme	
Broadmeadow	4Ba1260 (Upstream of proposed viaduct)	5.36	5.36	0.00
	4Ba982 (Upstream of proposed viaduct)	5.22	5.22	0.00
	4Ba484 (At the crossing with the proposed viaduct)	5.11	5.11	0.00
	4Ba415 (Downstream of proposed viaduct)	4.29	4.29	0.00
	4Ba318 (Downstream of proposed viaduct)	4.26	4.26	0.00
Ward	4Wa816 (Upstream of proposed viaduct)	7.94	7.94	0.00
	4Wa480 (Upstream of proposed viaduct)	5.58	5.58	0.00

	4Wa188 (At the crossing with the proposed viaduct)	5.10	5.10	0.00

Note: Cross Section Locations are provided in Figure 7.9.

Table 7.3 Comparison between the baseline and with scheme 0.1 % AEP peak levels

Watercourse	Location - Model Cross Section	0.1% AEP Peak Water Level (mAOD)		Difference in Peak Water Levels (m)
		Existing Situation	With Scheme	
Broadmeadow	4Ba1260 (Upstream of proposed viaduct)	5.63	5.636	0.00
	4Ba982 (Upstream of proposed viaduct)	5.49	5.49	0.00
	4Ba484 (At the crossing with the proposed viaduct)	5.38	5.38	0.00
	4Ba415 (Downstream of proposed viaduct)	4.56	4.56	0.00
	4Ba318 (Downstream of proposed viaduct)	4.53	4.53	0.00
Ward	4Wa816 (Upstream of proposed viaduct)	8.21	8.21	0.00
	4Wa480 (Upstream of proposed viaduct)	5.85	5.85	0.00
	4Wa188 (At the crossing with the proposed viaduct)	5.37	5.37	0.00

Note: Cross Section Locations are provided in Figure 7.5.

Table 7.4 Comparison between with scheme peak levels and proposed viaduct soffit level

AEP Event	Flood Level at Proposed Viaduct (mAOD	Minimum Top Of Rail (TOR) level (mAOD)	Difference / Freeboard Allowance (m)
10% (1 in 10)	4.91	5.90	+0.99
1% (1 in 100)	5.10		+0.80
0.1% (1 in 1000)	5.37		+0.53

Table 7.4 compares the with flood levels immediately upstream of the viaduct against the proposed viaduct soffit level. As shown a minimum freeboard of 0.53m is provided for the 0.1% AEP flow. This would meet the guidelines of OPW Section Consent requirements.

Figure 7.10 compares the baseline and with 0.1% AEP flood extents. As shown, there is no difference in the predicted extent of flooding with the Proposed Scheme

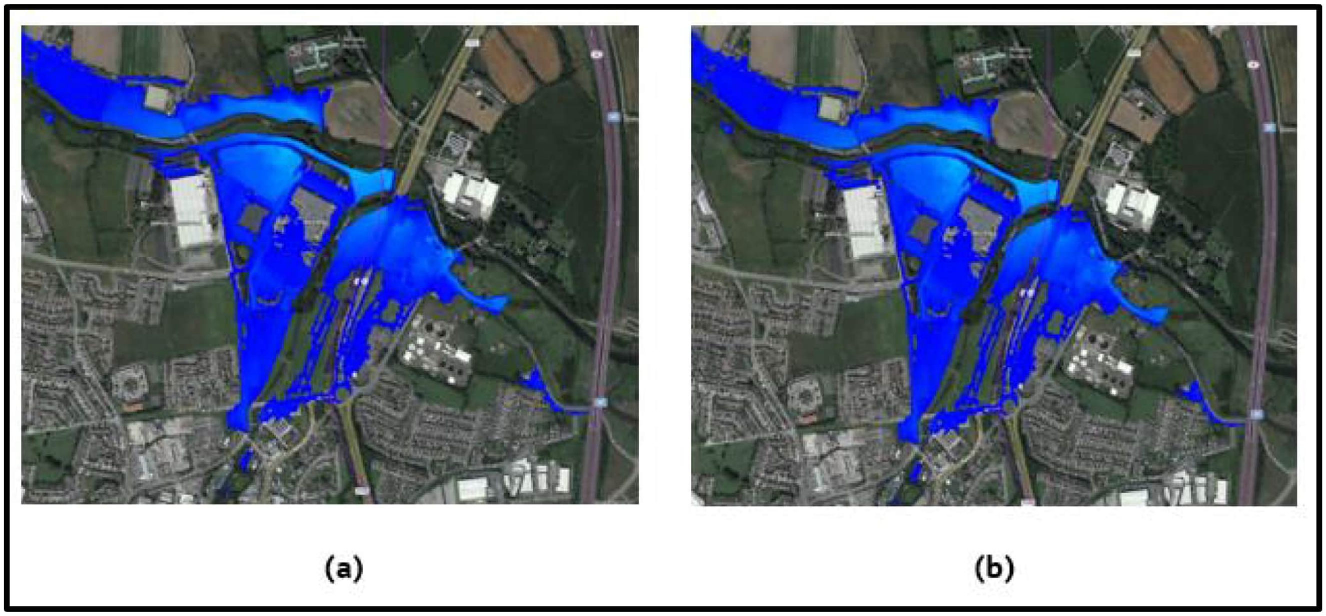


Figure 7.10 Flood extents for the baseline model (a) and after including the viaduct (b)

7.2.3 Conclusion

The Stage 3 Flood Risk Assessment for Broadmeadow and Ward Rivers concluded that the Proposed Scheme is not at risk of fluvial flooding up to and including the 0.1% AEP flood event. The Proposed Viaduct also provides 0.5m freeboard for the 0.1% AEP flood. The proposed floodwall downstream of the viaduct also protect the open cut section of the track from flooding.

There is no change in fluvial flood risk as a result of the construction of the proposed viaduct and floodwall between Ch. 1 + 500 and Ch. 1 + 760.

As was demonstrated in Section 5, fluvial flood risk is the dominant source of flooding from the Broadmeadow and Ward Rivers at the Proposed Scheme. The design of the Proposed Scheme to accommodate the 0.1% AEP fluvial flow means that it is also sufficient to contain the 0.1% AEP coastal event. As shown in Section 5, the 0.1% AEP coastal flood level is 2 m lower that the 0.1% fluvial peak flood level.

7.3 North to Naul Road, Ch. 5 + 765 – Ch. 5 + 963, associated with Sluice River and a Tributary.

7.3.1 Introduction

This section follows on from the findings in the Stage 1 and Stage 2 Flood Risk Assessments that culverts are required to carry the Proposed Scheme over a tributary of Sluice River (Ch. 05 +765) and Sluice River itself (Ch. 05 + 963). Whilst existing flood risk information suggests there is little natural floodplain associated with the Sluice River and its tributary, refer to Figure 7.11. A Stage 3 Detailed Flood Risk Assessment has been completed to show no adverse impacts from the proposed scheme.

A quantitative appraisal of potential flood risk to the proposed development is provided, assessing its potential impacts on flood risk elsewhere and of the effectiveness of any proposed mitigation measures. This was undertaken by conducting a detailed hydrological assessment of flows and constructing a site-specific hydraulic model across the study area to assess the catchment wide impacts and hydrological process involved.

The MetroLink Scheme will cross a tributary of Sluice River at Ch. 5 + 765 and the Sluice River at Ch. 5+963 via embankments. These watercourses will need to be to be culverted as these watercourses are passing under the Metrolink track.

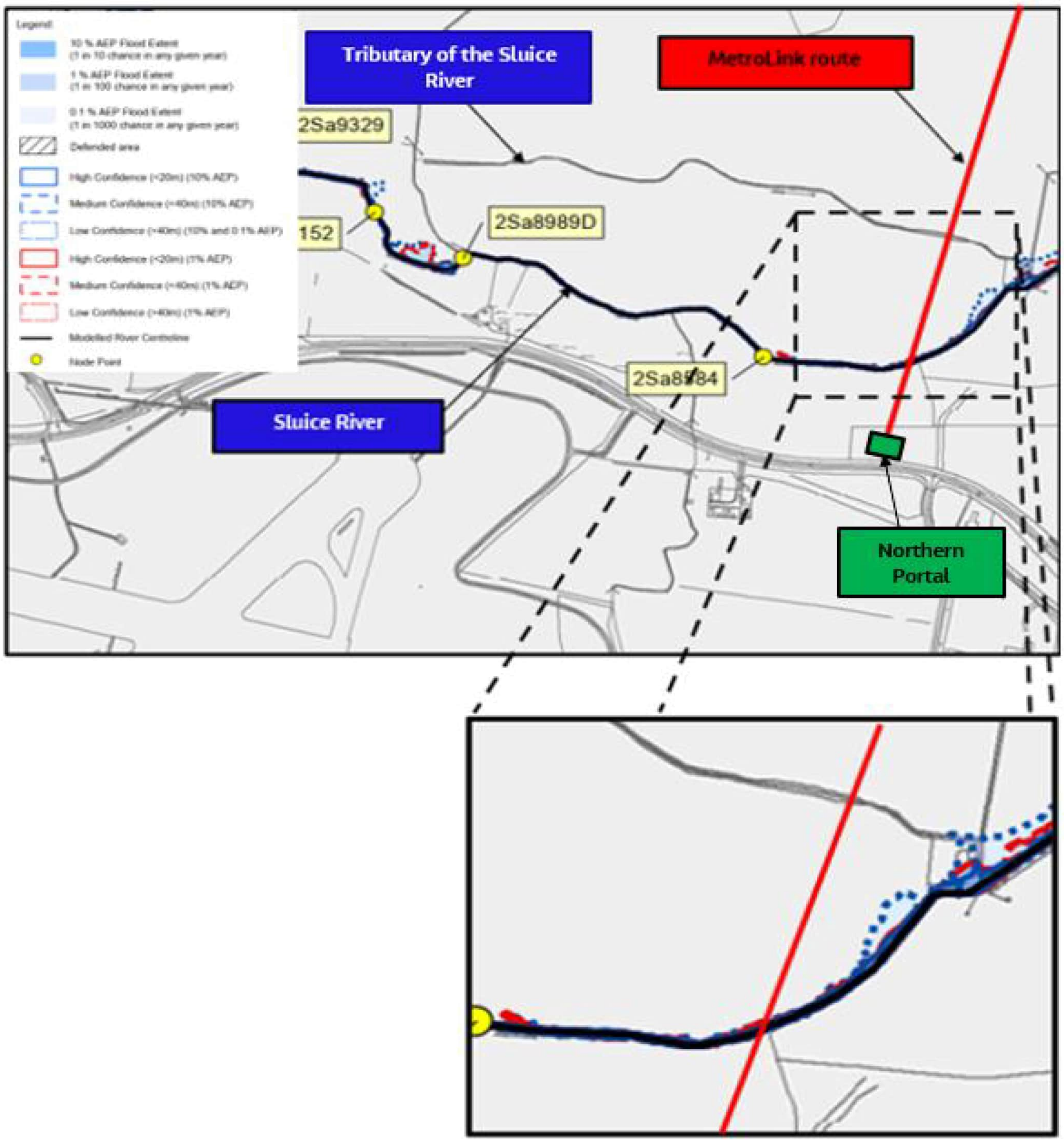


Figure 7.11 Extract of fluvial flood mapping from CFRAM study around the Sluice River and tributary crossings (Ch. 5 + 765 and Ch. 5 + 963)

7.3.2 Proposed Scheme Works

The proposed works comprise construction of two culvert crossings on Sluice River (Ch. 5 + 963) and its tributary (Ch. 5 + 765), refer to Figure 7.12 below.

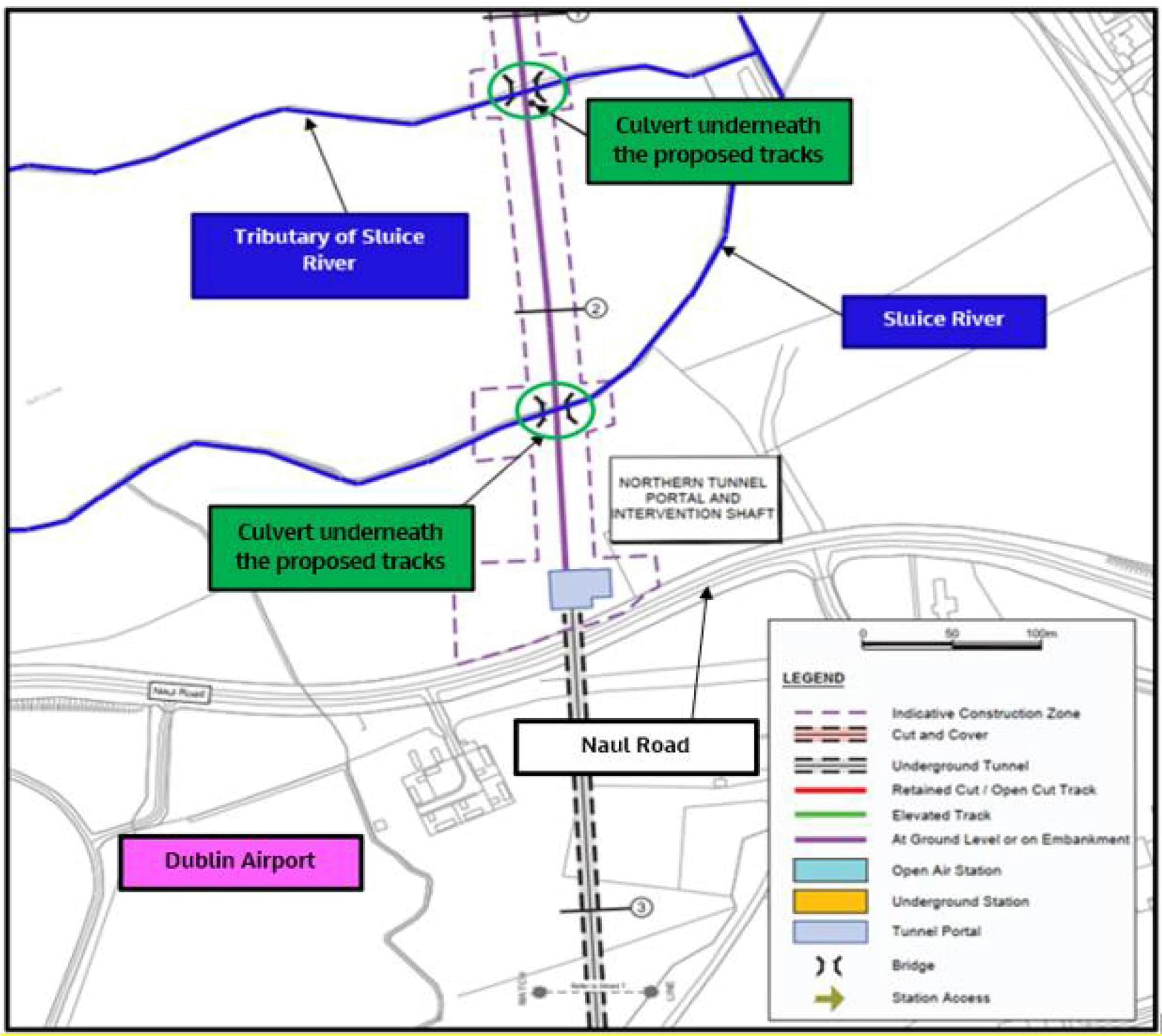


Figure 7.12 Location of the proposed culvert crossings at Ch. 05 + 765 and Ch. 05 + 963 on Sluice River and tributary.

Figure 7.13 and drawing 'ML1-JAI-RTA-ROUT_XX-DR-Y-00014' in Appendix C show longitudinal and cross sections of both culverts. The minimum culvert sections are as follows:

- Sluice River Tributary: 1.5m wide by 1.5m high (clear opening)
- Sluice River: 2m wide by 2.5m high (clear opening).

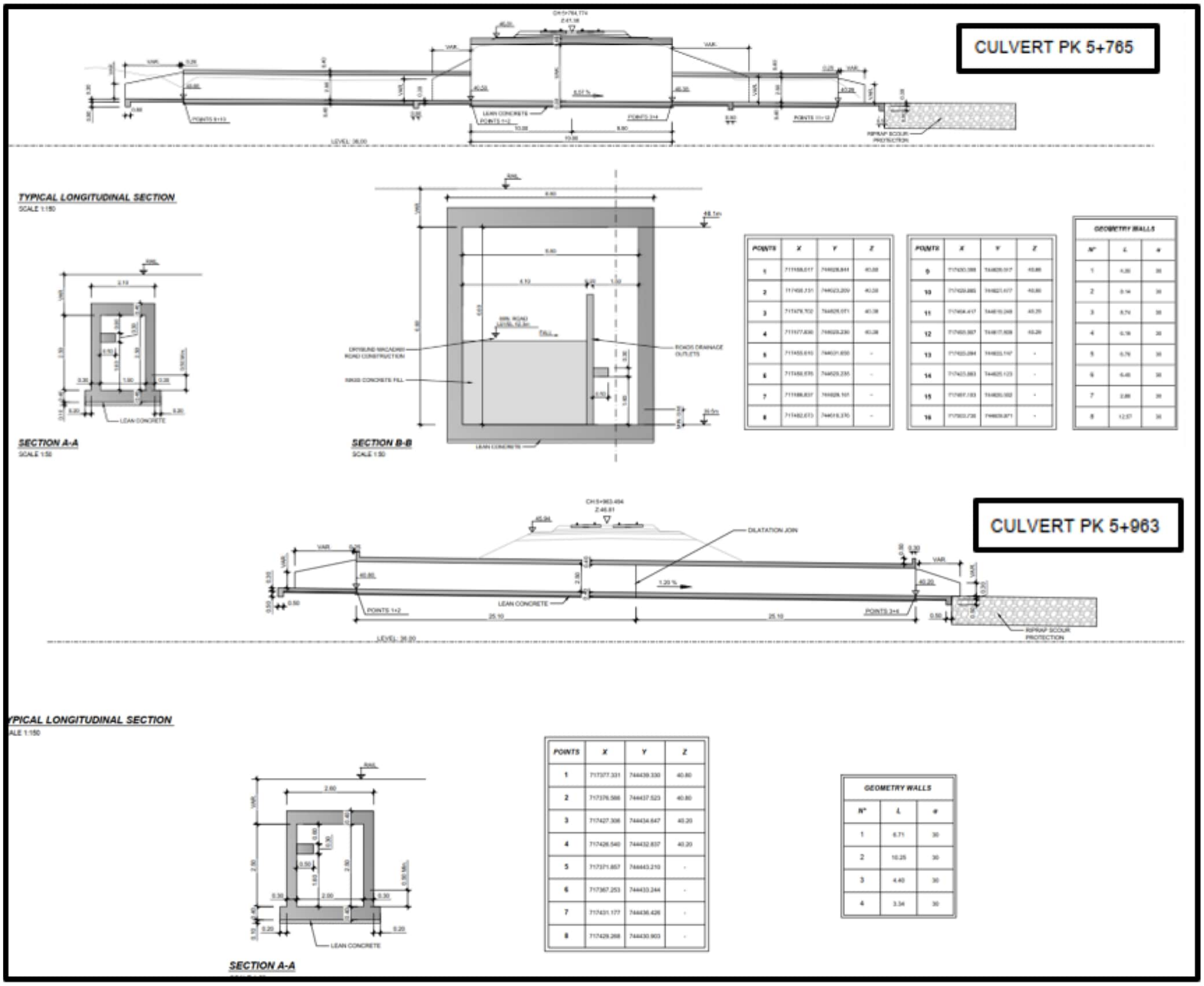


Figure 7.13 Typical longitudinal section of the proposed culvert crossings at Ch. 05 + 765 and Ch. 05 + 963 on Sluice River and tributary.

7.3.3 Hydraulic Model

The Sluice River has its source near Barberstown and Pickardstown to the north of Dublin Airport and flows in a south-easterly direction until it discharges to the Baldoyle Estuary at Portmarnock Bridge. The Sluice River FEM FRAMs model is a combined 1D-2D hydrodynamic model comprising a 1-D channel representation and 2-D floodplain domain.

The Manning's coefficient for the Sluice River and tributary ranged from 0.03 to 0.035 in the river channel and from 0.002 and 0.025 in the culverts. The Manning's coefficient was 0.06 in the floodplain.

The FEM FRAMs model was run for the 1%, 1% & climate change and 0.1% AEP floods for baseline scenario and with the proposed scheme in place.

7.3.3.1 Analysis of the Proposed Scheme

The Sluice River FEM FRAMs model was adjusted to represent the proposed scheme (i.e. with the proposed culverts) and then run for the 1%, 1% & climate change 0.1% AEP fluvial floods. A cross section location plan for the model is presented in Figure 7.14 with the results for the baseline and with scheme conditions tabulated below.

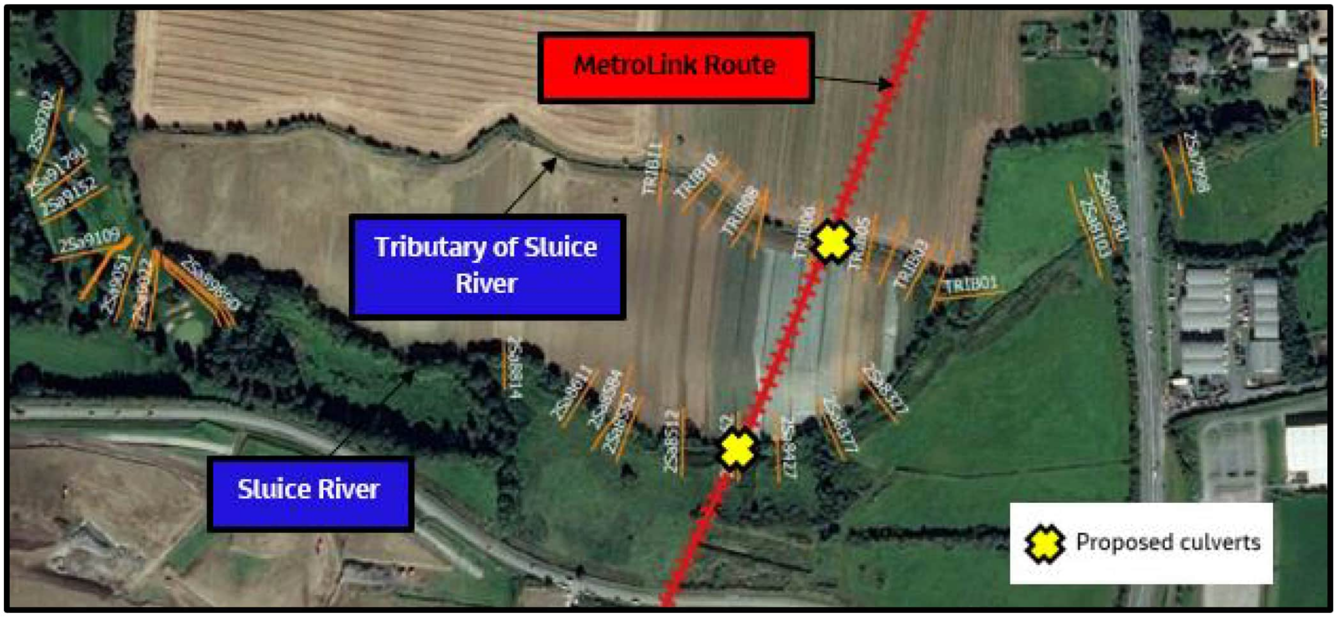


Figure 7.14 Cross-sections along the Sluice River Tributary

7.3.3.2 Sluice River Tributary

Tables 7.5 to 7.7 compare the peak flood levels for the existing (baseline) situation and with the proposed scheme. As shown, the proposed scheme results in no increase in peaks water levels along the tributary of the Sluice River. The proposed track level at the crossing of the tributary is 46.84 mAOD which significantly exceeds the 0.1% AEP flood level. There is no coastal risk of flooding along the tributary of the Sluice River.

Table 7.5 Comparison between the baseline and with scheme 1% AEP peak levels

Location - Model Cross Section	1% AEP Flood Peak Water Level		
	Peak Water Level (mAOD)	Peak Flow (m^3/s)	Peak Velocity (m/s)
Just upstream of the proposed culvert – TRIB06U	41.30	41.30	0.00
In channel just downstream of the proposed culvert – TRIB06D	40.63	40.63	0.00

Note: Cross Section Locations are provided in Figure 7.14.

Table 7.6 Comparison between the baseline and with scheme 1% AEP & climate change peak levels

Location - Model Cross Section	1% AEP & Climate Change Flood Peak Water Level		
	Peak Water Level (mAOD)	Peak Flow (m^3/s)	Peak Velocity (m/s)
Just upstream of the proposed culvert – TRIB06U	41.43	41.43	0.00
In channel just downstream of the proposed culvert – TRIB06D	40.73	40.73	0.00

Note: Cross Section Locations are provided in Figure 7.14.

Table 7.7 Comparison between the baseline and with scheme 0.1% AEP peak levels

Location - Model Cross Section	0.1% AEP Flood Peak Water Level		
	Baseline (mAOD)	With Scheme (mAOD)	Difference (m)
Just upstream of the proposed culvert – TRIB06U	41.50	41.50	0.00
In channel just downstream of the proposed culvert – TRIB06D	40.83	40.83	0.00

Note: Cross Section Locations are provided in Figure 7.14.

7.3.3.3 Sluice River

Tables 7.8 to 7.10 compare the peak flood levels for the existing (baseline) situation and with the proposed scheme. As shown, the proposed scheme results in no increase in peaks water levels along the Sluice River. The proposed track level at the crossing of the Sluice River is 46.81mOD which significantly exceeds the 0.1% AEP flood level. There is no coastal risk of flooding along the Sluice River where it is crossed by the Proposed Scheme.

Table 7.8 Comparison between the current and with 1 % AEP peak levels for the Sluice River

Location - Model Cross Section	1% AEP Peak Water Level (mAOD)		Difference (m)
	Baseline	With Scheme	
Just upstream of the proposed culvert – 2Sa8512	42.15	42.15	0.00
In the channel downstream of the proposed culvert – 2Sa8427	41.23	41.23	0.00

Note: Cross Section Locations are provided in Figure 7.14.

Table 7.9 Comparison between the current and with 1 % AEP & Climate Change peak levels for the Sluice River

Location - Model Cross Section	1% AEP & Climate Change Peak Water Level (mAOD)		Difference (m)
	Baseline	With Scheme	
Just upstream of the proposed culvert – 2Sa8512	42.28	42.28	0.00
In the channel downstream of the proposed culvert – 2Sa8427	41.33	41.33	0.00

Note: Cross Section Locations are provided in Figure 7.14.

Table 7.10 Comparison between the current and with 0.1 % AEP peak levels for the Sluice River

Location - Model Cross Section	0.1% AEP Peak Water Level (mAOD)		Difference (m)
	Baseline	With Scheme	
Just upstream of the proposed culvert – 2Sa8512	42.35	42.35	0.00
In the channel downstream of the proposed culvert – 2Sa8427	41.43	41.43	0.00

Note: Cross Section Locations are provided in Figure 7.14.

7.3.4 Conclusion

The Stage 3 Flood Risk Assessment for Sluice River and its tributary concluded that the proposed MetroLink Scheme is not at risk of fluvial flooding up to the 0.1% AEP flood event. There is no change in fluvial flood as a result of the construction of the proposed culverts across either watercourse up to and including the 0.1% AEP flood.

7.4 Dardistown Depot associated with the diversion of the Turnapin Stream

7.4.1 Introduction

Figure 7.15 shows that Turnapin Stream needs to be diverted to permit construction of the new Dardistown train depot and station development. The Stage 2 assessment in Section 5 has shown that there is little natural floodplain associated with the Turnapin Stream.

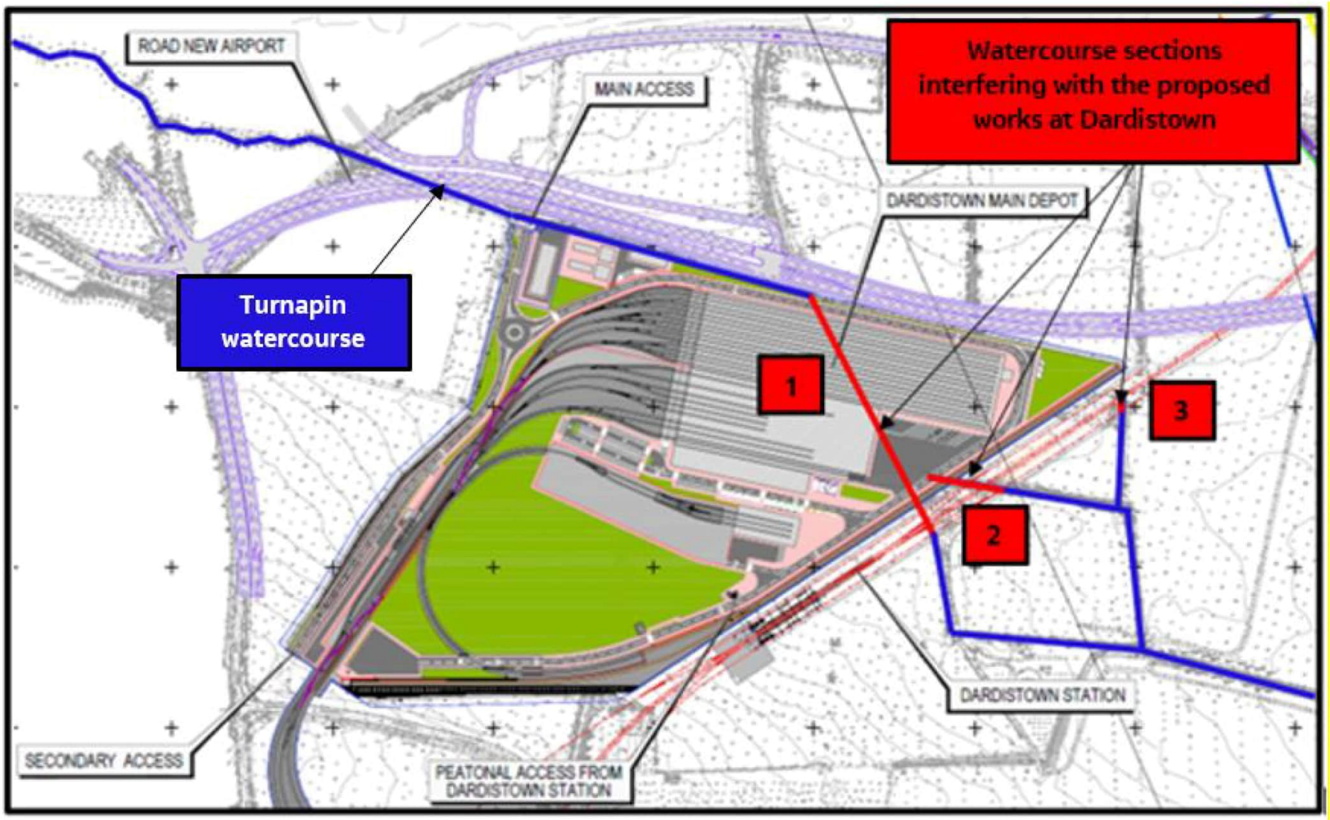


Figure 7.15 Proposed works for the MetroLink scheme at Dardistown

Figures 7.16 and 7.17 show the scope of the proposed diversion of the Turnapin Stream. The stream will be diverted as a naturalised channel with a 10 to 15 m wide riparian buffer provided as per the local development plan. The stream will also receive flows from an interceptor ditch which is to be constructed along the western boundary of the depot site.

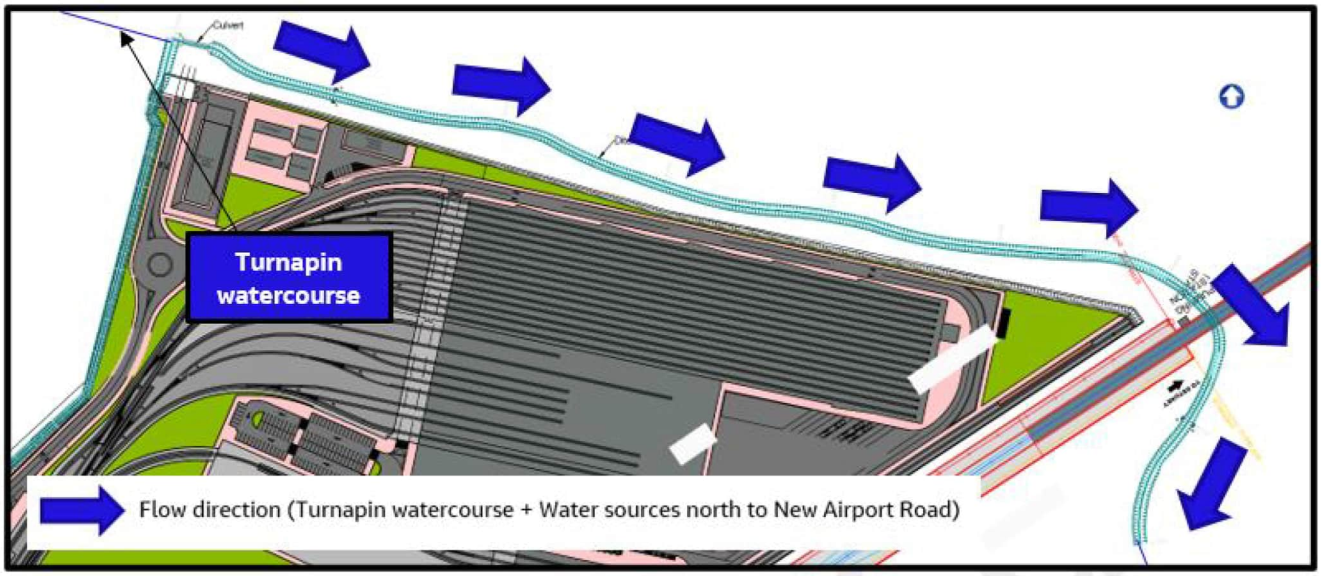


Figure 7.16 Flow direction of the diverted Turnapin Stream

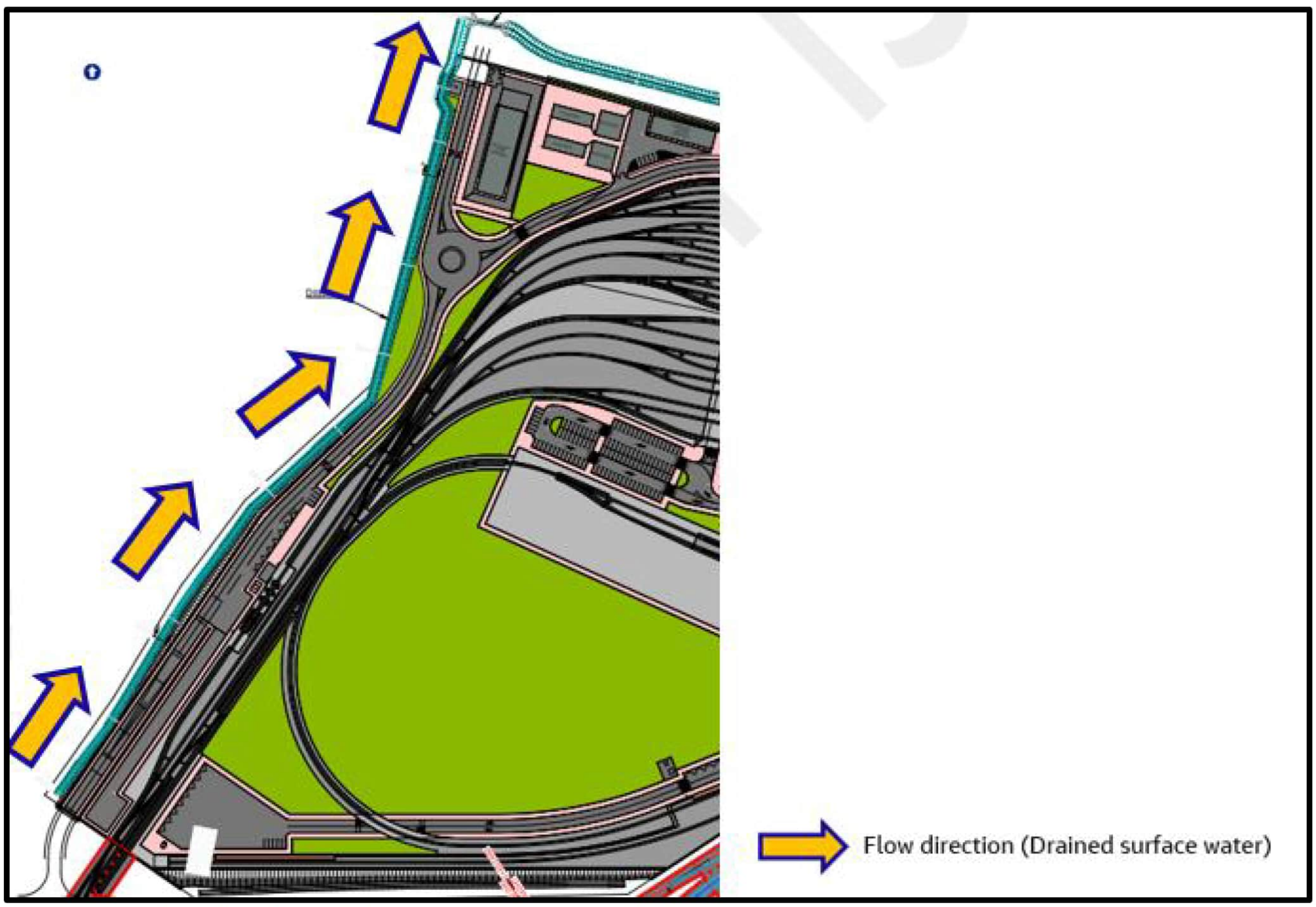


Figure 7.17 Flow direction of the Depot Interceptor Ditch

7.4.2 Diversion Design

A hydraulic design of the proposed diversion has been developed in order to avoid any increase in flood risk to the proposed area of works (embedded mitigation) and ensure the Proposed Scheme is adequately protected from flooding. This means that all new ditch and stream sections have been designed to contain the 0.1% AEP flood as there is no existing natural floodplain present along the watercourse for its current course.

Full details for the proposed design are contained in Appendix as follows:

- Drawing 'ML1-JAI-ARL-MS06_XX-M2-Y-00001'. Proposed watercourse diversion.
- Drawing 'ML1 -JAI-PLD-MS06_XX-DR-Y-00001'. Proposed minimal ditch and culvert cross and long section.
- Drawing 'ML1 -JAI-PLD-MS06_XX-DR-Y-00002'. Plan view and cross sections of ditch 14.
- Drawing 'ML1 -JAI-PLD-MS06_XX-DR-Y-00003'. Plan view and cross sections of ditch 13.

A 1-D model of the proposed scheme was built using Flood Modeller to develop the hydraulic design and determine the required size of the channel sections. A 1-D model was considered to be appropriate as there is no requirement to represent floodplain flows for the proposed diversion as all flows need to be contained in-bank. Figure 7.18 provides an overview of the cross sections incorporated into the diversion model.

Figure 7.18 Cross-sections along the Turnapin watercourse diversion

Manning's coefficients for the diversion scheme equalled 0.04 in the diversion channel, 0.06 in the floodplain and 0.025 in the culvert.

The model was run for the 1%, 1% & climate change and 0.1% AEP floods. A summary of the peak water levels for a number of cross-sections along the diversion is provided in Table 7.11

Table 7.11 Summary of the diversion Model Results

Location - Model Cross Section	Designed Bank-top Levels (mAOD)		Peak Water Levels (mAOD)		
	Left Bank	Right Bank	1% AEP	1% AEP MRFS +20%	0.1% AEP
Ditch 14 at Ch. 200 – DIT14_CH200	61.90	61.90	61.16	61.26	61.46
Ditch 14 Downstream – DIT14_CH489	61.74	61.71	61.16	61.26	61.46
Ditch 13 Upstream - DIT13_CH000	61.76	61.72	61.16	61.26	61.46
Culvert Upstream – CH006_CU	N/A	N/A	61.05	61.15	61.33
Culvert Downstream – CH021_CD	N/A	N/A	61.02	61.11	61.27
Ditch 13 at Ch. 050 - DIT13_CH050	61.39	61.20	60.94	61.03	61.19
Ditch 13 at Ch. 300 – DIT_CH300	60.43	60.43	60.14	60.23	60.38
Ditch 13 at Ch. 500 – DIT13_CH500	59.95	59.92	59.53	59.62	59.78
Ditch 13 at Ch. 650 – DIT13_CH650	59.40	59.39	59.15	59.24	59.39
Ditch 13 at Ch. 780 – DIT13_CH780	59.16	59.21	58.96	59.03	59.14

Note: Cross-Section Locations are provided in Figure 7.18

The diversion model results demonstrate that there is no risk of flooding from the proposed diversion channel as the flood flows are contained in-bank up to and including the 0.1% AEP flow. All culverts along the route of the proposed channel are design to convey the 1% AEP & climate change AEP flow with a 350 mm freeboard allowance.

7.4.3 Conclusion

The Stage 3 Flood Risk Assessment for the proposed diversion of the Turnapin watercourse concluded that the proposed MetroLink Scheme is not at risk of fluvial flooding up to the 0.1% AEP flood event. There is no change in fluvial flood risk in the area of interest as a result of the construction of the proposed diversion as the channel has been designed to contain all flows up to and including the 0.1% AEP flood.

7.5 Tara Station, on Tara Street, Ch. 17 + 400.

7.5.1 Introduction

This section follows on from the findings in the Stage 2 Flood Risk Assessment that the proposed Tara Station (Ch. 17 + 400) is at risk from coastal flooding with the effects of future climate change. As shown in Table 7.12, with the effects of climate change the 0.5% AEP and 0.1% AEP coastal flood levels exceed the station threshold level. This could result in not only flooding of the station but also inundation of the tunnelled sections of the MetroLink line.

Table 7.12 River Liffey Coastal Flood Levels for the proposed MetroLink scheme with the effects of Climate Change (Tara Station, Ch. 17 + 400)

AEP Event	Flood Level (mAOD)	Minimum Station Threshold Level (mAOD)	Difference / Freeboard Allowance (m)
10% (1 in 10)	3.28*		+0.22
0.5% (1 in 200)	3.62*	3.40	-0.28
0.1% (1 in 1000)	3.85*		-0.45

* Values obtained from node 09LIFF00280

To ensure that Tara Station is sufficiently resilient to flooding, the proposed design will make the provision for the addition of demountable defences across each entrance to the station, refer to Figure 7.19. The demountable and the station building will be designed to prevent flooding up to a level of 4.35 mAOD. This equates to the 0.1% AEP coastal flood level with HEFS allowance for climate change.

Figure 7.19 Example of a Demountable Defence

If Tara Station is made resilient to flooding, it has the potential to displace floodplain storage that is currently available when the Liffey overtops its banks. A floodplain displacement analysis has therefore been completed to determine the potential impacts of the scheme on flood risk.

7.5.2 Displacement Volume Calculation process

The displacement calculation process seeks to demonstrate that the proposed Tara Station will not increase flood risk to other receptors. Fluvial and coastal flood maps for the 0.1% AEP flood with the High-End Future Scenario (HEFS) were obtained from OPW. The footprint of the proposed development was overlaid on the flood maps using QGIS. Figure 7.20 compares the 0.1% coastal flood extent with the High-End Future Scenario (HEFS) against the footprint of the proposed development at Tara Station.

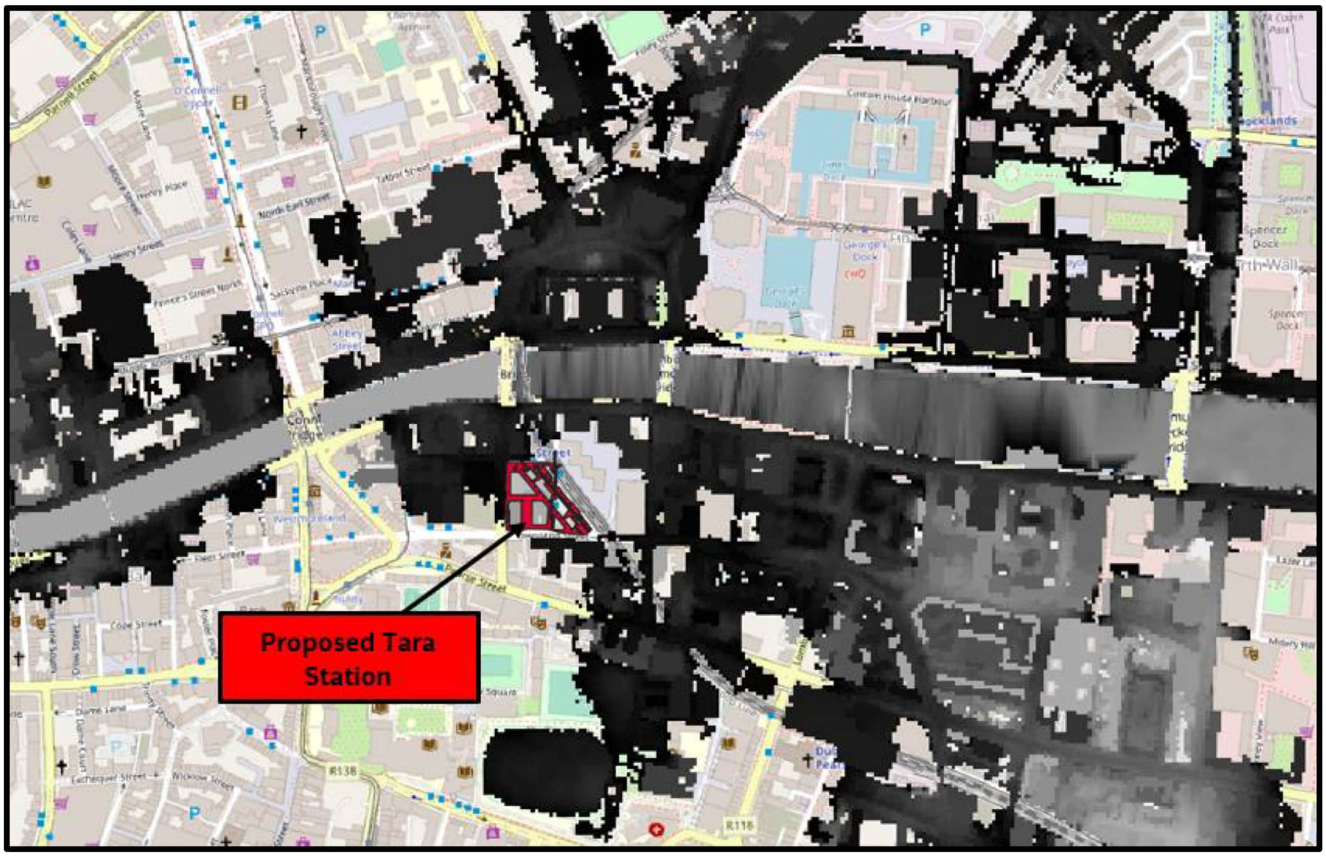


Figure 7.20 Proposed Tara Station, spatially overlaid on OPW fluvial High-End Future Scenario flood map on QGIS.

The displacement volume is calculated as follows.

$$\textit{Displacement Volume } [m^3] = \textit{Flooded area } [m^2] \textit{ x Average flood depth } [m]$$

Displacement volumes have been calculated for the following scenarios:

- 0.1% AEP Fluvial Flood (Current scenario).
- 0.1% AEP Coastal Flood (Current scenario).
- 0.1% AEP Fluvial Flood (HEFS).

- 0.1% AEP Coastal Flood (HEFS).

7.5.3 Results

This section summarises the displacement volume results for the flood scenarios assessed. The flood water volume displaced by the construction of the proposed Tara Station will be compared to the following:

- Total flood water volume displaced in the floodplain.
- Flood water volume displaced in the floodplain area south of the River Liffey where Tara station will be constructed.

7.5.3.1 Current scenario

7.5.3.1.1 Fluvial

OPW flood maps indicate that there is currently no fluvial risk at the location of the proposed Tara Station.

7.5.3.1.2 Coastal

Table 7.13 provides the displacement volume results for the 0.1% AEP coastal flood event (current scenario).

Table 7.13 Flood displacement volumes for the 1000-year coastal flood under the current coastal flood scenario

0.1% AEP Current Coastal Flood Displacement Volumes [m^3]			(a) as a % of (b)	(a) as a % of (c)
(a) Total Flood displaced due to the construction of Tara Station	(b) Total flood volume on the floodplain	(c) Flood volume on the floodplain area south of the river		
5.75	1,447,114	480,277	0.40%	1.20%

The construction of Tara Station would result in 5,75 m^3 of flood water being displaced, a volume which represents only 0.40% of the total flood water volume that a 0.1% AEP current coastal flood event.

The flood water being displaced by Tara Station was also compared to the flood volume on the floodplain area south to River Liffey and it was found to represent only 1.20% of the latter, confirming the minimal impact of the development on current coastal flood risk patterns.

Therefore, the impact of the proposed Tara Station on the 0.1% AEP coastal flood (current scenario) is shown to be negligible.

7.5.3.2 High-End Future Scenario (HEFS)

7.5.3.2.1 Fluvial

Table 7.14 provides the displacement volume results for the 0.1% AEP high-end fluvial flood event.

Table 7.14 Flood displacement volumes for the 0.1% fluvial flood under the HEFS

0.1% AEP High-End Fluvial Flood Displacement Volumes [m3]			(a) as a % of (b)	(a) as a % of (c)
(a) Total Flood displaced due to the construction of Tara Station	(b) Total flood volume on the floodplain	(c) Flood volume on the floodplain area south of the river		
11,663	1,985,415	85,415	0.59 %	1.31 %

The construction of Tara Station results in 11,663m^3 of flood water being displaced, a volume which represents only 0.59 % of the total flood water volume for a 0.1% AEP HEFS fluvial flood.

The floodwater being displaced by Tara Station was also compared to the flood volume on the floodplain area south to River Liffey and it was found to represent only 1.31 %, confirming the minimal impact of the development on high-end fluvial flood risk patterns.

Therefore, the impact of the proposed Tara Station on the 0.1% AEP fluvial flood (HEFS) is shown to be negligible.

7.5.3.2.2 Coastal

Table 7.15 provides the displacement volume results for the 0.1% high-end coastal flood event.

Table 7.15 Flood displacement volumes for the 0.1% AEP coastal flood under the HEFS

0.1% AEP High-End Costal Flood Displacement Volumes [m^3]			(a) as a % of (b)	(a) as a % of (c)
(a) Total Flood displaced due to the construction of Tara Station	(b) Total flood volume on the floodplain	(c) Flood volume on the floodplain area south of the river		
11,821	11,369,989	3,226,033	0.10%	0.37%

The proposed development would result in 11,821 m^3 of flood water being displaced, a volume which represents only 0.10% of the total flood water volume for a 0.1% AEP coastal flood.

The flood water being displaced by Tara Station was also compared to the flood volume on the floodplain area south of the river and it was found to represent only 0.37 %, confirming the minimal impact of the development on high-end coastal flood risk patterns.

Therefore, the impact of the proposed Tara Station on the 0.1% AEP coastal flood (HEFS) is shown to be negligible.

7.5.3.3 Assessment of impact on fluvial and coastal flood risk

Table 7.16 summarises and compares the results of the displacement volume calculations for the flood scenarios assessed.

Table 7.16 Flood displacement volumes summary

Flood scenario	Flood Displacement Volumes [m^3]		(a) expressed as a % of (b)
	(a) Proposed development at Tara Station	(b) Total flood volume on the floodplain	
0.1% AEP Current Fluvial Flood	N/A	N/A	N/A
0.1% AEP Current Coastal Flood	5,751	1,447,114	0.40%
0.1% AEP High-End Fluvial Flood	11,663	1,985,415	0.59%
0.1% AEP High-End Coastal Flood	11,821	11,369,989	0.10%

The proposed development at Tara Station is shown to displace less than 1% of the total flood volume on the floodplain during all the flood scenarios assessed and hence, the impact on both fluvial and coastal flood extents is deemed to be negligible.

7.5.4 Conclusion

A Stage 3 Detailed Risk Assessment has been completed and demonstrates that the change in the fluvial and coastal flood risk for the current and HEF scenarios can be considered as negligible at this location.

8. Flood Risk Management and Evaluation

8.1 The Sequential Approach to Development Planning

The FRA indicates that part of the Proposed Scheme will be located in Flood Zones A and B. '*The Planning System and Flood Risk Management: Guidelines for Planning Authorities and Technical Appendices, 2009*' classifies the proposed development as 'highly vulnerable' with respect to flooding.

Application of the sequential approach within the FRM Guidelines would be to steer the Proposed Scheme away from flood zones A and B. This is not practicable however, as the works comprise the proposal of new MetroLink route, parts of which, for practicality are required to cross watercourses above ground.

8.1.1 Justification Test

'The Planning System and Flood Risk Management, Guidelines for Planning Authorities' (2009)', 5.15, Box 5.1 sets out the criteria for the Justification Test and is replicated below in Figure 8.1. An assessment of the Proposed Scheme against these criteria is presented in **Error! Reference source not found.**, Table 8.2, Table 8.3 and Table 8.4.

Box 5.1 Justification Test for development management to be submitted by the applicant)

When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2, the following criteria must be satisfied:

1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines.
2. The proposal has been subject to an appropriate flood risk assessment that demonstrates:
   - (i) The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk.
   - (ii) The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible.
   - (iii) The development proposal includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and
   - (iv) The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.

The acceptability or otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.

Note: See section 5.27 in relation to major development on zoned lands where sequential approach has not been applied in the operative development plan.

Refer to section 5.28 in relation to minor and infill developments.

Figure 8.1 Justification Test Criteria

Table 8.1 Assessment against Justification Test Criteria - Fluvial Flood Risk

Criteria to be satisfied	Justification	Criteria Met
The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines.	MetroLink forms a key part of wider development proposals within Dublin and part of Project Ireland 2040	Yes
The development will not increase flood risk elsewhere, and, if practicable, will reduce overall flood risk.	As shown in Sections 5, 6 and 7, the Proposed Scheme will not increase flood risk from any watercourse that is crossed by the scheme	Yes
The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably practicable.	The Proposed Scheme including the track, stations and all associated infrastructure are designed to be resilient to the 0.1% AEP fluvial flood.	Yes
The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access.	The Proposed Scheme including the track, stations and all associated infrastructure are designed to be resilient to the 0.1% AEP fluvial flood. The Proposed Scheme has no impact on the performance of any existing Flood Relief Schemes	Yes
The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.	The proposed development meets the objectives set out in the Dublin City Development Plan 2016-2022 and in the Fingal Development Plan 2017 - 2023. as it forms a key part of achieving the required rate of sustainable urban growth by promoting active travel and public transport.	Yes

Table 8.2 Assessment against Justification Test Criteria – Coastal Flood Risk

Criteria to be satisfied	Justification	Criteria Met
The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines.	MetroLink forms a key part of wider development proposals within Dublin and part of Project Ireland 2040	Yes
The development will not increase flood risk elsewhere, and, if practicable, will reduce overall flood risk.	As shown in Sections 5, 6 and 7, the Proposed Scheme will not increase coastal flood risk from any watercourse that is crossed by the scheme	Yes
The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably practicable.	The Proposed Scheme including the track, stations and all associated infrastructure are designed to be resilient to the 0.1% AEP coastal flood.	Yes
The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access.	The Proposed Scheme including the track, stations and all associated infrastructure are designed to be resilient to the 0.1% AEP coastal flood. The Proposed Scheme has no impact on the performance of any existing Flood Relief Schemes	Yes
The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.	The proposed development meets the objectives set out in the Dublin City Development Plan 2016-2022 and in the Fingal Development Plan 2017 - 2023. as it forms a key part of achieving the required rate of sustainable urban growth by promoting active travel and public transport.	Yes

Table 8.3 Assessment against Justification Test Criteria - Pluvial Flood Risk and Surface Water Drainage

Criteria to be satisfied	Justification	Criteria Met
The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines.	MetroLink forms a key part of wider development proposals within Dublin and part of Project Ireland 2040	Yes
The development will not increase flood risk elsewhere, and, if practicable, will reduce overall flood risk.	As shown in Sections 5 and 6, the Proposed Scheme will not increase pluvial flood risk from any receiving watercourse or existing drainage network. This is because all attenuation (SuDS) measures are provided for all new impermeable surfaces that are created by the scheme ensuring no increase on existing run off rates.	Yes
The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably practicable.	All proposed scheme drainage schemes for the track, stations and other infrastructure is designed to contain a 1% AEP storm with MRFS climate change with a freeboard allowance (300mm on all ponds and/or 20% pipe drainage capacity).	Yes
The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access.	All proposed scheme drainage schemes for the track, stations and other infrastructure is designed to contain a 1% AEP storm with MRFS climate change with a freeboard allowance (300mm on all ponds and/or 20% pipe drainage capacity). The Proposed Scheme has no impact on the performance of any drainage networks as there is no change in existing runoff rates.	Yes
The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.	The proposed development meets the objectives set out in the Dublin City Development Plan 2016-2022 and in the Fingal Development Plan 2017 - 2023. as it forms a key part of achieving the required rate of sustainable urban growth by promoting active travel and public transport.	Yes

The Proposed Scheme can be shown to satisfactorily meet the requirements of the Justification Test for pluvial, fluvial and coastal flooding.

9. Summary & Conclusions

The following sources and level of flood risk along the MetroLink scheme are:

- A risk of pluvial flooding due to the limited capacity of the existing drainage network.
- A risk of fluvial flooding from the proposed diversion of a tributary of Staffordstown Stream, Broadmeadow and Ward Rivers, Sluice River and a tributary and the proposed diversion of the Turnapin Stream.
- A risk of coastal flooding from River Liffey to proposed Tara Station.

Pluvial Flooding

There is a risk of pluvial flooding along the entire MetroLink Scheme. This is a function of the capacity of the existing surface water network, which is typically designed to contain a 20 % AEP storm. It is beyond the scope of the MetroLink Scheme to increase the capacity of the existing surface water network.

The MetroLink scheme will result in the creation of additional impermeable surfaces for the proposed track, stations and other infrastructure. A comprehensive programme of SuDS measures have been implemented to ensure that there is no change in existing runoff rates as a consequence of the scheme. This will ensure no increase in the risk of pluvial flooding.

Fluvial Flooding

The MetroLink scheme is at risk of fluvial flooding from the proposed diversion of a tributary of Staffordstown Stream, Broadmeadow and Ward Rivers, Sluice River and a tributary and the proposed diversion of the Turnapin Stream.

A new viaduct has been proposed over Broadmeadow and Ward Rivers. Qualitative and quantitative analysis completed for a Stage 3 Assessment carried out shows that the proposed viaduct will not impact on flood levels for the Broadmeadow and Ward Rivers. This is because the viaduct makes sufficient provision to maintain floodplain flows beneath the Proposed Scheme.

New culverts have been proposed over Sluice River and its tributary. Qualitative and quantitative analysis completed for a Stage 3 Assessment carried out show that the proposed culverts will not impact on flood levels for the Sluice River and its tributary. This is because both culverts have been overdesigned for 0.1% AEP flood.

Two watercourse diversions have been proposed to allow for the construction of the proposed Park & Ride at Lissenhall and Depot at Dardistown. A tributary of the Staffordstown Stream (Lissenhall) and the Turnapin Stream (Dardistown) will be diverted. Qualitative and quantitative analysis completed for a Stage 3 Assessment carried out shows that the diversions have been designed so their banks will not be overtopped by the 0.1% AEP flood.

Coastal Flooding

The MetroLink scheme (proposed Tara Station) is at risk of coastal flooding from the River Liffey with the effects of climate change.

It is not possible to raise the street level of the Tara Station entrances to allow for the effects of climate change. Tara Station will therefore be designed to be resilient to including, including the provision of demountable for the 0.1% AEP flood with the HEFS scenario for climate change.

Qualitative and quantitative analysis completed for a Stage 3 Assessment carried out shows that the proposed Tara Station will not impact on flood levels for the River Liffey. The proposed development at Tara Station is shown to displace less than 1% of the total flood volume on the floodplain and hence, the impact on both fluvial and coastal flood extents is deemed to be negligible.

Climate Change

Climate change will result in an increased risk of flooding to the MetroLink scheme due to:

- Increased river flows.
- Increased rainfall depths and intensity.
- Increased sea levels.

Increased rainfalls depths and intensities will increase the risk of pluvial flooding from the existing surface water drainage network. New drainage measures which installed as part of the scheme, including any SuDS, are designed to allow for future climate change.

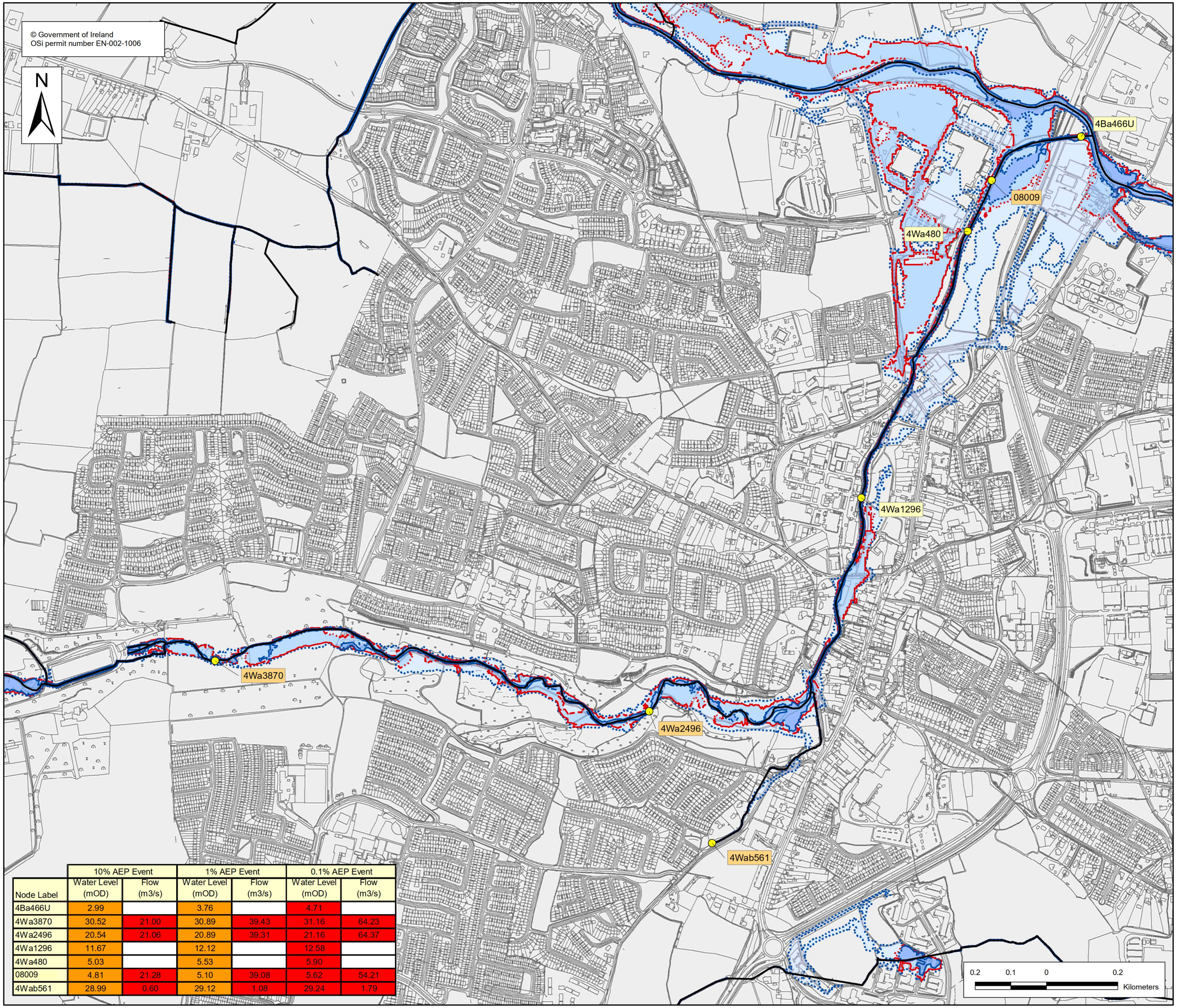
The design of the scheme also ensures that it is resilient to effects of climate change on fluvial and coastal flood risk.

Appendix A. Information sources checklist

No.	Information Source	Status	Reference/Comments
1	OPW Preliminary Flood Risk Assessment indicative fluvial flood maps	X	Not available
2	National Coastal Protection Strategy Study flood and coastal erosion risk maps.	X	Not available
3	Predictive and historic flood maps, and Benefiting Lands Map	√	Flooding History was provided by OPW floodinfo.ie
4	Predictive flood maps produced under the CFRAM studies	√	CFRAM maps are available and have been used.
5	River Basin Management Plans and reports	√	River Basin Management Plan for Ireland (2018-2021)
6	Indicative assessment of existing flood risk under Preliminary Flood Risk Assessment	X	
7	Previous Strategic Flood Risk Assessments	√	Dublin City Development Plan 2016-2022 (Strategic Flood Risk Assessment) and Fingal County Council Development Plan 2017-2023.
8	Expert advice from OPW who may be able to provide reports containing the results of detailed modelling and flood-mapping studies including critical damage areas, and information on historic flood events and local studies etc.	X	
9	Topographical maps, in particular digital elevation models produced by aerial survey or ground survey techniques.	√	Topographic Survey Data dated 17 February 2020 is available.
10	Information on flood defence condition and performance	N/A	
11	Alluvial deposit maps	N/A	

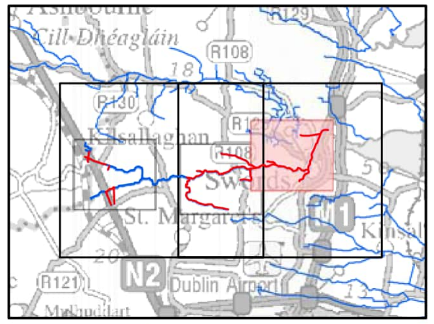
12	'Liable to Flood' markings on the old 6" Inch Map	X	
13	Local Libraries and newspaper reports	√	Adequate information on Flooding History was provided by OPW floodmaps.ie
14	Interviews with local people, local history/ natural history societies etc.	X	
15	Walkover survey to assess potential sources of flooding, likely routes for flood water and the site's key features, including flood defences, and their condition	X	

Appendix B. OPW Preliminary Flood Risk Assessment Mapping



	10% AEP Event		1% AEP Event		0.1% AEP Event	
Node Label	Water Level (mOD)	Flow (m3/s)	Water Level (mOD)	Flow (m3/s)	Water Level (mOD)	Flow (m3/s)
4Ba466U	2.99		3.76		4.71	
4Wa3870	30.52	21.00	30.89	39.43	31.16	64.23
4Wa2496	20.54	21.06	20.89	39.31	21.16	64.37
4Wa1296	11.67		12.12		12.58	
4Wa480	5.03		5.53		5.90	
08009	4.81	21.28	5.10	39.08	5.62	54.21
4Wab561	28.99	0.60	29.12	1.08	29.24	1.79

Location Plan :



EXTENT MAP

Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 1 % AEP Flood Extent (1 in 100 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (>40m) (10% and 0.1% AEP)
- High Confidence (<20m) (1% AEP)
- Medium Confidence (<40m) (1% AEP)
- Low Confidence (>40m) (1% AEP)
- Modelled River Centreline
- Node Point
- 21Ma237 Node label with level data (refer to table)
- 21Ma237 Node level with flow & level data (refer to table)

High confidence
Medium confidence
Low confidence
refer to table

USER NOTE :

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF A BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.

HalcrowBarry
Tramway House
32 Dartry Road
Dublin 6
Tel: +353-1-4975716

Clients :

Fingal County Council
Meath County Council
OPW

Project :

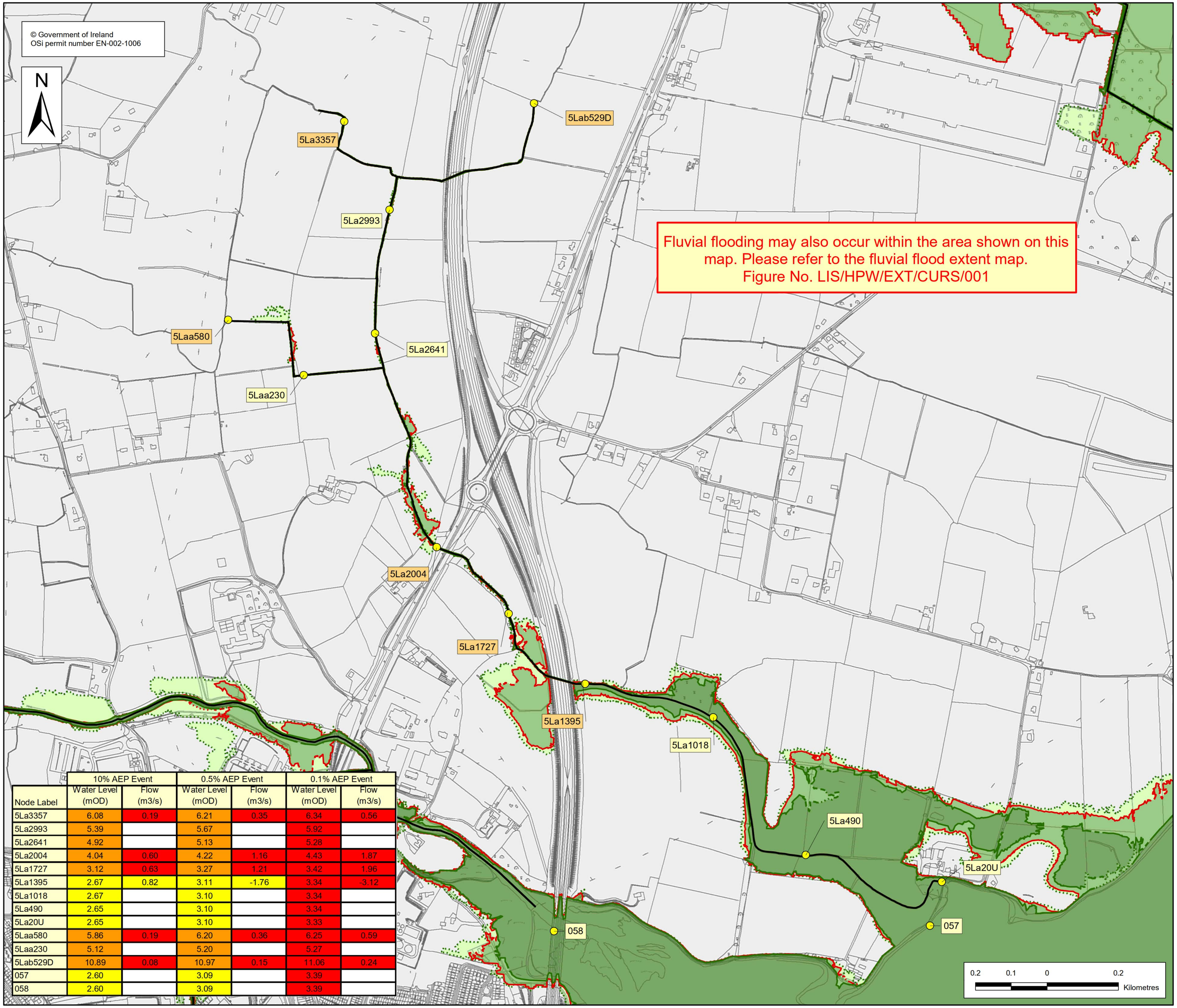
Map :
WARD MODEL FLOOD EXTENT MAP

Map Type :	FLOOD EXTENT
Source :	FLUVIAL FLOODING
Map area :	HIGH PRIORITY WATERCOURSE
Scenario :	CURRENT

Figure By :	Mara Ruiz	Date :	8 August 2010
Checked By :	Sergio Herbón	Date :	8 August 2010
Approved By :	Clare Dewar	Date :	8 August 2010

Figure No. :	Revision
WAR/HPW/EXT/CURS/003	0

Drawing Scale : 1:10,000 Plot Scale : 1:1 @ A3



Node Label	10% AEP Event Water Level (mOD)	10% AEP Event Flow (m3/s)	0.5% AEP Event Water Level (mOD)	0.5% AEP Event Flow (m3/s)	0.1% AEP Event Water Level (mOD)	0.1% AEP Event Flow (m3/s)
5La3357	6.08	0.19	6.21	0.35	6.34	0.56
5La2993	5.39		5.67		5.92	
5La2641	4.92		5.13		5.28	
5La2004	4.04	0.60	4.22	1.16	4.43	1.87
5La1727	3.12	0.63	3.27	1.21	3.42	1.96
5La1395	2.67	0.82	3.11	-1.76	3.34	-3.12
5La1018	2.67		3.10		3.34	
5La490	2.65		3.10		3.34	
5La20U	2.65		3.10		3.33	
5Laa580	5.86	0.19	6.20	0.36	6.25	0.59
5Laa230	5.12		5.20		5.27	
5Lab529D	10.89	0.08	10.97	0.15	11.06	0.24
057	2.60		3.09		3.39	
058	2.60		3.09		3.39	

Location Plan :

EXTENT MAP

Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 0.5 % AEP Flood Extent (1 in 200 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (> 40m) (10% and 0.1% AEP)
- High Confidence (<20m) (0.5% AEP)
- Medium Confidence (<40m) (0.5% AEP)
- Low Confidence (>40m) (0.5% AEP)
- Modelled River Centreline
- Node Point
- 21Ma237 Node label with level data (refer to table)
- 21Ma237 Node level with flow & level data (refer to table)
- High confidence / Medium confidence / Low confidence — refer to table

USER NOTE :

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF A BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.

HalcrowBarry
Tramway House
32 Dartry Road
Dublin 6
Tel: +353-1-4975716

Clients : Fingal County Council, Meath County Council, OPW

Project : FEM FRAMS

Map : LISSENHALL MODEL FLOOD EXTENT MAP

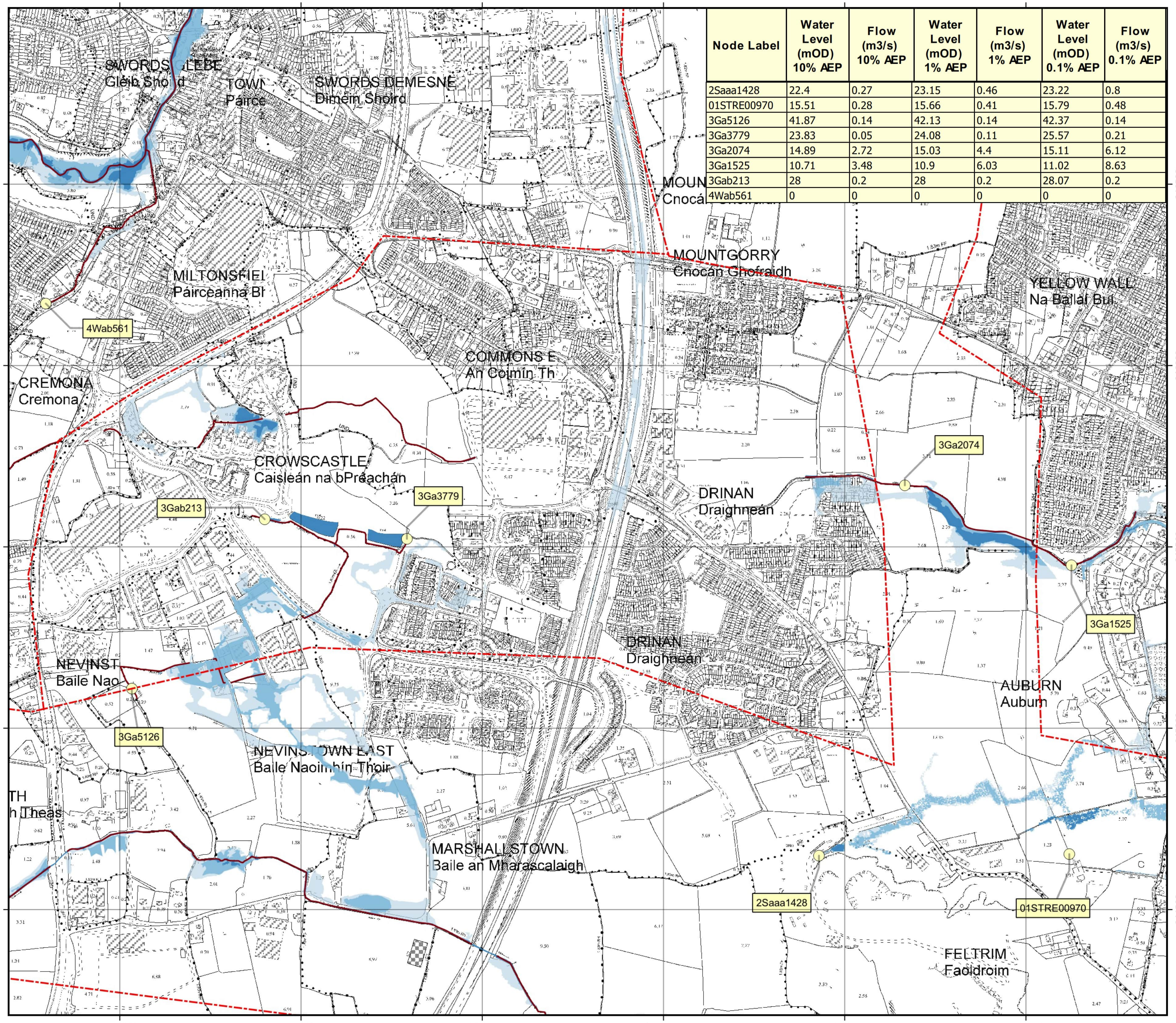
Map Type :	FLOOD EXTENT
Source :	TIDAL FLOODING
Map area :	HIGH PRIORITY WATERCOURSE
Scenario :	CURRENT

Figure By :	Mara Ruiz	Date : 17 January 2011
Checked By :	Sergio Herbón	Date : 17 January 2011
Approved By :	Clare Dewar	Date : 17 January 2011

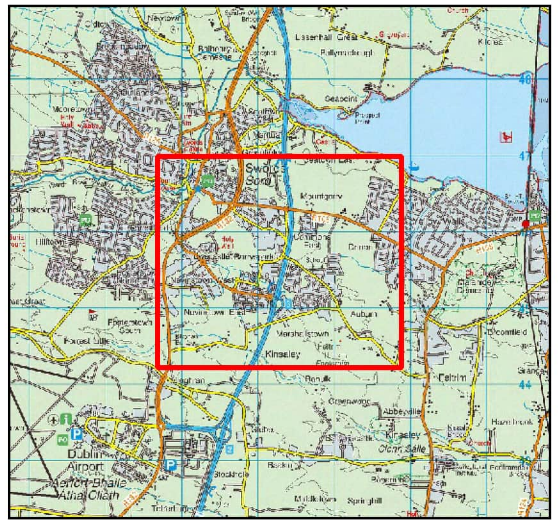
Figure No. : LIS/HPW/EXT/CURS/T/001 — Revision 1

Drawing Scale : 1:10,000 — Plot Scale : 1:1 @ A3

Node Label	Water Level (mOD) 10% AEP	Flow (m3/s) 10% AEP	Water Level (mOD) 1% AEP	Flow (m3/s) 1% AEP	Water Level (mOD) 0.1% AEP	Flow (m3/s) 0.1% AEP
2Saaa1428	22.4	0.27	23.15	0.46	23.22	0.8
01STRE00970	15.51	0.28	15.66	0.41	15.79	0.48
3Ga5126	41.87	0.14	42.13	0.14	42.37	0.14
3Ga3779	23.83	0.05	24.08	0.11	25.57	0.21
3Ga2074	14.89	2.72	15.03	4.4	15.11	6.12
3Ga1525	10.71	3.48	10.9	6.03	11.02	8.63
3Gab213	28	0.2	28	0.2	28.07	0.2
4Wab561	0	0	0	0	0	0



Location Plan:



LEGEND

- AFA Boundary
- Defended Area
- Modelled River Centreline
- Node Point
- 10% AEP Fluvial Extent (High Risk)
- 1% AEP Fluvial Extent (Medium Risk)
- 0.1% AEP Fluvial Extent (Low Risk)
- Flood Defence - Embankment
- Flood Defence - Wall
- Gate
- NODE123 Node Label
- x.x% AEP Standard of Protection of Flood Defence

IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

OPW
Oifig na nOibreacha Poiblí
The Office of Public Works

The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath

Project:
FINGAL EAST MEATH FRAM STUDY

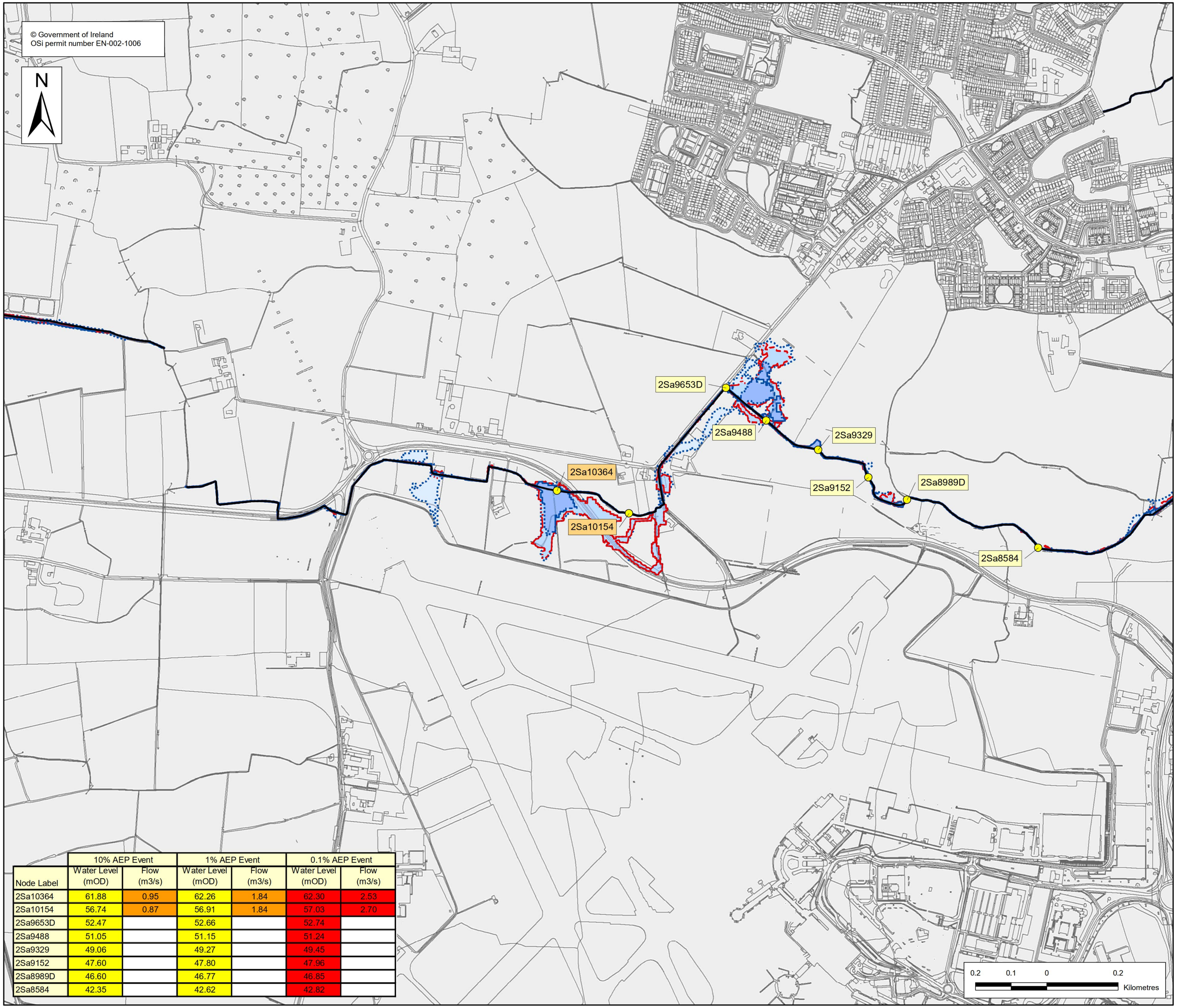
Map:
SWORDS
FLUVIAL EXTENT MAP

Map Type:	EXTENT		
Source:	FLUVIAL		
Map Area:	HPW		
Scenario:	CURRENT		
Drawn by:	IH	Date:	Mar - 2019
Checked by:	TC	Date:	Mar - 2019
Approved by:	GP	Date:	Mar - 2019

Map No.:
E08SWO_EXFCD_F1_34

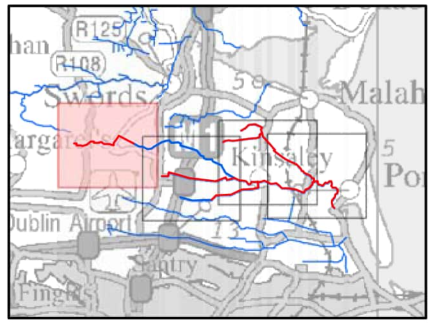
Revision: F1

Map Scale: 1:10000   Plot Scale: 1:1 @ A3



Node Label	10% AEP Event Water Level (mOD)	10% AEP Event Flow (m3/s)	1% AEP Event Water Level (mOD)	1% AEP Event Flow (m3/s)	0.1% AEP Event Water Level (mOD)	0.1% AEP Event Flow (m3/s)
2Sa10364	61.88	0.95	62.26	1.84	62.30	2.53
2Sa10154	56.74	0.87	56.91	1.84	57.03	2.70
2Sa9653D	52.47		52.66		52.74	
2Sa9488	51.05		51.15		51.24	
2Sa9329	49.06		49.27		49.45	
2Sa9152	47.60		47.80		47.96	
2Sa8989D	46.60		46.77		46.85	
2Sa8584	42.35		42.62		42.82	

Location Plan :



EXTENT MAP

Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 1 % AEP Flood Extent (1 in 100 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (>40m) (10% and 0.1% AEP)
- High Confidence (<20m) (1% AEP)
- Medium Confidence (<40m) (1% AEP)
- Low Confidence (>40m) (1% AEP)
- Modelled River Centreline
- Node Point
- 21Ma237 Node label with level data (refer to table)
- 21Ma237 Node level with flow & level data (refer to table)

High confidence
Medium confidence
Low confidence
refer to table

USER NOTE :

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF A BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.

HalcrowBarry
Tramway House
32 Dartry Road
Dublin 6
Tel: +353-1-4975716

Clients :

Fingal County Council
Meath County Council
OPW

Project :
FEM FRAMS

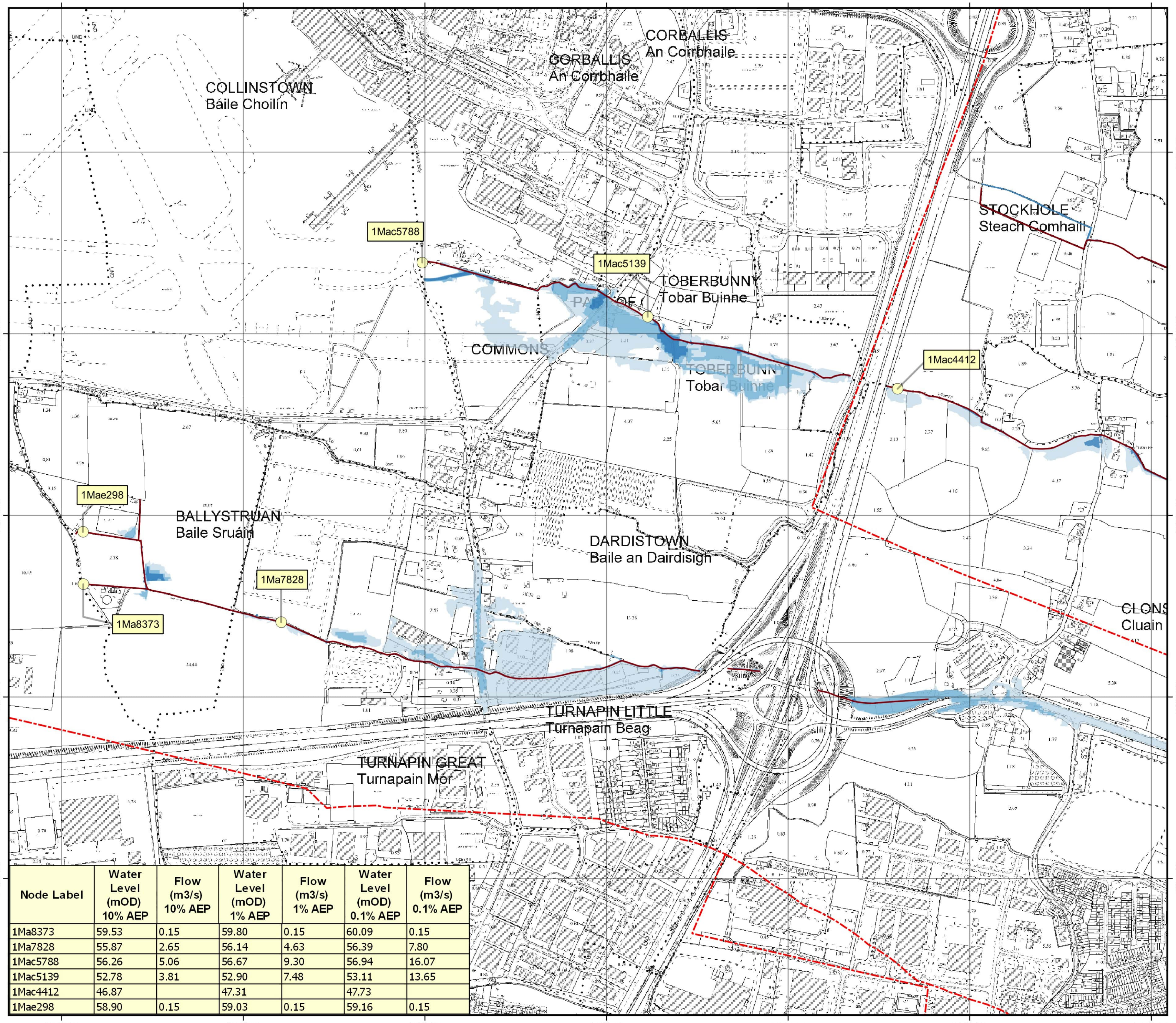
Map :
SLUICE MODEL FLOOD EXTENT MAP

Map Type : FLOOD EXTENT
Source : FLUVIAL FLOODING
Map area : HIGH PRIORITY WATERCOURSE
Scenario : CURRENT

Figure By : Mara Ruiz — Date : 8 August 2010
Checked By : Sergio Herbón — Date : 8 August 2010
Approved By : Clare Dewar — Date : 8 August 2010

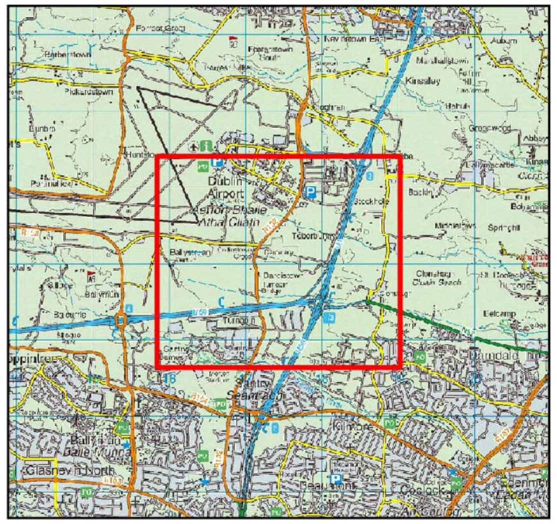
Figure No. : SLU/HPW/EXT/CURS/001 — Revision 0

Drawing Scale : 1:10,000 — Plot Scale : 1:1 @ A3



Node Label	Water Level (mOD) 10% AEP	Flow (m3/s) 10% AEP	Water Level (mOD) 1% AEP	Flow (m3/s) 1% AEP	Water Level (mOD) 0.1% AEP	Flow (m3/s) 0.1% AEP
1Ma8373	59.53	0.15	59.80	0.15	60.09	0.15
1Ma7828	55.87	2.65	56.14	4.63	56.39	7.80
1Mac5788	56.26	5.06	56.67	9.30	56.94	16.07
1Mac5139	52.78	3.81	52.90	7.48	53.11	13.65
1Mac4412	46.87		47.31		47.73	
1Mae298	58.90	0.15	59.03	0.15	59.16	0.15

Location Plan:



LEGEND

- AFA Boundary
- Defended Area
- Modelled River Centreline
- Node Point
- 10% AEP Fluvial Extent (High Risk)
- 1% AEP Fluvial Extent (Medium Risk)
- 0.1% AEP Fluvial Extent (Low Risk)
- Flood Defence - Embankment
- Flood Defence - Wall
- Gate
- NODE123 — Node Label
- x.x% AEP — Standard of Protection of Flood Defence

IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

OPW
Oifig na nOibreacha Poiblí
The Office of Public Works

The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath

Project:
FINGAL EAST MEATH FRAM STUDY

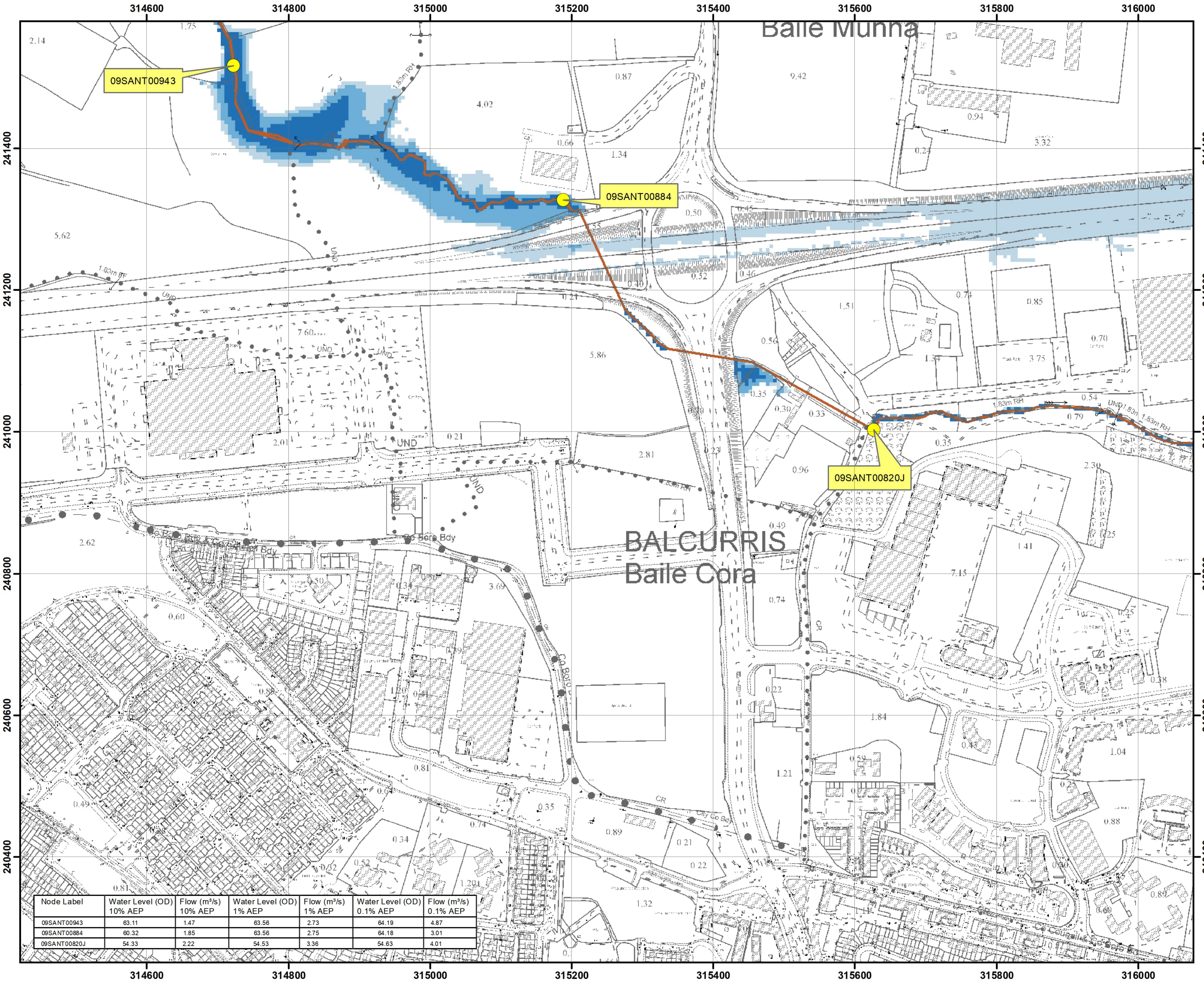
Map:
Mayne Model
FLUVIAL FLOOD EXTENT MAP

Map Type:	EXTENT		
Source:	FLUVIAL		
Map Area:	HPW		
Scenario:	CURRENT		
Drawn by:	IH	Date:	Dec - 2017
Checked by:	JM	Date:	Dec - 2017
Approved by:	JM	Date:	Dec - 2017

Map No.:
MAY/HPW/EXT/CURS/001

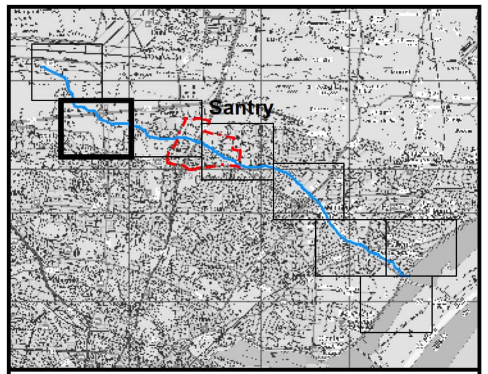
Revision: F1

Map Scale: 1:10,000 Plot Scale: 1:1 @ A3



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
09SANT00943	63.11	1.47	63.56	2.73	64.19	4.87
09SANT00884	60.32	1.85	63.56	2.75	64.18	3.01
09SANT00820J	54.33	2.22	54.53	3.36	54.63	4.01

0 50 100 200 300 400 500 Metres



IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

- 10% Fluvial AEP Event
- 1% Fluvial AEP Event
- 0.1% Fluvial AEP Event
- Modelled River Centreline
- AFA Extents
- Node Point
- Node ID Node Label

FINAL

REV:	NOTE:	DATE:
01	Amendment to flood zones to include Raheny AFA	15/12/17

EASTERN CFRAM STUDY
CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT

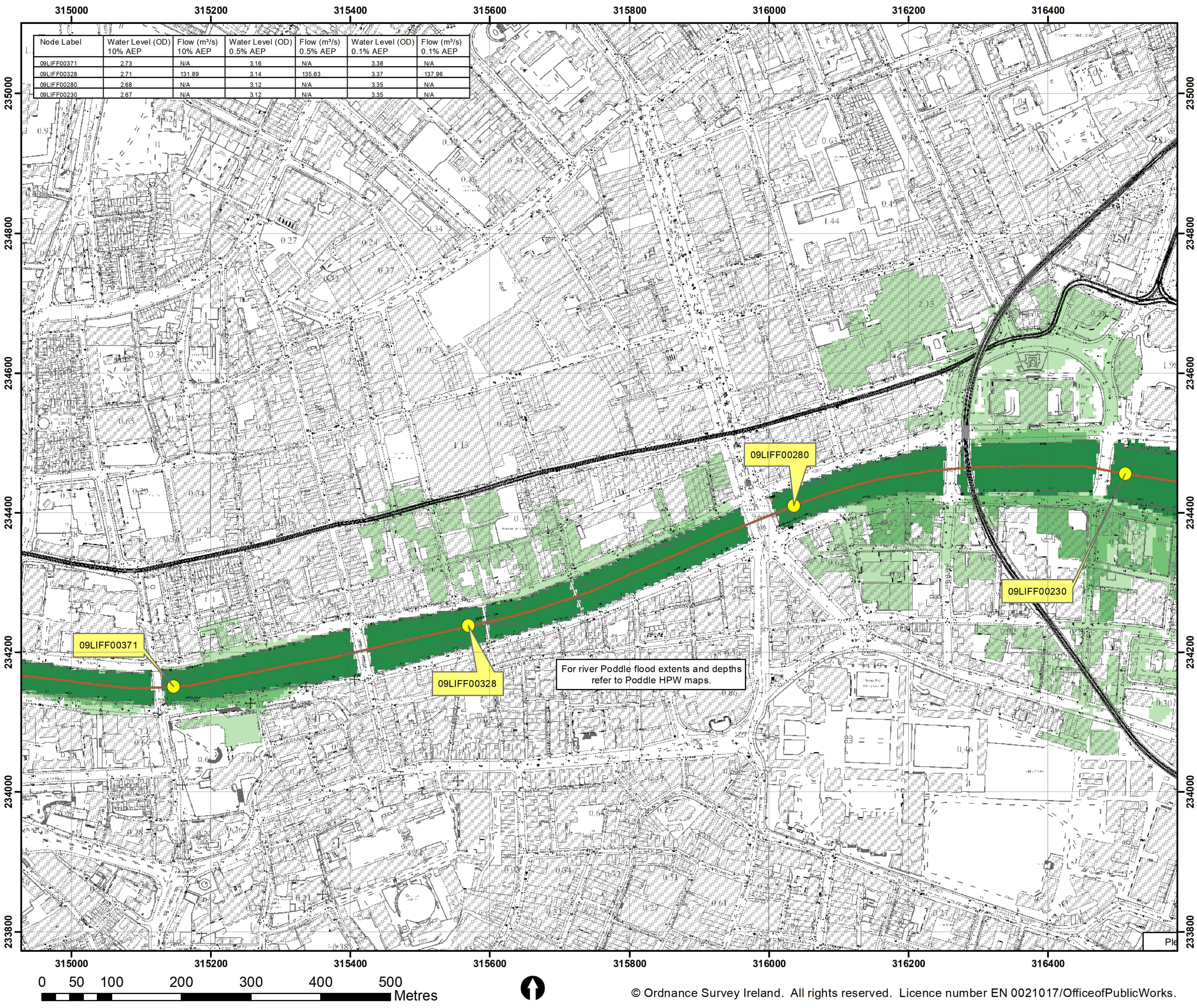
The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

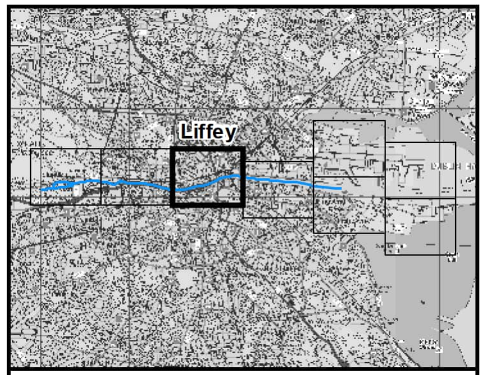
Elmwood House
74 Boucher Road
Belfast
BT12 6RZ
T +44(0) 28 90 667914
F +44(0) 28 90 668286
W www.rpsgroup.com
E ireland@rpsgroup.com

Map:
Santry Fluvial Flood Extents

Map Type: EXTENT
Source: FLUVIAL
Map Area: HPW
Scenario: CURRENT
Drawn By : C.C. **Date :** 15 December 2017
Checked By : A.S. **Date :** 15 December 2017
Approved By : S.P. **Date :** 15 December 2017
Drawing No. :
E09SAY_EXFCD_F1_02
Map Series : Page 2 of 8
Drawing Scale : 1:5,000 @A3

Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 0.5% AEP	Flow (m³/s) 0.5% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
09LIFF00371	2.73	N/A	3.16	N/A	3.38	N/A
09LIFF00328	2.71	131.89	3.14	135.63	3.37	137.96
09LIFF00280	2.68	N/A	3.12	N/A	3.35	N/A
09LIFF00230	2.67	N/A	3.12	N/A	3.35	N/A





IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

- 10% Tidal AEP Event
- 0.5% Tidal AEP Event
- 0.1% Tidal AEP Event
- Modelled River Centreline
- AFA Extents
- Node Point
- Node ID Node Label

FINAL

REV:	NOTE:	DATE:
01	Amendments to Flood Extents.	05/12/16

EASTERN CFRAM STUDY

The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

T +44(0) 28 90 667914
F +44(0) 28 90 668286
W www.rpsgroup.com
E ireland@rpsgroup.com

Map: Liffey Tidal Flood Extents

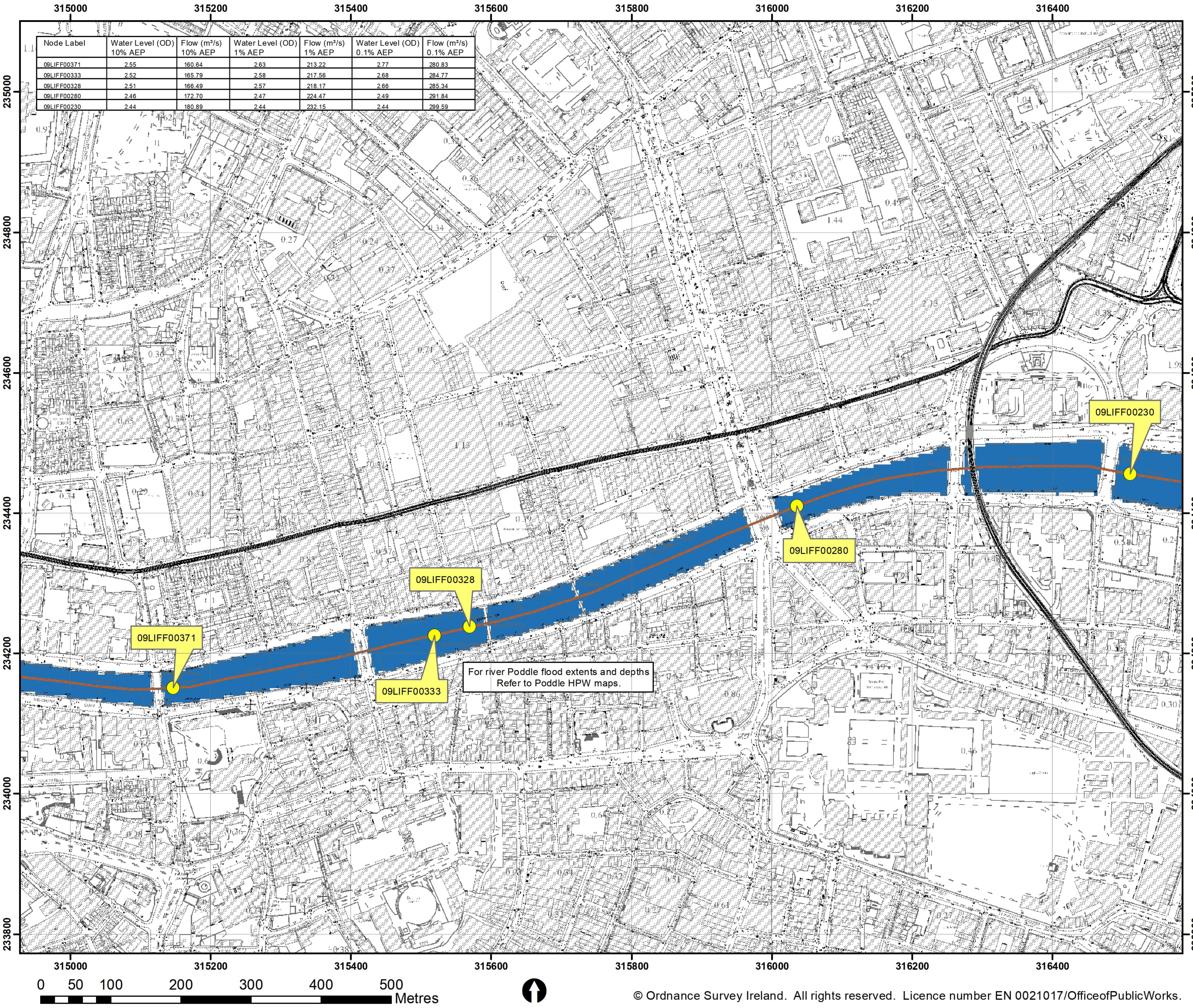
Map Type:	EXTENT
Source:	TIDAL
Map Area:	COASTAL
Scenario:	CURRENT
Drawn By : C.C.	Date : 9 May 2017
Checked By : A.S.	Date : 9 May 2017
Approved By : S.P.	Date : 9 May 2017

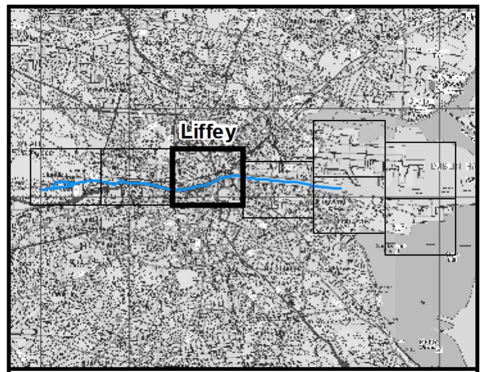
Drawing No. : E09LIF_EXCCD_F1_03

Map Series : Page 3 of 8

Drawing Scale : 1:5,000 @ A3

Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
09LIFF00371	2.55	160.64	2.63	213.22	2.77	280.83
09LIFF00333	2.52	165.79	2.58	217.56	2.68	284.77
09LIFF00328	2.51	166.49	2.57	218.17	2.66	285.34
09LIFF00280	2.46	172.70	2.47	224.47	2.49	291.84
09LIFF00230	2.44	180.89	2.44	232.15	2.44	299.59





IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

- 10% Fluvial AEP Event
- 1% Fluvial AEP Event
- 0.1% Fluvial AEP Event
- Modelled River Centreline
- AFA Extents
- Node Point
- Node ID Node Label

FINAL

REV:	NOTE:	DATE:
01	Amendments to Flood Extents.	05/12/16

EASTERN CFRAM STUDY
CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT

OPW
RPS

The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

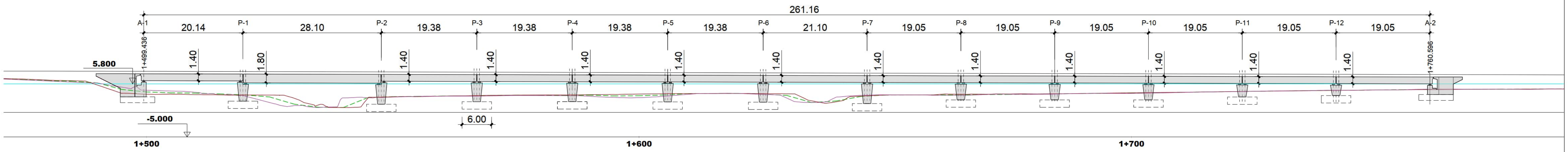
T +44(0) 28 90 667914
F +44(0) 28 90 668286
W www.rpsgroup.com
E ireland@rpsgroup.com

Map:
Liffey Fluvial Flood Extents

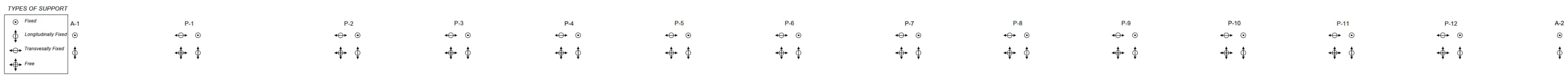
Map Type: EXTENT
Source: FLUVIAL
Map Area: HPW
Scenario: CURRENT
Drawn By : C.C. Date : 9 May 2017
Checked By : A.S. Date : 9 May 2017
Approved By : S.P. Date : 9 May 2017
Drawing No. :
E09LIF_EXFCD_F1_03
Map Series : Page 3 of 8
Drawing Scale : 1:5,000 @A3

Appendix C. Proposed structures across the MetroLink Scheme

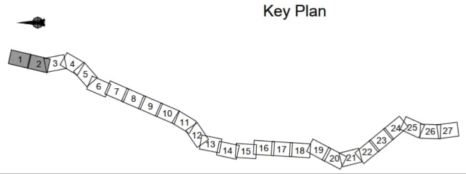
PLAN
SCALE 1:400



LONG SECTION
SCALE 1:400



Key Plan



REV	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	AL	JB	NC
P02	11/12/20	Final Preliminary Design	DT	AL	JB	NC
P01	18/11/19	Preliminary Design	DT	AL	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority
Project: METROLINK
Consultant: JACOBS, IDOM

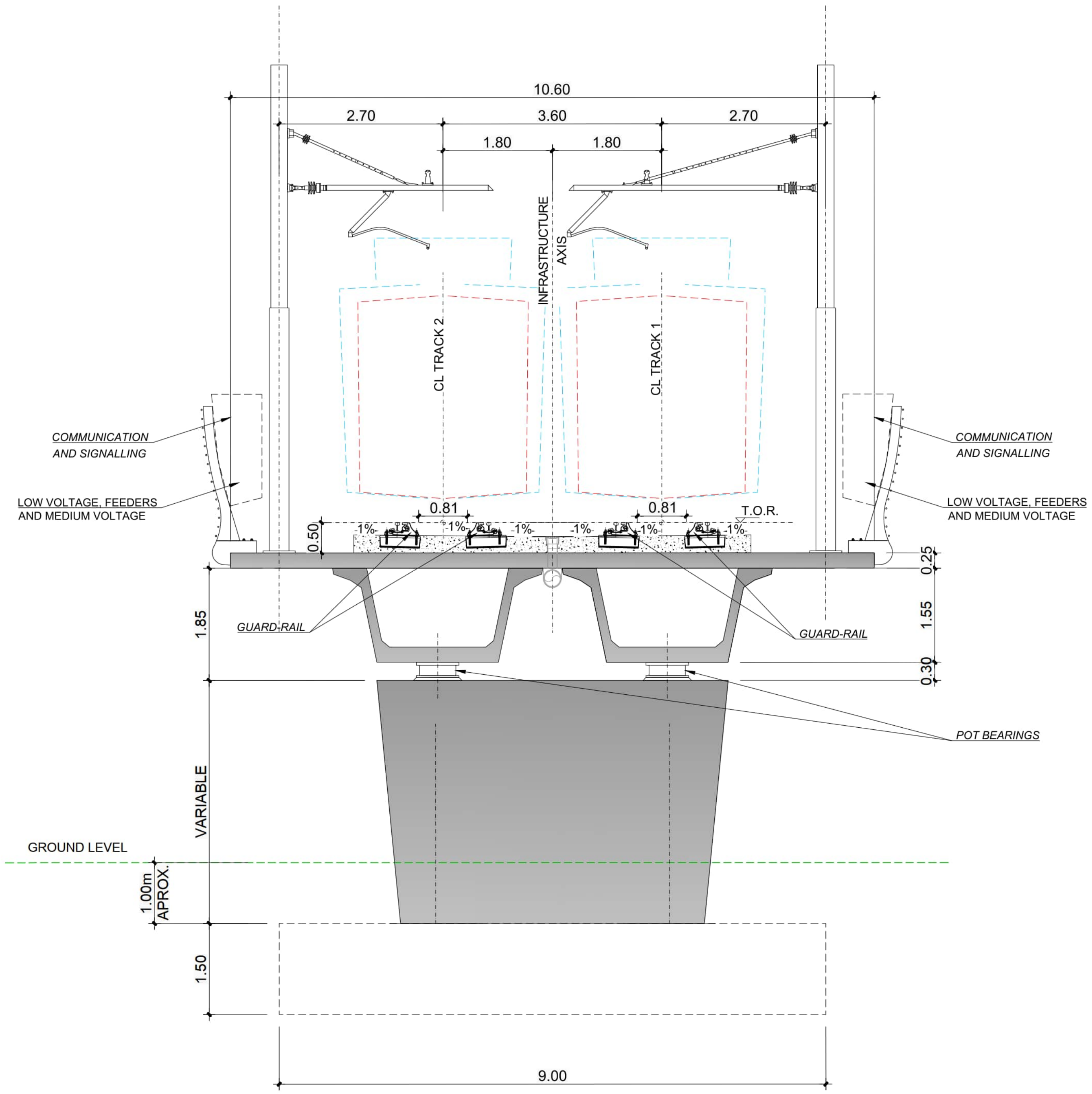
Drawing Title: BROAD MEADOW AND WARD RIVER VIADUCT
PRELIMINARY DESIGN ISSUE
GENERAL ARRANGEMENT

Drawing Status: S4

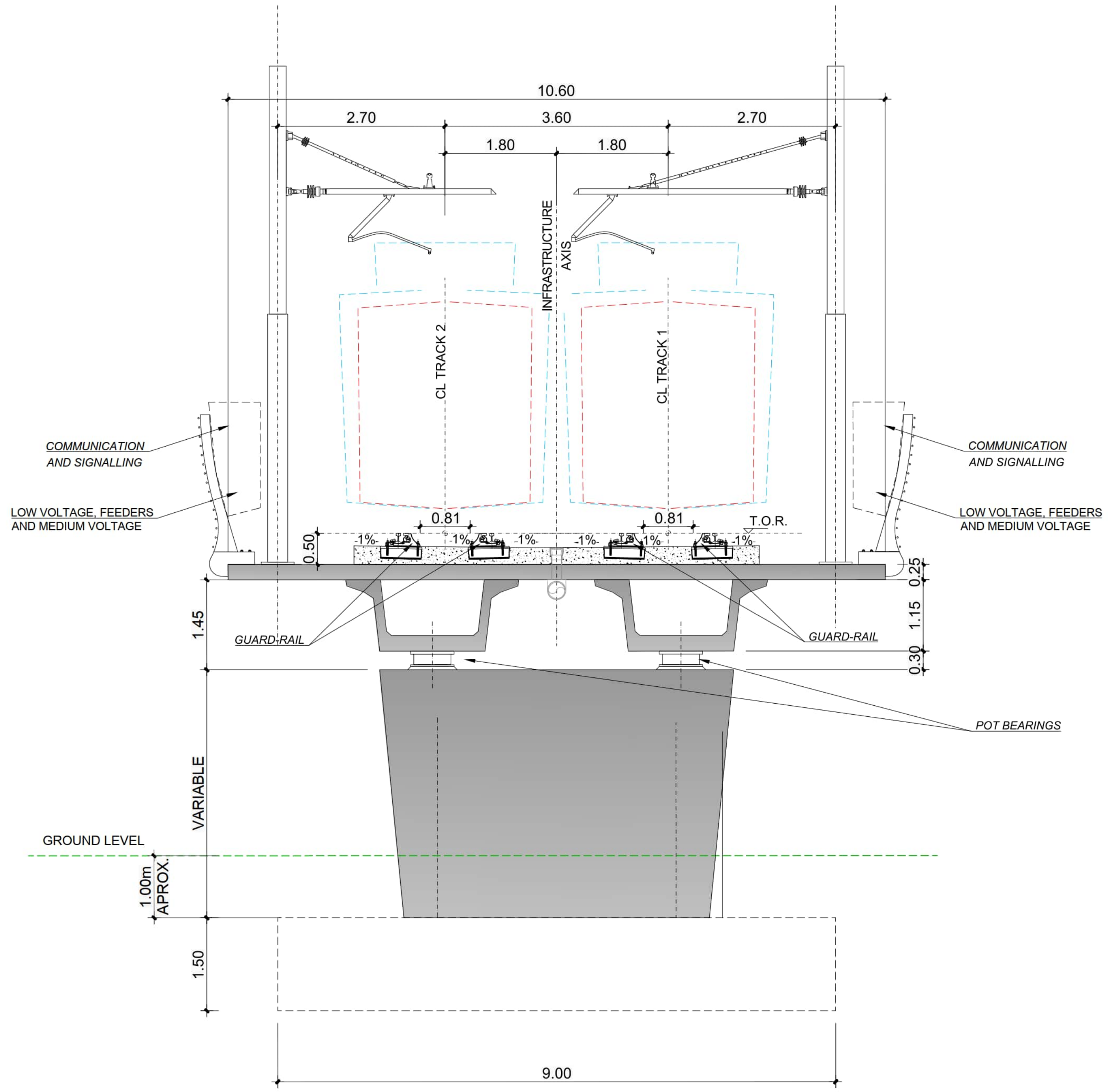
Drawing Nº: ML1-JAI-SGN-SC01_XX-DR-Y-00002

Scales Original Size A1 1:400

Sheet 1 of 1

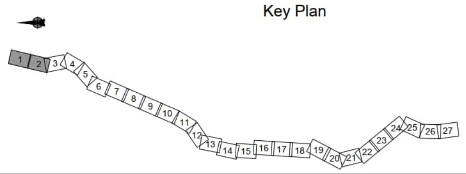


P1/P2 SECTION
SCALE 1:50



TYPICAL SECTION
SCALE 1:50

Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	AL	JB	NC
P02	11/12/20	Final Preliminary Design	DT	AL	JB	NC
P01	18/11/19	Preliminary Design	DT	AL	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

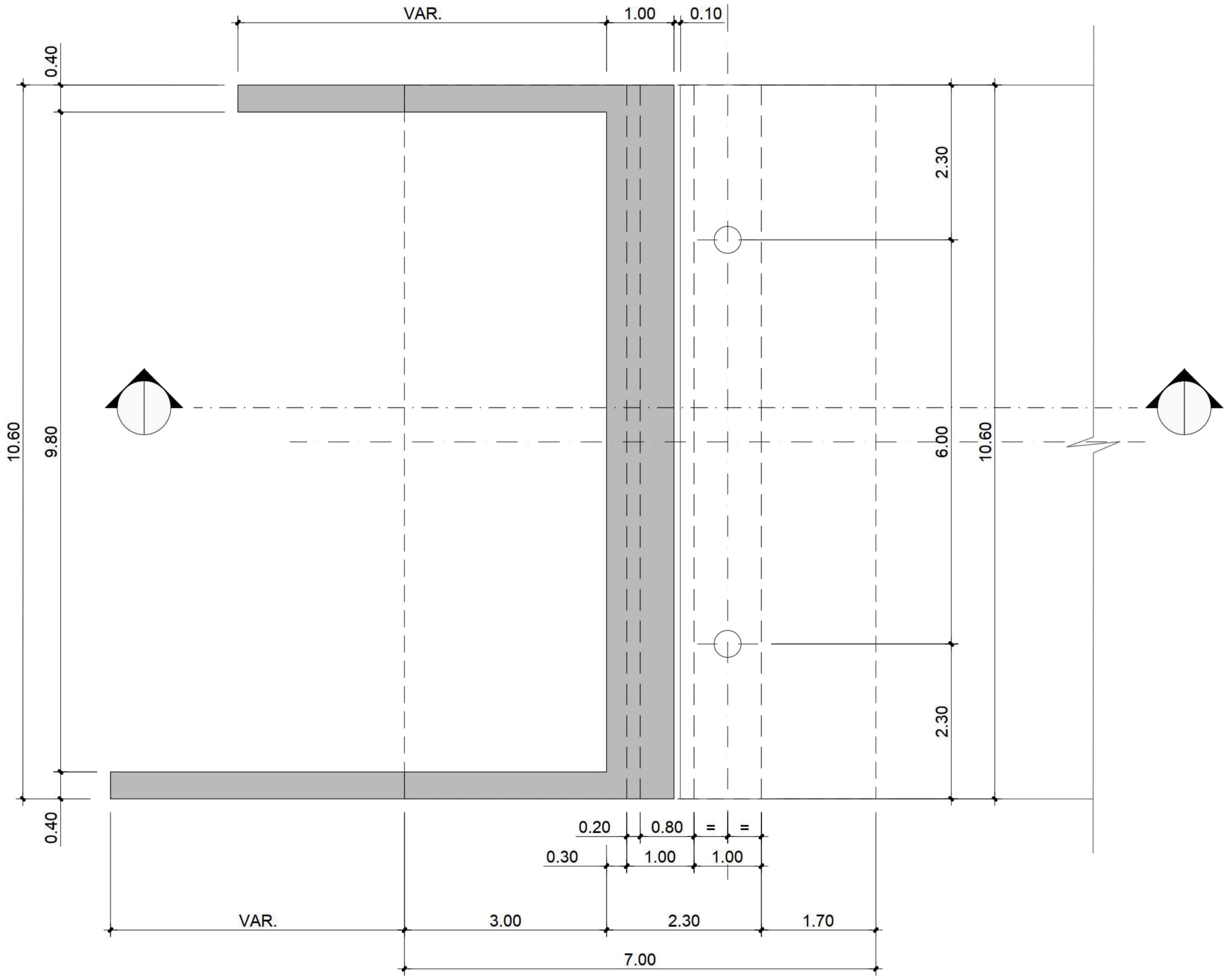
Drawing Title: BROAD MEADOW AND WARD RIVER VIADUCT
PRELIMINARY DESIGN ISSUE
CROSS SECTIONS

Drawing Status: S4

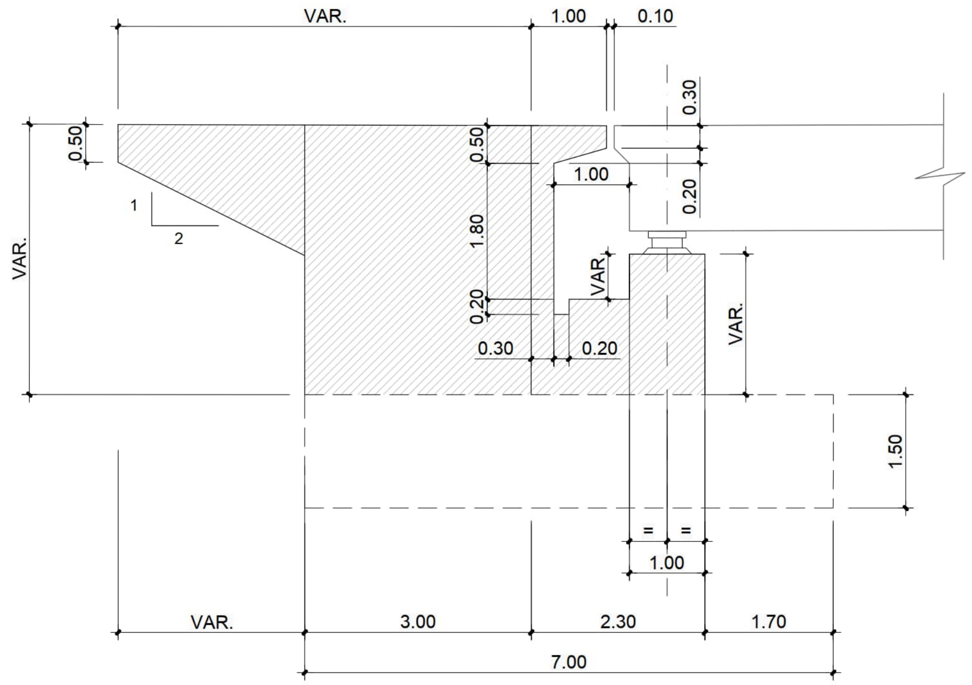
Drawing Nº: ML1-JAI-SGN-SC01_XX-DR-Y-00003

Scales Original Size A1 1:50

Sheet 1 of 1

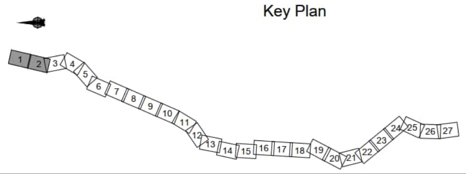


PLAN
SCALE 1:50



TYPICAL SECTION
SCALE 1:50

Key Plan



REV	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	AL	JB	NC
P02	11/12/20	Final Preliminary Design	DT	AL	JB	NC
P01	18/11/19	Preliminary Design	DT	AL	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: BROAD MEADOW AND WARD RIVER VIADUCT
PRELIMINARY DESIGN ISSUE
ABUTMENT

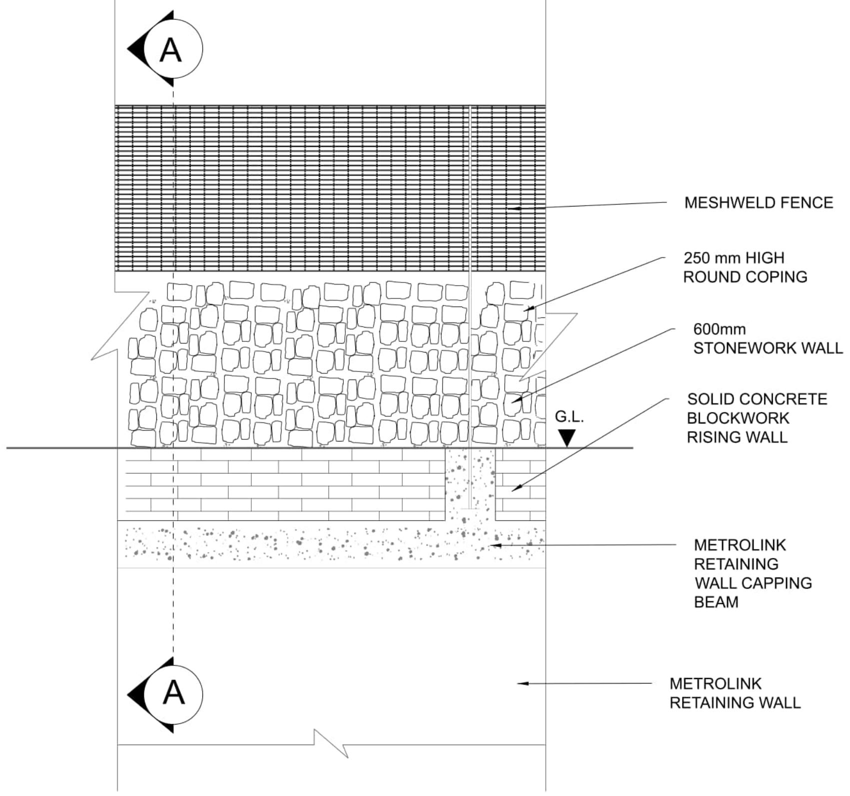
Drawing Status: S4

Drawing Nº: ML1-JAI-SGN-SC01_XX-DR-Y-00004

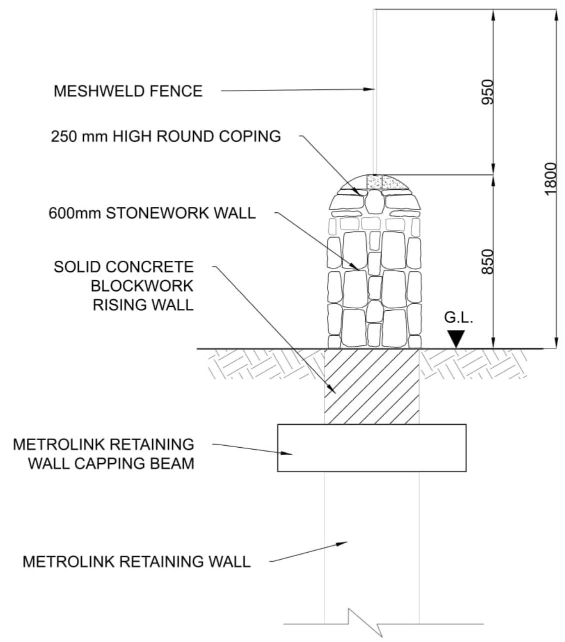
Scales Original Size A1 1:50

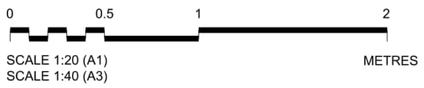
Sheet 1 of 1

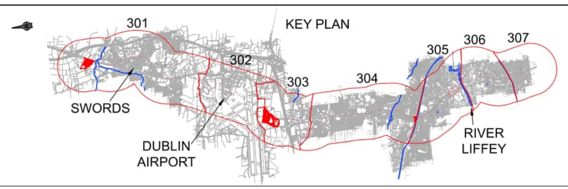
ELEVATION



SECTION A-A







REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01	06/08/21	For Railway Order	MM	AS	AS	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client

Project: METROLINK

Consultant

Drawing Title: METROLINK - BOUNDARY TREATMENT
FENCE TYPE B
TYPICAL DETAIL

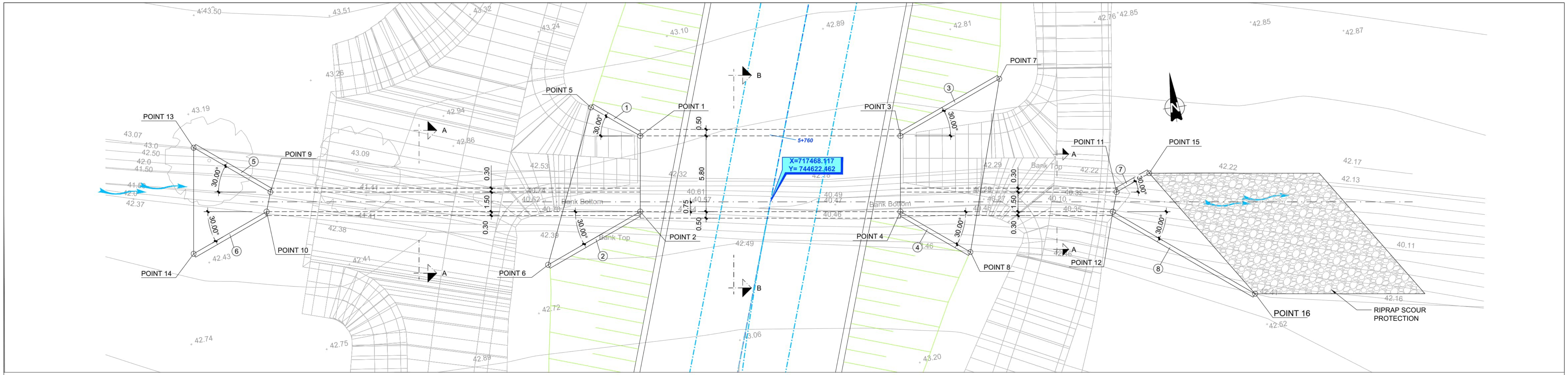
Drawing Status: S0

Drawing Nº: ML1-JAI-SRD-ROUT_XX-DR-Y-07002

Plan Drawing Nº: ML-BT O-O2

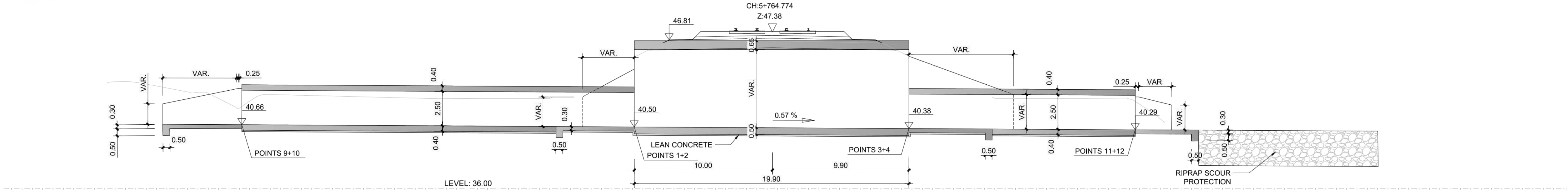
Scales Original Size A1 1:20

Sheet 1 of 1



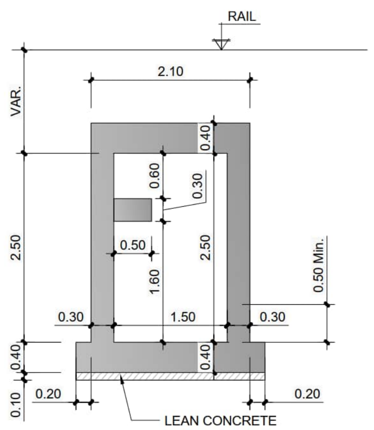
PLAN

SCALE 1:150



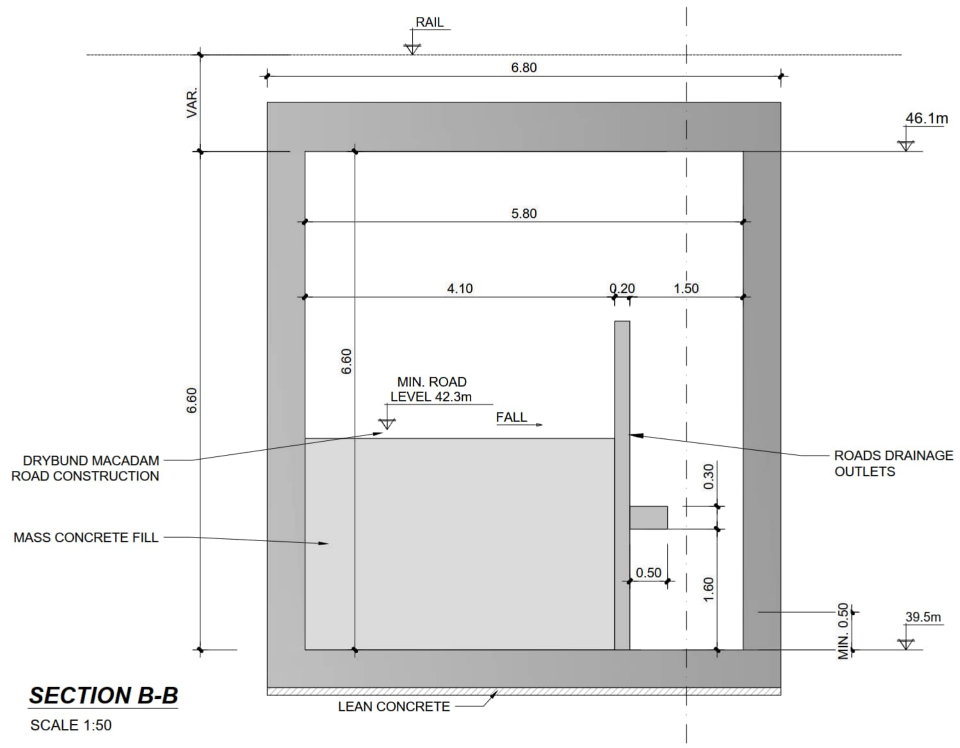
TYPICAL LONGITUDINAL SECTION

SCALE 1:150



SECTION A-A

SCALE 1:50



SECTION B-B

SCALE 1:50

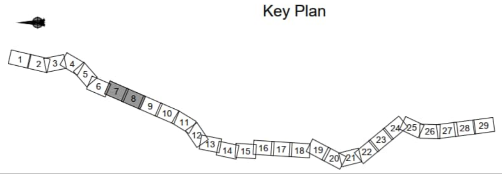
POINTS	X	Y	Z
1	717459.017	744628.944	40.50
2	717458.151	744623.209	40.50
3	717478.702	744625.971	40.38
4	717477.836	744620.236	40.38
5	717455.616	744631.658	-
6	717450.576	744620.235	-
7	717486.837	744629.161	-
8	717482.673	744616.376	-

POINTS	X	Y	Z
9	717430.395	744628.917	40.66
10	717429.885	744627.477	40.66
11	717494.417	744619.249	40.29
12	717493.907	744617.809	40.29
13	717425.094	744633.147	-
14	717423.883	744625.123	-
15	717497.103	744620.302	-
16	717503.730	744609.971	-

GEOMETRY WALLS

Nº	L	α
1	4.35	30
2	8.14	30
3	8.74	30
4	6.19	30
5	6.78	30
6	6.45	30
7	2.88	30
8	12.57	30

Key Plan



REV	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P02	18/06/21	Preliminary Design Issue	DT	IM	JB	NC
P01	18/11/19	Preliminary Design	DT	IM	JB	NC

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

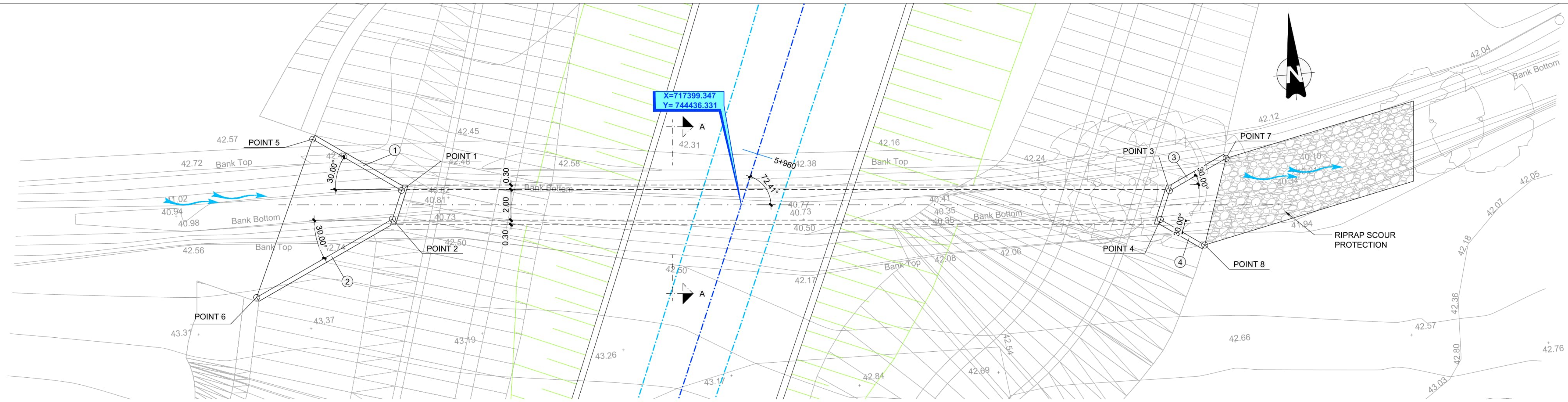
Drawing Title: CULVERT PK 5+765

Drawing Status: S4

Drawing Nº: ML1-JAI-RTA-ROUT_XX-DR-Y-00014

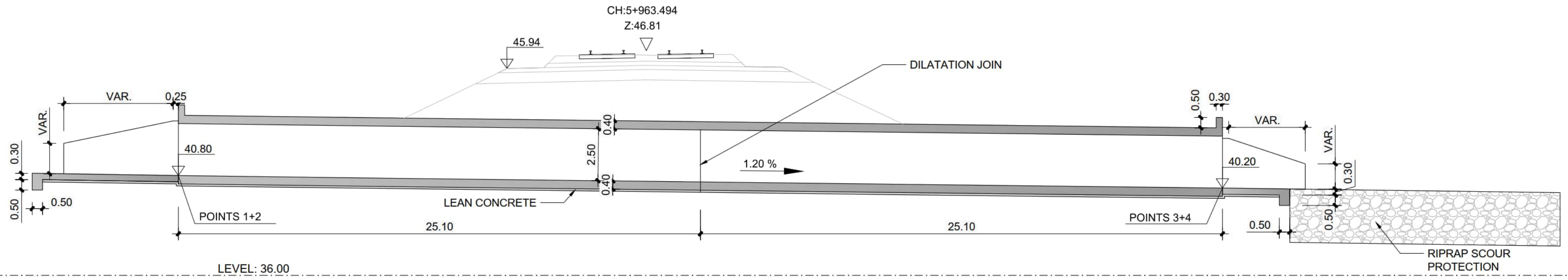
Scales Original Size A1

Sheet 1 of 2



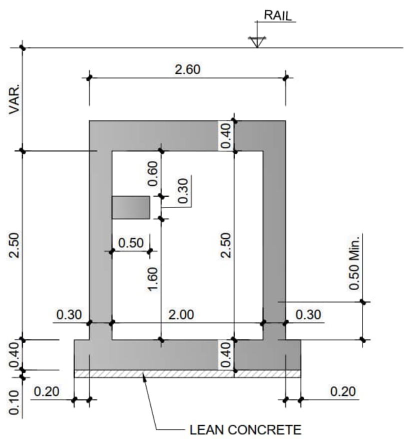
PLAN

SCALE 1:150



TYPICAL LONGITUDINAL SECTION

SCALE 1:150



SECTION A-A

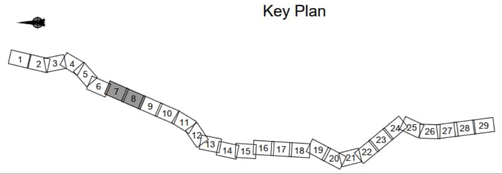
SCALE 1:50

POINTS	X	Y	Z
1	717377.331	744439.330	40.80
2	717376.566	744437.523	40.80
3	717427.306	744434.647	40.20
4	717426.540	744432.837	40.20
5	717371.857	744443.210	-
6	717367.253	744433.244	-
7	717431.177	744436.426	-
8	717429.268	744430.903	-

GEOMETRY WALLS

Nº	L	α
1	6.71	30
2	10.25	30
3	4.40	30
4	3.34	30

Key Plan



REV	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P02	18/06/21	Preliminary Design Issue	DT	IM	JB	NC
P01	18/11/19	Preliminary Design	DT	IM	JB	NC

Client: TII, NTA
Project: METROLINK
Consultant: JACOBS, IDOM

Drawing Title: CULVERT PK 5+963
Drawing Status: S4
Drawing Nº: ML1-JAI-RTA-ROUT_XX-DR-Y-00014
Scales Original Size A1
Sheet 2 of 2

NOTES:

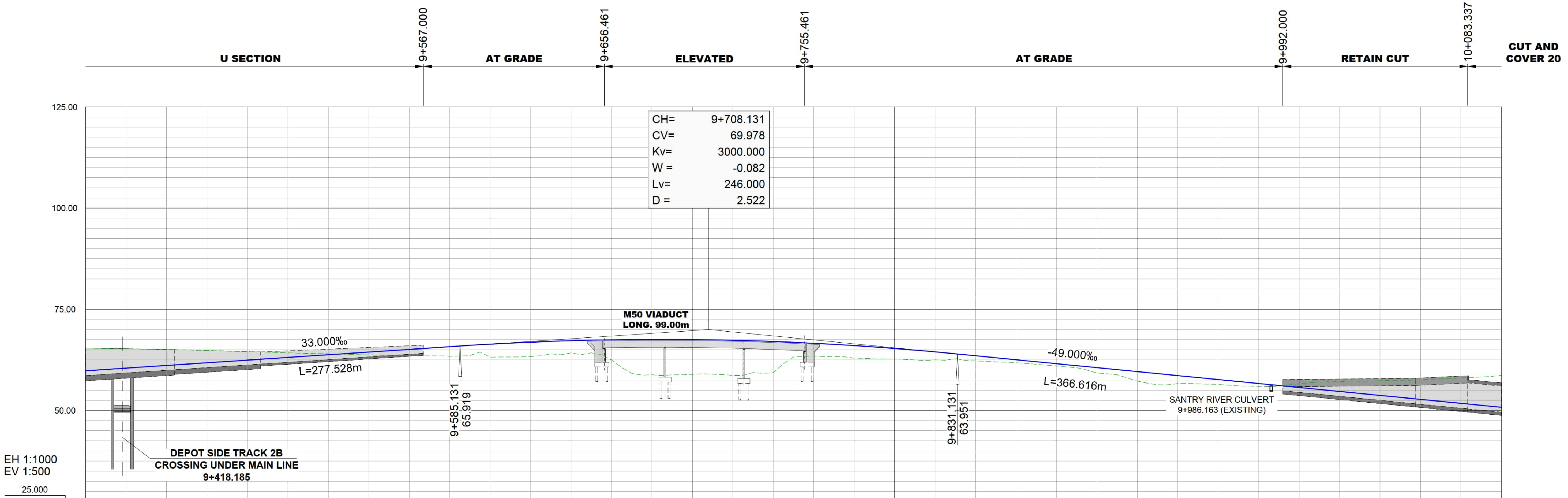
KV= Vertical curve radio (m)
CV= Vertex level (m)
W = Difference between the exit slope minus the entrance slope (‰)
D = External Distance, difference between CV and TOR level (m)

SYMBOLOGY:

Existing Ground Level

TOR

Rail Level (TOR)



CHAINAGE	9+400					9+500					9+600					9+700		
LEVELS T.O.R. DESIGN	59.810	60.470	61.130	61.790	62.450	63.110	63.770	64.430	65.090	65.750	66.373	66.867	67.228	67.456	67.550	67.511	67.338	67.032
LEVELS GROUND	65.418	65.261	65.059	64.830	64.531	64.225	64.016	63.707	63.550	63.386	63.170	63.312	64.234	62.495	58.812	58.929	58.686	59.322
CUT / FILL DEPTHS	-5.608	-4.792	-3.929	-3.040	-2.081	-1.116	-0.246	0.723	1.539	2.364	3.203	3.555	2.994	4.961	8.738	8.582	8.652	7.711

CHAINAGE			9+800					9+900					10+000					10+100
LEVELS T.O.R. DESIGN	66.593	66.021	65.315	64.476	63.517	62.537	61.557	60.577	59.597	58.617	57.637	56.657	55.677	54.697	53.717	52.737	51.757	50.777
LEVELS GROUND	63.414	62.941	62.698	62.511	62.247	61.787	61.004	59.244	57.261	56.643	56.418	55.932	56.612	57.085	57.336	57.581	58.048	58.687
CUT / FILL DEPTHS	3.180	3.080	2.617	1.965	1.269	0.750	0.552	1.333	2.336	1.973	1.219	0.724	-0.935	-2.389	-3.619	-4.844	-6.292	-7.910

GEOMETRY

VERTICAL: 33.000‰ L=277.528 | KV=3000.000 L=246.000 | -49.000‰ L=366.616

CANT: LEFT —— RIGHT – – | 110mm | 70mm

HORIZONTAL: R=365.000 L=309.212 | 9+503.373 | A=147.986 L=60.000 | 9+563.373 | STRAIGHT L=180.213 | 9+743.586 | A=165.831 L=55.000 | 9+798.586 | R=500.000 L=216.284 | 10+014.870 | A=165.831 L=55.000 | 10+069.870 | STRAIGHT L=314.022

TO ESTUARY

TO CHARLEMONT

Key Plan

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27

REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P04	31/03/21	Preliminary Design Issue	DT	RS	JB	NC
P03	11/12/20	Final Preliminary Design	DT	RS	JB	NC
P02	05/12/19	Preliminary Design	DT	RS	JB	NC
P01	18/11/19	Preliminary Design	DT	RS	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

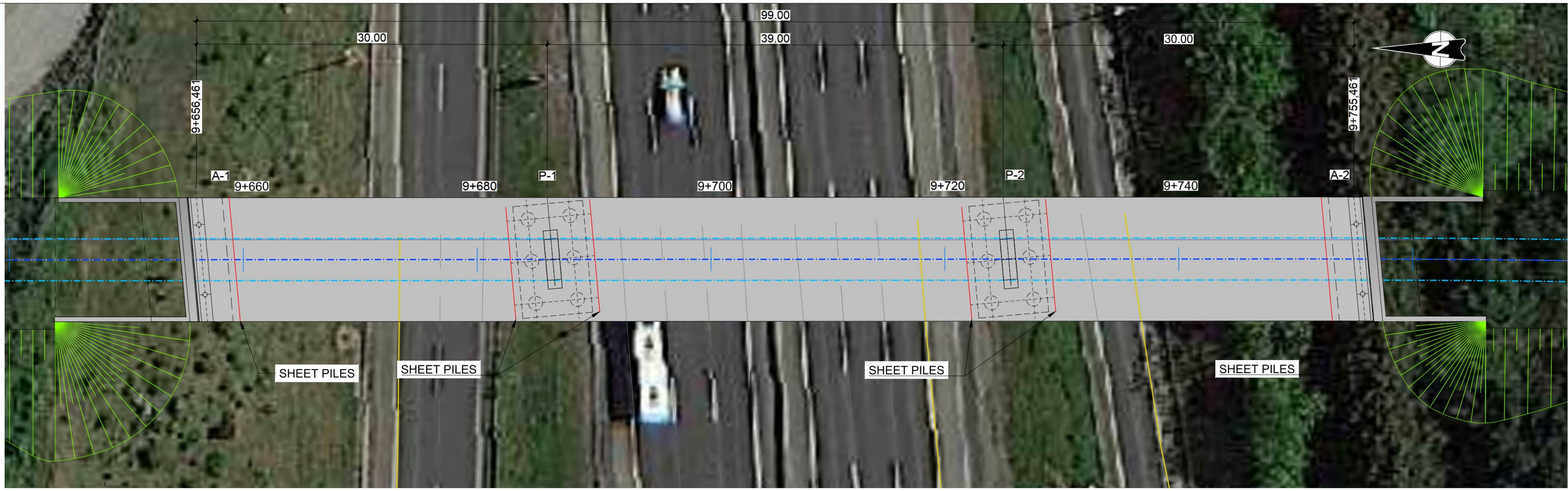
Consultant: JACOBS, IDOM

Drawing Title: ALIGNMENT VERTICAL PROFILES ALIGNMENT VERTICAL PROFILES SHEET 13

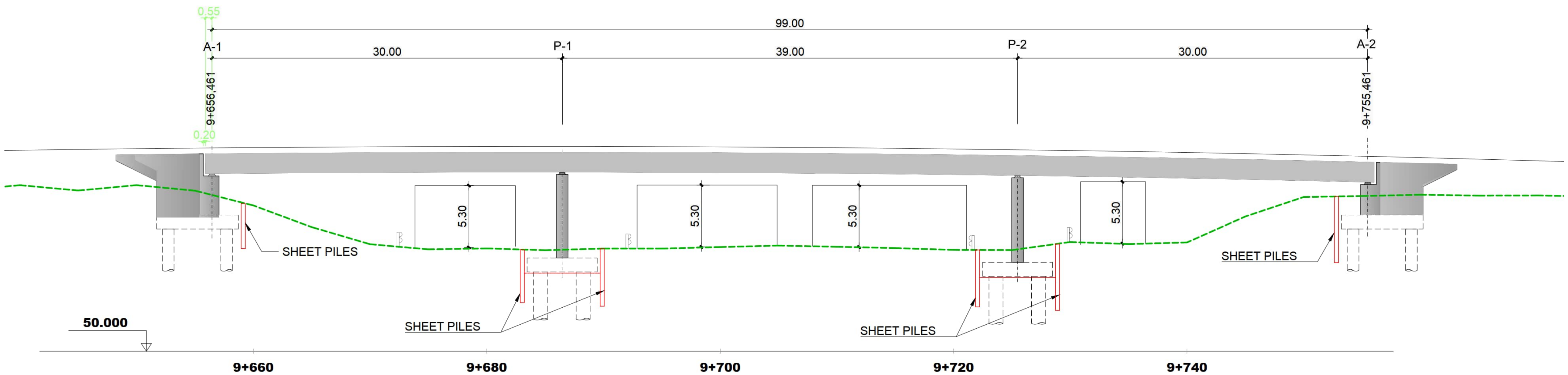
Drawing Status: S4

Drawing Nº: ML1-JAI-RTA-ROUT_XX-DR-Y-02013

Scales Original Size A1 H 1:1000 V 1:500



SCALE 1:200



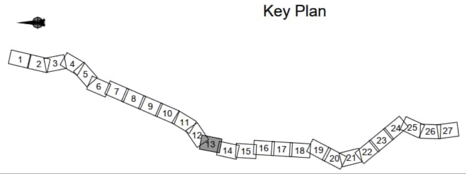
TYPES OF SUPPORT

⊙	*Fixed*
↕	*Longitudinally Fixed*
↔	*Transvesally Fixed*
✥	*Free*

A-1	P-1	P-2	A-2
⊙	*NO BEARINGS*	*NO BEARINGS*	↔
↕			✥

SCALE 1:200

Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	AL	JB	NC
P02	11/12/20	Final Preliminary Design	DT	AL	JB	NC
P01	18/11/19	Preliminary Design	DT	AL	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

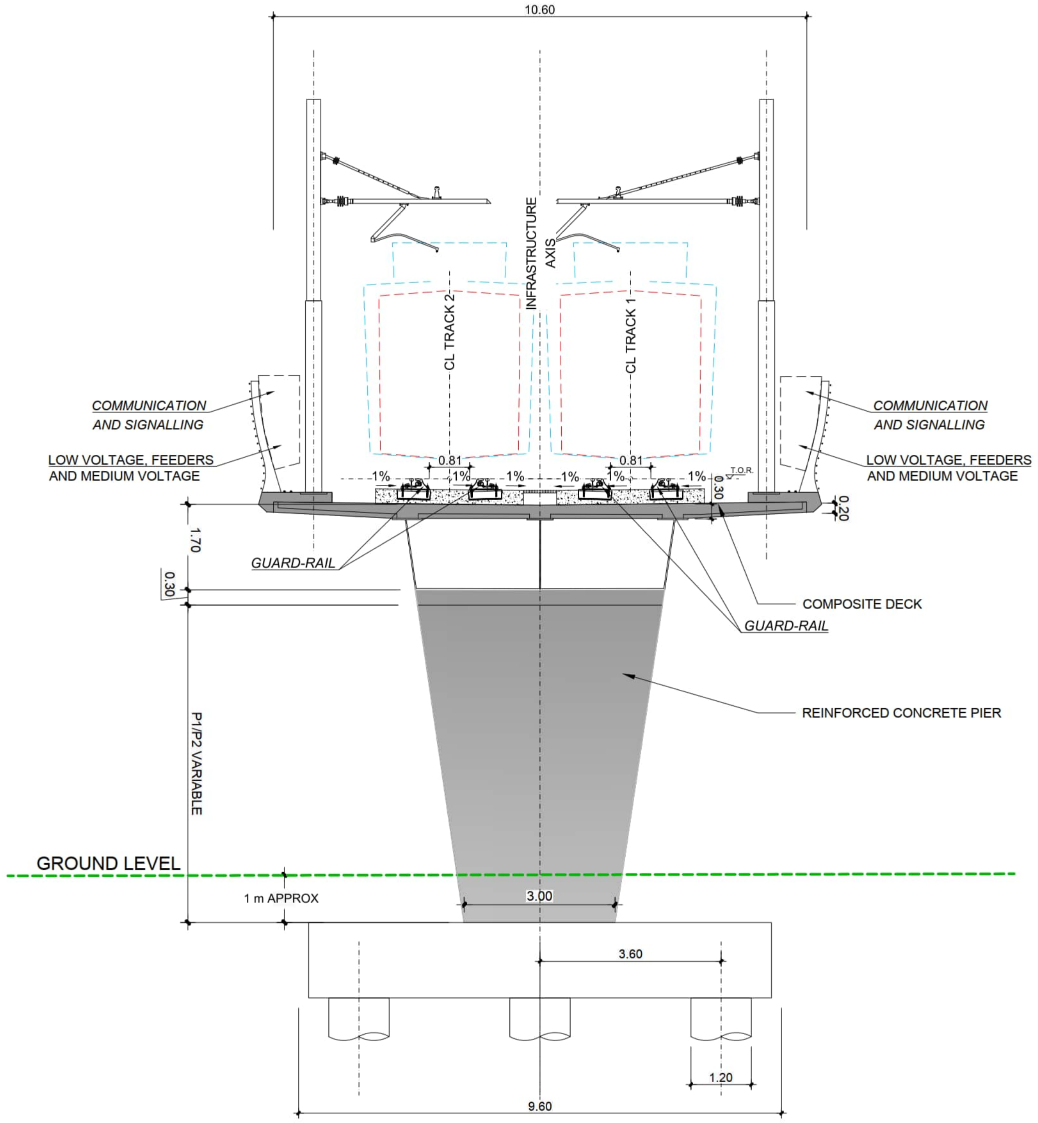
Drawing Title: M50 VIADUCT
PRELIMINARY DESIGN ISSUE
GENERAL ARRANGEMENT

Drawing Status: S4

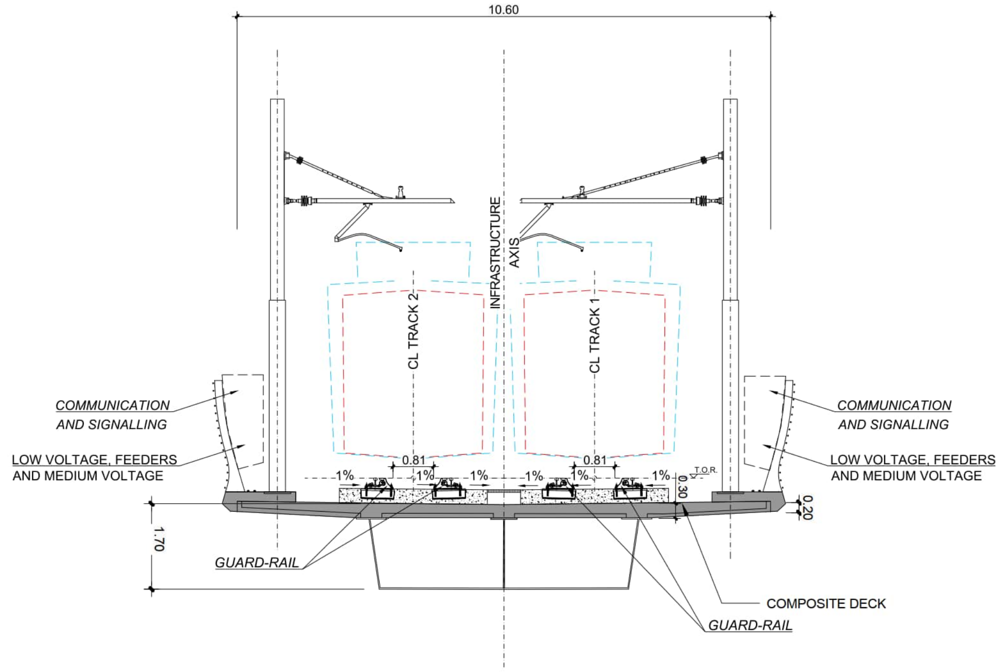
Drawing Nº: ML1-JAI-SGN-SC06_XX-DR-Y-00011

Scales Original Size A1

Sheet 1 of 1

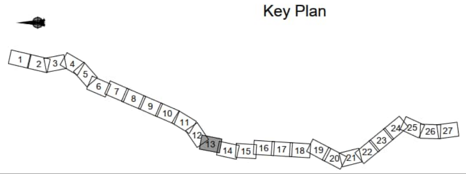


PILE SECTION
SCALE 1:75



TYPICAL SECTION
SCALE 1:75

Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	AL	JB	NC
P02	11/12/20	Final Preliminary Design	DT	AL	JB	NC
P01	18/11/19	Preliminary Design	DT	AL	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Consultant: JACOBS, IDOM

Project: METROLINK

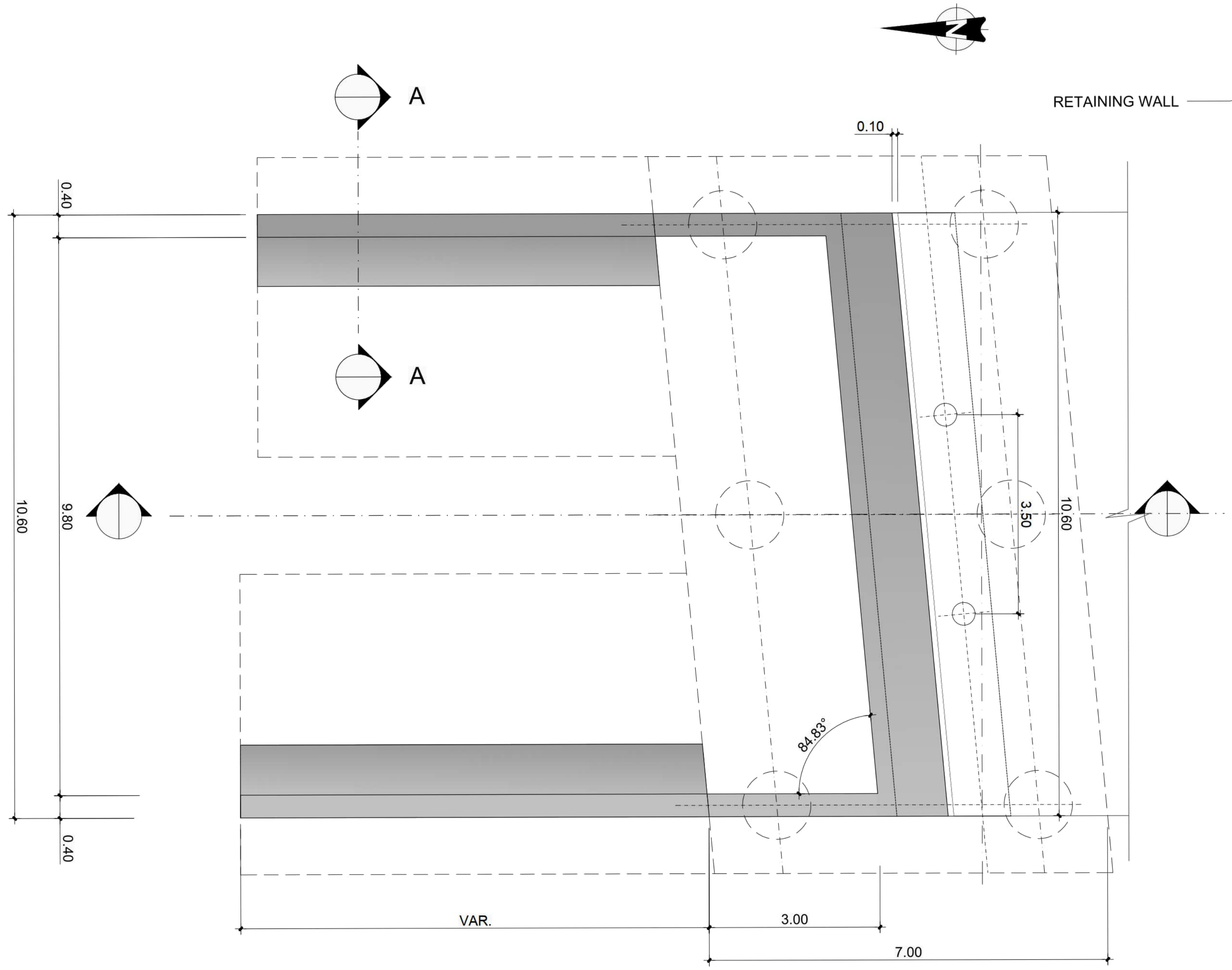
Drawing Title: M50 VIADUCT
PRELIMINARY DESIGN ISSUE
CROSS SECTIONS

Drawing Status: S4

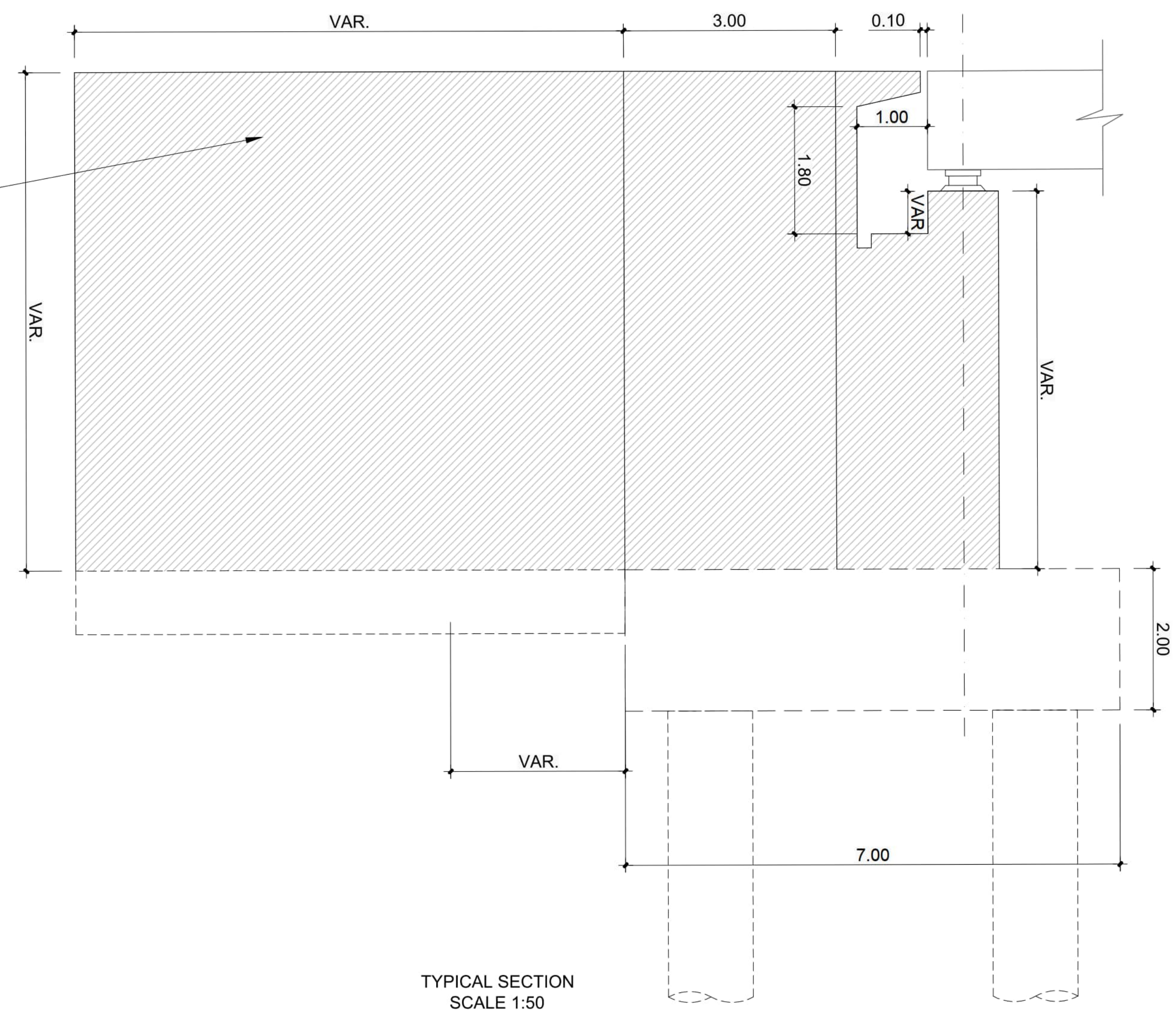
Drawing Nº: ML1-JAI-SGN-SC06-XX-DR-Y-00012

Scales Original Size A1

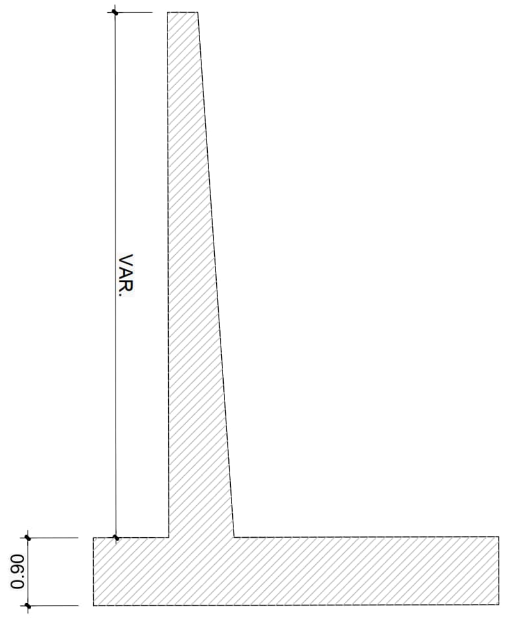
Sheet 1 of 1



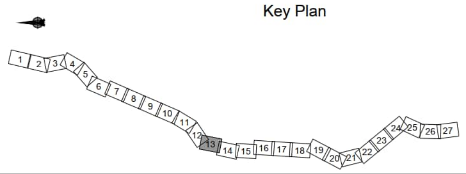
PLAN
SCALE 1:50



TYPICAL SECTION
SCALE 1:50



SECTION A-A
SCALE 1:50



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	AL	JB	NC
P02	11/12/20	Final Preliminary Design	DT	AL	JB	NC
P01	18/11/19	Preliminary Design	DT	AL	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA
Project: METROLINK
Consultant: JACOBS, IDOM

Drawing Title: M50 VIADUCT
PRELIMINARY DESIGN ISSUE
ABUTMENT DETAILS

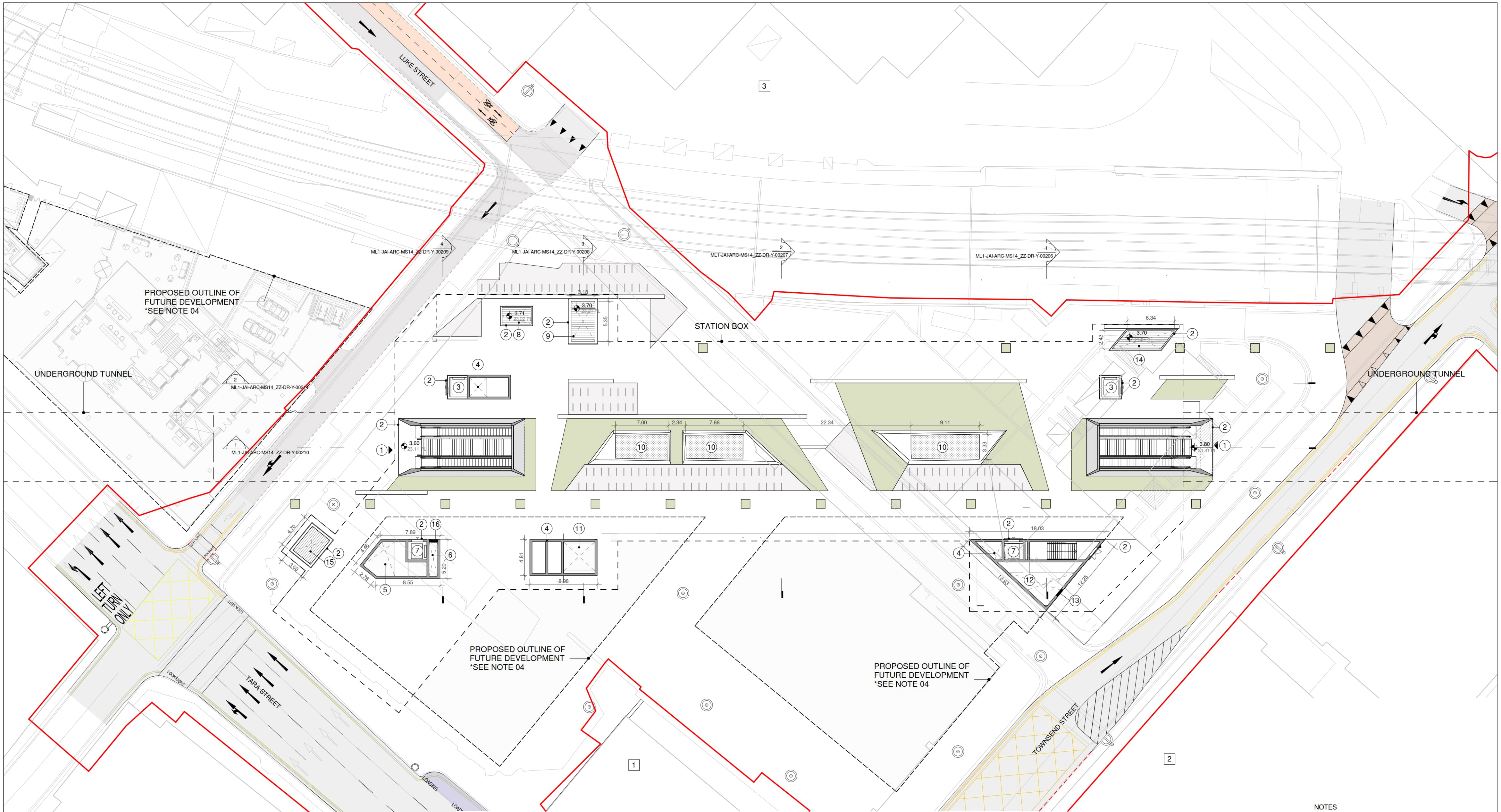
Drawing Status: S4

Drawing Nº: ML1-JAI-SGN-SC06_XX-DR-Y-00013

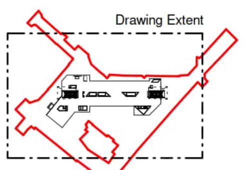
Scales Original Size A1

Sheet 1 of 1

Appendix D. Proposed Tara Station. Street Level Design Plan and Longitudinal Section



ARC_05_Proposed Street Level Design Plan
1 : 250



Railway Order application boundary (see note 01)

PUBLIC LIGHTING ELEMENTS - LEGEND

- 8m column with post top Luminaire
- 10m column with post top Luminaire
- 6m column with centered post top Luminaire
- Luminaire Swap Only - New Luminaire
- 6m column with offset post top Luminaire
- Existing Luminaire

URBAN LANDMARKS - LEGEND

1. The Irish Times Building
2. Central Fire Station
3. George's Quay Plaza

SURFACE FEATURES - LEGEND

1. Station Access
2. Flood Defense System
3. Passengers Lift
4. Make Up Air, Pressurization and Ventilation Air Inlet $6m^2$ / Façade
5. Smoke and Ventiation Exhaust / $14m^2$ / OSD Façade
6. Substation ventilation / $4m^2$ OSD Façade or Roof
7. DFB Lift
8. Upstand floor hatch / h= 0.00m
9. Draught Relief / TVS / Equipment Exit - $20m^2$ / h = 0.00
10. Skylight
11. OTE / TVS $14m^2$ / OSD Facade or Roof
12. Draught Relief / TVS / Equipment Exit. OSD Facade or Roof / $20m^2$
13. Indicative position of station and tunnel supplies inlet point: Fire Department Connections (Station/Tunnel), Internal Wet Fire Mains (Station), Telecoms
14. OTE / TVS - $16m^2$ / h = 0.00
15. Equipment Exit / $12m^2$ / h=0.00m
16. Indicative position of station and tunnel supplies inlet point: Water and Sewage (Station), Fire Department Connections (Station/Tunnel), Internal Wet Fire Mains (Station)

NOTES

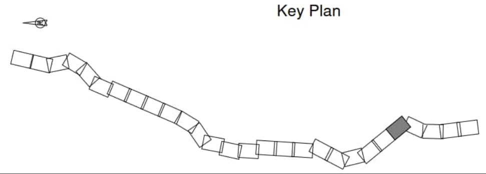
01. The design on this drawing is based on topographical survey mapping. The Railway Order application boundary has been developed based on Ordinance Survey Mapping therefore some differences may be observed between the exact position of surveyed land boundaries and the Railway Order application boundary.

02. Grilles next to roads must withstand vehicular load.

03. Demountable flood defense system to be provided for all street level station openings to mitigate the impacts of the 0.1% AEP flood. Final requirements to be confirmed at Detailed Design Stage of the Project.

04. PROPOSED OUTLINE OF FUTURE DEVELOPMENT: The building line indicated on this drawing has been adopted from the Grimshaw Concept Design. It is indicative and is for reference only. The design of this building is not currently part of the present MetroLink project.

Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P04	04/06/21	Preliminary Design Issue	AMM	GDV	JBL	NC
P03	11/12/20	Final Preliminary Design	AMM	GDV	JBL	NC
P02	18/11/19	Preliminary Design	GRM	GDV	GDV	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: Bonneagar Iompair Éireann / Transport Infrastructure Ireland; NTA Údarás Náisiúnta Iompair / National Transport Authority

Project: METROLINK

Consultant: JACOBS IDOM

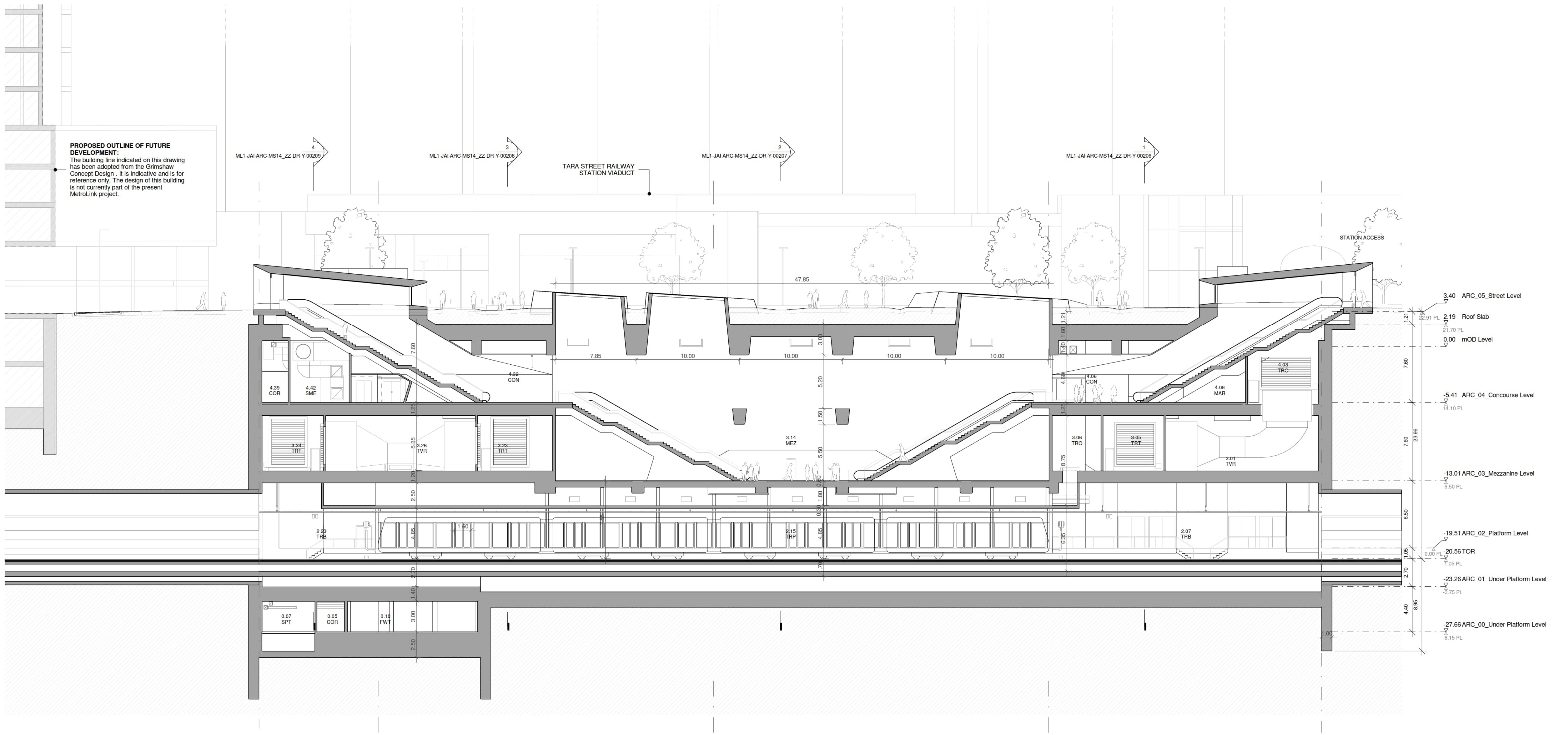
Drawing Title: Tara Station
Proposed Street Level Design Plan
Preliminary Design Issue

Drawing Status: S4

Drawing Nº: ML1-JAI-ARC-MS14_GF-DR-Y-00203

Scales Original Size A1 1 : 250

Sheet 1 of 1



Longitudinal Section 01

1 : 200

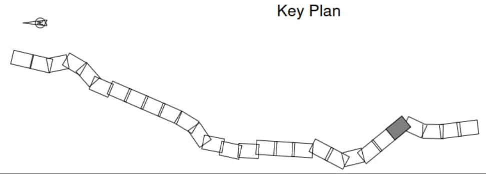
00.00 ARC_00_Level / Survey Level, Absolute Coordinates

00.00 PL / Project Level, Relative Coordinates

NOTE

Trees are indicative only. For exact placement and species of trees, please refer to Landscape Drawings.

Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P04	04/06/21	Preliminary Design Issue	AMM	GDV	JBL	NC
P03	11/12/20	Final Preliminary Design	AMM	GDV	JBL	NC
P02	18/11/19	Preliminary Design	GRM	GDV	GDV	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client

Consultant

JACOBS IDOM

Project

METROLINK

Drawing Title

Tara Station
Longitudinal Section 01
Preliminary Design Issue

Drawing Status

S4

Drawing Nº

ML1-JAI-ARC-MS14_ZZ-DR-Y-00210

Scales Original Size A1 1 : 200

Sheet 1 of 1

Appendix E. Greenfield Run-Off Rate (Greater Dublin Area)

HR Wallingford
Working with water

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Pablo De la Torre
Site name:	Dublin
Site location:	Dublin

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.34986° N
Longitude:	6.26307° W
Reference:	1582645453
Date:	Nov 16 2021 08:19

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	786	786
Hydrological region:	12	12
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.13	2.13
Growth curve factor 100 years:	2.61	2.61
Growth curve factor 200 years:	2.86	2.86

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

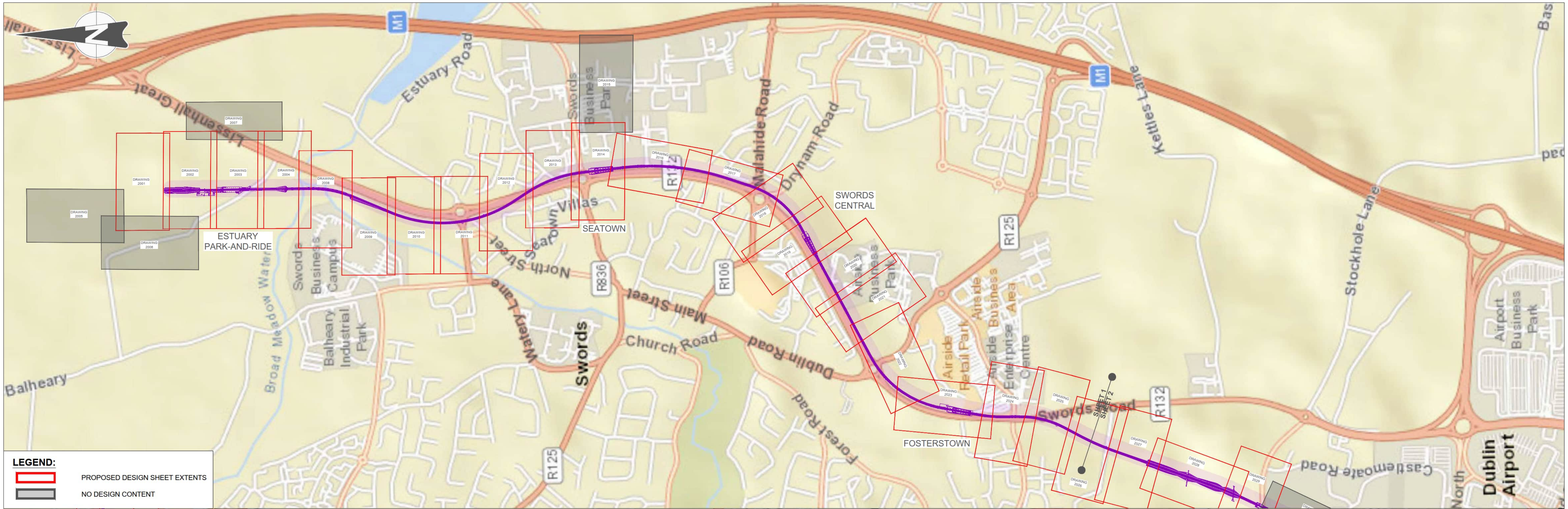
Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

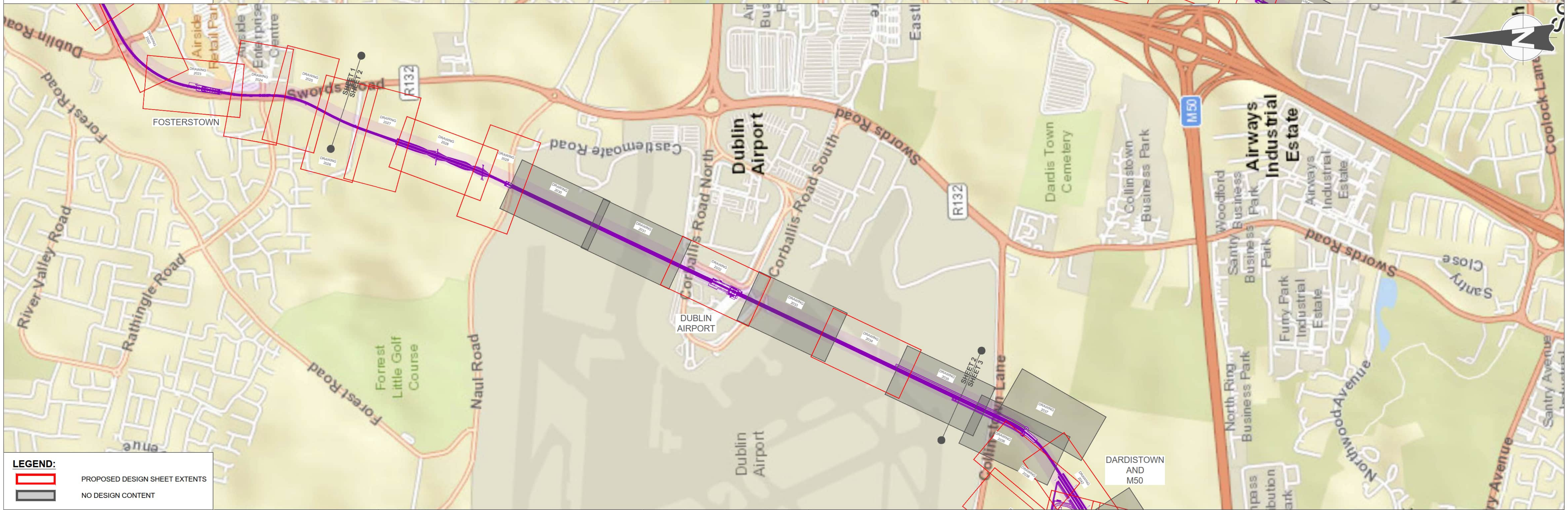
(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	5.53	5.53
1 in 1 year (l/s):	4.7	4.7
1 in 30 years (l/s):	11.78	11.78
1 in 100 year (l/s):	14.43	14.43
1 in 200 years (l/s):	15.81	15.81

Appendix F. General Drainage Design Drawings





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.01	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Drawing Title: METROLINK - PROPOSED DRAINAGE KEY PLAN

Drawing Status: S0

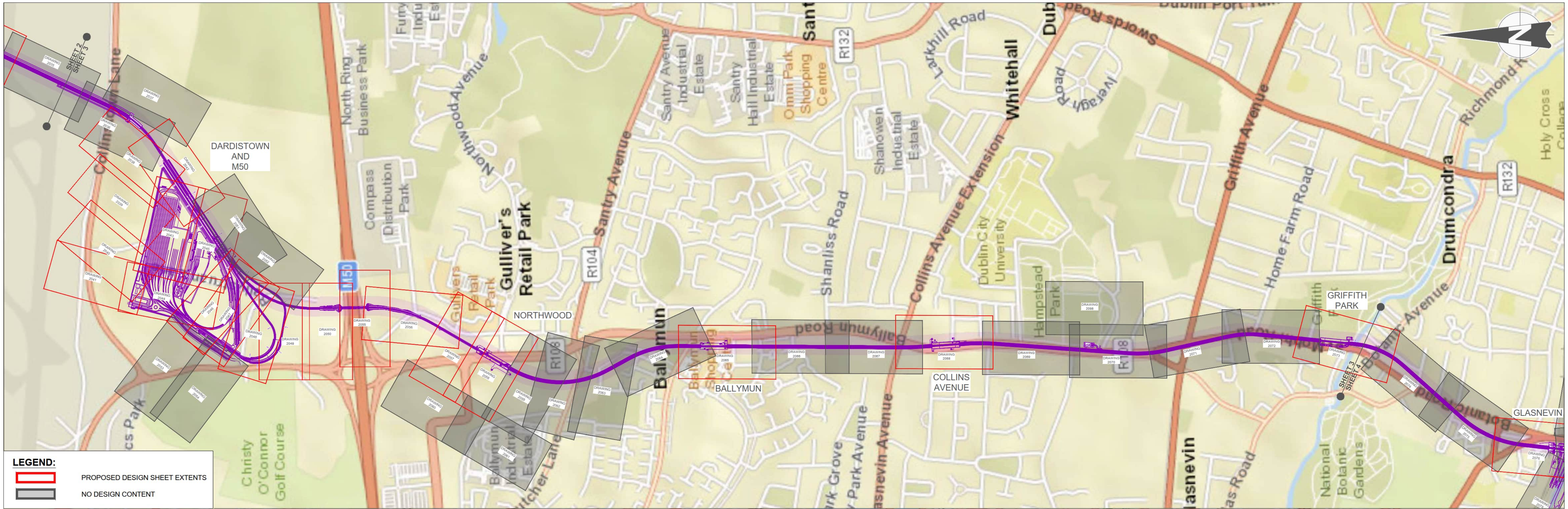
Consultant: JACOBS, IDOM

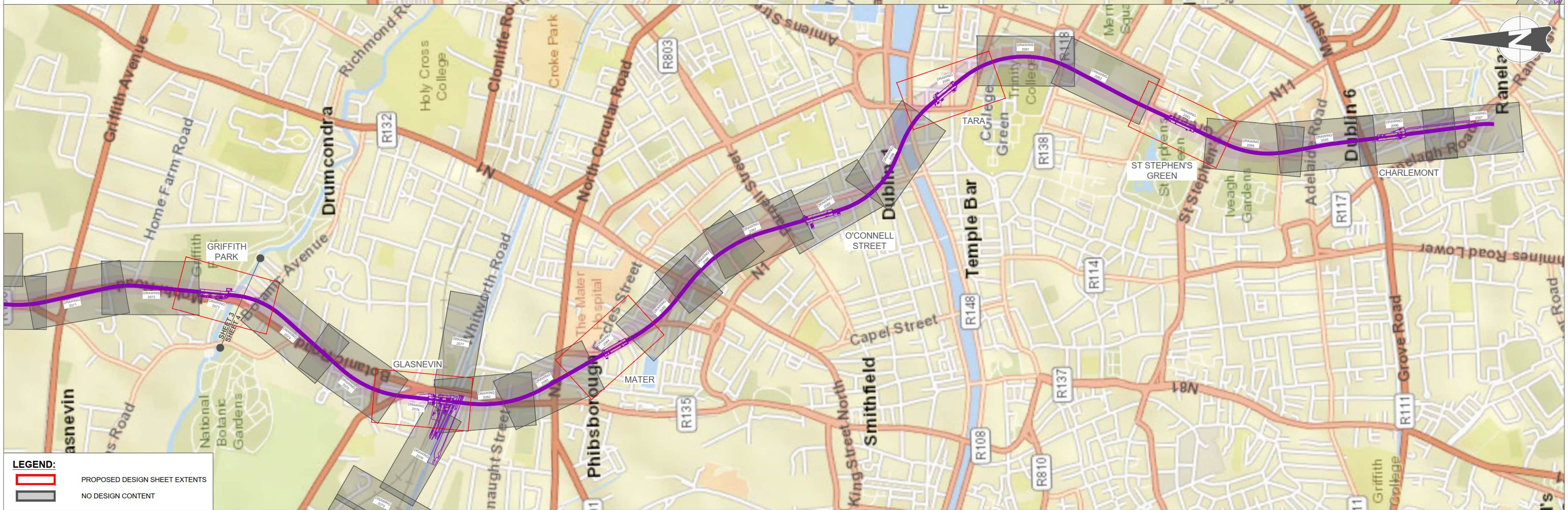
Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02105

Plan Drawing Nº 1

Scales Original Size A1 NTS

Sheet 1 of 2





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.01	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED DRAINAGE KEY PLAN

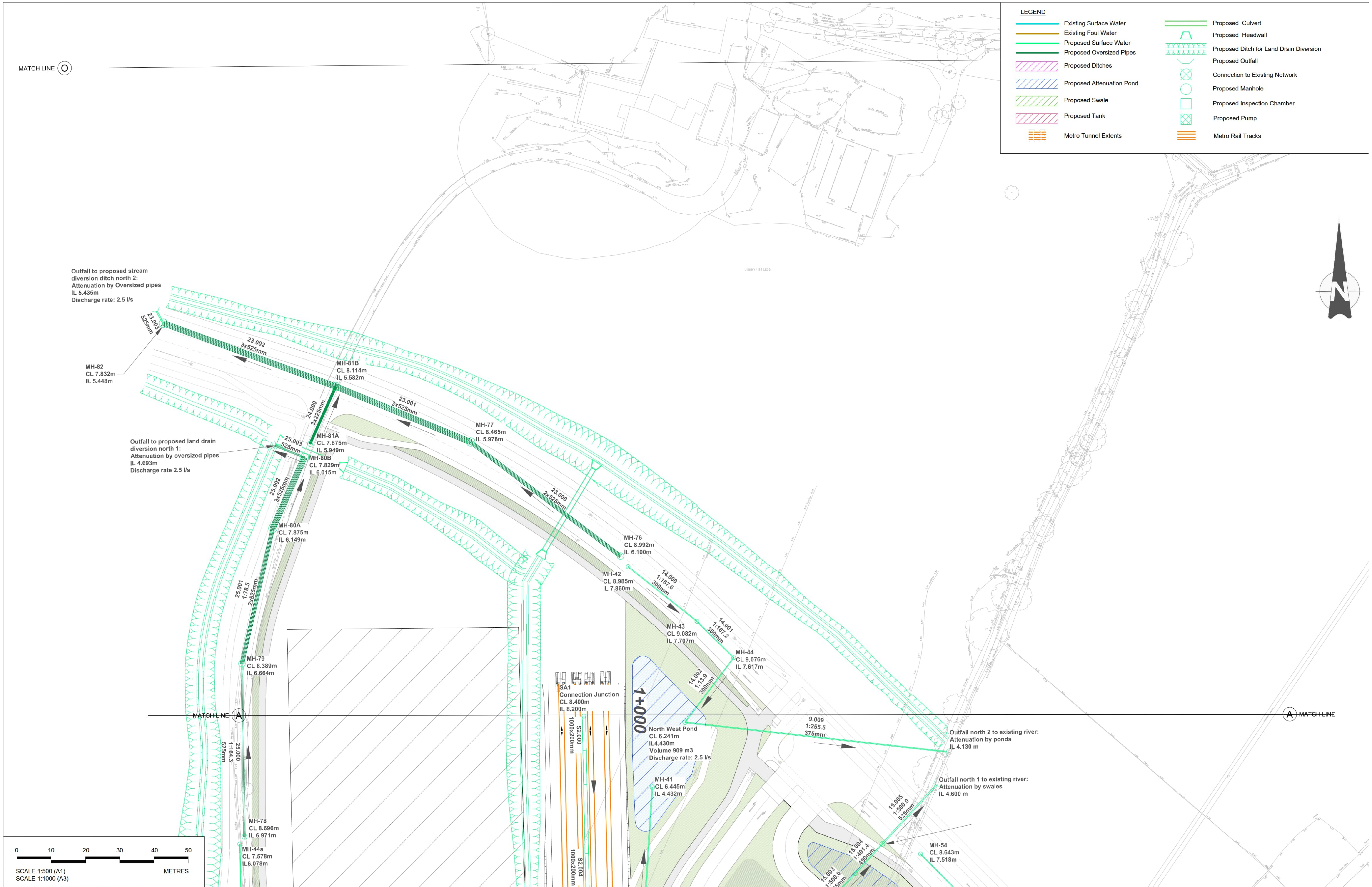
Drawing Status: S0

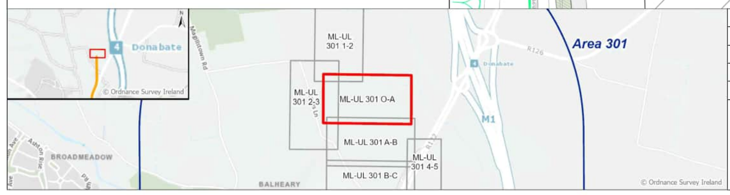
Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02105

Plan Drawing Nº 1

Scales Original Size A1 NTS

Sheet 2 of 2





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

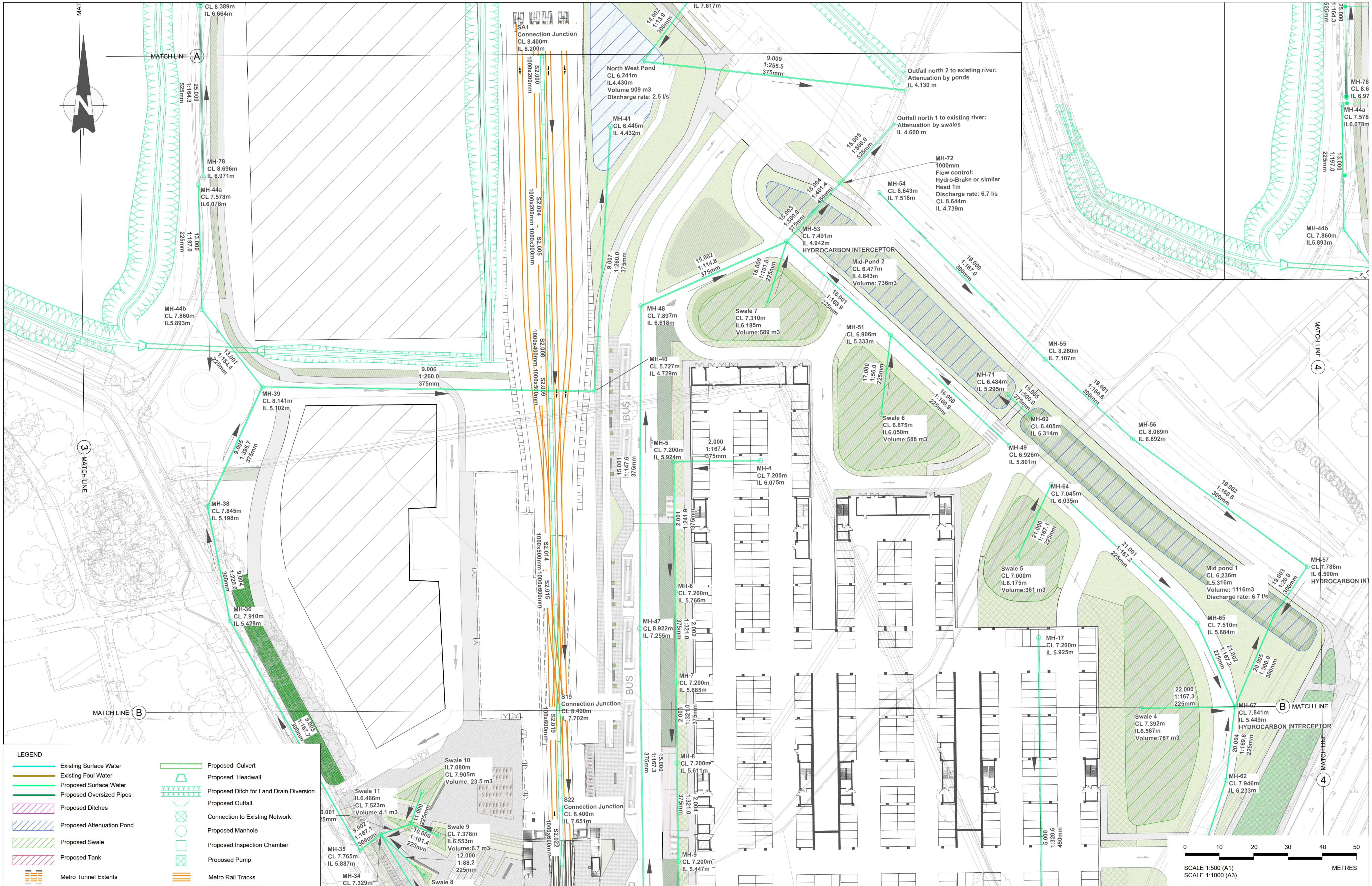
Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE LISSENHALL LITTLE (SHEET 1 OF 4)

Drawing Status: S0

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02001

Plan Drawing Nº: ML-UC 301 O-A

Scales Original Size A1 1:500



P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS
REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA
Project: METROLINK
Consultant: JACOBS, IDOM

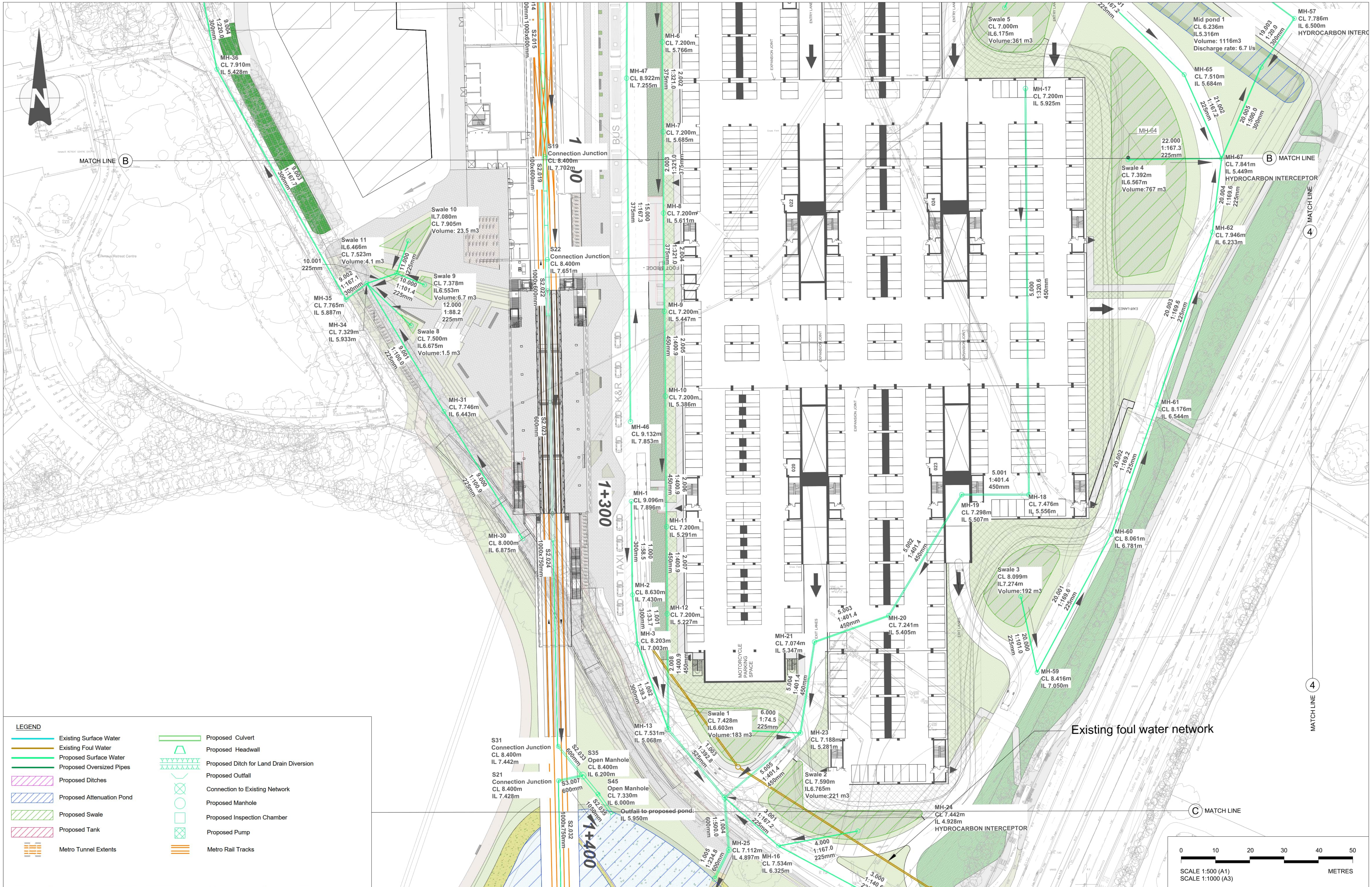
Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE LISSENHALL LITTLE (SHEET 2 OF 4)

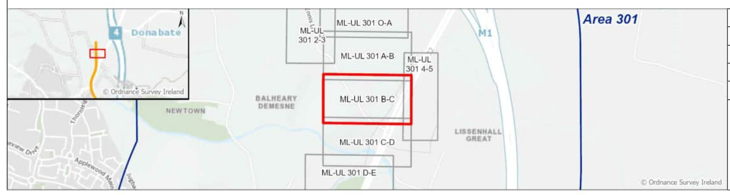
Drawing Status: S0

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02002

Plan Drawing Nº: ML-UC 301 A-B

Scales Original Size A1 1:500





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA
Project: METROLINK
Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE ESTUARY

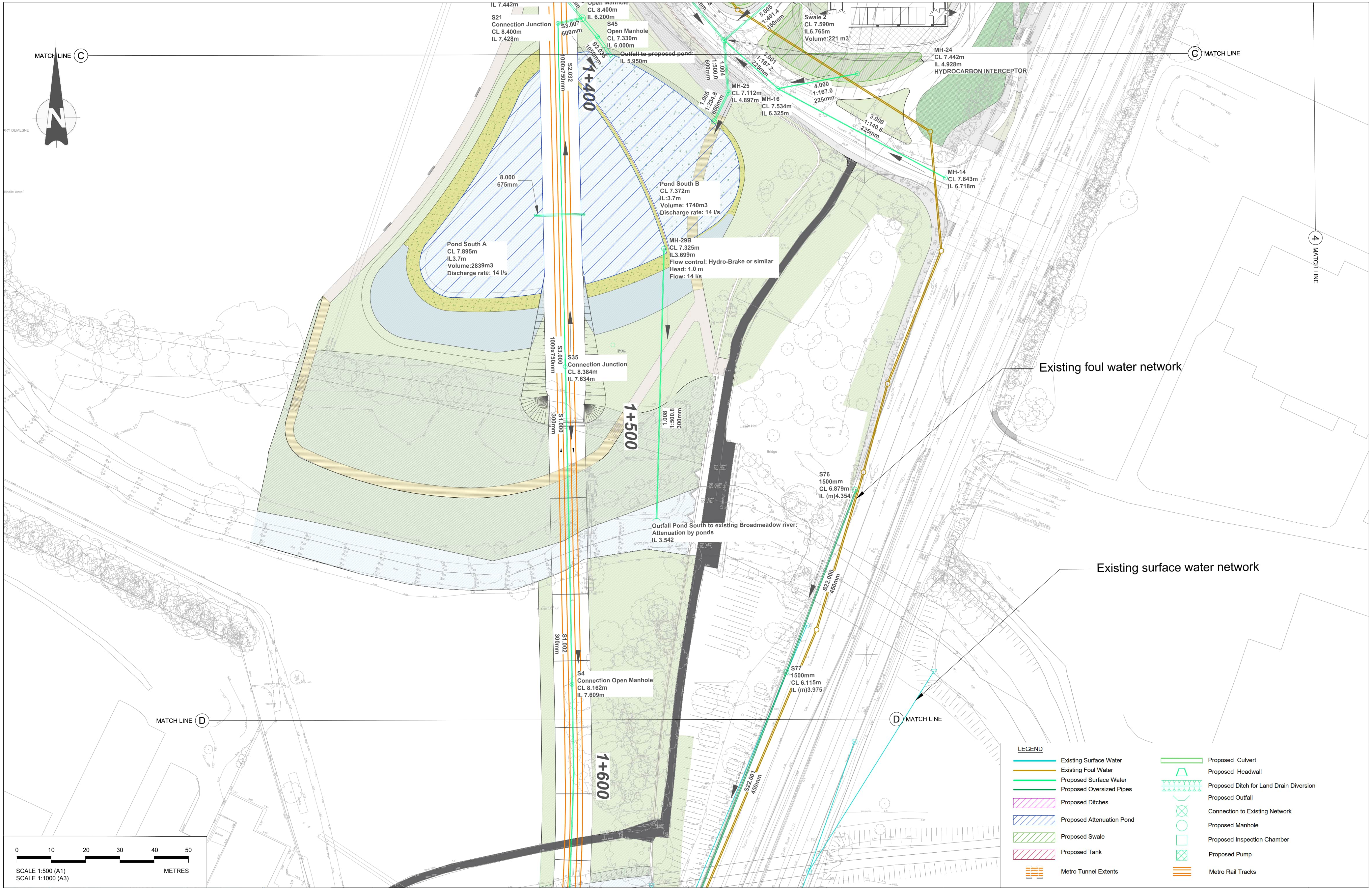
Drawing Status: S0

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02003

Plan Drawing Nº: ML-UC 301 B-C

Scales Original Size A1 1:500

Sheet 1 of 1



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE BALHEARY DEMESNE (SHEET 1 OF 5)

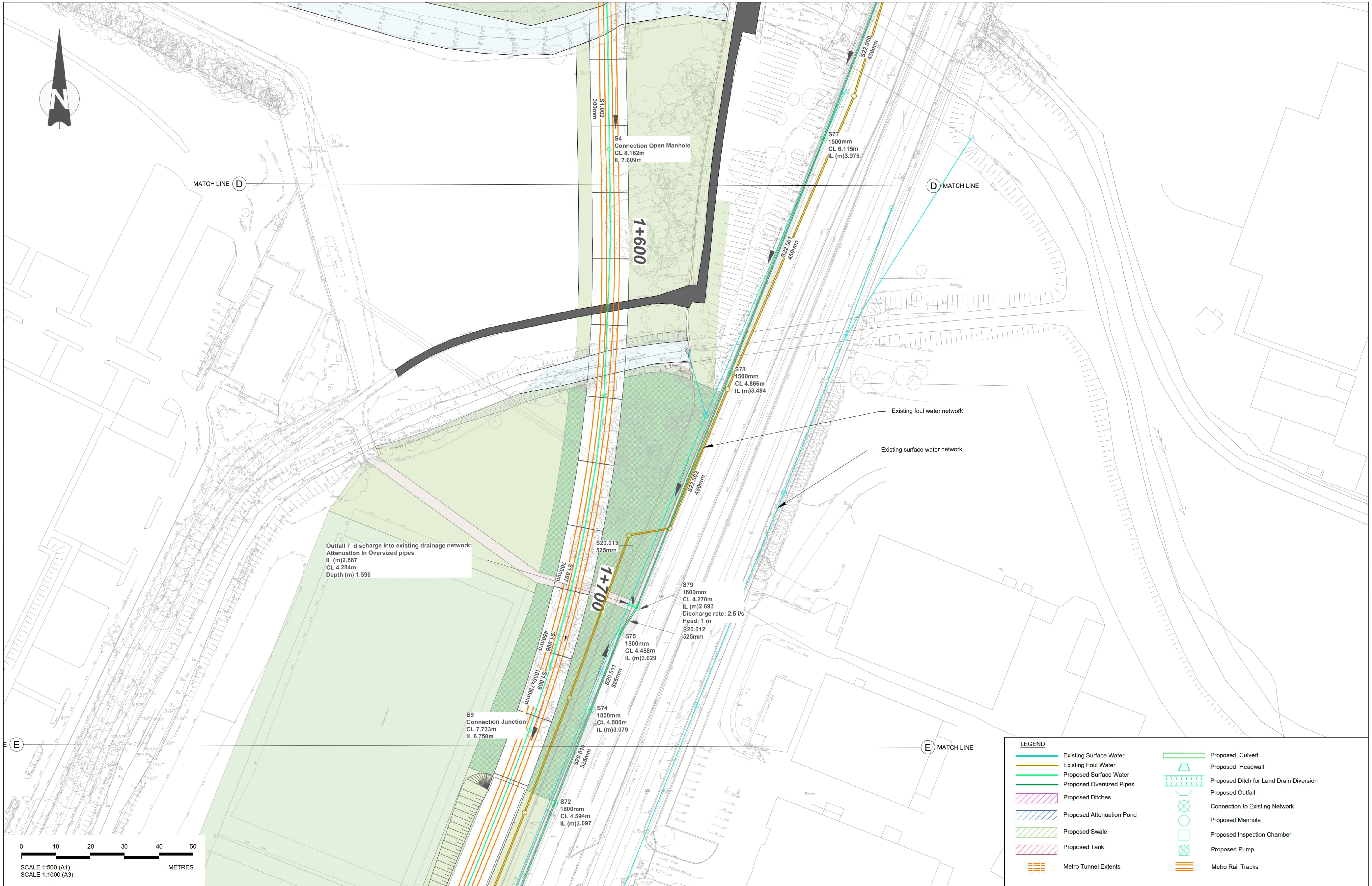
Drawing Status: S0

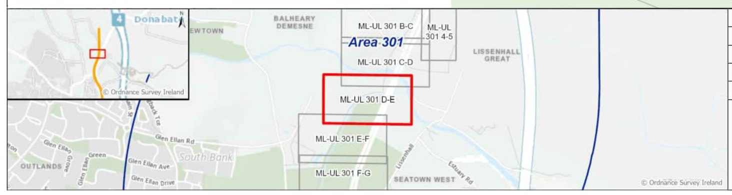
Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02004

Plan Drawing Nº: ML-UC 301 C-D

Scales Original Size A1 1:500

Sheet 1 of 5





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE BALHEARY DEMESNE (SHEET 2 OF 5)

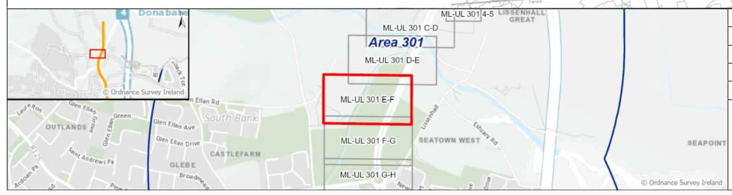
Drawing Status: S0

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02008

Plan Drawing Nº: ML-UC 301 D-E

Scales Original Size A1 1:500

Sheet 2 of 5



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

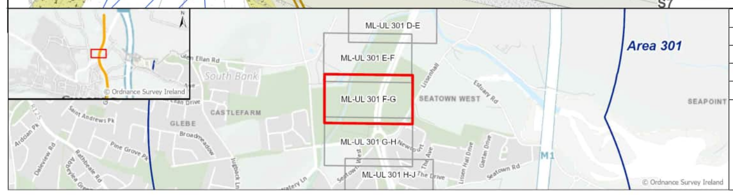
All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title	METROLINK - PROPOSED SURFACE DRAINAGE BALHEARY DEMESNE (SHEET 3 OF 5)
Drawing Status	S0
Drawing Nº	ML1-JAI-URD-ROUT_XX-DR-Y-02009
Plan Drawing Nº	ML-UC 301 E-F
Scales Original Size A1	1:500
Sheet	3 of 5



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE BALHEARY DEMESNE (SHEET 4 OF 5)

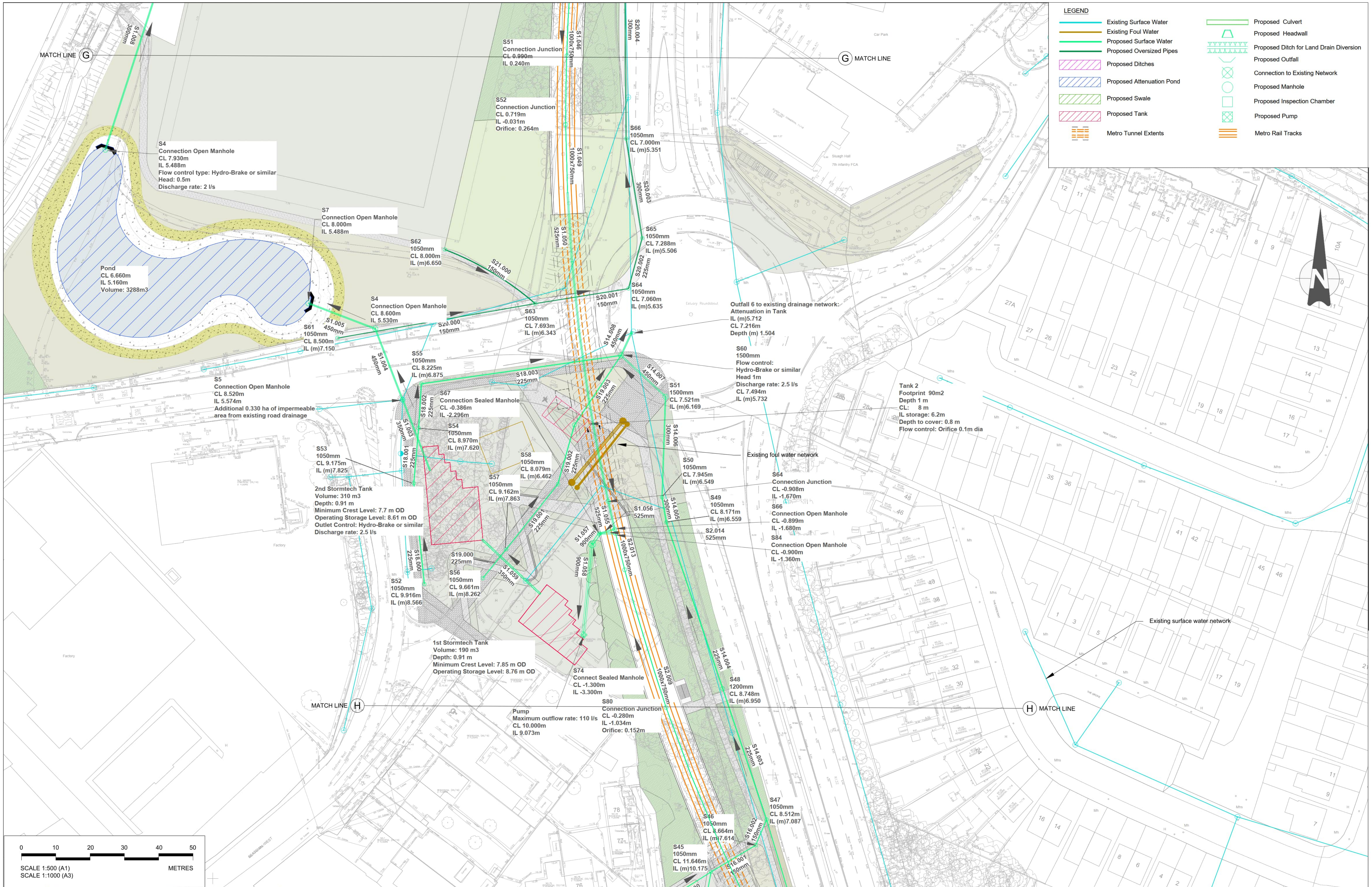
Drawing Status: S0

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02010

Plan Drawing Nº: ML-UC 301 F-G

Scales Original Size A1 1:500

Sheet 4 of 5



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE BALHEARY DEMESNE (SHEET 5 OF 5)

Drawing Status: S0

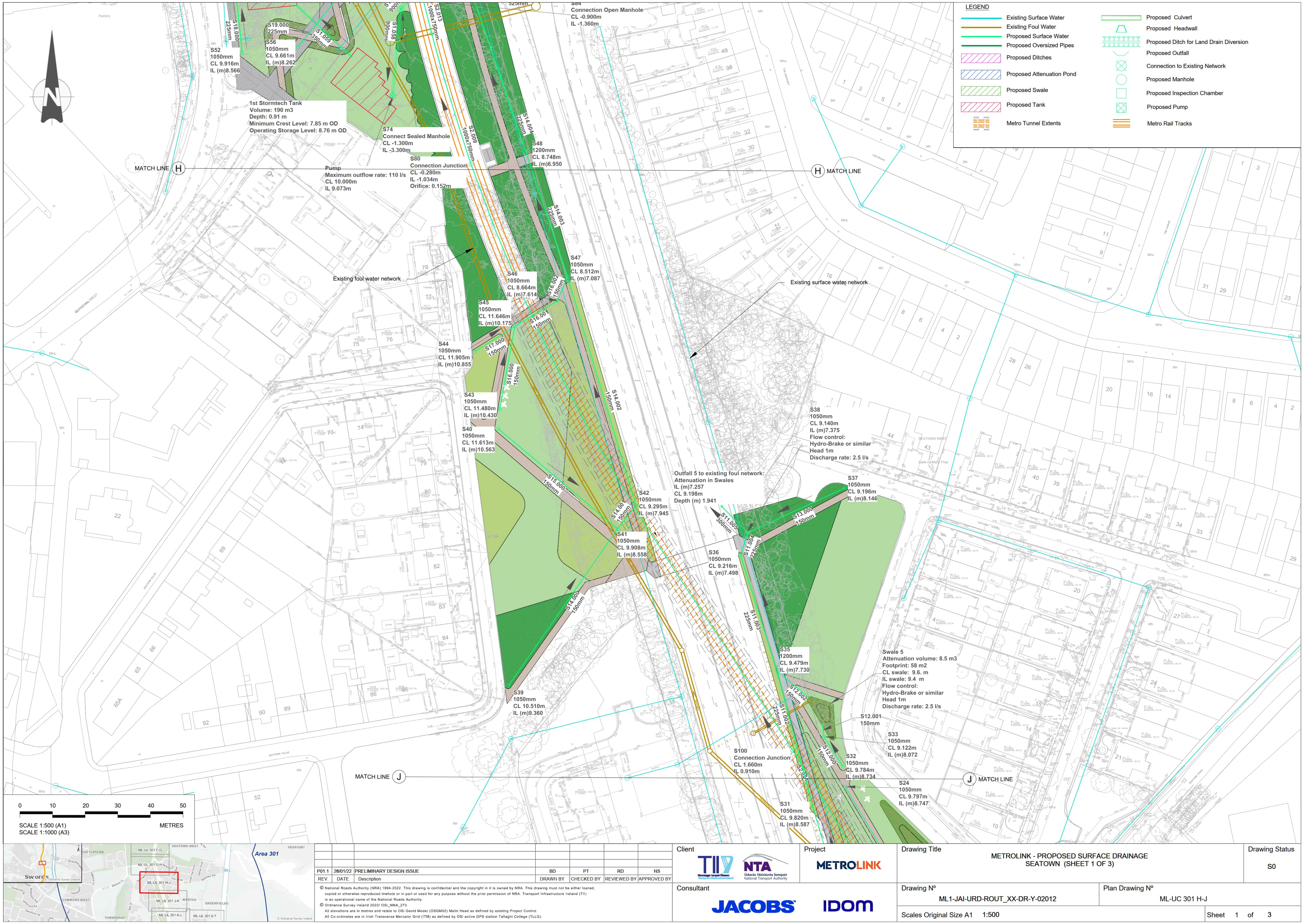
Consultant: JACOBS, IDOM

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02011

Plan Drawing Nº: ML-UC 301 G-H

Scales Original Size A1 1:500

Sheet 5 of 5



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE SEATOWN (SHEET 1 OF 3)

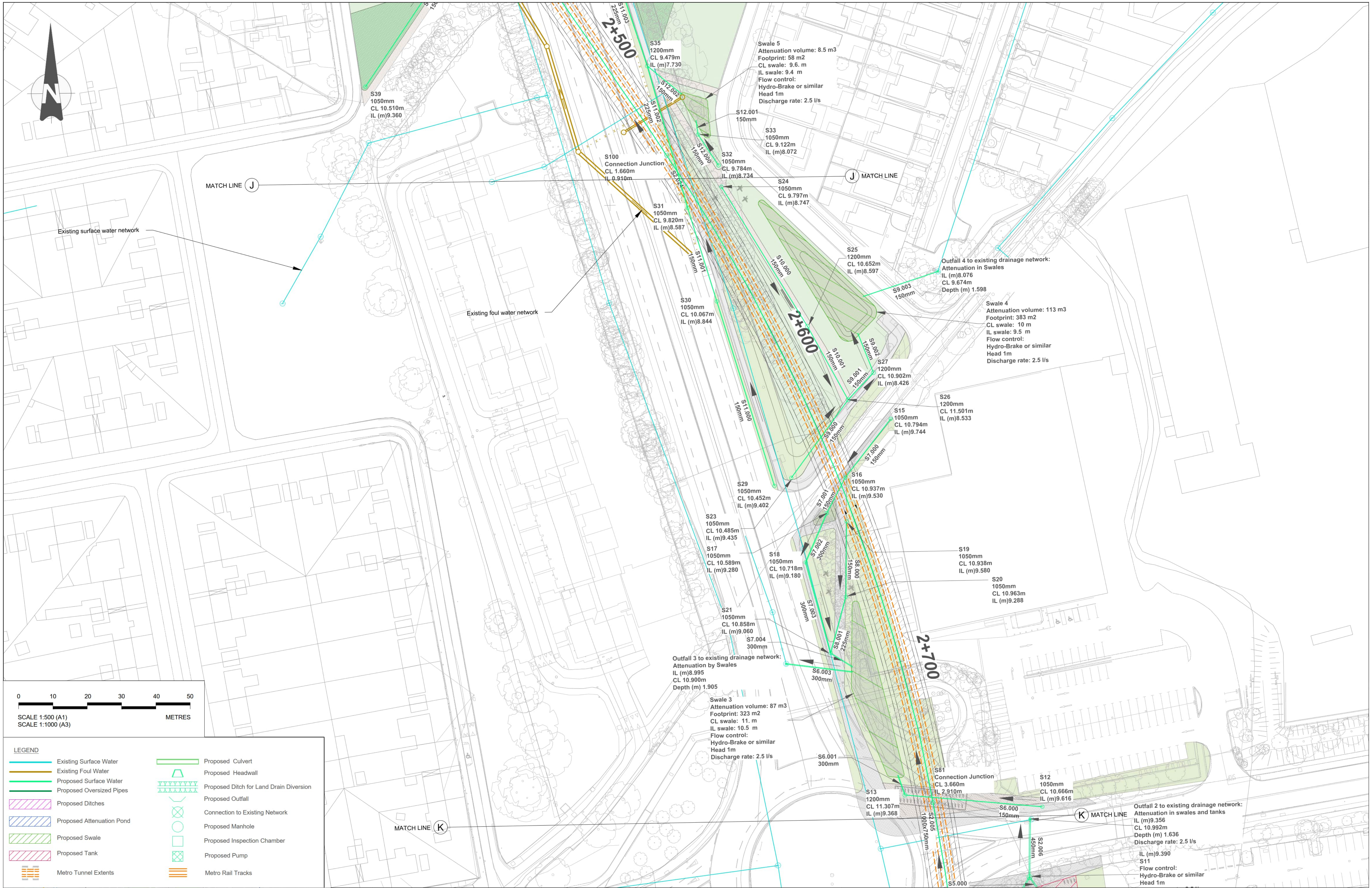
Drawing Status: S0

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02012

Plan Drawing Nº: ML-UC 301 H-J

Scales Original Size A1 1:500

Sheet 1 of 3



P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS
REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY

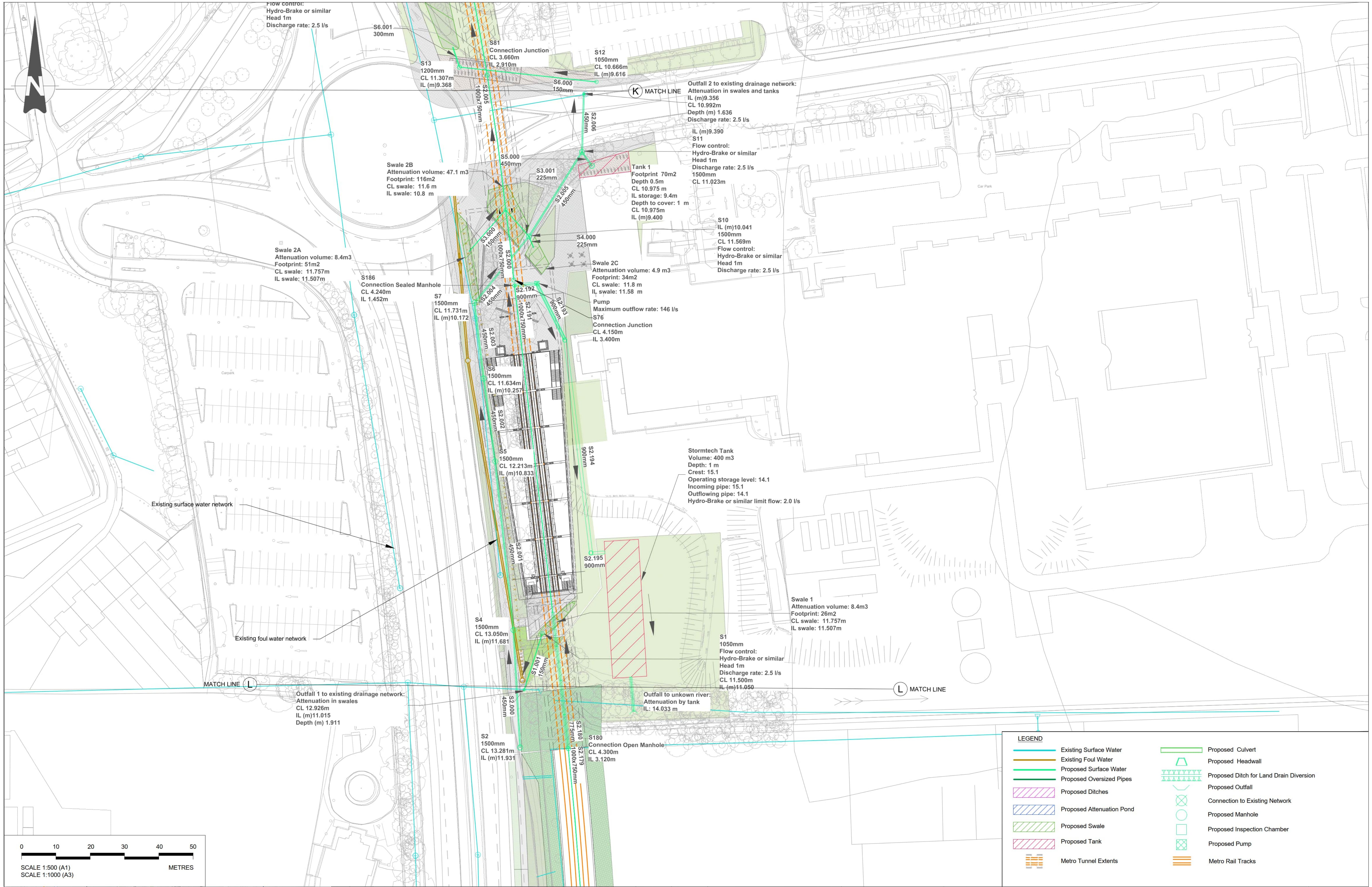
All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght Office (TLLG).

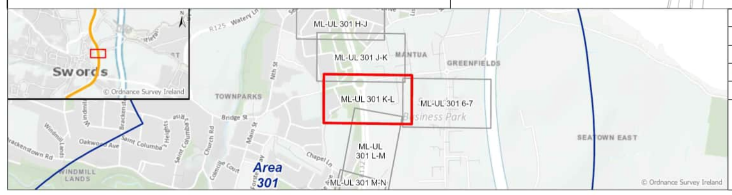
Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority
Project: METROLINK
Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE SEATOWN (SHEET 2 OF 3)

S0

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02013
Plan Drawing Nº: ML-UC 301 J-K
Scales Original Size A1 1:500
Sheet 2 of 3





P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS
REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

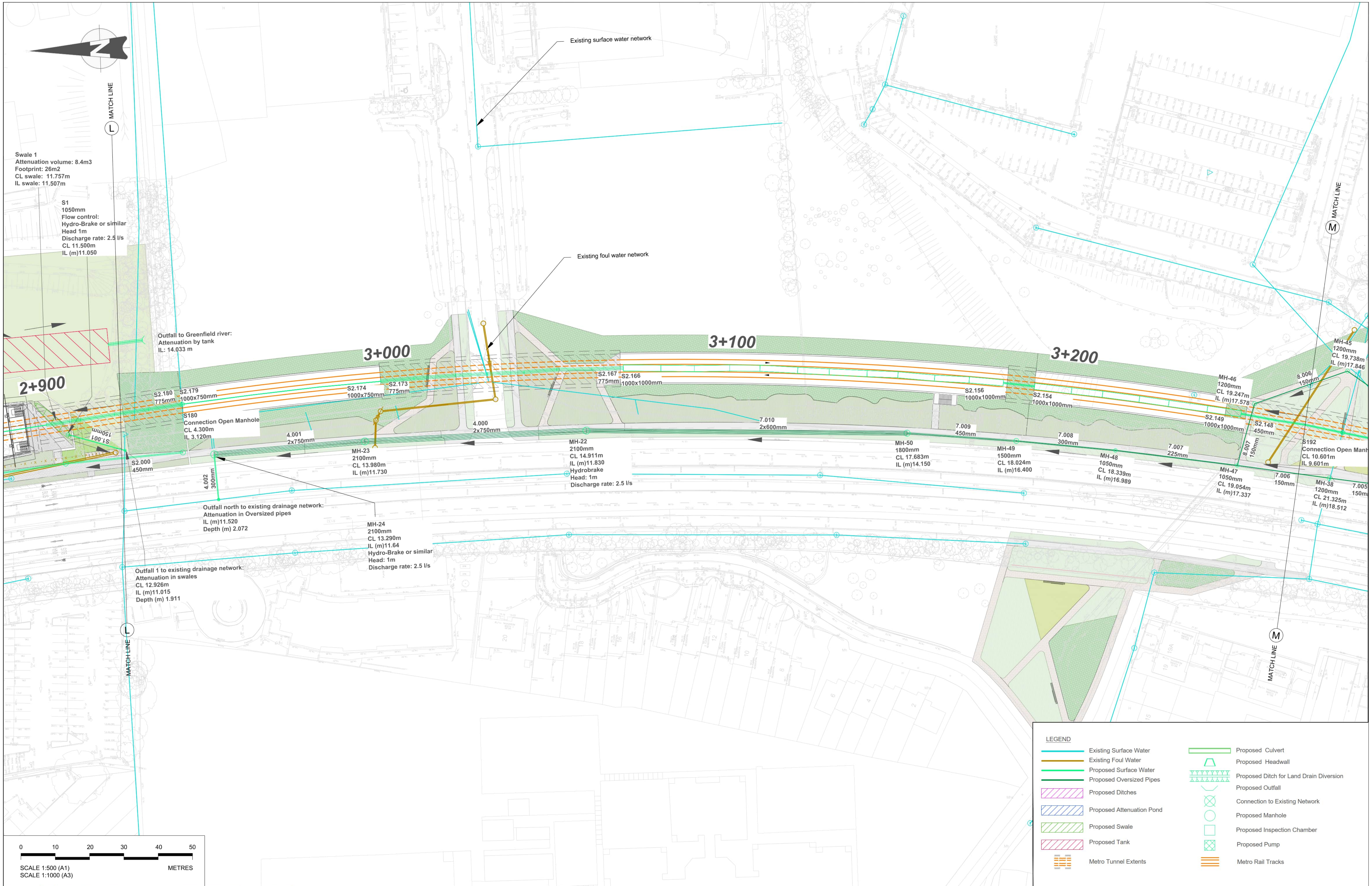
Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE SEATOWN (SHEET 3 OF 3)

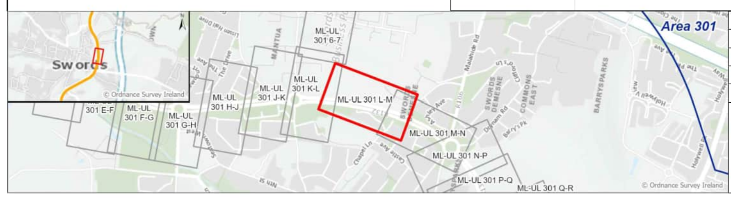
Drawing Status: S0

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02014

Plan Drawing Nº: ML-UC 301 K-L

Scales Original Size A1 1:500





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Protect Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE SWORDS DEMESNE (SHEET 1 OF 2)

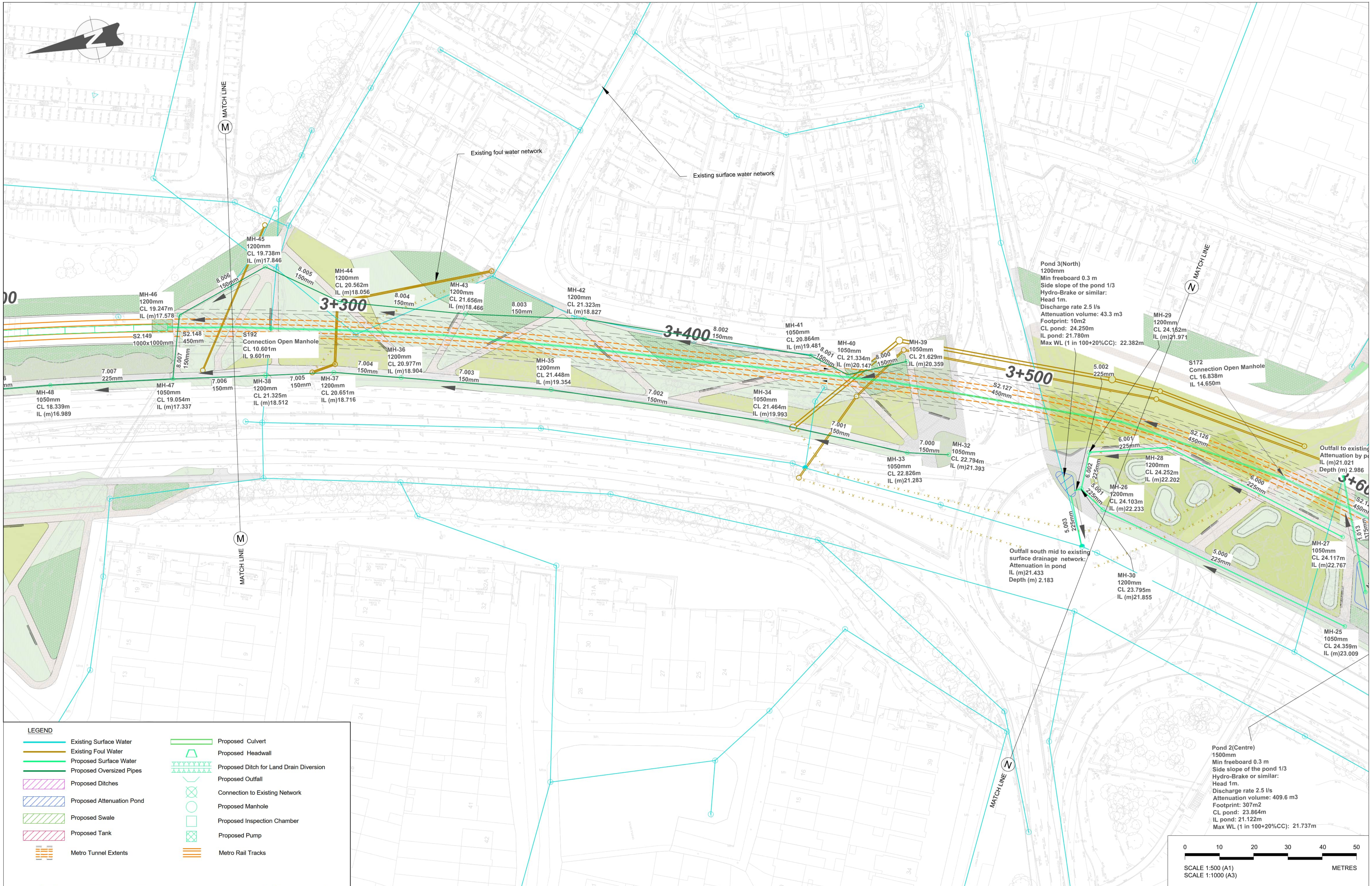
Drawing Status: S0

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02016

Plan Drawing Nº: ML-UC 301 L-M

Scales Original Size A1 1:500

Sheet 1 of 2



LEGEND

Existing Surface Water	Proposed Culvert
Existing Foul Water	Proposed Headwall
Proposed Surface Water	Proposed Ditch for Land Drain Diversion
Proposed Oversized Pipes	Proposed Outfall
Proposed Ditches	Connection to Existing Network
Proposed Attenuation Pond	Proposed Manhole
Proposed Swale	Proposed Inspection Chamber
Proposed Tank	Proposed Pump
Metro Tunnel Extents	Metro Rail Tracks

REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE SWORDS DEMESNE (SHEET 2 OF 2)

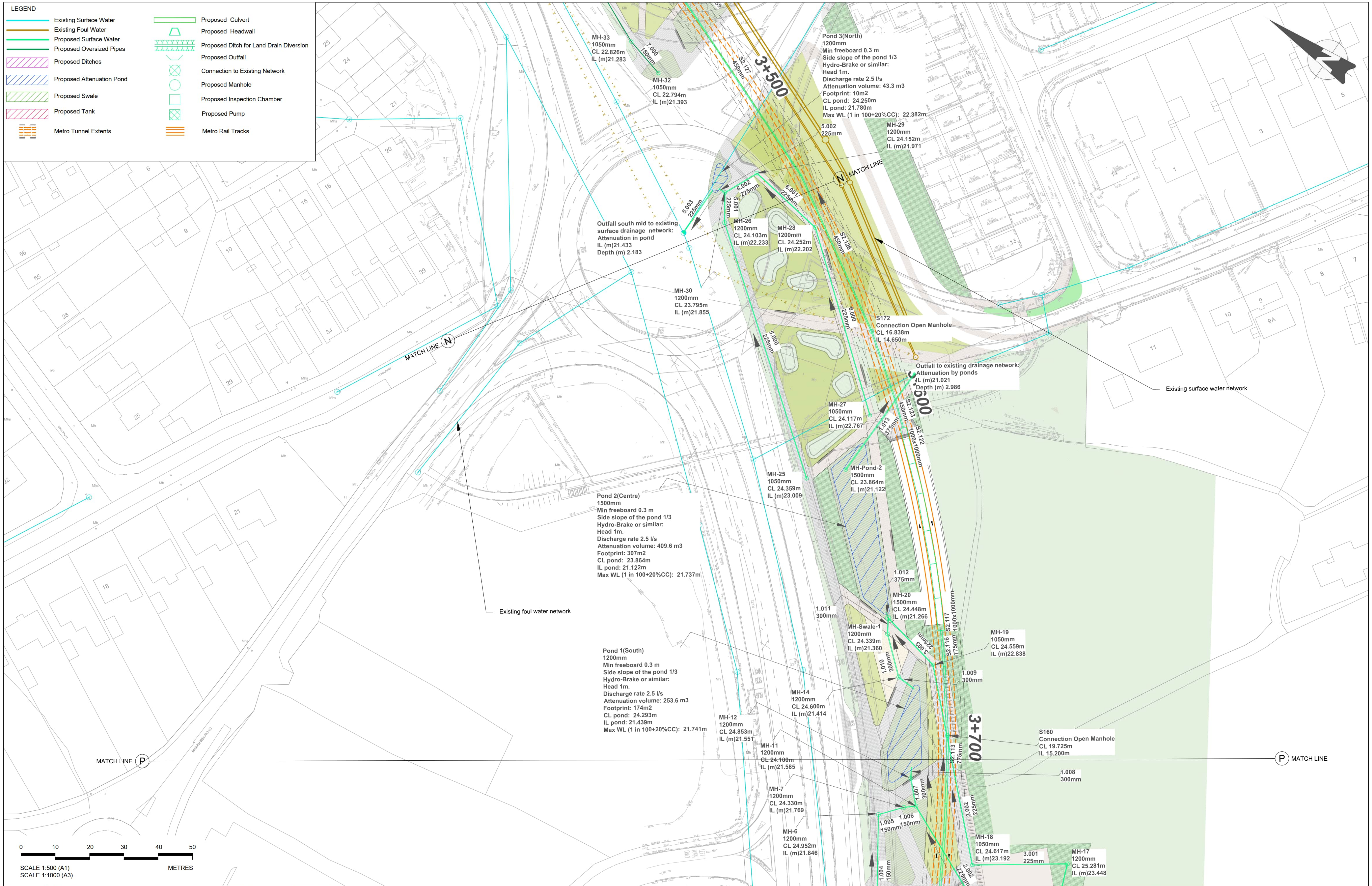
Drawing Status: S0

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02017

Plan Drawing Nº: ML-UC 301 M-N

Scales Original Size A1 1:500

Sheet 2 of 2



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	25/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA
Project: METROLINK
Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE MALAHIDE ROAD ROUNDABOUT

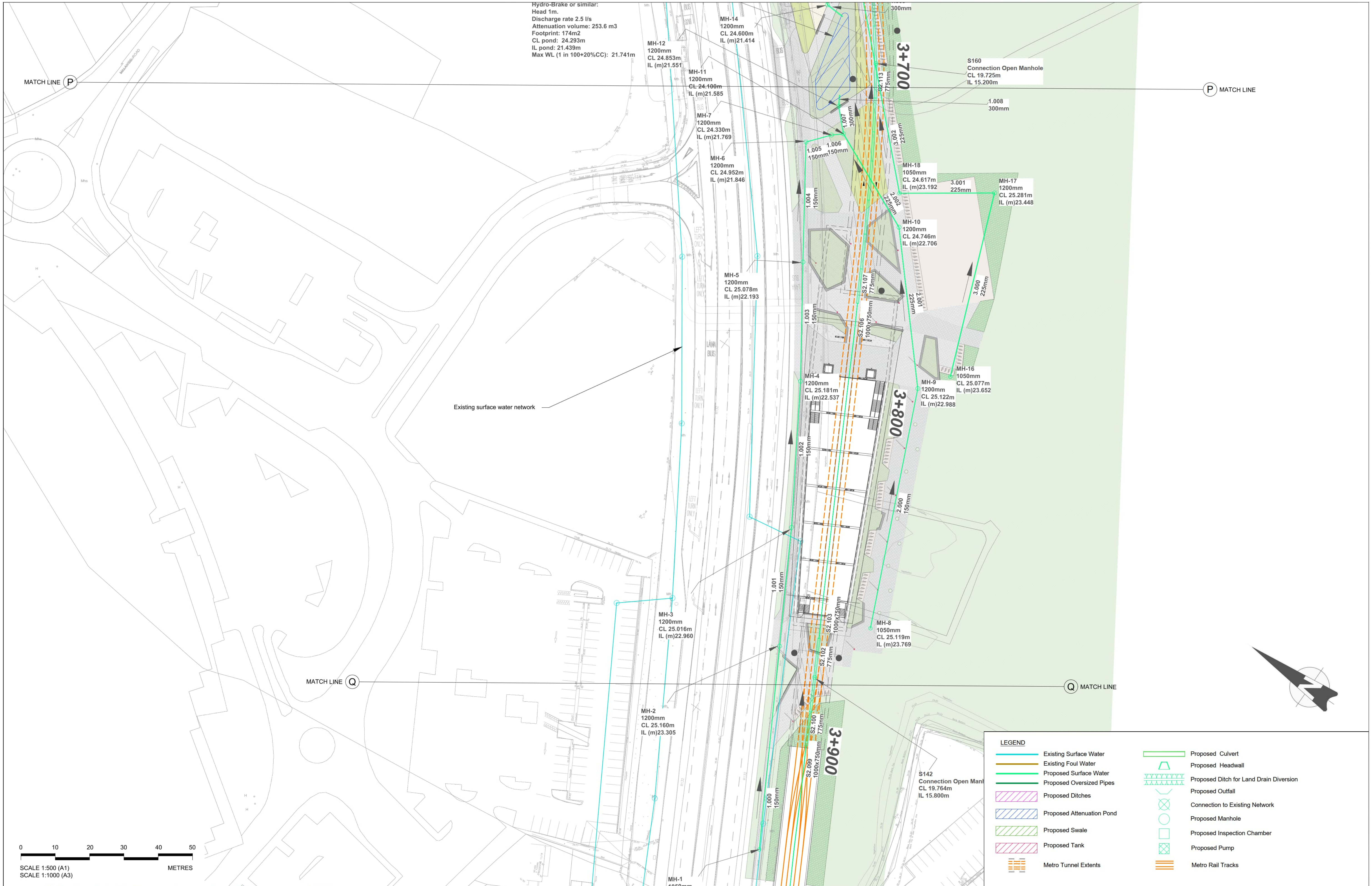
Drawing Status: S0

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02018

Plan Drawing Nº: ML-UC 301 N-P

Scales Original Size A1 1:500

Sheet 1 of 1



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE SWORDS CENTRAL

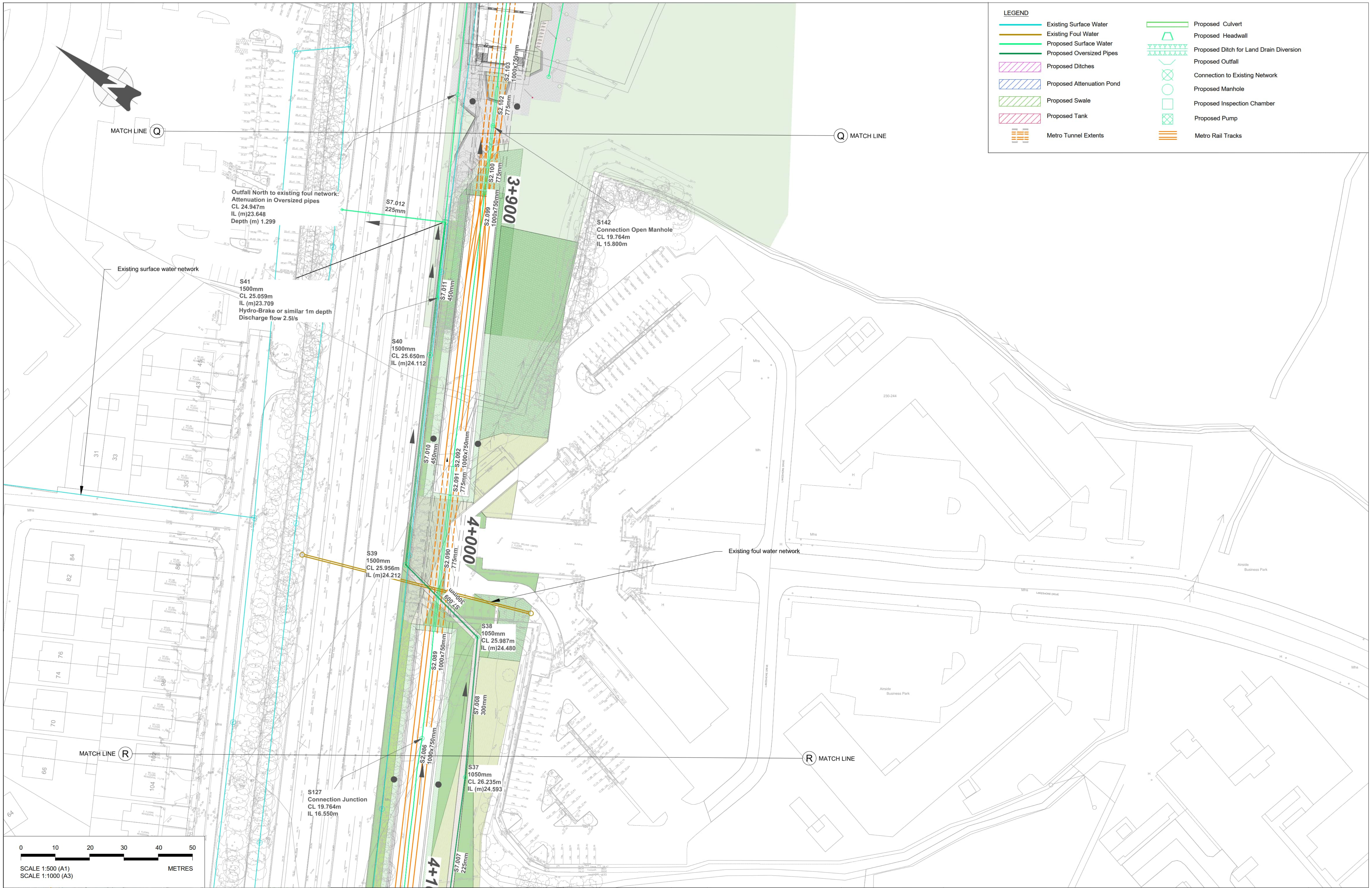
Drawing Status: S0

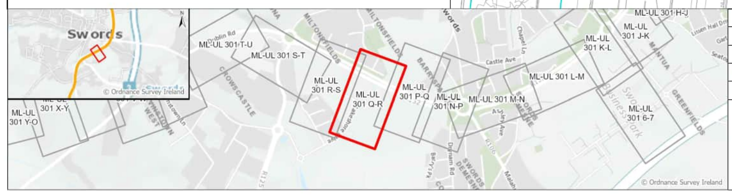
Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02019

Plan Drawing Nº: ML-UC 301 P-Q

Scales Original Size A1 1:500

Sheet 1 of 1





P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS
REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE AIRSIDE BUSINESS PARK (SHEET 1 OF 2)

Drawing Status: S0

Consultant: JACOBS, IDOM

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02020

Plan Drawing Nº: ML-UC 301 Q-R

Scales Original Size A1 1:500

Sheet 1 of 2

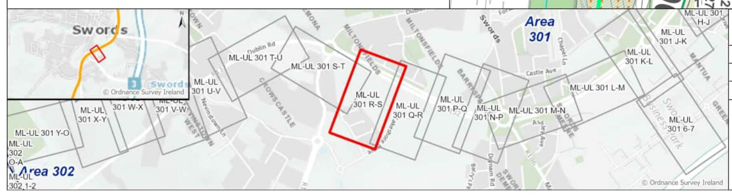
LEGEND

	Existing Surface Water		Proposed Culvert
	Existing Foul Water		Proposed Headwall
	Proposed Surface Water		Proposed Ditch for Land Drain Diversion
	Proposed Oversized Pipes		Proposed Outfall
	Proposed Ditches		Connection to Existing Network
	Proposed Attenuation Pond		Proposed Manhole
	Proposed Swale		Proposed Inspection Chamber
	Proposed Tank		Proposed Pump
	Metro Tunnel Extents		Metro Rail Tracks

0 10 20 30 40 50

SCALE 1:500 (A1) METRES

SCALE 1:1000 (A3)



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE AIRSIDE BUSINESS PARK (SHEET 2 OF 2)

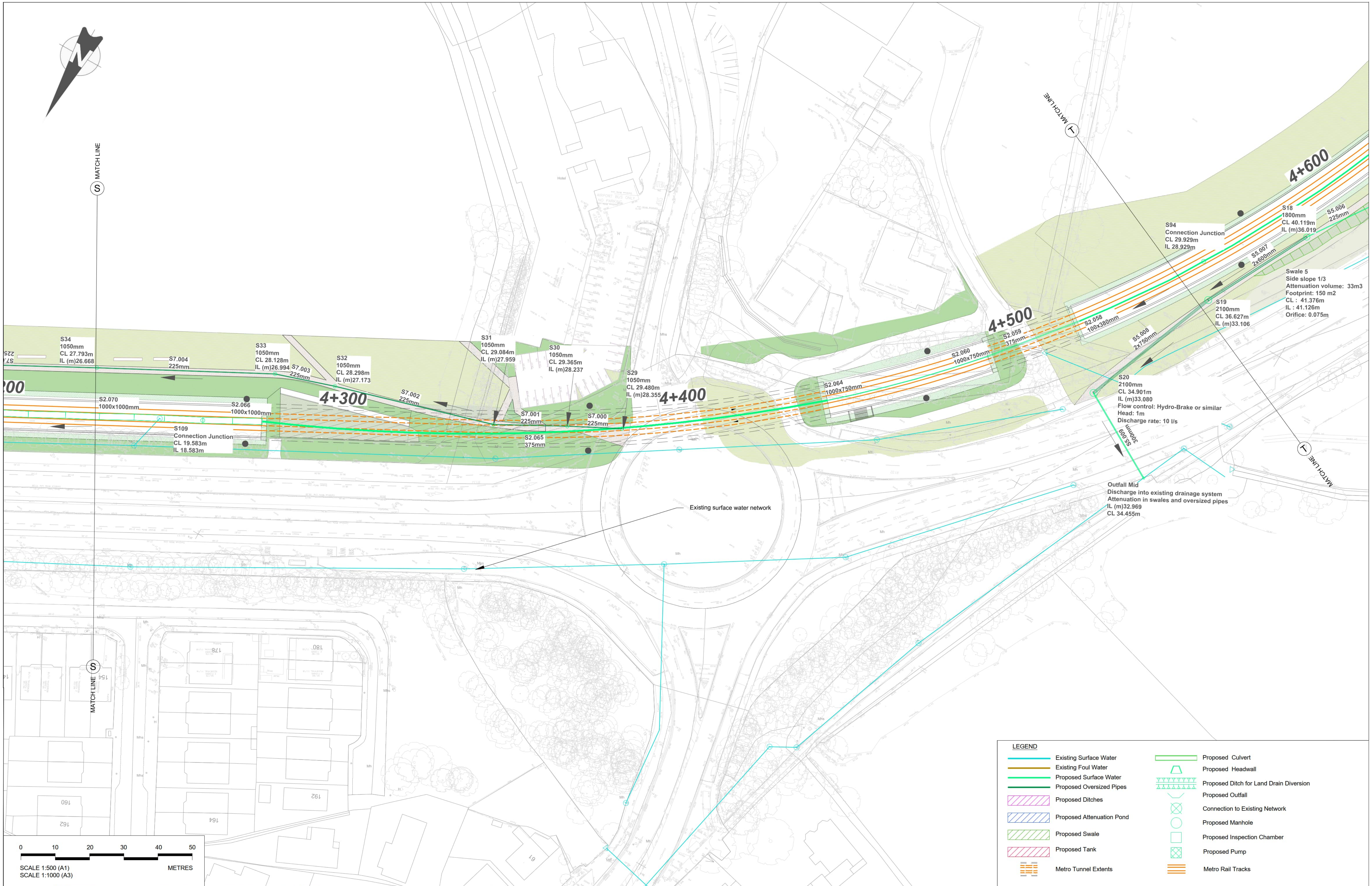
Drawing Status: S0

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02021

Plan Drawing Nº: ML-UC 301 R-S

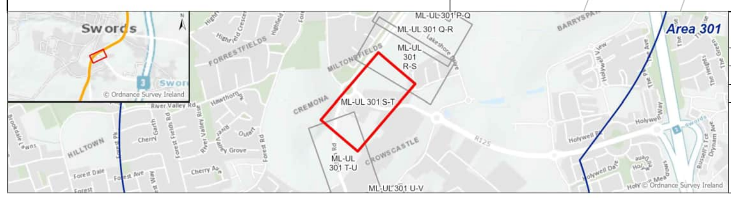
Scales Original Size A1 1:500

Sheet 2 of 2



LEGEND

	Existing Surface Water		Proposed Culvert
	Existing Foul Water		Proposed Headwall
	Proposed Surface Water		Proposed Ditch for Land Drain Diversion
	Proposed Oversized Pipes		Proposed Outfall
	Proposed Ditches		Connection to Existing Network
	Proposed Attenuation Pond		Proposed Manhole
	Proposed Swale		Proposed Inspection Chamber
	Proposed Tank		Proposed Pump
	Metro Tunnel Extents		Metro Rail Tracks



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE PINNOCK HILL ROUNDABOUT

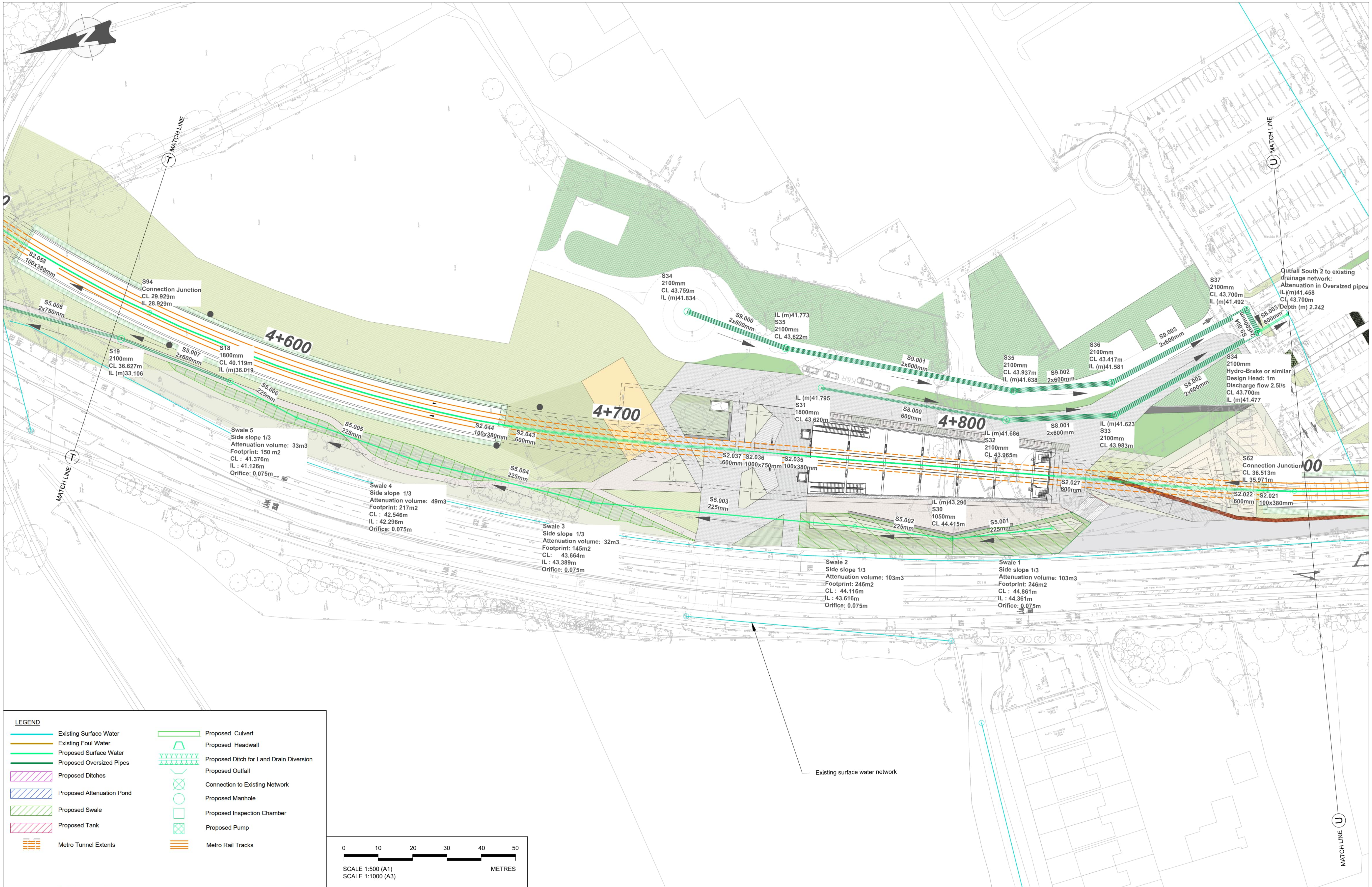
Drawing Status: S0

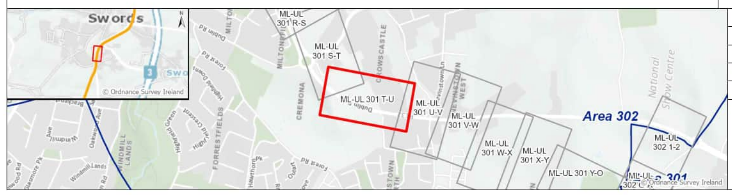
Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02022

Plan Drawing Nº: ML-UC 301 S-T

Scales Original Size A1 1:500

Sheet 1 of 1





P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS
REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA
Project: METROLINK
Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE AIRSIDE SHOPPING CENTRE (SHEET 1 OF 2)

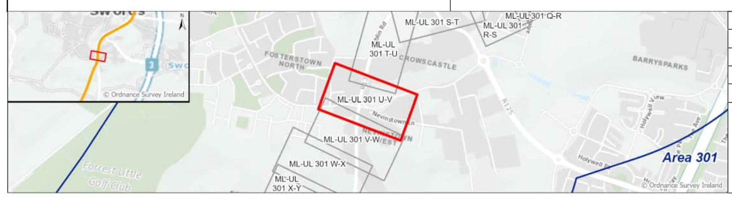
Drawing Status: S0

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02023

Plan Drawing Nº: ML-UC 301 T-U

Scales Original Size A1 1:500

Sheet 1 of 2



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE AIRSIDE SHOPPING CENTRE (SHEET 2 OF 2)

Drawing Status: S0

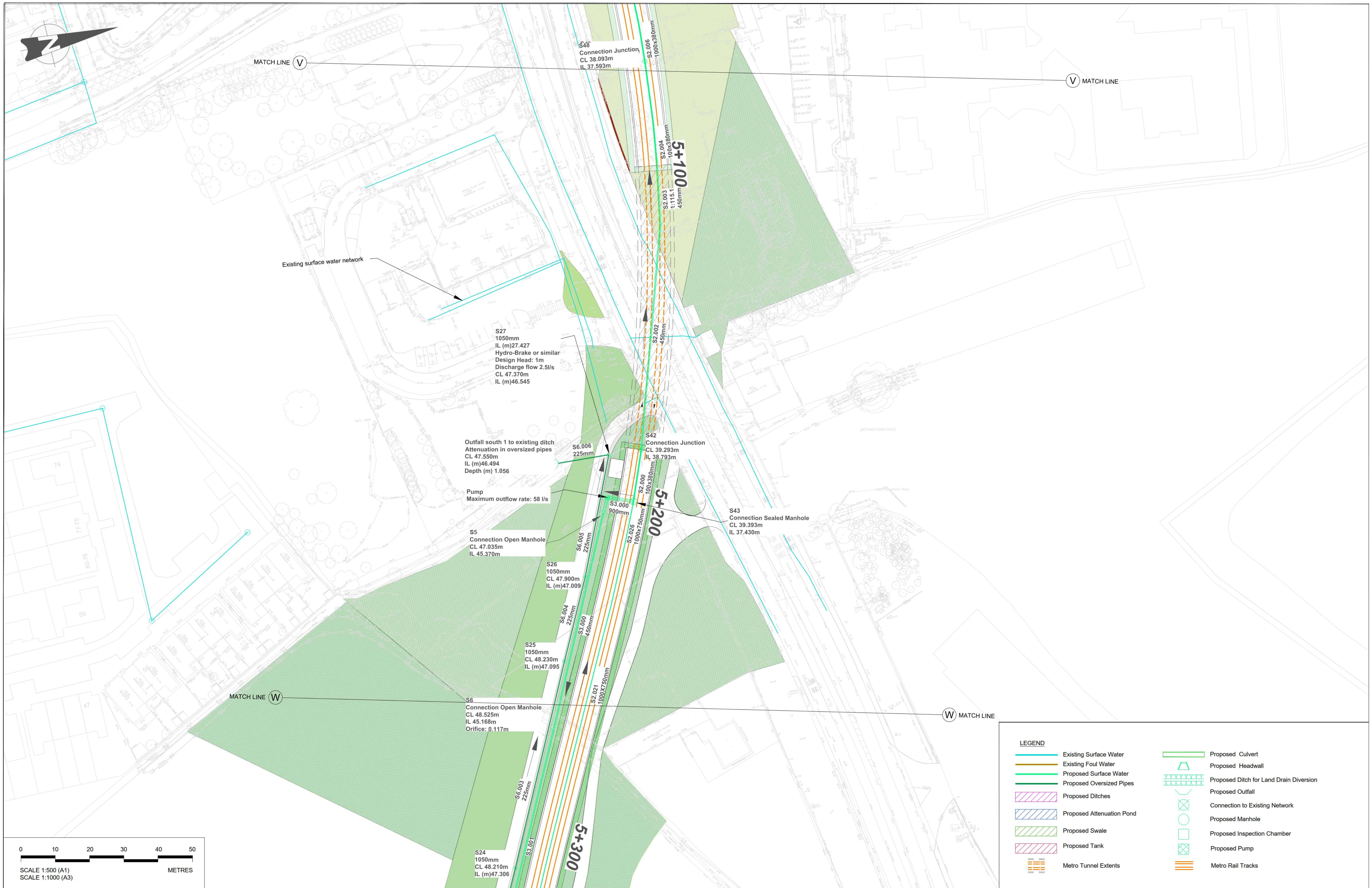
Consultant: JACOBS, IDOM

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02024

Plan Drawing Nº: ML-UC 301 U-V

Scales Original Size A1 1:500

Sheet 2 of 2



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII / NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS / IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE NEVINSTOWN

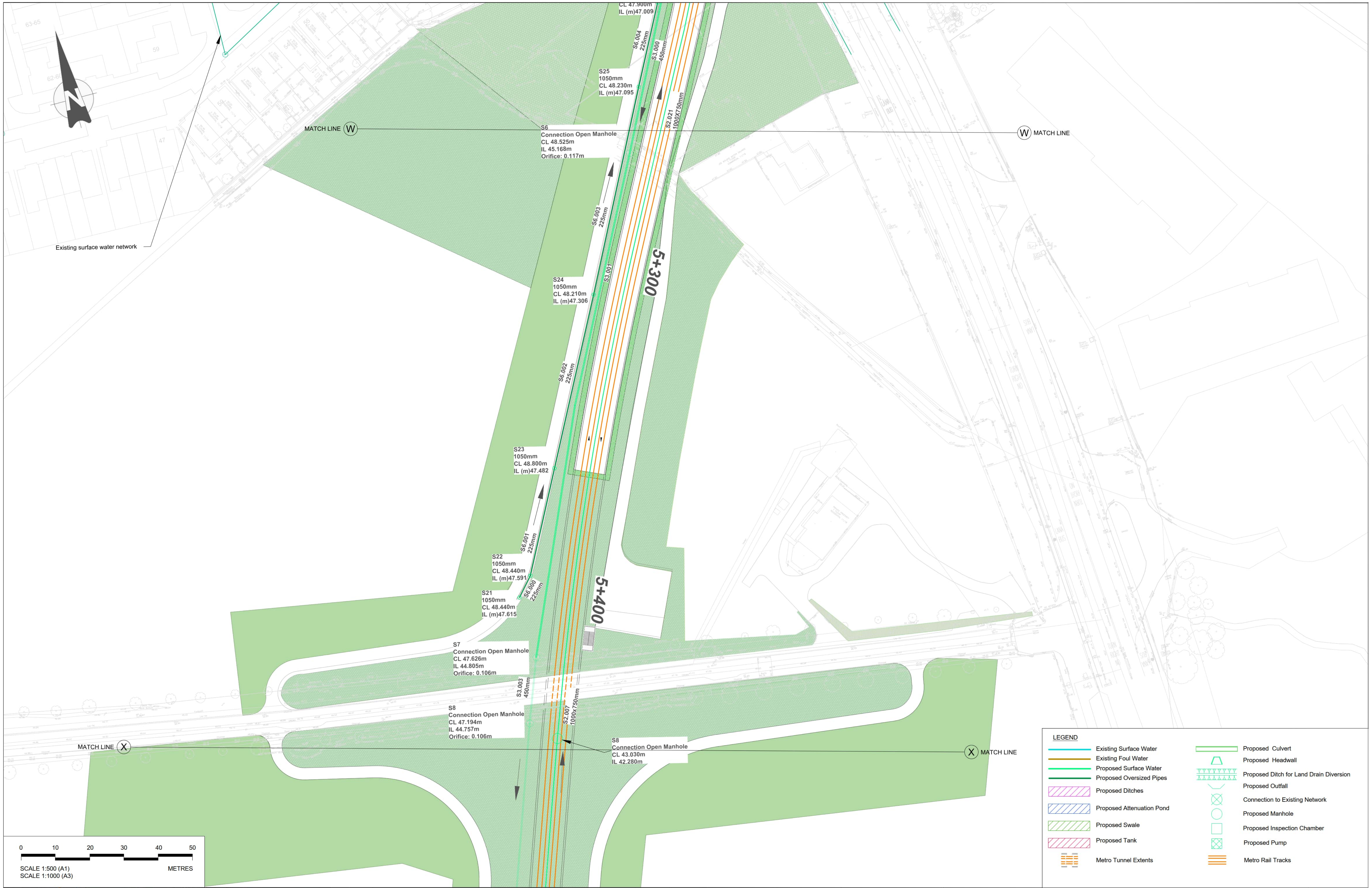
Drawing Status: S0

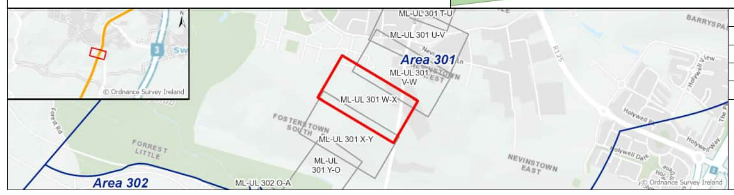
Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02025

Plan Drawing Nº: ML-UC 301 V-W

Scales Original Size A1 1:500

Sheet 1 of 1





P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS
REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE FOSTERSTOWN (SHEET 1 OF 3)

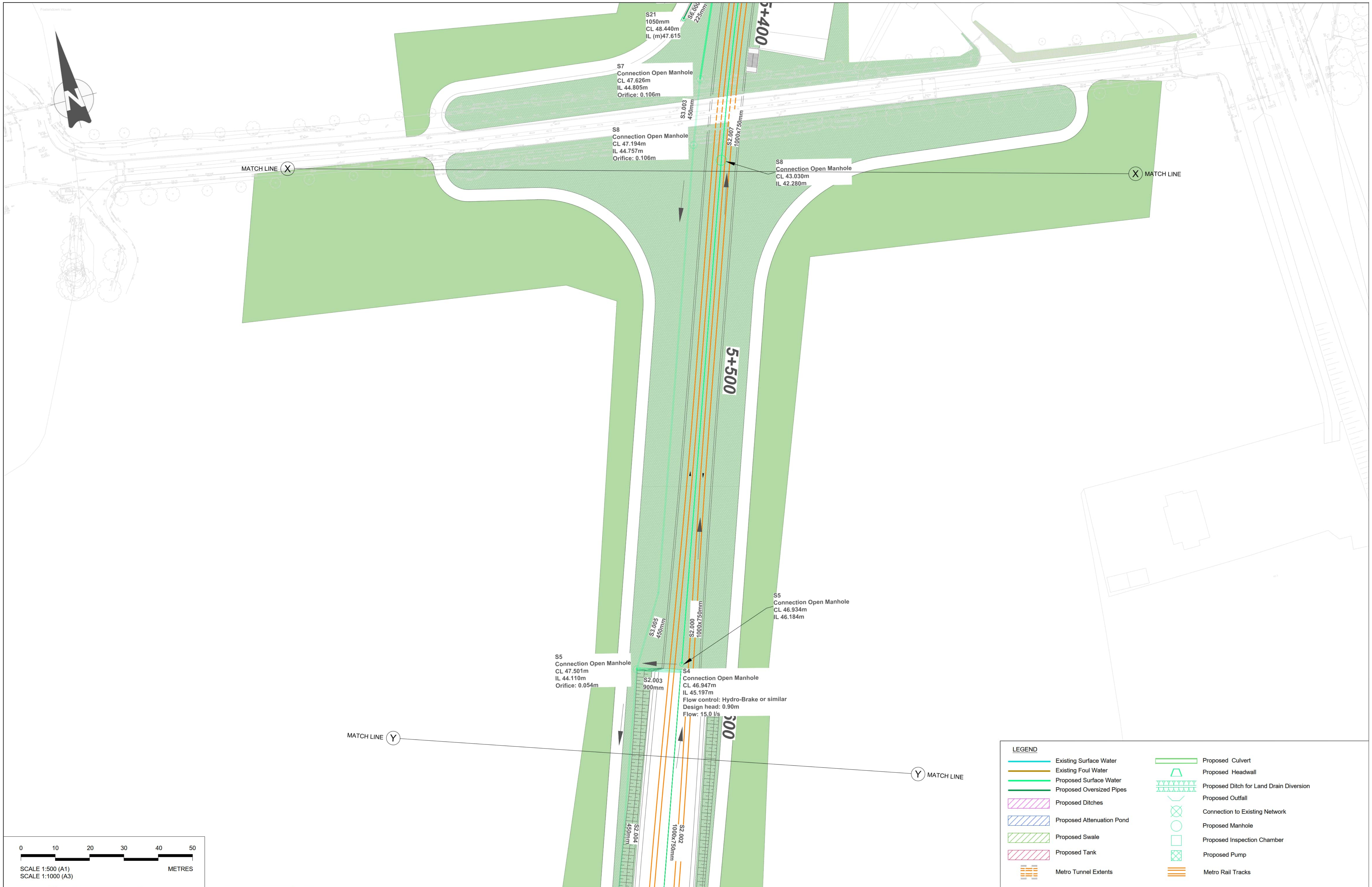
Drawing Status: S0

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02026

Plan Drawing Nº: ML-UC 301 W-X

Scales Original Size A1 1:500

Sheet 1 of 3



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

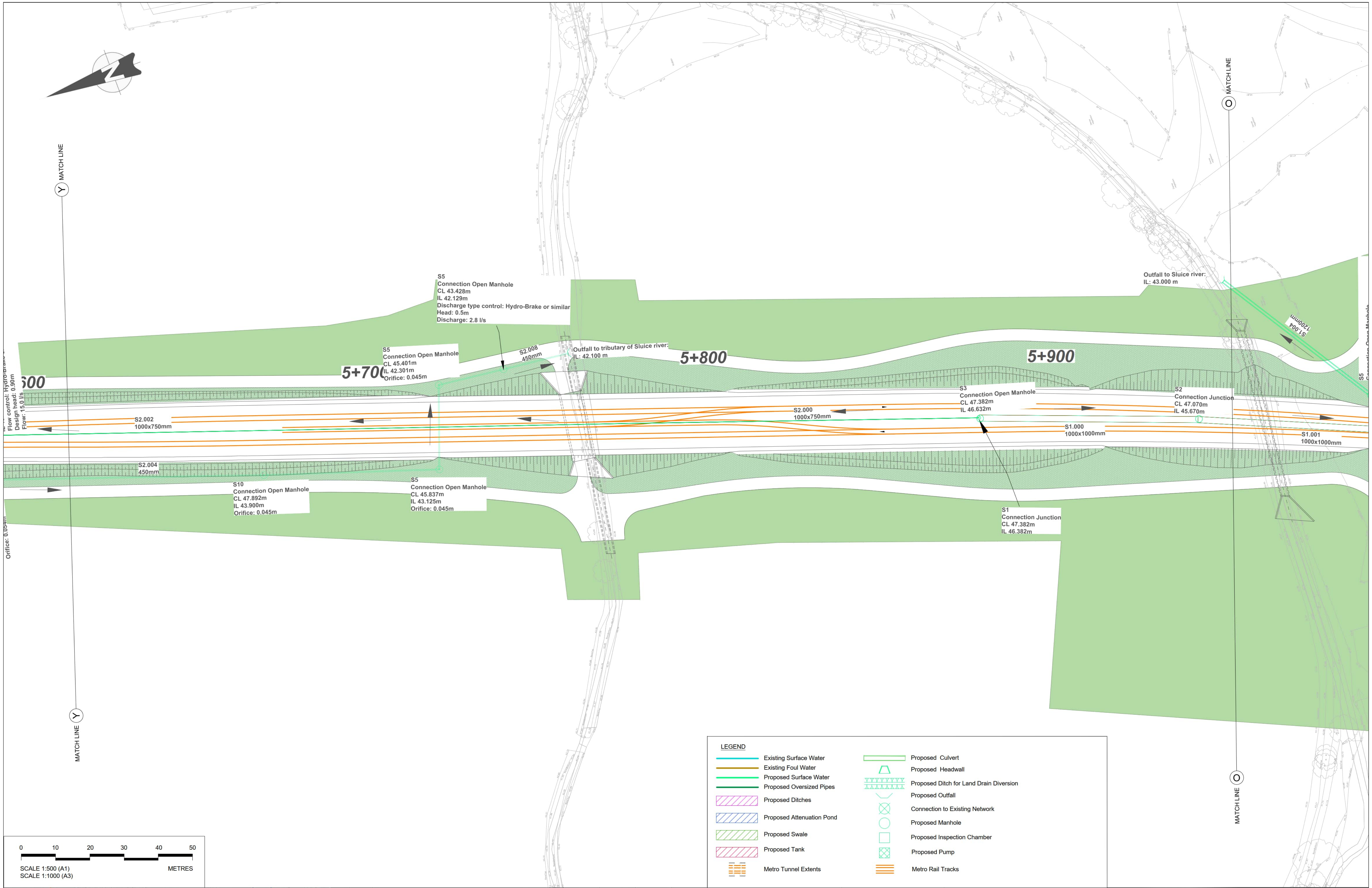
Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE FOSTERSTOWN (SHEET 2 OF 3)

Drawing Status: S0

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02027

Plan Drawing Nº: ML-UC 301 X-Y

Scales Original Size A1 1:500



P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS
REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE FOSTERSTOWN (SHEET 3 OF 3)

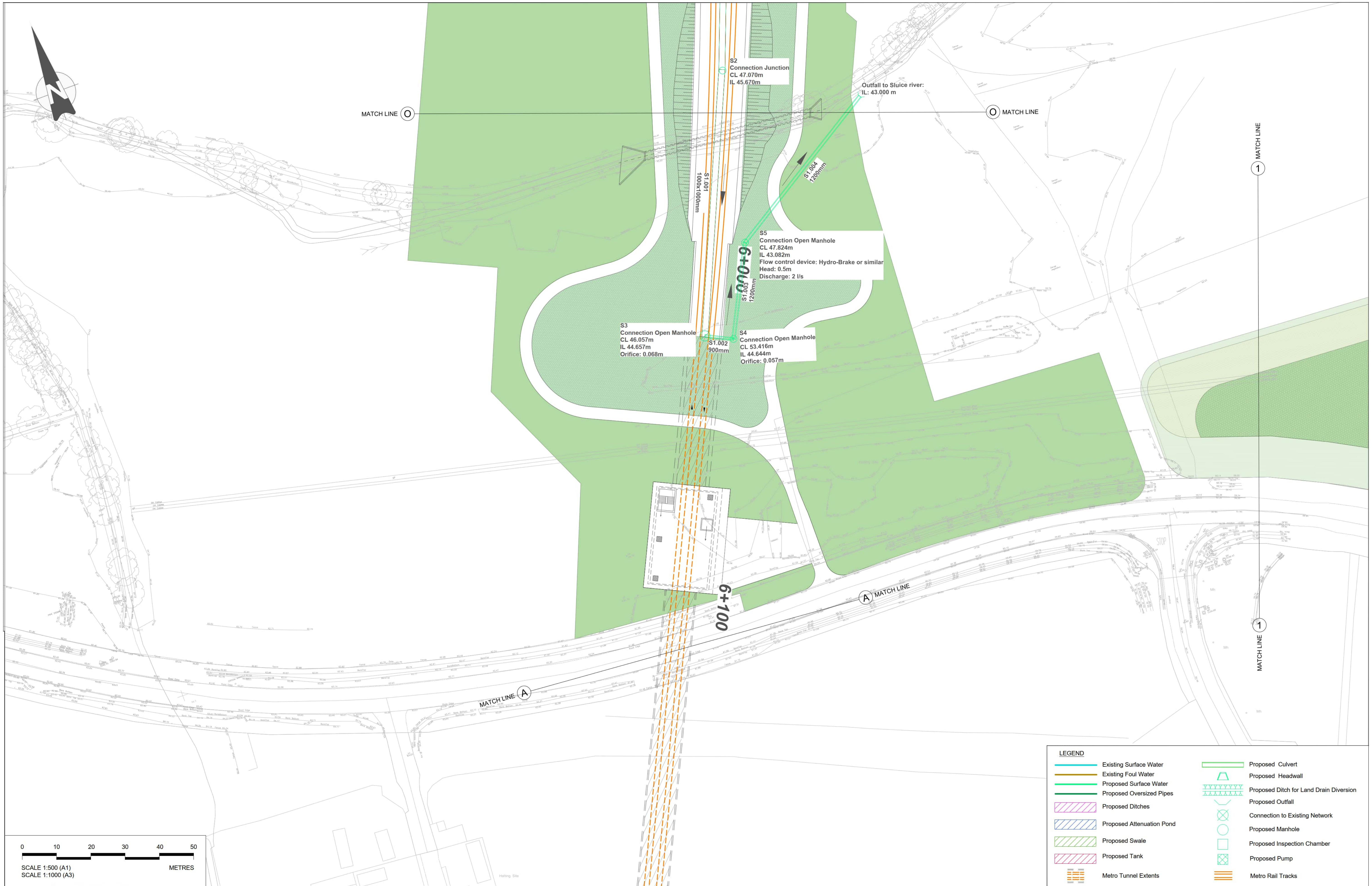
Drawing Status: S0

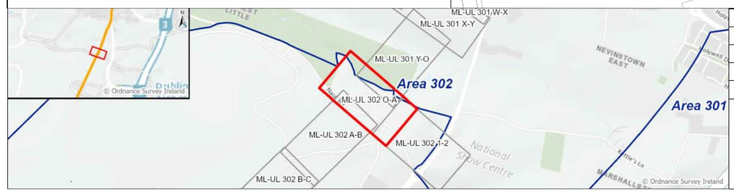
Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02028

Plan Drawing Nº: ML-UC 301 Y-O

Scales Original Size A1 1:500

Sheet 3 of 3





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinales are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE NAUL ROAD

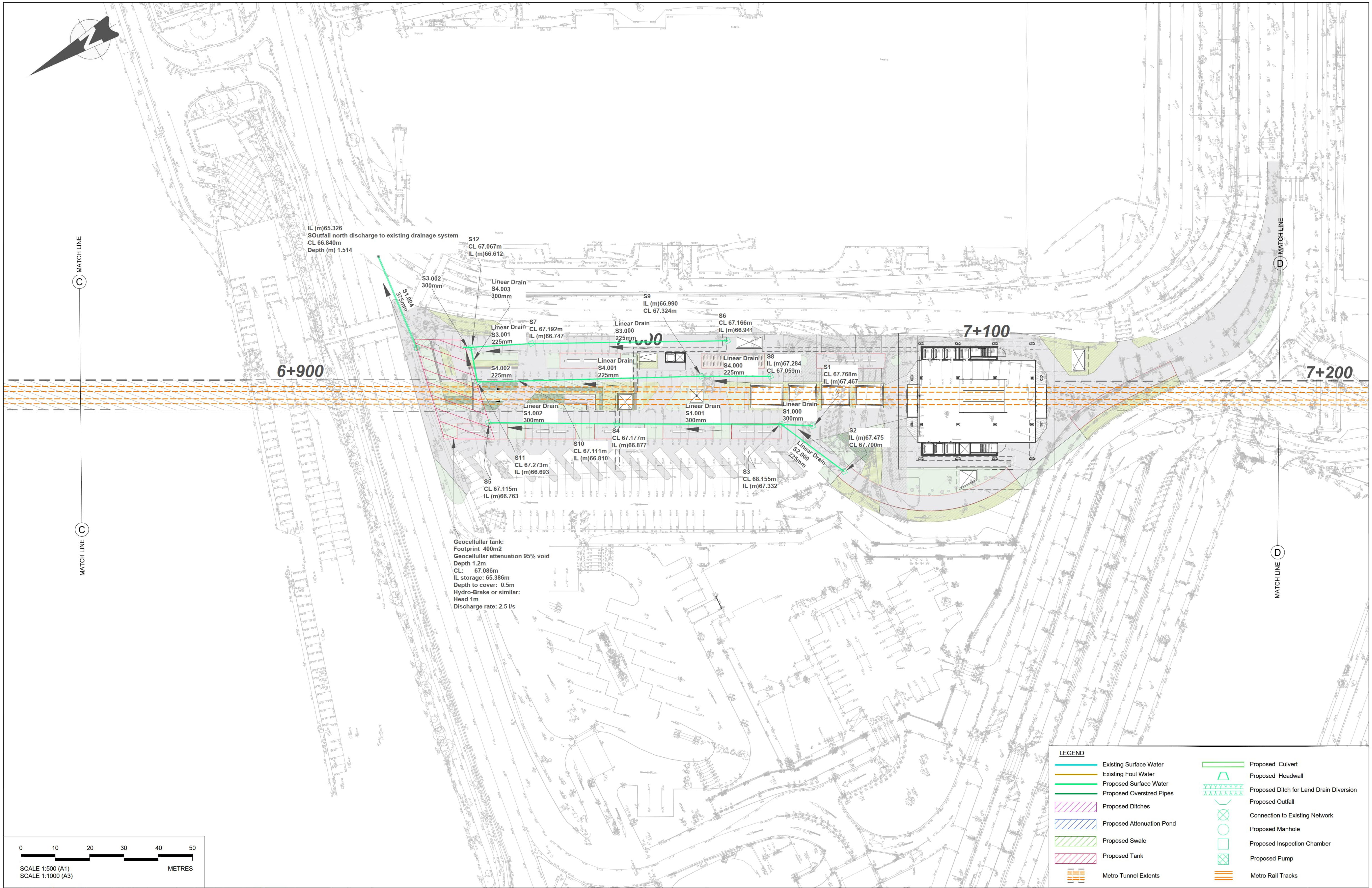
Drawing Status: S0

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02029

Plan Drawing Nº: ML-UC 302 O-A

Scales Original Size A1 1:500

Sheet 1 of 1



P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS
REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Consultant: JACOBS, IDOM

Project: METROLINK

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE DUBLIN AIRPORT (SHEET 2 OF 5)

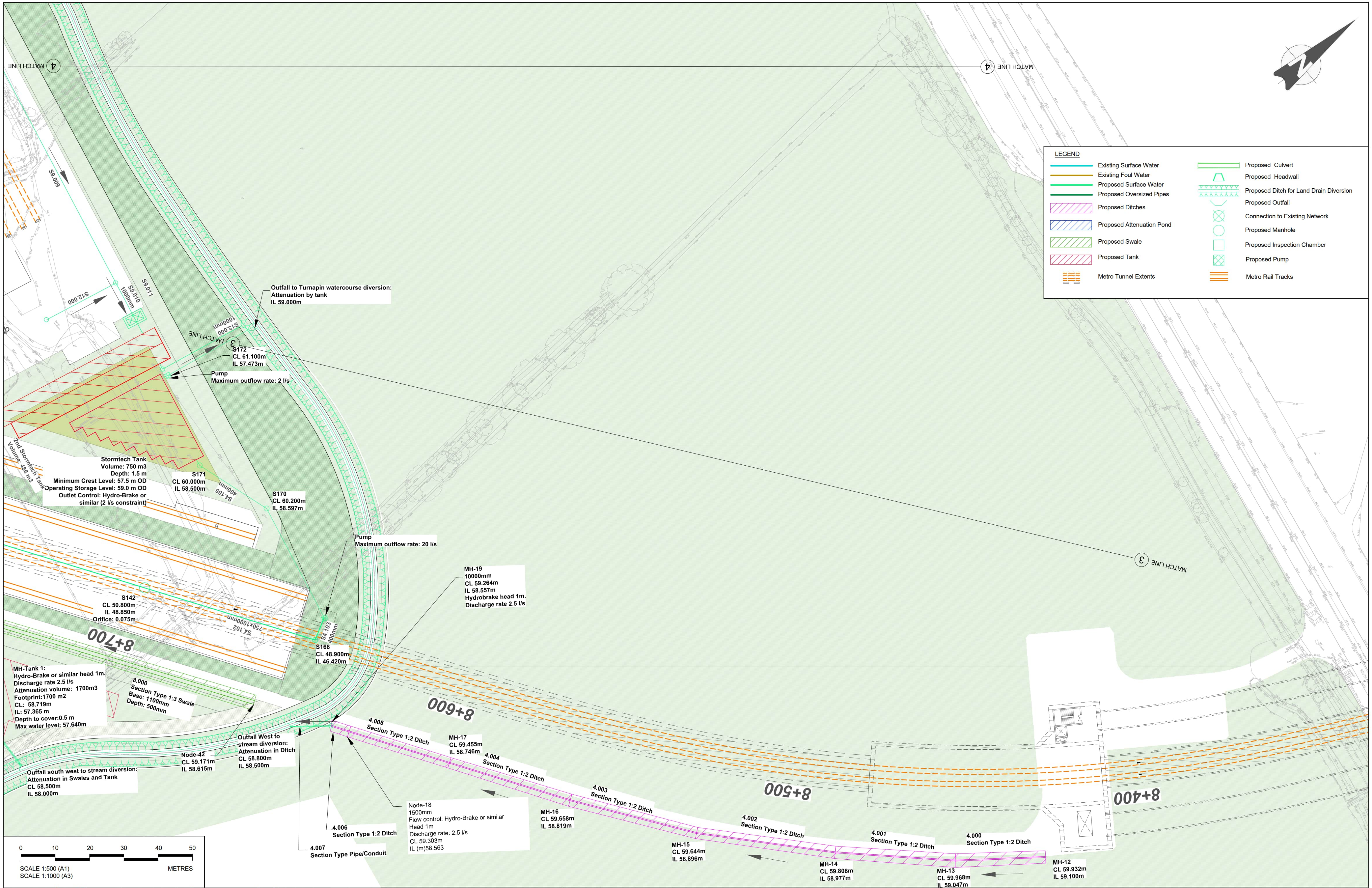
Drawing Status: S0

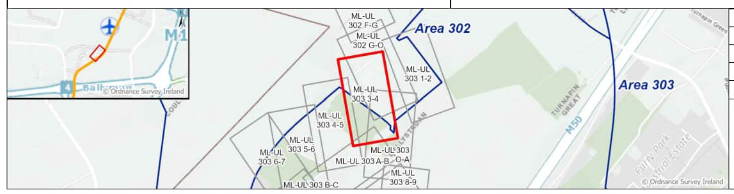
Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02032

Plan Drawing Nº: ML-UC 302 C-D

Scales Original Size A1 1:500

Sheet 2 of 5





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE BALLYSTRAUN (SHEET 3 OF 7)

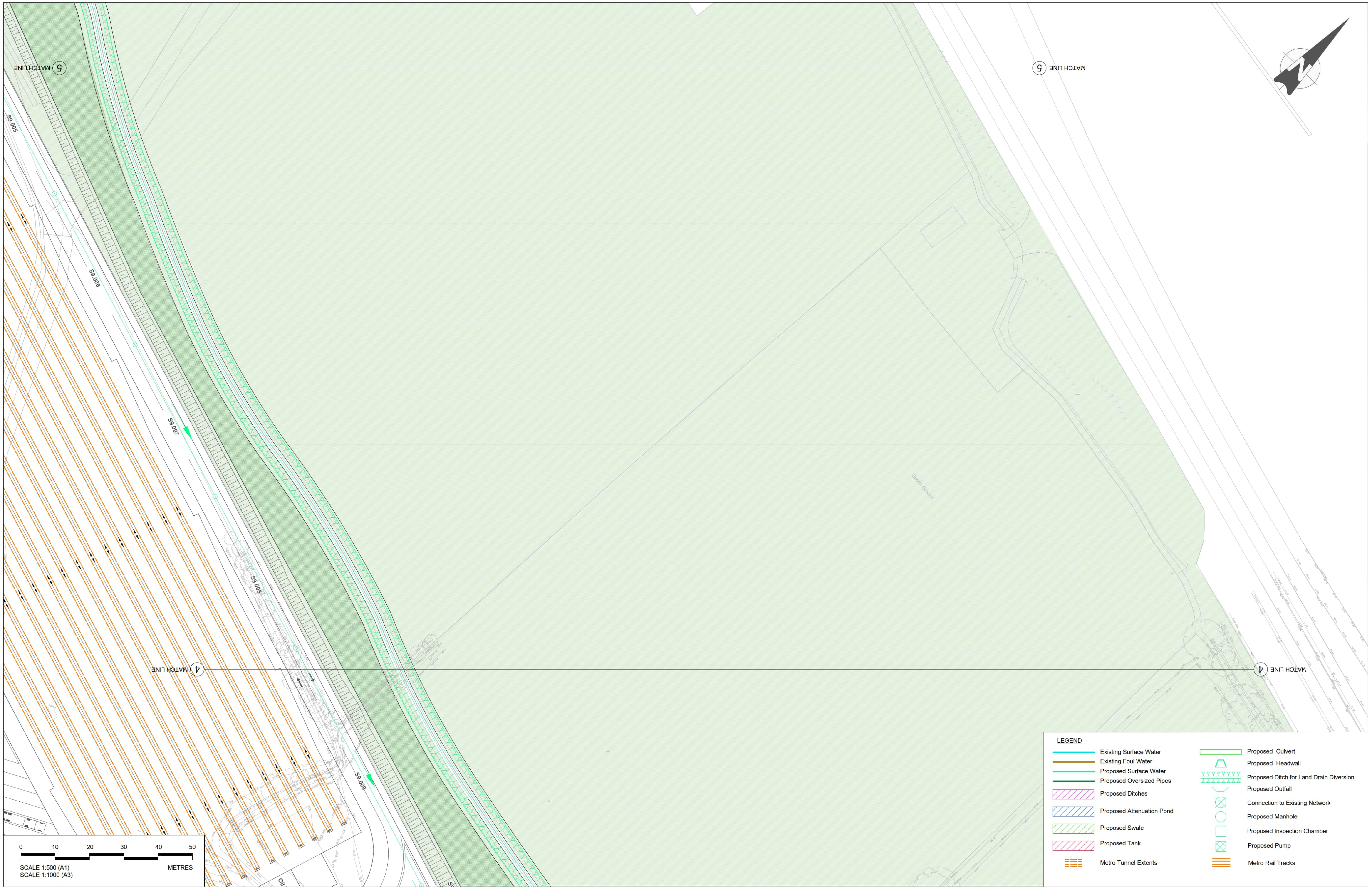
Drawing Status: S0

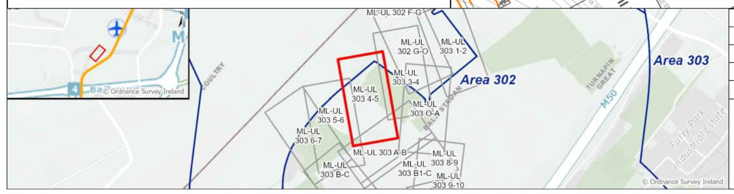
Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02038

Plan Drawing Nº: ML-UC 303 3-4

Scales Original Size A1 1:500

Sheet 3 of 7





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE BALLYSTRAUN (SHEET 4 OF 7)

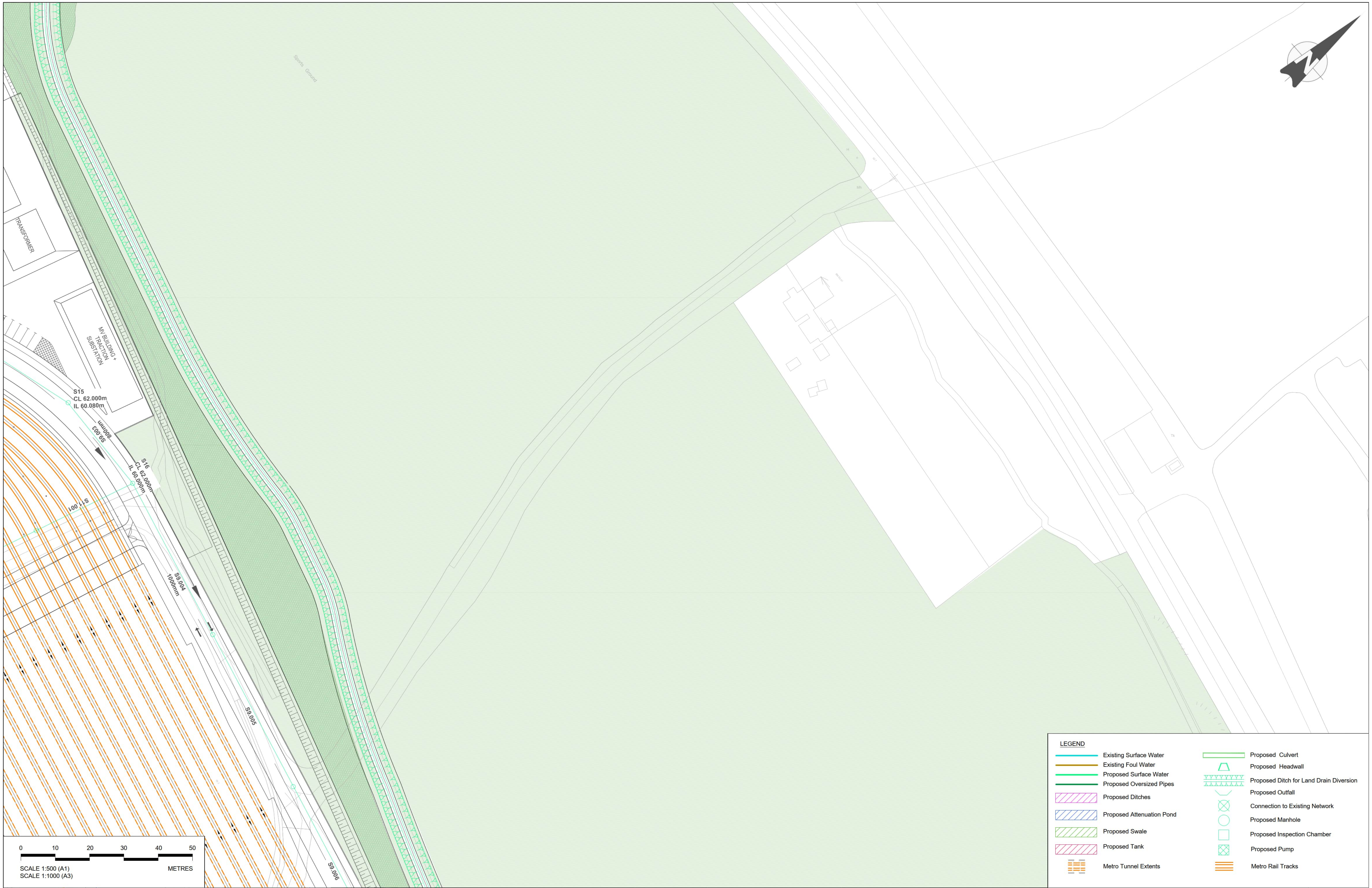
Drawing Status: S0

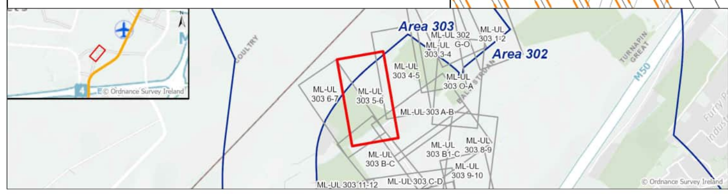
Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02039

Plan Drawing Nº: ML-UC 303 4-5

Scales Original Size A1 1:500

Sheet 4 of 7





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE BALLYSTRAUN (SHEET 5 OF 7)

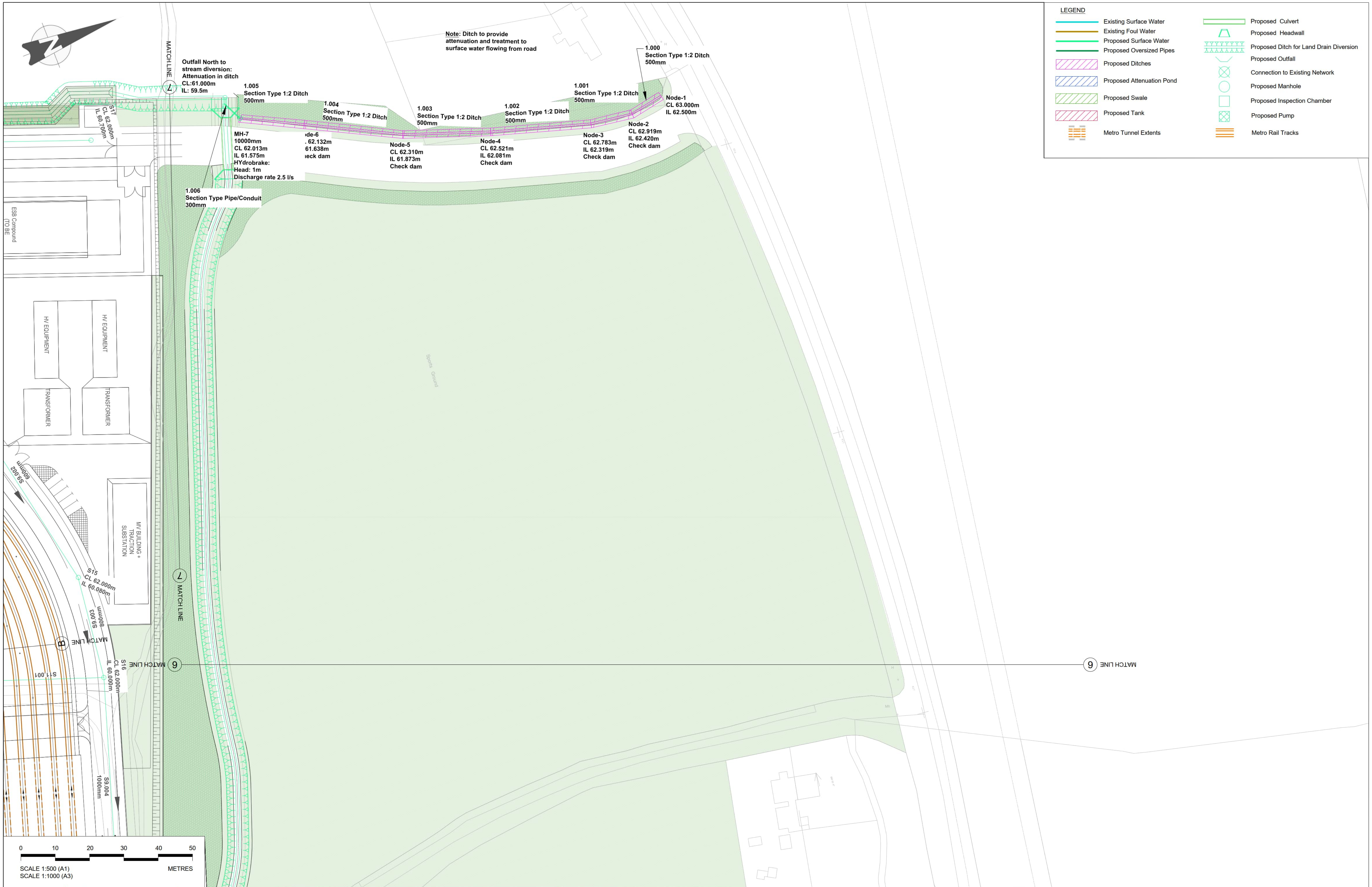
Drawing Status: S0

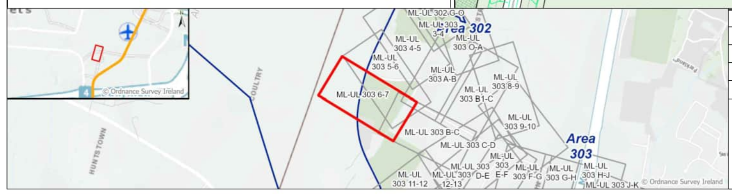
Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02040

Plan Drawing Nº: ML-UC 303 5-6

Scales Original Size A1 1:500

Sheet 5 of 7





P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS
REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII / NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE COULTRY

Drawing Status: S0

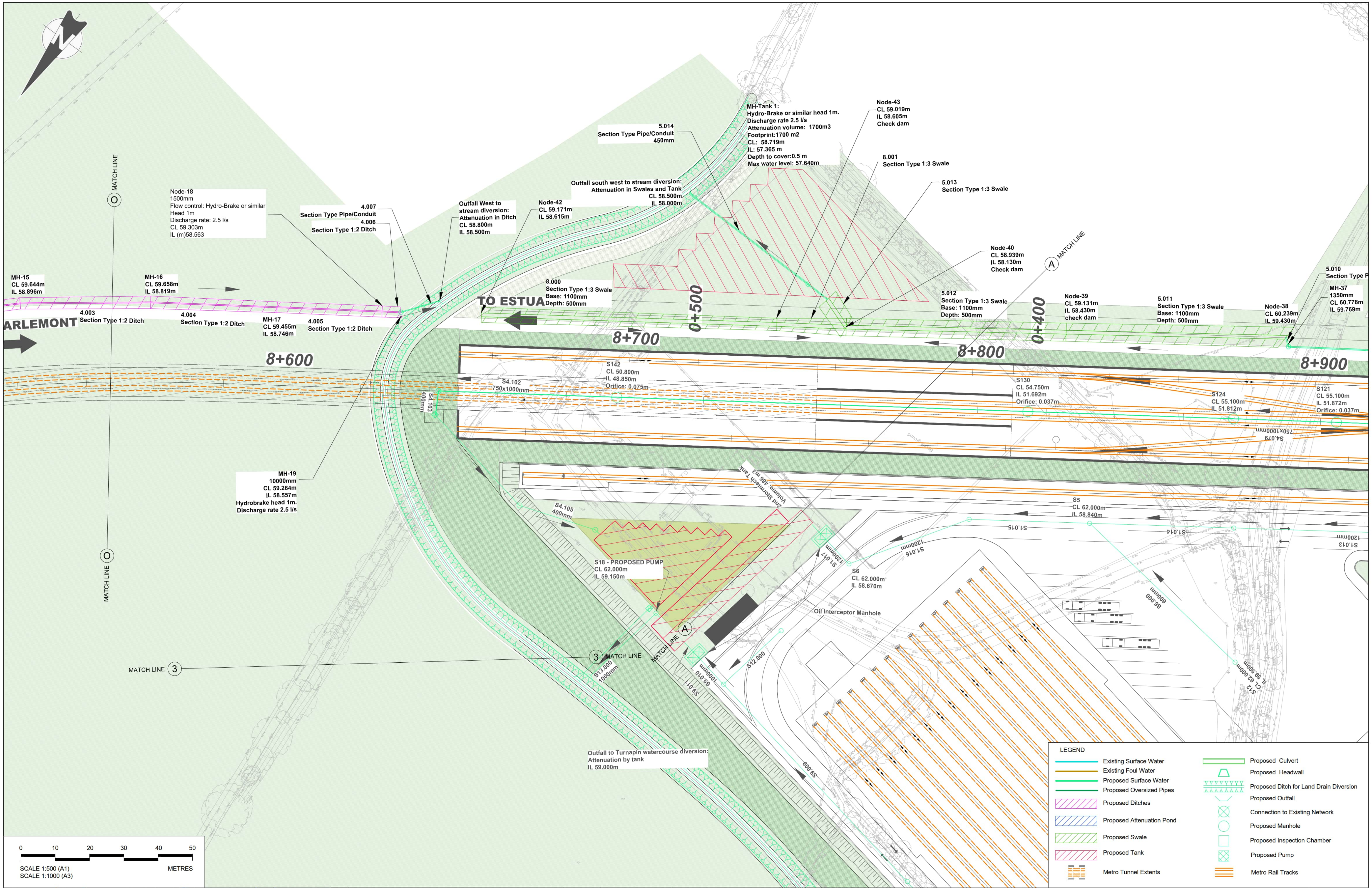
Consultant: JACOBS IDOM

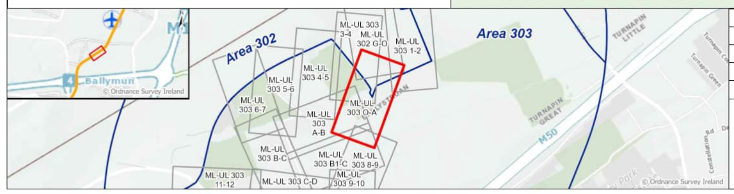
Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02041

Plan Drawing Nº: ML-UC 303 6-7

Scales Original Size A1 1:500

Sheet 1 of 1





REV	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE BALLYSTRAUN (SHEET 6 OF 7)

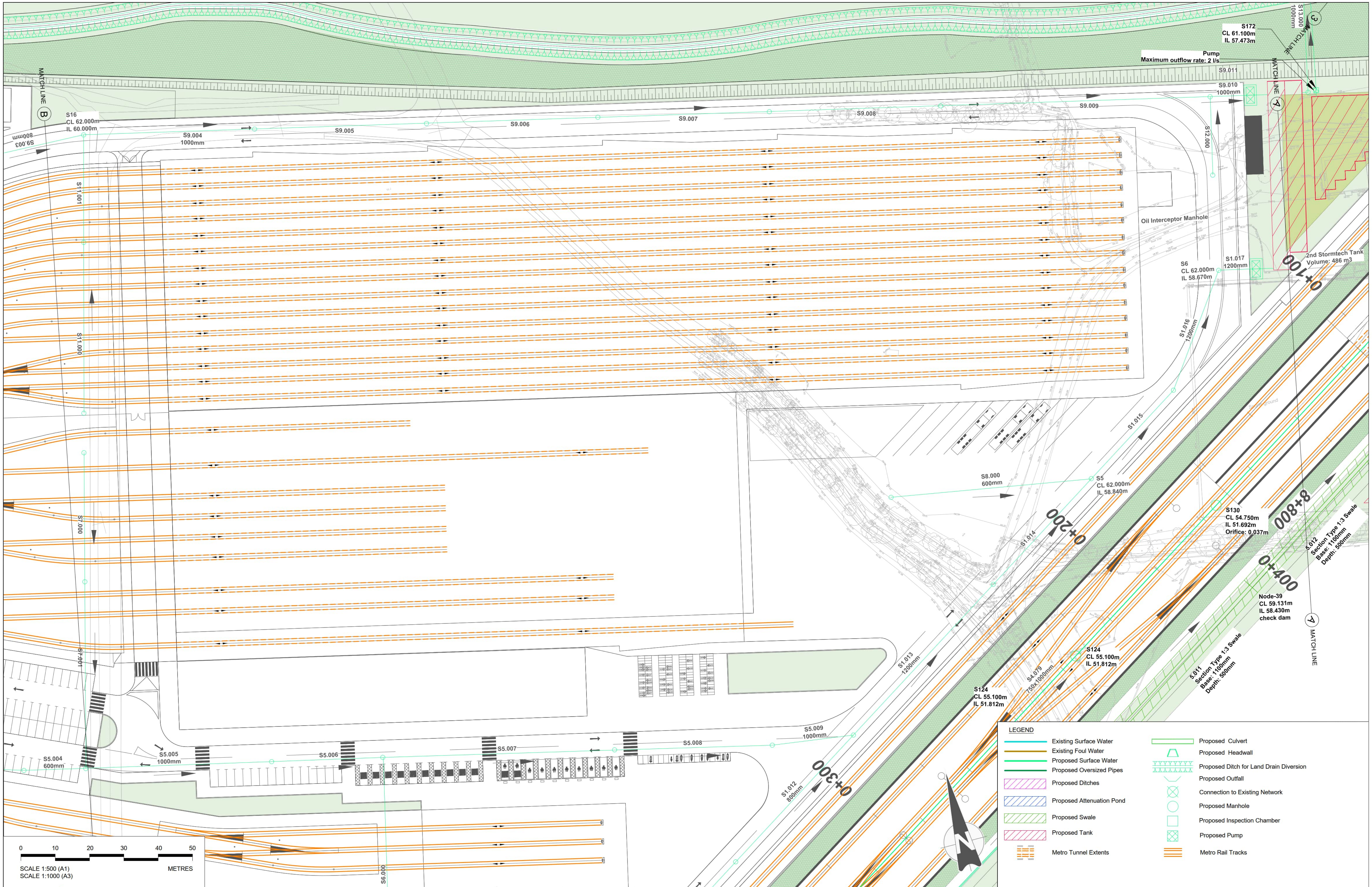
Drawing Status: S0

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02042

Plan Drawing Nº: ML-UC 303 O-A

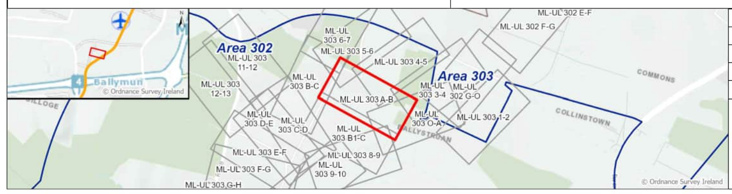
Scales Original Size A1 1:500

Sheet 6 of 7



LEGEND

	Existing Surface Water		Proposed Culvert
	Existing Foul Water		Proposed Headwall
	Proposed Surface Water		Proposed Ditch for Land Drain Diversion
	Proposed Oversized Pipes		Proposed Outfall
	Proposed Ditches		Connection to Existing Network
	Proposed Attenuation Pond		Proposed Manhole
	Proposed Swale		Proposed Inspection Chamber
	Proposed Tank		Proposed Pump
	Metro Tunnel Extents		Metro Rail Tracks



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE BALLYSTRAUN (SHEET 7 OF 7)

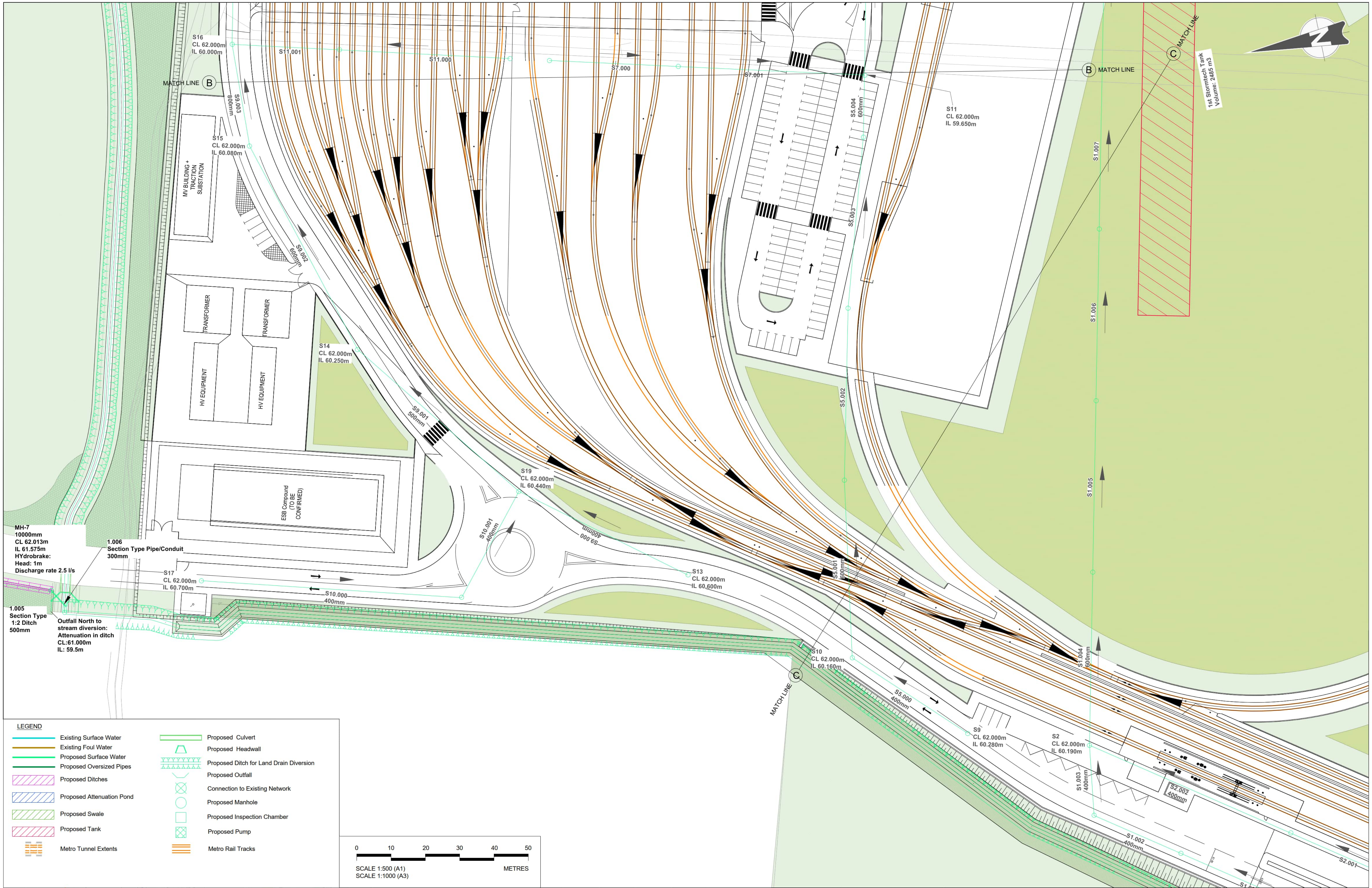
Drawing Status: S0

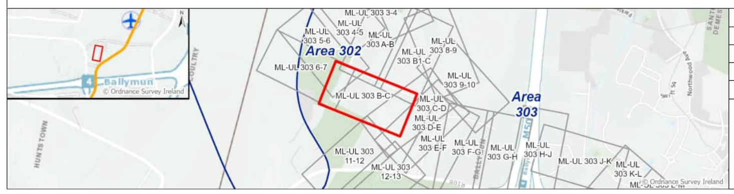
Consultant: JACOBS, IDOM

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02043

Plan Drawing Nº: ML-UC 303 A-B

Scales Original Size A1 1:500





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE BALLYMUN (SHEET 1 OF 11)

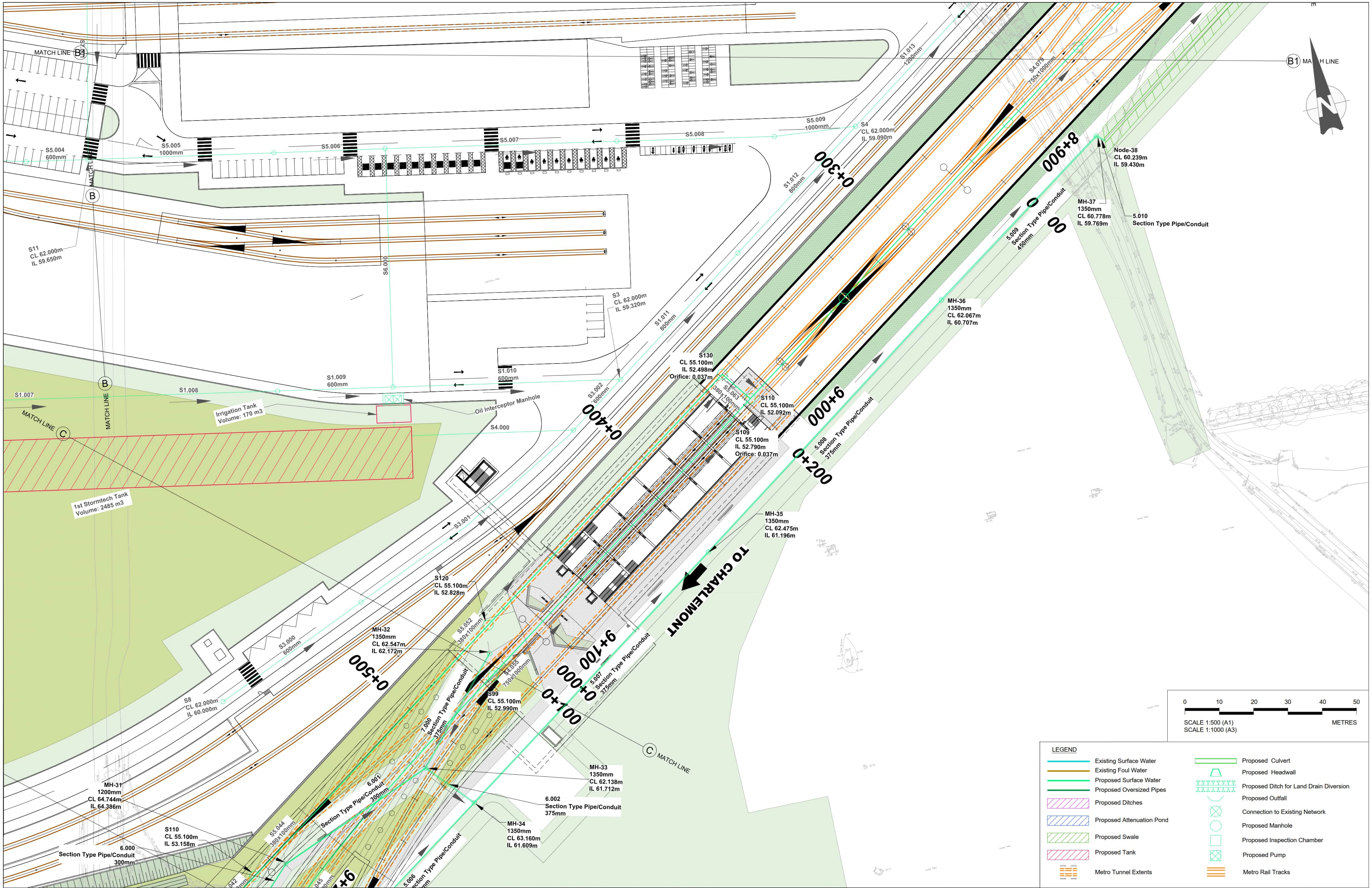
Drawing Status

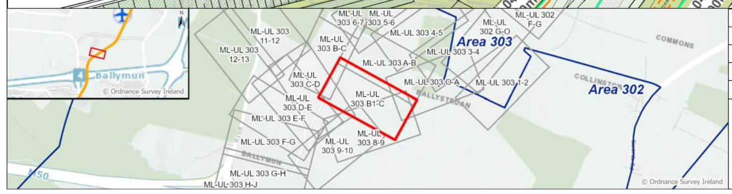
Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02044

Plan Drawing Nº: ML-UC 303 B-C

Scales Original Size A1 1:500

Sheet 1 of 11





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE BALLYMUN (SHEET 2 OF 11)

Drawing Status

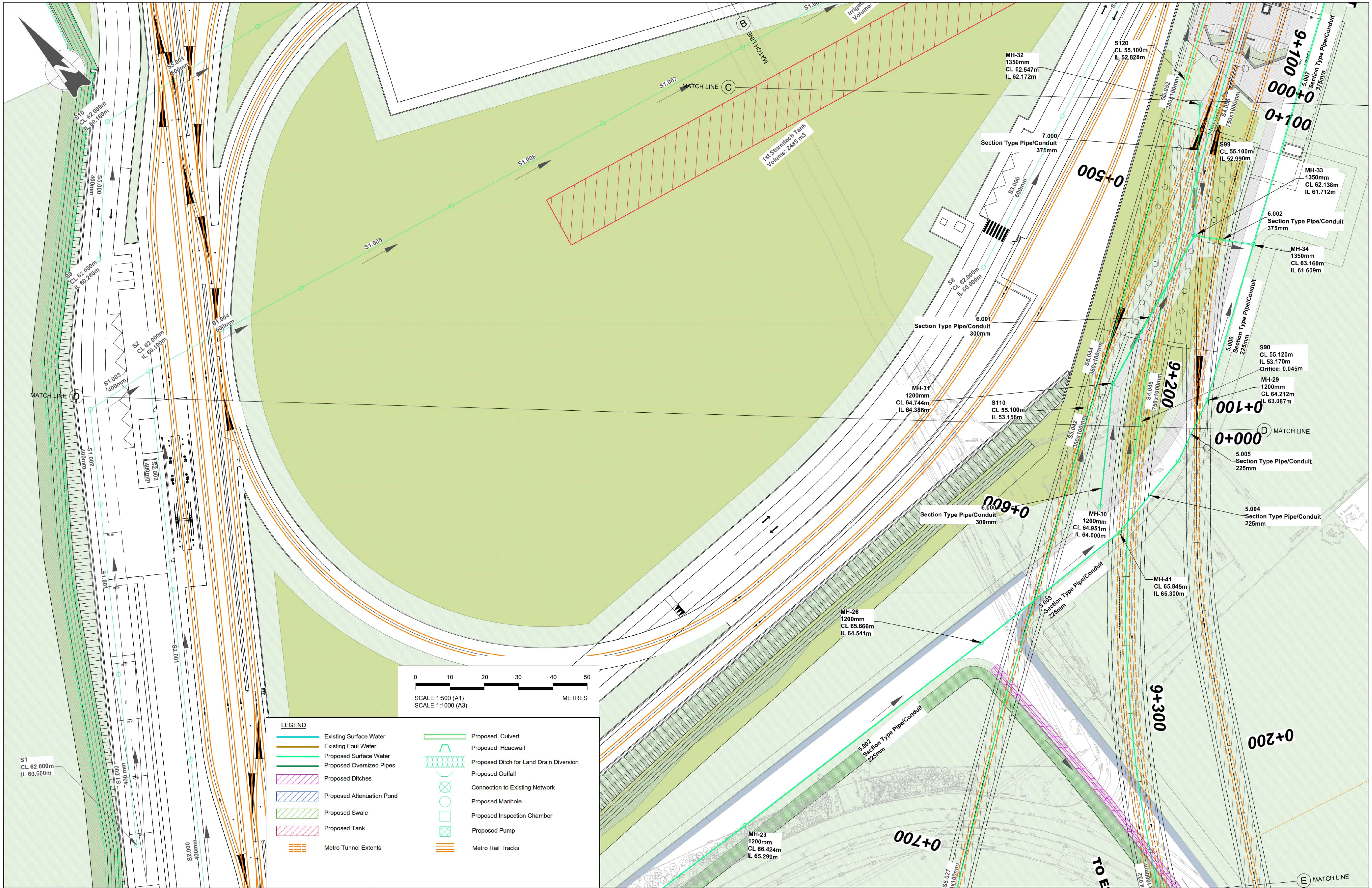
Consultant: JACOBS, IDOM

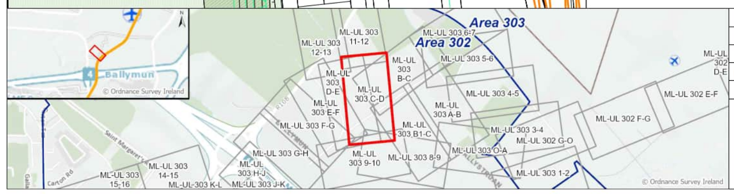
Drawing N°: ML1-JAI-URD-ROUT_XX-DR-Y-02045

Plan Drawing N°: ML-UC 303 B1-C

Scales Original Size A1: 1:500

Sheet 2 of 11





P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS
REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.

All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA — Údarás Náisiúnta Iompair, National Transport Authority

Project: METROLINK

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE BALLYMUN (SHEET 3 OF 11)

Drawing Status

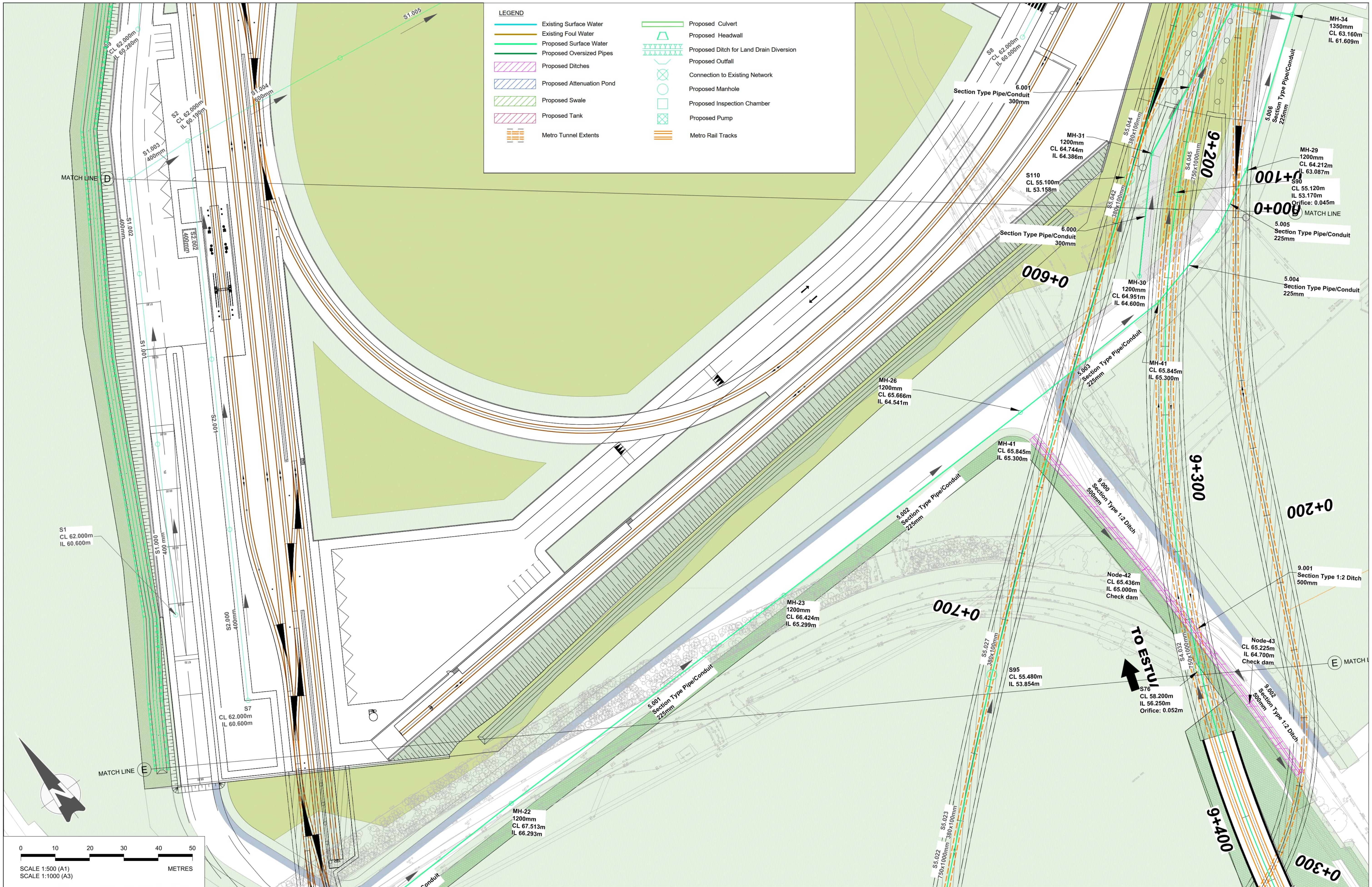
Consultant: JACOBS, IDOM

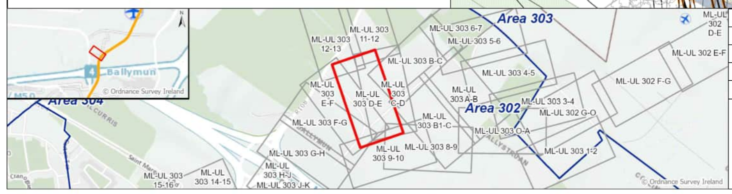
Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02046

Plan Drawing Nº: ML-UC 303 C-D

Scales Original Size A1 1:500

Sheet 3 of 11





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE BALLYMUN (SHEET 4 OF 11)

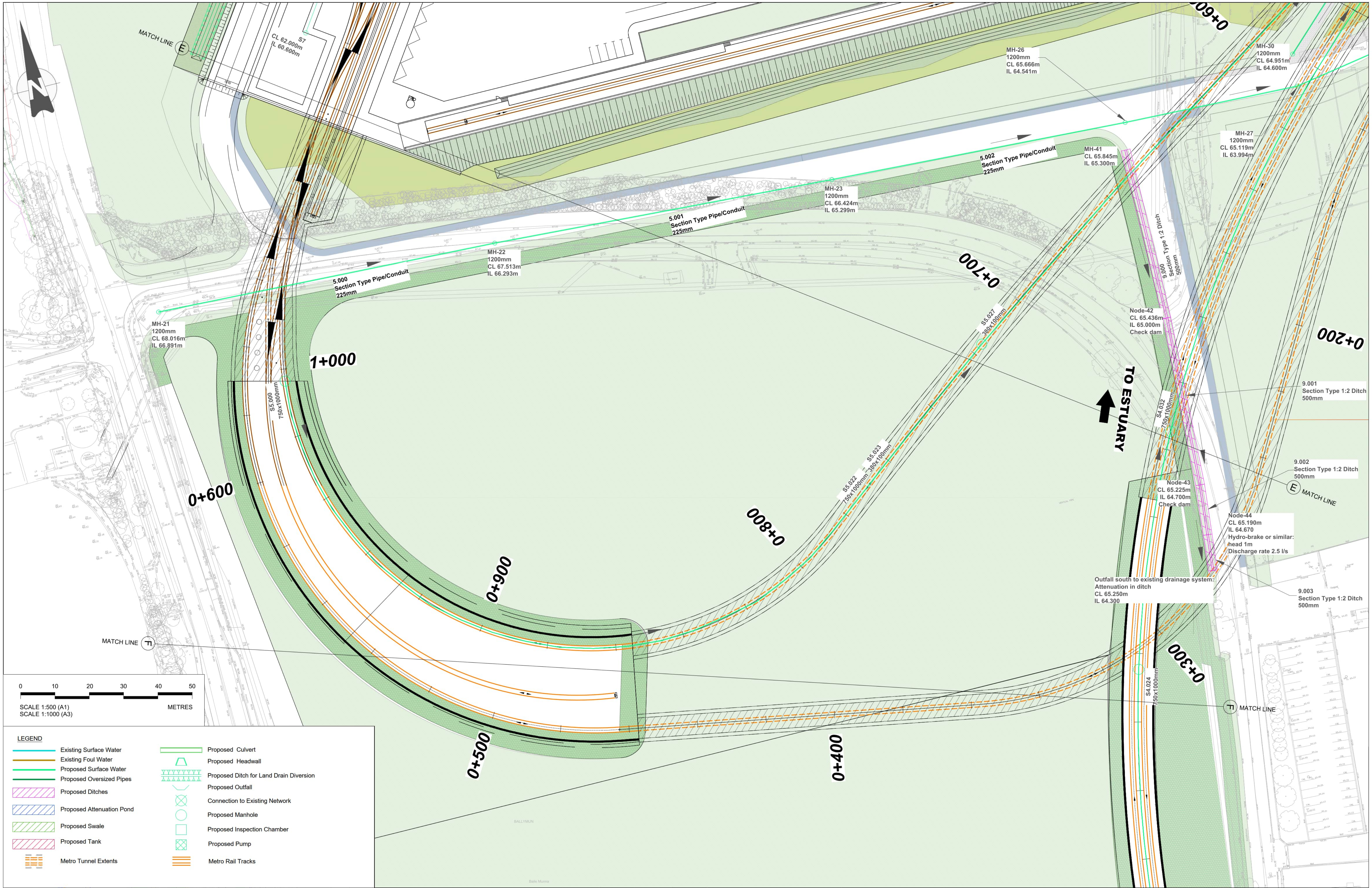
Drawing Status

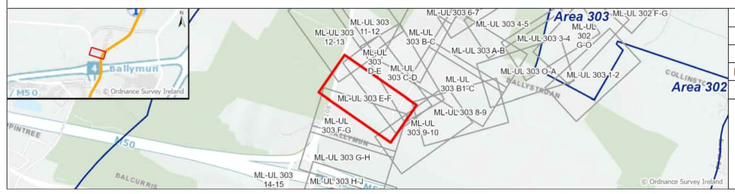
Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02047

Plan Drawing Nº: ML-UC 303 D-E

Scales Original Size A1 1:500

Sheet 4 of 11





REV	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA — Údarás Náisiúnta Iompair, National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE BALLYMUN (SHEET 5 OF 11)

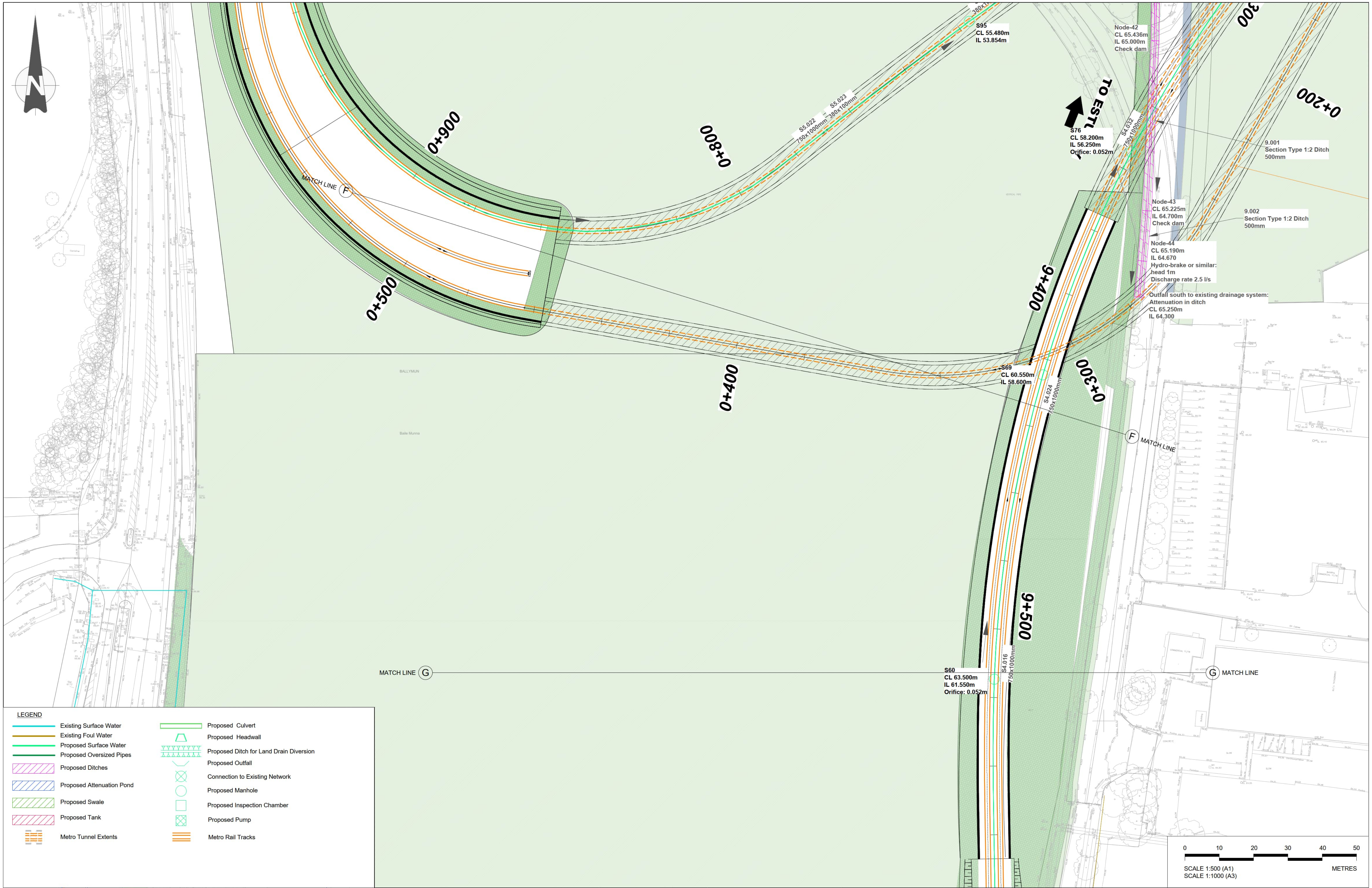
Drawing Status:

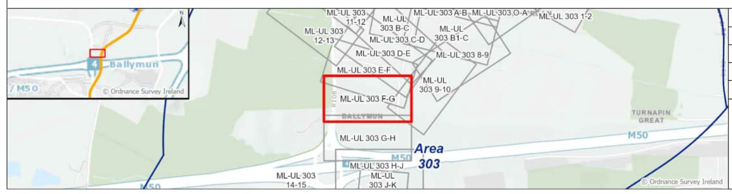
Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02048

Plan Drawing Nº: ML-UC 303 E-F

Scales Original Size A1 1:500

Sheet 5 of 11





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client

Project

METROLINK

Consultant

JACOBS IDOM

Drawing Title

METROLINK - PROPOSED SURFACE DRAINAGE
BALLYMUN (SHEET 6 OF 11)

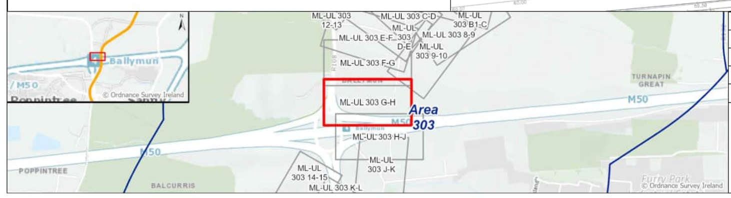
Drawing Status

Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02049

Plan Drawing Nº ML-UC 303 F-G

Scales Original Size A1 1:500

Sheet 6 of 11



P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS
REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

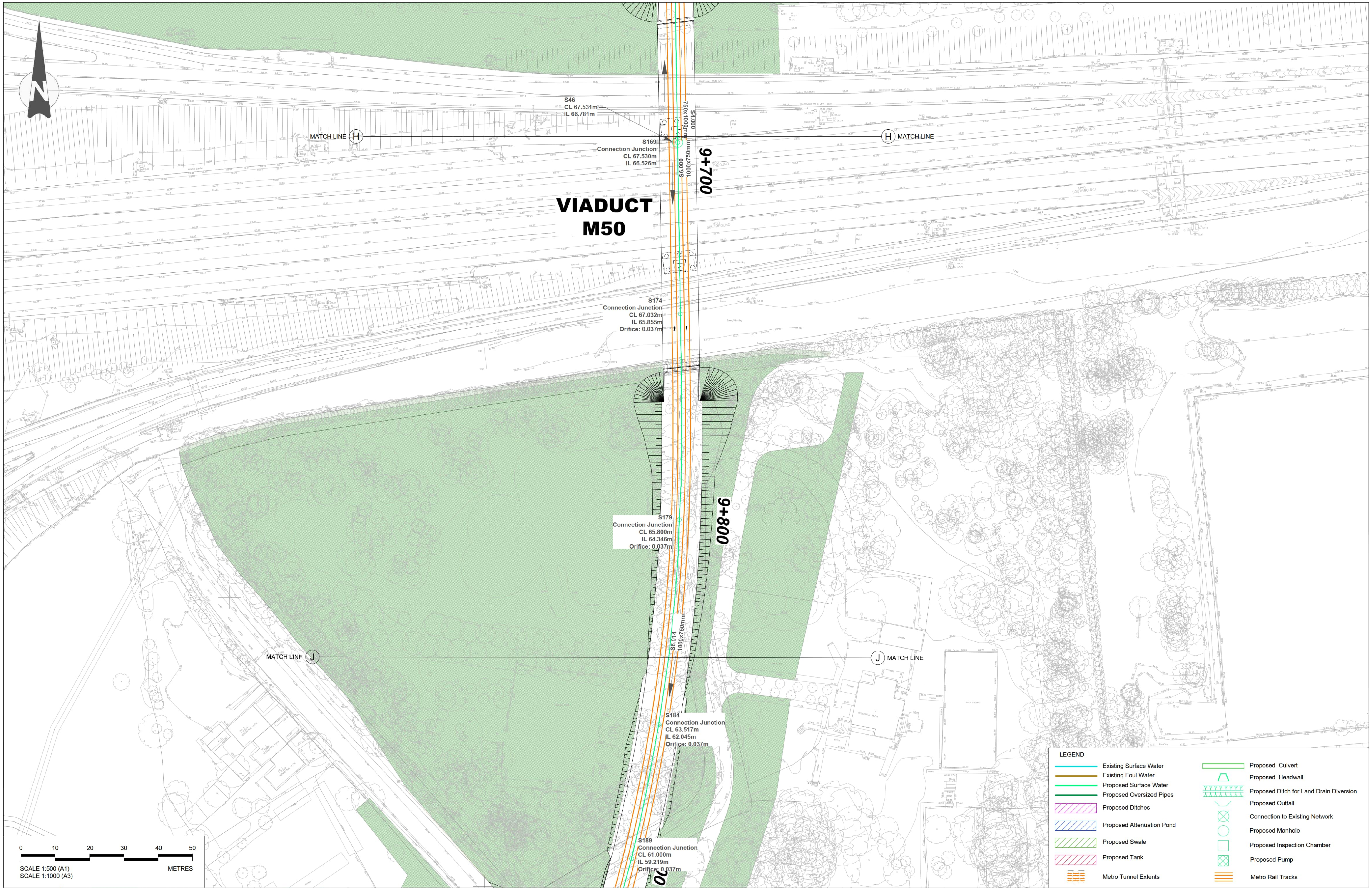
Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE BALLYMUN (SHEET 7 OF 11)

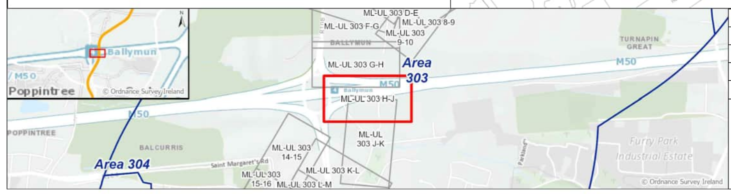
Drawing Status

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02050

Plan Drawing Nº: ML-UC 303 G-H

Scales Original Size A1 1:500





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE M50 JUNCTION 4, BALLYMUN

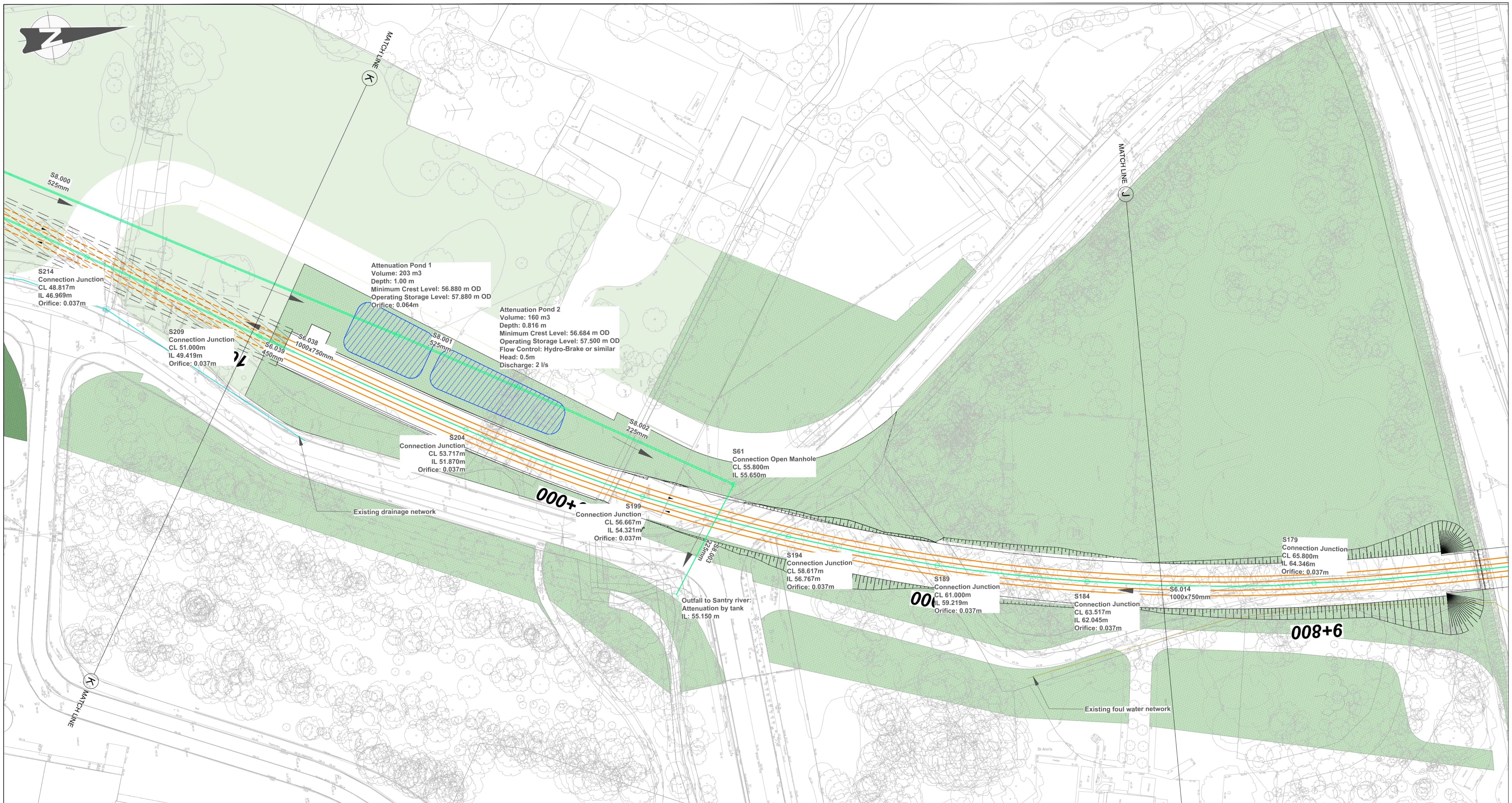
Drawing Status

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02055

Plan Drawing Nº: ML-UC 303 H-J

Scales Original Size A1 1:500

Sheet 1 of 1

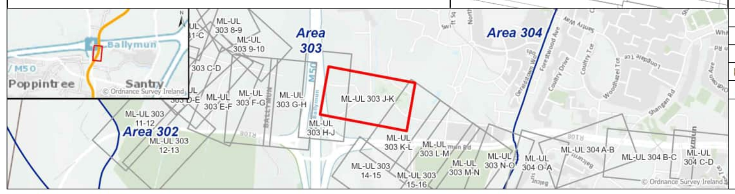


LEGEND

	Existing Surface Water		Proposed Culvert
	Existing Foul Water		Proposed Headwall
	Proposed Surface Water		Proposed Ditch for Land Drain Diversion
	Proposed Oversized Pipes		Proposed Outfall
	Proposed Ditches		Connection to Existing Network
	Proposed Attenuation Pond		Proposed Manhole
	Proposed Swale		Proposed Inspection Chamber
	Proposed Tank		Proposed Pump
	Metro Tunnel Extents		Metro Rail Tracks

0 10 20 30 40 50

SCALE 1:500 (A1) METRES
SCALE 1:1000 (A3)



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE OLD BALLYMUN ROAD (NORTH)

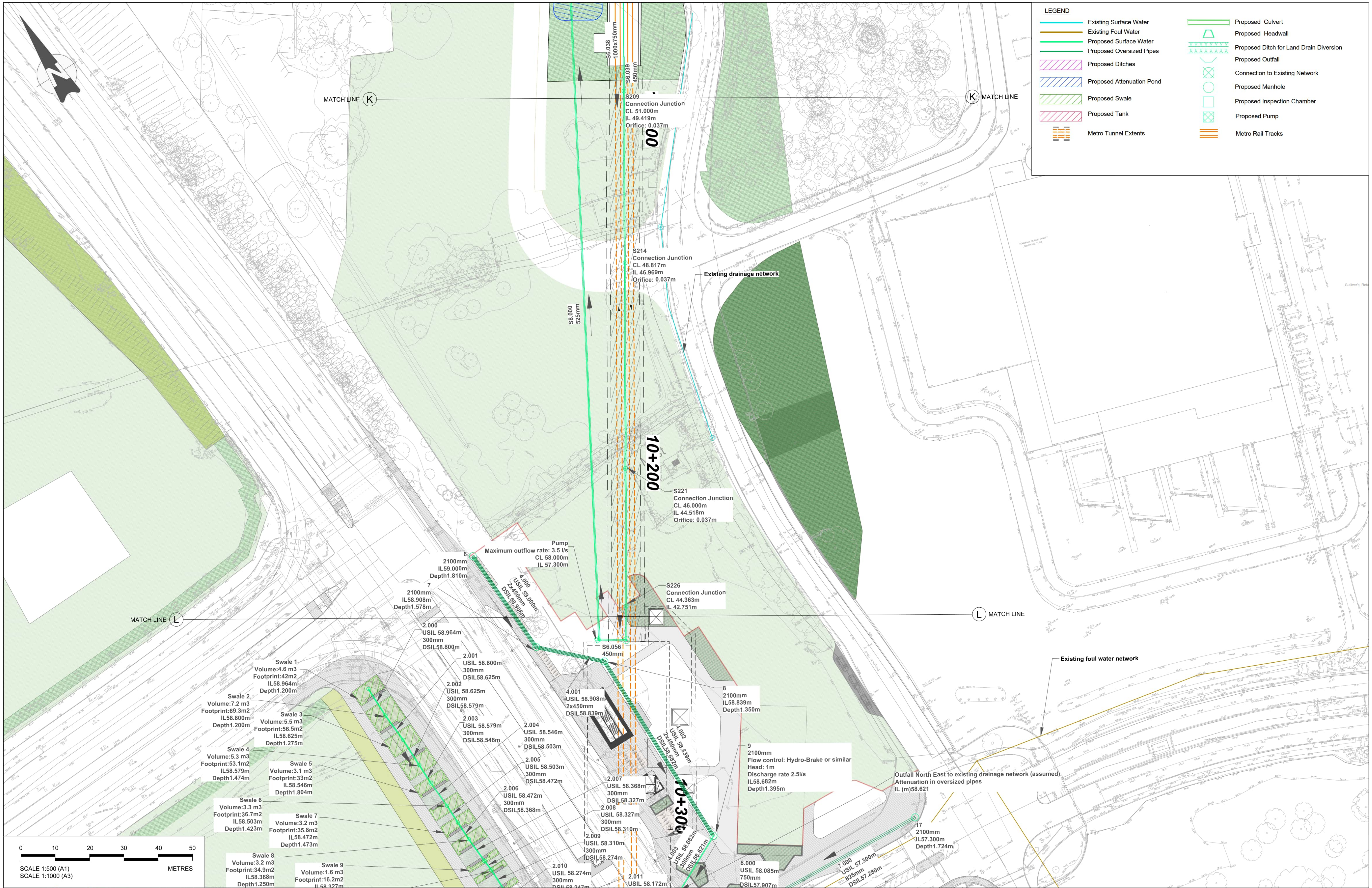
Drawing Status

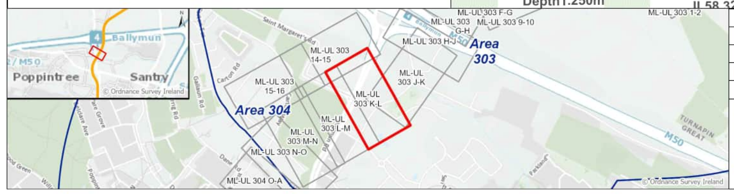
Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02056

Plan Drawing Nº: ML-UC 303 J-K

Scales Original Size A1 1:500

Sheet 1 of 1





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE GULLIVER'S RETAIL PARK

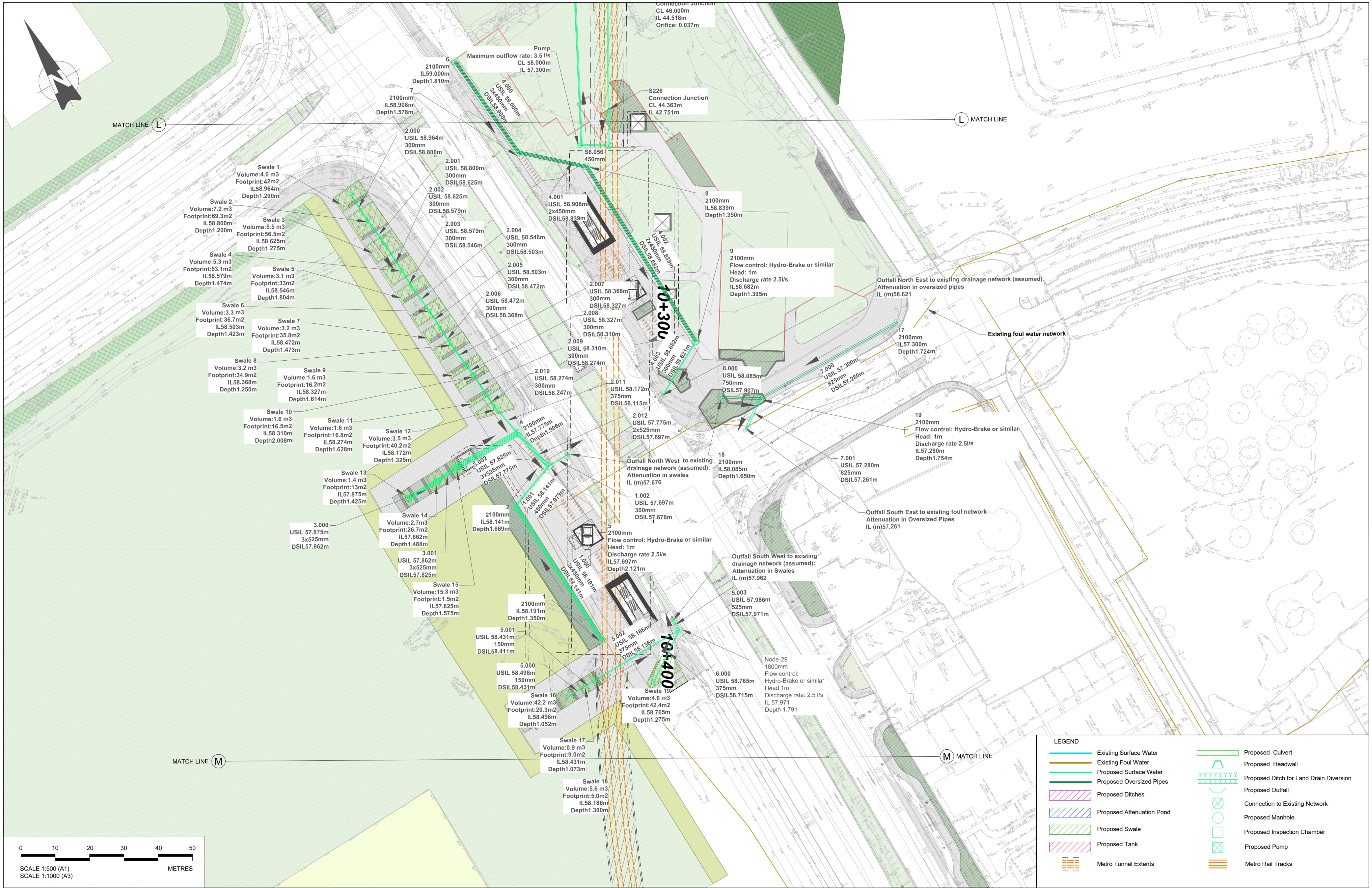
Drawing Status

Drawing N°: ML1-JAI-URD-ROUT_XX-DR-Y-02057

Plan Drawing N°: ML-UC 303 K-L

Scales Original Size A1 1:500

Sheet 1 of 1



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE NORTHWOOD (SHEET 1 OF 2)

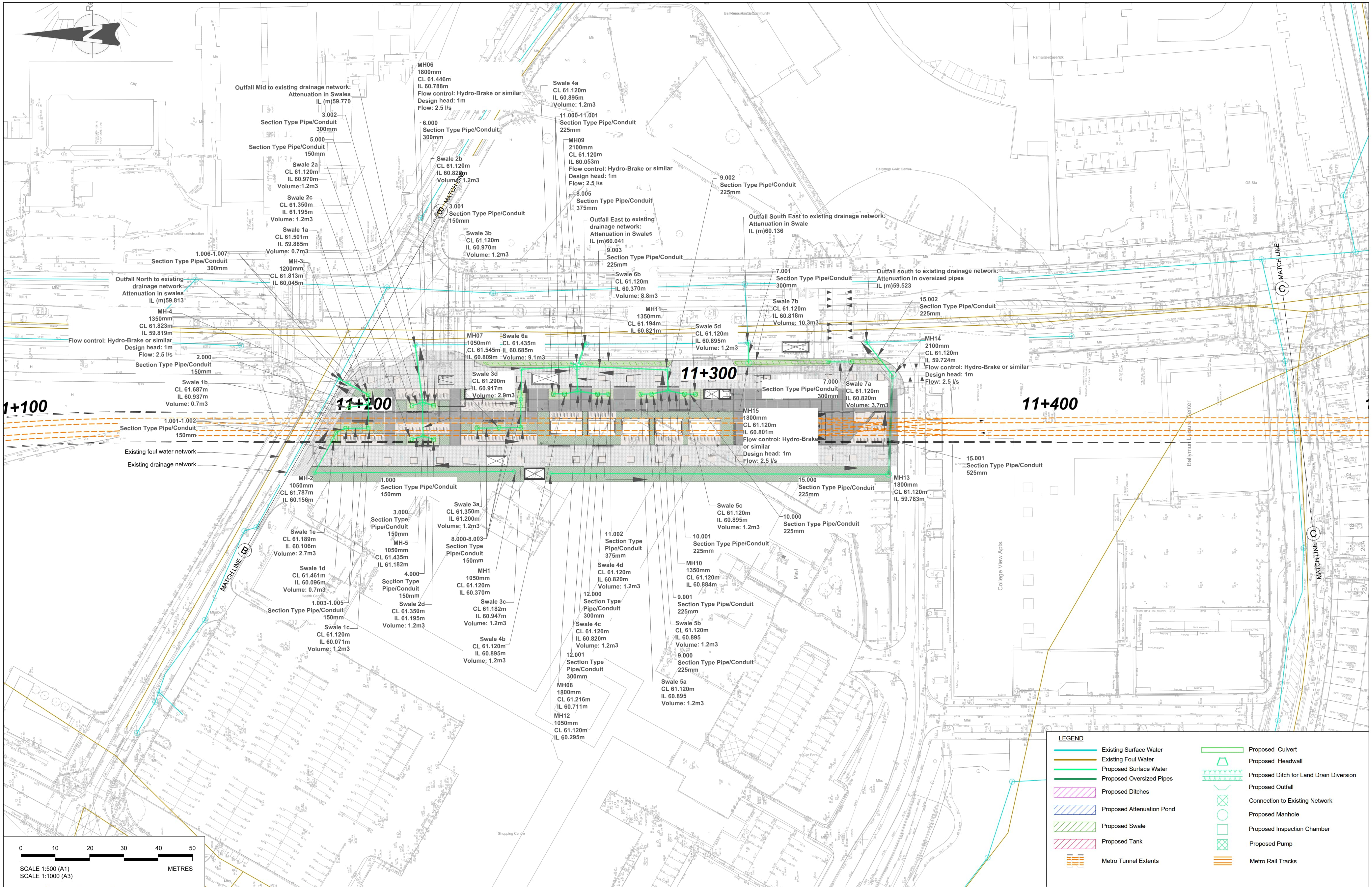
Drawing Status

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02058

Plan Drawing Nº: ML-UC 303 L-M

Scales Original Size A1 1:500

Sheet 1 of 2



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE SHANGAN ROAD TO GATEWAY CRESCENT

Drawing Status

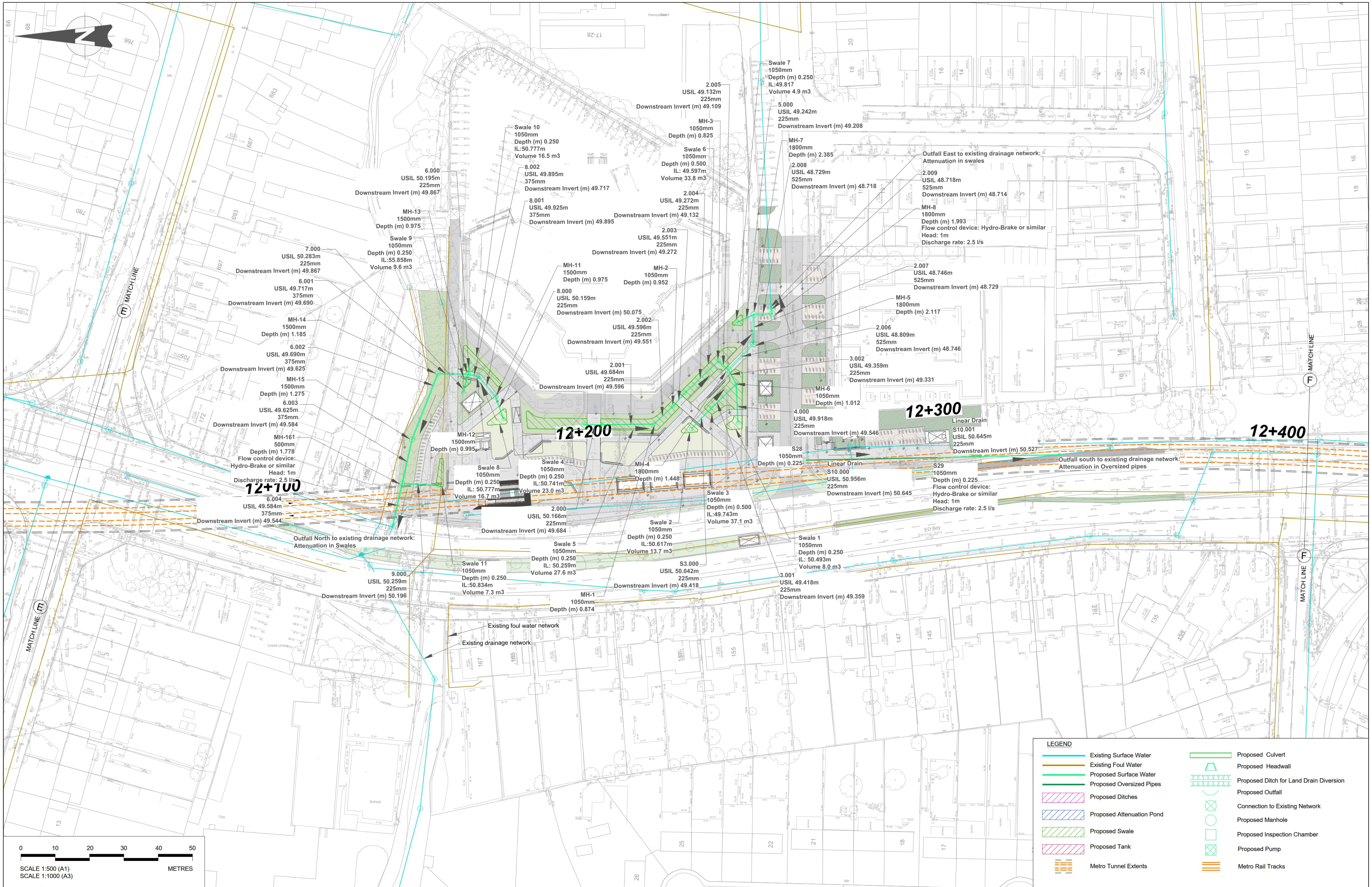
Consultant: JACOBS, IDOM

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02065

Plan Drawing Nº: ML-UC 304 B-C

Scales Original Size A1 1:500

Sheet 1 of 1



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII / NTA

Project: METROLINK

Consultant: JACOBS / IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE GLASNEVIN AVENUE TO SAINT PAPPIN ROAD

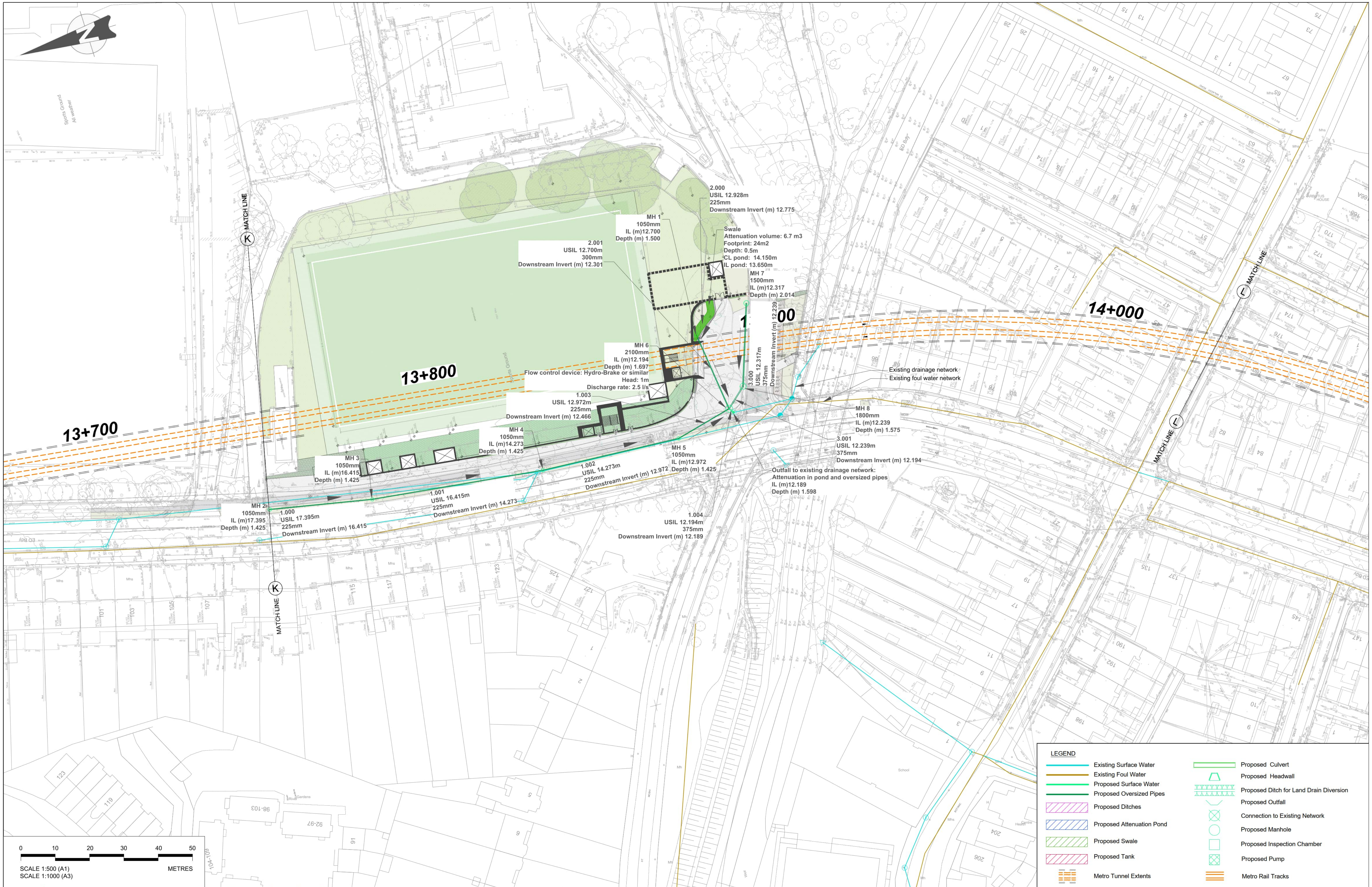
Drawing Status

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02068

Plan Drawing Nº: ML-UC 304 E-F

Scales Original Size A1 1:500

Sheet 1 of 1



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE GRIFFITH PARK TO BOTANIC AVNEUE

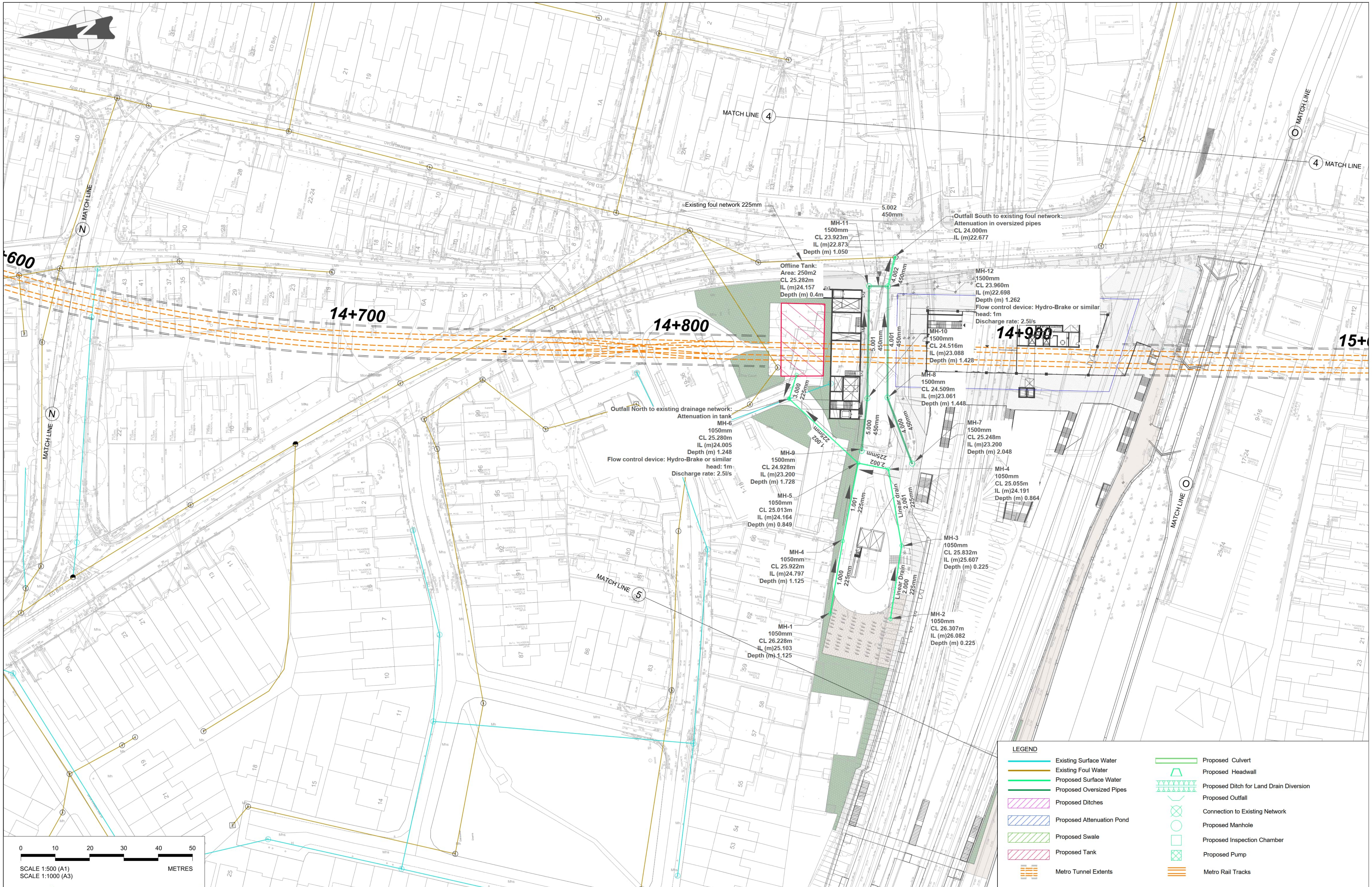
Drawing Status

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02073

Plan Drawing Nº: ML-UC 304 K-L

Scales Original Size A1 1:500

Sheet 1 of 1



REV	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE PROSPECT WAY TO ROYAL CANAL

Drawing Status

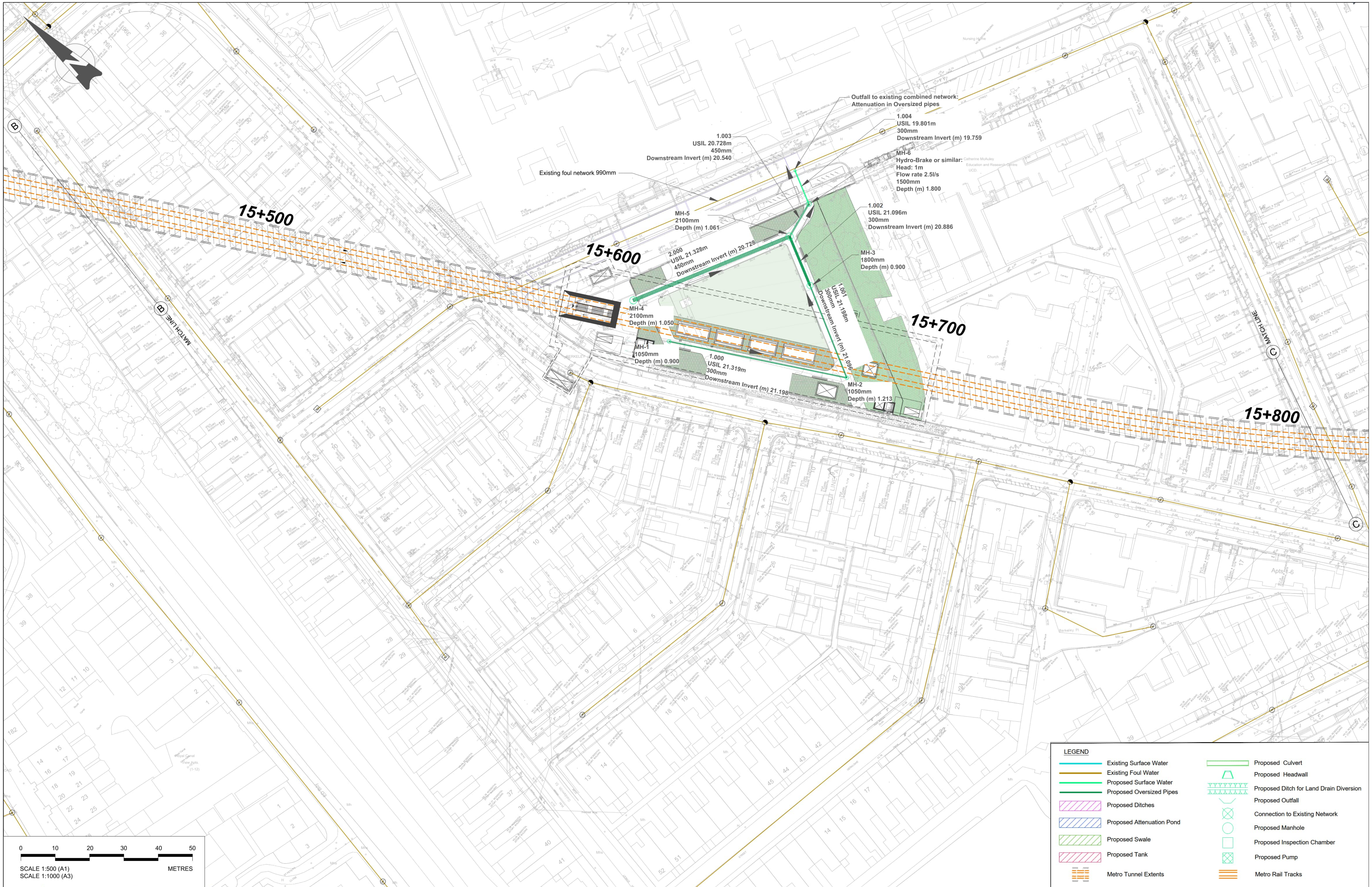
Consultant: JACOBS, IDOM

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02076

Plan Drawing Nº: ML-UC 304 N-O

Scales Original Size A1 1:500

Sheet 1 of 1



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA
Project: METROLINK
Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE GOLDSMITH STREET TO NELSON STREET

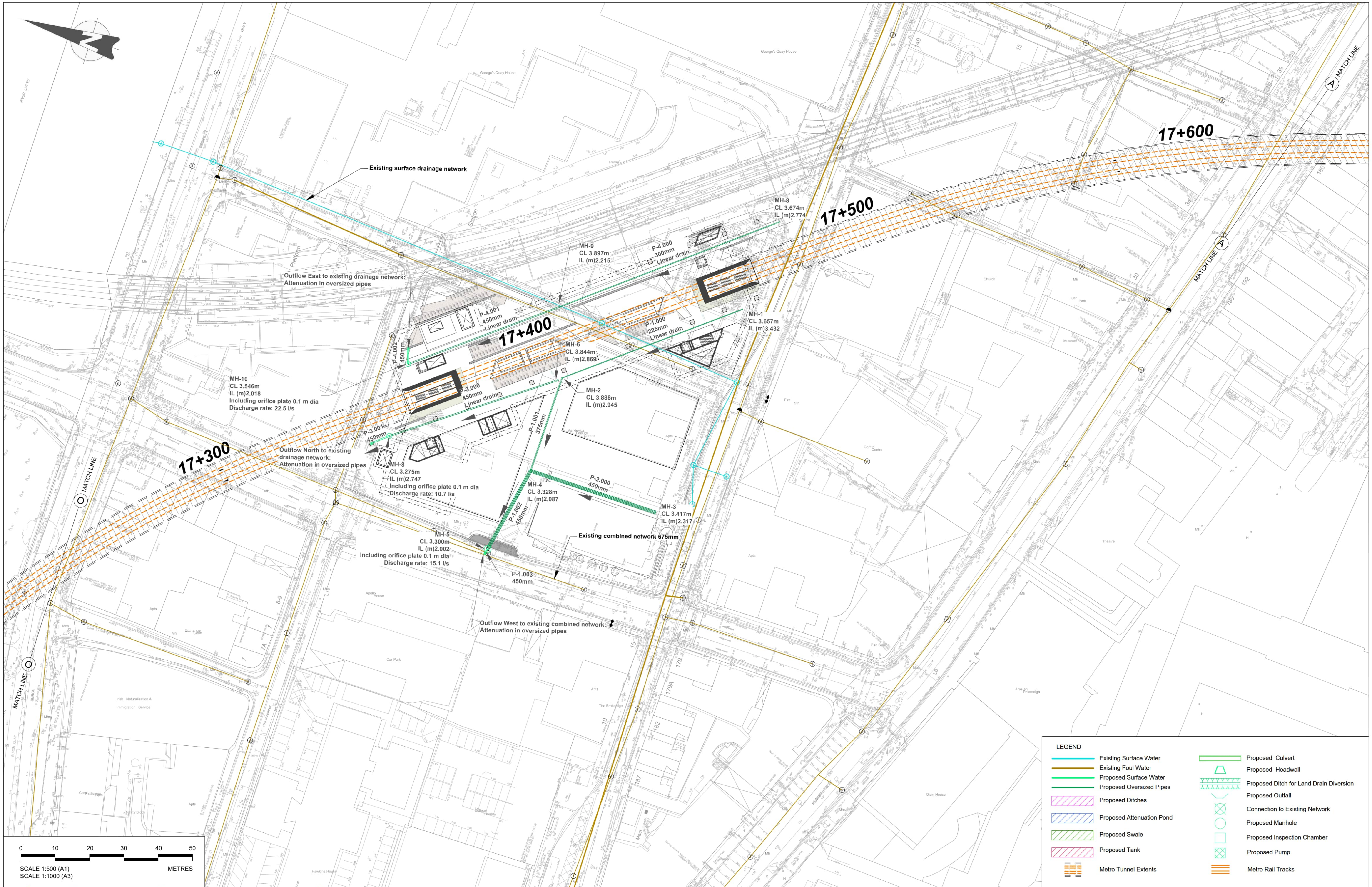
Drawing Status

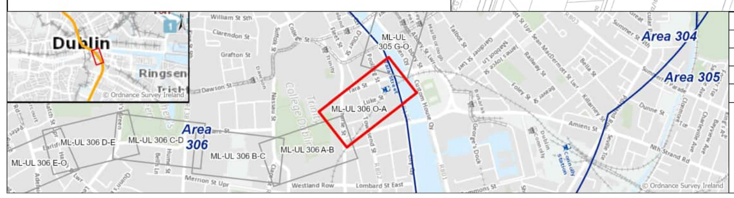
Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02084

Plan Drawing Nº: ML-UC 305 B-C

Scales Original Size A1 1:500

Sheet 1 of 1





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE BURGH QUAY TO PEARSE STREET

Drawing Status

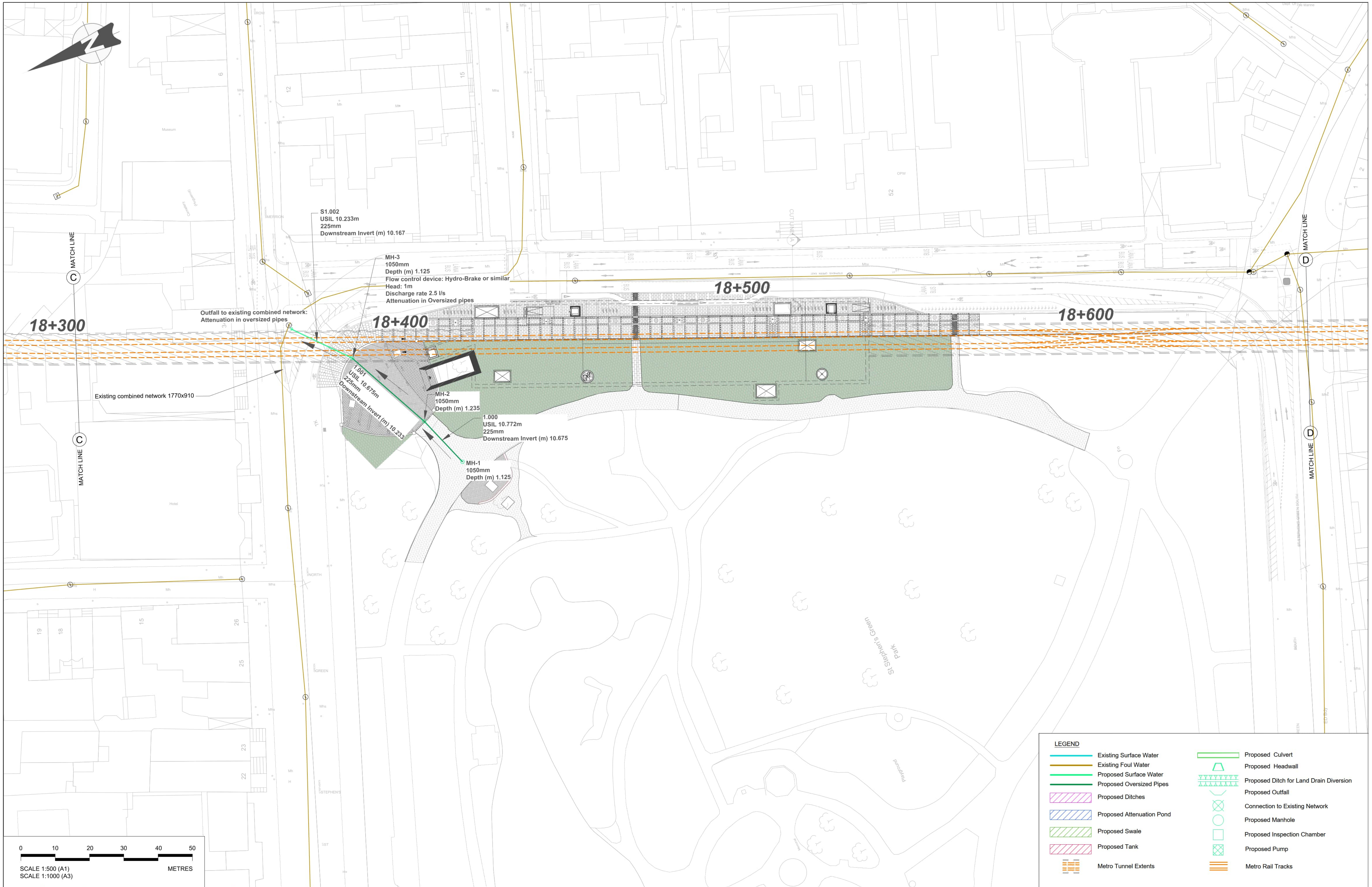
Consultant: JACOBS, IDOM

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02090

Plan Drawing Nº: ML-UC 306 O-A

Scales Original Size A1 1:500

Sheet 1 of 1



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	28/01/22		BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED SURFACE DRAINAGE SAINT STEPHEN'S GREEN

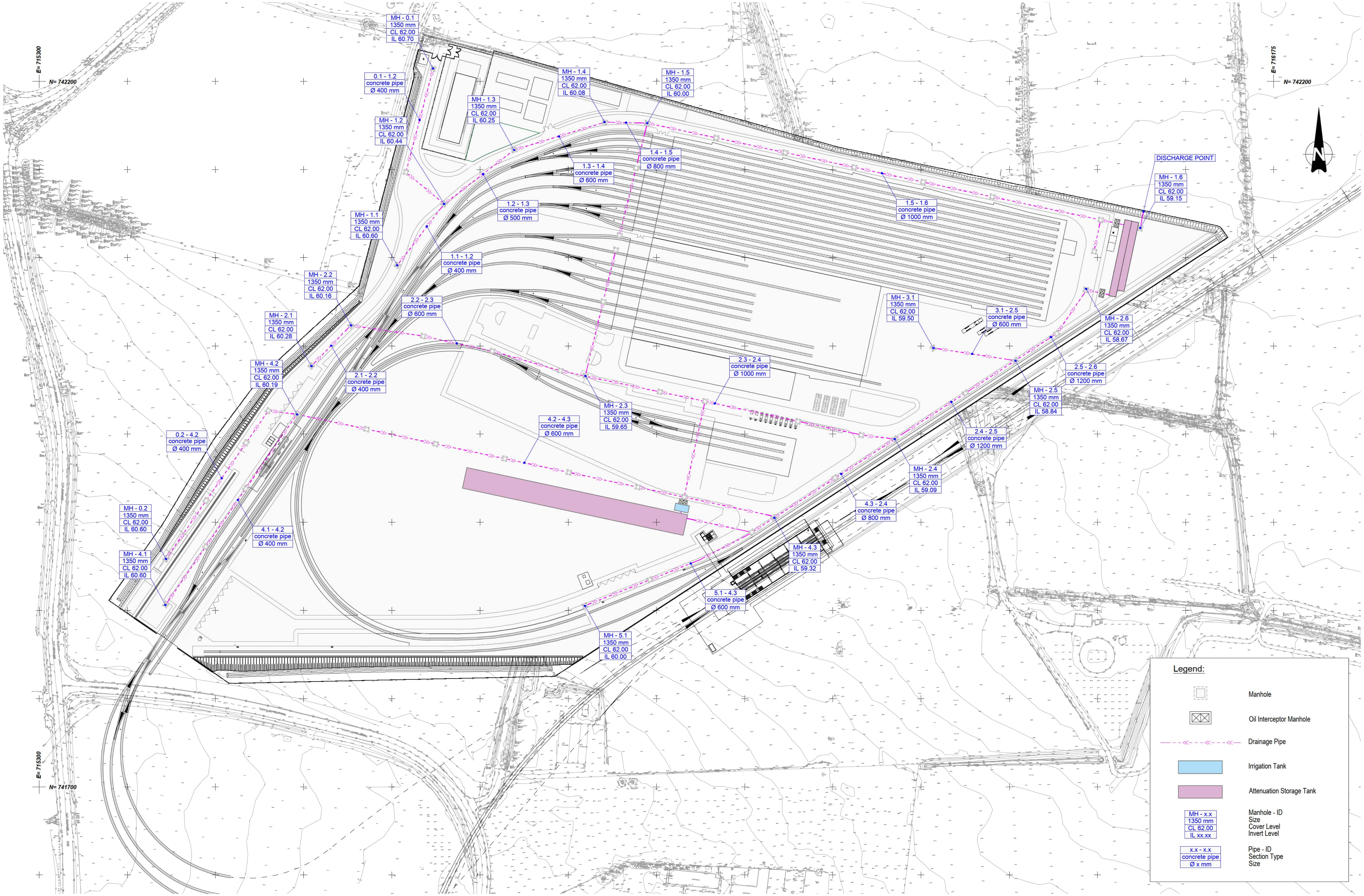
Drawing Status

Drawing Nº: ML1-JAI-URD-ROUT_XX-DR-Y-02093

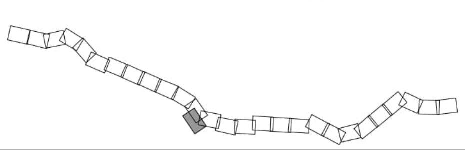
Plan Drawing Nº: ML-UC 306 C-D

Scales Original Size A1 1:500

Sheet 1 of 1



Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P05	29/10/21	Preliminary Design Issue	SSR	JDR	JBL	NC
P04	31/03/21	Preliminary Design Issue	SSR	JDR	JBL	NC
P03	11/12/20	Final Preliminary Design	SSR	JDR	JBL	NC
P02	28/08/20	Preliminary Design Interim Completion	SSR	JDR	JBL	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: Main Depot
Utilities
Surface Water Drainage
Preliminary Design Issue

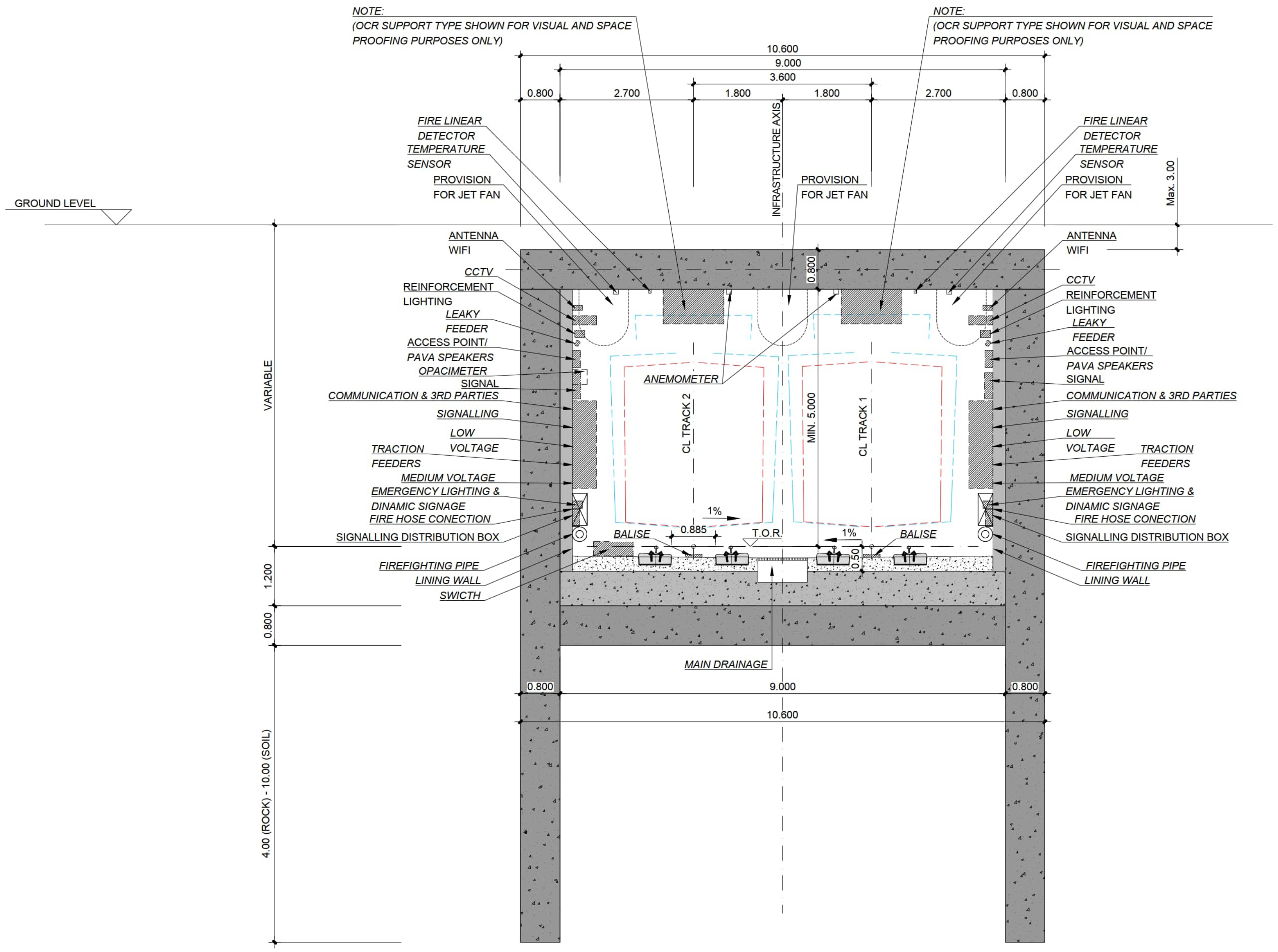
Drawing Status: S4

Drawing Nº: ML1-JAI-DRN-DEPM_XX-DR-Y-50101

Scales Original Size A1 1/1.250 0 5 10 15 20 25 50 100

Sheet 1 of 1

Appendix G. Typical Track Cross-Sections

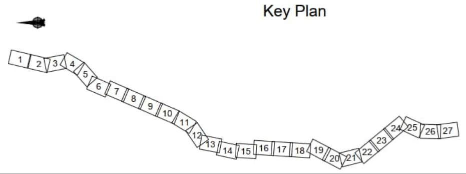


TYPICAL CROSS SECTION IN CUT AND COVER (6.30m < TOR/TERRAIN < 9.00m)

(CANT 0)

SCALE 1:60

Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	RS	JB	NC
P02	11/12/20	Final Preliminary Design	DT	RS	JB	NC
P01	06/11/19	Preliminary Design	DT	RS	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client

Project

METROLINK

Consultant

JACOBS

IDOM

Drawing Title

TYPICAL CROSS SECTION
CUT AND COVER (6.30m < TOR/TERRAIN < 9.00m)

Drawing Status

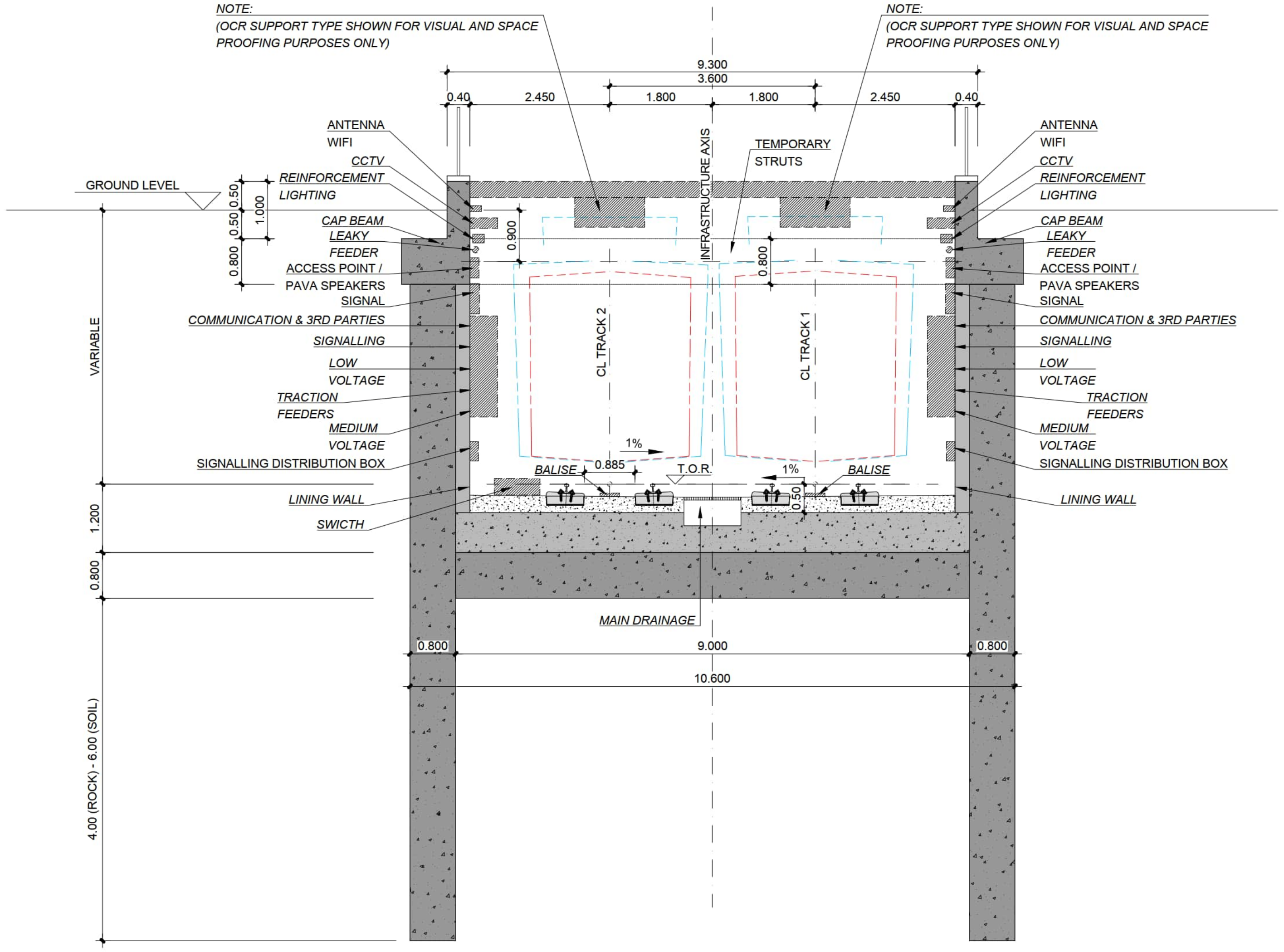
S4

Drawing Nº

ML1-JAI-RTA-ROUT_XX-DR-Y-03003

Scales Original Size A1 1:60

Sheet 1 of 1

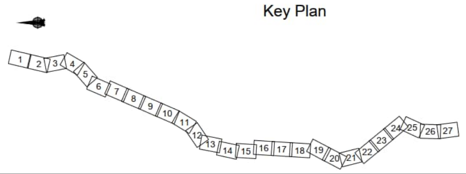


TYPICAL CROSS SECTION IN RETAIN CUT (TOR/TERRAIN < 4.8)

(CANT 0)

SCALE 1:60

Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	RS	JB	NC
P02	11/12/20	Final Preliminary Design	DT	RS	JB	NC
P01	06/11/19	Preliminary Design	DT	RS	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client

Consultant

Project

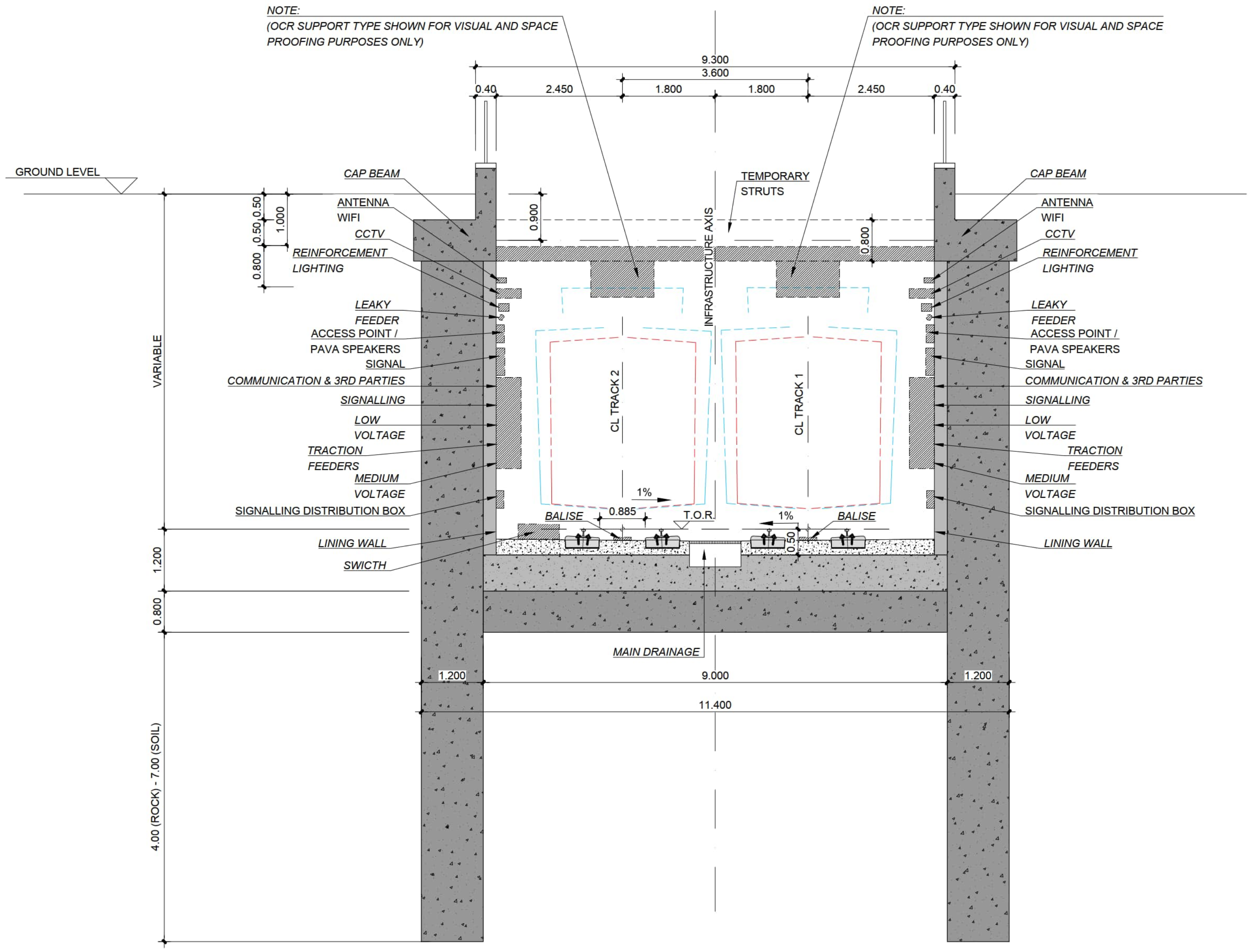
Drawing Title: TYPICAL CROSS SECTION RETAIN CUT (TOR/TERRAIN < 4.8)

Drawing Status: S4

Drawing Nº: ML1-JAI-RTA-ROUT_XX-DR-Y-03004

Scales Original Size A1 1:60

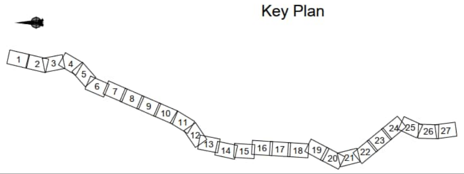
Sheet 1 of 1



TYPICAL CROSS SECTION IN RETAIN CUT (4.80m < TOR/TERRAIN < 6.30m) (CANT 0)

SCALE 1:60

Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	RS	JB	NC
P02	11/12/20	Final Preliminary Design	DT	RS	JB	NC
P01	06/11/19	Preliminary Design	DT	RS	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client

Consultant

Project

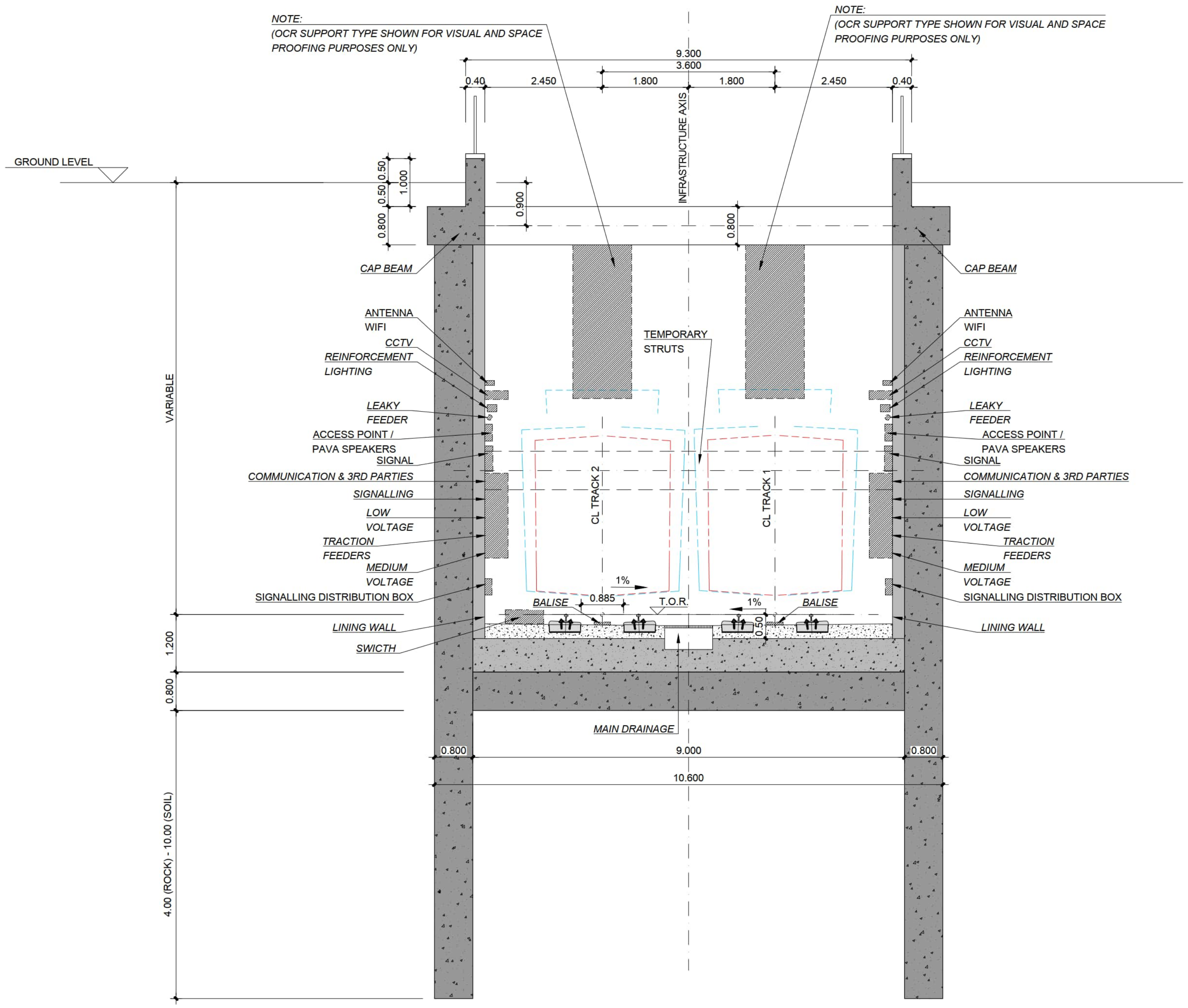
Drawing Title: TYPICAL CROSS SECTION RETAIN CUT (4.80m < TOR/TERRAIN < 6.30m)

Drawing Status: S4

Drawing Nº: ML1-JAI-RTA-ROUT_XX-DR-Y-03005

Scales Original Size A1 1:60

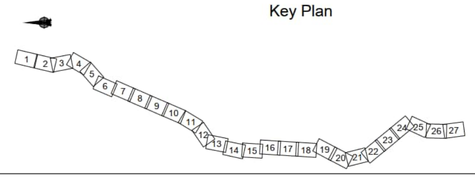
Sheet 1 of 1



TYPICAL CROSS SECTION IN RETAIN CUT (6.30m < TOR/TERRAIN < 9.00m)
(CANT 0)

SCALE 1:60

Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	RS	JB	NC
P02	11/12/20	Final Preliminary Design	DT	RS	JB	NC
P01	06/11/19	Preliminary Design	DT	RS	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client

Consultant

Project

Drawing Title

TYPICAL CROSS SECTION
RETAIN CUT (6.30m < TOR/TERRAIN < 9.00m)

Drawing Status

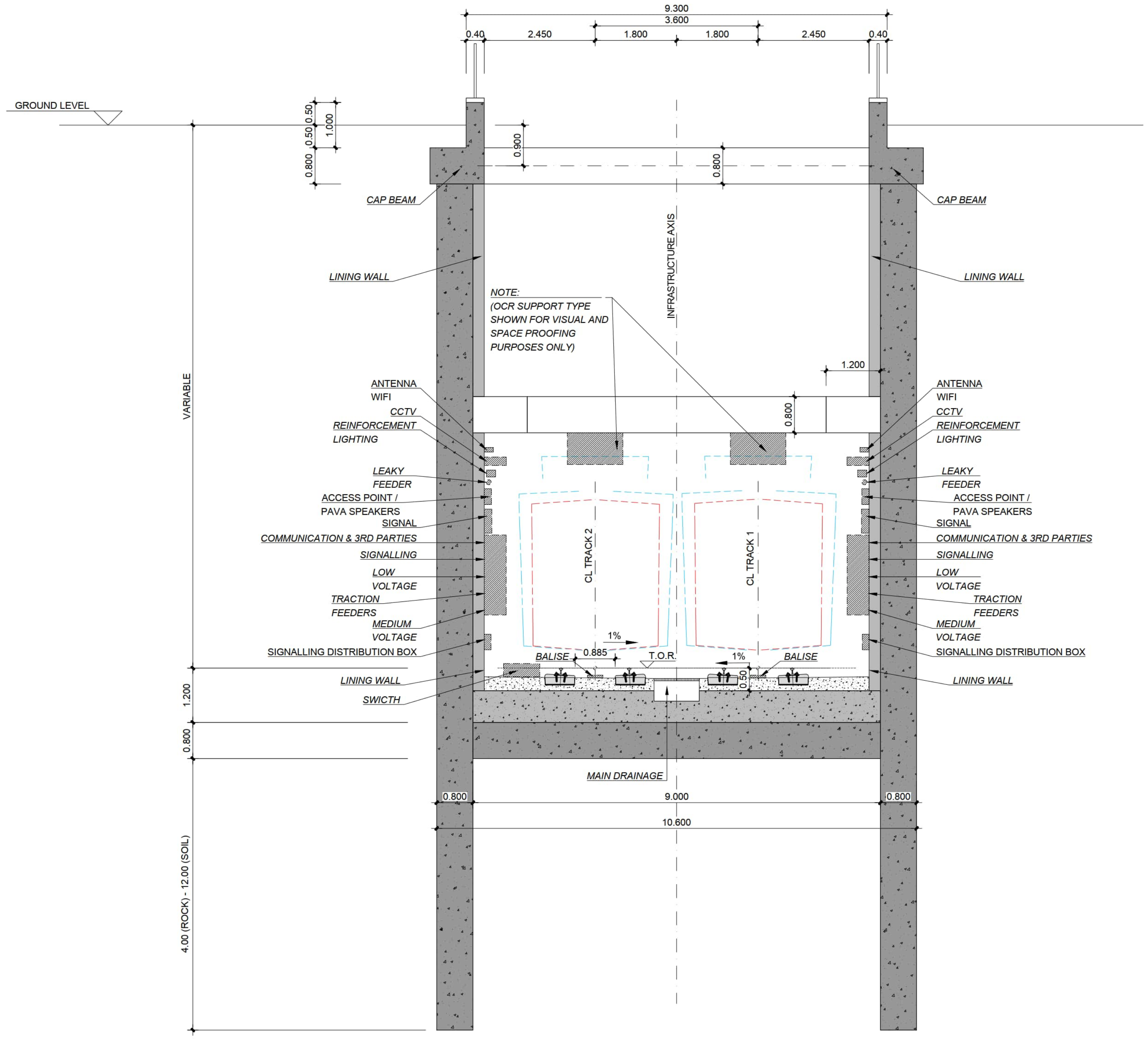
S4

Drawing Nº

ML1-JAI-RTA-ROUT_XX-DR-Y-03006

Scales Original Size A1 1:60

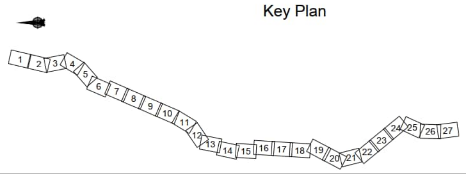
Sheet 1 of 1



TYPICAL CROSS SECTION IN RETAIN CUT (9.00m < TOR/TERRAIN < 12.00m) (CANT 0)

SCALE 1:60

Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	RS	JB	NC
P02	11/12/20	Final Preliminary Design	DT	RS	JB	NC
P01	06/11/19	Preliminary Design	DT	RS	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

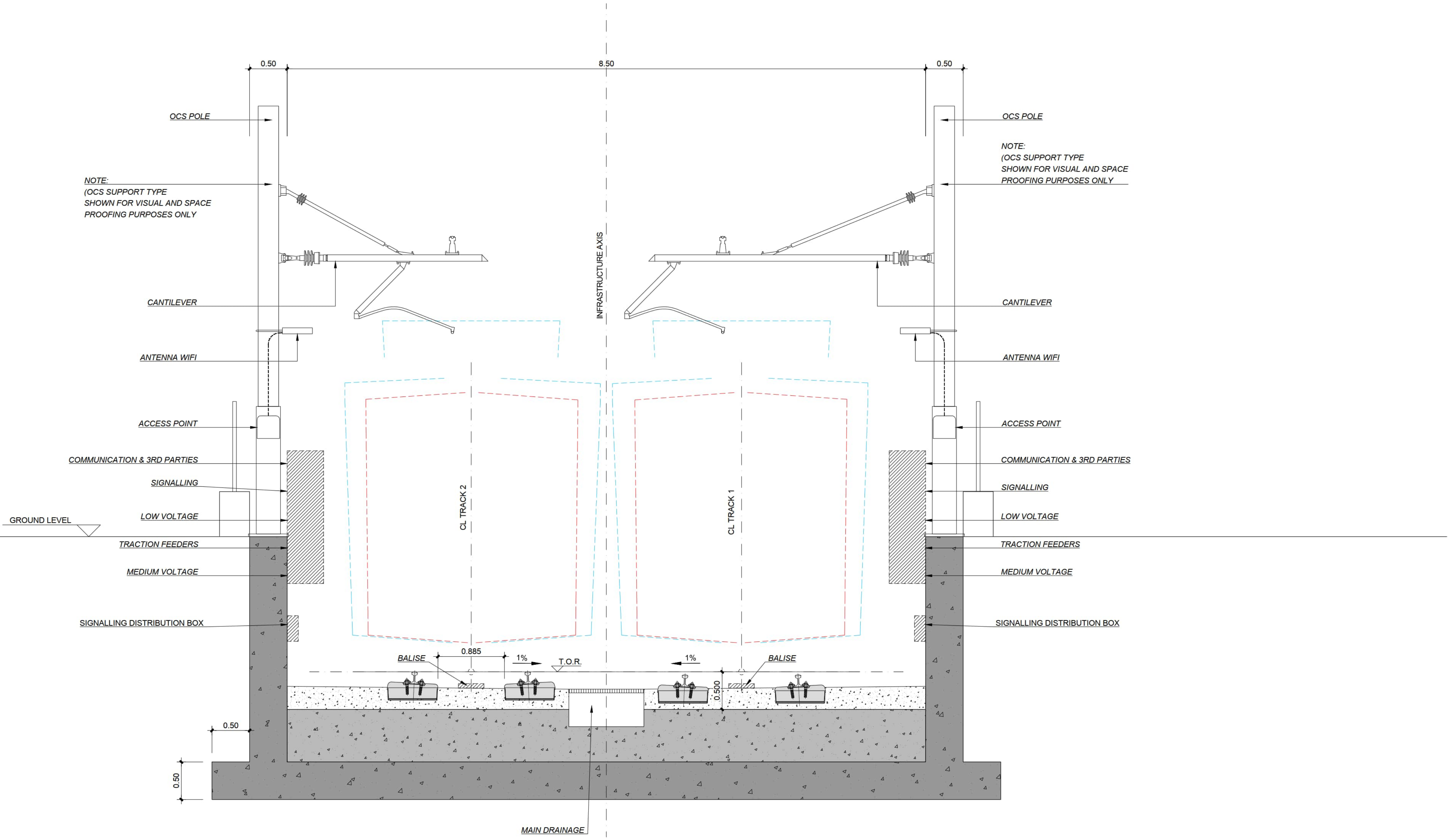
Drawing Title: TYPICAL CROSS SECTION RETAIN CUT (9.00m < TOR/TERRAIN < 12.00m)

Drawing Status: S4

Drawing Nº: ML1-JAI-RTA-ROUT_XX-DR-Y-03007

Scales Original Size A1 1:60

Sheet 1 of 1

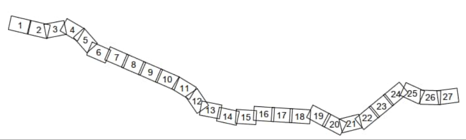


TYPICAL CROSS SECTION. U SECTION (0.8m < TOR / TERRAIN < 1.8m)

(CANT 0)

SCALE 1:30

Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	RS	JB	NC
P02	11/12/20	Final Preliminary Design	DT	RS	JB	NC
P01	06/11/19	Preliminary Design	DT	RS	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

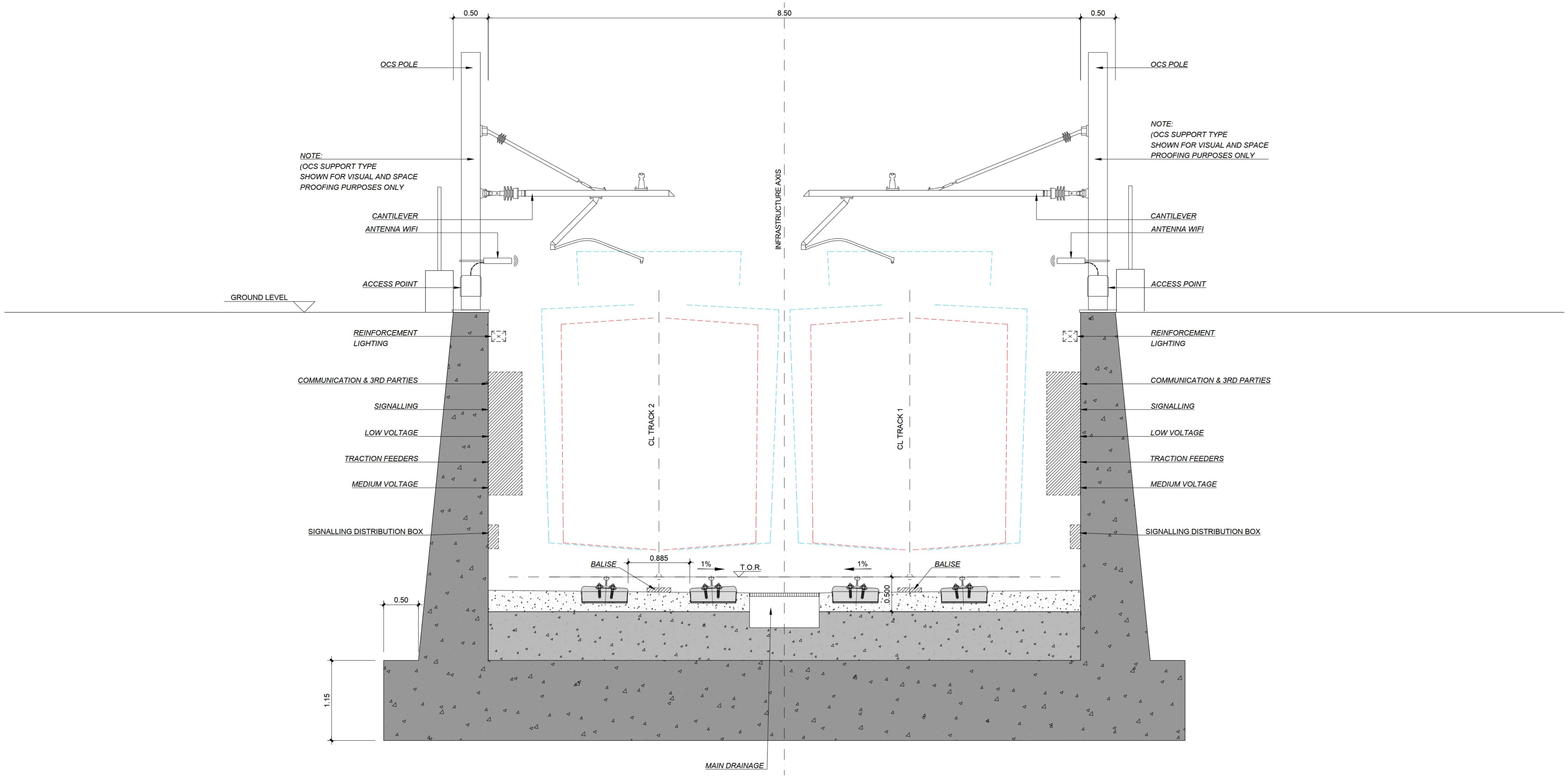
Drawing Title: TYPICAL CROSS SECTION U SECTION (0.8m < TOR / TERRAIN < 1.8m)

Drawing Status: S4

Drawing Nº: ML1-JAI-RTA-ROUT_XX-DR-Y-03010

Scales Original Size A1 1:30

Sheet 1 of 1

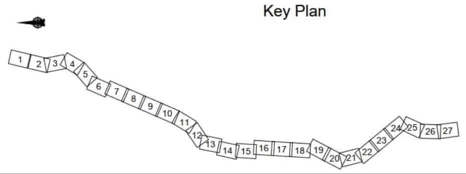


TYPICAL CROSS SECTION. U SECTION (1.8m < TOR / TERRAIN < 3.8m)

(CANT 0)

SCALE 1:30

Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	RS	JB	NC
P02	11/12/20	Final Preliminary Design	DT	RS	JB	NC
P01	06/11/19	Preliminary Design	DT	RS	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

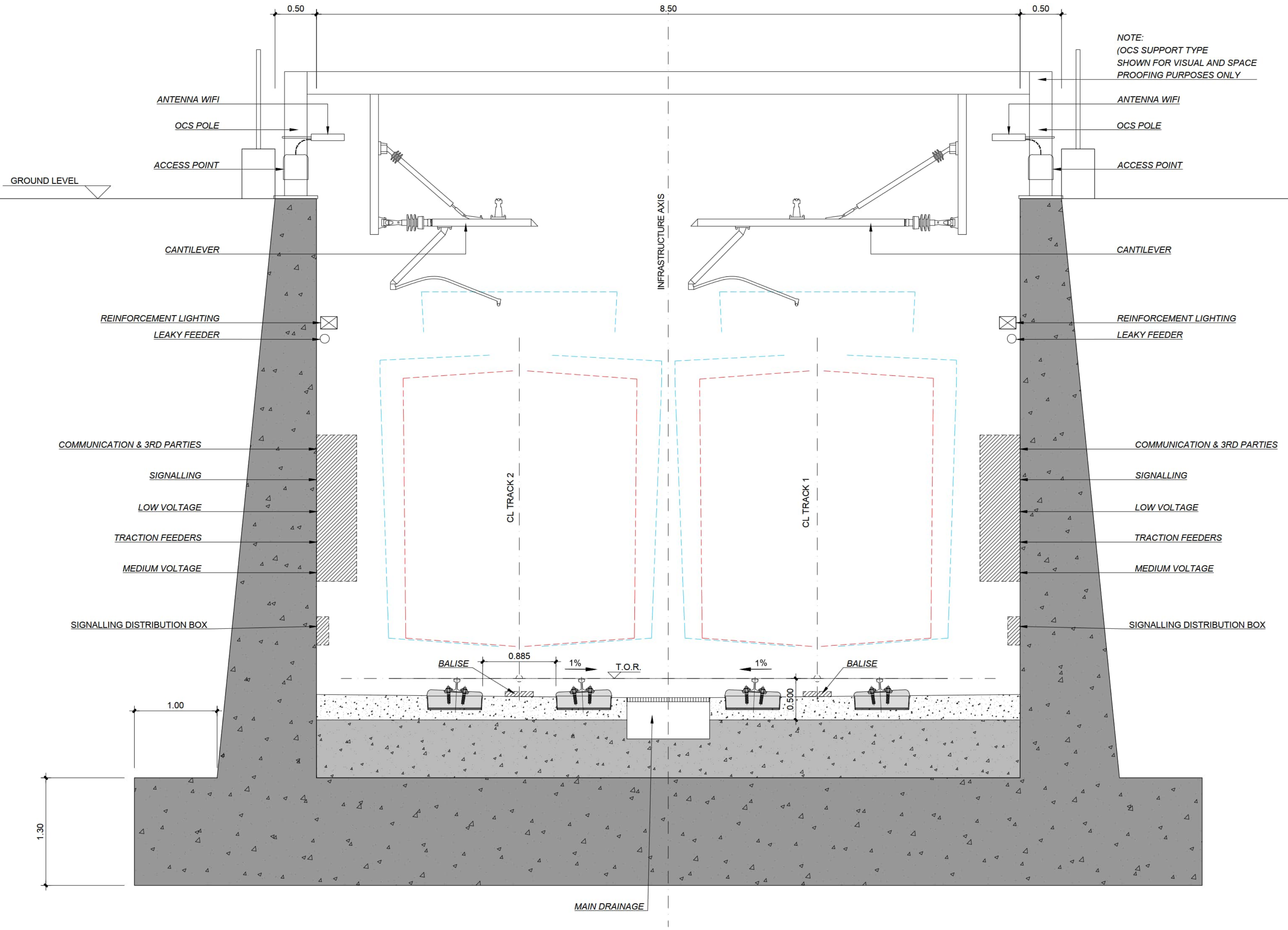
Drawing Title: TYPICAL CROSS SECTION U SECTION (1.8m < TOR / TERRAIN < 3.8m)

Drawing Status: S4

Drawing Nº: ML1-JAI-RTA-ROUT_XX-DR-Y-03011

Scales Original Size A1 1:30

Sheet 1 of 1

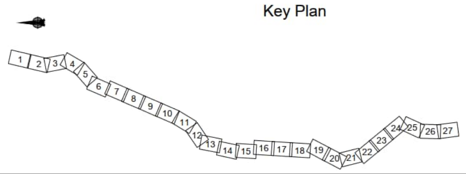


TYPICAL CROSS SECTION. U SECTION (3.8m < TOR / TERRAIN < 5.8m)

(CANT 0)

SCALE 1:30

Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	RS	JB	NC
P02	11/12/20	Final Preliminary Design	DT	RS	JB	NC
P01	06/11/19	Preliminary Design	DT	RS	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client

Project

METROLINK

Consultant

JACOBS

IDOM

Drawing Title

TYPICAL CROSS SECTION
U SECTION (3.8m < TOR / TERRAIN < 5.8m)

Drawing Status

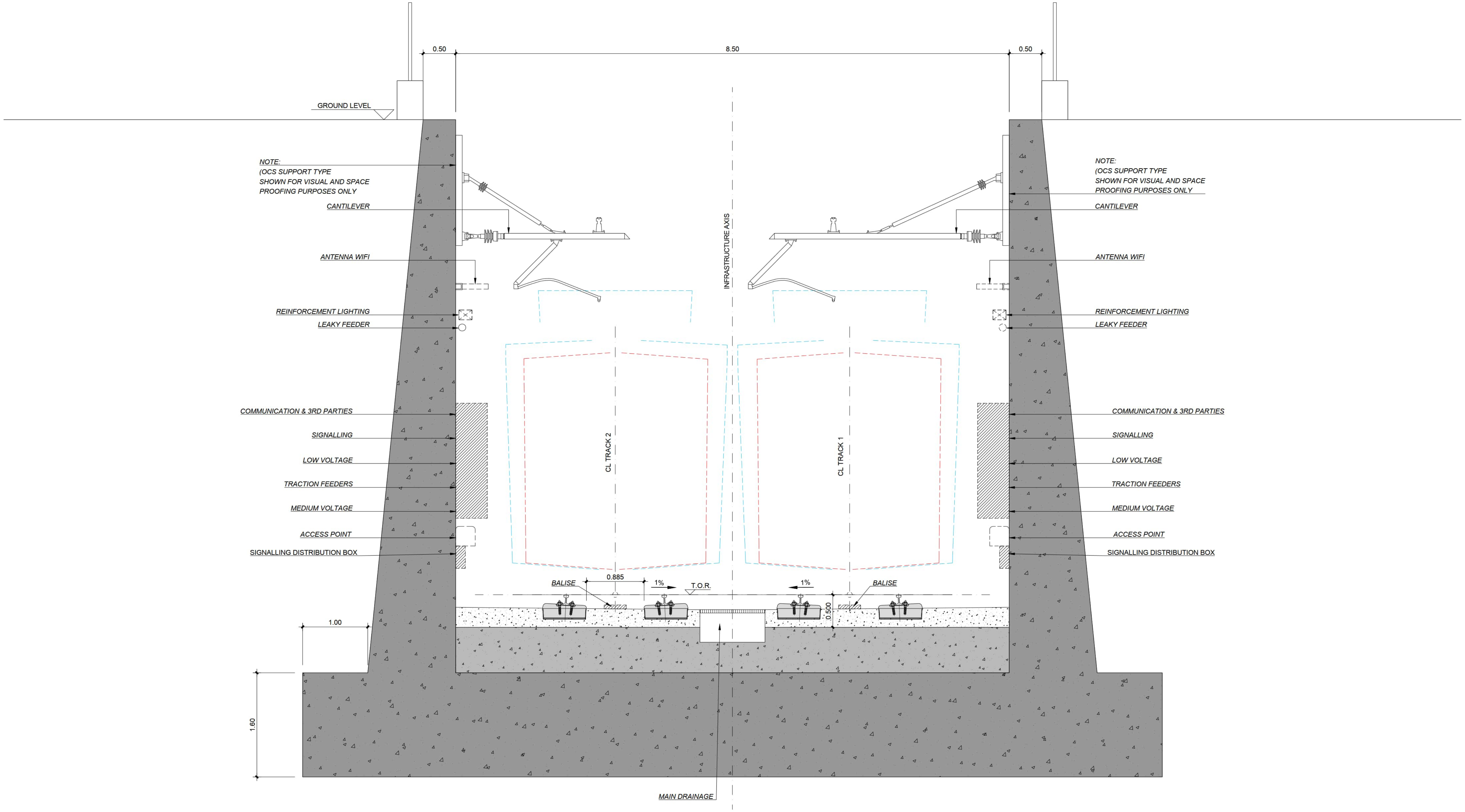
S4

Drawing Nº

ML1-JAI-RTA-ROUT_XX-DR-Y-03012

Scales Original Size A1 1:30

Sheet 1 of 1

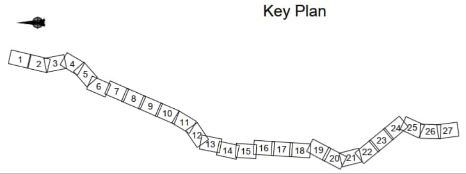


TYPICAL CROSS SECTION. U SECTION (5.8m < TOR / TERRAIN < 7.3m)

(CANT 0)

SCALE 1:30

Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	RS	JB	NC
P02	11/12/20	Final Preliminary Design	DT	RS	JB	NC
P01	06/11/19	Preliminary Design	DT	RS	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

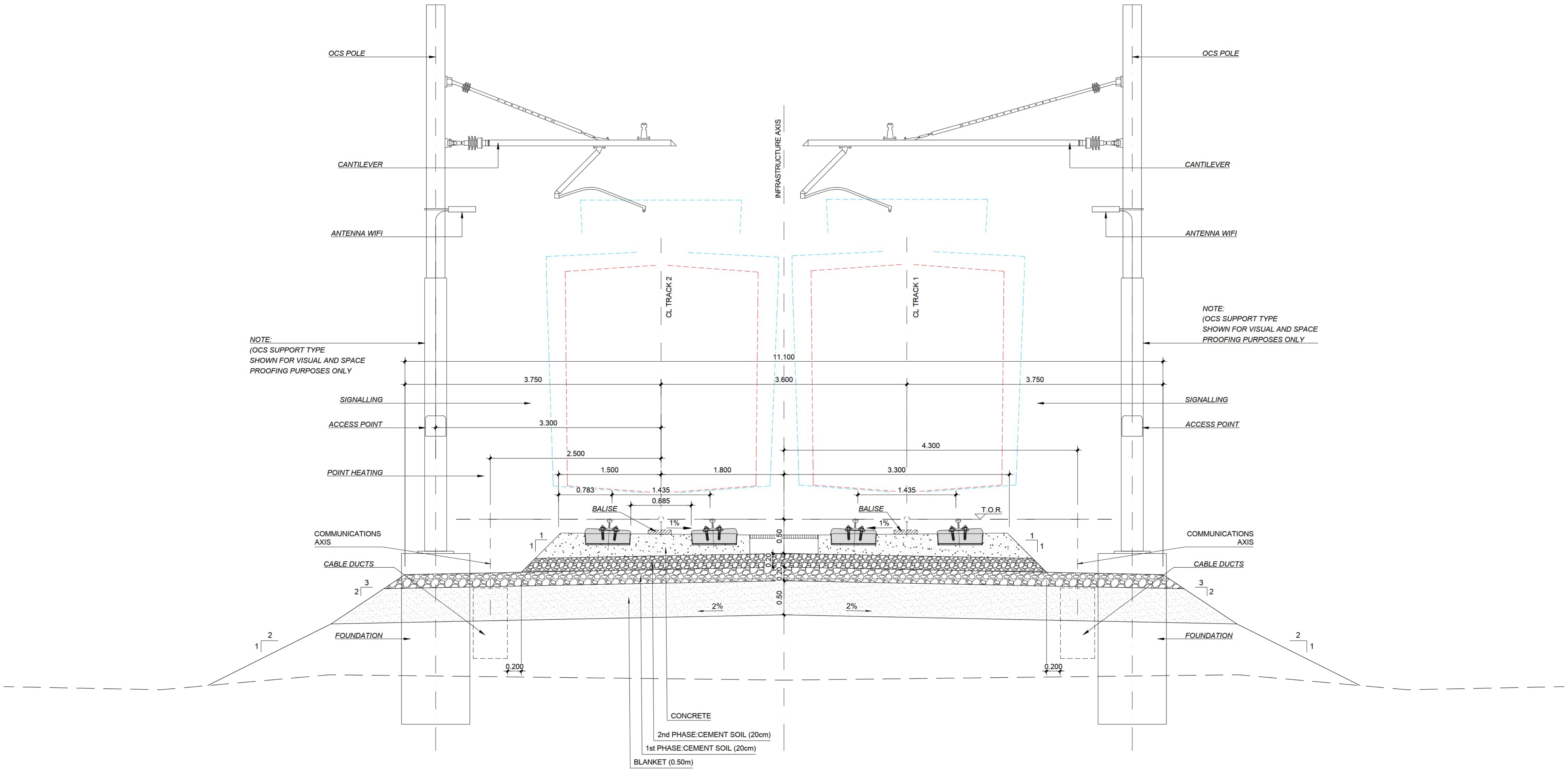
Drawing Title: TYPICAL CROSS SECTION U SECTION (5.8m < TOR / TERRAIN < 7.3m)

Drawing Status: S4

Drawing Nº: ML1-JAI-RTA-ROUT_XX-DR-Y-03013

Scales Original Size A1 1:30

Sheet 1 of 1

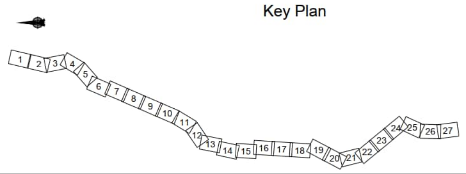


TYPICAL CROSS SECTION AT GRADE

(CANT 0)

SCALE 1:30

Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	RS	JB	NC
P02	11/12/20	Final Preliminary Design	DT	RS	JB	NC
P01	06/11/19	Preliminary Design	DT	RS	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

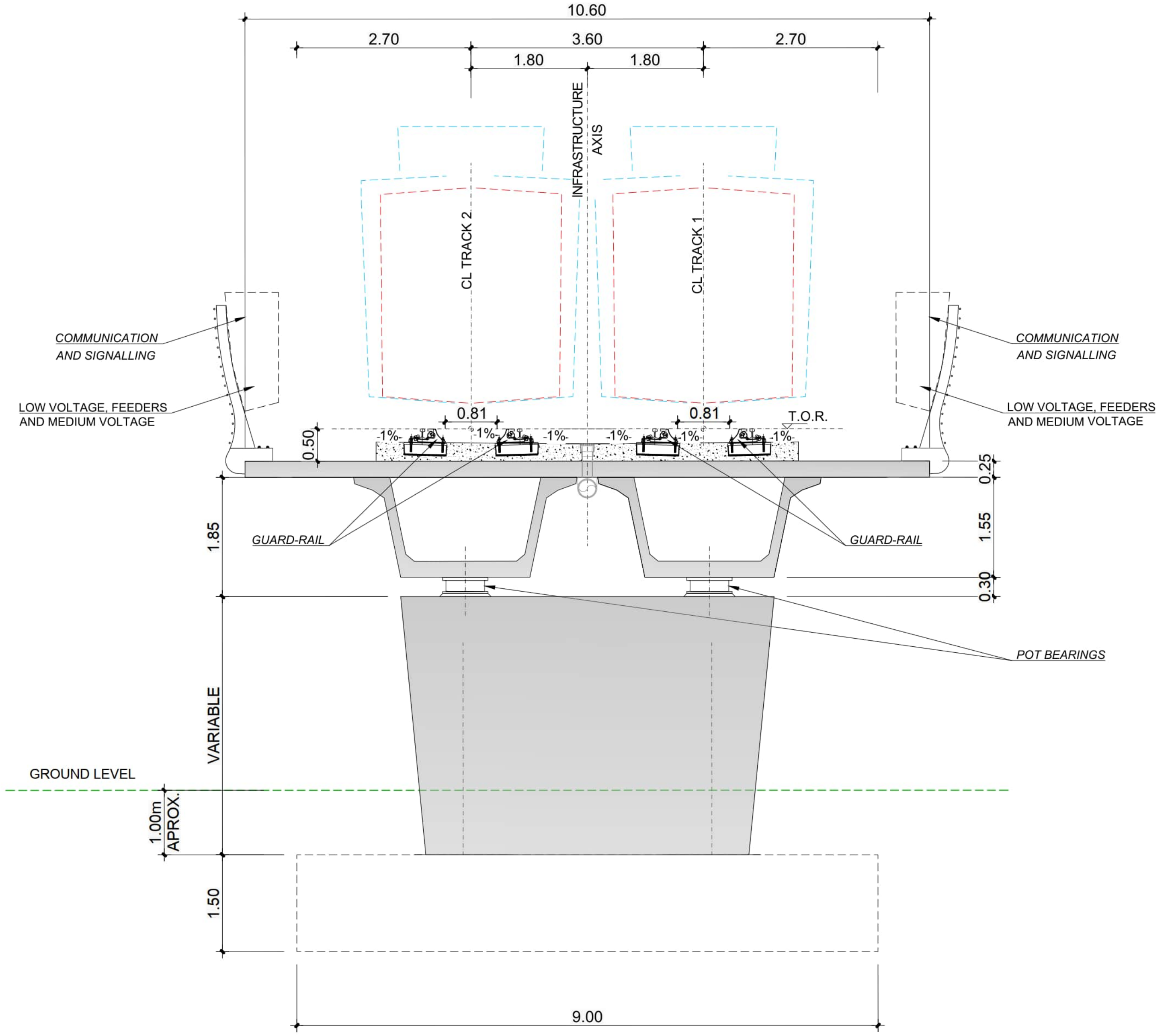
Drawing Title: TYPICAL CROSS SECTION AT GRADE

Drawing Status: S4

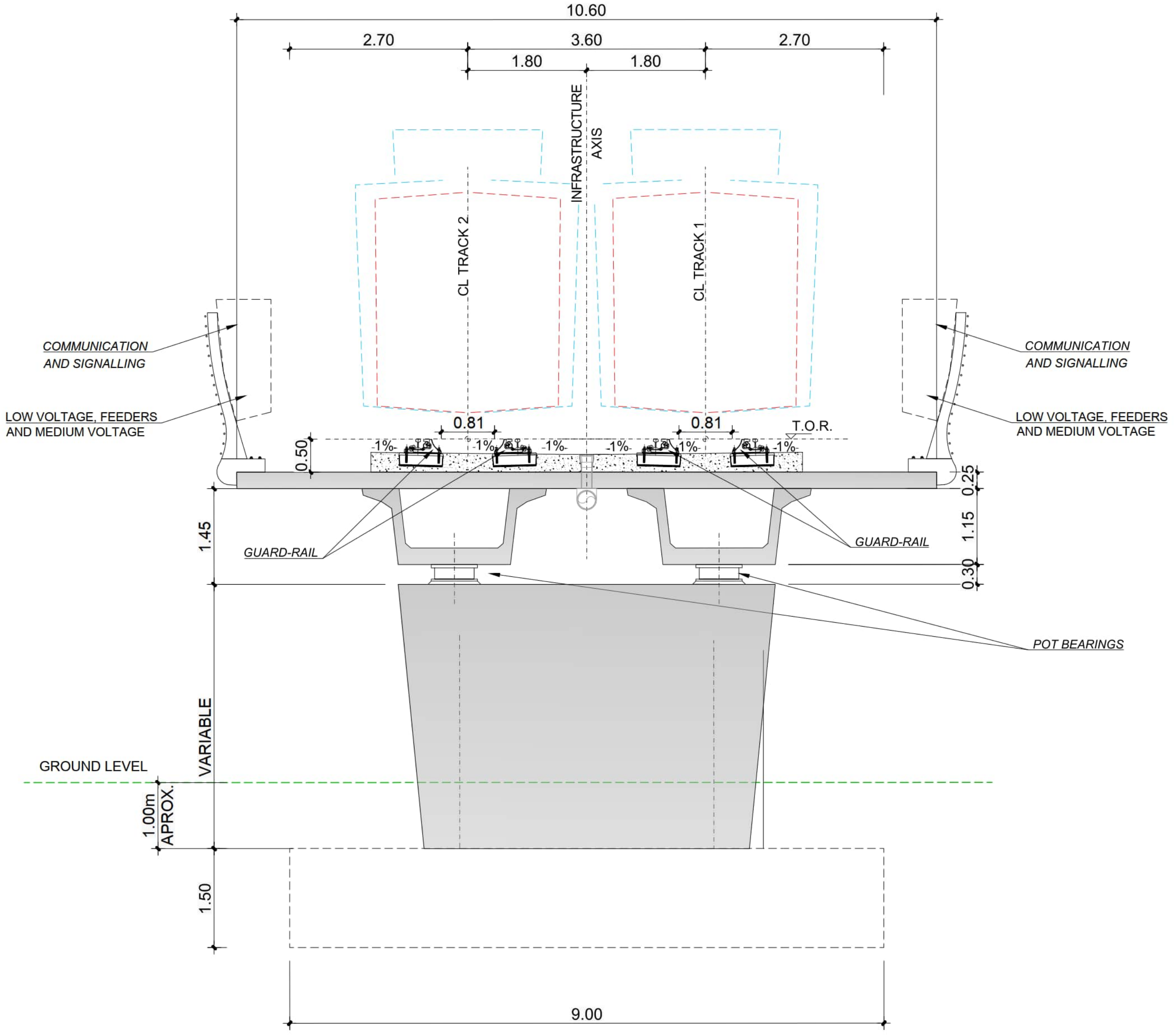
Drawing Nº: ML1-JAI-RTA-ROUT_XX-DR-Y-03015

Scales Original Size A1 1:30

Sheet 1 of 1

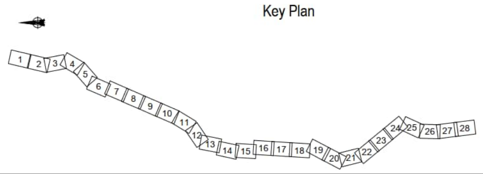


P1/P2 SECTION
SCALE 1:50



TYPICAL SECTION
SCALE 1:50

Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	RS	JB	NC
P02	11/12/20	Final Preliminary Design	DT	RS	JB	NC
P01	06/11/19	Preliminary Design	DT	RS	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

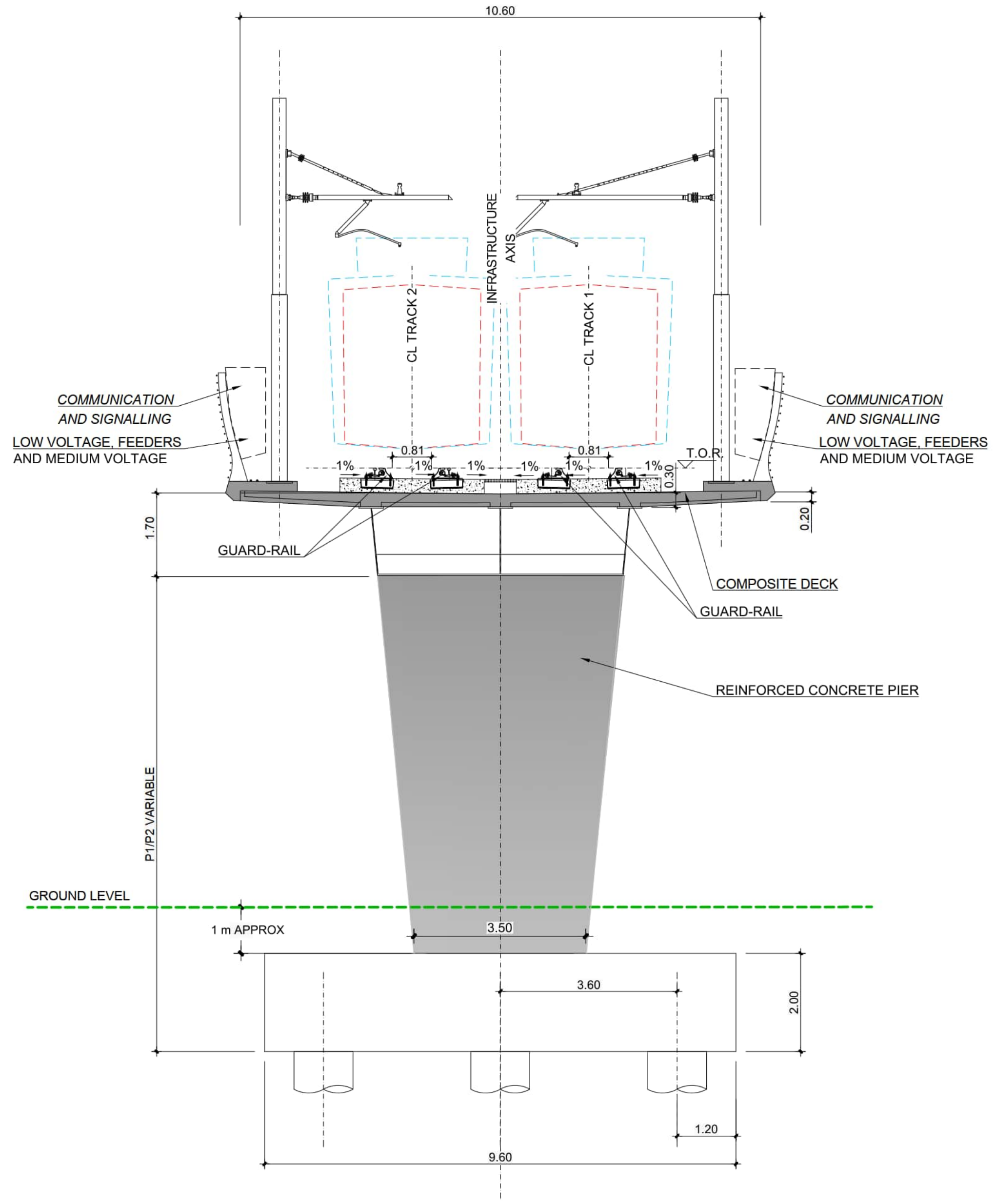
Drawing Title: TYPICAL CROSS SECTION BROADMEADOW AND WARD RIVER VIADUCT

Drawing Status: S4

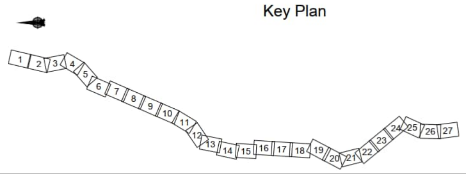
Drawing Nº: ML1-JAI-RTA-ROUT_XX-DR-Y-03016

Scales Original Size A1: 1:50

Sheet 1 of 1



Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P03	31/03/21	Preliminary Design Issue	DT	RS	JB	NC
P02	11/12/20	Final Preliminary Design	DT	RS	JB	NC
P01	06/11/19	Preliminary Design	DT	RS	JB	NC

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: TYPICAL CROSS SECTION
M50 VIADUCT
COMPOSITE DECK WITHOUT CENTRAL PIER

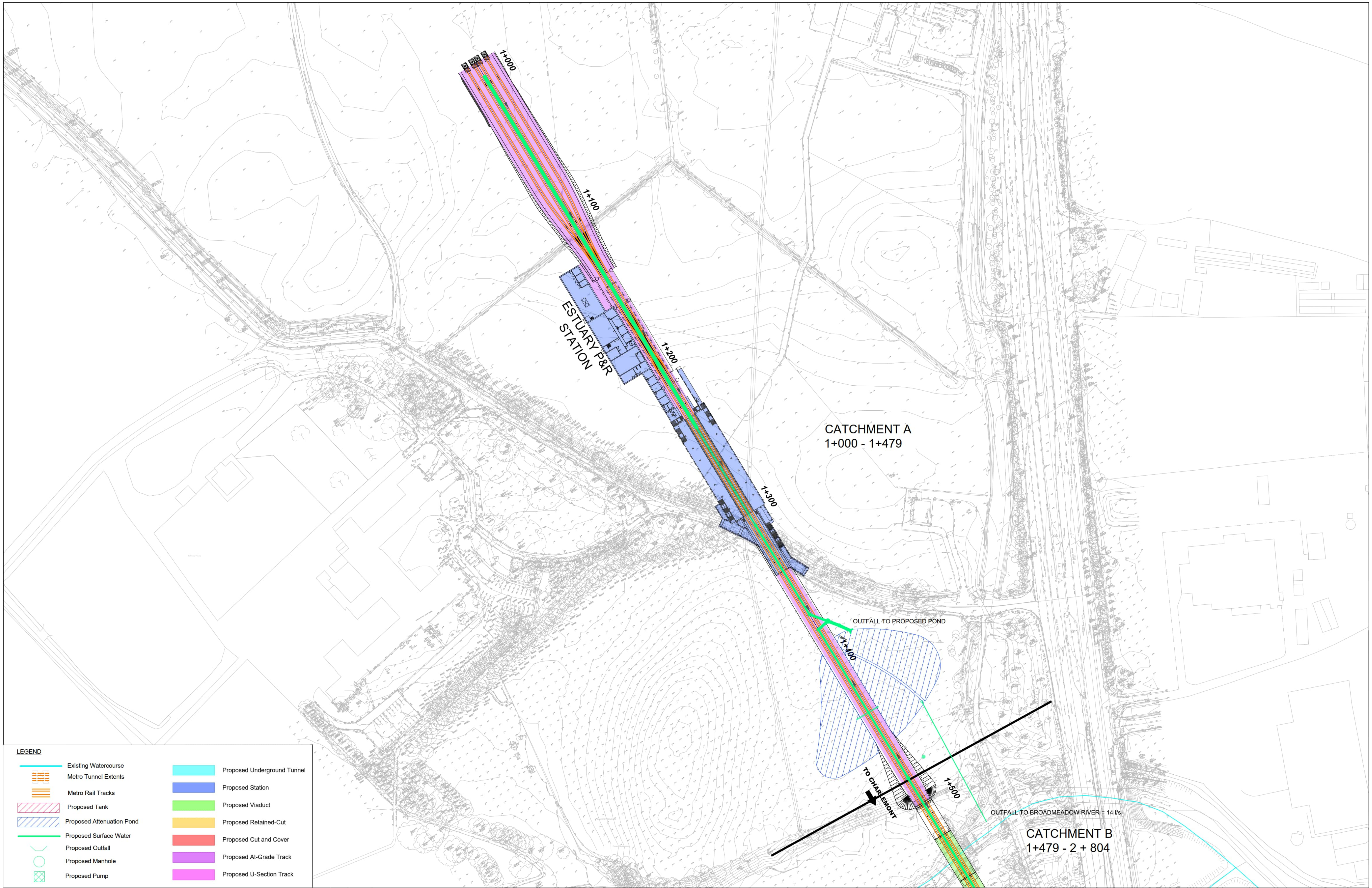
Drawing Status: S4

Drawing Nº: ML1-JAI-RTA-ROUT_XX-DR-Y-03017

Scales Original Size A1 1:75

Sheet 1 of 1

Appendix H. Track Cross-Section across the overground works



LEGEND

- Existing Watercourse
- Metro Tunnel Extents
- Metro Rail Tracks
- Proposed Tank
- Proposed Attenuation Pond
- Proposed Surface Water
- Proposed Outfall
- Proposed Manhole
- Proposed Pump
- Proposed Underground Tunnel
- Proposed Station
- Proposed Viaduct
- Proposed Retained-Cut
- Proposed Cut and Cover
- Proposed At-Grade Track
- Proposed U-Section Track

REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.01	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Drawing Title: METROLINK - PROPOSED DRAINAGE TRACK TYPE CATCHMENTS A

Drawing Status: S0

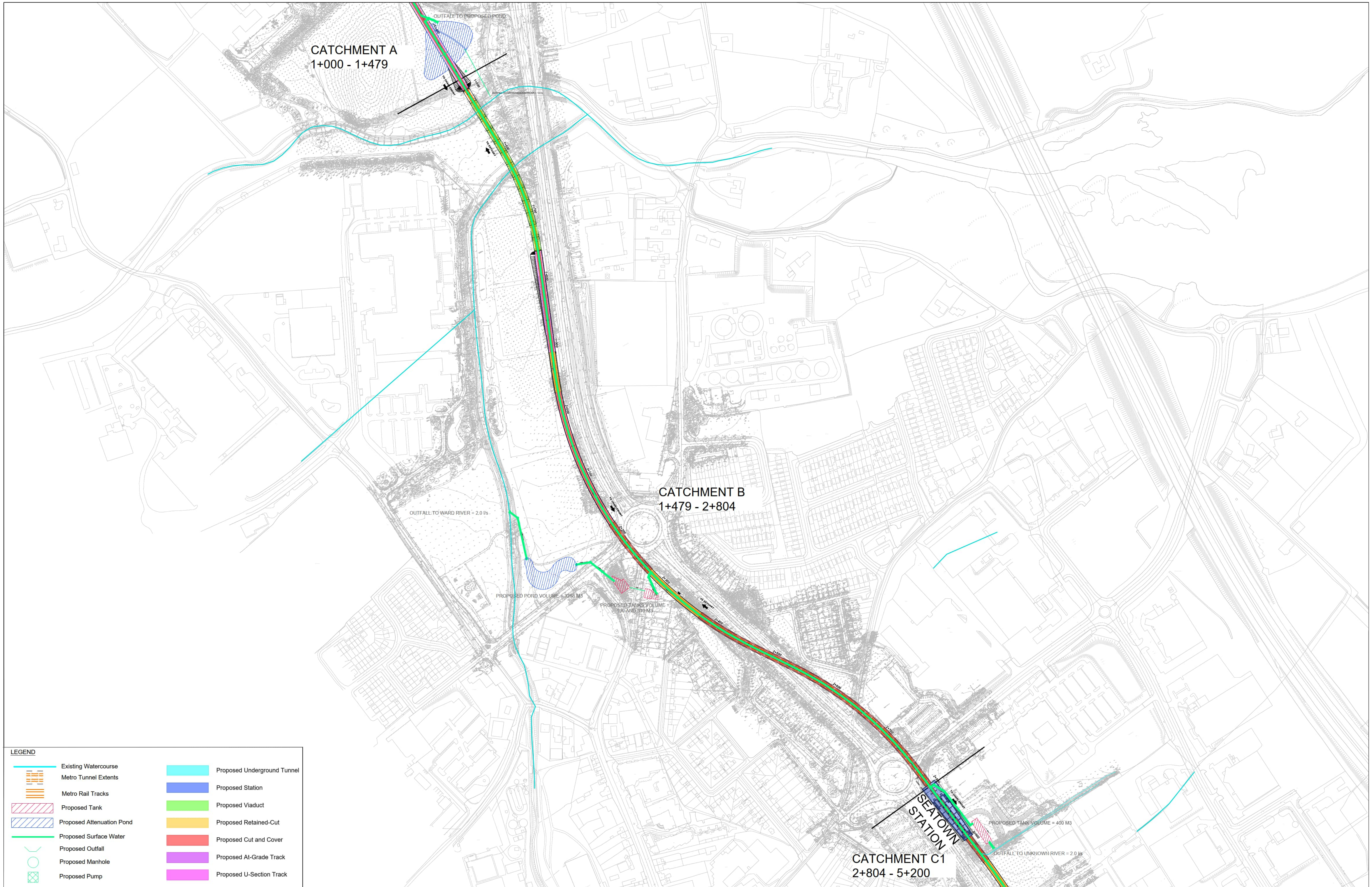
Consultant: JACOBS, IDOM

Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02099

Plan Drawing Nº 1

Scales Original Size A1 NTS

Sheet 1 of 8



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.01	26/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED DRAINAGE TRACK TYPE CATCHMENTS B

Drawing Status: S0

Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02100

Plan Drawing Nº 1

Scales Original Size A1 NTS

Sheet 2 of 8

LEGEND

Existing Watercourse	Proposed Underground Tunnel
Metro Tunnel Extents	Proposed Station
Metro Rail Tracks	Proposed Viaduct
Proposed Tank	Proposed Retained-Cut
Proposed Attenuation Pond	Proposed Cut and Cover
Proposed Surface Water	Proposed At-Grade Track
Proposed Outfall	Proposed U-Section Track
Proposed Manhole	
Proposed Pump	

REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.01	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client

Project

METROLINK

Consultant

JACOBS IDOM

Drawing Title

METROLINK - PROPOSED DRAINAGE
TRACK TYPE CATCHMENTS
C1

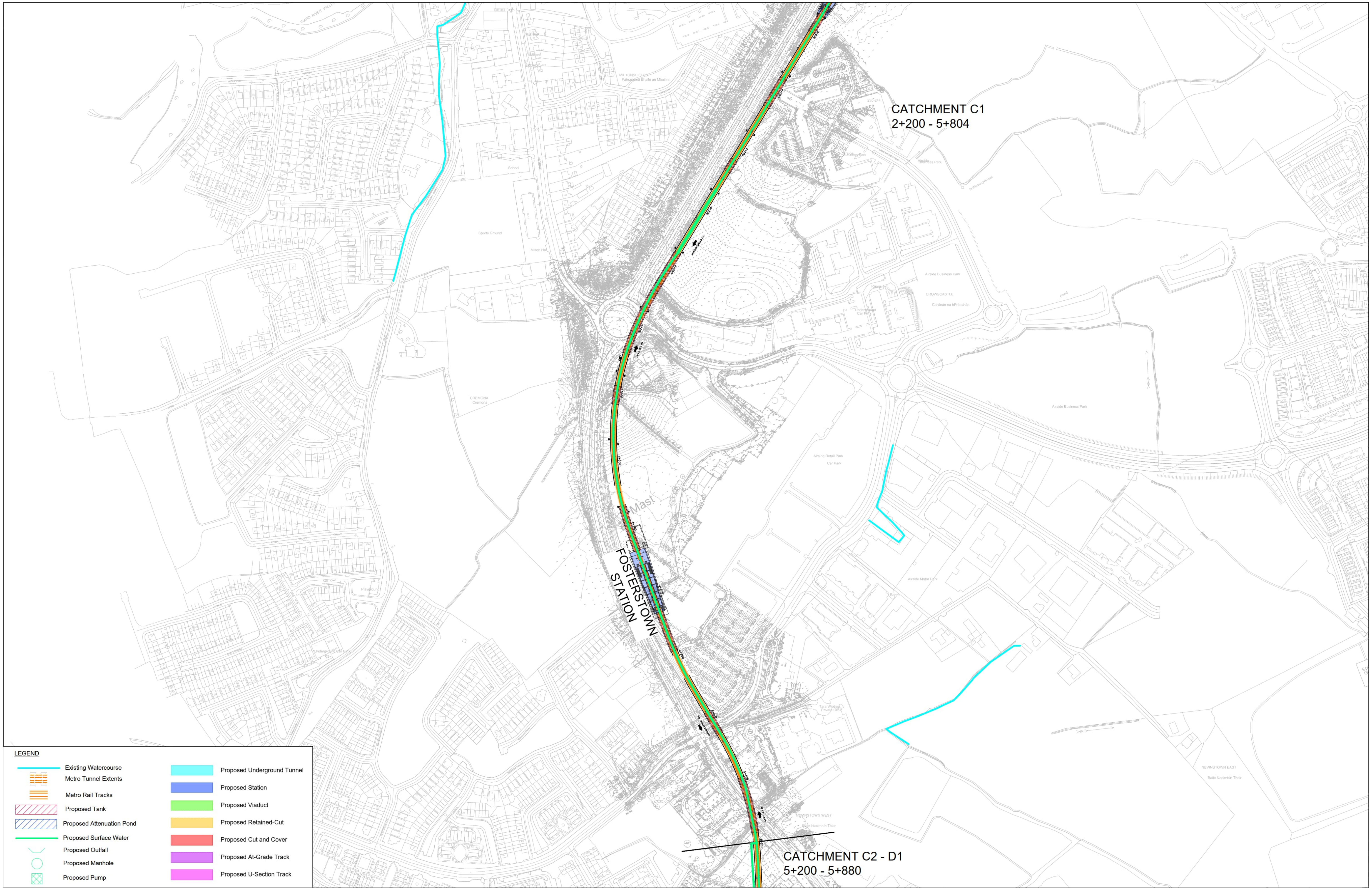
Drawing Status

S0

Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02101

Plan Drawing Nº 1

Scales Original Size A1 NTS



LEGEND

	Existing Watercourse		Proposed Underground Tunnel
	Metro Tunnel Extents		Proposed Station
	Metro Rail Tracks		Proposed Viaduct
	Proposed Tank		Proposed Retained-Cut
	Proposed Attenuation Pond		Proposed Cut and Cover
	Proposed Surface Water		Proposed At-Grade Track
	Proposed Outfall		Proposed U-Section Track
	Proposed Manhole		
	Proposed Pump		

REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.01	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Drawing Title: METROLINK - PROPOSED DRAINAGE TRACK TYPE CATCHMENTS C1

Drawing Status: S0

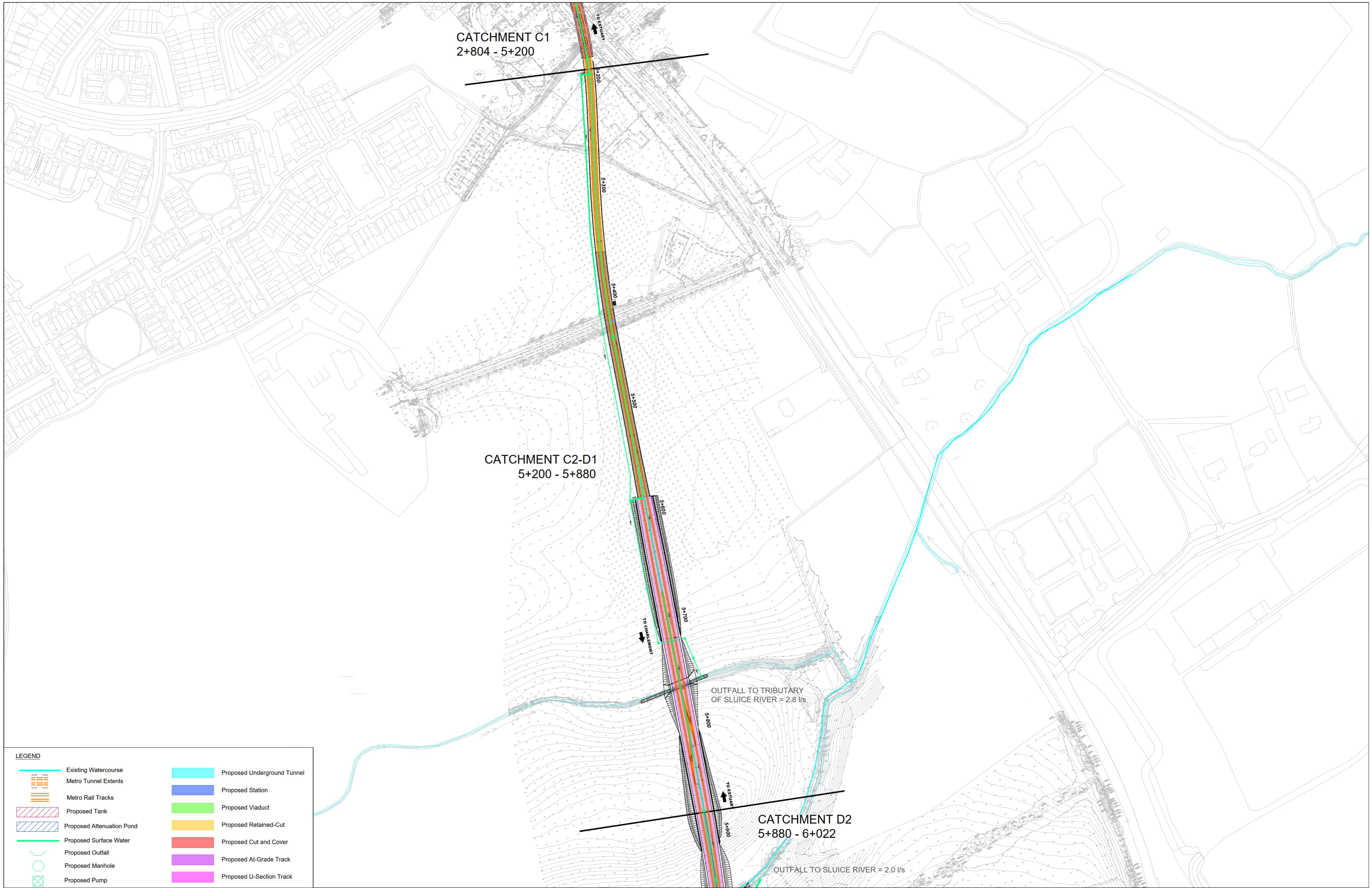
Consultant: JACOBS, IDOM

Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02101

Plan Drawing Nº 1

Scales Original Size A1 NTS

Sheet 4 of 8



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.01	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Drawing Title: METROLINK - PROPOSED DRAINAGE TRACK TYPE CATCHMENTS C2-D1

Drawing Status: S0

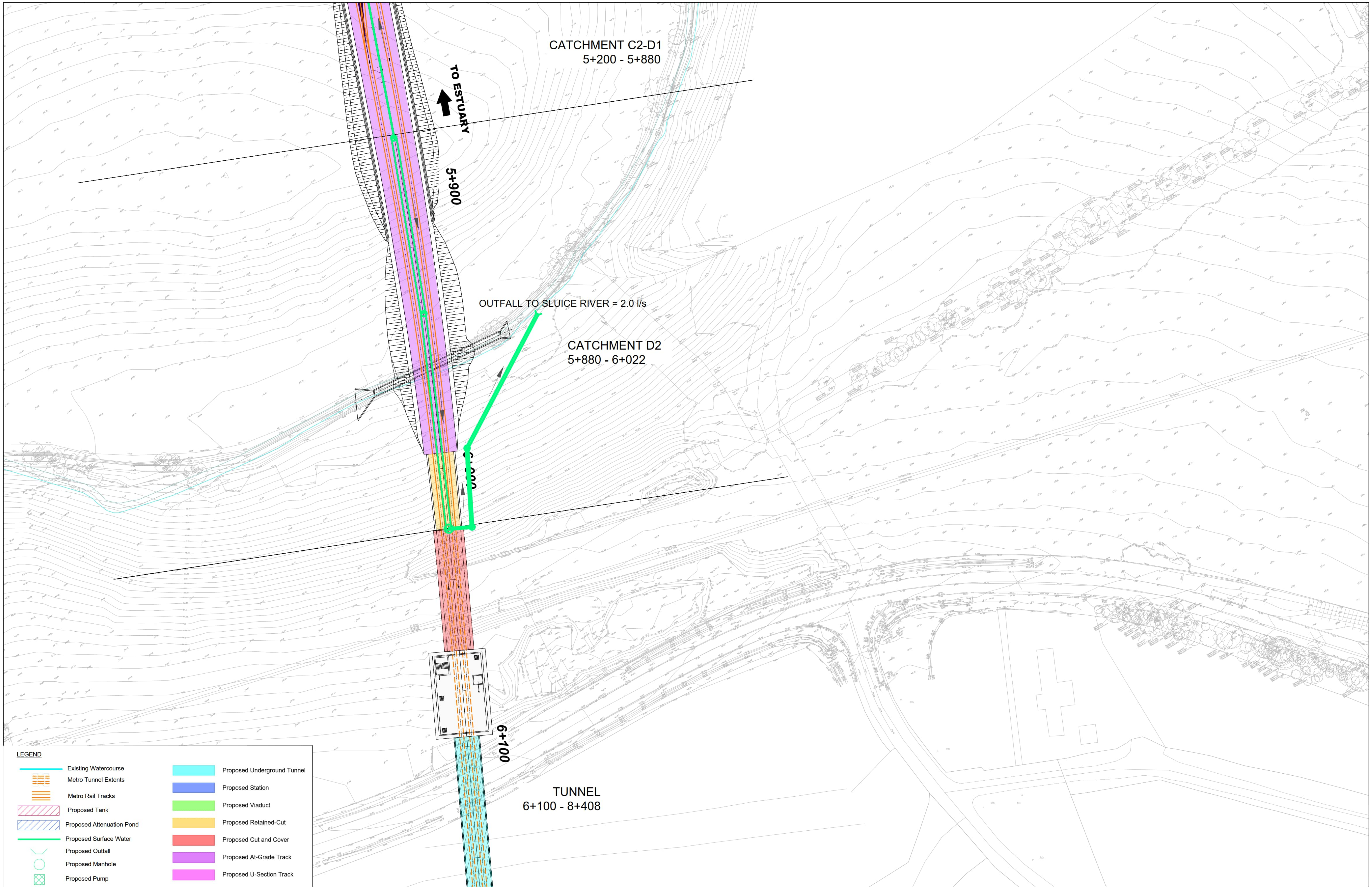
Consultant: JACOBS, IDOM

Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02102

Plan Drawing Nº 1

Scales Original Size A1 NTS

Sheet 5 of 8



LEGEND

Existing Watercourse	Proposed Underground Tunnel
Metro Tunnel Extents	Proposed Station
Metro Rail Tracks	Proposed Viaduct
Proposed Tank	Proposed Retained-Cut
Proposed Attenuation Pond	Proposed Cut and Cover
Proposed Surface Water	Proposed At-Grade Track
Proposed Outfall	Proposed U-Section Track
Proposed Manhole	
Proposed Pump	

REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.01	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

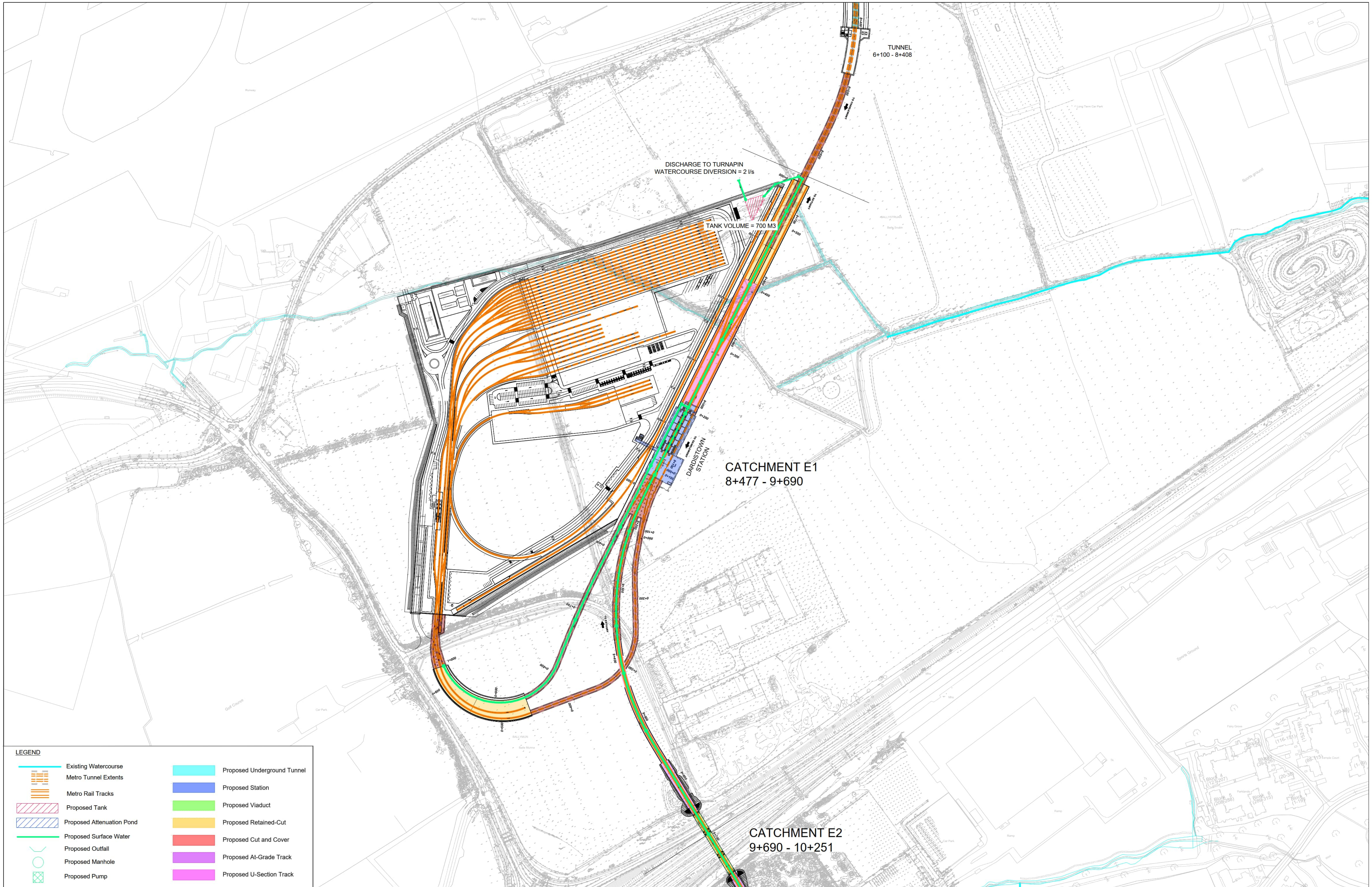
Drawing Title: METROLINK - PROPOSED DRAINAGE TRACK TYPE CATCHMENTS D2

Drawing Status: S0

Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02103

Plan Drawing Nº 1

Scales Original Size A1 NTS



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.01	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED DRAINAGE TRACK TYPE CATCHMENTS E1

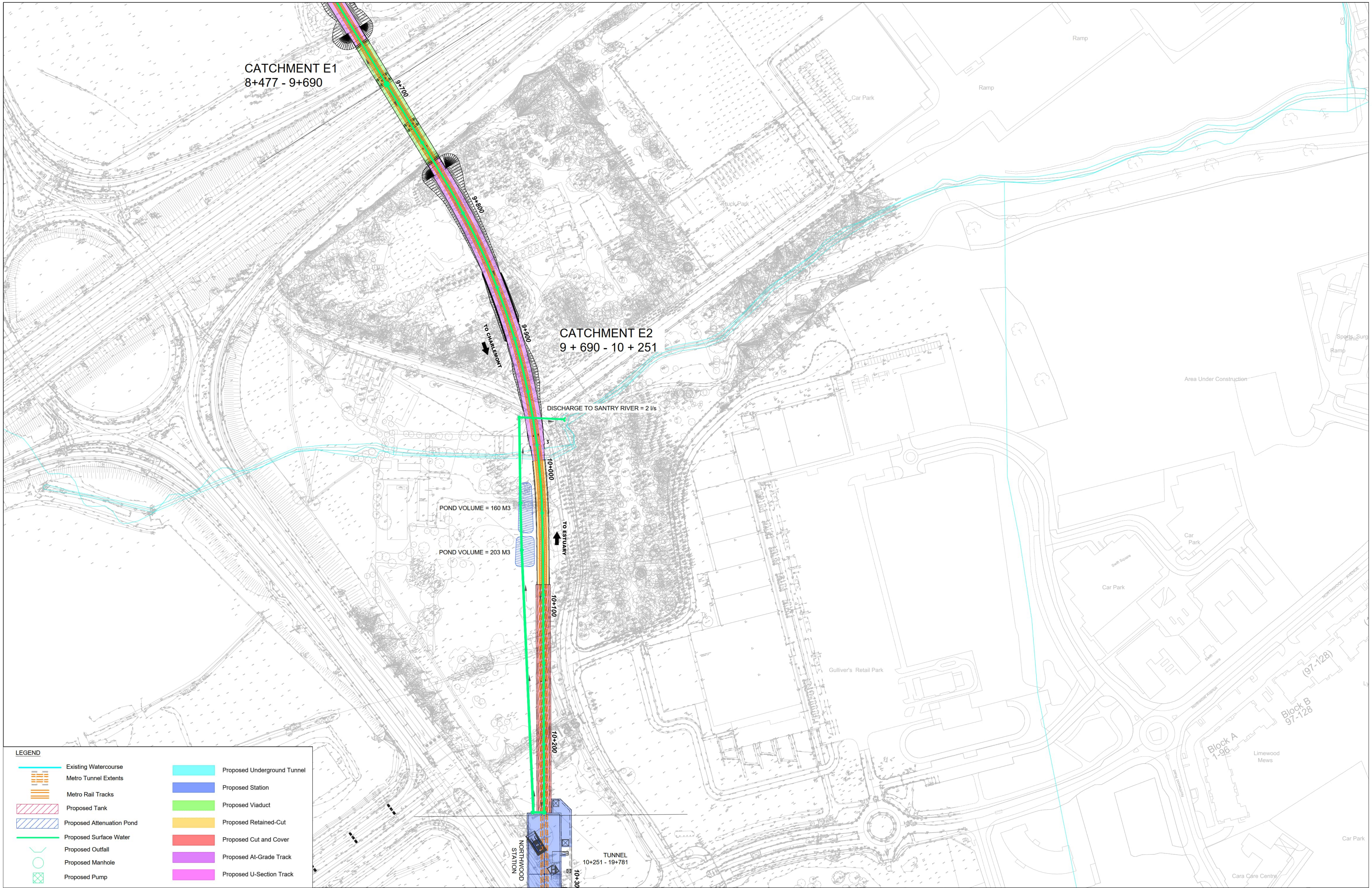
Drawing Status: S0

Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02104

Plan Drawing Nº 1

Scales Original Size A1 NTS

Sheet 7 of 8



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.01	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED DRAINAGE TRACK TYPE CATCHMENTS E2

Drawing Status: S0

Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02105

Plan Drawing Nº 1

Scales Original Size A1 NTS

Sheet 8 of 8

Appendix I. Track Drainage Design Features

REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.01	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED DRAINAGE TRACK DRAINAGE CATCHMENTS A

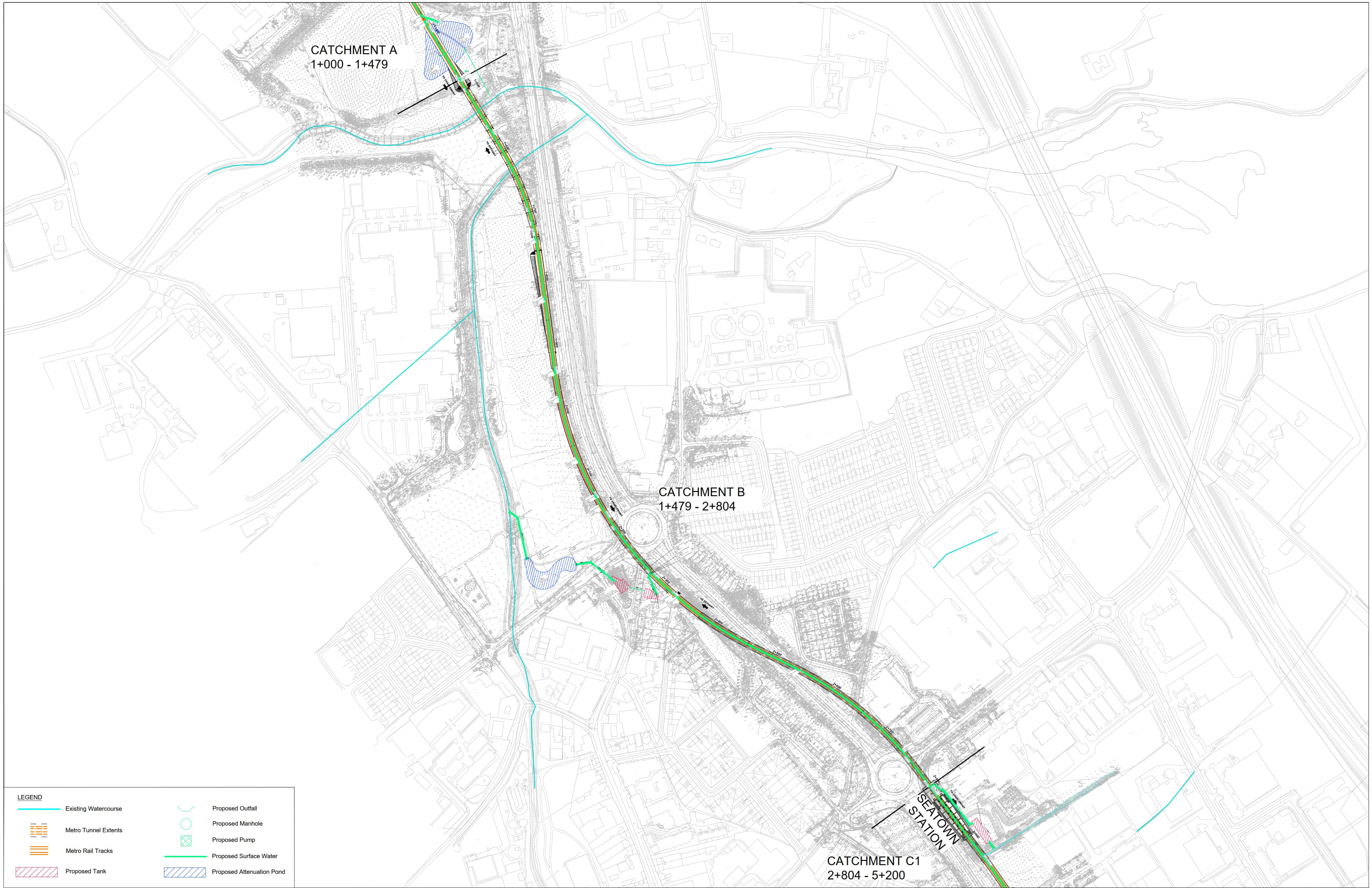
Drawing Status: S0

Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02099

Plan Drawing Nº 2

Scales Original Size A1 NTS

Sheet 1 of 8



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.01	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Drawing Title: METROLINK - PROPOSED DRAINAGE TRACK DRAINAGE CATCHMENTS B

Drawing Status: S0

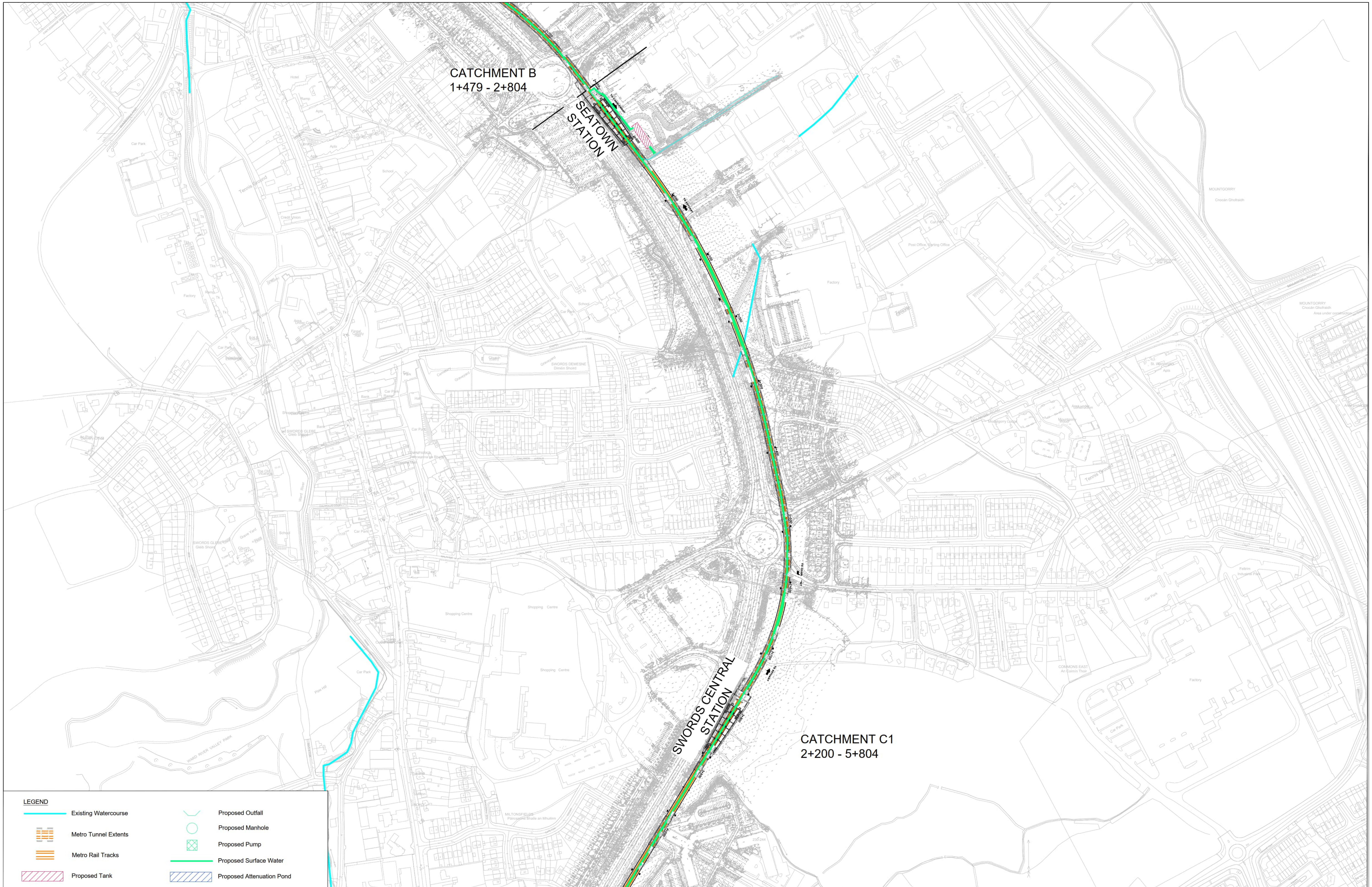
Consultant: JACOBS, IDOM

Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02100

Plan Drawing Nº 2

Scales Original Size A1 NTS

Sheet 2 of 8



LEGEND

- Existing Watercourse
- Metro Tunnel Extents
- Metro Rail Tracks
- Proposed Tank
- Proposed Outfall
- Proposed Manhole
- Proposed Pump
- Proposed Surface Water
- Proposed Attenuation Pond

REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.01	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Drawing Title: METROLINK - PROPOSED DRAINAGE TRACK DRAINAGE CATCHMENTS C1

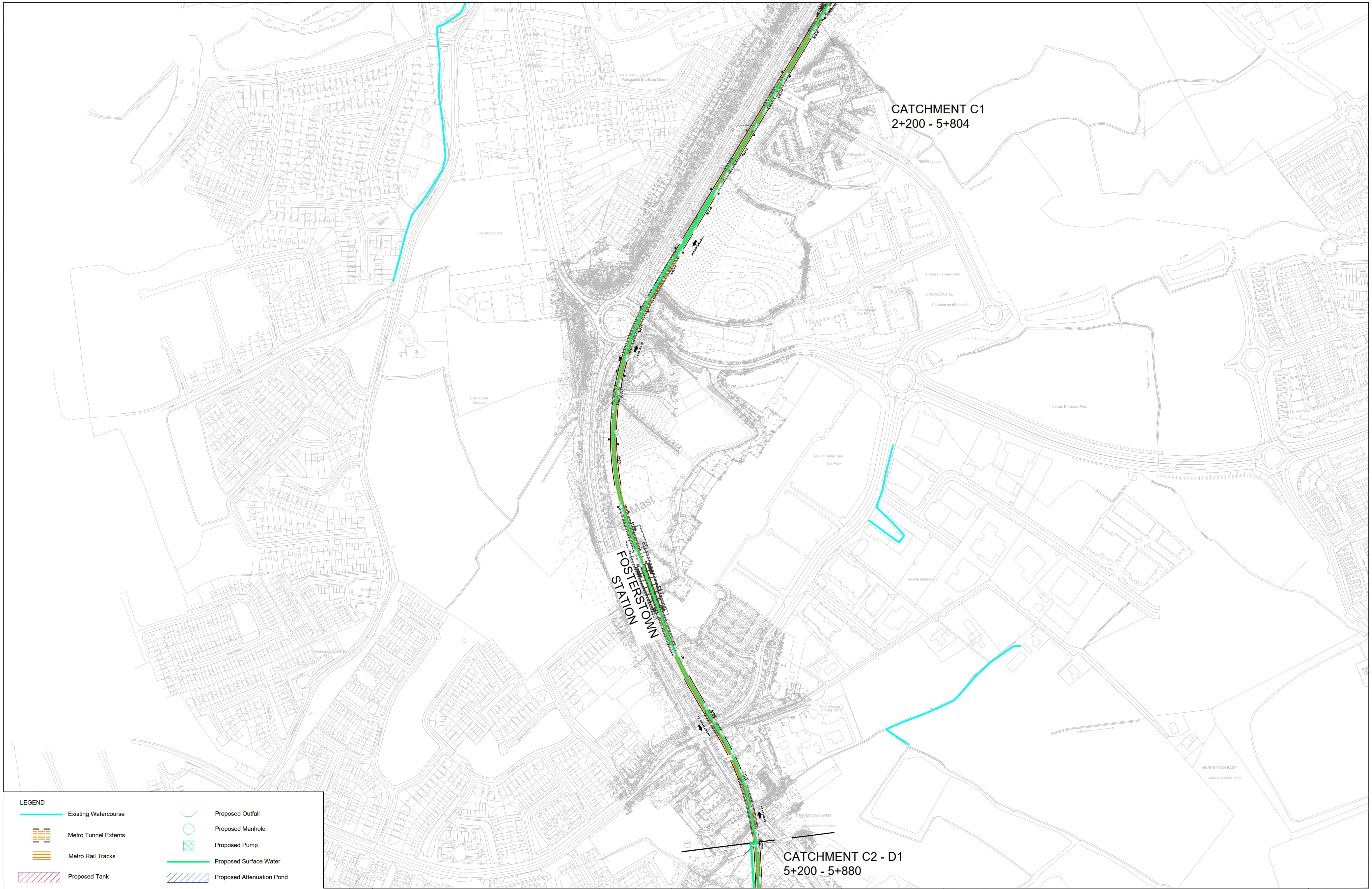
Drawing Status: S0

Consultant: JACOBS, IDOM

Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02101

Plan Drawing Nº 2

Scales Original Size A1 NTS



LEGEND

Existing Watercourse	Proposed Outfall
Metro Tunnel Extents	Proposed Manhole
Metro Rail Tracks	Proposed Pump
Proposed Tank	Proposed Surface Water
	Proposed Attenuation Pond

P01.01	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS
REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client

Project

Drawing Title
METROLINK - PROPOSED DRAINAGE
TRACK DRAINAGE CATCHMENTS
C1

Drawing Status
S0

Consultant

Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02101

Plan Drawing Nº 2

Scales Original Size A1 NTS

Sheet 4 of 8

REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.01	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED DRAINAGE TRACK DRAINAGE CATCHMENTS C2-D1

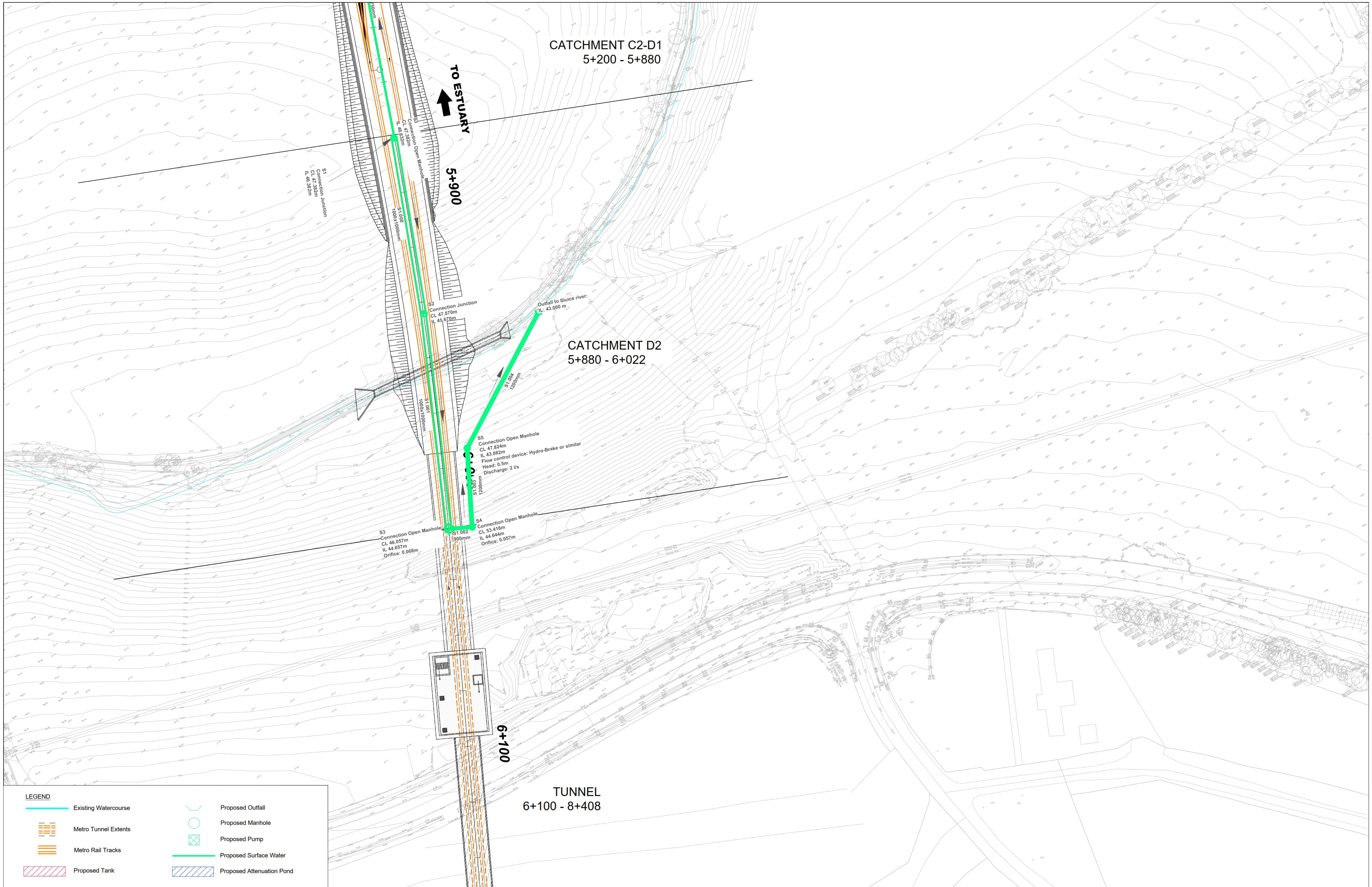
Drawing Status: S0

Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02102

Plan Drawing Nº 2

Scales Original Size A1 NTS

Sheet 5 of 8



P01.01	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS
REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Drawing Title: METROLINK - PROPOSED DRAINAGE TRACK DRAINAGE CATCHMENTS D2

Drawing Status: S0

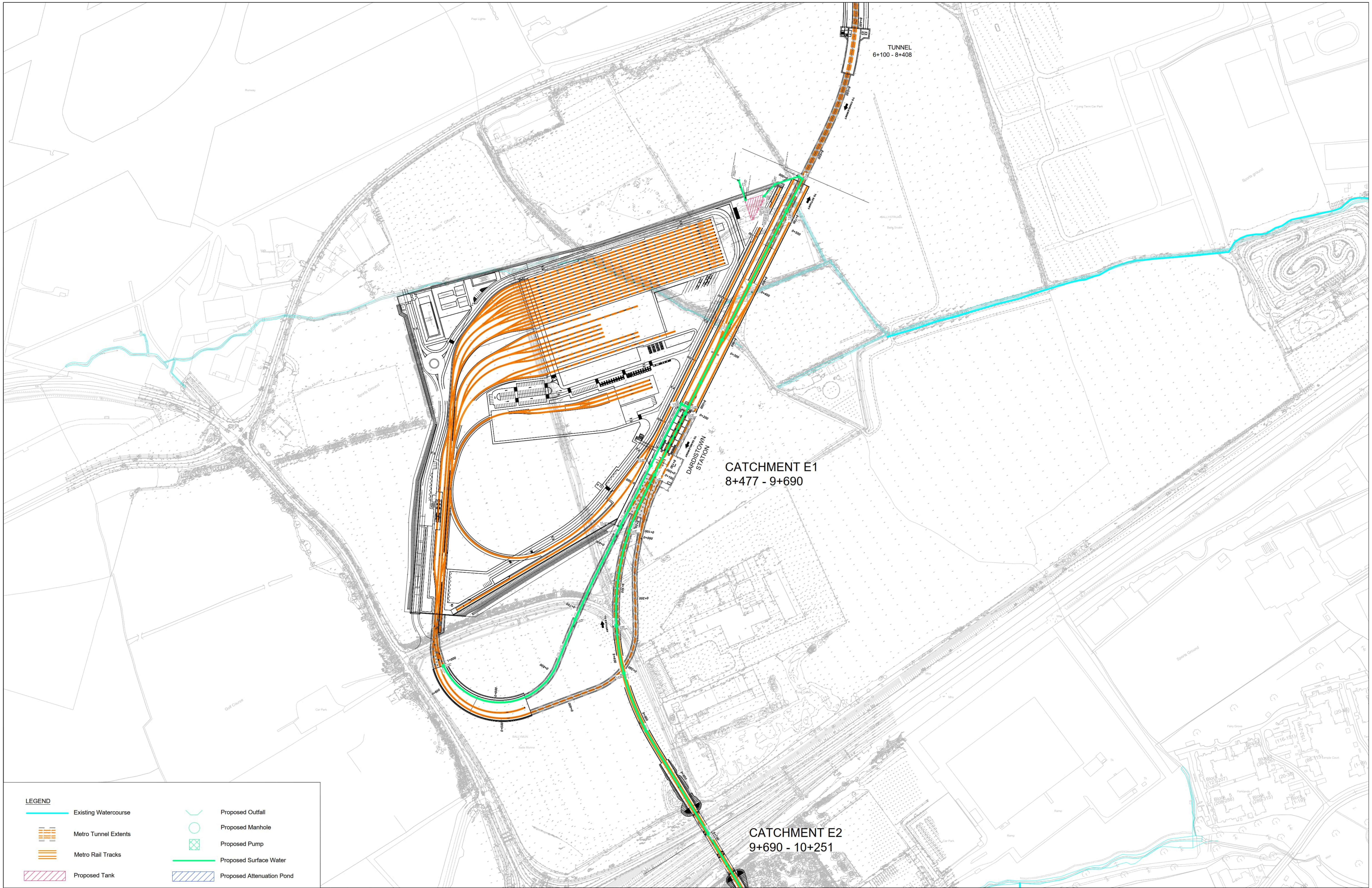
Consultant: JACOBS, IDOM

Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02103

Plan Drawing Nº 2

Scales Original Size A1 NTS

Sheet 6 of 8



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.01	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA (Údarás Náisiúnta Iompair, National Transport Authority)

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED DRAINAGE TRACK DRAINAGE CATCHMENTS E1

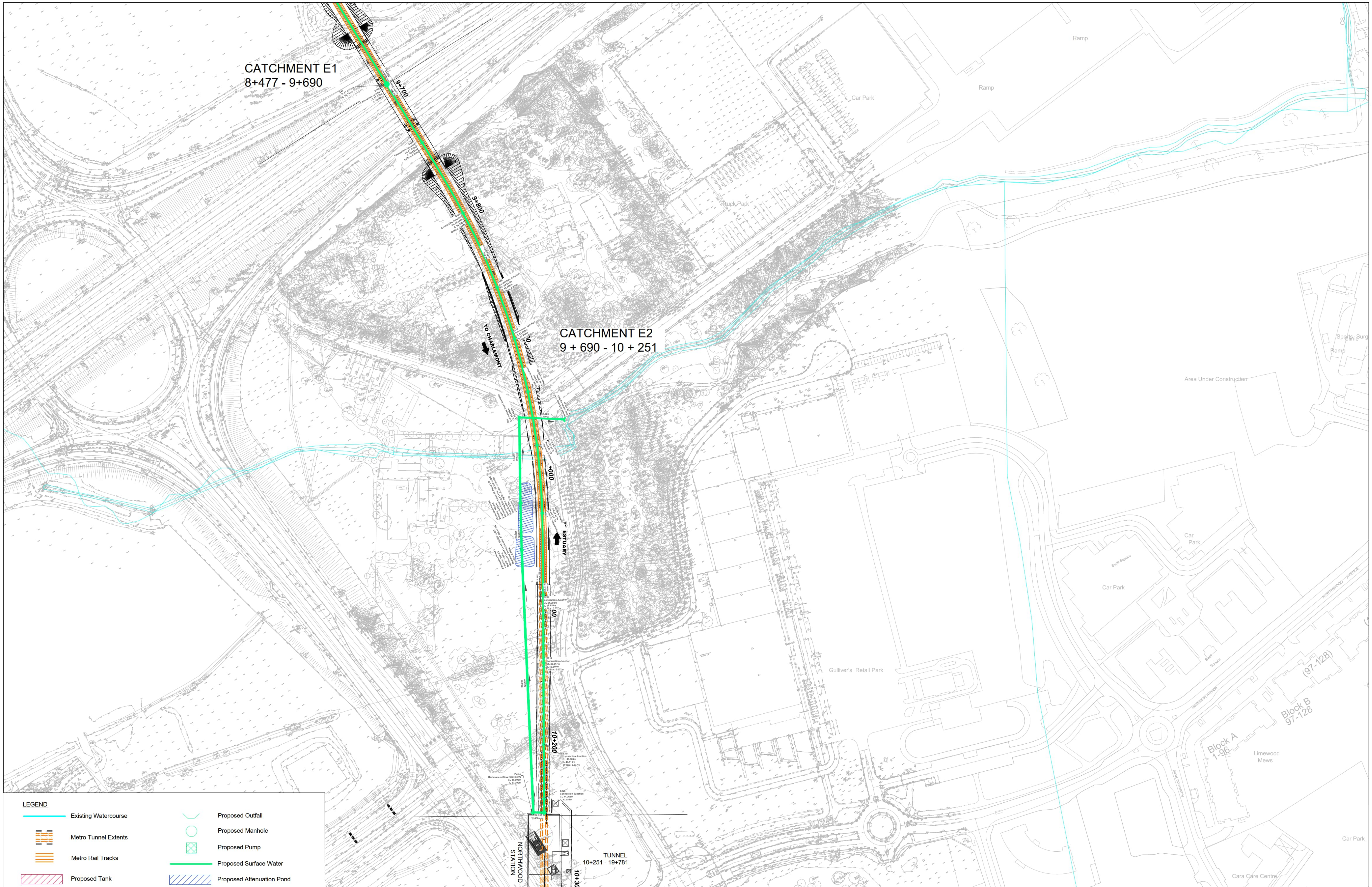
Drawing Status: S0

Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02104

Plan Drawing Nº 2

Scales Original Size A1 NTS

Sheet 7 of 8



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.01	28/01/22	PRELIMINARY DESIGN ISSUE	BD	PT	RD	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.

All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: METROLINK - PROPOSED DRAINAGE TRACK DRAINAGE CATCHMENTS E2

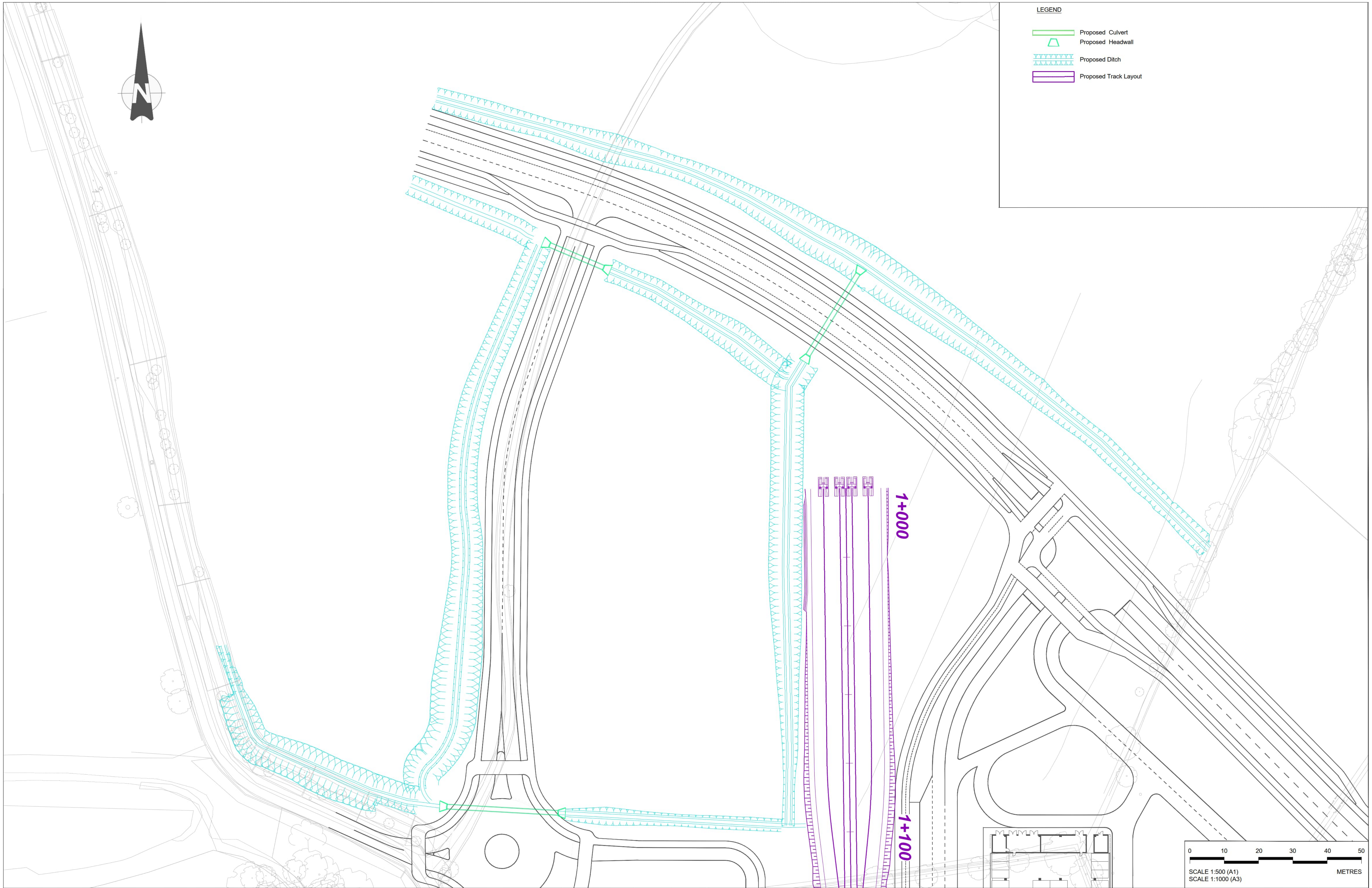
Drawing Status: S0

Drawing Nº ML1-JAI-URD-ROUT_XX-DR-Y-02105

Plan Drawing Nº 1

Scales Original Size A1 NTS

Appendix J. Proposed Diversion Works across the MetroLink Scheme



LEGEND

- Proposed Culvert
- Proposed Headwall
- Proposed Ditch
- Proposed Track Layout

0 10 20 30 40 50

SCALE 1:500 (A1)
SCALE 1:1000 (A3)
METRES

REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
C01	16/11/19	Preliminary Design	AR	WK	NC	NC
P02	19/12/20	Draft Updated Preliminary Design	LP	RD	RD	NC
P03	29/07/21	Preliminary Design Issue	AL	PT	RD	NC
P04.1	19/01/22	Preliminary Design	ANH	CP	CP	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.

All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client

Project

Consultant

Drawing Title

Estuary
Proposed Stream Diversion
Preliminary Design Issue

Drawing Status

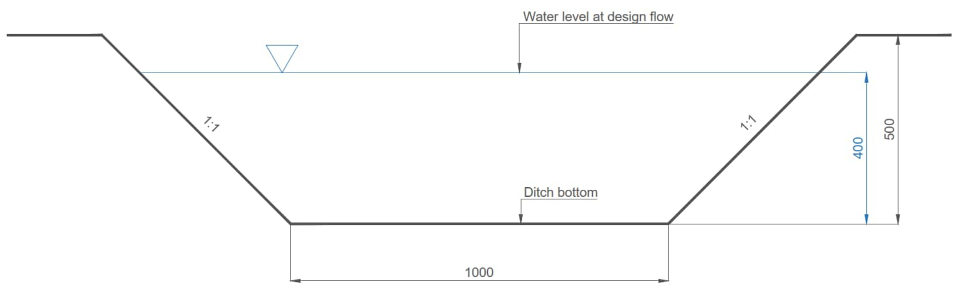
S4

Drawing Nº

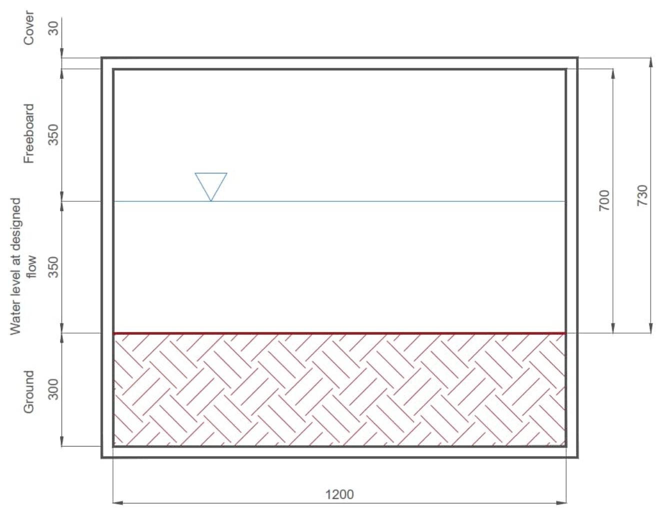
ML1-JAI-VUT-MS01_XX-DR-Y-00198

Scales Original Size A1 1:500

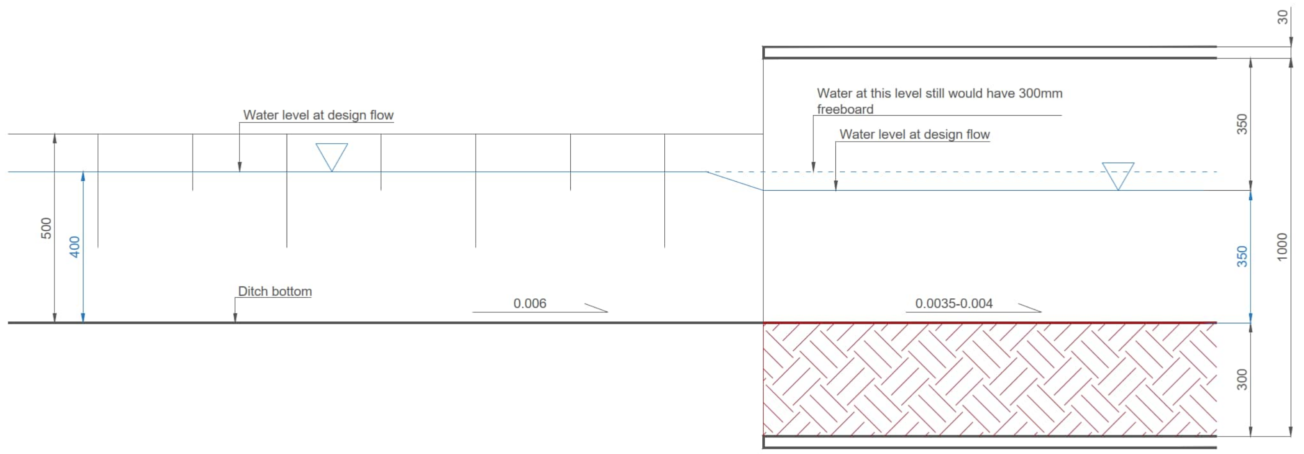
Sheet 1 of 1



Cross-section of ditch



Cross-section of culvert



Longitudinal section of ditch-to-culvert connection

REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	17/12/21	Preliminary Design	ANH	CP	CP	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client

Consultant

Project

Drawing Title
Minimal Ditch and Culvert
Cross Section and Long Section
At Estuary Diversion

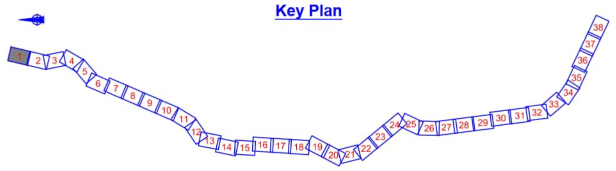
Drawing Status
S0

Drawing Nº
ML1-JAI-PLD-MS01_XX-DR-Y-00001

Scales Original Size A1 1:10

Sheet 1 of 1

Key Plan



REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.5	27/04/21		FP	FP		
P01.6	29/04/21		LC	LC		
P01.7	30/04/21	Preliminary Design Issue	FP	FP		
P01.8	18/06/21	Preliminary Design Issue				

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

Drawing Title: Dardistown Station
2D Landscape Layout
Preliminary Design Issue

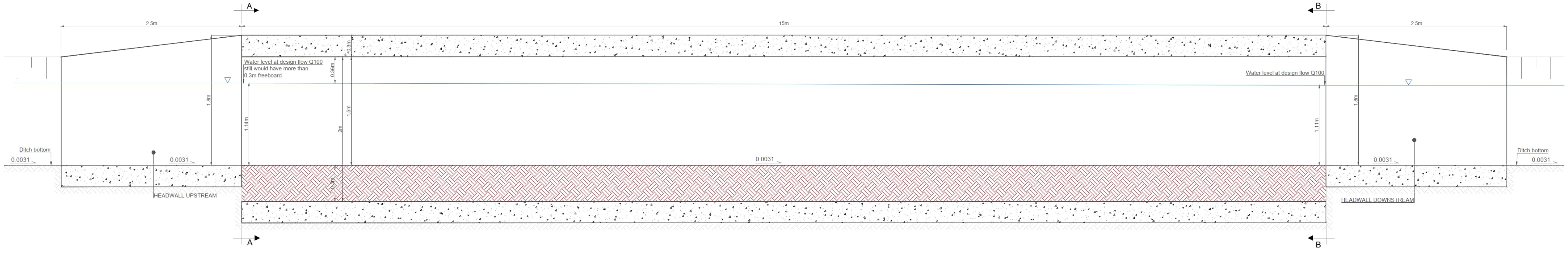
Drawing Status: S4

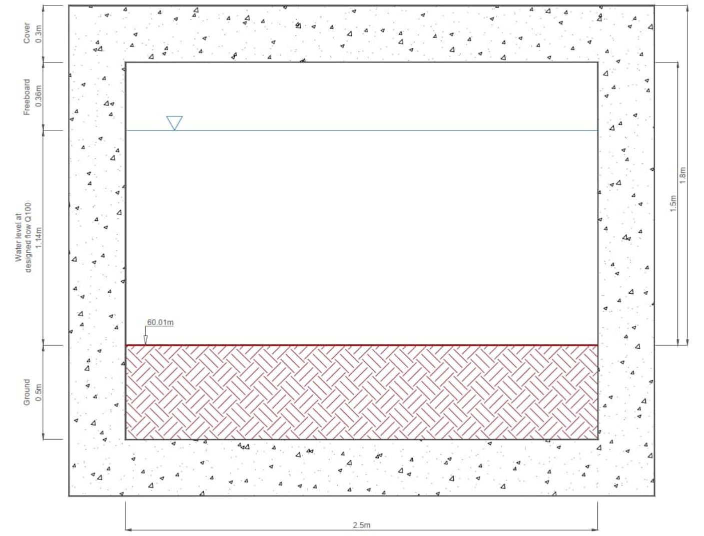
Drawing Nº: ML1-JAI-ARL-MS06_XX-M2-Y-00001

Scales Original Size: A1

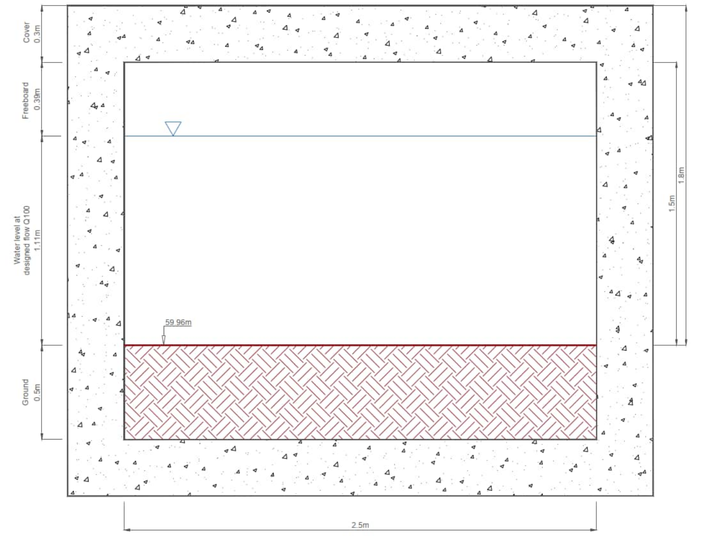
Sheet 1 of 1

Longitudinal section of culvert
Sc 1:30

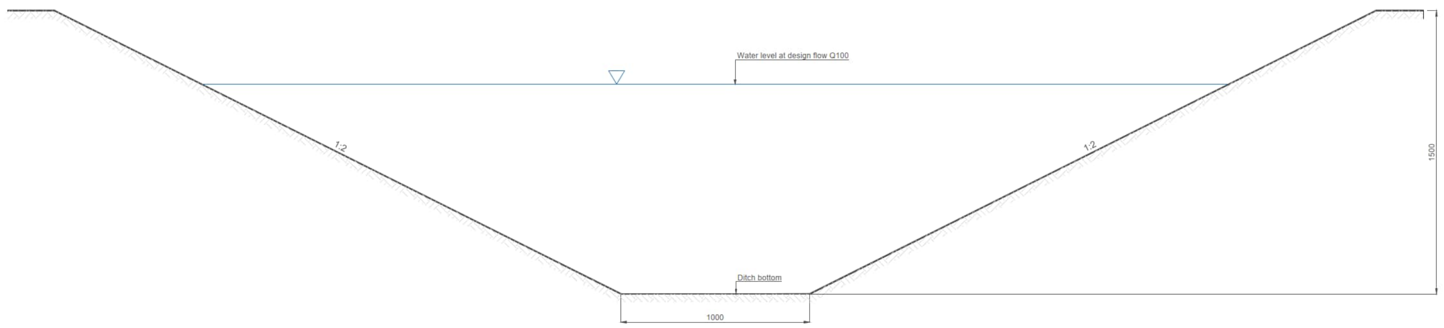




A - A
Upstream Cross-section of culvert
Sc 1:20



B - B
Downstream Cross-section of culvert
Sc 1:20



Cross-section of ditch
Sc 1:20

REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	11/01/22		PC	PT	PT	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA Údarás Náisiúnta Iompair National Transport Authority

Project: METROLINK

Consultant: JACOBS, IDOM

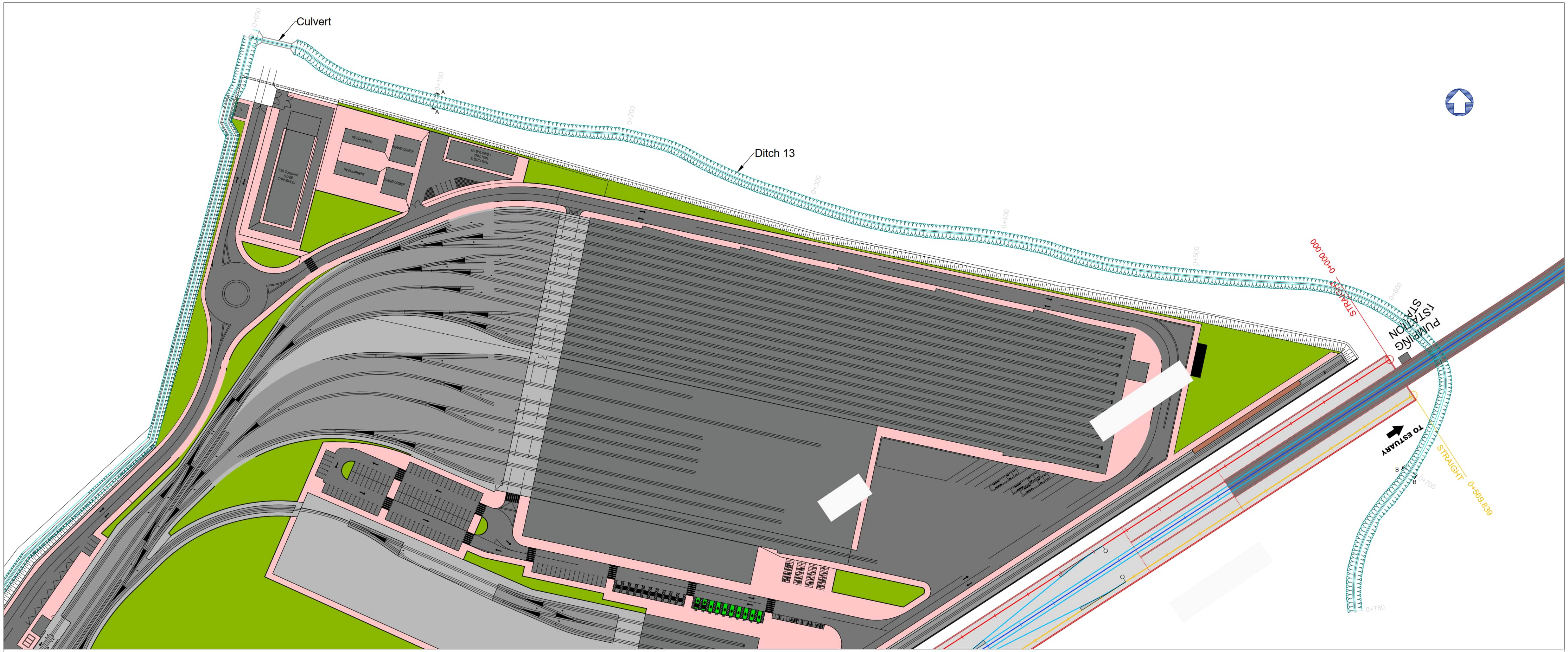
Drawing Title: Minimal Ditch and Culvert Cross Section and Long Section at Dardistown Diversion

Drawing Status: S0

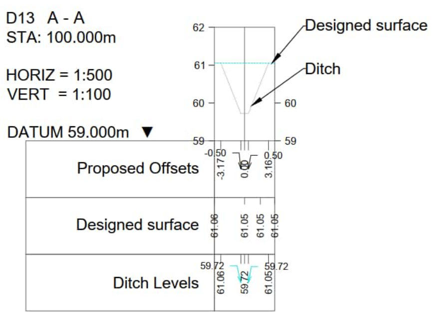
Drawing Nº: ML1-JAI-PLD-MS06_XX-DR-Y-00001

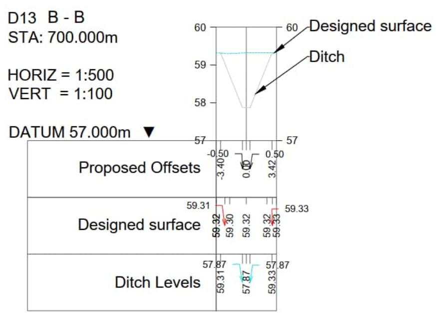
Scales: AS SHOWN

Sheet 1 of 1



DARDISTOWN Ditch 13
Scale 1:1000





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	25/01/22	PRELIMINARY DESIGN	PC	PT	PT	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Project: METROLINK

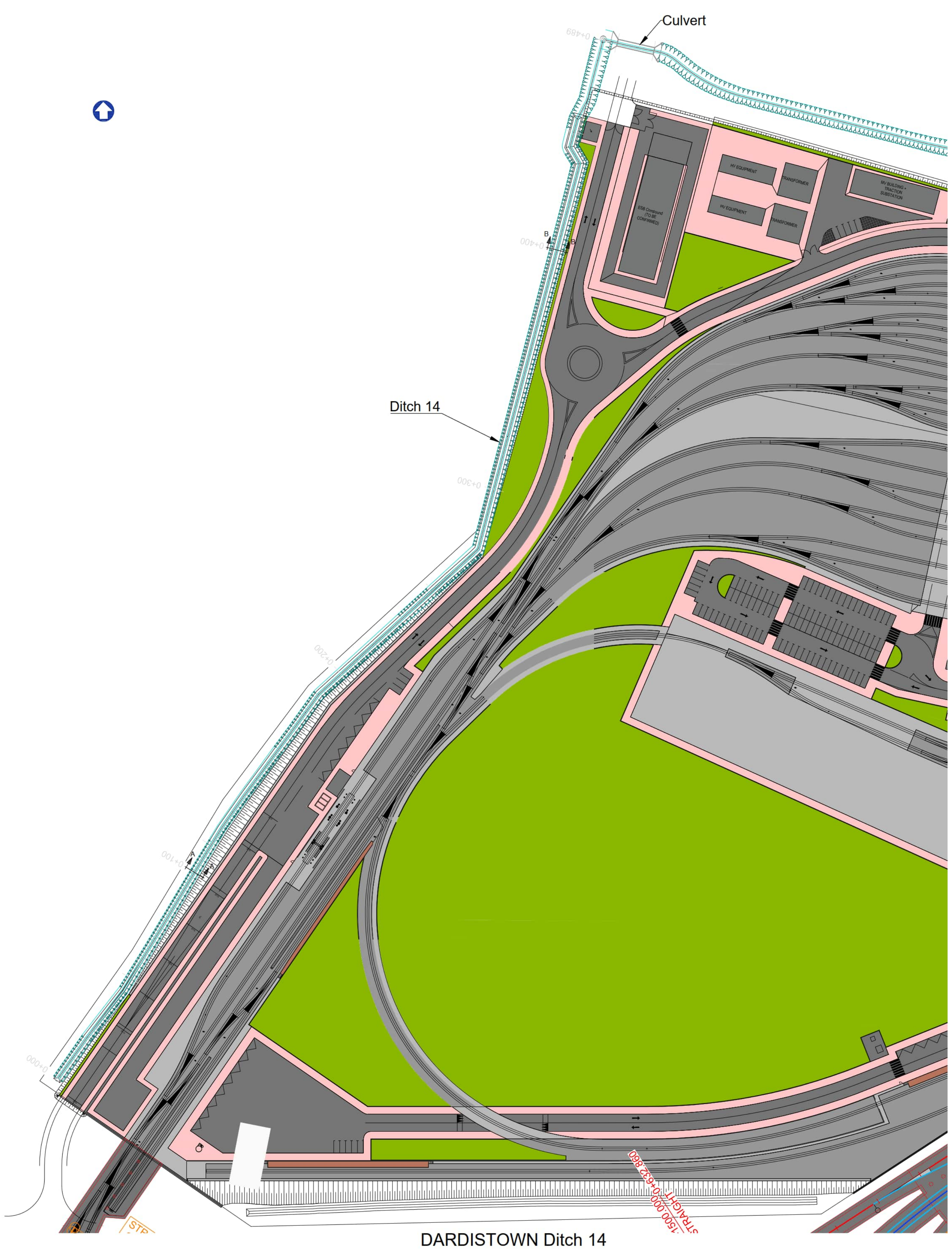
Consultant: JACOBS, IDOM

Drawing Title: Utility Diversion
Ditch 13 Dardistown
Plan View and Cross Sections

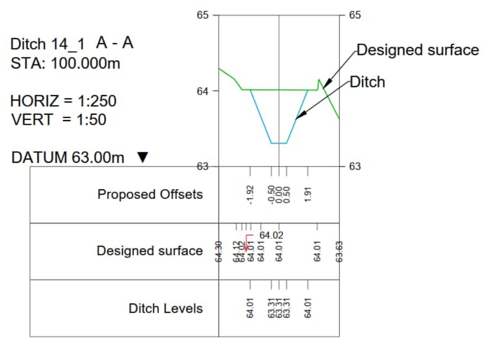
Drawing Status: S0

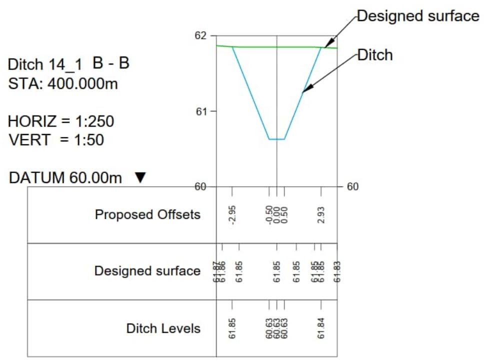
Drawing Nº: ML1-JAI-PLD-MS06_XX-DR-Y-00003

Scales: AS SHOW | Original Size A1 | Sheet 1 of 1



DARDISTOWN Ditch 14
Scale 1:1000





REV.	DATE	Description	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
P01.1	25/01/22	PRELIMINARY DESIGN	PC	PT	PT	NS

All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.
All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Client: TII, NTA

Consultant: JACOBS, IDOM

Project: METROLINK

Drawing Title: Utility Diversion
Ditch 14 Dardistown Diversion
Plan View and Cross Section

Drawing Status: S0

Drawing Nº: ML1-JAI-PLD-MS06_XX-DR-Y-00002

Scales: AS SHOWN

Original Size A1

Sheet 1 of 1