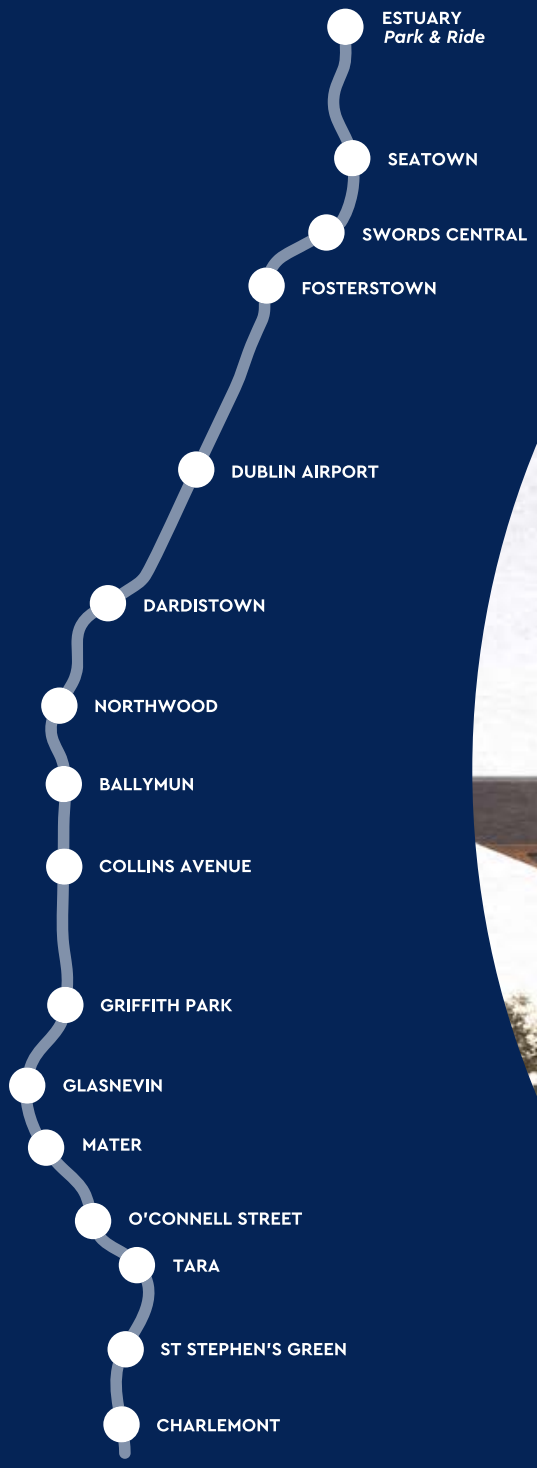


5 MetroLink Construction Phase

Contents

List of Abbreviations

Acronym	Meaning
ACM	Asbestos Containing Materials
BTS	British Tunnelling Society
CEF	Community Engagement Framework
CEMP	Construction Environmental Management Plan
CMS	Cable Management System
CRs	Constructability Reports
DAA	Dublin Airport Authority
DCC	Dublin City Council
DCU	Dublin City University
DMP	Dust Minimisation Plan
DP	Demolition Plan
D-Walls	Diaphragm Walls
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMS	Environmental Management System
EPB	Earth Pressure Balance
ESBN	Electricity Supply Board Networks
EU	European Union
FCC	Fingal County Council
HGV	Heavy Goods Vehicles
IFI	Inland Fisheries Ireland
IP	Ingress Protection
ISMP	Invasive Species Management Plan
M&E	Mechanical & Electrical
MEP	Mechanical Electrical Plumbing
NDC	North Dublin Corporate Park
NPWS	National Parks and Wildlife Services
OCC	Operational Control Centre
OCR	Overhead Conductor Rail
OCS	Overhead Contact System
OHLE	Overhead Line Equipment
OPW	Office of Public Works
PCA	Project Conservation Architect
PPV	Peak Particle Velocity
PSCS	Project Supervisor Construction Stage
RMP	Record of Monuments and Places
RO	Railway Order
SCL	Sprayed Concrete Lining
STMP	Scheme Traffic Management Plan
TBM	Tunnel Boring Machine
T&C	Testing and Commissioning

Acronym	Meaning
TII	Transport Infrastructure Ireland
TMP	Traffic Management Plan
TOR	Top of Rail
WI	Waterways Ireland
WMP	Waste Management Plan

5. MetroLink Construction Phase

5.1 Introduction

This Chapter of the Environmental Impact Assessment Report (EIAR) provides an overview of the construction activities and methods that are anticipated to be used during construction, systems testing and commissioning of the MetroLink Project (hereafter referred to as the proposed Project). The methods and equipment proposed represent a feasible construction approach at this stage.

The activities described in this Chapter are intended to represent the likely most significant environmental impacts for the construction work to be undertaken along the alignment (i.e. a reasonable worst-case scenario). The approach is intended to satisfy An Bord Pleanála (hereafter referred to as the Board) that all of the likely significant impacts on the environment have been identified, described, and evaluated and that the mitigation proposed in the EIAR will be effective to reduce those impacts to levels consistent with the proper planning and sustainable development of the areas affected by the proposed Project. The final work methodologies, final programme and schedule of works will then be developed in accordance with the Railway Order (RO) consent granted by the Board.

To inform the EIAR, numerous construction methodologies have been used to undertake the assessment and set the environmental constraints within which MetroLink is to be constructed. These reasonably predict the likely environmental impact of constructing the project and set a reasonable assessment of the time required to construct.

It is however possible that subsequent design and build contractors propose alternative layouts, sequencing, equipment and / or methodologies to the benefit of MetroLink and the wider community. The use of alternatives is not precluded so long as the overarching environmental impact of the work is not any different to, or any greater than that assessed in the EIAR and it is accepted by TII.

In the development of this Chapter, information has been obtained from construction advisors, designers, Transport Infrastructure Ireland (TII) and EIAR specialists. In addition, stakeholder engagement was held with key stakeholders and potentially sensitive receptors (such as healthcare and educational facilities) which have been detailed in Chapter 8 (Consultation) of this EIAR.

This Chapter should be read in conjunction with the following chapters and their appendices of this EIAR:

- Chapter 4 (Description of the MetroLink Project) which provides a detailed description of the infrastructural elements of the proposed Project; and
- Chapter 6 (MetroLink Operations & Maintenance) which provides a detailed description of the proposed operation of the proposed Project.

Figures 5.1 to 5.3 supporting this Chapter are provided at the end of the text. All other figures referenced in the Chapter are provided in Volume 4 (Figures). Appendices referenced in the Chapter are provided in Volume 5 (Appendices) of this EIAR.

Diagram 5.1 and Table 5.1 provides an overview of the principal infrastructural elements of the proposed Project and their geographical extent and location. The total length of the alignment is 18.8km.

The Chapter provides a description of the construction areas including site offices and Construction Compounds. It discusses the phasing of construction activity, proposed working hours, the principal construction activities, area specific construction activities, and measures required to minimise the impact of construction activities on the receiving environment. The overall Construction Phase is expected to take 9.25 years following award of main infrastructure works.

An outline Construction Environmental Management Plan (CEMP) has been prepared and is included as Appendix A5.1. The outline CEMP is a working document, and the appointed contractor(s) will be responsible for updating the CEMP prior to the commencement of construction, in order to incorporate any conditions imposed as part of the RO. This responsibility will be included in the Works Requirements of the Contract. The CEMP will be maintained and updated regularly as the proposed Project progresses.

Limits of deviation have been set for the proposed Project and this is addressed in the Wider Effects Report annexed at Appendix A5.19.

Diagram 5.1: Infographic Overview of Principal Locations along the Proposed Alignment

Table 5.1: Description of the Principal Locations along the Proposed Project

Project Elements	Outline Description
Permanent Project Elements	
Tunnels	It is proposed to construct two geographically separate, single-bore tunnels, using a Tunnel Boring Machine (TBM). Each section of tunnel will have an 8.5m inside diameter and will contain both northbound and southbound rail lines within the same tunnel. These tunnels will be located as follows: The Airport Tunnel: running south from Dublin Airport North Portal (DANP) under Dublin Airport and surfacing south of the airport at Dublin Airport South Portal (DASP) and will be approximately 2.3km in length; and The City Tunnel: running for 9.4 km from Northwood Portal and terminating underground south of Charlemont Station.
Cut Sections	The northern section of the alignment is characterised by a shallow excavated alignment whereby the alignment runs below the existing ground level. Part of the cut sections are open at the top, with fences along the alignment for safety and security. While other sections are “cut and cover”, whereby the alignment is covered.
Tunnel Portals	The openings at the end of the tunnel are referred to as portals. They are concrete and steel structures designed to provide the commencement or termination of a tunnelled section of route and provide a transition to adjacent lengths of the route which may be in retained structures or at the surface. There are three proposed portals, which are: ▪ DANP; ▪ DASP; and ▪ Northwood Portal. There will be no portal at the southern end of the proposed Project, as the southern termination and turnback will be underground.
Stations	There are three types of stations: surface stations, retained cut stations and underground stations: ▪ Estuary Station will be built at surface level, known as a ‘surface station’; ▪ Seatown, Swords Central, Fosterstown Stations and the proposed Dardistown Station will be in retained cutting, known as ‘retained cut stations’; and ▪ Dublin Airport Station and all 10 stations along the City Tunnel will be ‘underground stations’.
Intervention Shaft	An intervention shaft will be required at Albert College Park to provide adequate emergency egress from the City Tunnel and to support tunnel ventilation. Following the European Standard for safety in railway tunnels TSI 1303/2014: Technical Specification for Interoperability relating to ‘safety in railway tunnels’ of the rail system of the European Union, it has been recommended that the maximum spacing between emergency exits is 1,000m. As the distance between Collins Avenue and Griffith Park is 1,494m, this intervention shaft is proposed to safely support evacuation/emergency service access in the event of an incident. This shaft will also function to provide ventilation to the tunnel. The shaft will require two 23m long connection tunnels extending from the shaft, connecting to the main tunnel. At other locations, emergency access will be incorporated into the stations and portals or intervention tunnels will be utilised at locations where there is no available space for a shaft to be constructed and located where required (see below).
Intervention Tunnels	In addition to the two main ‘running’ tunnels, there are three shorter, smaller diameter tunnels. These are the evacuation and ventilation tunnels (known as Intervention Tunnels): ▪ Airport Intervention Tunnels: parallel to the Airport Tunnel, there will also be two smaller diameter tunnels; on the west side, an evacuation tunnel running northwards from DASP for about 315m, and on the east side, a ventilation tunnel connected to the main tunnel and extending about 600m from DASP underneath Dublin Airport Lands. In the event of an incident in the main tunnel, the evacuation tunnel will enable passengers to walk out to a safe location outside the Dublin Airport Lands. ▪ Charlemont Intervention Tunnel: The City Tunnel will extend 360m south of Charlemont Station. A parallel evacuation and ventilation tunnel is required from the end of the City Tunnel back to Charlemont Station to support emergency evacuation of maintenance staff and ventilation for this section of tunnel.
Park and Ride Facility	The proposed Park and Ride Facility next to Estuary Station will include provision for up to 3,000 parking spaces.

Project Elements	Outline Description
Broadmeadow and Ward River Viaduct	A 260m long viaduct is proposed between Estuary and Seatown Stations, to cross the Broadmeadow and Ward Rivers and their floodplains.
Proposed Grid Connections	Grid connections will be provided via cable routes with the addition of new 110kV substations at DANP and Dardistown. (Approval for the proposed grid connections to be applied for separately but are assessed in the EIAR).
Dardistown Depot	A maintenance depot will be located at Dardistown. It will include: ▪ Vehicle stabling; ▪ Maintenance workshops and pits; ▪ Automatic vehicle wash facilities; ▪ A test track; ▪ Sanding system for rolling stock; ▪ The Operations Control Centre for the proposed Project; ▪ A substation; ▪ A mast; and ▪ Other staff facilities and a carpark.
Operations Control Centre	The main Operations Control Centre (OCC) will be located at Dardistown Depot and a back-up OCC will be provided at Estuary.
M50 Viaduct	A 100m long viaduct to carry the proposed Project across the M50 between the Dardistown Depot and Northwood Station.
Temporary Project Elements	
Construction Compounds	There will be 34 Construction Compounds including 20 main Construction Compounds, 14 Satellite Construction Compounds required during the Construction Phase of the proposed Project. The main Construction Compounds will be located at each of the proposed station locations, the portal locations and the Dardistown Depot Location (also covering the Dardistown Station) with satellite compounds located at other locations along the alignment. Outside of the Construction Compounds there will be works areas and sites associated with the construction of all elements of the proposed Project, including an easement strip along the surface sections.
Logistics Sites	The main logistics sites will be located at Estuary, near Pinnock Hill east of the R132 Swords Bypass and north of Saint Margaret's Road at the Northwood Compound. (These areas are included within the 14 Satellite Construction Compounds).
Tunnel Boring Machine Launch Site	There will be two main tunnel boring machine (TBM) launch sites. One will be located at DASP which will serve the TBM boring the Airport Tunnel and the second will be located at the Northwood Construction Compound which will serve the TBM boring the City Tunnel.

In a similar approach to that adopted in Chapter 4 (Description of the MetroLink Project), site specific construction activities will be detailed throughout each of the four distinct geographical areas as detailed in Table 5.2.

Table 5.2: Geographical Areas

Ref.	Geographical Split	Description of Extent of Geographical Section
AZ1	Northern Section	Estuary Station to DANP. It includes the rail line crossing on the proposed viaduct over the Broadmeadow and Ward Rivers and associated flood plains. This section will include open, retained cut and cut-and-cover sections. This section includes the proposed Park and Ride Facility at Estuary Station.
AZ2	Airport Section	This section of the proposed Project includes Dublin Airport North Portal, the tunnel underneath Dublin Airport, Dublin Airport Station and Dublin Airport South Portal. It also includes the smaller diameter evacuation and ventilation tunnels running parallel to the Airport Tunnel.

Ref.	Geographical Split	Description of Extent of Geographical Section
AZ3	Dardistown to Northwood	From south of DASP to the Northwood Portal. This section includes the proposed Dardistown Depot, the M50 viaduct crossing and the proposed construction compound and TBM launch site at Northwood. This section will include open, retained cut and cut-and-cover sections.
AZ4	Northwood to Charlemont	This section comprises the City Tunnel and associated stations south of Northwood Portal. There are nine underground stations in this southern section. The Albert College Park Intervention Shaft and the Charlemont evacuation and ventilation tunnel.

5.1.1 Structure of Chapter

The construction and commissioning activities for the principal elements of the proposed Project will be discussed in this Chapter, as applicable, in the following order:

- **Section 5.2:** Outline of the proposed construction phasing, including programme, working hours, employment and contracts;
- **Section 5.3:** Provides an introduction to and classification of the construction compounds, construction haul routes and vehicles, plant and equipment;
- **Section 5.4:** Enabling Construction Works;
- **Section 5.5:** Main Construction Works;
- **Section 5.6:** Area specific construction activities running linearly from north to south of the proposed Project, including:
- **Section 5.6**: AZ1 Northern Section;
- **Section 5.8:** AZ2 Airport Section;
- **Section 5.9:** AZ3 Dardistown to Northwood; and
- **Section 5.10** AZ4 Northwood to Charlemont.
- **Section 5.11:** Construction health and safety; and
- **Section 5.12:** Environmental management and sustainability.

In describing the typical approach to construction, cognisance has been taken of other dependencies such as the number of contracts to be employed, the type of contracts and their interfaces (Section 5.2.1).

5.2 Construction Phasing

5.2.1 Procurement of Contracts

TII are currently planning to procure the detailed design and construction of the proposed Project using Design and Build contracts that will be divided up by geographical sections and by type of works. This will include:

- Multiple contractors carrying out the Enabling Works to facilitate the main construction works. These are described in Section 5.4 and summarised in Diagram 5.2 below;
- Three main construction contracts by geographical area as part of the main civil engineering works (referred to as the Main Works) for the stations, shafts, portals, tunnels and cutting and associated works. These are described in Section 5.5 and summarised in Diagram 5.2 below; and
- A further package or packages for architectural, mechanical, electrical and other services fit-outs, line-wide systems, rolling stock, commissioning and hand over. These are described in Section 5.5.15 and summarised in Diagram 5.2 below.

Responsibility for ensuring compliance with the RO by the appointed contractors throughout the detailed design, construction and operation phase is the responsibility of the applicant, TII.

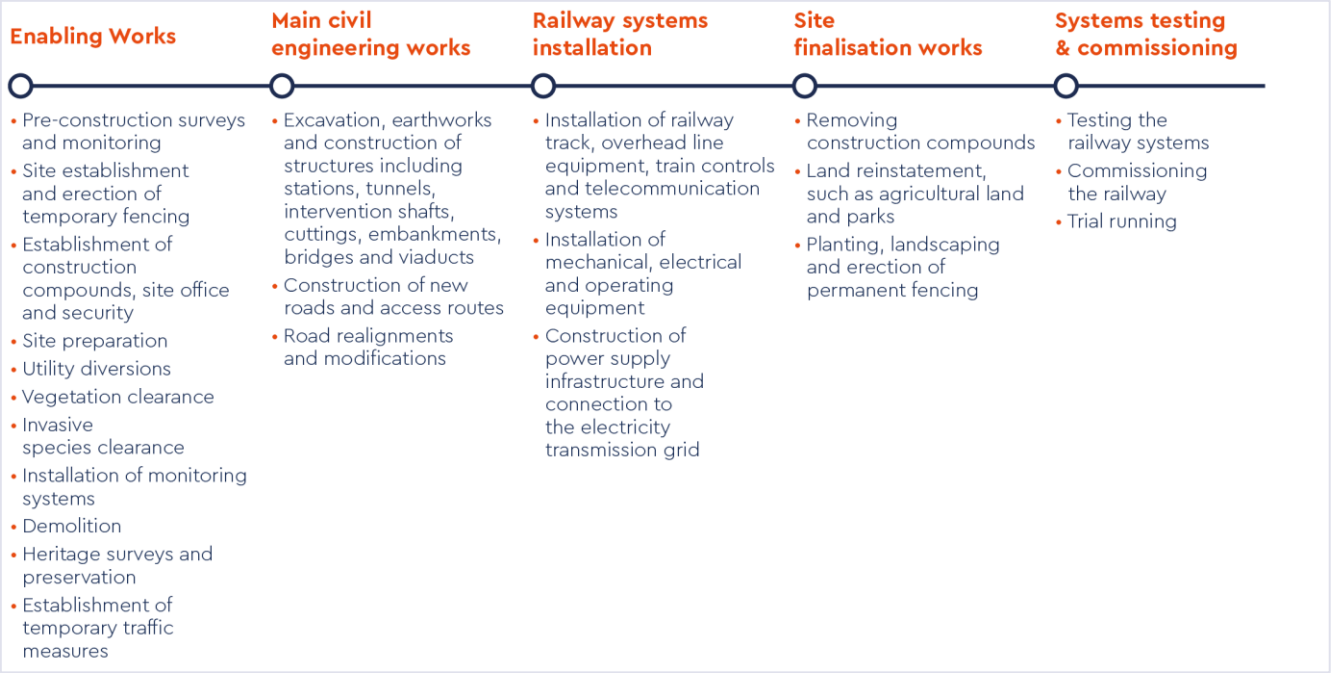


Diagram 5.2: Proposed Construction Phase Activities

5.2.2 Construction Programme

The programme for the construction of the proposed Project has been optimised to minimise the duration of the Construction Phase, where possible, in order to lessen the duration of potential environmental impacts, while ensuring that the areas surrounding the works sites remain operational and functional. In general terms, the construction works will involve the activities laid out in Diagram 5.2. Section 5.4 and Section 5.5 of this Chapter will describe these activities in further detail.

A summary programme showing the duration and phasing for construction of the proposed stations and surface works along the alignment is shown in Diagram 5.3. This also shows the duration that each of the proposed construction compounds will be in place. Please refer to Appendix A5.2 for a more detailed construction programme, including the tunnelling elements. The indicative construction programme has been developed based on experience on similar major infrastructure projects such as High Speed 1 in the United Kingdom (UK), Crossrail (UK) and Madrid Metro in Spain. The achievement of the programme is based on some core assumptions which are as follows:

- Work will run concurrently at several locations;
- Rolling stock will be supplied during the Construction Phase; and
- A period of approximately one year for testing and commissioning the system is also required.

There is likely to be concurrent construction works with other planned projects, should these receive planning consent and funding within the lifetime of the proposed Project. The known major projects where a construction overlap is possible with the proposed Project alignment include the following:

- The R132 Connectivity Project;
- BusConnects;
- The DART+ Programme; and
- Dublin Central Site 2

During the development of the indicative construction programme for the proposed Project, consultation has been undertaken with each of these project teams to coordinate predicted construction phasing to minimise potential impacts associated with concurrent construction activity. A Construction Sequence Report is provided in Appendix A5.3.

Many other developments also have the potential to take place concurrently and form part of the cumulative impact assessment presented in Chapter 30 (Cumulative Impacts of Interactions Between Other Projects) of this EIAR.

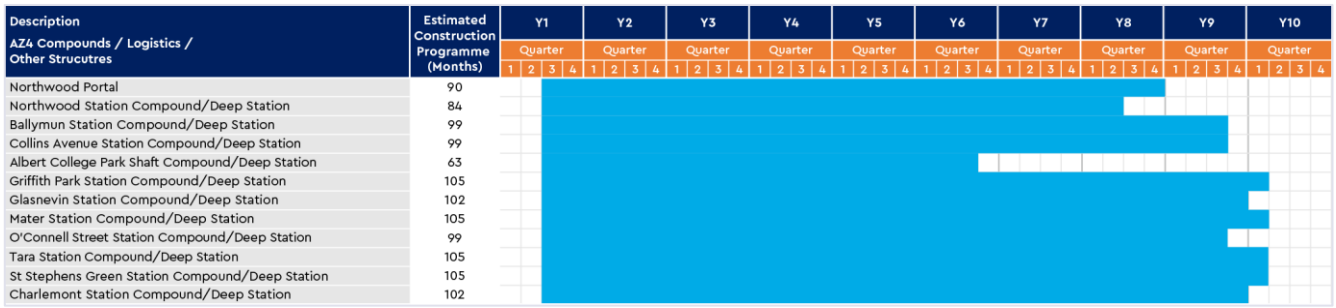
Diagram 5.3: Summary Construction Programme

Description AZ1 Compounds / Logistics / Other Strucutres	Estimated Construction Programme (Months)	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
		Quarter	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter
		1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Start to Estuary Station											
Estuary Station Main Compound	33										
Estuary Railhead	60										
Broadmeadow and Ward Rivers Viaduct	21										
Pedestrian Underpass	6										
Estuary Station to the R132 Under-crossing											
Seatown West Satellite Site	33										
Estuary Court Satellite Site	36										
Woodie's Satellite Site	54										
Mantua Satellite Site (bridge demo)	54										
Fingallian's Satellite Site (bridge demo)	24										
Surface Station	48										
Cut and Cover	69										
Retaining Cut	51										
U Section	15										
Retaining Wall	6										
Seatown Station to Swords Central Station											
Seatown Station Compound	66										
North Dublin Corporate Business Park Compound Satellite Site	69										
Pavilion's Shopping Centre	69										
Surface Station	69										
Cut and Cover	63										
Retaining Cut	60										
Swords Central Station to Fostertown Station											
Swords Central Station Compound	60										
Pinnock Hill Roundabout Satellite Site	51										
Surface Station	63										
Cut and Cover	42										
Retaining Cut	30										
Fostertown to Airport North Portal											
Fostertown Station Compound	63										
Nevinstown Lane Satellite Site	51										
Boland Satellite Site	66										
Surface Station	66										
Cut and Cover	42										
Retaining Cut	51										
U Section	30										

Description AZ2 Compounds / Logistics / Other Strucutres	Estimated Construction Programme (Months)	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
		Quarter	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter
		1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Airport – Tunnels and Structures											
Dublin Airport Station Compound	99										
Dublin Airport North Portal Compound	60										
Dublin Airport South Portal Compound	90										
Deep Station	57										
Portal North	60										
Portal South	81										
U Section	15										

Diagram 5.4: Summary Construction Programme (Continued).

Description AZ3 Compounds / Logistics / Other Strucutres	Estimated Construction Programme (Months)
Airport South to Dardistown	
Cut and Cover	63
U Section	72
Dardistown Station, Depot and Access Works	21
Stations Retaining Cuts	72
Dardistown Station Compound	57
Dardistown Depot	57
Cut and Cover	60
Dardistown Railhead	39
M50 Viaduct and Approaches	54
Central Section Surface Works at M50 Crossing	54
M50 Viaduct	15
St. Anne's South of M50 Crossin	69
Northwood Station Compound	66
Retained Cut	33
Cut and Cover	30



Description AZ4 Compounds / Logistics / Other Strucutres	Estimated Construction Programme (Months)
Northwood Portal	90
Northwood Station Compound/Deep Station	84
Ballymun Station Compound/Deep Station	99
Collins Avenue Station Compound/Deep Station	99
Albert College Park Shaft Compound/Deep Station	63
Griffith Park Station Compound/Deep Station	105
Glasnevin Station Compound/Deep Station	102
Mater Station Compound/Deep Station	105
O'Connell Street Station Compound/Deep Station	99
Tara Station Compound/Deep Station	105
St Stephens Green Station Compound/Deep Station	105
Charlemont Station Compound/Deep Station	102

5.2.3 Construction Employment

The construction workforce numbers will vary depending on the Construction Phase stage of the project. However, it is anticipated that at the peak of construction there will be a construction workforce of approximately 4,300 people directly employed. In addition, it is anticipated that there will be significant indirect employment supported by the proposed Project, for example; in logistical support companies, material and plant suppliers, traffic management companies and in the local service industry. Further details on predicted employment arising from the proposed Project is presented in Chapter 11 (Population & Land Use). The estimated peak employment numbers associated with each construction location are outlined in Appendix A5.4.

5.2.4 Construction Working Hours

The proposed standard working hours for the Construction Phase are set out below. There will be a requirement to work outside of these core hours for certain activities, including 24 hour working, as described below.

5.2.4.1 Standard Working Hours

Standard working hours, as set out in Table 5.3, are from 07:00hrs to 19:00hrs on weekdays (excluding Bank and Public Holidays) and from 07:00hrs to 13:00hrs on Saturdays. This includes standard delivery hours to the construction sites.

Table 5.3: Standard Working & Delivery Hours (5.5 Days)

Days	Hours
Monday to Friday:	07:00 hrs to 19:00 hrs (this includes a half hour to prepare site at each end, giving 11 hours working: 07:30 hrs to 18:30 hrs)
Saturday:	07:00 hrs to 13:00 hrs (this includes a half hour to prepare site at each end, giving 5 hours working: 07:30 hrs to 12:30 hrs)
Sunday / Public Holidays, including annual and extraordinary events:	None (only by exception, with those activities listed below under additional working hours)

Proposed working hours for each site will be outlined in the outline CEMP, in addition to procedures to extend working hours, should this be required. Any restrictions to working hours associated with major events in the area of

works will be agreed with the Local Authorities. In addition, a Noise and Vibration Management and Control Plan will be included as part of the outline CEMP and this will include for specific working hour measures at sensitive locations. For example, works outside churches will need to take into consideration mass or funeral events. Additional special measures may be required during marches and public demonstrations.

The appointed contractor(s) will require staff and sub-contractors to adhere to these standard working hours for each site, insofar as reasonably practicable, unless otherwise permitted by the relevant Local Authority.

5.2.4.2 Additional Working Hours

Most construction activities will be undertaken during the proposed standard working hours, as outlined above in Section 5.2.4.1, however there will be a number of activities that require working outside of these standard hours. These will include:

- Tunnelling: the passage of the Tunnel Boring Machine (TBM) through the station and associated activities will be carried out on a 24 hour a day, seven days a week basis;
- Excavation in rock: at some stations excavation of rock will be carried out during standard hours, but on a 7 day a week basis and for all intervention tunnels (drilling and moving rock underground) will be carried out on a 24 hour a day basis for seven days per week;
- Some large concrete pours: may require working outside of standard hours;
- Dewatering excavations: the pumping of groundwater will be continuous (24 hours a day, seven days a week) for the duration required for construction at each location;
- Track bed and track laying: and associated concrete batching will be continuous (24 hours a day, seven days a week) from the locations detailed in Section 5.5.10;
- MEP (Mechanical Electrical & Plumbing) fit out at the stations: will be carried out on a 24 hour a day, seven days a week basis;
- Utilities and roadworks (as directed by the relevant authorities): may be extended to working outside of standard hours; and
- 'Special/abnormal' deliveries: may require extended hours or overnight deliveries.

For those activities that require working outside of the standard hours, the proposed schedule of hours is set out in Table 5.4.

Table 5.4: Working & Delivery Hours Outside of Standard Hours

7-Day Working (Day Shift Only)	Hours
Monday to Sunday:	07:00hrs to 19:00hrs (this includes a half hour to prepare site at each end, giving 11 hours working: 07:30hrs to 18:30hrs)
Public Holidays, including annual and extraordinary events:	None (apart from the exceptions listed below)
7-Day Working (24 Hours)	**Hours**
Monday to Sunday:	24 hours per day
Public Holidays, including annual and extraordinary events:	24 hours per day
Deliveries	**Hours**
Abnormal deliveries	These are deliveries specific to activities requiring abnormal loads where 'out of hours' transport is required. These are to be agreed with An Garda Síochána and the Local Authority.
Overnight / weekend	These are deliveries required for large concrete pours, roadworks and works done during weekend possessions. Overnight and weekend delivery hours are to be defined with the Local Authority.

Table 5.5 details where activities require working outside of the standard hours at each construction compound location.

It should be noted that tunnelling and activities directly associated with it (such as removal of excavated material, supply of materials and maintenance of tunnelling equipment on site) will be carried out on a 24 hour a day, seven

days a week basis from each of the tunnel launch sites. Where reasonably practicable, material will be stockpiled within the relevant main construction compound for removal during standard working hours. The management of excavated material is discussed in Section 5.5.14.

Station construction will predominantly be undertaken during standard working hours (with the exceptions detailed in Table 5.5). Glasnevin Interchange requires a different working day schedule due to the complexity of this site and the requirement to work in the vicinity of the existing railway. Further details are provided in Section 5.10.6. Further information detailing the construction works at Glasnevin, including working hours, is detailed in Appendix A5.5.

Occasional night-time works may be required for specific activities such as traffic management, abnormal deliveries, footbridge installation inter-alia. If night works are required timings/activities are to be planned in advance and agreed with the Local Authority, taking sensitive receptors into consideration, particularly local residents.

If activities require work outside the hours set out in Table 5.4, an approval will be sought from the relevant Local Authority for these on a case-by-case basis. For example, the appointed contractor(s) may seek to extend the working hours for a particular activity, to take advantage of daylight hours during the summer at a location where standard 7am to 7pm working hours (5.5 days) are scheduled.

Table 5.5: Schedule of Working Hours at each Construction Compound

Construction Compound	Local Authority	Standard Working 5.5 days	7- days working (Dayshift only)	7- days working (24 hours)
Estuary Station & Logistics Site	Fingal CC	√		Supply site for: ▪ Track Installation (from Estuary railhead to DANP) ▪ 2nd stage concrete (Estuary railhead to DANP) ▪ Systemwide fit- out for surface line (Estuary Station to DANP)
Fingallian Footbridge	Fingal CC	√		
Seatown West	Fingal CC	√		
Estuary Court	Fingal CC	√		
Woodie's	Fingal CC	√		
Mantua Park	Fingal CC	√		
Seatown Station	Fingal CC	√		
North Dublin Corporate Park (NDC)	Fingal CC	√		
Chapel Lane	Fingal CC	√		
Pavilion's Shopping Centre	Fingal CC	√		
Swords Central Station	Fingal CC	√		
Pinnock Hill Roundabout	Fingal CC	√		
Fosterstown Station	Fingal CC	√		
Nevinstown Lane	Fingal CC	√		
Boland	Fingal CC	√		
North Portal (North section)	Fingal CC	√		
Dublin Airport North Portal (DANP)	Fingal CC	√		▪ TBM removal

Construction Compound	Local Authority	Standard Working 5.5 days	7- days working (Dayshift only)	7- days working (24 hours)
Dublin Airport Station	Fingal CC	√		▪ TBM traverse through station ▪ MEP station works
Dublin Airport South Portal (DASP)	Fingal CC	√		▪ TBM launch shaft ▪ TBM assembly ▪ Supply site for all TBM tunnel works and 1st stage concrete track bed. ▪ Evacuation and Ventilation Tunnels
Dardistown Station and Depot	Fingal CC	√		Supply site for: ▪ Track installation ▪ 2nd stage concrete ▪ MEP fit out
Central Section Surface Works at M50 Viaduct	Fingal CC	√		▪ Several overnight (including weekend) possessions required for M50 Viaduct works
St Anne's South of M50 Viaduct	Fingal CC	√		▪ Several overnight (including weekend) possessions required for M50 Viaduct works
Northwood Station and Portal	Fingal CC	√	▪ Pre TBM drive	▪ TBM launch shaft ▪ TBM assembly ▪ Supply site for all TBM tunnel works and 1st stage concrete track bed from Griffith Park to Northwood ▪ MEP station works
Northwood Logistics Site	Fingal CC	√		
Ballymun Station	Dublin City	√	▪ Works at the station during TBM stoppages	▪ MEP station works ▪ TBM traverse (if required)
Collins Avenue Station	Dublin City	√	▪ Works at the station during TBM stoppages	▪ MEP station works ▪ TBM traverse (if required)
Albert College Park Intervention Shaft	Dublin City	√		▪ SCL tunnel and main tunnel connection
Griffith Park Station	Dublin City	√	▪ Works at the station during TBM stoppages	▪ Strip and clean tunnel ▪ 1st stage concrete track bed from Charlemont South to Griffith Park Station ▪ MEP station works
Glasnevin Station	Dublin City	√	▪ Works at the station during TBM stoppages ▪ Station south end construction ▪ Station critical civil works ▪ Station architectural fit out	▪ Sliding new rail bridge into position ▪ MEP station works ▪ Blockades or weekend possession work required with Irish railway (GSWR & MGWR)
Mater Station	Dublin City	√		▪ TBM traverse through station ▪ MEP station works
O'Connell Street Station	Dublin City	√	▪ Subway and vent shafts	▪ TBM traverse through station ▪ Post TBM final civils and construction

Construction Compound	Local Authority	Standard Working 5.5 days	7- days working (Dayshift only)	7- days working (24 hours)
			▪ Station civils and architectural works	▪ MEP station works
Tara Station	Dublin City	√		▪ TBM traverse through station ▪ MEP station works
St Stephen's Green Station	Dublin City	√		▪ TBM traverse through station ▪ MEP station works
Charlemont Station	Dublin City	√	▪ Station construction ▪ Civils and architectural works ▪ Clear site and reinstate	▪ TBM traverse through station ▪ SCL Evacuation & Ventilation Tunnels ▪ MEP station works
Key		Satellite construction compound		
		Main construction compound		

5.3 Construction Elements and Compound Classification

This section introduces the construction compounds that will be required in order to construct the principal proposed Project elements described in Chapter 4 (Description of the MetroLink Project). It also provides an overview of the proposed designated haul routes that will be used during the Construction Phase and provides an overview of the type of construction vehicles, plant and equipment that will be used during this phase of the proposed Project.

Thirty-four compounds will be required for the construction and commissioning of the proposed Project. A temporary working strip of land will also be required along areas where the track is on the surface or in cut/cut-and-cover.

Land required for construction activities has been minimised wherever possible and boundaries adjusted to avoid and/or minimise impacts as far as possible. The siting of construction compounds is considered in Section 7.8 of Chapter 7 (Description of the Alternatives) of this EIAR. Any effects on the environment as a result of site set up or the activities carried out within construction compounds have been assessed in the relevant EIAR chapters.

Construction compounds have been detailed linearly from AZ1 to AZ4 in Section 5.7 to Section 5.10 of this Chapter. The Construction Compounds will support the Enabling Works and main civil engineering works (Main Works), two of the key stages of the principal construction works for the proposed Project. They will therefore be established as a requirement of the Enabling Works, such that they support and remain in place until the conclusion of the Main Works.

The following figures support this section:

- Figure 5.1 (Construction Compound Locations); and
- Figure 5.2 (Haul Routes).

5.3.1 Classification of Construction Compounds

Construction compounds and site offices will generally be situated along, or near, the elements of the proposed Project that they are intended to support. Construction compounds, including any areas used for access, will be returned to the most appropriate use as soon as reasonably practicable after completion of the works (apart from areas used for permanent land-take, listed in Chapter 21 (Land Take)).

The proposed construction compounds have been classified into five broad categories, namely:

- Main construction compounds;
- Satellite construction compounds;

- Linear working areas along the railway track alignment; and
- Logistics areas.

The main construction compounds will act as strategic hubs for core project management activities (i.e. engineering, planning and construction delivery) and for office-based construction personnel. They will include:

- Offices and welfare facilities;
- Workshops and stores;
- Storage and laydown areas for materials and equipment (e.g. aggregates, structural steel, steel reinforcement); and
- Limited parking for construction vehicles.

Satellite construction compounds will generally be smaller and provide:

- Local office and welfare facilities;
- Local storage for plant and materials; and
- Limited parking for construction vehicles.

Lorry holding areas have been allocated within the main and satellite construction compounds as space allows.

The main logistics sites will be located at Estuary, near Pinnock Hill east of the R132 Swords Bypass and north of Saint Margaret's Road at the Northwood Compound.

Finally, temporary working areas located along the proposed Project alignment within AZ1 and AZ3 will be provided to aid the construction of retained cut, cut and cover, elevated track and surface track sections. These strips of land range from 10m to 25m wide on either side of the alignment and will be used for logistics and access along the route. A portion of these strips will remain a permanent easement feature for MetroLink maintenance purposes (refer to the Property Drawings submitted with the RO application).

The proposed land area for each compound is detailed in Table 5.6. A detailed list of facilities required in the construction compounds, together with detail on construction site establishment, is discussed in Section 5.4.5.

Table 5.6: Construction Compounds Spatial Requirements

Compound Name	Compound Classification	Proposed Area (m^2)
North Section		
Start of Route (Estuary Station) to Seatown		
Estuary Station construction and logistics site	Main	171,100
Fingallian Footbridge site	Satellite (Ancillary)	18,000
Seatown West	Satellite	13,300
Estuary Court	Satellite	3,500
Seatown Station to Malahide Roundabout		
Seatown Station	Main	18,200
Woodie's	Satellite	5,700
Mantua Park	Satellite	1,900
North Dublin Corporate Park (NDC)	Satellite	16,500
Chapel Lane	Satellite	1,500
Pavilion's Shopping Centre	Satellite	15,400
Malahide Roundabout to Pinnock Hill Roundabout		
Swords Central Station	Main	39,100
Pinnock Hill Roundabout construction and logistics site	Satellite	38,000
Pinnock Hill Roundabout to North Portal (North Section)		

Compound Name	Compound Classification	Proposed Area (m^2)
Fosterstown Station	Main	27,000
Nevinstown Lane	Satellite	10,200
Boland	Satellite	16,300
North Portal (North Section)	Satellite	7,200
Central Section		
Dublin Airport North Portal	Main	37,900
Dublin Airport Station	Main	10,900
Dublin Airport South Portal	Main	83,700
Dardistown Station and Depot	Main	405,100
Central Section Surface Works at M50 Viaduct	Satellite	6,000
St Anne's South of M50 Viaduct	Main	50,500
South Section		
Northwood Station and Portal	Main	63,500
Northwood Logistics Yard	Satellite	32,700
Ballymun Station	Main	15,100
Collins Avenue	Main	9,000
Albert College Park Intervention Shaft	Main	6,300
Griffith Park Station	Main	11,700
Glasnevin Station*	Main	53,400
Mater Station	Main	5,400
O'Connell Street Station	Main	12,000
Tara Station	Main	7,300
St Stephen's Green Station	Main	6,000
Charlemont Station	Main	4,200

Note:

* Actual site area is constrained by existing railway infrastructure; thus, is considerably less than listed.

The location of the proposed construction compounds, satellite compounds, logistics areas and linear working areas along the alignment are depicted in Diagram 5.5 below and shown in detail on Figure 5.1.

Diagram 5.3: Summary Construction Programme, shows the duration that each of the proposed construction compounds will be in place.

Detail on the temporary and permanent land-take boundaries for the proposed Project are detailed in Chapter 21 (Land Take) and in the property drawings and schedules. Land parcels to be impacted by the proposed Project are identified using a unique reference number, as indicated on the property drawings.

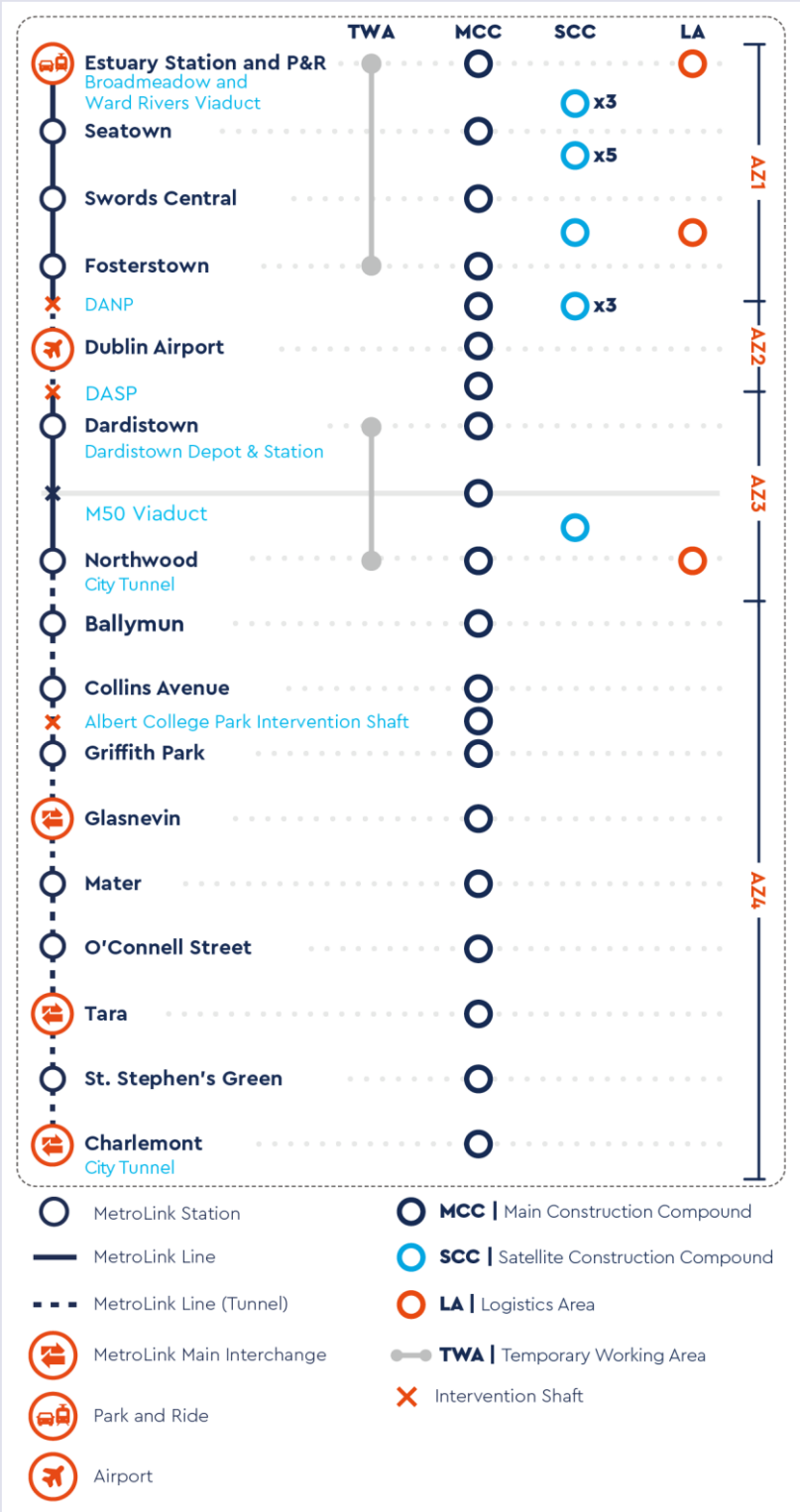


Diagram 5.5: Proposed Construction Compound Locations

5.3.2 Haul Routes

Haul routes will be required for the transport of excavated material and movement of construction materials, equipment and plant to and from the Construction Compounds. The haul routes have been determined based on a review of all potential road crossings/access points for traffic to and from the construction sites/compounds and based on the identification of those road crossings/access points with the potential capacity to accept a large number of vehicle movements. The haul routes have been developed in line with the Dublin City Council (DCC) Heavy Goods Vehicles Management Strategy (DCC 2007) which aims to enhance Dublin City Centre through banning 5+ axle vehicles during the hours of 07:00hrs – 19:00hrs seven days a week, unless a valid permit is obtained.

Regional roads, primary roads and sections of the M50 Motorway will be used at every opportunity in order to reduce traffic impacts to local roads with reduced capacity. Haul routes to and from the construction compounds are illustrated in Figure 5.2 at the end of this Chapter. Haul routes have been discussed further in the Scheme Traffic Management Plan (STMP) in Appendix A9.5 of this EIAR and Chapter 9 (Traffic & Transport).

5.3.2.1 Abnormal Loads

As outlined in S.I. No. 5/2003 – Road Traffic (Construction and Use of Vehicles) Regulations 2003 and in addition with the Road Safety Authority (RSA) Guidelines on Maximum Weights and Dimensions of Mechanically Propelled Vehicles and Trailers, Including Manoeuvrability Criteria (RSA 2020), the movement of s required during the Construction Phase of the proposed Project will require an Abnormal Load Permit to be issued by An Garda Síochána and the Local Authority. Also, for exceptional abnormal loading (e.g. greater than 180 tonnes) on bridges and other structures, pre and post transit structural inspections will be required and carried out. Each vehicle operating under this system will have escort vehicles and a 'Wide Load' sign visibly displayed. An abnormal load is classified as any vehicle and associated load that is:

- Over 16.5m in length;
- Over 2.9m in width
- Over 4.65m in height; or
- Over 46 tonnes in weight.

Abnormal Loads will be required in order to facilitate the movement of the following type of plant during the Construction Phase:

- TBM components (e.g. cutter head, shields, screw conveyor and drive module);
- Water cooling plant, silos and gantry crane;
- Construction Phase equipment such as D-wall grabs, cranes and excavation plant;
- Precast concrete sections (e.g. for viaduct);
- Substation parts including the transformer and switch gear; and
- MetroLink Rolling Stock.

Furthermore, an Abnormal Load Route Survey Report (see Appendix A5.6) was prepared that informed the designated haul routes for the delivery of abnormal loads including the identification of all pinch points on the selected routes and swept path analysis and vertical assessments.

5.3.3 Construction Vehicles, Plant and Equipment

Construction vehicles, plant and equipment have been listed in Appendix A5.7 including a breakdown of vehicle movements per day. The proposed type of tunnel boring machine (TBM) is detailed in Section 5.5.3.1.3 and in Appendix 5.13.

Depending on the site activities, typical plant and equipment will include:

- Excavators, vacuum excavators, dumpers, rollers, bulldozers and graders;
- Pile boring rigs;
- Mechanical rock excavators (road header);
- D-wall hydrofraise and D-wall rigs;
- Hydraulic grabs;
- Hydraulic breakers and hammers;
- Crane-mounted augers;
- Well drilling rigs;
- Disc cutters;
- Concrete batching plants;
- Concrete pumps and water pumps;
- Silos;
- Bentonite plant;
- Slurry treatment plants;
- Dust suppression equipment;
- Jet washers;

- Wastewater treatment plants;
- Generators and compressors;
- Road sweepers;
- Site lighting;
- Skip wagons;
- General site loaders;
- Wheel washers; and
- Crane and telehandlers.

Images of the less familiar construction vehicle, plant and equipment types are shown in Diagram 5.6.

Road Header – a rock cutting machine used for tunnel formation where mechanical excavation is required.

Vacuum Excavator – for the safe excavation of ground around buried services. Compressed air is used to loosen the ground and then the soil removed by the vacuum.

Hydrofraise – a drilling machine used for the construction of diaphragm walls (D-walls) in difficult conditions, typically the excavation of rock and hard layers of soil.

Hydraulic grab - excavating grab used in soft ground for the construction of D-walls.

Diagram 5.6: Construction Vehicle Plant and Equipment Examples (not to scale)

5.4 Construction Phase - Enabling Works

This Section describes the proposed Enabling Works required prior to the main construction works detailed in Section 5.5, as outlined above in Section 5.2.

Enabling Works are the works to be undertaken in advance of the main infrastructure works, including the preparation of site compounds and land take for the main work activities.

The potential environmental impacts associated with Enabling Works have been considered and where relevant are discussed in this EIAR.

5.4.1 Environmental Mitigation Works

All mitigation measures are listed in Chapter 31 (Summaries of the Route Wide Mitigation & Monitoring Proposed) of this EIAR and will be managed via the outline CEMP.

5.4.2 Background Surveys and Environmental Baseline Monitoring

A significant number of surveys have been undertaken to categorise the receiving environment for this EIAR. Further survey requirements to be undertaken during Enabling Works include further biodiversity surveys, contamination investigations, groundwater monitoring, noise and vibration monitoring and ground movement monitoring. These surveys will confirm and update the findings of surveys completed for the EIAR. In addition, they will provide further detail to allow for the most effective implementation of the mitigation and monitoring required by the RO.

5.4.3 Vegetation and Tree Clearance, Including the Removal of any Invasive Alien Plant Species

Environmental impacts associated with the removal of trees, vegetation and invasive species have been assessed in Chapter 15 (Biodiversity). A summary of locations where vegetation clearance will be required for the proposed Project is as follows:

- Agricultural and semi-improved fields with hedgerow, treeline and/or scrub boundaries located north and south of the Broadmeadow River, at the proposed Seatown, Swords Central and Northwood stations, at the proposed crossing point on the Sluice River, at the proposed depot in Dardistown;
- Amenity grassland and parkland with hedgerow and/or treeline boundaries, mature woodland and/or ornamental shrubs located at the proposed Collins Avenue, Griffith Park, Mater and St Stephen's Green stations and the proposed ventilation shaft at Albert College Park; and
- Hedgerow, treeline and/or scrub habitat located along the proposed crossing points on the Broadmeadow River, Ward River, Sluice River, Mayne River and Santry River and at the proposed works at the Glasnevin Interchange.

As part of the Enabling Works, all trees and vegetation will be removed from the proposed construction areas and invasive plant species will be controlled in line with the requirements of the outline CEMP and any required mitigation measures. Furthermore, the clearance of invasive species will be undertaken in line with the outline Invasive Species Management Plan (ISMP) contained within Appendix A15.8 of the EIAR. A comprehensive tree survey has been undertaken and the boundaries of the construction compounds adjusted where feasible to retain trees.

A description of the agricultural land take and potential impacts is provided in EIAR Chapter 23 (Agronomy).

Visual impacts associated with the removal of trees and vegetation is assessed in Chapter 27 (Landscape & Visual). An Arboricultural Impact Assessment Report is provided in Appendix A27.3.

5.4.4 Cultural Heritage

Referring to the MetroLink Cultural Heritage Strategy (Appendix A25.1) in this EIAR and Chapter 25 (Archaeology & Cultural Heritage) and Chapter 26 (Architectural Heritage) of this EIAR, archaeological investigation and resolution of archaeological constraints in greenfield areas and parklands will be required at various locations and these have been included in the Enabling Works programme. These works will comprise a variety of techniques dependent on the following:

- The nature of the receiving archaeological constraint; and
- Archaeological works already undertaken at the location to date, either as a component of the proposed Project, old Metro North or as a component of an oversite development.

The archaeological techniques likely to be used (where not already undertaken) will include archaeological geophysical surveys, underwater and detection surveys, archaeological test excavations, archaeological monitoring and, where necessary, preservation by record (excavation). This work will be carried out by specialist Archaeological Contractors (for bespoke Archaeological Contracts) or Archaeological Consultants appointed by the Enabling Works Contractors (e.g. for Utility Works, Demolition Works or Heritage Works). During Main Construction Works, archaeological monitoring and preservation by record (excavation) will be required in areas previously not accessible (e.g. parks or carriageway), or those not fully resolved during the Enabling Works (e.g. utility works), and for which preservation in-situ is not possible. These works will be undertaken by the Contractor's Archaeological Consultants.

The Project Conservation Architect (PCA) is in the process of undertaking Structural and Condition Surveys of built and cultural heritage constraints that require removal to secure storage (followed by conservation and reinstatement) or protection in-situ. The PCA will also prepare specifications for these works. A specialist Heritage Works Contractor will be appointed to remove, store and conserve these constraints. The Main Construction Works Contractors will appoint Consultant Conservation Architects to implement required preservation of in situ works.

Appropriate licences or consents, in accordance with the National Monuments Act 1930 (as amended) will be applied for, and no archaeological works or works relating to a National Monument may take place in advance of receipt of such licences or consents from the Minister for Housing, Local Government and Heritage. All works will take place in strict compliance with these licences/ consents and the Code of Practice for Archaeology as agreed between TII and the Minister for Housing, Local Government and Heritage.

The TII Project Archaeologist is responsible for coordinating all heritage issues on the project. The MetroLink Cultural Heritage Strategy (Appendix A25.1) will be maintained as a live document throughout the Construction Phase of the project and will be updated in response to new information received from the above-described archaeological investigations, the PCA surveys, ongoing stakeholder engagement and in response to changes in the receiving baseline environment.

5.4.5 Establishment of Construction Site, Office and Compounds

The land required (temporarily) for construction compounds is shown on Figure 5.1, provided at the end of this Chapter. Detail on the temporary and permanent land-take boundaries for the proposed Project are detailed in Chapter 21 (Land Take) and in the property drawings and schedules. Land parcels to be impacted by the proposed Project are identified using a unique reference number, as indicated on the property drawings.

Environmental impacts associated with the site establishment activities have been assessed within the EIAR and requirements with regards to appropriate mitigation measures are set out in the outline CEMP in Appendix A5.1 in this EIAR. The following site establishment activities will be undertaken at each of the construction compounds:

- Establish environmental monitoring and mitigation measures;
- Resolution of archaeology/removal of heritage constraints;
- Establish and get appropriate approvals for construction traffic management requirements for diversions and haulage routes;
- Establish and implement appropriate surface water management procedures, flood protection measures and install temporary and permanent drainage (refer to Sections 5.12.10 and 5.12.12);
- Establishment of site entrances and exits;
- Installation of the site hoarding/fencing (2.4m in height as a minimum) and gates to ensure that the sites are secure. An exception to the standard 2.4m hoarding or fencing will be at areas that need specific sound barriers or boundary treatment identified in Chapter 13 (Airborne Noise & Vibration) and as identified in the Landscape and Visual Impact Assessment discussed in Chapter 27 (Landscape & Visual);
- Establish temporary lighting in a safe and secure location (refer to Section 5.12.11);
- Undertake vegetation removal and stripping of topsoil as required in relevant working areas;
- Development of site haul routes and material storage areas. The route through the site should ideally be one-way and avoid reversing wherever possible;
- Undertake all required utility and services diversions and provide a connection to the local sewerage network, water distribution and electrical networks as required (refer to Sections 5.4.10 and 5.12.10);

- Laying of a crushed stone working platform and concrete hardstanding will be provided where required at some entrances, main internal traffic routes and spoil stockpile locations;
- Establish storage area for hazardous materials and/or substance. Ensure hydrocarbons and chemicals are stored securely in a bunded area away from surface water and any potential flood zones;
- Installation of the site office and welfare facilities. These will be sized according to the maximum number of personnel expected on the site;
- Installation of site security facilities, goods received checking area, unloading and loading areas, and wheel wash;
- Establishment of segregated pedestrian and vehicle routes to the working areas with clear, designated crossing points; and
- Establishment of areas for materials, bentonite mixing and storage area (where required) and waste storage.

In addition to the footprint of the permanent works, during the Construction Phase, lands will be required temporarily for the construction of the project including inter alia the following:

- Construction of main compounds, satellite compounds and logistic compounds (as characterised in Section 5.3.1). The proposed land area for each compound is detailed in Table 5.6. The diversion, realignment and widening of roads and junctions, and/or the provision of temporary alternative routes (Chapter 9 (Traffic & Transport));
- The diversion and realignment of public rights of way and private accesses, and/or the provision of temporary alternatives routes;
- The diversion and realignment of sections of existing watercourses, railways and utilities (please refer to Appendix A5.10 on methodology for stream diversions and culvert installation and Chapter 22 (Infrastructure & Utilities); and
- Groundwater control, bentonite and grout storage and mixing activities (see Appendix A5.11 (Water Management)).

5.4.6 Temporary Power Supply

Where practical, mains electricity will be provided at the construction compounds during the site setup stage, in preference to the extended usage of electricity generated by diesel power in the early stages of construction. To avoid any unnecessary wastage, permanent power supplies will be brought on-site to supply the construction works at the level of supply required for permanent operations, where possible. However, power for construction at the main tunnelling sites, and for the TBMs in particular, will be well in excess of the power requirements for permanent operations in these locations and will potentially require decommissioning of capacity at these locations post completion of the works. Applications for temporary MV power supplies have been submitted to Electricity Supply Board Networks Ltd. (ESBN) to provide electricity at the TBM launch sites; DASP and Northwood to provide power during the tunnelling works. Temporary power connections for other construction compounds will be made locally at each specific site.

Permanent power supply for the proposed Project will be provided by ESBN. Grid Connections will be provided via cable routes and two new 110kV (kilovolt) substations at Dublin Airport North Portal and Dardistown. Planning approval for the proposed grid connections will be applied for separately but routes for the cables have been agreed with ESBN and these are assessed in this EIAR. The proposed Project will also require eight new traction substations to provide power to the trains. The construction methodology for the substations is detailed in Section 5.5.18.

5.4.7 Temporary Water and Wastewater Management

A supply of water will be required at all construction sites. Potable (mains) water will be required for drinking and welfare and a source for general site use which will be a combination of mains water, and water recycled from other sources on-site such as dewatering, rainwater harvesting from buildings and water filtered from bentonite recycling during D-wall and piling construction.

It is expected that a mains supply will be available at all main station (surface and deep), intervention shaft and tunnel worksites. Satellite sites which are located in or adjacent to existing urban facilities would also be expected to benefit from a mains supply.

An early study has been undertaken to assess potential availability for connection supply and foul water disposal at each of the worksites. Where the review identified a construction compound which does not have a suitable

connection in proximity, it also provided an estimate of how far infrastructure would need to be laid to provide a connection into site from an existing supply.

For worksites in the northern section in particular, it is likely that tankers will be used to supply water to sites which are remote to mains supply or other sources. It is anticipated that methods of collecting (harvesting) rainwater, and recycling and treatment of wastewater for general site use, will be adopted wherever practical to do so. Requirements for dewatering installations at deep station, tunnel portals, shafts and shallow sub surface works could provide a valuable source of water for general site use.

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

Foul water drainage will be installed at the construction sites to collect discharge from office and welfare accommodation. Where possible, this will be connected to mains sewers in local highways, or alternatively to a septic tank for emptying by road tanker.

Pre-application enquiries for water supply and foul discharge connection have been submitted to Irish Water for each station and consultation is on-going.

Further information on drainage and wastewater discharge is contained in Section 5.12.8.

5.4.8 Remediation of Contamination Sites

Remediation of ground contamination will be carried out within the proposed Project construction areas where necessary. Although adequate ground investigation surveys were undertaken for the EIAR, in order to fully identify and characterise areas of contamination, further investigations will be undertaken pre-construction to inform detailed remediation requirements.

The likely significant impacts on the environment of the remediation of ground contamination have been identified, described and evaluated in Chapter 20 (Soils & Geology). The presence of contaminated ground was identified at several station locations including Dublin Airport, Dardistown and Glasnevin. Examples of the sources of this existing contamination include tanks, petrol stations, old quarries, hospitals and urban made ground. In areas where contaminated material is disturbed and requires removal off site, it will be replaced by clean infill material. As described in Chapter 20 (Soils & Geology) and Chapter 24 (Materials & Waste Management), the Excavated Materials Management Strategy (Appendix 24.1 to the EIAR) will be used to inform disposal options for contaminated ground.

5.4.9 Demolition

A summary of the main demolition requirements for the proposed Project is provided in Table 5.7. There will be other more minor demolition requirements associated with utility structures and boundary walls. The main properties and structures requiring demolition are also detailed in Figure 5.3 (provided at the end of this Chapter).

A technical appendix (Appendix A5.8) has been prepared to accompany this Chapter which details the general approach to demolition for the proposed Project and lists the properties to be demolished in advance of the main construction works.

Table 5.7: Summary of Main Demolition Requirements

Title	Demolition Category
Swords (Estuary, Seatown, Swords Stations)	Footbridges, community and residential properties: ▪ Malahide Roundabout - 120m footbridge; ▪ Chapel Lane, Swords - 64m footbridge; ▪ R132 Swords Bypass, Mantua, Swords - 101m footbridge; ▪ Seaview Bungalow - single storey house; ▪ Seatown West Bungalow, Seatown West – single storey house; ▪ Estuary Roundabout, Swords – 142m long footbridge; and ▪ Lissenhall Great, Swords - residential building off Ennis Lane; and ▪ Unofficial halting site.

Title	Demolition Category
Airside, Swords (Fosterstown Station)	Commercial/ industrial properties: ▪ Retail unit at Airside Retail Park; ▪ Airside HV substations* – 2 no. single storey buildings; and ▪ Northwest of Airside Retail Park - communications tower. *Once the diversion and building structure to the new location is complete (as required).
Nevinstown West, Swords (Fosterstown Station)	Residential and commercial properties: ▪ Nevinstown Lodge – single storey bungalow; and ▪ East of Nevinstown Lane – residential building, and ▪ Boland Car Dismantler – 2 no. single storey bungalows and adjoining commercial land.
M50 (Dardistown Depot)	Community / industrial properties: ▪ Whitehall Rangers Club house – single storey community building and adjacent portal frame structure; and ▪ Sillogue Green Road – 2 single storey commercial warehouse buildings.
Santry Demense (Northwood Station)	Residential properties: ▪ North of Santry Lodge Gatehouse – 2 storey residential building; ▪ Santry Lodge Gatehouse (bungalow) – single storey residential building; ▪ Old Ballymun Road opposite Gulliver's Retail Park – redundant single storey residential building, and ▪ Old Ballymun Road opposite Gulliver's Retail Park – communications tower*. *Once the diversion and building structure to the new location is complete (as required)
Griffith Park	Community property: ▪ Sports changing rooms and café.
Glasnevin Station	Commercial/industrial properties during Enabling Works and retaining walls and MGWR tunnel during Civil Works: ▪ Prospect House, Prospect Road - commercial 2-storey building; ▪ Des Kelly Interiors, 1A, Prospect Road - large 2-storey commercial/ industrial building; and ▪ Brian Boru Public House, 5 Prospect Road – 2-storey building.
O'Connell Street Station (Metrolink and Developer delivered scenarios)	Commercial properties to be demolished: ▪ 46-49 O'Connell Street Upper; and ▪ 55-56 O'Connell Street Upper. Commercial properties to be partially demolished, maintained and supported: ▪ 43 O'Connell Street Upper – building façade; ▪ 44 O'Connell Street Upper – building façade; ▪ 45 O'Connell Street Upper – building façade; ▪ 52-54 O'Connell Street Upper – building façade; ▪ 57 O'Connell Street Upper- building façade; and ▪ 58 O'Connell Street Upper- building façade.
Tara Station	Commercial and residential properties: ▪ Ashford House, Tara Street - large 8-storey office building; ▪ Poolbeg Street - large 4-storey office building; ▪ Markievicz Leisure Centre (includes College Gate Apartments) - 7-storey building; ▪ 22 Luke Street - 4 storey residential building (disused); ▪ 24 Townsend Street – 4 storey residential building (disused); and ▪ 25 - 32 Townsend Street - 3 storey building.
Charlemont Station	Industrial/ commercial properties: ▪ 19 and 19a Dartmouth Road - 2 storey commercial building; and ▪ Existing boundary wall; a lane way wall west of Dartmouth Square West - northern half of the wall to be removed and reinstated after construction, southern section of the wall to be protected during construction.

Due to the constrained space available at Tara Construction Compound, Appendix A5.9 illustrates the demolition approach at this complex and sensitive location. Further detail on the demolition required at the proposed Glasnevin Station is detailed in Appendix A5.5. This proposed construction site is also very constrained and in order to carry out the works, multiple phasing of activities will be required. There are existing Iarnród Éireann structures (retaining walls and tunnel) that will be demolished and removed as the works are carried out.

Demolition will generally include top-down construction or deconstruction methods due to the urban environment of the proposed Project (Diagram 5.7) and all properties will require pre-demolition surveys and the preparation of a Demolition Plan (DP). The use of a mobile crusher for producing re-cycled aggregate from demolition brick and concrete arisings which can be stockpiled and used for backfilling on site is proposed at Tara, Glasnevin and O'Connell Street Stations.

Demolition has been considered and assessed throughout various environmental chapters, all of which feed into the outline CEMP (Appendix A5.1). Pre-demolition surveys will be undertaken to confirm the proposed methodology and provide sufficient detail to allow the full management of the demolition and resulting materials. Pre-demolition surveys will include appropriate hazardous materials surveys to identify all asbestos containing materials and other hazardous materials that may be present. Demolition Survey Mitigation measures to limit dust, noise, vibration and air pollution (e.g. through dust and fumes) will be implemented. The monitoring of noise, vibration and dust will be carried out on a regular basis during the demolition phase both on-site and in sensitive areas adjacent to the site. Environmental control measures are detailed in Appendix A5.8 and the outline CEMP in Appendix A5.1.

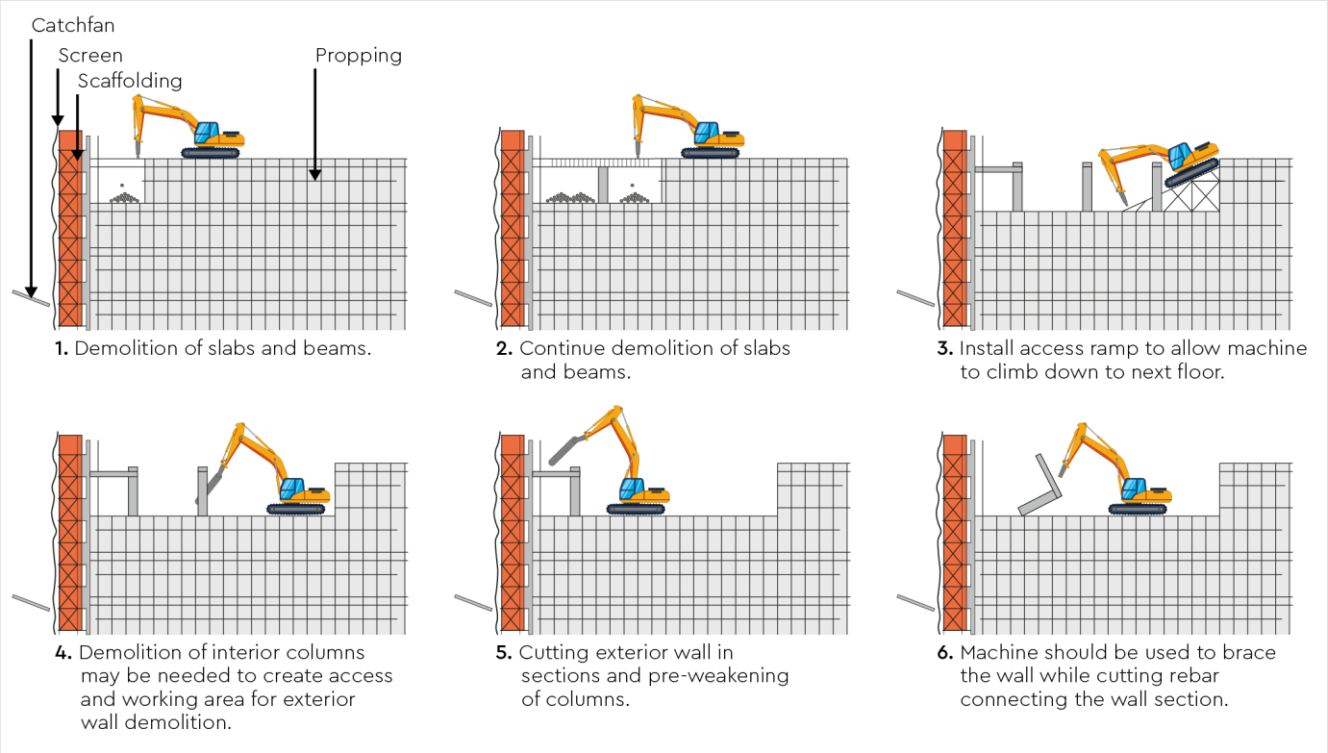


Diagram 5.7: Typical Top-Down Demolition Sequence

5.4.10 Utility Diversions and Protection

The project is located in an urban environment and as such there are a large number of utilities and services located in the public road, adjacent to carriageways and in footpaths along the alignment, particularly along the R132 Swords Bypass and in Dublin City Centre. These existing utilities and services include:

- Surface water, foul and combined sewers;
- Drainage sumps, tanks and attenuation;
- Watermains;
- Public lighting and electricity supplies;
- Overhead and underground cables;
- Gas mains; and

- Telecommunication and cable services including fibre optics.

Where utilities clash with the proposed Project alignment an assessment of the impact has been considered. The assessment methodology, impact assessment and proposed mitigation measures are contained in Chapter 22 (Infrastructure & Utilities).

Utility diversions known to be required at this time have been agreed in principle with the relevant statutory undertakers and the designs are include within the RO application. Following the grant of any RO all utility diversions and protection measures will be finalised and agreed with the relevant utility stakeholders (and relevant agencies).

The following construction methods are typically applied during the construction of, for example, a pipe installation:

- Pipes (and other material) will be delivered into compound area and offloaded by the use of, for example, a HIAB crane. Pipes can be stored in front of the works, space permitting, and away from the excavation;
- Trial pits are excavated to confirm the locations of existing services before the main excavation starts;
- The main bulk excavation to the trench is undertaken. Excavated material will be removed from the work area almost immediately;
- The required shoring (or propping support) is placed inside the excavation to temporarily support the trench throughout the pipe installation works;
- Once the required pipe bedding has been placed by the excavator, and levelled, the pipe is then lifted into position. Bedding material is typically imported by a 20-tonne tipper wagon or dumper; and
- The pipe is then backfilled up to the required level, the shoring lifted out and surface layers are placed. Backfill material will be in accordance with the required engineering specification and will necessitate the importation of new granular fill material. Stages 1 to 6 are repeated until the required length of pipe is installed.

It is necessary to divert an existing water main beneath the Broadmeadow and Ward River. This diversion will be carried out using directional drilling. The diverted utility will pass under both rivers using Horizontal Directional Drilling (HDD) technology, thereby removing the requirement to impact the waterbody during the Construction Phase.

Drainage requirements during the Construction Phase are detailed in Section 5.12.8.

A settlement analysis has been completed to assess the impacts of predicted settlement on utilities caused by construction of the proposed Project. This analysis is detailed in Chapter 22 (Infrastructure & Utilities). Control measures to manage this risk of settlement during construction are detailed in Section 5.5.3.1.6.

5.4.11 Ground Settlement Monitoring and Mitigation Works

Excavation for the tunnels and other below ground structures could potentially lead to ground movements at the surface and below ground. The amount of ground movement will depend on a number of factors including the nature of the construction depth and volume of works below ground, soil and groundwater conditions. The impact of any ground movement will depend on the proximity and nature of any building foundations/third party assets. In most cases this would have no material impact on property or third-party assets.

5.4.11.1 Assessment Methodology

A comprehensive analysis of the potential for ground settlement on buildings, bridges and other assets has been undertaken. The ground movement predictions and the building damage assessment methodology adopted for MetroLink is based on the approach adopted in tunnel projects around the world, including London Crossrail and High Speed 2 in England. The assessment methodology comprises three phases:

- Phase 1 – assessment of the greenfield settlement contours induced by the tunnelling and station box construction works using generic ground parameters and the identification of buildings that are i) within the 10mm contour or with a ground settlement slope > 1:500 and ii) those buildings enclosed by the 1mm contour subject to special considerations.
- Phase 2 – buildings identified in Phase 1 are assessed using the greenfield ground movement profile making some standard foundation assumptions and are classified into Damage Categories 0 – 5; those buildings placed in Damage Category of 3 or more and those subject to special considerations are carried through to Phase 3.

- Phase 3 – each identified building is considered individually to determine its behaviour using detailed information and assessment methods; this may include undertaking refined ground modelling, detailed structural surveys and/or sophisticated soil-structure interaction analysis.

'Special' considerations in the context of building damage assessment are described in Section 5.4.11.2 below.

For the Phase 1 survey, a zone of influence of the tunnel and other works was taken as 30m width on either side of the tunnel plus half the tunnel diameter. This is equivalent to a 45-degree influence line from the tunnel axis level at a depth of 30m.

Cut and cover station boxes, cut and cover tunnels and retained cuttings along the alignment will be constructed using either D-walling or secant piling methods. Ground movements will occur both due to the installation of the walls and then due to the subsequent bulk excavation for the station box or retaining wall constructions. The magnitude of the ground movements will be dependent on the type of ground, the ground water conditions and the method of construction (top-down or bottom-up) and the stiffness of the wall/propping system. Settlement assessments due to wall construction and bulk excavation associated with the station box and retaining walls have been undertaken based on the case history data documented in CIRIA Report C760[1].

5.4.11.2 Ground Settlement Assessment Findings

The assessment of the effects of ground movements and potential impacts on existing buildings has been carried out in two stages (Phase 1 and Phase 2a) as part of the Scheme Design. This is detailed in Appendix 5.17 (Building Damage Report). The assessment methodology is also detailed in Chapter 20 (Soils & Geology) which provides a summary of predicted impacts on Irish Geological Heritage Sites during construction.

A review of the alignment has been undertaken to identify buildings that could be affected by the tunnelling works. The Phase 1 preliminary assessment identified 219 no. 'representative' buildings within 30m either side of the proposed tunnel alignment for the Phase 2a building damage assessment works. Some of these buildings have been designated as 'special' due to their nature and will be taken through to Phase 2b/3 assessment regardless of their Phase 2a assessment results. The following criteria have been adopted to designate 'special' buildings:

- Listed buildings;
- Prominent buildings;
- Buildings in poor condition;
- Sensitive buildings;
- Prestigious buildings;
- Buildings with historical and cultural relevance; and
- Buildings with high value (public buildings or hospitals).

In addition, buildings with basements deeper than 4m will also be subject to Phase 2b/3 assessment regardless of the Phase 2a assessment results.

A preliminary Phase 2b assessment has been carried out as part of the scheme design to inform the geotechnical and environmental assessment of the proposed Project. The preliminary Phase 2b assessment indicated that there would be only three buildings that would require a Phase 3 assessment. (This is in addition to 64 buildings that have been identified in Phase 2a for subsequent Phase 3 assessment due to being Special Buildings or buildings with a basement depth over 4m).

The three buildings remaining in Damage Category 3 (Moderate Damage[2]) following the Phase 2b assessment were as follows:

- Carroll's Building; and
- Two terraced residential blocks, south of Griffith Park Station.

Considering that the Carroll's Building is very close to the Charlemont Station box perimeter wall, the impact on the building has been re-assessed using detailed modelling of the stepped excavation profile for the station box. This

[1] CIRIA Report C760, "Embedded retaining walls – guidance for economic design" February 2017.
[2] Building and Structure Damage Classification (after Burland et al (1977) and Boscarding and Cording (1989))

refined assessment reduced the damage category for the building to Category 2 (Moderate). Ground treatment in this area is proposed to minimise the impacts of settlement due to the close proximity.

The two terraced residential blocks are situated above the City Tunnel, south of Griffith Park Station. At this stage, the modelling cannot be further refined for these properties, however, the Phase 2 assessment is based on building deformation conforming to greenfield settlement contours without any beneficial effect from the overall stiffness of the building. The damage category for these terraced blocks will very likely achieve Damage Category 2 or below at the end of the Phase 3 assessment to be carried out during the detailed design stage. Despite the above, there are other measures that the Contractor(s) could consider to control the potential risk to these properties, for example, by adjusting the slurry pressure at the tunnel head when tunnelling under this zone. These residential blocks will be surveyed prior to the commencement of the Metrolink construction works and carefully monitored during the tunnelling works in the area.

Chapter 26 (Architectural Heritage) considers the risk of settlement affecting the integrity of protected buildings and structures.

The settlement impacts on infrastructure and utilities are detailed in Chapter 22 (Infrastructure & Utilities) of the EIAR.

5.4.11.3 Settlement Effects due to Dewatering

The perimeter walls forming the station boxes will provide effective water cut-off during the excavation works for the station box construction. Further, any upward water flow from below the station formation level will be limited and in case if it is excessive, it is likely that a water cut-off plug will be formed inside the perimeter walls and just below the toe level. No external dewatering is therefore anticipated during the construction of the station boxes. Any settlement due to the lowering of the water table outside the boundaries of the site will be therefore insignificant.

Similarly, no dewatering outside the cut and cover tunnel sections or other retained cuttings is anticipated.

The effects of dewatering on ground stability and dewatering are detailed in Chapter 19 of this EIAR (Hydrogeology).

5.4.11.4 Further Assessment, Monitoring and Mitigation

During any subsequent Phase 3 assessment, each identified building will be considered individually to determine its behaviour using detailed information and assessment methods. A detailed structural survey will be carried out as a part of the Phase 3 assessment to provide additional information in order to determine the structural form and condition of each building. This will be followed by a detailed analysis of how individual elements of the building would be affected by the predicted ground movements. The method and extent of the detailed analysis will be determined on a case-by-case basis.

As a result of this Phase 3 analysis, the requirements for any structural protection works or ground treatment works shall be considered. Depending on the level of risk, either no action will be required, buildings will be monitored during construction, or mitigation measures will be implemented. Mitigation measures will be applied in order to ensure that any residual impacts of settlement on all buildings will be below Damage Category 2 level or below and will include, as appropriate:

- Enhanced at source means (reduced face loss due to TBM excavation or ground treatment adjacent to shafts and station boxes)
- underpinning of the building;
- lateral support systems for excavations; and
- post-construction repair work.

Measures to reduce settlement have been detailed in Chapter 20 (Soils & Geology) and in the outline CEMP (Appendix A5.1).

TII is committed to having a Property Owner Protection Scheme (POPS) in place prior to construction works commencing. This will involve condition surveys of private properties and other selected properties along the route of the proposed Project. The purpose of the condition surveys would be to ascertain the condition of the properties before, during (if deemed necessary), and after completion of the proposed Project to determine whether there has

been any deterioration of any of the properties surveyed and whether the same may be attributable to the proposed Project and it will recommend repairs as appropriate. Further detail on the POPS can be found in Chapter 21 of the EIAR (Land Take) and Chapter 11 (Population & Land Use).

A programme of ground movement monitoring will be implemented, with the monitoring locations informed by the Phase 2b and Phase 3 analysis to be undertaken during the detailed design stage.

An appropriate instrumentation and monitoring strategy will be developed.

In addition, groundwater monitoring points will be established along the alignment to monitor for groundwater levels. Any excavation below ground could result in and a lowering of the water table and could also result in settlement at the ground surface. Groundwater inflow rates have been assessed in Chapter 19 (Hydrogeology). Several methods can be used for groundwater extraction and disposal, and these are chosen based on the anticipated quantities expected and the availability of discharge options (assessed in Chapter 18 (Hydrology)). Extraction methods include localised sump pumping as excavation progresses, deep well dewatering and well point dewatering. Disposal methods include recharging the aquifer, discharging into sewer, removing the water from site using tankers and disposal into local watercourses. See Section 5.12.8 for further information on wastewater disposal.

5.4.12 Traffic Works

The extent and nature of Construction Phase traffic management measures are based on data from road audit assessments of the site entrances and exits, assessments of predicted Heavy Goods Vehicle (HGV) numbers and exiting traffic levels, the agreed haul routes to and from the site, and the location of the vehicle holding areas.

All temporary traffic measures can be found in the Scheme Traffic Management Plan (STMP) which can be found in Appendix A9.5. The STMP sets out management and mitigation measures to minimise the transport impact during the Construction Phase of the proposed Project. It defines the mechanisms for managing the movement of construction related vehicles and also the process for consultation with the relevant authorities. As identified in the STMP, the traffic management works required include traffic diversions, lane closures, junction/road modifications and traffic light re-timing for the management of site entrance and exits, new pedestrian crossings for pedestrians passing outside the site, temporary repositioning of bus stops and the erection of direction signage to construction sites.

In the event of approval being granted for the proposed Project and prior to commencement of works, the appointed contractor(s) will review the STMP and constraints imposed therein. If there is a requirement for temporary traffic measures that are not identified in the RO, applications will be made to the relevant highway authority in advance of the works, in consultation with TII. The submission will include:

- Scheme details and layouts including drawings and any traffic signal amendments;
- Phasing and programming of the scheme, including control measures;
- Traffic modelling and reports for traffic management and control measures, where necessary;
- Safety audits on all permanent highway works, temporary diversion routes and accesses;
- Details of mitigation measures to reduce impacts on traffic (buses, cyclists and pedestrians) including traffic signal modifications, temporary diversions and measures to minimise the duration of the scheme; and
- Proposed publicity to notify and inform users before and during the implementation of all traffic management and control measures.

Fingal County Council (FCC) and DCC have statutory authority to issue directions in relation to the carrying out of any roadworks in their functional area under Section 101D of the Road Traffic Act 1961. The purpose of those directions is to ensure that regard is had to the need to coordinate different roadworks happening in parallel and to minimise consequential disruption to traffic. Prior to implementation, all traffic management measures will be agreed with FCC and DCC and where relevant, consultation with An Garda Síochána and other statutory stakeholders such as Iarnród Éireann will be undertaken. Traffic management measures and road construction works is based on the following key principles:

- Uninterrupted access for emergency vehicles;
- Maintaining continual access to all properties during works;
- Where required, a safe alternative route shall be given to pedestrians and vulnerable road users, such as children, and visually and mobility impaired;
- Cyclists and motorcyclists are specifically catered for;

- Detour routes will be kept as short as possible and detour signage will be clear and easy to understand;
- All potential clashes with public transport are identified and services are maintained where possible. If this is not feasible then planned alternatives need to be considered and prior notice will be given to the impacted operator;
- Monitoring of road works will be undertaken periodically throughout the duration of the works;
- A contact telephone number will be displayed at roadwork sites for people to report any problems with traffic control or safety of the site. A Freephone (e.g. 1800) helpline service will be maintained during the Construction Phase to deal with enquiries and concerns from the general public;
- Minimise traffic delay, congestion and inconvenience to the road user; and
- Ensure licenced approval for the erection of all hoardings and fences on public road. In addition, where footpaths are closed, ensure adequate provision to protect pedestrians from traffic.

5.5 Construction Phase - Main Works

This Section of the EIAR describes the proposed construction methodology of the main construction works (Main Works) required to develop the principal elements of the proposed Project described in Chapter 4 (Description of the Metrolink Project) and Section 5.3 of this Chapter.

This Main Works consists of two elements which will follow the Enabling Works, as described in Section 5.4 above, and these are:

- Main Civil Works; and
- Railway Systems, Commissioning and Finalisation.

The main work activities are detailed in Table 5.8.

Table 5.8: Main Construction Work Activities

Main Civil Work	Railway Systems, Commissioning and Finalisation
▪ Road construction; ▪ Station construction; ▪ Ventilation shafts and other subsurface structures; ▪ Tunnel construction; ▪ At grade and elevated railway structures; ▪ Construction of depots; ▪ Landscaping and architecture; and ▪ Temporary works associated with the delivery of this scope. Temporary works out with the main compounds will include, inter alia: traffic management; ground and groundwater movement control and monitoring; environmental monitoring and mitigation; utility diversion and protection; heritage works; material management and disposal; traffic logistics; and reinstatement on completion.	▪ The installation and fit-out out of railway systems; and ▪ Systems testing and commissioning.

5.5.1 Road Construction and Traffic

The proposed Project comprise a number of key structural elements that impact the existing road networks, such as earthworks, culverts, footbridges, site entrances, embankments, retained cut, cut and cover works and bridges. This will result in the requirement for road diversions, closures, and/or realignment of existing roads, footways, cycle lanes and entrances. The proposed Project also requires the provision of some new roads and underpasses.

The STMP that has been prepared is designed to ensure that any impacts associated with the Construction Phase on the wider Dublin transport network will be minimised where possible. This is further detailed in Chapter 9 (Traffic & Transport) in addition with traffic impacts and mitigation measures. Furthermore, as discussed above, HGV haul routes are illustrated in Figure 5.2 provided at the end of this Chapter.

New road construction works will typically include the following construction sequencing:

- Earthworks which will involve the removal of topsoil, along with any vegetation, cut and fill works, grading the area and levelling the ground;
- Installation of the utilities, surface water drainage system comprising pipes and chambers, as required, and connect to the designated outfall point;
- Laying of the road foundation material;
- Installation of any required kerbs and the drainage collector system, such as gullies, and lighting, signing and traffic signals;
- Laying the road pavement material;
- The addition of road markings and cat's eyes as required; and
- Once the new road is inspected and accepted for use by the relevant Local Authority, it can be opened to traffic and public use.

Where the new road (either temporary or permanent) is being tied into an existing road (for diversion or realignment purposes) the following works will generally be involved:

- Utility service tie in, diversion, or protection;
- Drainage works;
- Works to footways, cycle paths;
- Alteration and, or realignment of carriageway;
- Signing and road marking; and
- Boundary treatment.

Construction of cut and cover road crossings are illustrated in Diagram 5.14 and detailed in Section 5.5.6.

5.5.2 Subsurface Structures

Construction of the proposed Project permanent subsurface structures will commence with the installation of vertical walls from the surface in the form of concrete secant piles, D-walls or sheet piling. This will provide lateral ground support prior to the main excavation being carried out. These methodologies have been assessed within the EIAR for all subsurface works and foundations.

A detailed methodology for these construction methods has been provided in Appendix A5.12 and the following sections provide a high-level overview of a typical approach to each.

5.5.2.1 Secant Piling

Secant piling is proposed for retained cut sections, cut-and-cover tunnels and some cut and cover station boxes (Seatown, Swords Central, Fosterstown and the future Dardistown station).

Secant piles are essentially interlocking piles excavated to form a supporting wall in the ground prior to bulk excavation. Diagram 5.8 shows an example of a secant piled wall installation. A typical construction sequence for secant piled walls is as follows:

1. The formation of a piling platform to support piling activities;
2. The construction of a shallow guide wall used to guide the piles into place, using reinforced concrete (e.g. concrete with the addition of steel rods);
3. Installation of the first set of primary piles using a piling rig. This is filled with concrete and left to cure;
4. Installation of a second set of piles that overlap with the first set of piles. This ensures a continuous retaining wall; and
5. The guide walls are removed, and a reinforced concrete pile cap will be constructed on top of the wall.

Typical equipment required for secant piling includes the use of piling rig(s), concrete pump, mixer drum, compressor(s), jet washes, water bowser, crane suspended vibrator with power pack, hand tools including power tools, crawler crane (or similar), backhoe excavator, tipper(s) and remixer(s). (Refer to Appendix A5.12 for more information on construction plant).

A typical site set up during secant piling construction is illustrated in Diagram 5.7. Images depicting the piling method and typical piling rigs are shown in Diagram 5.9.

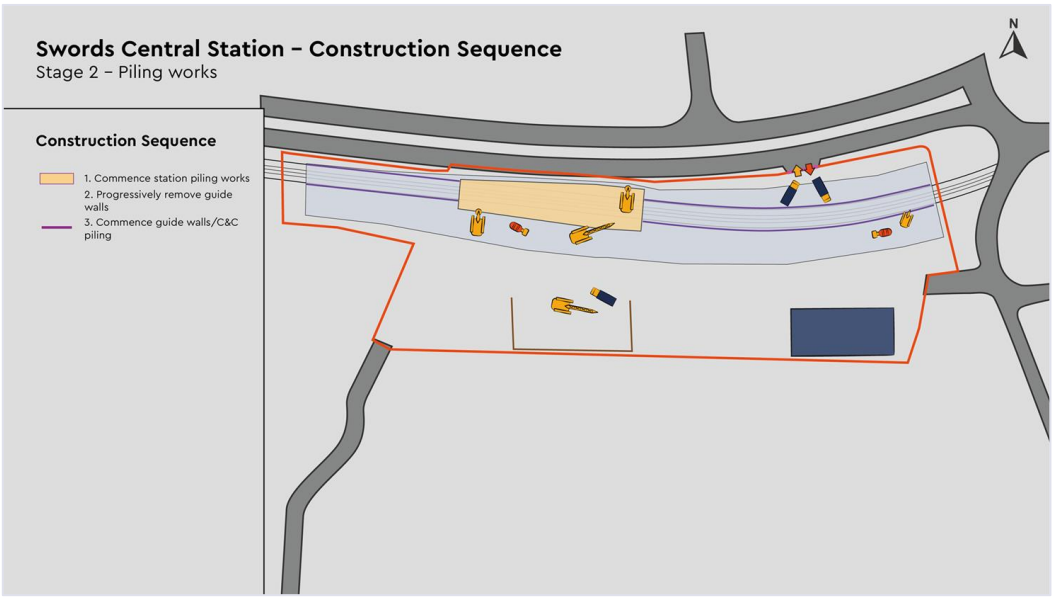


Diagram 5.8: Example of Typical Secant Piling Operations Site Layout

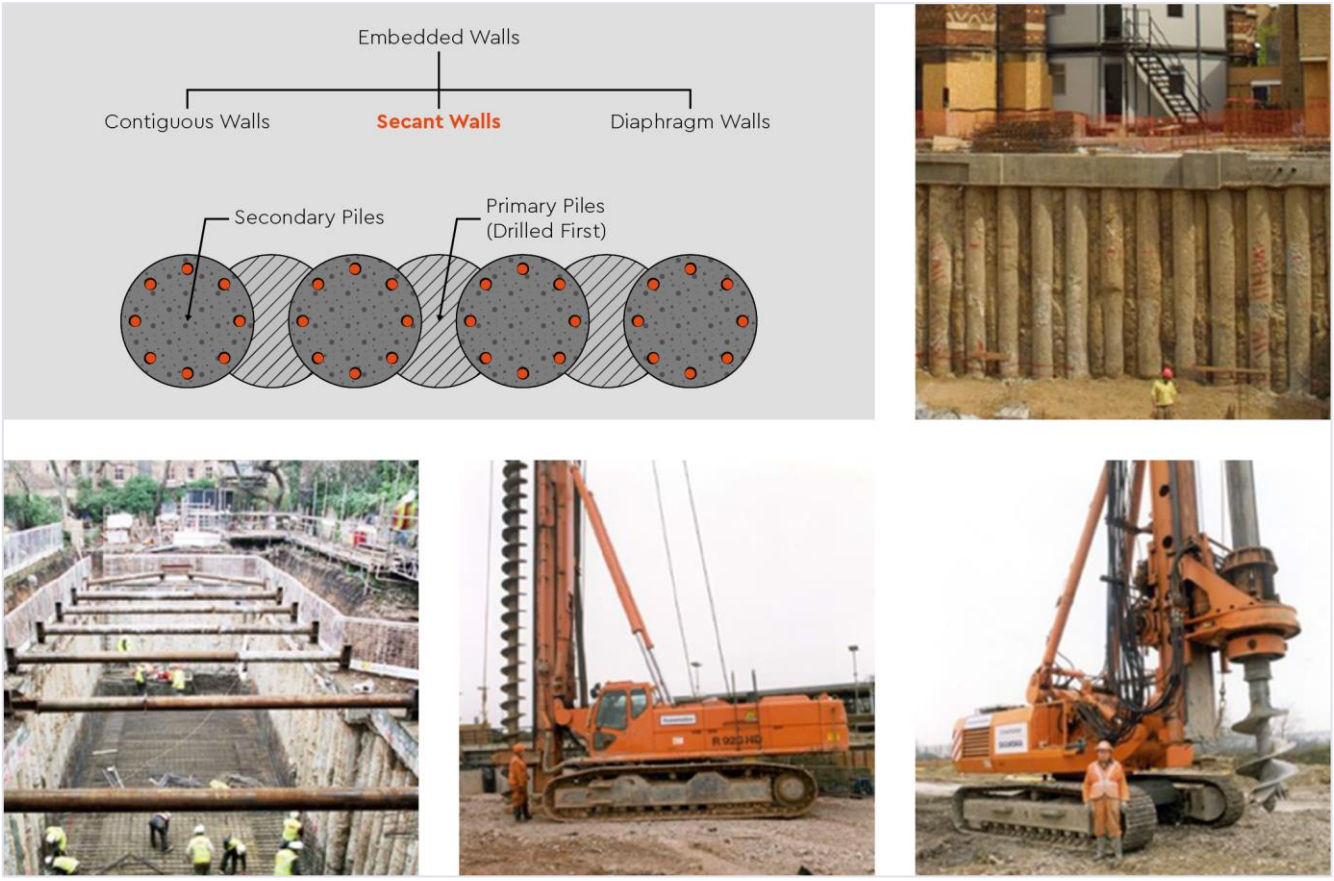


Diagram 5.9: Example of Secant Piling Works and Rotary Bore Piling Rig

5.5.2.2 Diaphragm Walls

Diaphragm walls, often referred to as 'D-walls', are proposed at most station locations. These are continuous, reinforced (steel or fibre glass) concrete walls placed in the ground as individual panels, prior to the excavation of the station/basement structure.

D-Walls are similar to secant piles in that they are excavated from the surface and then filled with reinforcing steel and concrete. However, they are constructed as rectangular sections of trench, rather than circular piles, and bentonite is used to support the ground before concreting. Following site establishment, a typical construction sequence for this activity is shown in Diagram 5.10 and includes:

1. The formation of a piling platform to support piling activities and the preparation of a bentonite mixing and storage area (e.g. silos to store bentonite), D-wall cage storage area and installation of ground monitoring equipment (Section 5.5.3.1.5 provides further information on bentonite);
2. The construction of a piling mat and guide walls;
3. The construction of the D-walls using machinery including grabs and hydrofraise / trench cutters;
4. The construction of concrete panels by using reinforced concrete; and
5. The D-wall will be constructed to the level of the proposed station roof slabs and the surface will be backfilled with gravel.

A typical site set up during D-wall construction is illustrated in Diagram 5.10, with an illustration showing a typical site layout during D-wall construction shown in Diagram 5.11.

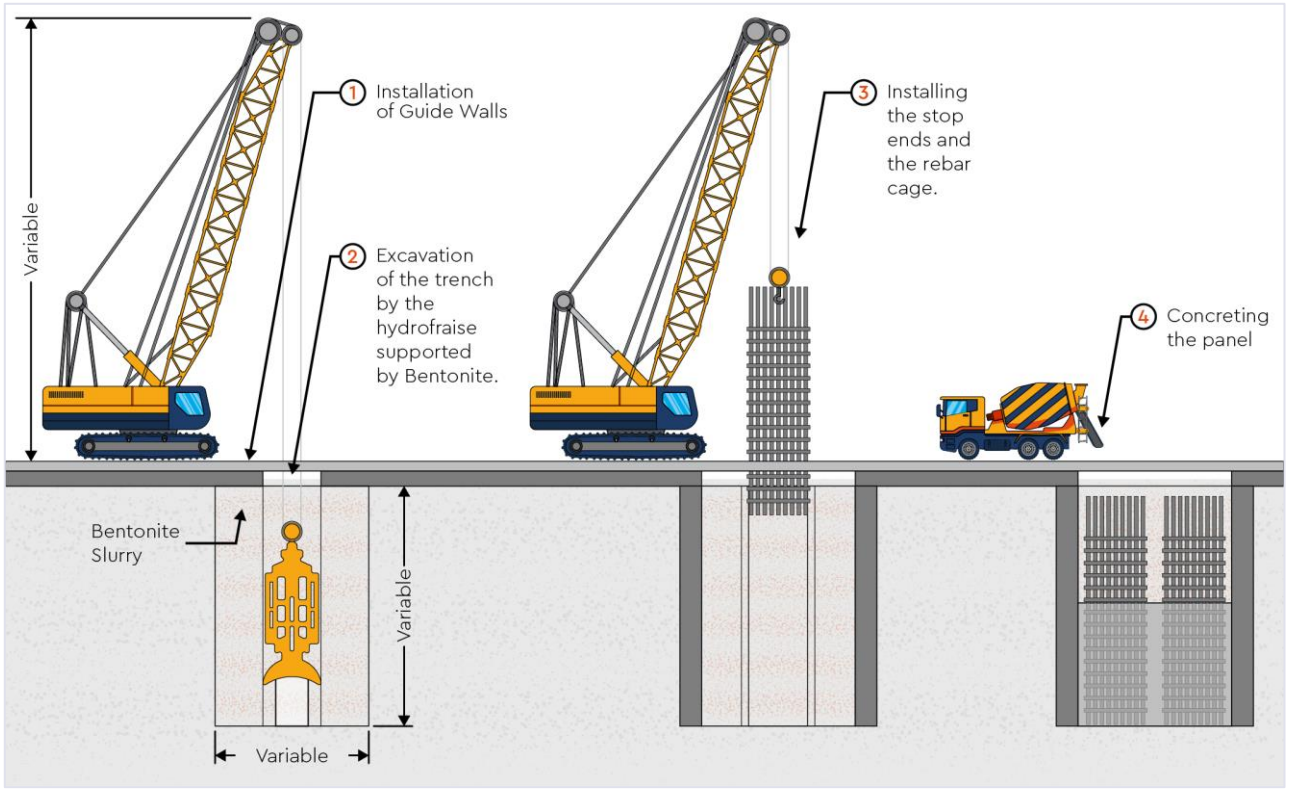


Diagram 5.10: Example of D-wall Construction

Typical plant required for D-walls includes hydraulic grab(s), hydrofraise (hydromills), cranes, concrete pump(s), mixing plant(s), bentonite silos/recycling plant, dehydration unit, backhoe unit, backhoe excavator, jet wash, dumper(s), compressors(s), remixer(s), tipper(s) and wheel wash. The exact requirements will depend on each site configuration, geology, the construction programme and the number of grabs or hydrofraise being utilised Appendix A5.12 has more information on construction plant.

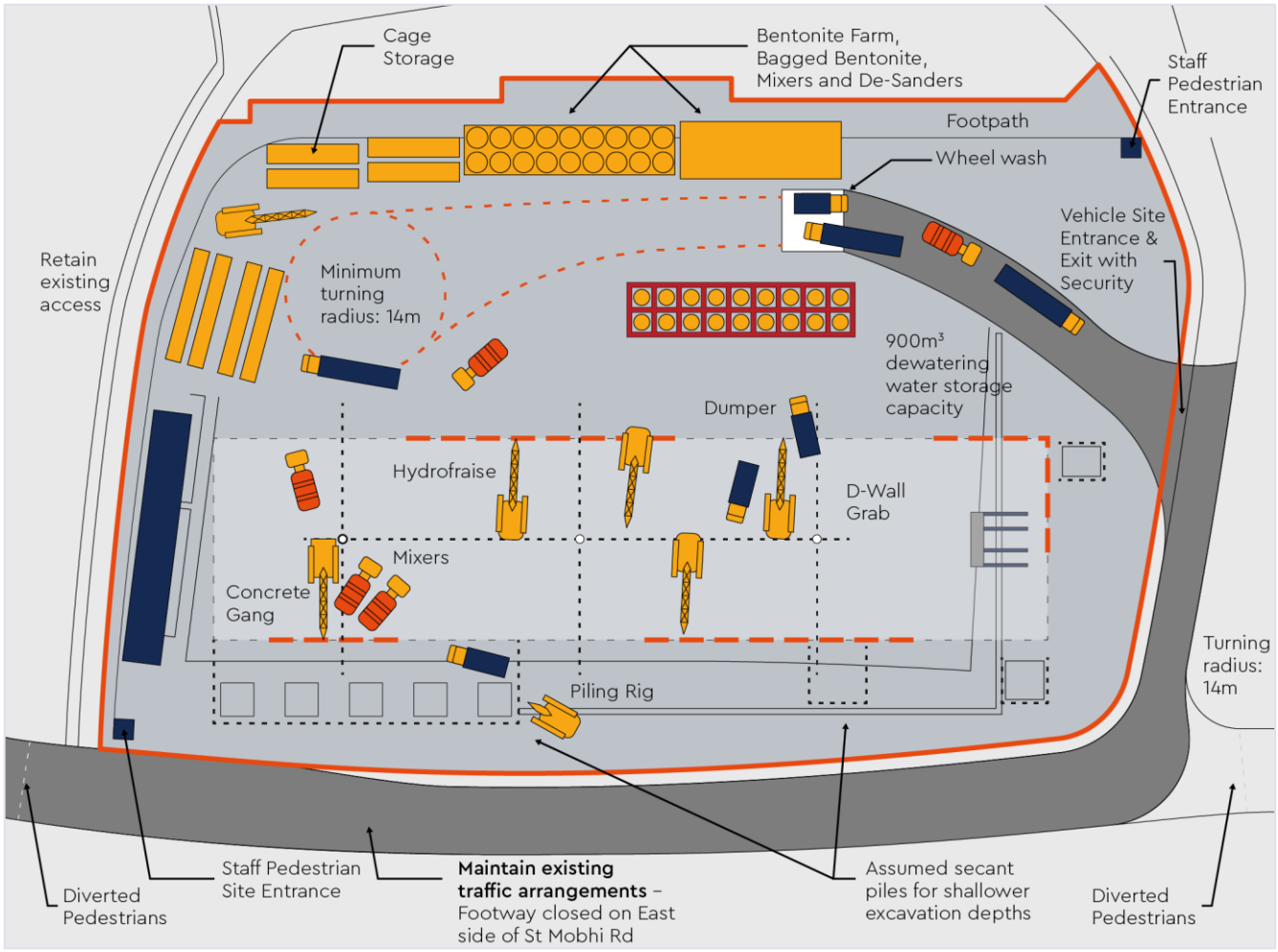


Diagram 5.11: Example of Typical D-wall Operations Site Layout

In order to minimise the likelihood of water ingress below the toe of the D-wall panels during excavation, additional ground investigation and in-situ permeability testing (pump tests) will be undertaken. Deep wells will be installed to lower the water table level within the footprint of the station box, and piezometers inside and outside the footprint will be monitored to determine the drawdown of the groundwater level and hence the adequacy of the cut-off. If required grouting to the toe of the D-walls may be required as shown in Diagram 5.12.

Separately, grouting will be carried out to seal any groundwater leaks that are subsequently found at D-wall panel junctions, as the excavation within the D-wall box progresses and at the connection between the base slab and the D-walls.

Several methods can be used for groundwater extraction and disposal, and these are chosen based on the anticipated quantities expected and the availability of discharge options (assessed in Chapter 18 (Hydrology)).

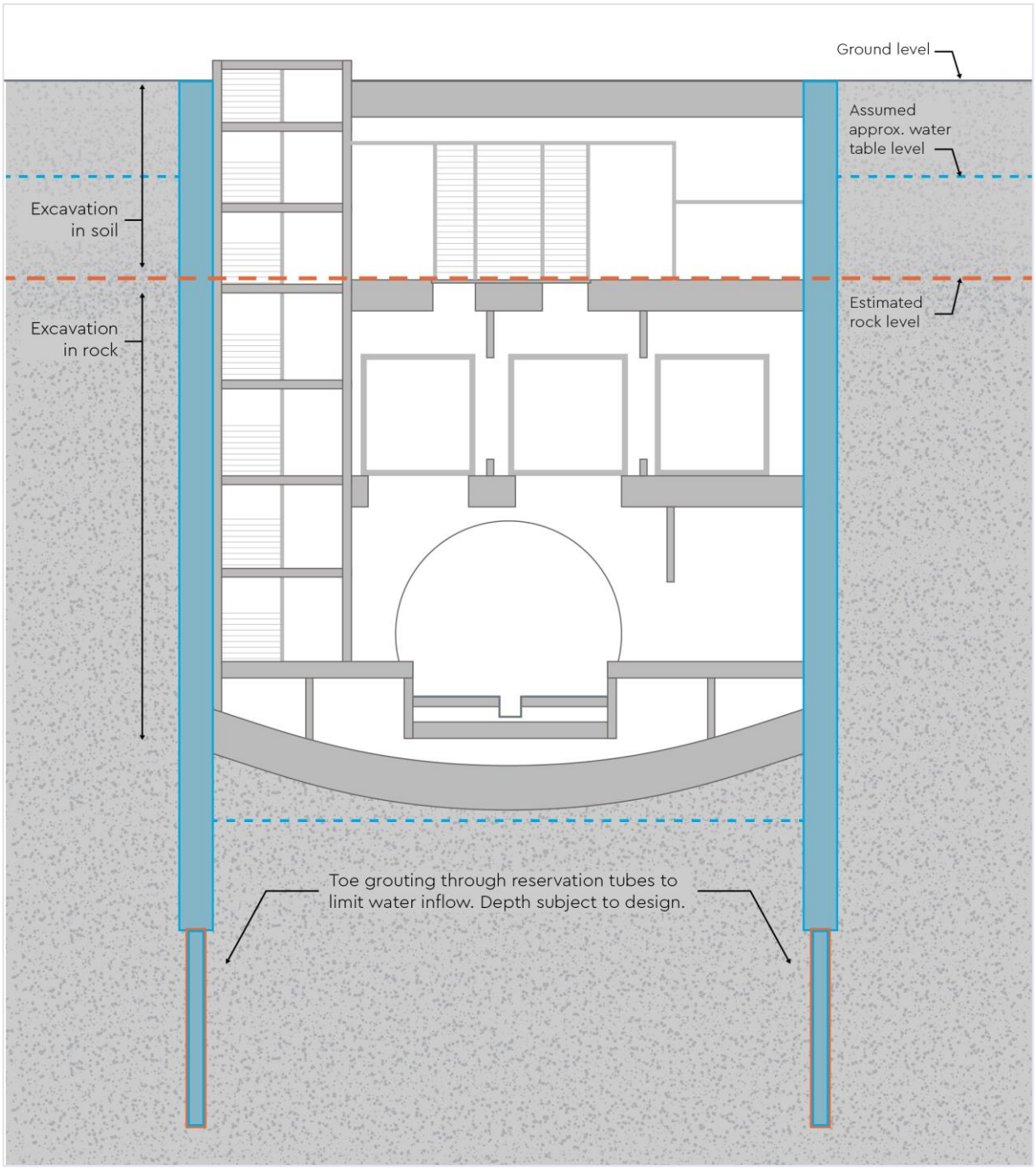


Diagram 5.12: Toe Grouting to Limit Water Inflow into the Excavation Through the Base

5.5.2.3 Retained Cut Alignment

There will be a number of retained cut sections excavated, primarily in the northern section of the proposed Project along the R132 Swords Bypass. Diagram 5.12 shows a typical cross section and site layout for construction. The depth of excavation from ground level within these sections varies from between approximately 6m to over 10m in some areas, and significantly deeper in other areas (approximately 10m+).

Subject to detailed design, the proposed methodology for retained cuttings consists of:

1. Construct and install secant pile walls;

2. Construct capping beam and excavate down to underside of the first row of props;

3. Install row of temporary props. If the depth of the retained cut is very deep, a second sequence of excavation and a second row of temporary props may be required;

4. Excavate down to the underside of the base slab and cast base slab. If the depth of the alignment dictates, an intermediate permanent prop will also be cast at this stage / or temporary props will be removed. Pumping out of the excavations, beneath the water table, will be required; and

5. Install track bed. Finalise by installing rail systems and mechanical and engineering fit out.

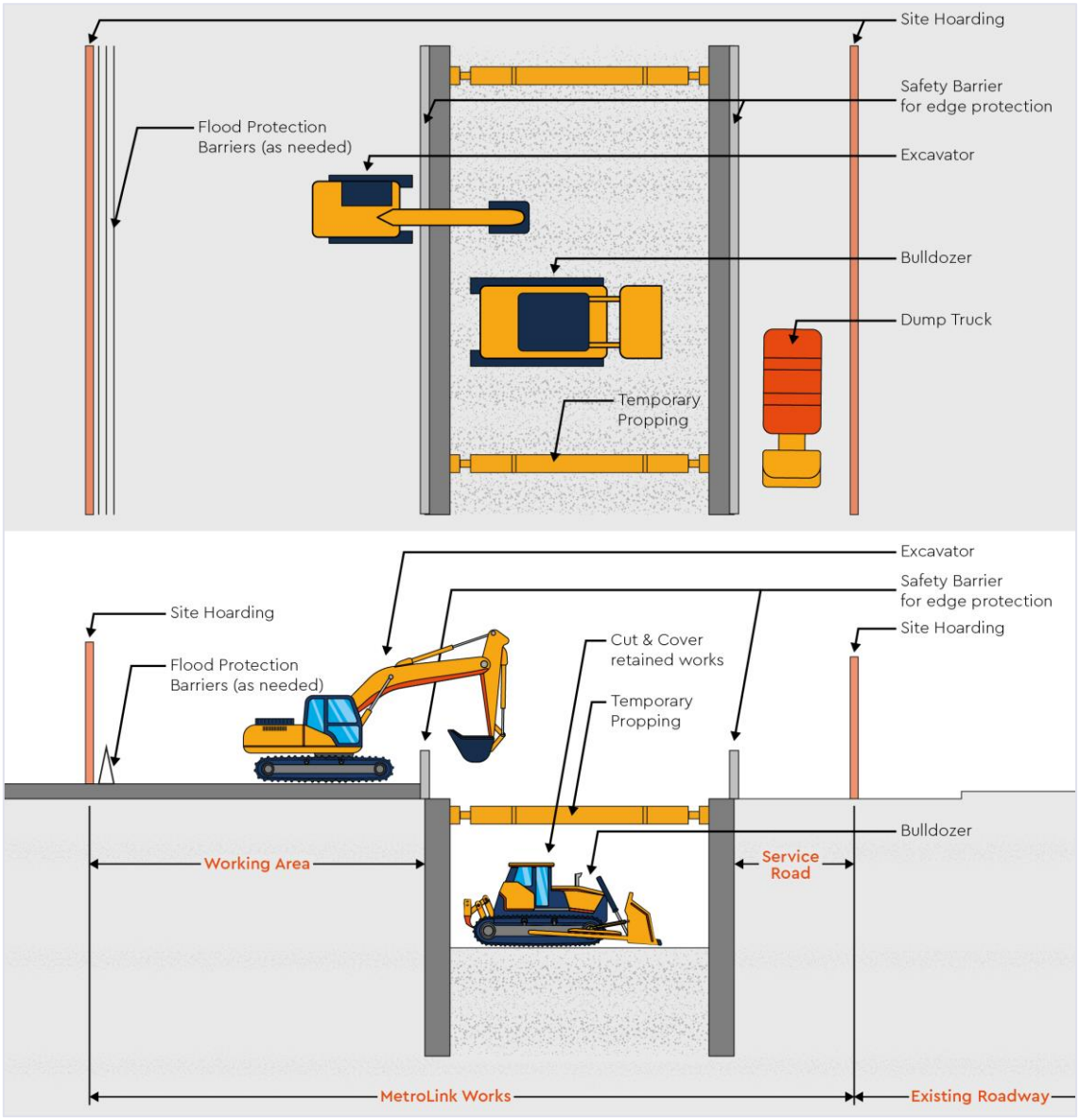


Diagram 5.13: Retained Cut Typical Plan Area View and Cross Section

5.5.2.4 U-Section

Certain retained sections will require a U-section construction technique, involving temporary excavation support with either sheet piles or battered excavations (as opposed to secant piles). Following this, excavation works will commence and props will be installed and a base slab cast. Formwork will be installed; walls will be cast and formwork removed. The track bed will be cast and backfilled to grade as required. Temporary props and sheet piles will be removed and can be reused elsewhere. The sequence of proposed works is as follows:

1. Install sheet piles;

2. Excavate in stages and install props, prepare formation;

3. Cast base slab;
4. Install formwork, cast walls, and strip formwork;
5. Cast track-bed base slab;
6. Backfill behind and compact in layers;
7. Remove temporary props, and sheet piles; and
8. Install railway systems, cable troughs and walkways.

5.5.2.5 Cut and Cover Section

There will be a number of areas where cut and cover construction will be used. These primarily include road crossings such as Malahide Roundabout crossing, Pinnock Hill Roundabout crossing, and Nevinstown Lane crossing.

The depth of the excavation in these sections is between approximately 6m to 8m below ground level. The construction of the cut and cover tunnels consists of the same methodology as the retained cut sections with the addition of a roof slab and reinstatement of surface level.

Where cut and cover sections are constructed during road closures, the roof slab will be constructed at the earliest opportunity to minimise disruption to traffic flows. The following stages describe the typical approach to cut and cover through road crossings:

- Stage 1: secure the site, establish the construction compound and form the construction access. Saw cut the existing roadway to limit extent of damage to existing road surfacing and buried services;
- Stage 2: divert utilities in accordance with the methodology detailed in Section 5.4.10 and install temporary works as needed. Excavate and remove the existing roadway down to required formation level to enable the capping beams and cut and cover roof slab to be constructed;
- Stage 3: commence backfilling and reinstatement of road drainage, utilities, road construction including transition/strengthening slabs below the reinstated approach edges to both sides of the cut and cover structure as indicated in Diagram 5.14. Commence top-down construction by excavation techniques, lowering the formation level in planned stages and installing temporary props (if required) to brace the cut and cover structure side walls. The road reinstatement could be undertaken concurrently or at the earliest opportunity to open up traffic and minimise disruption on the local community; and
- Stage 4: complete the cut and cover structure base slab, remove any temporary props and complete internal walls and infill openings in the roof slab of the box structure. Follow on works, such as track bed and railway systems installation, can continue through the completed cut and cover structure.

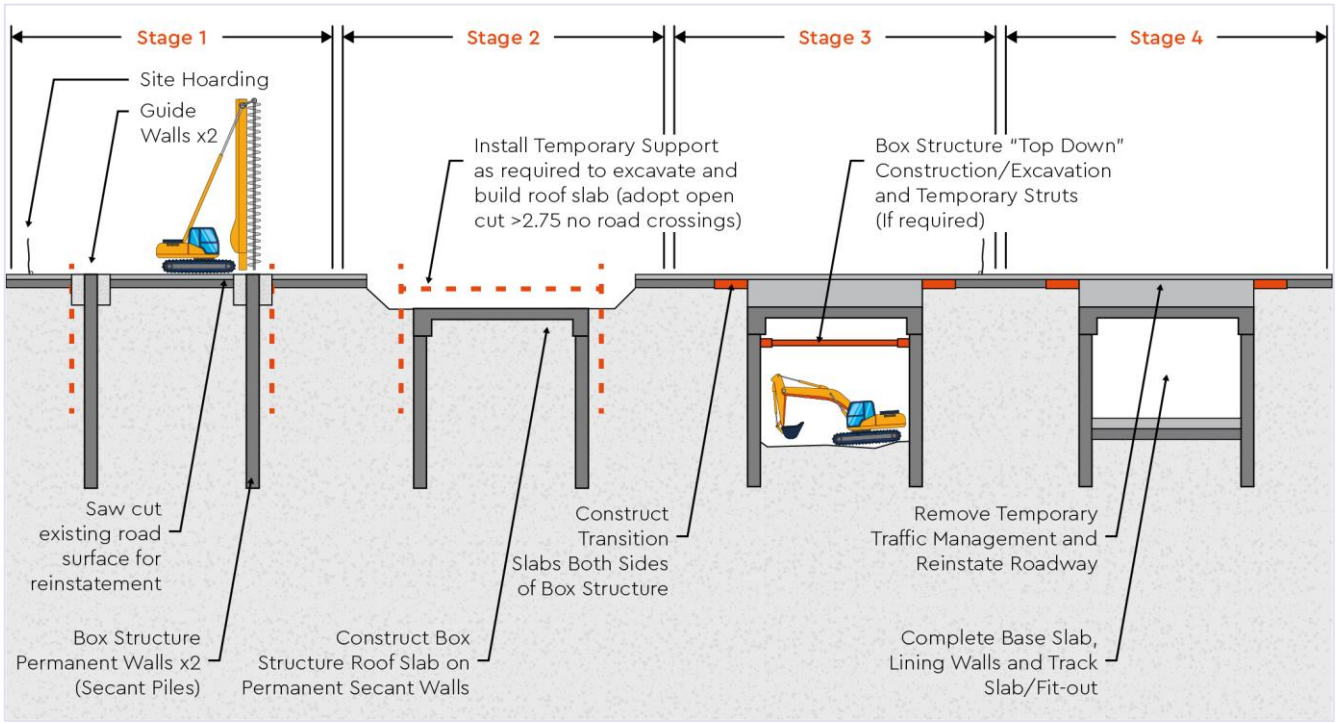


Diagram 5.14: Typical Cut and Cover Road Crossing Staging

5.5.3 Tunnelling

Diagram 5.15: Tunnelled Sections of the Proposed Alignment

The openings at the end of a tunnel are referred to as portals. They are concrete and steel structures designed to allow the commencement or termination of a tunnelled section of route. There are three proposed portals, which are:

- DANP;
- DASP; and
- Northwood Portal.

As detailed in Chapter 4 (Description of the MetroLink Project) and illustrated in Diagram 5.14, the alignment through Dublin Airport and the City is achieved through two TBM bored tunnel sections:

- **Dublin Airport Tunnel:** The Airport Tunnel passes beneath Dublin Airport and is approximately 2.3km long running between DANP and DASP in the AZ2 Airport Section. The TBM will launch from DASP and will drive north underneath Dublin Airport to DANP. It is estimated that this tunnel drive will take approximately 30 months to progress with the associated evacuation and ventilation tunnels (see below); and
- **City Tunnel:** The longer bored tunnel, at approximately 9.4km, runs from Northwood Station to south of Charlemont Station (AZ4). A TBM launch site will be constructed at Northwood Station and from here a TBM will drive south from Northwood to Charlemont. It is estimated that the tunnel drive will take approximately 45 months to progress.

Both tunnel sections consist of a single bore, twin track tunnel with an external diameter of 9.2m and an internal diameter of 8.5m. A cross section of a typical bored tunnel configuration is shown in Diagram 4.19 of Chapter 4 (Description of the MetroLink Project).

In addition to the two main running bored tunnels, there are three shorter, smaller diameter tunnels. These are the evacuation and ventilation tunnels (known as Intervention Tunnels):

- **Airport Evacuation and Ventilation Tunnels -** Parallel to the Airport Tunnel, there will also be two smaller diameter tunnels; on the west side an evacuation tunnel running northwards from DASP for about 315m and on the east side a ventilation tunnel connected to the main tunnel and extending about 600m from DASP underneath Dublin Airport Lands. In the event of an incident in the main tunnel, the evacuation tunnel will enable passengers to walk out to a safe location outside the Dublin Airport Lands. The alignment of the intervention tunnels is shown in Diagram 5.16. The construction of these tunnels is by TBM and is described in Section 5.5.3.1 and Section 5.8.4. Sprayed concrete lining (SCL) techniques will be used to construct the connecting passages from these tunnels to the Airport Tunnel. The TBM will junction with these structures, be dismantled and returned to the portal to drive the second (City) tunnel.
- **Charlemont Evacuation and Ventilation Tunnel -** At the southern end of the City Tunnel, a parallel evacuation and ventilation tunnel (Charlemont Intervention Tunnel) will be provided that extends for approximately 300m from the end of the City Tunnel back to Charlemont Station. This parallel tunnel is incorporated to support emergency evacuation of maintenance staff and ventilation for the tunnel section south of Charlemont. The construction of this tunnel is by sprayed concrete lining (SCL) techniques incorporating mechanical and / or drill and blast excavation, as described in Charlemont Intervention Tunnel Section 5.5.5.1.1 and Section 5.5.8.

The ventilation tunnels would typically have an internal diameter of about 6m and the pedestrian evacuation tunnels would be provided with an inner clearance about 2.3m wide and 2.4m high.

Following the completion of the TBM tunnel works:

- The main drive TBM (used to excavate the City Tunnel) will be driven off-line south of Charlemont Station and buried; and
- The Airport drive TBM will mine into the DANP structure, where it will be dismantled and removed from site.

The following sections provide summary information of the TBM and tunnelling phase, please refer to Appendix A5.13 for further detail on the tunnelling methodology.

Diagram 5.16: Alignment of Evacuation (left) and Ventilation (right) Tunnels at DASP

5.5.3.1 Main Bored Tunnels

5.5.3.1.1 Construction Locations

The construction of the tunnels will require the establishment of several construction sites and associated compounds. The main sites required are listed in Table 5.9. The TBMs will be launched from the portals constructed at Northwood and DASP. Both portals will be constructed using cut and cover techniques.

Table 5.9: Schedule of Sites Associated with Main Tunnel Works

Construction Site	Activity					
	Launch and drive TBM	Receive TBM	TBM burial site	Tunnel clean out support	First stage concrete support	Track and MEP installation
1. Dublin Airport South Portal (DASP)	Yes			Yes	Yes	
2. Dublin Airport North Portal (DANP)		Yes				
3. Northwood Portal and Station Main Compound	Yes				Yes	
4. Charlemont			Yes			
5. Griffith Park				Yes	Yes	
6. Estuary						Yes
7. Dardistown Depot						Yes

5.5.3.1.2 Proposed TBM type

The assessment has been carried out on the basis of use of a Variable Density TBM. No significantly different environmental effects will arise from use of other types of TBMs.

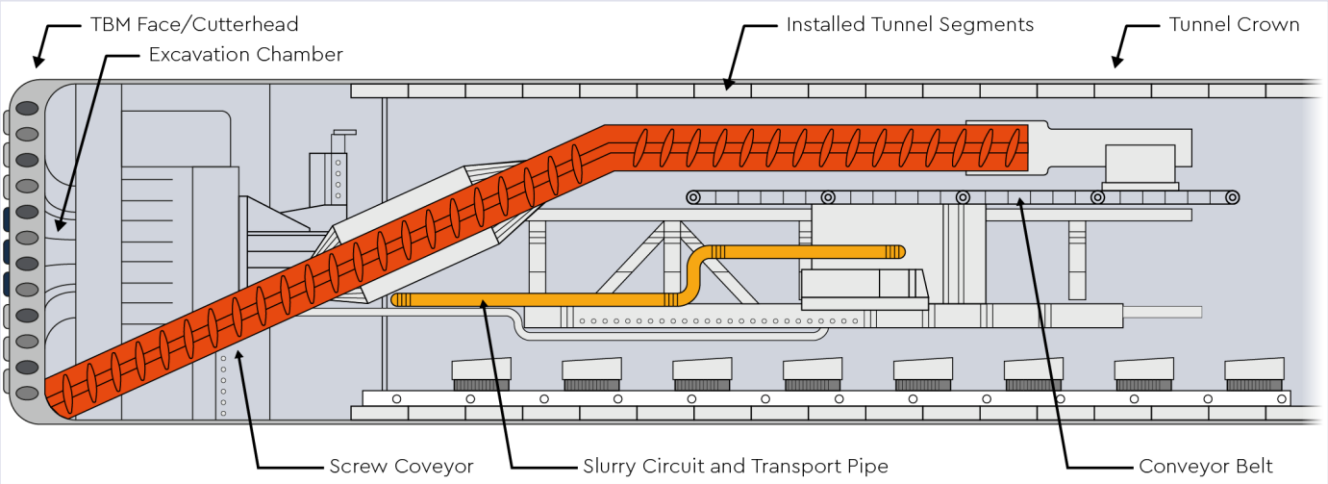


Diagram 5.17: A Typical Variable Density TBM

A Variable Density TBM (see Diagram 5.17) is effectively a multi-mode machine, that allows:

- Open mode, where there is no pressure required to stabilise the cutting head and the cut material is removed from the cutting face by a screw conveyor operating at low pressure. Material is then discharged on to a belt conveyor for transport to the launch site;
- EPB mode, where pressure is required to stabilise the ground at the cutting head. The cut material is removed by the screw conveyor to maintain the pressure at the cutter head. The EPB mode is well suited to cohesive clays, silts and fine sands; and
- Slurry mode, with the cut material removed within a slurry generated at the surface and pumped to the cutting head with the pressure in the cutting chamber maintained by an air bubble. The slurry mode is well suited to cohesionless coarser grained sand gravels.

5.5.3.1.3 Tunnelling Support Plant and Equipment

During tunnelling, in addition to the portals constructed to launch the TBM (at Northwood and DASP), the site must include:

- A slurry treatment plant for separating the excavated material from the TBM (when in 'slurry' mode) from the transfer slurry, which is then stored and reused. The mode of operation for the TBM is detailed in Section 5.5.3.1.2. Handling of the excavated material is described in Section 5.5.3.1.5;
- Conveyors for the transfer of excavated material from the TBM (when in Earth Pressure Balance (EPB) mode) from the portal to the storage area. The mode of operation for the TBM is detailed in Section 5.5.3.1.2. Handling of the excavated material is described in Section 5.5.3.1.5;
- Storage for excavated material and an area for loading this into road vehicles (including a holding area for the tipper-type trucks to wait);
- Craneage to lift plant and material in and out of the portal structure (these are likely to be gantry cranes, but mobile and crawler cranes will also be required at times);
- A tunnel grout plant to store and mix the grout used to fill the annulus around the tunnel rings;
- Large storage areas (secure, covered and open (with bunds as appropriate)) for efficient deliveries and to minimise the risk of delay from material supply;
- Workshops and repair areas;
- A substantial high voltage (HV) power supply (approximately 7 mega volt ampere (MVA)), switch, sub-station, transformers and electrical distribution;
- Tunnel ventilation equipment (see Section 5.5.19);
- Large tanks in which the TBM cooling water cools down prior to going back into the TBM;
- Rainwater collection from roofs and storage of this water for recycling;
- Site runoff collection and water treatment tanks for this run-off and water pumped from the tunnel;

- A wheel wash over which all HGVs leaving site must pass;
- A large office and welfare complex; and
- Limited carparking for vehicles required for the construction activity and for employees with disabilities where a vehicle is required. The use of public transport should be encouraged by the provision of a minibus pick-up from bus or rail stops.

5.5.3.1.4 TBM Delivery, Assembly and Dismantling

On arrival to launch sites, the TBM will be assembled and then tested and commissioned. Noise and vibration from these works have been assessed in Chapter 13 (Airborne Noise & Vibration) and Chapter 14 (Groundborne Noise & Vibration). Diagram 5.14 provides an overview of a typical Variable Density TBM and Diagram 5.18 provides an example of a typical TBM being lowered into the launch shaft (portal).

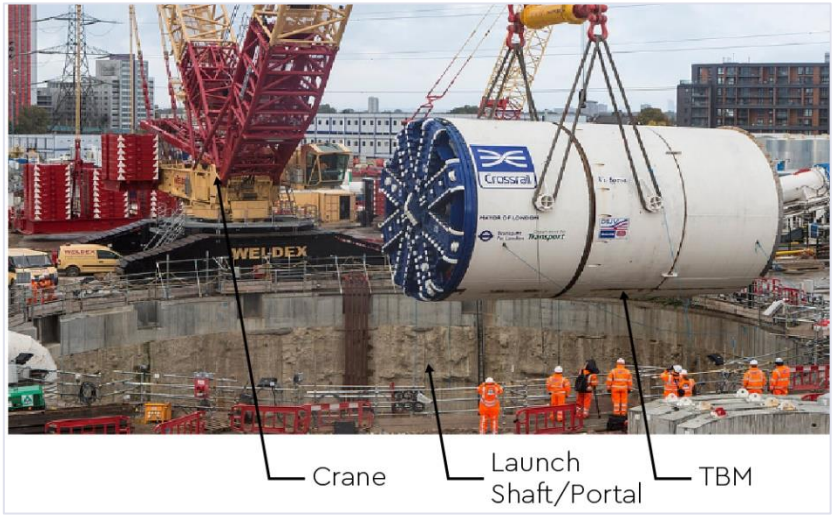


Diagram 5.18: Example of Crossrail TBM Being Lowered into the Launch Shaft

On completion of tunnelling, it is expected that the main drive TBM (used to excavate the City Tunnel) will be driven sufficiently off the line of route to be sealed and buried underground. The cutterhead and main shell of the TBM will remain permanently in the ground south of Charlemont Station. All the TBM back up gantries and equipment will be removed together with the internal components of the TBM itself. The cutterhead, TBM skin, tail-can and structural components will be left in-situ. All oils and greases will be removed prior to the grouting in the TBM.

Components will be thoroughly cleaned of grease, oil and dirt before loading on to transport, with these works carried out in a purpose built 'cleaning bay' from which drainage water will be collected and passed through a treatment plant and an oil interceptor. Any potential for contamination to groundwater and/or soil has been assessed in Chapter 19 (Hydrogeology) and Chapter 20 (Soils & Geology).

The Airport Tunnel TBM will break through into DANP, be dismantled and then transported off site.

5.5.3.1.5 Excavated Material

The type of excavated material will depend on the operating mode of the closed face TBM (i.e. Open Mode, Slurry Mode or EPB Mode).

Open Mode: There is no additional pressure required to stabilise the cutting head and the cut material is removed from the cutting face by a screw conveyor operating at low pressure. Material is then discharged onto a belt conveyor for transport to the launch site. As no additional face pressure is required, there is no slurry added to the cutterhead and the material requires no subsequent processing and is simply stored for onward transportation to the designated disposal site.

Slurry Mode: To transport the excavated material via a pipeline from the TBM back to the surface, a bentonite slurry is used. The purpose of the slurry is to act as a transport medium to carry the excavated material; to pressurise the face of the excavation to control ground movement; and to limit wear to the TBM and slurry system components. Bentonite is blended from naturally occurring clay minerals and is supplied in a fine powder form. Polymers may also

be added to the slurry to prevent the mix flowing to the ground under the pressure inside the head and to help prevent the mix sticking to metal surfaces. The slurry is subsequently pumped through a series of booster pumps along the tunnel, up to the surface and into a bentonite slurry treatment plant (Refer to Diagram 5.19). Further information on the use of bentonite is contained in Appendix A5.14 (TBM Consumables).

The treatment plant separates the excavated material from the bentonite slurry. The treatment process separates the excavated material by size and a number of stockpiles are produced before removal from the site. The screening technology includes hydro-vacuum cyclones, vertical separators and centrifuges to ensure that fine particles are removed. The separated bentonite slurry is held in storage tanks and then pumped back down to the TBM for re-use. Please refer to Appendix A5.13 for a more detailed description of the treatment process and layout of the construction site.

On completion of all tunnelling works the bentonite slurry will be disposed of to a designated waste disposal site. During tunnelling, spent bentonite that is no longer suitable for reuse will also need to be disposed of on occasions. Transport of the bentonite slurry will be by road tanker. Under Irish regulations it is classified as a non–hazardous waste. It will not be possible to reuse, recycle or recover this waste further and disposal to a licenced landfill could be required.

Detailed description on resource and waste management and potentially suitable destinations for spoil and bentonite slurry transported by road are discussed in Chapter 24 (Materials & Waste Management) and in the Excavated Materials Management Strategy (Appendix A24.1).

Diagram 5.19: A Typical Bentonite Slurry Treatment Plant

'EPB' Mode: Excavated material is mixed with spoil conditioning additives to make the cut ground more consistent and easier to handle, it will reduce friction in the cutterhead and reduce tool wear and a subsequent reduction in power used to turn the cutter head. In addition, the spoil conditioning additive helps by allowing the spoil to form a pressure plug in the screw conveyor which is fundamental to the operation of an EPB TBM and its ability to maintain face pressure.

The spoil conditioning additives generally consist of a detergent that is mixed with water in foam generators on the backup gantries to produce a thick shaving-like foam than can be injected into the chamber in front of the bulkhead. In addition to the foam, polymers can be added to reduce the clogging (stickiness) of the clay. The foam breaks down after a few hours or days. All materials are non-hazardous and biodegradable with no harmful residual chemicals. Further information on the use of spoil conditioning additives is contained in Appendix A5.14 (TBM Consumables).

This material will be transported out of the tunnel on a conveyor as shown in Diagram 5.20 (on the upper right-hand side of the image). The excavated material is then transferred to a storage stockpile.

Diagram 5.20: Typical Tunnel Conveyor System

5.5.3.1.6 Settlement

Buildings and Infrastructure

A comprehensive Settlement Assessment has been undertaken to determine the potential impacts that construction of the proposed Project will have on sensitive receptors such as buildings and infrastructure from the advance of the TBM. The ground movement predictions and the building damage assessment methodology adopted for MetroLink is based on the approach adopted in most tunnel projects around the world, including London Crossrail and High Speed 2 in England. This is described in Section 5.4.11 (Ground Settlement Monitoring and Mitigation Works).

Utilities

Excavation for the tunnels and other below ground structures could potentially lead to ground movements at the surface and below ground, with associated settlement impacts on utilities. A settlement analysis has been completed to assess the impacts of predicted settlement on utilities caused by construction of the proposed Project. This analysis and a description of the protective measures that will be applied is detailed in Chapter 22, Infrastructure & Utilities.

5.5.3.1.7 Tunnel Concrete Segments

As the TBM progresses cutting the tunnel, pre-cast concrete segments are immediately inserted by the TBM to form the tunnel. (Refer to Diagram 5.21 for an image of segments inserted to form a tunnel).

Diagram 5.21: Example of Tunnel Segments in the Tunnel

The proposed Project will require a large number of pre-cast concrete segments to be manufactured. These concrete segments will be manufactured at a specialist facility off site and transported to site by HGVs where they will be stored at the Northwood Construction Compound. Refer to Diagram 5.22 for an image of the concrete segments.

Diagram 5.22: Example of Concrete Segments to be Stored On-Site

5.5.3.1.8 Tunnel Finishing Works

On completion of the Airport Tunnel, the tunnel will be cleaned out working from the DANP back to the DASP. On completion of the City Tunnel, it is proposed that the tunnel will be cleaned out from both Northwood and Griffith Park sites to accelerate this activity. The tunnel clean out consists of:

- TBM retrieval/removal;
- Repairs of any outstanding ring damage or water leakage;
- Removal of tunnel conveyor, pipes (except for fire main and drainage);
- Removal of unnecessary electrics (but small power, lighting and communications to remain); and
- Cleaning the tunnel lining.

The first stage concrete track bed is then installed with the tunnel drainage and cross-ducts, where required. The track is then installed followed by a second stage track bed, which is poured around the railway sleepers after the

installation and welding of the track. The second stage concrete will contain the stray current protection, the drainage channels and cable pits. The track and track bed installation is described in more detail in Section 5.5.16. The tunnel fit out can then be completed from work trains (rubber tyred vehicles) consisting of installation and commissioning of the fire main, drainage pumps, pipes, overhead conductor rail (OCR), traction power, small power and lighting, communications, closed circuit television (CCTV) and signalling.

5.5.4 Intervention Tunnels

In addition to the two main running tunnels, there are three shorter, smaller diameter tunnels. These are the evacuation and ventilation tunnels (known as Intervention Tunnels):

- **Airport Evacuation and Ventilation Tunnels -** Parallel to the Airport Tunnel, there will also be two smaller diameter tunnels; on the west side, an evacuation tunnel running northwards from DASP for about 315m, and on the east side, a ventilation tunnel connected to the main tunnel and extending about 600m from DASP underneath Dublin Airport Lands. In the event of an incident in the main tunnel, the evacuation tunnel will enable passengers to walk out to a safe location outside the Dublin Airport Lands. The construction of these tunnels is by closed face TBM and is described in Section 5.5.3.1 and Section 5.8.4.
- **Charlemont Evacuation and Ventilation Tunnel -** At the southern end of the City Tunnel, a parallel evacuation and ventilation tunnel will be provided that extends for 300m from the end of the City Tunnel back to Charlemont Station. This parallel tunnel is incorporated to support emergency evacuation of maintenance staff and ventilation for the tunnel section south of Charlemont. The construction of this tunnel is by mechanical excavation and by blasting, as described in Section 5.5.5.

5.5.5 Sprayed Concrete Lining (SCL) Tunnel

It is expected that whilst mechanical excavation (including the use of a roadheader machine) will be sufficient for many areas, drill and blast may be required for some of the tunnel excavation. The use of hydraulic breakers will be required, although for limited periods of time.

Sprayed concrete lining (SCL) tunnel construction will be required at:

- Dublin Airport - connecting the Airport Tunnel to the parallel evacuation and ventilation tunnels (see Section 5.5.3).
- Albert College Park – connecting the intervention shaft to the City Tunnel (see Section 5.5.11).
- Charlemont – construction of the evacuation/ ventilation tunnel and its connection to the City Tunnel (see Section 5.5.5.1.1).

5.5.5.1.1 Charlemont Intervention Tunnel

The rock support for the first 50m of the tunnel is assumed to be steel frames or lattice girders, as indicated schematically in Diagram 5.23. As the tunnel advances down into rock, and the ground conditions improve, the rock support method is to be rock bolts and reinforcing mesh in conjunction with a sprayed concrete lining (SCL) for additional support in weaker strata.

As the tunnel advances, SCL works will be required to stabilise and form the tunnel. A temporary primary lining of sprayed concrete with a waterproof membrane will be applied. Following completion of the primary SCL lining, secondary permanent lining can proceed. This could be either cast using SCL, but most likely cast in-situ concrete behind steel formwork to create a smooth finish.

Due to the slope, a continuous sump pumping operation is expected to be required for this tunnel during the whole Construction Phase. Temporary sumps will be located at the tunnel face as the tunnel progresses with additional sumps along the tunnel length in approximately 100m intervals. To ensure a safe and stable method of excavation, the SCL tunnel construction will be undertaken 24 hours per day, seven days per week.

The intervention tunnel route will be subject to a settlement and vibration monitoring regime which will ensure that settlement is in line with predictions and, subsequently no damage will be incurred to sensitive receptors and third-party assets along the alignment. (Refer to Chapter 31 of the EIAR, Summaries of the Route Wide Mitigation & Monitoring Proposed).

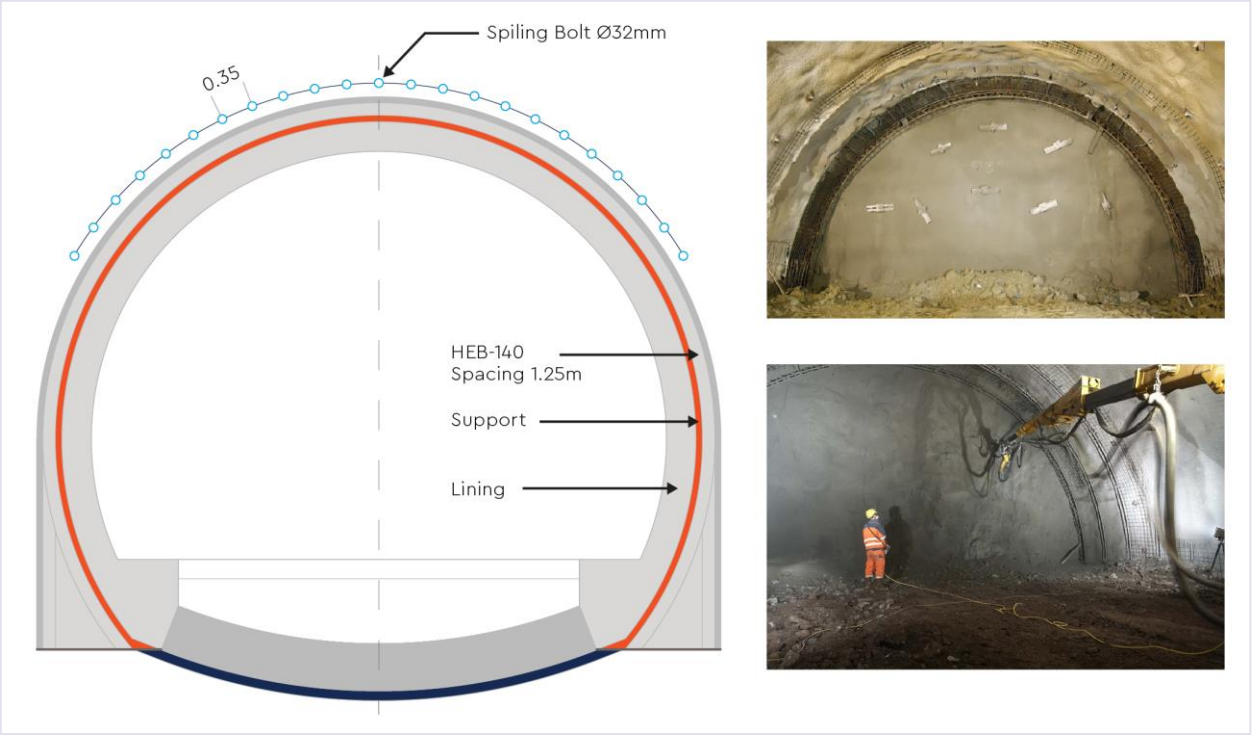


Diagram 5.23: Anticipated Rock Support for the First 50m of SCL Tunnel

5.5.6 Stations

As detailed in Chapter 4 (Description of the MetroLink Project), there are three types of stations; surface stations, retained cut stations and underground stations. Section 5.5.7 provides a high-level summary of the construction methodology proposed for station construction. Further detail on station construction methodology can be found in the area specific construction activity sections of this Chapter (Section 5.7 to Section 5.10) and associated appendices.

The visual impact of the proposed stations is considered in Chapter 27 (Landscape & Visual) with associated photomontages used to illustrate the landscape context provided in Appendix 27.1. The impacts on architectural heritage associated with the construction of new stations is assessed in Chapter 26 (Architectural Heritage).

5.5.7 Surface Station

As detailed in Chapter 4 (Description of the MetroLink Project), there is one surface station located in Estuary. Following the Enabling Works, the proposed methodology for the construction of surface stations is detailed in Section 5.7.2 and some of the keys works consists of:

1. Piling to provide foundation support for the station structure;
2. Minimal ground excavation (1m-2m of existing ground level) and the use of reinforced concrete for station construction);
3. Construction of the station and associated buildings;
4. Excavation of a pedestrian underpass;
5. The installation of a new footbridge over the tracks and passenger lifts to enable pedestrian access to all necessary areas of the Station and Park and Ride Facility;
6. Track installation, internal civil works; and
7. Finalise by completing architectural finishes, Mechanical Electrical Plumbing (MEP) and landscaping.

5.5.8 Retained Cut Stations

As detailed in Chapter 4 (Description of the MetroLink Project), there are four retained cut stations: Seatown, Swords Central, Fosterstown and Dardistown (future station). Following the Enabling Works, the proposed methodology for construction will consist of the following key works:

1. Construction and installation of secant pile walls;
2. Construct capping beam and excavate down to the underside of the permanent props and cast roof slab connecting to the piling walls. At platform level, cast permanent props;
3. Excavate to underside of permanent props and roof slab and install temporary prop;
4. Excavate down to the underside of the bottom slab and cast bottom slab. Remove temporary prop; and
5. Install track bed, platform walls and platform slab. Finalise by installing rail systems and mechanical and engineering fit out.

Following the main wall and internal slab construction internal civil works will include construction of waiting platforms, back of house area (areas accessible just to employees), blockwork walls to separate rooms at the back of house area and the installation of a canopy covering the concourse/entrance area and platforms. Architectural finishes will include prefabricated cladding panels. The floor finish in public areas will consist of non-slip floor tiles and in staff and plant areas, the floors will be sealed and painted. Walls will be tiled in public areas and sealed and painted in staff areas. The ceiling will be finished with the installation of a steel support frame and cladding. The station entrance will include the construction of a concrete upstand and a steel support frame to secure the entrance glazing panels and canopy. In addition, lighting, ticketing, bicycle storage and signage will be installed.

Surface works will include the installation of emergency exits and fire fighter entrance points. The surrounding landscape and street furniture will be reinstated/installed in accordance with the landscape design for the proposed Project. Engineered slopes will be constructed on both sides to maintain slope stability and create the safe, desired finish. These will be landscaped to be in keeping with the local area and design.

Once works are complete the construction sites will be demobilised, and the land will be reinstated to its original condition with landscaping in accordance with the landscape design and any associated mitigation measures such as replacement tree planting.

5.5.9 Underground Stations

As detailed in Chapter 4 (Description of the MetroLink Project), there are 11 underground stations: Dublin Airport, Northwood, Ballymun, Collins Avenue, Griffith Park, Glasnevin, Mater, O'Connell Street, Tara, St Stephens's Green and Charlemont.

Most of the underground stations are similar in size and depth. Glasnevin is an exception as it is an interchange station with the existing Iarnród Éireann network. Further details on the construction of this station are provided in Appendix A5.5 and Section 5.10.6. Further station specific details are provided in Table 5.10 below and in Section 5.6 of this Chapter.

Each station will be constructed using cut and cover, top-down construction within D-walls forming a concrete box below the roof slab. As illustrated in Chapter 4 (Description of the Metrolink Project), each station typically consists of three public levels: Concourse, Mezzanine, and Platform level.

Table 5.10: Data Applicable to Each Underground Station

Underground Station	Dublin Airport	Northwood	Ballymun	Collins Avenue	Griffith Park	Glasnevin	Mater	O' Connell St	Tara	St Stephens Green	Charlemont
Street Level to Top of Rail (TOR) in metres[1]	23.40	16.72	23.20	24.03	24.20	24.5	24.79	24.89	24.00	25.10	24.23
Groundwater inflow rate during construction in litres/ second[2]	41.1	10.3	12.2	16.3	8.22	10.12	15.74	15.74	17.8	7.82	20.56
Assumed discharge of groundwater during construction to[3]	Storm drain	Storm drain	Storm drain	Storm drain	Storm drain	Storm drain	Storm drain	Storm drain	Storm drain	Storm drain	Storm drain
Estimated % volume of rock	82%	45%	30%	58%	70%	26%	32%	30%	67%	75%	76%

[1] metres below ground (street) level.

[2] represents the maximum potential calculated underground water flow coming into the station in an excavation with free water flow. It is assumed Main Works Contractors will implement groundwater control measures reducing resultant groundwater inflow to 0.5 litres/second.

[3] assumes groundwater is treated to a quality standard suitable to discharge to sewer. If this is not possible, water will be tankered off site for disposal at a licensed treatment works.

The typical construction sequence for underground stations consists of:

1. **Diaphragm wall construction and grouting:** construction of the proposed Project's underground stations will start with the installation of vertical walls from the surface in the form of reinforced concrete D-walls. This methodology will be used for all subsurface works at each of the underground stations. D-wall construction is described in Section 5.5.2.2.
2. **Roof slab construction:** following the completion of the D-wall activities and foundation works, the site layout will be re-arranged with the removal of piling platforms, bentonite and D-wall plant. The roof slab will be cast in sections, leaving necessary openings to facilitate top-down construction, as depicted in the layout drawing below (Diagram 5.24).

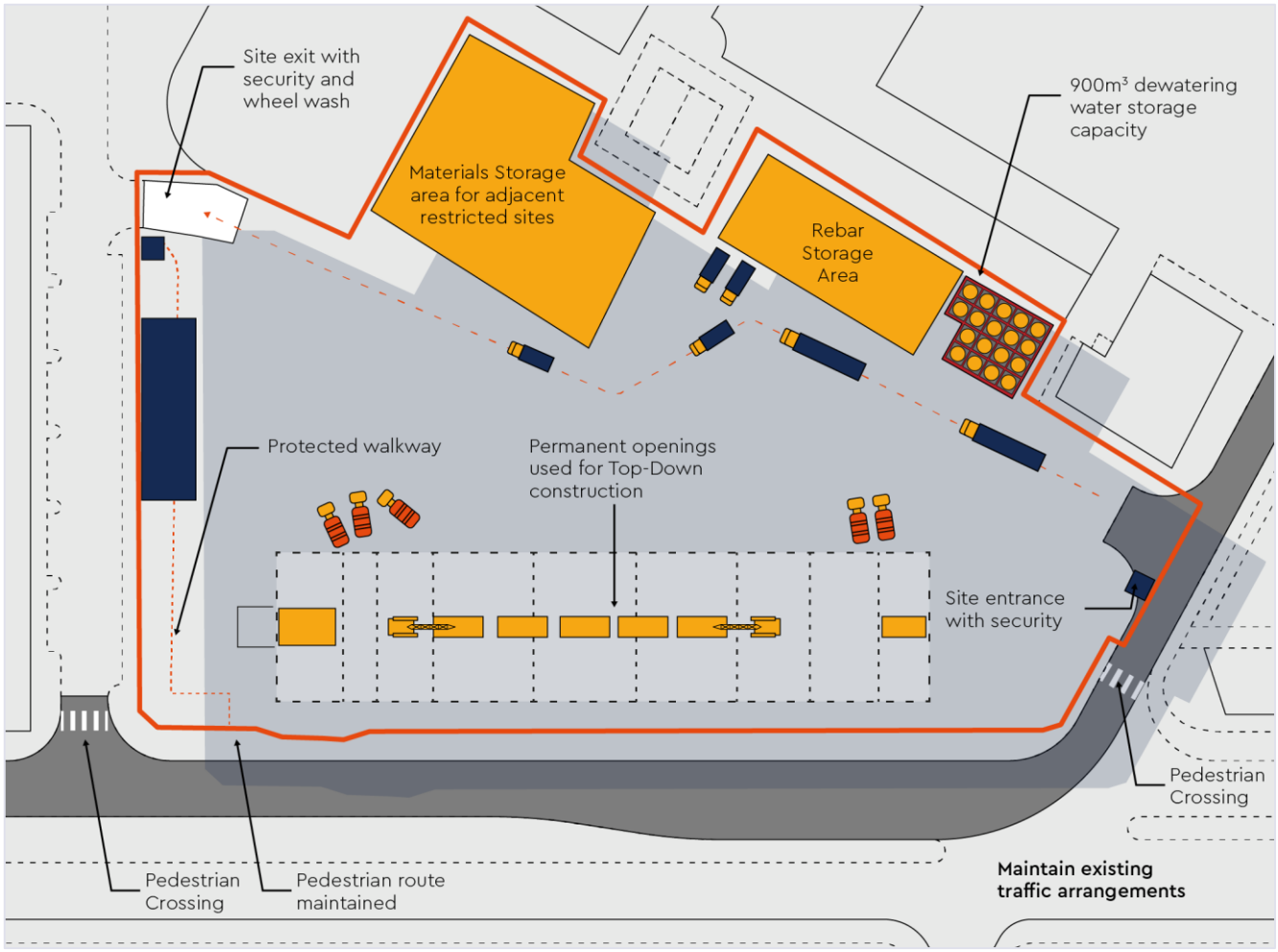


Diagram 5.24: Example of Roof Slab Construction at Proposed Ballymun Station

3. **Top down excavation in soil and rock:** once the first sections of the roof slab have been completed and gained sufficient strength, top down excavation will commence. Temporary props will be installed at openings in the roof slab. The type of excavation plant will vary depending on the extent of soil and rock. Temporary storage will be available on-site where it is required to store, sample or test material before transport to its final destination. However, where possible excavated material will be placed directly into tipper-type HGVs for transport to a materials management site (detailed in the outline CEMP in Appendix A5.1).

   Bulk excavation of rock is likely to require drilling and blasting. Drilling and blasting is an established construction method. Drilling and blasting is a method commonly used to excavate hard rock by using small charges to break up the rock. It involves pre-drilling a series of small diameter holes in the rock face, loading the holes with small charges and detonating them to break the rock into removable pieces. Typically, blasting will be carried out at agreed set times each day, which nearby residents will be informed of in advance. This method will require the necessary approvals and blasting licences to be obtained pre-construction. The proposed blasting strategy can be found in Appendix A5.20 and blasting methods and environmental controls have been discussed in Section 5.5.12. Following blasting, mechanical excavation will also be required to remove any remaining material.

   Rock can also be excavated using mechanical breakers, but for bulk excavation in the harder rock would result in a significantly longer construction programme and result in continuous high noise and ground borne vibration levels; hence drilling and blasting is the preferred method for rock excavation.

4. **Propping:** To minimise ground movement the D-walls will be braced by a mixture of permanent in-situ concrete slabs and temporary steel props. Diagram 5.25 illustrates a typical section through an underground station depicting temporary steep props and permanent cast in-situ slabs.

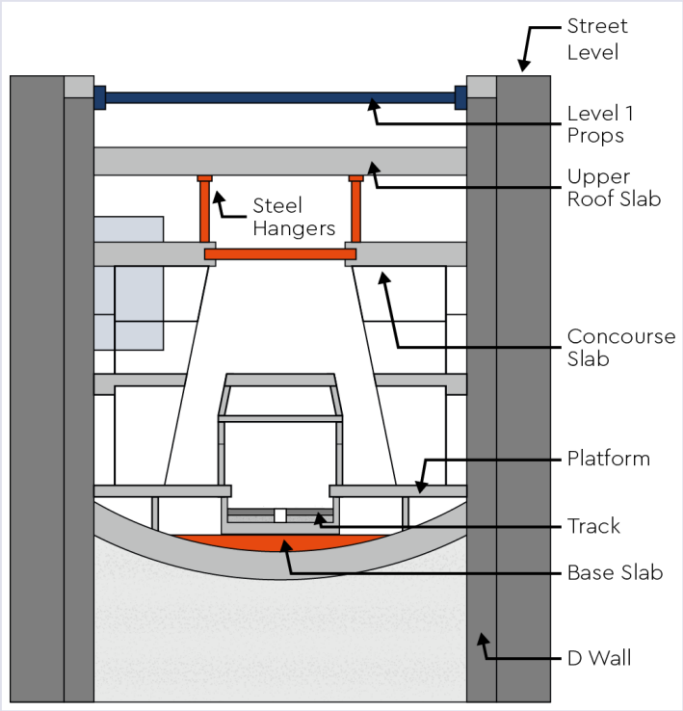


Diagram 5.25: Cross Section of Underground Station Depicting Temporary and Permanent Props

5. **Base slab construction and TBM passage through the station:** The excavation and propping sequence varies from station to station, mainly depending on whether the TBM is planned to arrive at the station prior to forming the base slab (TBM first) or following completion of the base slab (Station first) as identified in Table 5.10 and illustrated in

6. Diagram **5.26**:

- **Mater, O'Connell Street, St Stephen's Green and Charlemont:** Following the completion of excavation to formation level the base slab is cast. On its arrival the TBM can then be slid across the completed base slab on temporary rails; and
- **TBM first (all other underground stations):** Based on the current construction schedule all other underground stations are TBM first. Completion of the station at tunnel level and base slab construction is more complex in this situation, as the TBM passes through the station box and the contractor then installs props and digs down to construct the station base, eventually breaking into/opening up the tunnel over the length of the station.

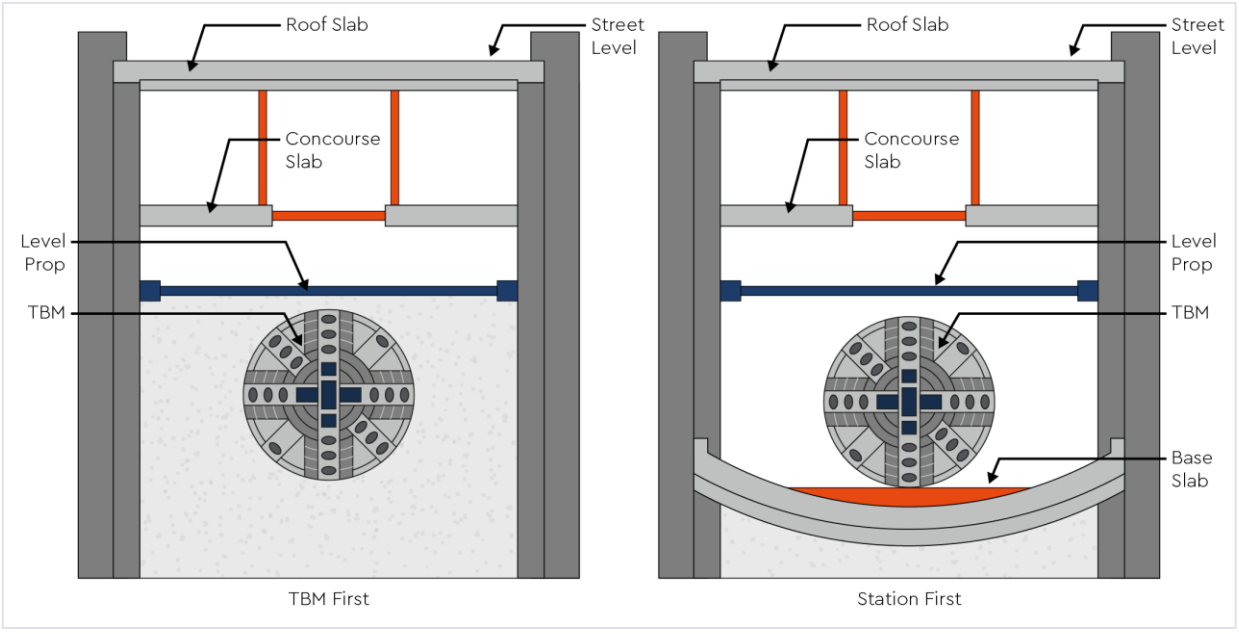


Diagram 5.26: Typical Cross Section Showing TBM First and Station First

7. **Internal concrete and civil works*:*** Following completion of the base slab the mass concrete section of the base will be poured. Depending upon the specific station, the lining walls and mezzanine slab can be installed around the ongoing supply of materials for the tunnelling process. Precast concrete sections will then be lowered and assembled in place to form the station platforms. Further installation includes the lift shafts and stairwells which will be constructed bottom up using pre-cast units. Plant rooms, staff areas, and passenger areas will be separated by blockwork or in-situ concrete walls. Ventilation shaft configurations are station specific.
8. **Architectural finishing:** Architectural finishings within the station public areas and back of house (employee only areas) include cladding systems, floor tiles, walls, doors and ceilings. Surface works include the emergency exits, fire fighter entrance points, ventilation louvers, lightwells with upstands and street furniture, bicycle storage and signage. Refer to the architectural design for the proposed Project for further detail. Aspects of architectural context and the design approach are addressed when assessing their impact on the existing landscape context, and in particular the public realm, in Chapter 27 of the EIAR (Landscape & Visual).
9. **Mechanical and electrical fit out, testing, commissioning and trial running:** The mechanical and electrical fit-out of stations will include high and low voltage power distribution, lighting, drainage pumping mains, ventilation, fire-mains and firefighting apparatus. It is envisaged that the appointed contractor(s) will carry out the majority of these works along with the station construction. Testing, commissioning and trial running will follow. Refer to Section 5.5.25 for more information on testing and commissioning.

5.5.10 Viaducts

There are two viaducts located along the alignment (the Broadmeadow and Ward Rivers Viaduct and the M50 Viaduct), as detailed in Chapter 4 (Description of the MetroLink Project). The two viaducts will follow a similar construction sequence. However, they are built in very different environments with one crossing over rivers and the other over the M50 Motorway. The setting of the Broadmeadow and Ward Rivers Viaduct in relation to the surrounding environment is discussed in Section 5.7.1, and the M50 Viaduct in Section 5.9.2. They both follow a similar construction sequence, including the following principal steps:

1. Site preparation, strip topsoil, install environmental mitigations, mobilise piling rigs and install piled foundations as required for the abutment walls and viaduct support piers in a north to south sequence;
2. Install bridge bearings and commence erection of precast concrete (PCC) beams;
3. Commence placement and laying of the in-situ concrete deck using concrete pumps;
4. Complete the upper part of the viaduct structure (e.g. parapets) and connect to the viaduct deck with in-situ concrete;
5. Backfill north and south abutment and create embankments;
6. Mechanical and electrical fit out and installation of the Overhead Contact System (OCS);
7. Landscape and reinstatement works and secure fencing; and
8. Testing, trial running and commissioning.

5.5.11 Albert College Park Intervention Shaft

In general, the underground stations are sufficiently close together to allow safe evacuation from the operational tunnel through the stations' emergency exits. However, at Albert College Park where the distance between stations is greater than 1,000m, an intermediate ventilation and escape shaft will be provided. The intervention shaft will provide separate access for emergency services and egress of evacuating passengers and will include a designated safe area at surface level for evacuating passengers.

The same construction principles for the underground stations apply to Albert College Park shaft with the following exceptions:

- Secant piles will be used for forming the shaft rather than D-walls; and
- The shaft will require two 23m long connection tunnels from the shaft, connecting to the main tunnel (see the general arrangement of the shaft in Diagram 5.27). Both tunnels will be constructed using the Sprayed Concrete Lining technique (SCL) which consists of cycles of excavation followed by the application of shotcrete (sprayed concrete), rockbolts and steel girders. The final connections will then be made from the main running tunnel (See Diagram 5.28).

As with the underground stations, drilling and blasting may be required for rock excavation during construction of the shaft and connection tunnels.

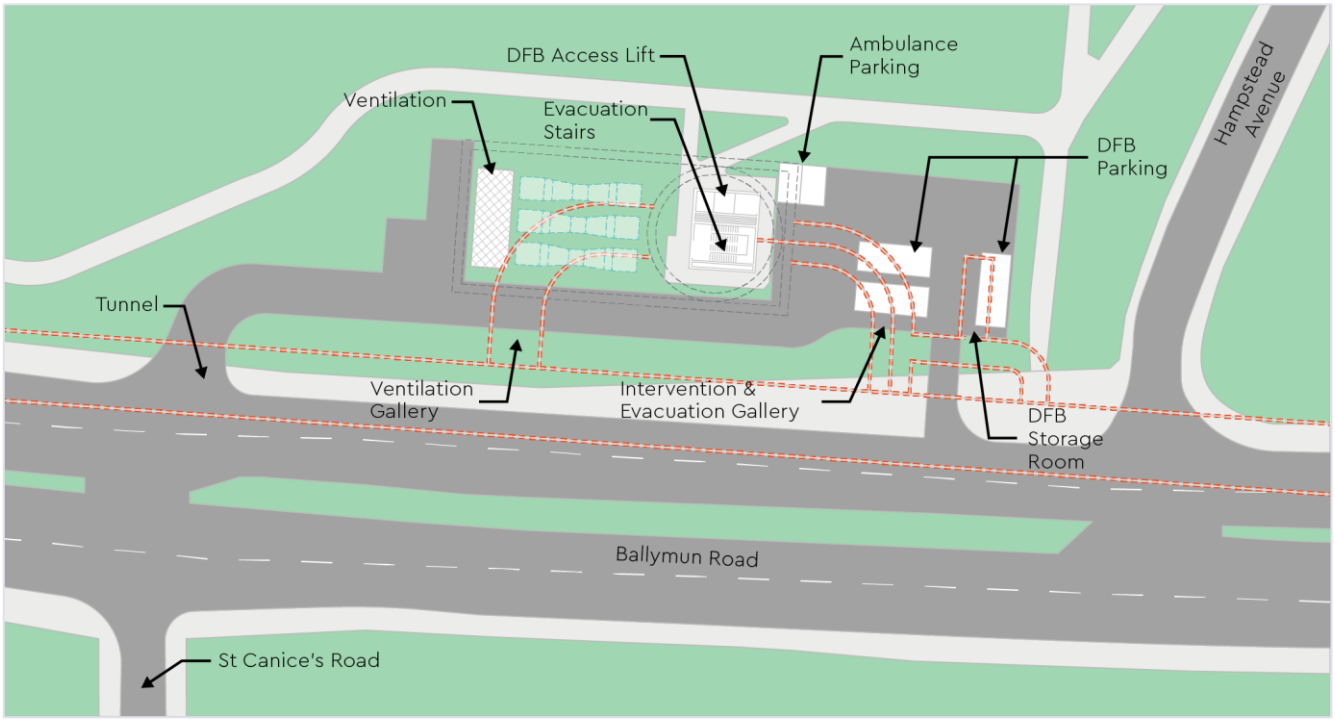


Diagram 5.27: General Arrangement of Albert College Park Intervention Shaft

Diagram 5.28: Example of Mechanical Excavation of Connecting Passage from the Main Tunnel in Tunnel Construction

5.5.12 Blasting

Blasting will be required as part of the excavation for the underground works at the following locations:

- Dublin Airport Station;
- Northwood Station;
- Ballymun Station;
- Collins Avenue Station;
- Griffith Park Station;
- Mater Station;
- O'Connell Street Station;
- Tara Station;
- St Stephen's Green Station; and
- Charlemont Station.

The use of blasting will require the necessary blasting licences to be obtained pre-construction from the Department of Justice and Equality and appropriate security measures agreed for the storage of explosives. The proposed blasting strategy can be found in Appendix A5.20 (Blasting Strategy Report). It is currently assumed that there will be no storage of explosives at the construction sites and that material will be transported from an existing licenced facility to the sites as required. The permitting and licensing of the use of explosives on construction sites is controlled by the Department of Justice. If, following advice from the Department of Justice, an alternate facility or facilities are determined to be more appropriate they would be permitted by the Department of Justice under their existing powers.

Blasting would be undertaken a maximum of two times per day and would involve the drilling of blast holes in a defined, engineered pattern and loading them with explosives. Typically, there is a sequence of detonations of small charges, separated by delays of 50 milliseconds or more. Following blasting the broken rock will be moved to the lift out location and water sprays used to minimise the release of dust into the air.

The effects of blasting that cause the most potential concern are:

- Ground vibration: propagate from the source through the ground to adjacent receptors;
- Air over-pressure (air blast): airborne pressure waves that results from the detonation of explosives; and
- Flyrock: (also called rock throw) the uncontrolled propelling of rock fragments produced by blasting.

The impacts of airborne noise and vibration arising from drilling and blasting are assessed in Chapter 13 of the EIAR and the impacts of groundborne noise and vibration in Chapter 14. For assessment of vibration from blasting, the metric conventionally used is peak particle velocity (PPV). To meet the environmental constraints for blasting due to the proximity of the blasting locations to sensitive buildings/third party structures, different drill and blast patterns have been designed to meet the requirements of PPV at each construction site. The drilling pattern ensures the distribution of the explosive in the rock and desired blasting result.

Mitigation measures that will be utilised to control the impacts of blasting, as required, are set out in Chapter 14 (Groundborne Noise & Vibration), Appendix A5.20 (Blasting Strategy Report) and in Section 6.12 of the outline CEMP (Appendix A5.1). In any case where the proximity of receptors or sensitivity of receptors is such that significant effects cannot be avoided due to blasting, then alternatives to blasting will be employed.

5.5.13 Material and Waste Management

The materials and waste streams that will arise during the Construction Phase of the proposed Project will include:

- Excavated material from earthworks, excavations and tunnels;
- Demolition waste;
- Construction waste; and
- Waste generated by workers at site compound facilities.

Materials and waste management will be based on the principles of the waste hierarchy, whereby priority is given to the prevention of waste generation, followed by (where possible) reuse, recycling and recovery respectively. Disposal to landfill will be undertaken only as a last resort.

A notification under Article 27 of the European Communities (Waste Directive) Regulations 2011 (S.I. No. 126 of 2011), as amended (Waste Directive Regulations (2011)) (referred to as Article 27) has been made to the Environmental Protection Agency on behalf of TII to classify much of the excavated material to be generated by the proposed Project as a by-product and not a waste.

Classification of material as a by-product means that the material is approved for a use that is not regulated by waste management legislation, and therefore is not required to be managed as per that legislation. For construction projects, excavated soil and stone can be categorised under this exemption provided the material adheres to the conditions stipulated under Article 27, in particular that it fulfils all relevant product, environmental and health protection requirements for the specific use and will not lead to overall adverse environmental or human health impacts.

The types and volumes of construction wastes to be generated by the proposed Project have been estimated by the construction team and indicative mitigation and monitoring measures are presented in Chapter 24 (Materials & Waste Management).

All waste from the proposed Project will be transported by an authorised waste collection permit holder. All material presented for disposal will have to meet the receiving site's waste acceptance criteria.

5.5.14 Excavated Material

Excavated material will be generated as part of the construction of the proposed Project, as detailed in the above construction methods and in Chapter 20 (Soils & Geology) and Chapter 24 (Materials & Waste Management). Nearly 3 million m^3 of excavated material is forecast to be generated by the proposed Project during the Construction Phase. The predicted excavation material quantities are based on the reference design and the vertical alignment determined for both the tunnelling and surface works.

It is predicted that 89.6% of the 3 million m^3 would be classified as a by-product under Article 27 which is approximately 2.7 million m^3 (4,887,488 tonnes); and 10.4% would be classified as waste which is approximately 310,317m^3 (558,571 tonnes). However, with approximately 99,931m^3 (176,876 tonnes) being used for backfilling and landscaping purposes on the proposed Project, this leaves a remaining 210,386m^3 (378,695 tonnes) that would be managed as a waste.

It has been predicted that approximately 94,775m^3 (170,595 tonnes) of this excavated material will be considered contaminated (this equates to 3% of the overall total of excavated material).

Whilst the current materials estimate provides a preliminary estimate of the key materials likely to be required during the construction of the proposed Project, it does not quantify all material and product types that would be required. The assessment parameters which form the basis of the materials and waste forecasting, will inevitably be subject to some changes as the proposed Project evolves through the construction stages.

A summary of the predicted quantities of excavated materials classified under Article 27, the quantity of excavated material to be reused onsite and those materials that are classified as inert, non-hazardous and hazardous is provided in Table 5.11. Refer to Chapter 24 (Materials & Waste Management) for further information.

Table 5.11: Excavated Material Breakdown

		Volume (m^3)	Tonnage
Total excavated material volume		3,025,588	5,446,058
Excavated material to be reused on site*		99,931	179,876
Total surplus excavated material		2,925,657	5,266,183
Material for re-use as a by-product (Article 27)		2,715,271	4,887,488
Classification of A27 non-compliant surplus as waste	Hazardous	94,775	170,595

		Volume (m^3)	Tonnage
	Non-hazardous	155,481	279,866
	Increased Inert**	49,093	88,367
	Inert	10,968	19,742
*There is a requirement for 99,931m3 of material for backfill on the Project. ** Refers to Irish Landfill Acceptance Criteria; Category B2 Inert Landfills with increased limits.			

Huntstown Quarry in County Dublin has been identified as the preferred location to accept the excavated material classified under Article 27 due to its ability to take all by-product material forecasted to be produced by the proposed Project. The quarry is operated by Roadstone and is located just outside the M50 Motorway near Junction 5, approximately 5.5km from the Northwood Portal location. (Refer to Chapter 24, Materials & Waste Management for further information). Should there be any issues with the use of Huntstown Quarry by the time construction commences, suitable alternatives will be found. Where practical the closest suitable facilities will be used to minimise the impacts associated with transporting the material, such as air and noise emissions from vehicle movements.

Where possible excavated material will be placed directly into tipper-type HGVs for transport to its final destination. However, where storage is required on-site, this will be done in accordance with all applicable legal requirements and in particular different types of excavated material will be segregated and any material which has been classified in accordance with Article 27 shall be stored separately to any material which is classified as a waste.

Detailed Excavated Materials Management Plans will be developed by the lead contractors, in accordance with the waste hierarchy set out in the Best Practice Guidelines on the Preparation of Resource and Waste Management Plans for Construction and Demolition Projects (EPA 2021), to ensure that all excavated spoil is managed in an appropriate manner, in full compliance with all relevant waste legislation. Please refer to Appendix A5.15 for detailed information on construction material management.

5.5.15 Rail Systems Installation

On completion of the tunnelling and other alignment works, the system-wide fit out work will take the structures and turn these into an operational railway (Chapter 6 (MetroLink Operations & Maintenance) details the Operational Phase). This includes installation of the following systems:

- Track and track bed;
- Traction power (including power supply, substations (Section 5.5.18.1), distribution, OCS and OCR (Section 5.5.18.2));
- Signalling;
- Telecommunications and control systems;
- Ventilation;
- Drainage;
- Lighting and power;
- Lifts and escalators; and
- Fire systems.

Additionally, this includes the fit out of the Dardistown Depot, the supply and delivery of rolling stock and the integrated testing, commissioning and trial running.

5.5.16 Track and Track Bed Installation

Track laying is required along the entire alignment; tunnel and open sections (retained cut, surface and viaducts). The following section provides a summary of this methodology, and a detailed track laying methodology is provided in Appendix A5.16. Concrete slab track is proposed along the length of the alignment in both open and tunnel sections and track laying will be installed in the same manner throughout the alignment. However, areas of particular sensitivity will require sections of floating track slab in order to mitigate groundborne noise and vibration, as outlined in Chapter 14, Section 14.5.2 (Operational Phase, Groundborne Noise & Vibration).

Track bed in tunnels is usually constructed in two stages, with stage one providing a flat surface on which the sleepers and rail are installed and stage two a concrete fill around the sleepers to ensure they cannot move during operation. These stages are described in further detail below.

5.5.16.1 First Stage Tack Bed

A first stage concrete track bed will be laid (Refer to Diagram 5.29 for detail on track bed concrete), providing a flat surface on which the sleepers and rail are installed. This allows most of the concrete to be placed prior to the rail, making installation of the rail easier. Concrete is placed using a tracked concrete paver machine. The paver is a self-propelled machine into which wet concrete is placed, in a hopper at the front. The concrete is fed into the mould underneath or to the side and compacted. As the machine moves forward, the finished concrete is extruded at the back. The concrete is carried through the tunnel in trucks which discharge into a storage hopper at the front of the paver. An illustration of a typical tunnel paver machine is provided in Diagram 5.30. The operation of this machine and the concrete installation process are described in detail in Appendix A5.16.

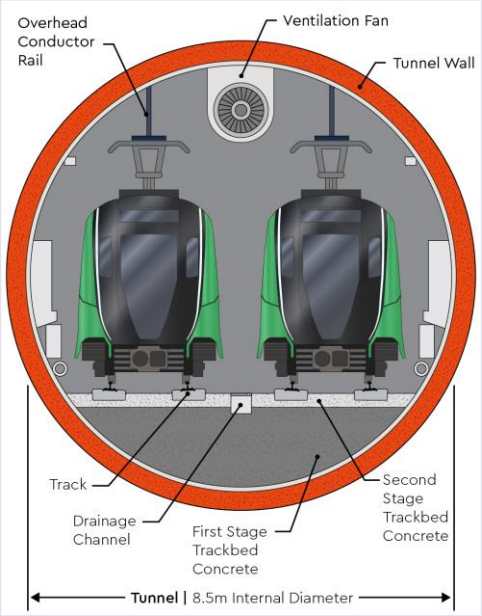


Diagram 5.29: Bored Tunnel Track Bed Concrete

Diagram 5.30: Typical Paver in a Tunnel

- Installation of the sleepers and rails will be carried out following the completion of a section of the first stage track bed. Sleepers, rail and clips will be delivered by road lorries to the railhead site and offloaded and stored. They will be laid out in a fixed pattern by placing into a 'jig' which ensures they are all placed in the correct positions. Completed sections of track will then be loaded onto flatbed rail cars for delivery through the tunnel to the work location.
- The track installation will be carried out by a portal type crane/gantry which runs on the first stage track bed, lifting one or two sections of track at a time, and transporting these to the laying point where they are bolted together. Once in place, the sections of rail are welded together using a purpose-designed welding machine. Once welded, the track is still flexible enough to be set in its final position before concrete is poured.

5.5.16.2 Second Stage Track Bed

During the second stage installation, the track bed is carefully aligned and checked, clamped, and then concreted in place. The second stage concrete will contain the stray current protection (continuous pieces of rebar, welded together and checked for continuity), the drainage channels and manhole access to drainage and cable pits. Concrete is delivered using a concreting train. The operation of this train and the concrete installation are described in detail in Appendix A5.16.

Diagram 5.31: Typical Second Stage Concrete Installation in a Twin Track Tunnel

5.5.17 Track and Track Bed Construction Logistics

This activity will require the installation and operation of two rail construction depots or 'railheads'. Railheads are work sites that have road access and also rail access to the under-construction railway. Service yards at the railheads will be used to supply the working areas. Two railhead sites are proposed:

- Adjacent to Dardistown Depot; and
- Adjacent to Estuary Station.

5.5.17.1 Dardistown Railhead

It will be necessary to service the track installation works at the same time as the construction of the Depot itself. This will require a large servicing yard, storage and laydown area and access for the loading and unloading of work-trains, test trains and rolling stock. Sleepers, rail and clips will be delivered by road lorries to the Dardistown Railhead.

These activities will mostly be contained within the footprint of the proposed Dardistown Depot and Station development site; however, an additional area of land to the west is expected to be required for a concrete batching plant during the second stage track bed installation. A proposed railhead construction site layout at Dardistown is illustrated in Diagram 5.32.

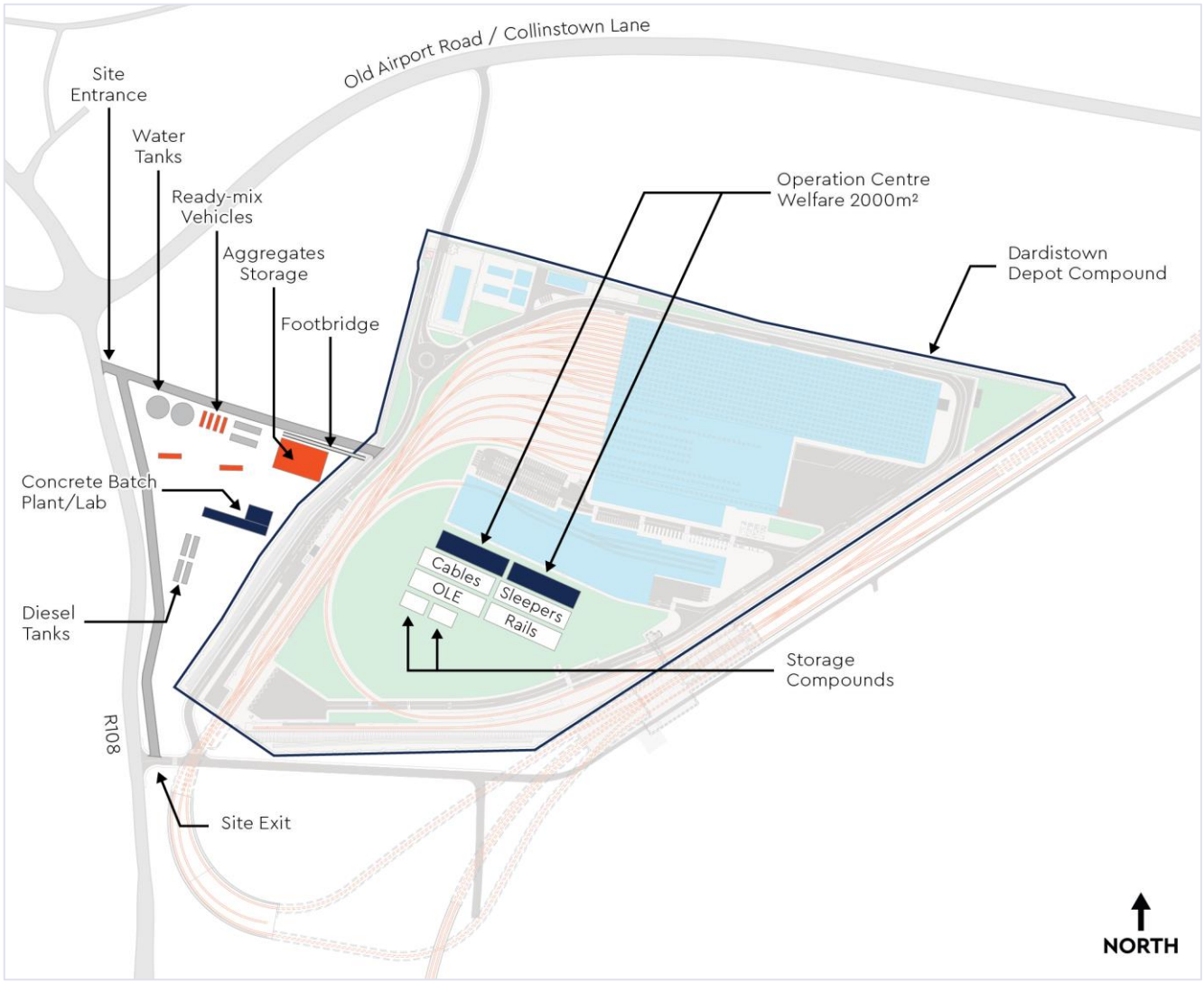


Diagram 5.32: Dardistown Depot and Railhead Site - Proposed Site Layout (During Construction)

5.5.17.2 Estuary Railhead

In order to reduce track installation delays, a railhead site will also be set up in Estuary to allow for early track installation in the northern section of the proposed Project. The Estuary Railhead site is required to allow:

- The installation of track to commence prior to the completion of the links from the main line to the depot at Dardistown; and
- The installation of track north of the Airport Tunnel to commence before that tunnel is completed.

Following the completion of the main civils works, the Estuary site will be converted to a railhead. This will require the installation of loading and storage siding; the installation of a concrete batching plant; the creation of secure storage areas for rail, sleepers, OLE equipment, cables and the creation of a temporary control centre for the safe operation of the railway under construction. The proposed layout of the Estuary Railhead site during construction is shown in Diagram 5.33 below.

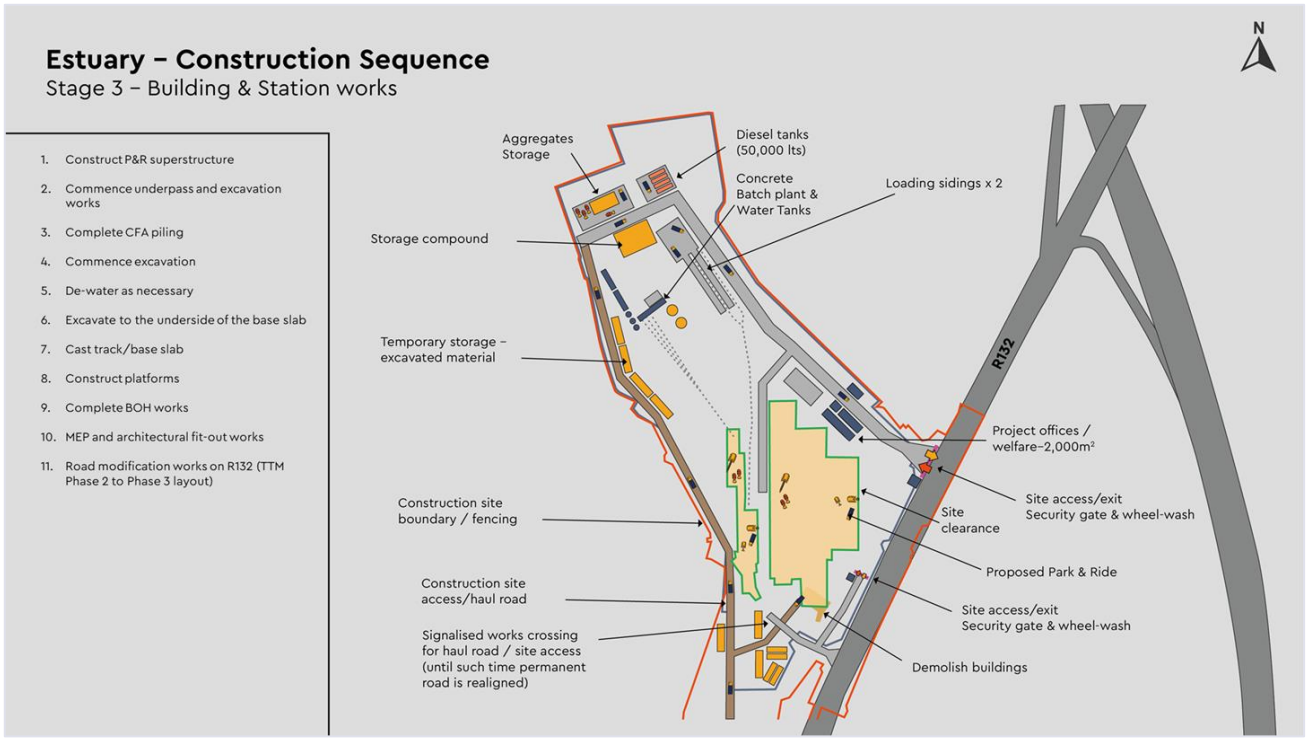


Diagram 5.33: Estuary Railhead Site – Proposed Layout

5.5.17.3 Supply Sites

The track will be installed, working away from the railhead sites at Estuary and Dardistown Depot. Construction materials will be delivered to the installation locations from supply sites.

For the first stage track bed, these supply sites will be located at Estuary, DASP (for Airport Tunnel), Dardistown Depot, Northwood Portal site and Griffith Park. Concrete for the first stage track bed will be batched on-site at Northwood Station and Portal site, Ballymun, Griffith Park and DASP.

Estuary and Dardistown Depots will provide track installation supplies and concrete batching for the second stage track bed.

Diesel trains will be used to deliver concrete, track and sleepers to the installation locations.

It is anticipated that the track laying operations (first and second stage) will take place 24-hours per day seven days per week as detailed in Table 5.5. Concrete batching will take place 24 hours, 7 days, with the exception of Ballymun which will operate during standard hours only. Deliveries to the batching plant will be during standard working hours.

During construction in the tunnel sections, power for the concrete pumps will be from electrical distribution points located along the alignment. However, welding machines may require standalone generators.

On surface sections, additional generators may be required for gantry lighting and for water mist sprays for dust suppression. All diesel plant used will use the latest low emission engines and particulate filters and fire suppression system for use in the tunnel. Generators requiring night-time operation will be fully attenuated to control noise emissions (refer to Chapter 13, Airborne Noise & Vibration).

- Noise and vibration arising from tracklaying activities and potential impacts on sensitive receptors are assessed within the EIAR in Chapters 13 (Airborne Noise & Vibration) and 14 (Groundborne Noise & Vibration).

In parallel with the installation of track and railway equipment in the tunnels, the stations, shafts and associated passageways will be undergoing fit-out.

5.5.18 Power System

Power will be provided through substations, as detailed in Chapter 4 (Description of the MetroLink). Power will be provided from the Electricity Supply Board Network at 110kV. For the operation of the proposed Project, two new primary high voltage (HV) supply substations will be provided at DANP and at the Dardistown Depot. Two step-down transformers will be required at each substation to reduce power supply to medium voltage (MV) and the MV supply will be distributed by way of "a ring system" consisting of cables which will run on the tunnel walls, in mounted cable trays, or in buried ducting along both sides of the track.

The proposed Project will also require eight new traction substations to provide power to the trains, seven for the mainline, which will be located at the following stations: Estuary, Fosterstown, Dardistown, Collins Avenue, Glasnevin, Tara and Charlemont, and one for Dardistown Depot. The substations will be supplied from the medium voltage ring and will include traction power transformers and rectifier units.

The transmission of traction power to the rolling stock will be powered using two types of catenary (overhead wire) system arrangements (see Section 5.5.9.2.3). The construction methodology for the installation of permanent and temporary power supply has been detailed below.

5.5.18.1.1 Substations

The two new high voltage substations will be supplied by way of new underground cable routes from existing substations in the area. The cables will be installed by ESBN through public roads or public lands as far as possible. These cable route connections do not form part of the proposed Project but are evaluated in this EIAR on the basis of the best and most up-to-date available information. An application for consent of the Operational Phase power supply will be made by ESBN. Once operational, the proposed substations will generally be unmanned and remotely monitored/operated by ESBN.

Cables will be laid by ESBN as far as the primary bulk supply substations. The proposed methodology for the construction of these substations will consist of the following:

- An underground ducting system will be installed, requiring the excavation of cable trenches approximately 0.6m wide x 1.25m deep, followed by reinstatement of the trenches and installation of the 110kV cables into the ducting system;
- The substation compound will be covered in a layer of crushed rock. Bituminous road construction will be laid on the access road and parking areas;
- MetroLink 110kV grid connections will enter the MetroLink HV substations by means of underground ducting. Elsewhere, the MetroLink auxiliary and traction substations will be supplied via the MetroLink 20kV distribution ring main along the track;
- Brickwork housing will be erected on a concrete slab foundation with a concrete roof;
- The proposed substation buildings are approximately 15m in height, 15m in width and 50m in length, and will house the Gas Insulated Switchgear (GIS) and auxiliary services equipment such as control and telecommunications equipment, an emergency diesel generator, batteries and welfare facilities (e.g. toilets, washing facilities);
- Transformers and switchgear will be delivered by road and installed using cranes;
- Cabling will be laid, and the equipment electrically connected and tested; and
- Lightning protection masts will be installed at each location.

There will be two physical interfaces between the proposed Project and ESBN. The first will define the boundary between the respective areas of responsibility of the proposed Project and ESBN on the HV power circuits. The second will define the boundary of responsibilities on the control and auxiliary circuits, which are used for protection, control, monitoring and signalling purposes. There will be two physical elements to the HV substations: one for ESBN and the other for the proposed Project.

The power supply into the new traction power substations will consist of the following:

- The installation of new power supply cables along the alignment of the proposed Project to each of the new substations. Trackside underground ducting will be provided for surface track or elevated track sections of the alignment. In underground, cut and cover and retained open cut sections, the cables will be affixed to cable trays on the tunnel walls;

- The installation of cable ducts and cable management trays through the stations to the relevant rooms; and
- Preparation of the relevant rooms including:

- In-situ (fire resistant) concrete walls;
- The installation of non-oil insulated transformers;
- Cable troughs and upstands cast into the floor, with the appropriate coverings; and
- All concrete surfaces to be cleaned and sealed to minimise dust generation.

5.5.18.1.2 Catenary System

The catenary system provides power from the traction power stations to the rolling stock. Two types of catenary system arrangements are proposed as described in Chapter 4 (Description of the MetroLink Project) and these are:

- OCS, which consists of a single contact wire and a single catenary wire supported from a support structure (poles mounted with cantilevers and "steady arms"); and
- OCR which is a rigid aluminium contact rail incorporating a contact wire.

5.5.18.2 OCR Installation:

The OCR system will be used for the majority of the alignment, which includes all of the bored tunnel sections, cut and cover sections, part of the retained cut sections and within the Dardistown Depot stabling and maintenance buildings.

The supports for the OCR will be placed every 10m or 12m. In the tunnels the OCR supports will be fixed to the roof of the tunnel. In the cut and cover and the retained cut sections, the OCR will be fixed to a rigid gantry anchored to the side walls. In the deeper retained cut sections the OCR may also be supported by a rigid gantry supported with wire ropes or galvanized steel tubes. A typical installation sequence of the OCR will include:

1. Installation of support brackets in the tunnel. In retained cut sections the OCR will be fixed to the roof slab or to a rigid gantry anchored to the walls;

2. Install and secure the power rails. The contact rails are rigid and will be installed in sections using profiled connectors;

3. Install the power connections; and

4. Provide earthing and bonding to eliminate any touch and step potentials.

The installation works will take place using rail-mounted elevating work platforms and will make use of appropriate custom-made lifting devices to minimise manual handling/manual drilling.

5.5.18.3 Communication-based Train Control (CBTC)

The signalling requirements are described in Chapter 4 (Description of the MetroLink Project) and will require a communication-based train control (CBTC) signalling system. The CBTC system will control all of the proposed Project alignment including the Dardistown Depot. Equipment will be installed in control or communication rooms, at stations and in the Dardistown Depot. System cables will be distributed to the rail network via cable ducts and chambers, ladder racks, tray and cable bridge structures:

- Tunnel/cuttings/bridges – will be constructed with 'open' cable routings; and
- Surface sections – will be constructed with ducted or chambered routings.

Much of the linear works will employ a specialised installation train running on the permanent rail tracks. Cable routes to stations control rooms and/or offices will be installed as soon as the civil works have been complete and mechanical construction takes place.

The systems will be installed with dual redundant cabling infrastructure for both power and communications, and cables will be selected of suitable robust construction to withstand the environment and with appropriate physical separations from other services in order to prevent electromagnetic interference and other external effects (see Chapter 12, Electromagnetic Compatibility & Stray Current).

Along the alignment, the hardware will comprise the CBTC systems described in Section 4.12.5 (Description of the MetroLink Project), two radio masts, and networks of cabling along the alignment. The radio masts will be at located at Dardistown Depot (20m in height) and at Estuary Station (30m in height).

5.5.18.4 OCS Installation

The OCS system is preferred for above ground sections where visual impact is a concern. Preliminary Design Report Volume 4 Book 8 (Power & Systems) proposes OCS in three distinct sections: (S1) section between Estuary and Seatown, (S2) section between Fosterstown and Dublin Airport, and (S3) when crossing the M50.

The OCS wires will be supported on poles not exceeding 8m in height with a cantilever and "steady arm" arrangement. The poles will be located on both sides of the track, approximately 45m apart. The OCS support pole foundations will be installed in tandem with the track bed formation along the alignment where required. The installation of the OCS and the power supply facilities will be installed following the completion of the track bed.

A typical installation sequence of the OCS will include the following:

1. Install bored piles for the support poles and cast a capping slab for each at the top at rail level. This work will be undertaken during the Main Civil Works and the rail system subsequently installed by the mechanical and electrical fit out contractor);

2. Install support posts and brackets on each pole. String the support cables between these brackets and tension, these will be installed using a specialist 'train' with appropriate safe access for working at height;

3. Install the power cables/wire. Cables that run between traction substations run along a tray, ladder or hangar CMS (cable management system) in the tunnels and cuts, cables run on the side barrier structure CMS of the bridge, and in a ducted or chamber network, the cables run along the surface sections;

4. Install the power connections and earthing to each post; and

5. All equipment will be suitably selected for the environment and be of the correct IP (ingress protection) level. A galvanic corrosion 'map' will be used to determine material types and corrosion classification for each area of the project and relative materials.

5.5.19 Ventilation

Ventilation shafts, as detailed in Chapter 4 (Description of the MetroLink Project), are required for underground stations, DANP, DASP, tunnelled sections, Albert College Park Shaft, Charlemont Intervention Tunnel, Airport intervention tunnel and Airport ventilation tunnel. This will include the installation of fans.

Temporary construction ventilation will be provided in tunnelled and cut and cover sections during construction in order to maintain a good working environment for the tunnel workers. This will be achieved using temporary fans and ducting. This will dilute any fumes to a safe level and remove dust. In the tunnelled sections, a forced system will ensure air is forced through the ducting using fans at the portals that will typically be suspended from the crown of the tunnel on wire rope. During excavation of station boxes and shafts (such as Albert College Intervention Shaft), the walls of the station/shaft will have ducting fixed to the D-wall or secant piling.

The noise from the fans will be controlled by placing them in soundproof containers which can reduce the noise effectively. In addition, vibration from the fans is anticipated to be minimal. Please refer to Chapters 13 (Airborne Noise & Vibration) and Chapter 14 (Groundborne Noise & Vibration). Dust extraction units will be used to control dust from tunnelling, shaft excavation or SCL activities. The positioning of the outlet for dust extraction units will be taken into consideration during construction to avoid blowing air onto public walkways or buildings. In addition, the position of the intake will be chosen carefully to avoid vehicle or plant exhaust fumes. Before commencing works, a detailed Dust Management Plan will be prepared by the contractor(s) and submitted for approval to the relevant planning authority. The Plan will be based on the outline Dust Management Plan (see Appendix A16.4 of the EIAR).

5.5.20 Drainage

Drainage will be installed throughout the alignment, particularly at low points where pumped drain routes will be used to remove any collected water. Mechanical lifting aids will be installed for ease of maintenance access. Drainage systems will be installed during the construction of the following structures:

- Stations – a low sump point will be fitted with two pumps (duty and standby), which pump to surface through a single pump connection.
- Shafts – the three shafts (DASP, DANP and Albert College Park) extend slightly below the tunnel level, therefore a small sump will be installed at the lowest point, from which any collected water can be pumped to the surface discharge point. Again, two pumps will be installed in these locations.
- Bored tunnels – for the City Tunnel (AZ4), the tunnel low points are generally at the stations and so no additional pumped drainage is required with the exception of the tunnel section between Tara Station and St Stephen's Green Station where a low point sump is needed. For the Airport Tunnel (AZ2), the tunnel has two low points, both of which are some distance from a shaft or station. Therefore, low point sumps must be constructed consisting of:

- A niche cut out of the side of the tunnel, with a shaft descending below it;
- Installation of a pipe connecting the tunnel drainage gully with the shaft for water to drain into the sump;
- Installation of two electric pumps, float switches to monitor water level;
- Installation of power supplies and control equipment;
- Installation of atmospheric monitoring (to monitor for gasses that can collect at low points); and
- A steel pump main taking water from the pumps to the sump in the adjacent station. The steel pump main is installed in the tunnel by placing on, and then clamping to, steel brackets which are fixed to the tunnel lining. The pipe is lifted onto the brackets by a hiab-type arm mounted on a rail wagon; and
- Cut and Cover sections – in the AZ1, there are a number of low points as cut and cover sections pass beneath roads or provide provision for future crossing locations. Design to take into account low points and create a niche similar to that described for the bored tunnels and pump systems will be installed.

- Cut and Cover sections – in the AZ1, there are a number of low points as cut and cover sections pass beneath roads or provide provision for future crossing locations. Design to take into account low points and create a niche similar to that described for the bored tunnels and pump systems will be installed.

The design of the operational drainage scheme includes a comprehensive programme of Sustainable Urban Drainage Systems (SuDS) measures 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. The design of the scheme also ensures that it is resilient to effects of climate change on fluvial and coastal flood risk. Refer to Section 5.12.12 of this chapter and Chapter 18 (Hydrology) and Appendix 18.5 (Flood Risk Assessment) for further information.

During construction, water arising from the drainage systems and from activities such as groundwater dewatering, washing down (surface, underground (deep stations) and tunnels), and dust suppression will be recycled or reused where possible. Water that cannot be recycled or reused will require disposal by discharge to foul sewer. Where this is not possible, wastewater will need to be tankered off site to a suitably licensed treatment facility. Wastewater may require pre-treatment prior to re-use or discharge (see Section 5.12.8 for further detail).

All wastewater discharges to sewer networks will be classed as trade effluent and will require a Trade Effluent Licence from Irish Water. The licence will specify discharge quality and volume conditions that must be complied with. Monitoring of the discharges will be undertaken in accordance with the licence requirements.

The potential impact of temporary dewatering of groundwater is assessed in Chapter 19 (Hydrogeology).

5.5.21 Lighting and Power

Permanent lighting requirements are discussed in Chapter 6 (MetroLink Operations & Maintenance). Lighting in station areas will be installed using stainless steel frames to support cladding, followed by the installation of cables and lights followed by testing. Lighting along the alignment will be lit to a sufficient level to allow for safe evacuation with lights placed on the outside of the tracks. In the bored tunnels, cut and cover and retained cut sections; at intervals along both sides of tunnel/cut, cables and lights will be fixed to the structure at shoulder level. In surface, elevated or open cut sections; at intervals alongside the track, cables will be placed in cable troughs or hung along the tracks on short poles. Construction lighting is discussed in Section 5.12.9.

5.5.22 Lifts and Escalators

Passenger lifts and escalators will be installed in each station. In addition, emergency services lifts will be provided in stations and shafts. Installation of escalators will be done with cranes from the surface or delivered to the installation location in full form and grouted into place. This will be followed by mechanical installation prior to connecting to power. Installation of lifts will be done with cranes, forklifts, pallet trucks and other lifting plant. Lift rails will be installed using a specialised gantry. Mechanical, communications and drainage installations will commence prior to connecting to power.

5.5.23 Fire Systems

Fire systems will be installed in compliance with all relevant legislative requirements. A Fire Safety Strategy for the proposed Project has been developed in liaison with Dublin Fire Brigade, as detailed in Chapter 6 (MetroLink Operations & Maintenance). Fire mains in the tunnel and cut and cover sections will be installed at both sides of the tunnel and fixed or clamped into position at regular intervals. The fire mains through the tunnels will be installed at the same time as the drainage main. Water tanks will be installed as part of the firefighting system equipment.

5.5.24 Landscaping and Reinstatement

Following the final construction works (i.e. railway systems installations), the construction compounds will be removed and landscaping and reinstatement will commence. Soft landscaping directly associated with the proposed Project will generally be confined to the linear park and station locations along the above ground sections of the proposed Project. Hard landscaping will include the track bed and the completion of the civil works around station entrances, substations, Dardistown Depot and Park and Ride Facility. Landscaping will commence on completion of the track laying, stations and erection of the overhead lines.

Landscaping will take place at the following locations along the alignment:

- Where retained cuts are designed, engineered slopes will need to be constructed on both sides to maintain slope stability and create the safe, desired finish. These will be landscaped to be in keeping with the local area and design;
- Where cut and cover sections are completed, the original or newly finished surface will be reinstated and the surrounding area landscaped to the desired design. On completion of the construction works, the construction sites will be demobilised and land-take reinstated to the agreed landscape design; and
- Where underground stations are complete, architectural finishes will be designed at the station public areas. Station entrances will include concrete upstands and a steel support frame to secure the entrance glazing panels and canopy, lighting, ticketing, bicycle storage and signage.

The impact of the proposed Project on the landscape and visual amenity during the Construction Phase and Operational Phase is assessed in Chapter 27 (Landscape & Visual) of the EIAR.

5.5.25 Testing, Commissioning and Decommissioning

Construction Completion: Completion of the Construction Phase will include the removal of all construction materials and the spread and seeding of topsoil and provision of landscaping (as discussed above).

Testing and Commissioning: While some systems have different requirements to others, testing and commissioning will generally consist of the following stages:

1. Factory and/or site acceptance testing of components and systems;

2. Standalone testing will be carried out once a system or section of a system has been completely installed, but before it is connected to other systems (e.g. the Supervisory Control and Data Acquisition (SCADA) system, as detailed in Chapter 4 (Description of the MetroLink Project);

3. Integrated testing and commissioning take place once all systems have been installed and connected together;

4. During a period of trial running, the system is operated without passengers, and emergency procedures are trialled in agreement with the Dublin Fire Brigade. In addition, staff training is provided; and

5. The testing will take place in stages, gradually commissioning the whole system. These will be timed so as to release the system for trial running in two sections:

- Section 1: from Estuary to Dardistown; and
- Section 2: from Dardistown to Charlemont (entire route).

The efficient installation and testing of the mechanical and electrical systems will require the successful management of a large number of interfaces, as the works cross the boundaries between sections and between contracts.

5.6 Area Specific Construction Activities

Section 5.4 and Section 5.5 discussed the principal construction methodologies that form part of the Enabling Works and the Main Construction Works for the proposed Project. This section focuses on the area specific construction activities supported by each construction compound, whilst recognising potentially sensitive environmental receptors during construction works. Potential environmental impacts resulting from the Construction Phase are assessed and mitigated in the relevant environmental chapters of this EIAR and mitigations are further outlined in the outline CEMP (Appendix A5.1).

These activities will be described linearly from north to south of the proposed Project, running in the order from AZ1 to AZ4 (Section 5.7 to Section 5.10). Chapter 4 of this EIAR provides a detailed description of the proposed Project and all of the associated infrastructure.

In this section, each site-specific area will discuss the following main items:

- Proposed programme for each construction activity;
- Location and activities;
- Access and egress arrangements;
- Specific Enabling Works and site establishment requirements (e.g. locations where demolition, archaeological excavations and invasive species works are required) as discussed in Section 5.4;
- Road and traffic works (as discussed in Section 5.4.12); and
- Construction methodology (as discussed in Section 5.5).

It is recommended to read this section in combination with Appendix A5.3 which describes the construction phasing at each location and Figure 5.2 (Haul Routes) provided at the end of this Chapter.

5.7 AZ1 Northern Section: Estuary Station to Dublin Airport North Portal

Diagram 5.34: AZ1 Northern Section - Principal Elements and Construction Site Locations

All works proposed in AZ1 (refer to Diagram 5.34) will be developed and phased with the aim of avoiding simultaneous road diversions and/or closures at the four major junctions along the R132 Swords Bypass namely the Estuary, Seatown Road, Pinnock Hill and Malahide Road Roundabouts. Construction phasing is detailed in Appendix A5.3.

Due to the linear nature of these works, several utility diversion works have been identified in AZ1 (assessed in Chapter 22 (Infrastructure & Utilities)) and will require temporary traffic management measures during this work. The typical construction methodology used for utility works has been detailed in Section 5.4.10. All temporary traffic measures required during the Construction Phase are outlined in the STMP (Appendix A9.5) and assessed in relevant chapters (Chapter 9 (Traffic & Transport), Chapter 13 (Airborne Noise & Vibration) and Chapter 16 (Air Quality)).

As outlined in Chapter 4 (Description of the MetroLink Project), the R132 Swords Bypass base scenario for this EIAR is that the R132 Swords Bypass will be upgraded by FCC prior to the construction of the proposed Project. This will include the removal of the existing roundabouts, the provision of signalised junctions, and the reduction in speed limits. The second scenario, if the R132 Swords Bypass upgrades are not developed prior to the proposed Project, will require minimal interventions at each station to allow for traffic calming and speed limit reductions, therefore ensuring a safe connection to the proposed Project services.

The required construction compounds to carry out the construction works falling within AZ1 (Northern Section) are outlined in Diagram 5.35.

The construction durations anticipated for the principal construction elements in AZ1 are detailed in Table 5.12.

Diagram 5.35: AZ1 Site Offices and Construction Compounds Location

Table 5.12: Estimated Construction Durations AZ1

Description	**Estimated Construction Duration (Months)**
AZ1 Compounds / Logistics / Other Structures	
Start to Estuary Station	
Estuary Station Main Compound	33
Estuary Railhead	60
Broadmeadow and Ward River Viaduct	21
Pedestrian underpass	6

Description AZ1 Compounds / Logistics / Other Structures Start to Estuary Station	Estimated Construction Duration (Months)
Estuary Station to the R132 Under-crossing	
Seatown West Satellite Site	33
Estuary Court Satellite Site	36
Woodie's Satellite Site	54
Mantua Satellite Site (bridge demo)	54
Fingallian's Satellite Site (bridge demo)	24
Surface Station	48
Cut and Cover	69
Retaining cut	51
U Section	15
Retaining Wall	6
Seatown Station to Swords Central Station	
Seatown Station Compound	66
North Dublin Corporate Business Park Compound Satellite Site	69
Pavilion's Shopping Centre	69
Surface Station	69
Cut and Cover	63
Retaining cut	60
Swords Central Station to Fostertown Station	
Swords Central Station Compound	60
Pinnock Hill Roundabout Satellite Site	51
Surface Station	63
Cut and Cover	42
Retaining cut	30
Fostertown to Airport North Portal	
Fostertown Station Compound	63
Nevinstown Lane Satellite Site	51
Boland Satellite Site	66
Surface Station	66
Cut and Cover	42
Retaining cut	51

5.7.1 Estuary Station to Seatown Station

This section of the proposed alignment will be between Estuary Station and Park and Ride Facility and Seatown Station. The works along this section will require one main construction compound and five satellite compounds in addition to the working areas along the track section.

5.7.2 Estuary Station Construction and Logistics Main Compound

The scope of works to be delivered at the Estuary Station Construction and Logistics Main Compound includes construction of the following structures:

- Estuary Station;
- Estuary Park and Ride;
- Traction substation; and
- Broadmeadow and Ward River Viaduct.

Estuary Station Construction and Logistics Main Construction Compound is located on agricultural lands in Lissenhall at the location of the proposed Estuary Station and Park and Ride Facility. Access into Estuary Construction Compound will be from the R132 Swords Bypass, via Ennis Lane, as illustrated in Appendix A5.3.

The proposed Project will also include the construction of the first section of the proposed Swords Western Distributor Road which will be located across the northern side of the compound. This road will be constructed in line with the methodologies detailed in Section 5.5.1.

Enabling Works will include the demolition of one residential property (Refer to Section 5.4.9). In addition, archaeology has been identified as detailed in Chapter 25 (Archaeology & Cultural Heritage) and in order to record and protect this archaeology, this site will undergo a thorough archaeological excavation prior to any construction works. Furthermore, invasive plant species assessed in Chapter 15 (Biodiversity) will require removal/treatment as outlined in Section 5.4.3. The remaining site establishment will follow the methodology as set out in Section 5.4.

The construction methodology for the station is detailed in Section 5.5.4.1. Piling will be required to provide lateral support for the station structure. Minimal ground excavation will be required (1m to 2m of existing ground level) and the use of reinforced concrete. The construction methodology for the Broadmeadow and Ward River Viaduct is detailed in Section 5.5.5. The construction methodology for the Park and Ride facility is detailed in Section 5.7.1.2 below.

The proposed Project will require eight new traction substations to provide power to the trains, one of which will be located at Estuary Station. Construction of the traction substations is detailed in Section 5.5.10.2.2.

A 30m high radio mast will be erected at Estuary Station as part of the Communications-Based Train Control (CBTC) signalling system, as described in Section 4.12.5 of Chapter 4 (Description of the MetroLink Project).

Following completion of the main civil works, the site will be converted into a 'railhead' site for the installation of the rail track and track bed as described in Section 5.5.16.

Local sensitive receptors identified include the Emmaus Retreat Centre (which will require alternative access) once Ennis Lane is closed, the Broadmeadow and Ward Rivers and Lissenhall Bridge. The location of these receptors in relation to the construction site is shown on Figure 5.1.

Lissenhall Bridge will not be used for construction traffic due to its protected status (as discussed in Chapter 25 (Archaeology & Cultural Heritage). Instead, temporary bailey bridges will be required within the working area to cross the watercourses and enable construction traffic and operatives to move freely without impact to Lissenhall Bridge or the local rivers. Flood protection measures will also be set up at this location. All construction works above, and near water will follow the environmental management measures detailed in the outline CEMP in Appendix A5.1. A Flood Risk Assessment (FRA) was carried out to identify areas at risk of flooding along the proposed Project. The FRA is provided as Appendix 18.5.

There are two drainage ditches coming from Staffordstown Stream located east and west of the Estuary Construction Compound. Both of these drainage ditches will be diverted during site establishment and pre-earthworks. In addition, open channels and attenuation ponds also form part of this diverted surface water system. The construction methodology for diversion works and culvert installation has been described in further detail in Appendix A5.10. Further detail on environmental impacts from works in watercourses can be found in Chapter 18 (Hydrology).

5.7.3 Estuary Park and Ride

On completion of the site establishment, the Park and Ride Facility will be constructed and will involve the following typical sequence of construction works using excavators, mobile cranes, mobile elevated work platforms (MEWP), teleporters, concrete pumps and booms:

1. Enabling Works: establish the construction compound as set out in Section 5.4;

2. Park and Ride Foundations: Install pad or piled foundations in accordance with the developed design and place concrete for ground floor slabs;

3. Ground Floor Slab: install reinforced steel and formwork for ground floor slab and concrete, repeat the sequence for ground floor beams;

4. Park and Ride Level 1, 2 and 3: install steel fixing and formwork for the Level 1, 2 and 3 floor slabs and concrete and repeat the sequence for floor beams, slab, ramps and columns;

5. Park and Ride Level 4 (roof slab): install steel fixing and formwork for roof slab and cure, install parapets and complete stairwells and lift cores;

6. External Façade: progressively complete the external façade in sequence with the reinforced concrete structural frame; and

7. External and Finishing Works: complete access roads, footways, MEP, drainage, lighting, security systems, connecting footbridge and architectural finishes including hard landscaping.

5.7.4 Broadmeadow and Ward Rivers Viaducts

Moving south of Estuary Station, two embankments (circa 3.5m high) will be constructed to allow for the development of the Broadmeadow and Ward River Viaduct spanning both rivers. Earthworks for embankments will include the bulk movement and transfer of excavated and/or fill material. The installation of track bed and completion of railway systems will follow at a later stage. Haul routes will be required, constructed and sequenced as the embankment construction progresses.

Substantial modelling has been undertaken to design the viaduct to avoid impacting on the flow characteristics of the Broadmeadow River and Ward River and relevant approvals will be obtained from the Office of Public Works (OPW) for this crossing as required under the Section 50 of the Arterial Drainage Act, 1945. A wetland pond will be constructed north of the Broadmeadow River to allow for sustainable drainage during the Operational Phase (detailed in Chapter 18 (Hydrology)). This will be excavated and completed with vegetation and tree planting. The discharge pipe will be installed to discharge into the Broadmeadow River.

The construction of the proposed viaduct over the Broadmeadow River and Ward River will comprise a 13-span concrete piled structure with twin concrete bridge deck beams taking one track each. The viaduct will involve the typical sequence of construction works detailed in Section 5.5.10. No in-river construction works will be required, however temporary ‘bailey’ bridges crossing the two watercourses will be required for access of construction traffic. Temporary foundations will be constructed for the temporary bridge crossings, to ensure minimal disturbance of the watercourse bank. Foundations will be excavated with the use of a cofferdam (a watertight structure) to protect the works from flooding and the watercourse from being contaminated (Diagram 5.36).

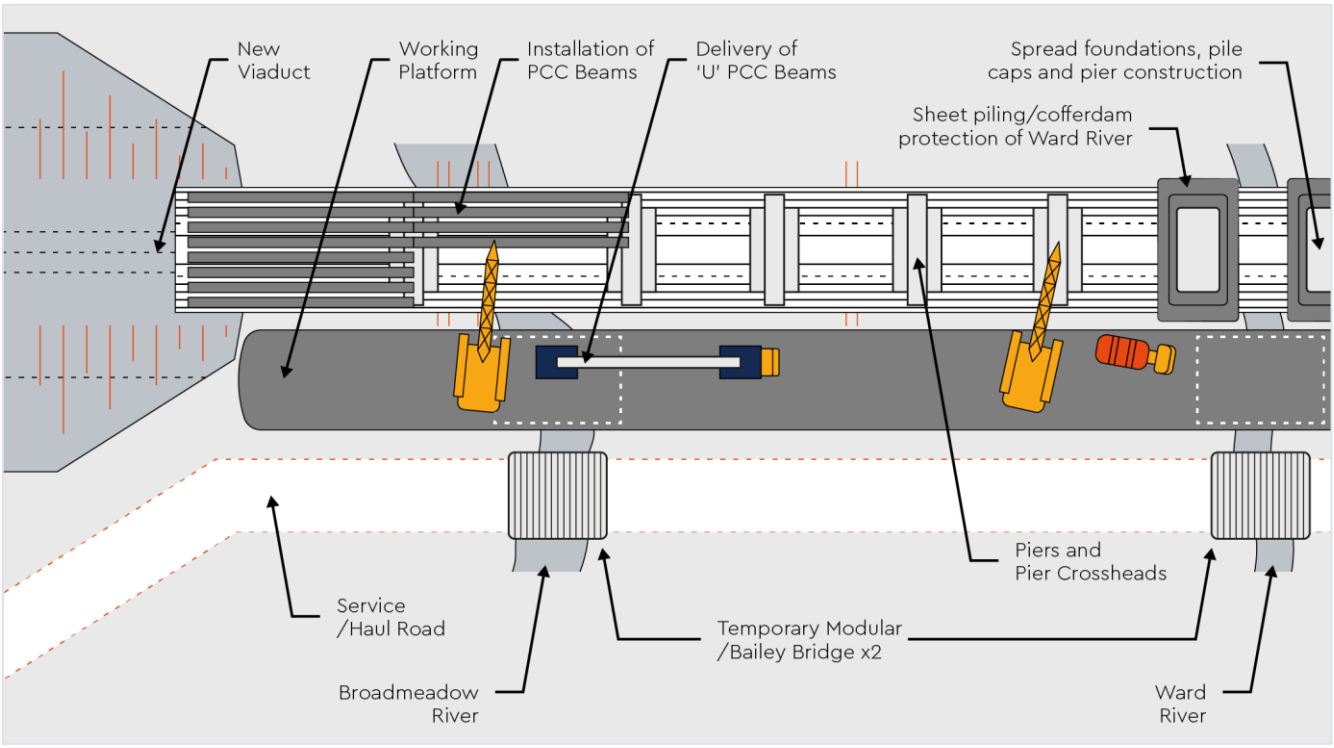


Diagram 5.36: Broadmeadow and Ward River Viaduct - Outline Construction Sequence

On completion of the viaduct, as the embankment moves down to ground level, a shallow excavation and a sheet piled excavation (U-section) will be required in order to bring the track down into a cut and cover section under Estuary Roundabout. This work will take place in Balheary Park which is currently used as a public park with playing pitches. The park is currently occupied by two sport clubs: Fingallians GAA and Swords Celtic FC. Fingallians GAA training grounds include two playing pitches; one full GAA pitch and one training pitch. Swords Celtic training grounds include two full size soccer pitches. Some Enabling Works will be required in order to temporarily realign some of the playing fields in order to allow for the construction of the proposed Project alignment along this section and continued use of pitches.

Minor alterations are proposed to the soccer pitches used by Swords Celtic. Both pitches are to be reduced in size with a minimum intervention in playing surface which will involve goalpost relocation, relining and localised grass treatment.

It is proposed to alter the pitches used by Fingallians GAA in two phases:

- Phase 1 (during the utility diversions) when a small reduction in the full-size pitch will be required, while the training pitch will remain unaffected; and
- Phase 2 will involve the installation of a new artificial training pitch. The main pitch will be re-established.

The works that will be required to construct an artificial pitch comprise:

- Site clearance, including where relevant tree and bush removal including stumps, spray off area for proposed pitch and run off areas;
- Strip topsoil and dispose of off site;
- Cut and fill to form base for new pitch and set levels to ensure positive drainage;
- Install primary drainage network to collect pitch drainage and outfall pipes to discharge location;
- Install secondary drainage network to drain pitch;
- Lay stone sub-base and geotextiles to required thickness and levels;
- Install floodlighting ducting and bases at this stage, if pitch is being floodlit;
- Install kerbs to pitch edges;
- Lay blinding stone layer and roll;
- Lay shock pad layers – depth and type of material depends on proposed sports usage;
- Lay artificial surfacing; and

- Once the artificial carpet is laid, lay silica sand then lay SBR rubber and brush into place.

South of Balheary Park, the alignment then passes into a retained cut before entering a cut and cover tunnel section under Estuary Roundabout and the R125 Castlegrange Road. Retained cut and cut and cover tunnel construction is outlined in Section 5.5.2.3 and Section 5.5.2.5, respectively. Temporary traffic management works will be required here and will include lane closures and diversion works (refer to the STMP in Appendix A9.5).

5.7.5 Fingallian's Footbridge Satellite Compound

This small satellite compound will act as an ancillary site (with most works coming from a working strip of land to the west) and will be used for access for the removal of Fingallians footbridge only. The compound will be required for approximately 24 months. Access into this satellite compound will be from R125 Castlegrange Road. The location of the compound is shown on Figure 5.1.

The footbridge provides general access across the R132 Swords Bypass. It also functions to link the Balheary Park playing pitches to the Fingallian's GAA Club. Its use becomes redundant by the proposed upgrade of R132 Swords Bypass through this area, with signalised crossings to be maintained as the removal of the bridge and the proposed Project works are progressed. The removal of the bridge is to be sequenced in such a way that an alternative safe pedestrian crossing is provided prior to demolition.

The Enabling Works for footbridge removal and associated traffic management will require a short road closure on the R132 Swords Bypass. Any remaining existing foundation and piers on the west side will be demolished.

5.7.6 Seatown West and Estuary Court Satellite Compound

The proposed Seatown West satellite site is situated on the west of the R132 Swords Bypass, running north/south on adjacent land. Access into Seatown compound will be from Seatown West off the R836. The Seatown West and Estuary Court Satellite Compound will act as a base for:

- Enabling Works;
- Retained cut at Seatown West;
- Cover and cover box crossing the R132 Swords Bypass; and
- Cut and cover section east of R132 Swords Bypass.

5.7.6.1.1 Cut and Cover Seatown Road/Roundabout Crossing

Enabling Works will include the demolition of two residential properties at Seatown West, in addition to utility diversion works (as described in Section 5.4.9 and Section 5.4.10). Sensitive receptors at this location include local residential buildings located adjacent to the compounds (including Seatown Villas, Comyn Manor and Estuary Court).

A new foul sewerage pumping station and associated storm tanks will be built in the Seatown West Satellite Compound following site establishment (see Section 5.4.5), and will include the following typical construction sequence:

- Pumping station: This will include the installation of a wet well and valve chamber. Construction will require open cut excavation and piling works, concrete pour and construction of a concrete slab. Surface works will require the installation of pumps and pipework along with surface cabinets and electrical panels housed within an enclosure before the site is fenced and made ready for commissioning; and
- Storm tanks: This construction will require excavation, a non-woven geotextile material will be placed, and clean crushed stone will be graded and compacted on top; inlet / outline pipe and storm chambers will be installed; a layer of stone is placed over the chambers; graded with topsoil placed on top. Inlet and outlet pipes will be constructed as detailed in Section 5.4.10.

A retained cut will be constructed running from Seatown West north to south before the alignment goes under the R132 Swords Bypass in a cut and cover tunnel. Retained cut and cut and cover tunnel construction is outlined in Section 5.5.2.3 and Section 5.5.2.5. The construction of the cut and cover crossing under the R132 Swords Bypass will require the establishment of Estuary Court construction site where services to the work area will be provided from the east. Access into Estuary Court compound will be from the R132 Swords Bypass.

A temporary road diversion will be required to enable the cut and cover to be constructed and a traffic management plan will be implemented to allow traffic movements on the R132 Swords Bypass and other feeder roads to continue. The road crossing will be phased to maintain traffic flow in both directions (lane width 3.5m).

Rail systems and MEP installation will take place within the cut and cover tunnel after reopening the road to minimise impact on the public and local traffic flow, once all Civil Works have been completed. The rail system is to be supplied from the Estuary Railhead.

A cut and cover tunnel will continue through the existing green area adjacent to Estuary Court, beneath Seatown Road and continue south running on the eastern verge of the R132 beside Woodies Seatown. The alignment goes under the existing footbridge at this location will be removed to facilitate cut and cover construction. The route continues along the eastern verge of the R132 beneath Seatown Road Roundabout before arriving at Seatown Station.

The retained cut and cover crossing construction sequence at Seatown Road and Roundabout will require temporary traffic works and will involve road diversions (at night) to set up and complete tie-ins on Seatown Road. The temporary traffic measures will be modified at Seatown Roundabout as the works progress. Once the cut and cover section has been constructed, the road will be resurfaced and reopened at the earliest opportunity.

5.7.7 Traffic Management: Estuary to Seatown Station

During the Construction Phase, a traffic management plan will be implemented in order manage traffic disruption caused during the Construction Phase. The traffic management plan will cover the following between Estuary and Seatown Station.

- Traffic diversions;
- Bus lane, cycle lane and traffic lane closures and narrowing during the Enabling Works;
- Increased traffic flow during main civil works;
- Construction of new signalised junction at Estuary Station;
- Reduced width of traffic lanes during main civil works;
- Maintenance of two traffic lanes in both directions throughout construction;
- Closure of Ennis Lane during main civil works; and
- Removal of footpaths and pedestrian crossings during main civil works.

A full assessment of all resulting impacts is presented in Chapter 9 (Traffic & Transport).

5.7.8 Seatown Station to Malahide Roundabout

This section of the proposed alignment will be located east of the R132 Swords Bypass and is bounded by Seatown and Malahide Roundabout. The works along this section will require one main construction compound and five satellite compounds, in addition with a working area along the track section. The location of the main compound and satellite compounds is shown on Figure 5.1.

5.7.9 Seatown Station Main Compound

Access into Seatown Station Construction Compound will be from the south, using the access road into North Dublin Corporate Park which will be temporarily diverted. The main construction traffic will arrive from the south from the M1 Motorway Junction 3 via the R125 and the R132 Swords Bypass. From the north, the traffic will come from the M1 Motorway and then directly into the R132 Swords Bypass.

Site establishment will follow the methodology as set out in Section 5.4.5. Furthermore, temporary storm tanks will be constructed south of Seatown Station and will follow the same methodology detailed in Section 5.7.6. Sensitive receptors at the Seatown Station Construction Compound include Hertz Europe Head Office.

Seatown Station will be built in a retained cut as per the methodology detailed in Section 5.5.8.

5.7.10 Woodie's, Mantua Park, North Dublin Corporate Park (NDC), Chapel Lane and Pavilion's Shopping Centre Satellite Compounds

After Seatown Station, the track alignment will ascend in a retained cut southward alongside the R132 Swords Bypass towards the Swords Central Station. The following are the principal construction elements at this location:

- Enabling Works (including site clearance and establishing temporary water/electricity);
- Compounds;
- Construction of the retained cut; and
- Construction of the cut and cover box at Malahide Road Roundabout.

5.7.10.1 The Woodie's Satellite Compound

The Woodie's satellite construction site will be established in line with the construction programme. The site will span Seatown Road, between Woodie's superstore and Sword Business Park, occupying a portion of the park area adjacent to the superstore. Prior to establishing the construction site, Seatown Road will be temporarily diverted. An additional small construction site will be required west of the R132 Swords Bypass and north of Seatown Road, at Mantua Park, to aid the demolition of the existing footbridge just north of Seatown Roundabout.

5.7.10.2 The NDC Satellite Compound

The NDC satellite compound will be established in line with the construction programme. This construction site will support the logistics for the principal construction elements at this location. Access into the NDC site will be from the R132 Swords Bypass via the access road for the NDC. Chapel Lane satellite compound will be accessed from Chapel Lane. The construction traffic will come from the R836 and then onto Chapel Lane.

5.7.10.3 Retained Cut Construction

The construction of the retained cut and cover under the access road to NDC will require a temporary diversion of access and will follow the methodology laid out in Section 5.5.2.5. Once works are complete, the access will be reinstated over the reinforced concrete slab as per the original alignment. The remaining section of retained cut can then be constructed where the access diversion is built.

Two additional satellite sites will also be required west of the R132 Swords Bypass, one at Chapel Lane and another next to the Pavilion's Shopping Centre at Malahide Road (R106) to aid the demolition of the existing footbridges.

Sensitive receptors along this section include the residential properties at Ashley Avenue and the surrounding housing estates. To reduce permanent impacts at this location, cut and cover construction will be used along the green area to the west of Ashley Avenue and the land will be reinstated to its original use following the works. In addition, the importance of the Chapel Lane footbridge to allow for connectivity to Swords Town from residential properties in this area has been identified through consultation. Alternative access will be provided across the R132 Swords Bypass by the proposed R132 Connectivity project.

The proposed Project alignment will continue south in a cut and cover section past the residential properties and under Malahide Road Roundabout. The construction phasing of the roundabout works will require temporary traffic measures including temporary diversions via local alternative routes and the closure of the R106 Swords Road and Drynam Road during cut and cover works. Furthermore, demolition of the existing footbridge will be undertaken.

5.7.11 Traffic Management: Seatown Station to Malahide Road Roundabout

The STMP (Appendix A9.5) details mitigation measures to be employed in order to manage traffic disruption caused during the Construction Phase. The STMP will be further developed by the contractors and will cover the following between Seatown Station and Malahide Road Roundabout:

- Removal of Footpath during Enabling Works;
- Cycle lane and traffic lane closures and narrowing during the Enabling Works and main civil works;
- Maintenance of two traffic lanes in both directions throughout construction;
- Removal of Footpath during main civil works;
- Diversions for access to sites during main civil works; and

- Removal of Parking during main civil works.

A full assessment of all resulting impacts are presented in Chapter 9 (Traffic & Transport).

5.7.12 Malahide Roundabout to Pinnock Hill

This section of the proposed alignment will be located east of the R132 Swords Bypass between Swords Central Station and Pinnock Hill Roundabout. The works along this section will require one main construction compound, one satellite compound and one lorry holding/logistics area, with a working area along the proposed alignment.

Sensitive receptors at the Swords Central Station Construction Compound include Fujitsu Ireland Limited, Travelodge Swords and Swords Veterinary Hospital.

Access into Swords Central Station Construction Compound will be from the R132. During construction, the public footpath access from the R132 Swords Bypass alongside the Fujitsu Ireland units and onto Lakeshore Drive to the rear, will be closed off. Pedestrian access into Fujitsu is situated to the rear of the units and will not be impacted.

The alignment passes through the entrance to Swords Veterinary Hospital at Pinnock Hill Roundabout. Access will be maintained into this property at all times and an alternative access provided during cut and cover works.

Following site establishment (Section 5.4.5) from Malahide Road Roundabout, the approach to Swords Station includes sections of retained cut through a greenfield site running parallel and adjacent to the R132 Swords Bypass. Swords Central Station will be built in a retained cut as per the methodology detailed in Section 5.5.8.

From Swords Central Station, the alignment will continue in a retained cut until it reaches Pinnock Hill Roundabout, with the exception of cut and cover sections at Fujitsu and at an access into a greenfield area. The alignment then continues into a cut and cover tunnel under the Pinnock Hill Roundabout. This section of works is supported by the Pinnock Hill Satellite Compound. This site will also include a lorry holding and logistics area that will service the whole of AZ1 and AZ2. A temporary access junction to the Pinnock Hill Satellite Compound via the R132 will reduce the need for construction traffic to use local roads. This junction would be subject to agreement with FCC.

The Pinnock Hill Roundabout crossing will be a challenging section of cut and cover due to the proposed alignment crossing under the R125 and cutting across the R132 Swords Bypass. Given the strategic importance of the R132 Swords Bypass for access to and from the local community, the construction phasing will aim to maintain traffic flowing through the roundabout during the Construction Phase, outlined in the STMP in Appendix A9.5.

5.7.12.1 Traffic Management: Malahide Road Roundabout to Pinnock Hill Roundabout

During the Construction Phase, a traffic management plan will be implemented in order to manage traffic disruption caused during the Construction Phase. The traffic management plan will cover the following between Malahide Road Roundabout and Pinnock Hill Roundabout:

- Bus lane, cycle lane and traffic lane closures and narrowing during the Enabling Works;
- Removal of Footpath during Enabling Works;
- Bus lane, cycle lane and traffic lane closures and narrowing during the main civil works;
- Removal of Footpath during main civil works;
- Diversions for access to sites during main civil works; and
- Removal of Parking during main civil works.

A full assessment of all resulting impacts are presented in Chapter 9 (Traffic & Transport).

5.7.13 Pinnock Hill Roundabout to DANP

The alignment continues to run in the eastern verge of the R132 Swords Bypass between Pinnock Hill Roundabout and just south of Nevinstown Lane. It then crosses to the east under the R132 Swords Bypass to connect with the DANP, located just north of Naul Road. The works along this section will require one main construction compound at Fosterstown Station and three satellite compounds (Nevinstown Lane, Boland and the North Portal), in addition with a working area along the track section.

5.7.13.1 Fosterstown Station Main Construction Compound

The Fosterstown Station Construction Compound will be located east of the R132 Swords Bypass and south of the R125, next to Airside Retail Park. Access into the Fosterstown Station Construction Compound will be from L2305. The main construction traffic will arrive from the M1 Motorway, along the R124, and then into the R132 Swords Bypass. The location of the construction compound in relation to the surrounding area is shown in Figure 5.1.

Enabling Works will include the relocation of a telecommunications mast and the demolition of a commercial warehouse at the Airside Retail Park, as detailed in Section 5.4.9. The Enabling Works will also involve the decommissioning and relocation of two electrical sub-stations at the Airside Retail Park. Site establishment will follow the methodology as set out in Section 5.4.

Fosterstown Station will be built in a retained cut as per the methodology detailed in Section 5.5.8. A new traction substation will be constructed at the north of the station with access from the platform level. The phasing of the works is detailed further in Appendix 5.3 (Construction Sequence Report).

The Fosterstown Station Construction Compound will also support the cut and cover box crossing the R132 Swords Bypass (east side of roundabout), further detailed in the next section.

5.7.13.2 Nevinstown Lane Satellite Construction Compound

The following are the principal construction elements at this location:

- Enabling Works;
- Construction of the cut and cover box;
- Construction of the retained cut; and
- Construction of the cut and cover box crossing R132 Swords Bypass (east side).

The proposed Nevinstown Lane Satellite Compound will span the L2305 and be located over the footprint of two existing properties that will require demolition, as detailed in Section 5.4.9. Access into Nevinstown Lane Construction Compound will be from Nevinstown Lane, with main construction traffic coming from the M1 Motorway, along the R125 and into Nevinstown Lane.

Sensitive receptors at this location include the Tara Winthrop Clinic. Site establishment will follow the methodology as set out in Section 5.4.5.

In order to cross under Nevinstown Lane and the R132 Swords Bypass, a 33m and 66m long cut and cover box will be built. A number of temporary road diversions will be required to build the cut and cover section under Nevinstown Lane and R132 Swords Bypass, outlined in the STMP in Appendix A9.5. As discussed previously, all traffic impacts have been assessed and detailed in Chapter 9 (Traffic & Transport).

5.7.13.3 Boland Satellite Construction Compound

The proposed Boland Construction Satellite Compound will be located west of the R132 Swords Bypass. Access into Boland Construction and DANP Construction Compounds will be from the R132 Swords Bypass south of an existing service station.

Construction activities within this area will include the following infrastructure:

- Cut and cover under R132 Swords By-pass;
- Construction of Fosterstown Accommodation Bridge;
- Construction of retained cut section;
- Construction of surface/at grade section; and
- Temporary watercourse diversions and culvert installations.

Enabling Works will include the demolition of two houses west of the R132 Swords Bypass and Boland's Car Dismantler as detailed in Section 5.4.9. Site establishment will follow the methodology as set out in Section 5.4.5.

The Boland Construction Compound will support the remaining cut and cover works from the west of the R132 Swords Bypass discussed in the last section. From here, the alignment will ascend into open cut and finally onto the surface although small cuttings and embankments of up to 4.7m are required in order to keep a constant gradient throughout the farmlands (until reaching DANP). Airport turnback is also in this area which will be serviced from Boland Compound.

The alignment will continue south before reaching the Sluice River and tributary (Forest Little Stream) in the agricultural land to the north of the Naul Road. These rivers are contained in bank with very little natural floodplain. Consequently, both watercourses will be culverted under the railway. The culvert for the Sluice River will include an underpass to allow the service roads on either side to be connected and provide connectivity for farm machinery and animals. The locations of the culverts are shown on Figure 4.1 in the EIAR Book of Figures.

Diagram 5.37 illustrates a typical temporary river diversion to be established prior to commencing the installation of the permanent box culvert structures for the permanent diversion of a river or stream. These works will be subject to a Section 50 of the Arterial Drainage Act 1945 application and approval by the OPW. It is likely that off-site precast concrete sections will be delivered to site and installed sequentially. Further detail on the construction methodology for the culvert is provided in Appendix A5.10. Potential environmental impacts from works in watercourses have been assessed in Chapter 18 (Hydrology) and Chapter 15 (Biodiversity) in addition with the environmental mitigation measures outlined in the outline CEMP in Appendix A5.1.

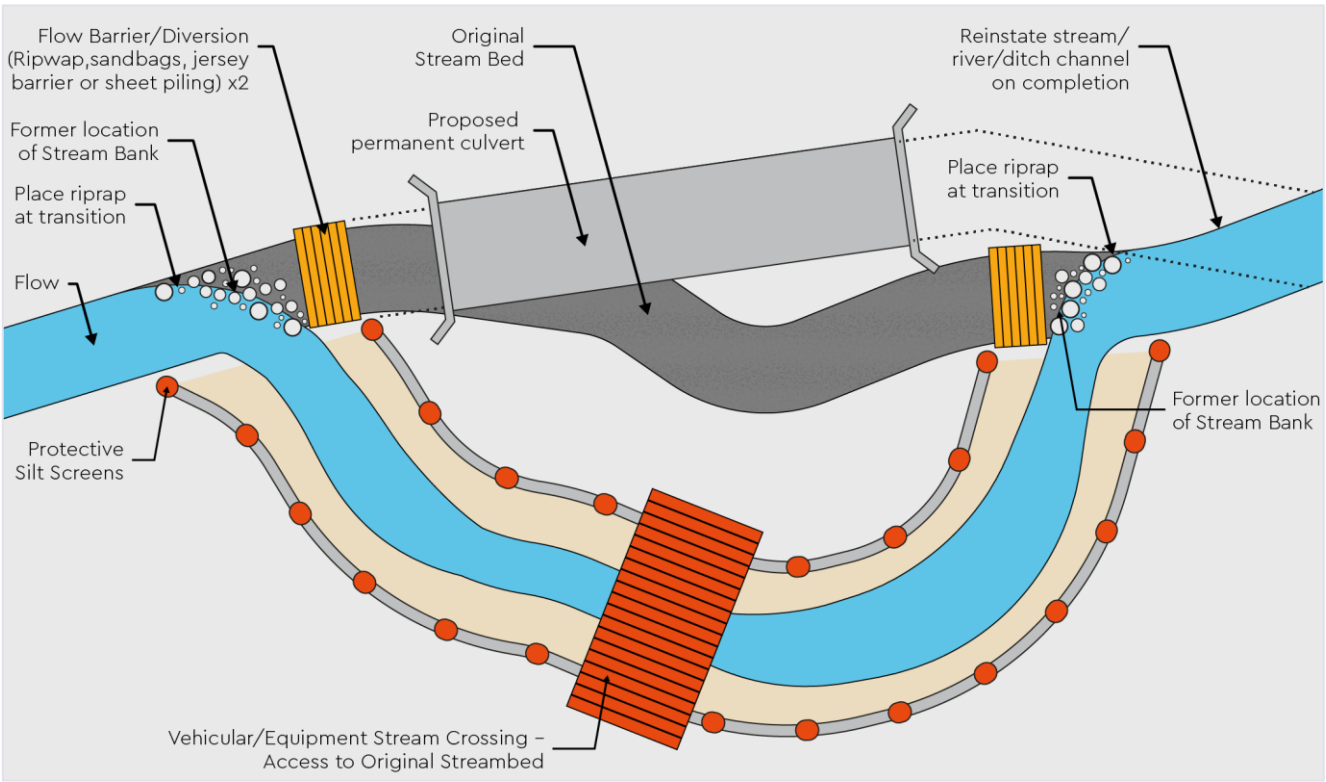


Diagram 5.37: Illustration Showing a Typical Temporary Diversion Channel

5.7.13.4 North Portal Satellite Construction Compound

The North Portal Satellite Site will be located on farmland north of Naul Road. It will be established on the flat area just before the natural slope leading to Naul Road and will provide limited logistics support for cut and cover and open cut sections. It will also support the construction of new road bridge (known as the McCormish overpass) over the proposed Project alignment. The bridge will be 12m wide and consist of a modular, precast concrete portal frame. It will be constructed at the access road into McComish Limited and will require temporary traffic diversions. The bridge is required in order to maintain full access to this property, as detailed in Chapter 4 (Description of the MetroLink Project).

5.7.13.5 Traffic Management: Pinnockhill Roundabout to DANP

During the Construction Phase, a traffic management plan will be implemented in order to manage traffic disruption caused during the construction phase. The traffic management plan will cover the following between Pinnockhill Roundabout and DANP:

- Bus lane, cycle lane and traffic lane closures and narrowing during the Enabling Works;
- Removal of Footpath during Enabling Works;
- Full closure of R125 southbound during main civil works;
- Traffic diversions due to R125 closure;
- Diversion of bus lanes and cycle lanes;
- Removal of footpath during main civil works;
- Diversions for access to sites during main civil works; and
- Removal of Parking during main civil works.

A full assessment of all resulting impacts is presented in Chapter 9 (Traffic & Transport).

5.8 AZ2 Airport Section: Dublin Airport North Portal to South Portal

This section will require three construction compounds, as detailed in Diagram 5.38 and Diagram 5.39, and these are:

- DANP Main Construction Compound;
- Dublin Airport Station Main Construction Compound; and
- DASP Main Construction Compound.

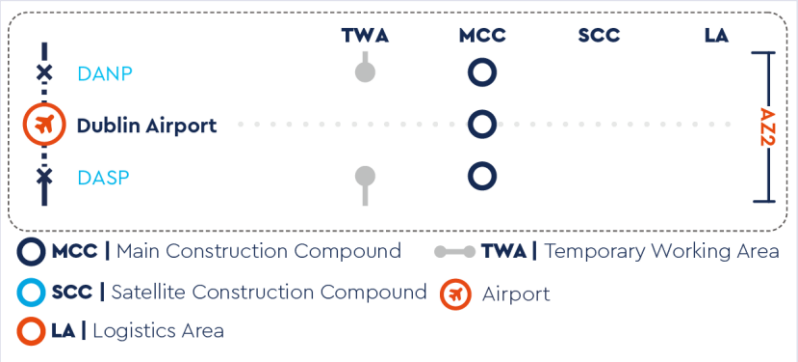


Diagram 5.38: AZ2 Airport Section - Principal Elements and Construction Sites

Works proposed in Area AZ2 will include the construction of the DANP, a 110KV substation at Naul Road, the DASP, underground tunnelling under Dublin Airport between both portals, evacuation and ventilation tunnels parallel to the main tunnel and the construction of Dublin Airport Station. Enabling Works will include road and utility diversion works. Construction phasing and haul routes are shown in Appendix A5.3 and Figure 5.2 at the end of this Chapter, respectively.

The following construction durations are anticipated for the principal construction elements in AZ2.

Table 5.13: Estimated Construction Durations AZ2

Description AZ2 Compounds / Logistics / Other Structures Airport – Tunnels and Structures	Estimated Construction Duration (Months)
Dublin Airport Station Compound	99
Dublin Airport North Portal Compound	60
Dublin Airport South Portal Compound	90
Deep Station	57
Portal North	60
Portal South	81
U Section	15

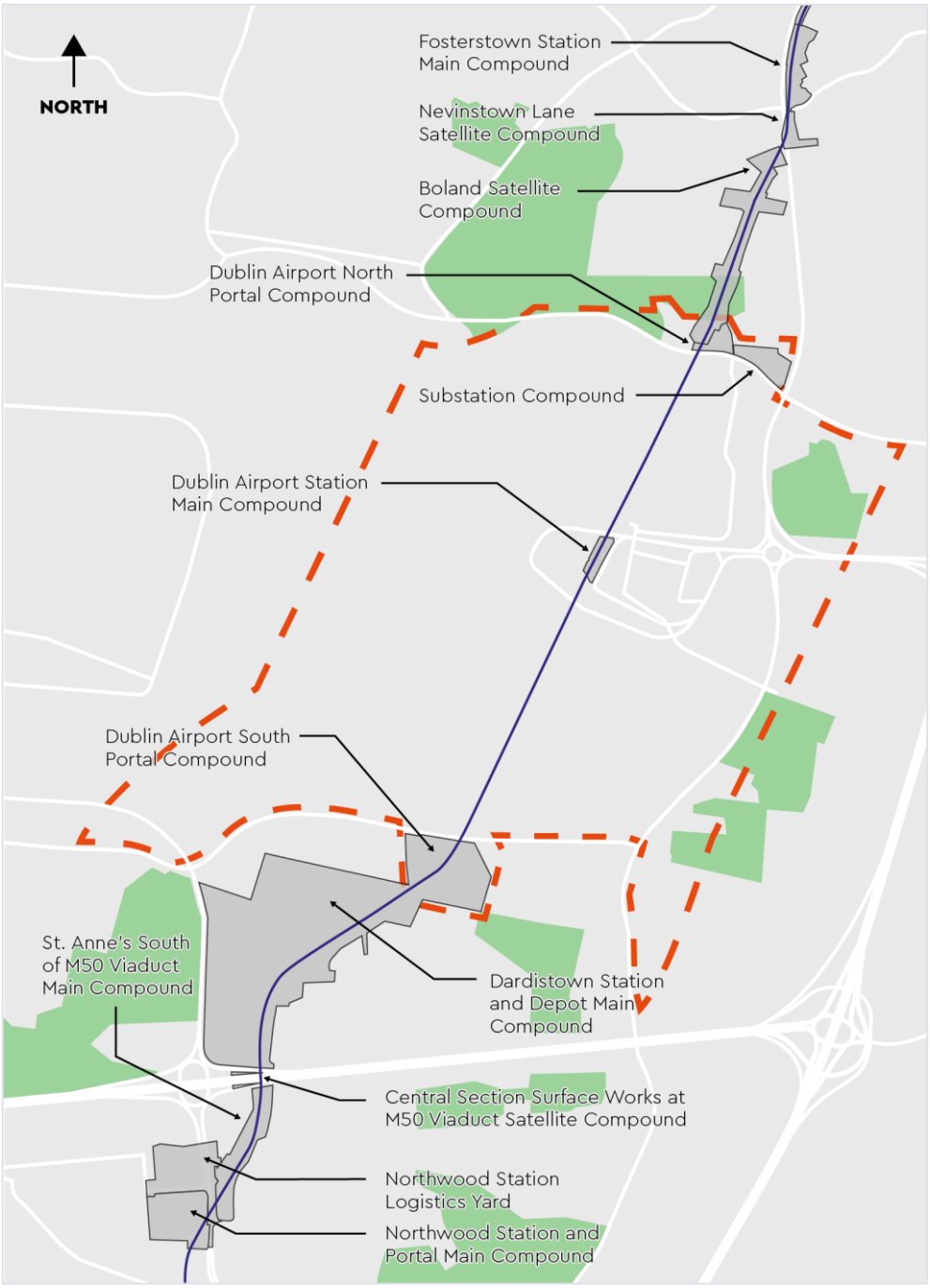


Diagram 5.39: AZ2 Site Offices and Compound Locations

5.8.1 Dublin Airport North Portal

The following are the main construction works anticipated for the principal construction elements at DANP Construction Compound:

- Enabling Works;
- Construction of DANP; and
- Construction of MetroLink HV Substation, comprising ESBN compound and structure, and Customer Compound and structures.

The DANP construction site is located north of Naul Road. Most of the land is currently comprised of greenfield land. The site will be used to support the construction of the alignment from the north and for the construction and support the TBM reception following the TBM drive from DASP.

The site will be used to extract the TBM after completion of the Dublin Airport Tunnel drive. The TBM will be dismantled at this location and will be removed from the site.

This construction site will require a new access and exit route to be constructed along the south west and south east of the site to allow access and egress for the construction vehicles and pedestrians. Local traffic management will be required for activities such as the installation and removal of the site entrances on Naul Road. HGVs travelling to and from the DANP Construction Compound will approach from the M1 Motorway, a distance of just over 1.5km.

Site establishment will follow the methodology set out in Section 5.4. An over-ground electricity line (supported by four wood poles) will be diverted from the site area prior to any work commencement with potential for some underground utility diversions. Typical construction methodology used for utility works has been detailed in Section 5.4.10.

Local sensitive receptors include Forest Little Golf Club located west of the proposed site.

Following site establishment, the construction sequence of the portal will progress in line with the following methodology:

1. Secant piling (as detailed in Section 5.5.2.1);
2. Grouting;
3. Portal excavation and portal bracing including a sequence of excavating and propping;
4. The formation of a base slab at the base of the portal;
5. TBM arrival (after completion of the Dublin Airport Tunnel drive). The TBM will break through a dedicated section of wall called a ‘head wall’ (Diagram 5.40) and it will be removed from the portal via a crane (refer to Section 5.5.3.1.4 for further detail). The TBM will be dismantled and removed from site;
6. Intermediates slabs and roof slabs will be constructed, and all props will be removed before concrete lining is poured;
7. Internal concrete and civil works will take place followed by architectural finishing, mechanical and electrical fit out. This will include emergency exits, fire fighter entrance points and hardstanding for emergency vehicles parking; and
8. Testing and commission and trial running will happen at a later stage.

Diagram 5.40: Example of a Headwall During the Construction to Allow TBM Breakthrough

To the north-west of the portal site, one of the two primary high voltage substations will be constructed at Forest Little to allow for power supply to the proposed Project. The substation compound will be located immediately north of the Naul Road and east of the DANP and will include both the ESBN substation, MetroLink substation and associated transformers. An underground power line will connect the MetroLink substation to the alignment. The methodology for construction of the substation has been detailed in Section 5.5.18.1.1. The location of the substation is shown on Diagram 5.39.

5.8.2 Traffic Management: DANP

During the Construction Phase, a traffic management plan will be implemented in order to manage traffic disruption caused during the Construction Phase. However, traffic impacts at this location during the Construction Phase are minimal with no impacts beyond increased traffic levels during site establishment and when abnormal loads require access to the site.

A full assessment of all resulting impacts is presented in Chapter 9 (Traffic & Transport).

5.8.3 Dublin Airport Station

The main Dublin Airport Station construction site will be on the west side of the Terminal 2 departure road which connects to a single carriage four lane road leading to the M50 Motorway via the M1 Motorway on the current Terminal 2 Surface Car Park. An additional site will be required for a lorry holding area, as the current site is constrained. This will enable the control of the flow of HGVs into site and prevent traffic queues on the Terminal 2 airport departure road. The location of this will be determined in coordination with the relevant authorities (daa and FCC).

Access and egress to the site will be from the Terminal 2 departure road to the north of the existing car park. A separate pedestrian entrance is proposed to be constructed on the south west corner of the site, for those working on or visiting site who arrive on foot or by public transport. Temporary traffic works can be found in the STMP in Appendix A9.5.

Sensitive receptors at this location include Dublin Airport and Our Lady Queen of Heaven Church.

The construction of Dublin Airport Station will require the relocation of the existing Surface Car Park at Terminal 2. The replacement carparking arrangements will be agreed between TII and daa.

Site establishment will follow the methodology set out in Section 5.4. Several services have been identified at this location that will require diversion.

The construction of the underground station at Dublin Airport will be undertaken as detailed in Section 5.5.9 and will include 'top down' construction. Once the underground station has been constructed, this area will be converted into a bus interchange, as detailed in Chapter 4 (Description of the MetroLink Project). The phasing of the works is detailed further in Appendix 5.3 (Construction Sequence Report).

5.8.4 Dublin Airport South Portal and Tunnels

The DASP is located south of Dublin Airport's boundary. The TBM will be launched from this location. The entrance to the tunnel (or portal) will comprise a TBM launching shaft, established using a cut and cover methodology.

The Airport Tunnel passes beneath Dublin Airport and is approximately 2.3km long, running between the DANP and the DASP in AZ2. Parallel to the Airport Tunnel, there will also be two smaller diameter evacuation tunnels on the west side running northwards from DASP for about 315m and on the east side two ventilation tunnels connected to the main tunnel and extending about 600m from DASP underneath Dublin Airport Lands. The evacuation tunnel will enable passengers to walk out to a safe location outside the Dublin Airport Lands in the event of an incident in the main tunnel. The evacuation area of 500m² at the surface will accommodate 1,000 persons in the event of an emergency.

The evacuation and ventilation tunnels will pass beneath very sensitive parts of Dublin Airport (runway, taxiway and stand areas). A closed face TBM method (assumed to be an earth pressure balance type) is therefore considered for the construction of these tunnels, as it provides a greater level of security against settlement and ground collapse. It is estimated that the tunnelling works will take approximately 30 months to progress.

The DASP Main Construction Compound is located immediately south of the Old Airport Road. The majority of the proposed land is currently greenfield locations. The required site area will support the construction of the portal and launching shaft, the open cut to the south; the TBM tunnelling; the construction of excavation and ventilation tunnels.

A separate access and exit route will be constructed along Old Airport Road to the north-west and north-east of the site to allow access and egress for the construction vehicles and pedestrians. Like most other compounds, this site is not located near public transport services. A Construction Sustainable Mobility Plan will be prepared by the contractor(s) to outline access arrangements to the construction site by sustainable travel modes. Each site will need a specific plan for project personnel mobility.

HGV vehicles delivering to site are expected to take either the M50 or M1 Motorways depending on their starting point. Most traffic leaving the site will turn left onto Old Airport Road and then left again onto the R108 Ballymun Road to the M50 Motorway. Further traffic arrangements are detailed in the STMP in Appendix A9.5 and assessed in Chapter 9 (Traffic & Transport).

Enabling Works will include archaeological excavation works to a recorded archaeological enclosure (RMP DU014-121), these works will be done in line with Section 5.4.4.

The site is located close to Runway 16/34 and the North Runway (10L/28R) of Dublin Airport, therefore maximum height restrictions of site plant and equipment have been identified to comply with these restrictions. All Construction Phase plant and equipment will be within the restrictions applied to ensure safety of approach to the Dublin Airport Runways.

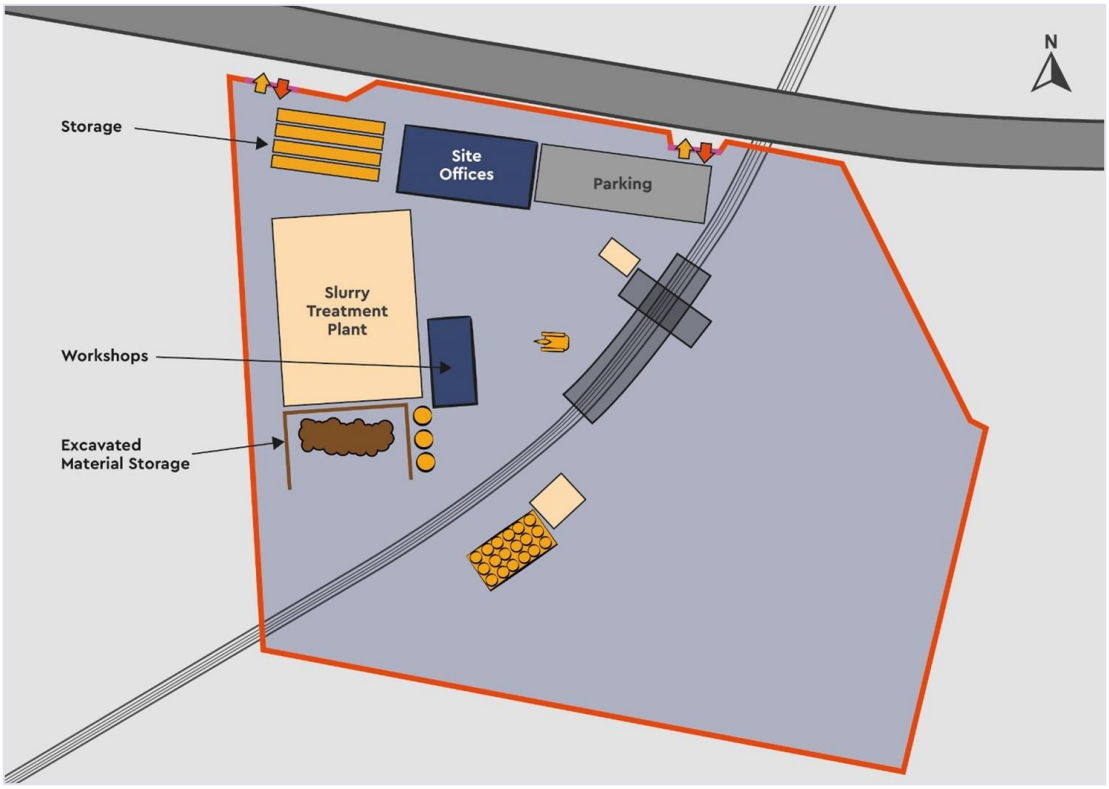


Diagram 5.41: Proposed Site Layout at DASP

Following site establishment, the construction sequence will progress in line with the methodology outlined in Section 5.8.1 which includes top down construction. Further to this, TBM delivery and assembly (Section 5.5.5.1.4) will be required and the Airport Tunnel drive will commence. After the completion of the main tunnel construction, evacuation and ventilation tunnels will be bored from the DASP Construction Compound. The evacuation and ventilation tunnels run parallel to either side of the main tunnel and will be connected to the main tunnel via a cross passage.

On completion of tunnelling activities, further civil works will be required to complete the tunnel portal; with the installation of a concrete top slab, intermediate lateral slabs and intermediate bracing frames (refer to Section 4.15.6 of Chapter 4 (Description of the MetroLink Project) for cross sections of DASP). At the surface, the following works will be undertaken:

- Emergency exits and fire fighter entrance points will be constructed;
- The ventilation structure will be constructed; and
- Hardstanding will be laid, and signs and floor markings installed for the evacuation area.

The remainder of the site will then be cleared and reinstated.

5.8.5 Traffic Management: DASP

During the Construction Phase, a traffic management plan will be implemented in order to manage traffic disruption caused during the Construction Phase. There is no requirement for traffic management during the Enabling Works phase. The traffic management plan will cover DASP during the main civil works phase and will cover:

- Increase in traffic flows;
- Installation of a new signalised junction; and
- Removal of Parking during main civil works.

A full assessment of all resulting impacts are presented in Chapter 9 (Traffic & Transport).

5.9 AZ3 Dardistown to Northwood: DASP to Northwood

This section will require two compounds as presented in Diagram 5.42 and Diagram 5.43 and these are:

- Dardistown Station and Depot Main Construction Compound; and
- Northwood Portal and Station Main Construction Compound (and logistics area).

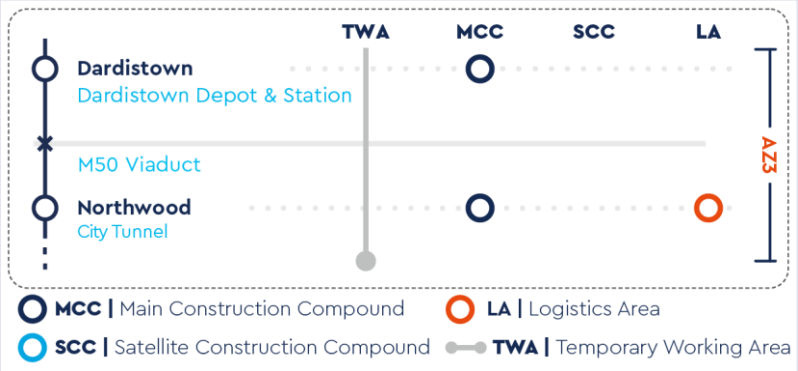


Diagram 5.42: AZ3 Principal Elements and Construction Compounds

Construction works proposed in Area AZ3 will include the construction of the proposed maintenance depot at Dardistown, the future Dardistown Station, the M50 Viaduct, Northwood Station and the Northwood Portal. Enabling Works will include stream diversions and culverts in addition to road and utility works.

The central section surface works will run from DASP to Northwood Station. It is anticipated that the main compound sites located at DASP, Dardistown Depot and Station, and the M50 Viaduct and Logistic site at Northwood Station will support construction of this section. However, a small satellite site will also be required to support this central section.

Appendix A5.3 describes the construction phasing at each location and Figure 5.2 at the end of this Chapter shows the proposed haul routes.

The following construction durations are anticipated for the principal construction elements in AZ3.

Table 5.14: Estimated Construction Durations AZ3

Description AZ3 Compounds / Logistics / Other Structures Airport South to Dardistown	Estimated Construction Duration (Months)
Cut and Cover	63
U Section	72
Dardistown Station, Depot and Access Works	
Stations Retaining Cuts	72
Dardistown Station Compound	57
Dardistown Depot	57
Cut and Cover	60
Dardistown Railhead	39
M50 Viaduct and Approaches	
Central Section Surface Works at M50 Viaduct	54
M50 Viaduct	15
St Anne's South of M50 Viaduct	69
Northwood Station Compound	66

Description AZ3 Compounds / Logistics / Other Structures Airport South to Dardistown	Estimated Construction Duration (Months)
Retained Cut	33
Cut and Cover	30

Diagram 5.43: AZ3 Site Offices and Construction Compounds

5.9.1 Dardistown Depot and Station

The Dardistown Depot will function as the main stabling area for the proposed Project rolling stock. All train maintenance will be undertaken at the Depot site. The Depot will cover an area of 19.5ha located between the Old Airport Road to the north and the M50 Motorway to the south. To the east are Dublin Airport long term car and

Dardistown and to the west the R108 and a golf club. The Dardistown Depot and associated buildings will be located to the west of the rail line and proposed future station at Dardistown which will lie in retained cutting.

There are six main buildings included in the Depot area: the Stabling Building, Workshop Building, Main Offices and Administration Building, Electrical Substation Building, Permanent Way Maintenance Building and the Main Access and Security Building. Refer to Chapter 4 (Description of the MetroLink Project), for further detail.

The construction sequence of the building structures is detailed in Appendix 5.3. The location of the construction compound is shown in Diagram 5.44 below.

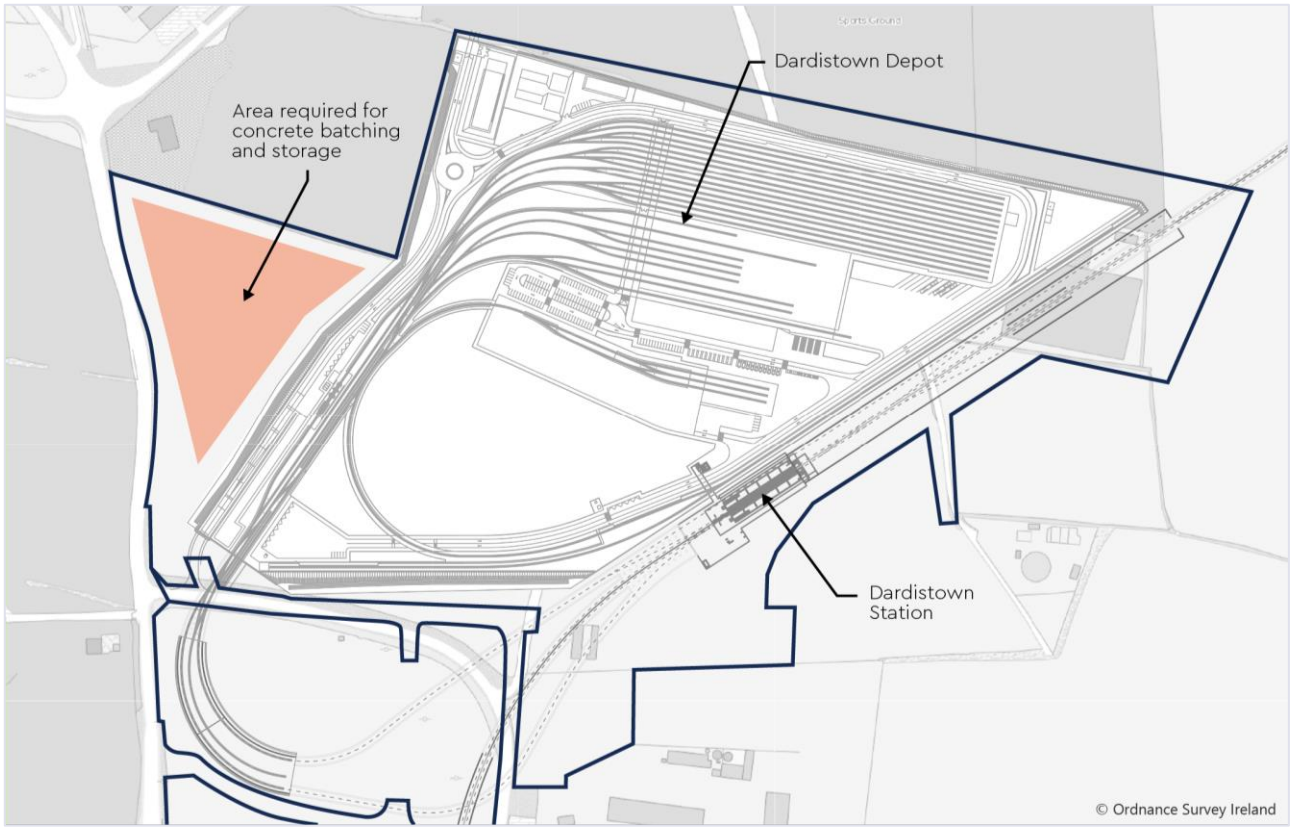


Diagram 5.44: Location of Dardistown Station and Depot Main Construction Compound

5.9.1.1 Dardistown Depot Construction

The Dardistown construction site will be located to the south of DASP and the east of the R108 Ballymun Road and north of the M50 Motorway. Most of the proposed land is currently primarily greenfield with a number of playing fields located to the north and north-west. In addition to the farmland, the works will require the acquisition of one of the playing fields (Whitehall Rangers Football Club).

Separate site access and egress will be provided to the site from the R108 Ballymun Road. In addition to the main access and exit, additional access/egress roads from Old Airport Road are proposed to facilitate the construction activities at different stages of work. HGVs travelling to site will approach and leave from the M50 Motorway, a distance of just over 500m. Temporary traffic works are detailed in the STMP in Appendix A9.5.

The construction of the proposed MetroLink depot and Dardistown Station will result in the disruption of the existing field boundaries and require the closure of part of Ballystruan Lane during construction. Access to the existing businesses on Ballystruan Lane will be maintained during construction via a separated access and exit route to the south and reconnecting to the existing lane. Temporary access will be maintained until such time as the permanent realigned Ballystruan Lane has been completed.

The works proposed will also impact on access off the Old Airport Road to an existing private wastewater treatment plant (WwTP). Access to this facility will be maintained during the course of the works, until the permanent access has been reinstated. The phasing of the works is detailed further in Appendix 5.3 (Construction Sequence Report).

Some Enabling Works will be required to realign and reinstate the playing fields used by Starlights GAA and Na Fianna GAA located north of the proposed construction compound. Works will include the installation of flood light foundations, parking area, relocation of club's changing facilities, resurfacing of pitches and installation of ball netting as required. The pitches will be reinstated, with some pitches including artificial grass using an all-weather/ third generation design, as described in Section 5.7.4. The timing of the works will be discussed with the sports clubs and organised to suit i.e., off season. This does not from part of the RO application.

Enabling Works will include undertaking utility diversion works as detailed in Section 5.4.10 and the demolition of Whitehall Rangers Club House as outlined in Section 5.4.9. Invasive plant species assessed in Chapter 15 (Biodiversity) will require removal/treatment as outlined in Section 5.4.3. Furthermore, archaeological excavations will be required as set out in Chapter 25 (Archaeology & Cultural Heritage).

Similar to Estuary, the Dardistown Construction Compound will also be used as a railhead site during the Construction Phase. Railheads are work sites that have road access and also rail access to the under-construction railway. Service yards at the railheads will be used to supply the working areas.

It will be necessary to service the track installation works at the same time as the construction of the Depot itself. This will require a large servicing yard, storage and laydown area and access for the loading and unloading of work-trains, test trains and rolling stock. These activities will mostly be contained within the footprint of the proposed Dardistown Depot and Station development site; however, an additional area of land to the west is expected to be required for a concrete batching plant during the second stage track bed installation. A proposed railhead construction site layout at Dardistown is illustrated in Diagram 5.32.

Site establishment will follow the methodology set out in Section 5.4.

The proposed Depot is located at the head of the Mayne River system and diversion of the Turnapin Stream, which is a tributary of the Mayne River, will be required to maintain local drainage routes. The location of the stream to be diverted is shown in Diagram 5.45 and typical construction methods are presented in Appendix A5.10. Relevant approvals will be obtained for this diversion from the Office of Public Works (OPW), as required under Section 50 of the Arterial Drainage Act, 1945. Further detail on environmental impacts from works in watercourses can be found in Chapter 18 (Hydrology).

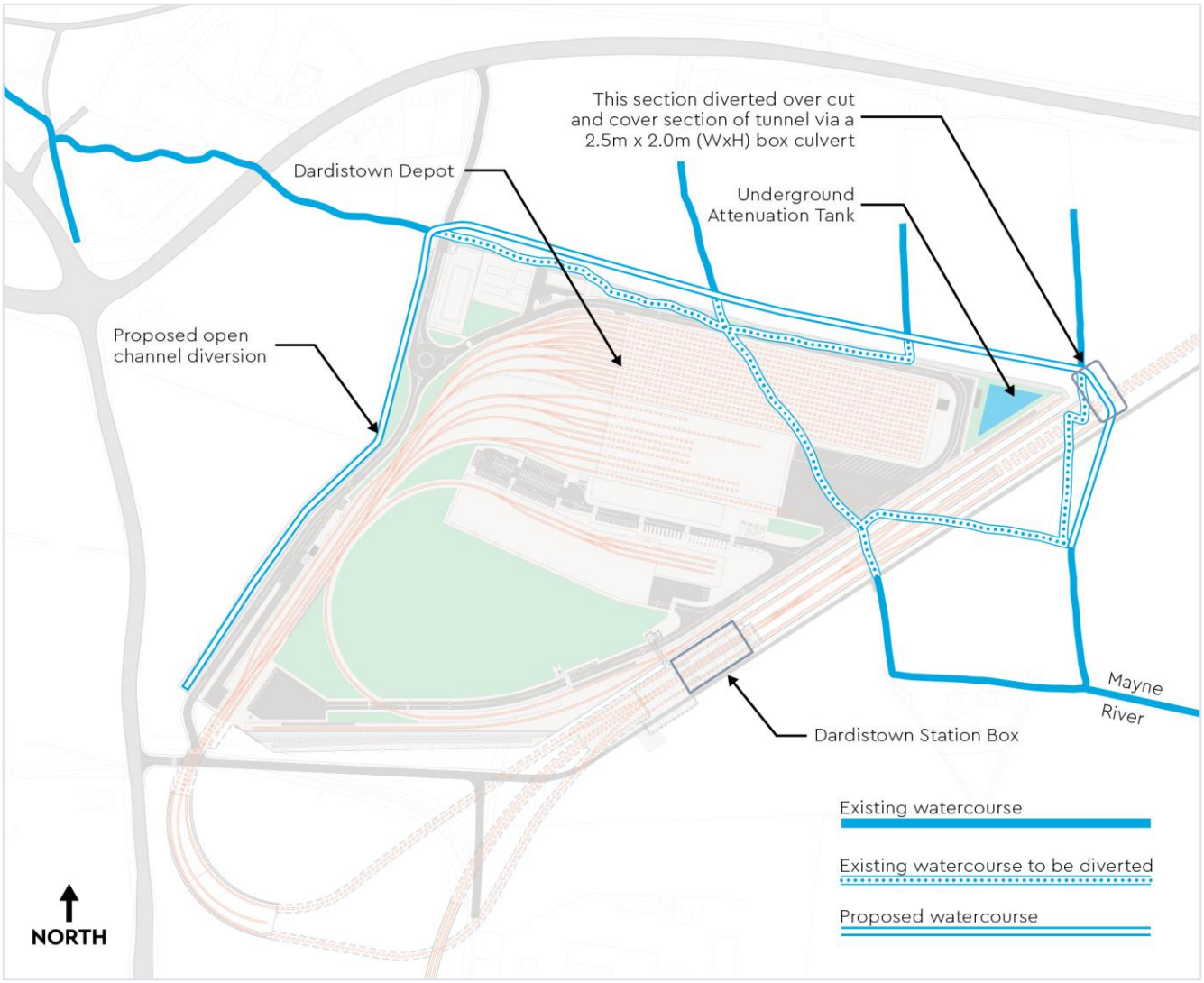


Diagram 5.45: Mayne Stream Diversion at Dardistown

There are six main buildings in the Depot area. Before building works can take place, a significant amount of earthworks will be required to balance the slope and elevation in the topography. Additional excavations will be required for tracks to the Depot to allow access from the main railway line and from the future Dardistown Station.

A 20m high radio mast will be erected at the Depot as part of the Communications-Based Train Control (CBTC) signalling system, as described in Section 4.12.5 of Chapter 4 (Description of the MetroLink Project).

The likely construction sequence of the buildings and trackwork at the Depot are broken down into several key stages of construction, as outlined below.

1. **Depot structures:** Phased construction and completion of the Depot and ancillary structures, working in principle from north-east to south-west:
    - Preparatory earthworks;
    - Build working platforms and construct foundations;
    - Construct concrete upstands, structural slabs;
    - Erect structural steel frames and install side and roof cladding system;
    - Workshop, Store and Office fit out;
    - Utilities connection; and
    - Commissioning.
2. **Rail Systems Works:**
    - Main site track formation and railway systems;
    - Temporary railhead west of Depot; and

- Laying concrete track bed, turnouts, track drainage, communications and OCS with phased hand overs to rail systems contractor for track installation.

3. **MEP works:**

- MEP Depot and ancillary buildings fit out;
- Operations and Incident Control Rooms fit out;
- Staff welfare and training facilities fit out;
- Workshops and stores fit out;
- Stabling and cleaning facilities fit out;
- Installation of test track;
- General power track, live railway and Overhead Line Equipment (OLE) with interfaces and communications infrastructure;
- MetroLink HV substation, comprising ESBN compound and structure, and Customer Compound and structures (see Section 5.5.18.1.1 for substations construction methods);
- Traction substation installation;
- Power distribution and lighting and small powers; and
- Communications systems.

4. **Test and Commissioning:**

- Supply and delivery of the rolling stock; and
- Signalling, SCADA and communications, trial running, test and commissioning.

5.9.1.2 Dardistown Station Construction

Dardistown station will be constructed as part of the proposed Project but will not be fitted out and opened to the public when the project first opens. The station will open to the public when proposed plans for the development of adjoining lands are in place. In the interim period the station will be available solely for the use of personal working in the Dardistown Depot. A public access road will not be provided as part of the proposed Project as there will not be any public access to MetroLink from this station. However, a maintenance access road will be constructed to facilitate routine maintenance of the station and surroundings. A description of the station and a diagram of the proposed layout is provided in Chapter 4 (Section 4.16.3).

The site is currently agricultural land. The landholding affected is illustrated on Sheet 4 Figure 4.1 in the EIAR Book of Figures and a description of the agricultural interests and potential impacts is provided in the EIAR Chapter 23 (Agronomy).

The future Dardistown Station will be constructed in a retained cut and will follow the construction methodology laid out in Section 5.5.4.2. A new traction substation will be required.

5.9.2 M50 Viaduct

Moving south of the Dardistown Depot, the alignment will go into an incline before crossing over the M50 Motorway on a viaduct. Access and egress to this section of works will be from R108 Ballymun Road from both north and south of the M50 Motorway. This work will be supported by the main compounds from Dardistown and Northwood and works will be carried out within the working strip along this section of works.

Enabling Works will require the demolition of three derelict properties as per the methodology in Section 5.4.9. In addition, invasive plant species assessed in Chapter 15 (Biodiversity) will require removal/treatment as outlined in Section 5.4.3.

Site establishment will follow the methodology set out in Section 4.5. Consideration will be taken with regard to the removal of trees in this area due to the ancient hedgerow that lines the M50 Motorway and the importance of Santry Demesne to protected bird species. This has been assessed in Chapter 15 (Biodiversity).

The works will require the diversion of Old Ballymun Road which provides access into St Anne's, Santry Lodge and the Tesco Distribution Centre. An alternative access will be provided during construction works to ensure continued access to these properties.

Following site establishment, construction of the M50 Viaduct will be broken down into a number of key phases of construction outlined in Section 5.5.10. Diagram 5.46 provides an illustration of the phases required to lift in the steel beams. Temporary traffic management will be required to provide access for the construction of the north and south piers. The installation of the steel beams and decking over the M50 Motorway will be undertaken in a series of phased temporary weekend night-time road closures. This process will commence with closures on the north slip road followed by the south slip road, and finally the M50 Motorway. During the M50 closure the slip roads will remain open for diversion. It is anticipated that between six and eight temporary weekend night-time road closures will be required to complete the phased installation of the bridge beams and decking. The phasing of the works is detailed further in Appendix 5.3 (Construction Sequence Report) and in Chapter 9 (Traffic & Transport).

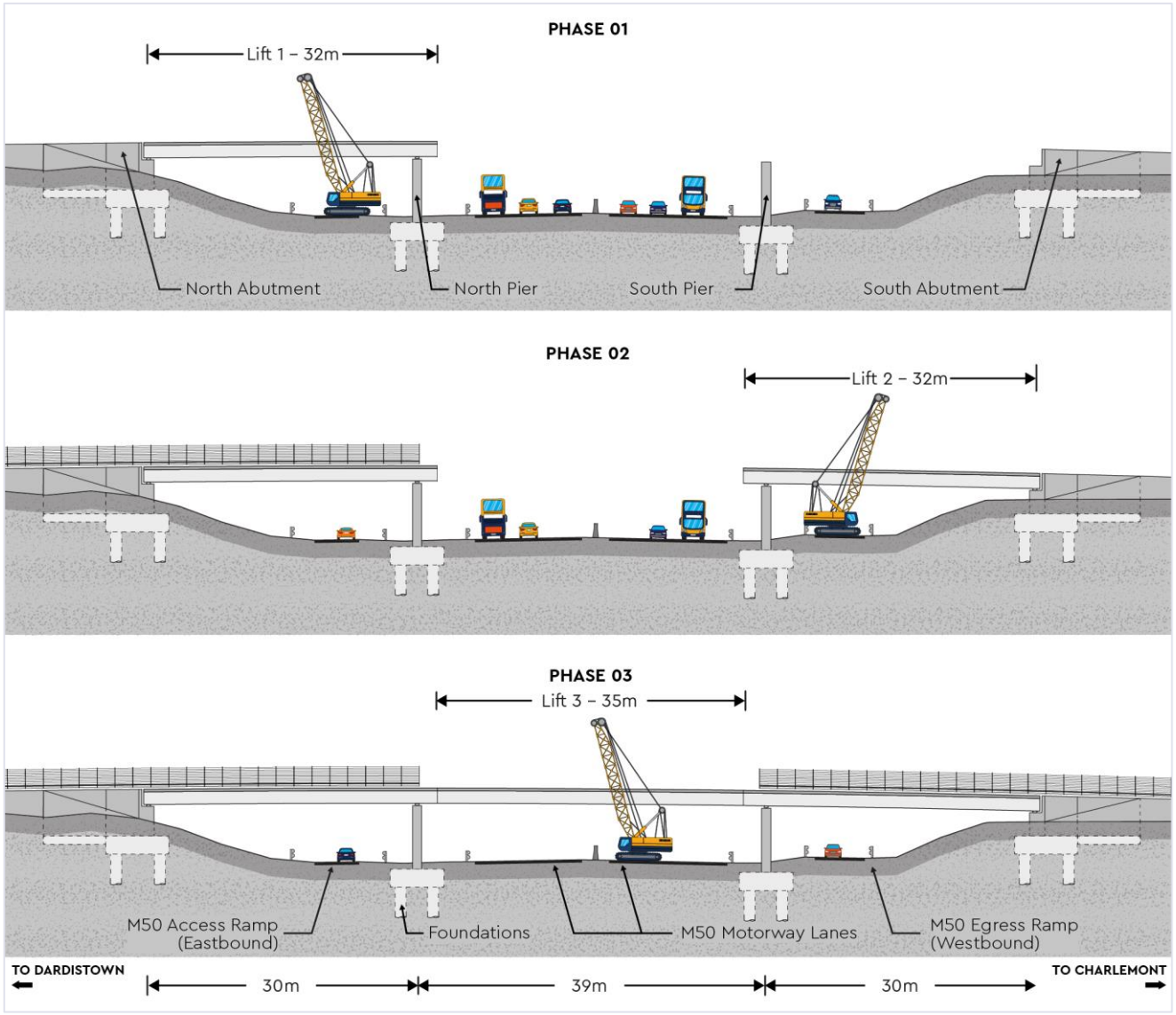


Diagram 5.46: Phased Construction of M50 Motorway Viaduct

5.9.2.1 South of the M50

In order to accommodate the proposed Project, some minor alterations will be implemented on the Santry River immediately downstream of the M50 viaduct to straighten the channel and provide scour protection. The location of the works is indicated on Figure 18.14 in the EIAR Book of Figures. These alterations have been assessed in the EIAR Chapter 15 (Biodiversity) and Chapter 18 (Hydrology).

Similar to Broadmeadow and Ward River Viaduct, the M50 Viaduct will require embankment works both north and south of the M50 Motorway before going back down into a retained cut and finally into a cut and cover to bring it under the R108 Ballymun Road.

5.9.3 Northwood Station and Portal

The proposed Northwood Station is located adjacent to and encompasses R108 Ballymun Road. The construction site will include land on both sides of R108 Ballymun Road and adjacent to St Margaret's Road.

The portal construction works and the station works from the west of the R108 Ballymun Road will be supported from the Northwood Station and Portal Main Construction Compound. This area is located in an open, greenfield site, away from residential and commercial development. The construction site footprint will change throughout the construction timeframe but will generally consist of two main sites. The East Site is located east of R108 Ballymun Road and the West Site is located to the west of R108 Ballymun Road and south of St Margaret's Road.

A logistics site will be located north of St Margaret's Road. This area will provide space for offices, welfare and construction logistics for the TBM tunnelling works from Northwood to DASP, including the temporary storage of excavated material.

The main construction works will require the realignment of R108 Ballymun Road throughout the majority of the construction timeframe. The proposed traffic management involves the realignment of the R108 and alteration to junctions on R108 / Northwood Avenue and R108/St Margaret's Road. There will also be a new signalised junction on St Margaret's Road, approximately 200 meters west of the R108/St Margaret's Road junction, which will facilitate site access. New pedestrian provision and segregated cycle facilities will be provided along the proposed new road. As part of the temporary traffic management changes, Balbutchers Lane (R104) will also be redesigned to better accommodate pedestrian and cyclist movements.

The site access points for both the east and west sites will be on the R108 Ballymun Road/ St Margaret's Road signalised junction. The site exit for the west site will be off St Margaret's Road.

A Construction Phase Traffic Impact Assessment has been undertaken at Northwood Station and is presented in the STMP in Appendix A9.5.

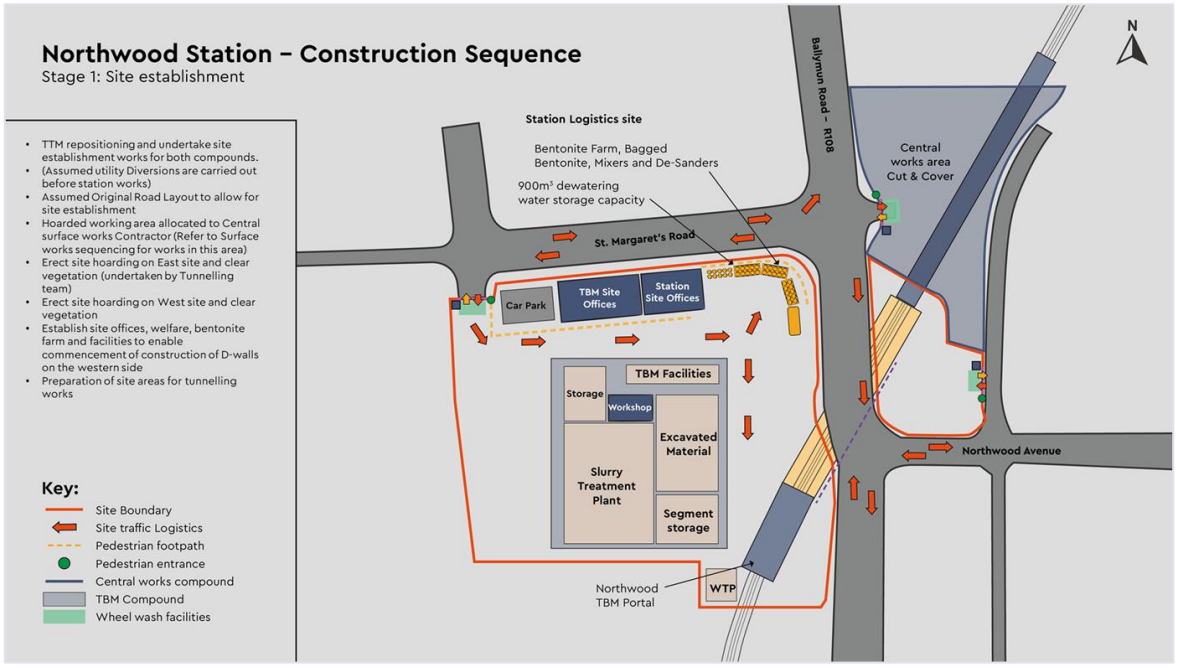


Diagram 5.47: Northwood Station and Portal Main Compound and Logistics Compound

Due to this site being required for the City Tunnel launch site, the site is of sufficient size to receive delivery vehicles within its boundary to minimise the impact of vehicles idling and causing congestion on the local roads during offloading. However, a small holding bay under 0.5km from site will still be required to manage gate access and check delivery credentials ahead of accessing site. The vehicle holding areas will be actively managed with a booking system that allows the logistics team to prepare for deliveries and ensure smooth operation of the site.

Enabling Works will include the removal/treatment of invasive plant species assessed in Chapter 15 (Biodiversity) as outlined in Section 5.4.3. Furthermore, several utilities have been identified at the Northwood site, primarily at the station location. Utility diversions will require traffic management. The typical construction methodology used for utility works has been detailed in Section 5.4.10. Site establishment will follow the methodology set out in Section 5.4. The phasing of the works is detailed further in Appendix 5.3 (Construction Sequence Report).

As detailed in Chapter 4 (Description of the MetroLink Project), the proposed Project interfaces with the proposed BusConnects Ballymun/Finglas to City Centre Scheme route at the Northwood Avenue and R108 Ballymun Road junction. Therefore, the construction programme has been programmed to minimise potential environmental impacts at this location.

The construction of the underground Northwood Station will be undertaken as detailed in Section 5.5.9 and be by 'top down' construction methods.

The construction of the TBM launch portal will follow a similar sequence to that detailed in Section 5.8.1 for DANP, with the addition of the TBM delivery and assembly. All tunnelling support works have been detailed in Section 5.5.3. This site will be important in terms of TBM activities and material management from the extraction of spoil material from the City Tunnel. The Northwood Main Construction Compound will have a slurry treatment plant, bentonite farm and excavated material sorting area. Material management has been detailed in Section 5.5.13, furthermore these works will be managed in accordance with the outline CEMP and Waste Material and Spoil Management Plan. Potential environmental impacts have been assessed in Chapter 20 (Soils & Geology) and Chapter 24 (Materials & Waste Management).

5.10 AZ4 Northwood to Charlemont: City Section

This section requires ten construction compounds as presented in Diagram 5.48 and includes:

- Ballymun Station Main Compound;
- Collins Avenue Station Main Compound;
- Albert College Intervention Shaft Main Compound;
- Griffith Park Station Main Compound;
- Glasnevin Station and Interchange Main Compound;
- Mater Station Main Compound;
- O'Connell Street Station Main Compound;
- Tara Station Main Compound;
- St Stephen's Green Station Main Compound; and
- Charlemont Station Main Compound.

Works proposed in Area AZ4 (City Section) will include the underground tunnelling from Northwood to Charlemont, the construction of nine underground stations, one interchange station at Glasnevin, an intervention shaft at Albert College Park and intervention tunnel at Charlemont. The required construction compounds to carry out the construction works falling within AZ4 are outlined in Diagram 5.49.

Appendix A5.3 describes the construction phasing at each location and Figure 5.2 at the end of this Chapter shows the proposed haul routes.

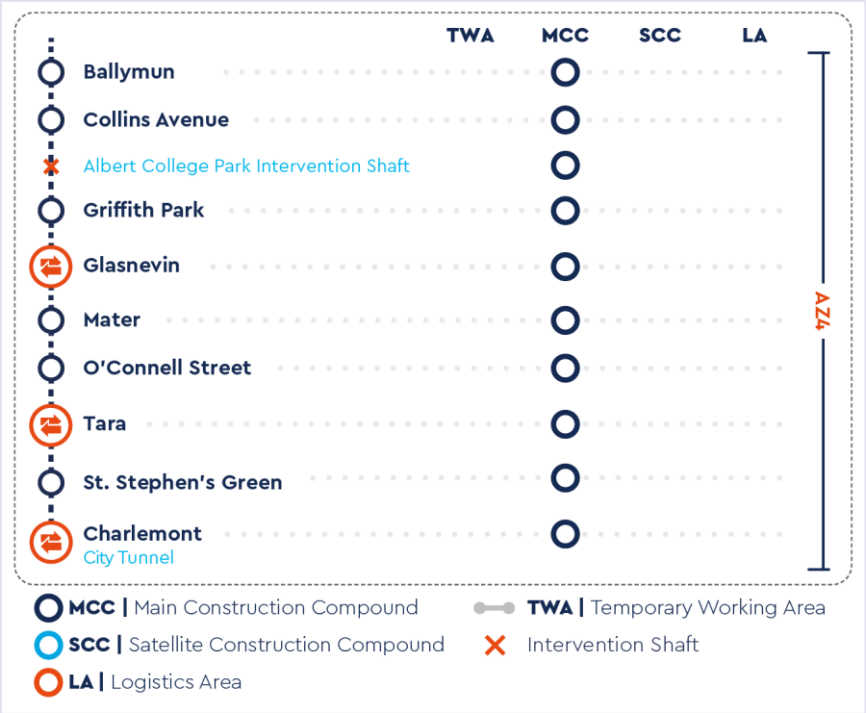


Diagram 5.48: AZ4 Principal Elements and Construction Compounds

The following construction durations are anticipated for the principal construction elements in AZ4.

Table 5.15: Estimated Construction Durations AZ4

Description AZ4 Compounds / Logistics / Other Structures	Estimated Construction Duration (Months)
Northwood Portal	90
Northwood Station Compound/Deep Station	84
Ballymun Station Compound/Deep Station	99
Collins Avenue Station Compound/Deep Station	99
Albert College Park Shaft Compound/Deep Station	63
Griffith Park Station Compound/Deep Station	105
Glasnevin Station Compound/Deep Station	102
Mater Station Compound/Deep Station	105
O'Connell Street Station Compound/Deep Station	99
Tara Station Compound/Deep Station	105
St Stephen's Green Station Compound/Deep Station	105
Charlemont Station Compound/Deep Station	102

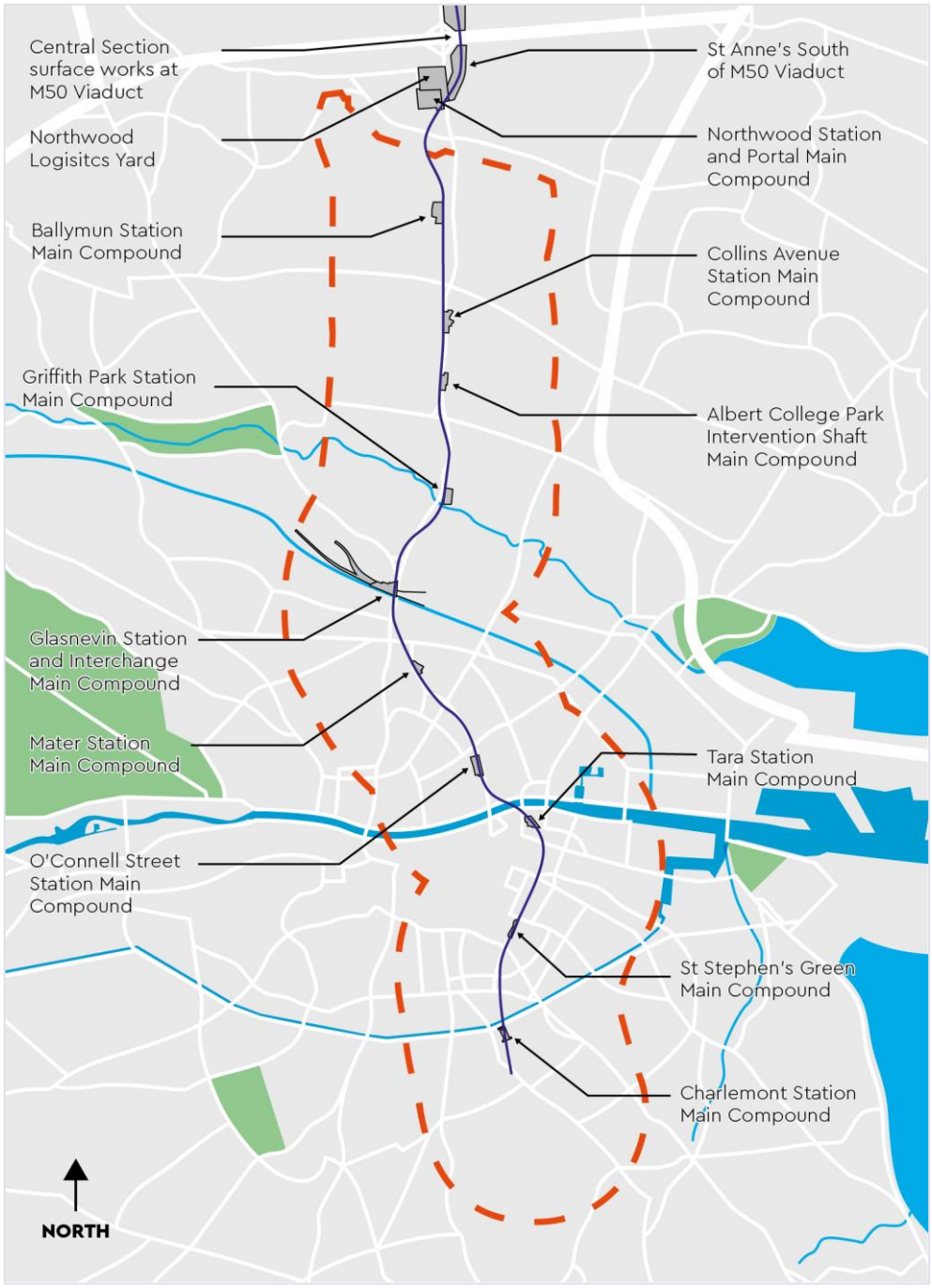


Diagram 5.49: AZ4 Site Offices and Construction Compounds

5.10.1 City Tunnel

The construction of the tunnel will be by a TBM as detailed in Section 5.5.3. The TBM will be launched from Northwood Portal and will tunnel southwards to a point approximately 400m south of Charlemont Station where the shell of the TBM will remain permanently in the ground. From there an intervention tunnel will connect the end of the tunnel to Charlemont to provide an emergency exit (detailed in Section 5.10.13).

It is anticipated that the tunnel drive will take at least 45 months to complete.

Access to the tunnelling site and portal is described in Section 5.9.3 Northwood Station and Portal above.

5.10.2 Ballymun Station

The main Ballymun Station construction site will be on the west side of R108 Ballymun Road, located in front of the former Ballymun Shopping Centre site which has been cleared and is earmarked for future redevelopment.

Vehicle access to site will be via Shangan Road and egress to the site will be on an unnamed road south of the site. A separate pedestrian entrance is proposed off the unnamed road to the south for those working on or visiting site who arrive on foot or by public transport. Vehicles delivering to the site are expected to approach from R108 Ballymun Road via the M50 Motorway.

There are interfaces with the proposed BusConnects Ballymun / Finglas to City Centre Core Bus Corridor Scheme route at this junction of the R108 Ballymun Road (refer to Chapter 31, Cumulative Impacts of Interaction Between Other Projects). The construction programme has therefore been coordinated with planned works for the BusConnects scheme to minimise potential environmental impacts at this location.

Enabling Works will include utility diversions that will require temporary traffic diversions, as detailed in Section 5.4.10. Site establishment will follow the methodology set out in Section 5.4.

The construction of the underground Ballymun Station will be undertaken as detailed in Section 5.5.9 and will include 'top down' construction. The phasing of the works is detailed further in Appendix 5.3 (Construction Sequence Report).

5.10.3 Collins Avenue Station

The main Collins Avenue Station construction site will be on the east side of R108 Ballymun Road. The station will be located predominantly in the green areas immediately in front of Our Lady of Victories Church and Albert College Court. The area required for the compound is defined by land for the construction of the underground station and ventilation shafts. The existing car parking spaces allocated to the residents of the Albert College Court will be used as part of the construction site. These will be replaced by taking spaces from the paid parking zone to the east. An additional site will be required as a lorry holding area as the site is constrained. This will enable the control of the flow of HGVs into site and prevent queuing on the public road. The Albert College Court access will remain closed throughout the duration of the works and alternative access will be provided for the residents at Albert College Lawn.

Vehicle and pedestrian access and egress to site will be via R108 Ballymun Road. Vehicles delivering to the site are expected to approach from R108 Ballymun Road via the M50 Motorway.

The site is located in close proximity to local sensitive receptors including Our Lady of Victories Church and nearby schools and residential properties. A grave is present in front of Our Lady of Victories Church at Collins Avenue; this will remain in-situ and will require protection during the construction works.

The construction of the underground Collins Avenue Station will be undertaken as detailed in Section 5.5.9 and will include 'top down' construction and will include the construction of four ventilation shafts. A new traction substation will be required. The phasing of the works is detailed further in Appendix 5.3 (Construction Sequence Report).

Temporary traffic measures will vary during construction works. Traffic lanes on the R108 Ballymun Road will be restricted to two lanes in each direction during station works and a central divider will be provided for safety.

Some phasing of works will be carried out to ensure traffic flow. Following the completion of the roof slab, the traffic on R108 Ballymun Road will be diverted over the completed structure to enable construction of two ventilation shafts under R108 Ballymun Road (Diagram 5.50).

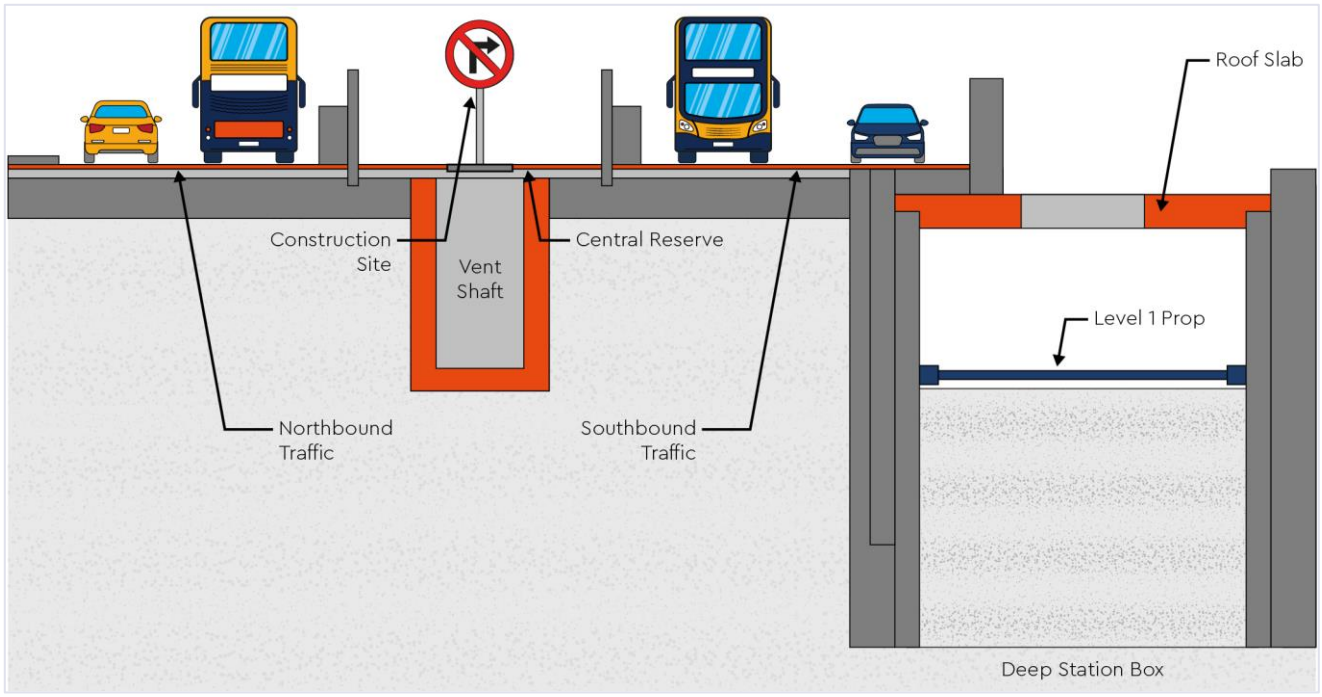


Diagram 5.50: Road Cross Section During Ventilation Shaft Construction on R108

Several utilities will be impacted by the works including an oil filled high voltage electricity cable and foul and surface water drains. Drawings detailing the extent of utilities diversion are included within the RO application. A typical construction methodology for the diversion of utilities is provided in Section 5.4.10.

5.10.4 Albert College Park Intervention and Escape Shaft

The compound will be located in Albert College Park between Collins Avenue Station and Griffith Park Station on the east side of R108 Ballymun Road and immediately north of Hampstead Avenue.

The area of the compound is defined by land required for the construction of the shaft, two short tunnels (which connect the shaft to the main tunnel) and an evacuation area at the surface.

The site entrance and exit are located off the R108 Ballymun Road, west of the site and will be used as both the entrance and exit location in order to reduce the number of trees to be removed, reduce impact to the traffic on the R108 Ballymun Road and will ensure control of the vehicles crossing the pavement being used by pedestrians. It is anticipated that the bus lane is suspended and used by the construction vehicles.

Vehicles delivering to the site are expected to approach via the M50 Motorway, and turn south onto the R108 Ballymun Road, before taking a left turn into the site. The total distance is 2.9km. Traffic leaving site will turn left onto R108 Ballymun Road and then U-turn onto the R108 Ballymun Road to the M50 Motorway. Temporary traffic measures are detailed in the STMP in Appendix A9.5.

Enabling Works will include the removal/treatment of invasive plant species assessed in Chapter 15 (Biodiversity) as outlined in Section 5.4.3. Site establishment will follow the methodology set out in Section 5.4.5.

The construction of Albert College Park Intervention Shaft will be undertaken as detailed in Section 5.5.5 and Section 5.5.11 and will include 'top down' construction.

5.10.5 Griffith Park Station

The main Griffith Park Station construction site will be on the east side of R108 St Mobhi Road on lands in the ownership of the Office of Public Works and leased to Home Farm Football Club. TII have agreed to provide alternative playing facilities for Home Farm FC during the construction period. The pitch will be fully reinstated on completion of the works.

An additional site will be required as a lorry holding area to control the flow of HGVs into site, preventing queuing on R108 St Mobhi Road. The existing footpath on the east of R108 St Mobhi Road will be required during construction and will require diversion by pedestrian crossings onto the west side of R108 St Mobhi Road.

Access and egress to site are from R108 St Mobhi Road into the road access to Whitehall College of Further Education. Due to the steep topography surrounding Home Farm Football Club, an access ramp will be built with an 8% gradient along a length of 40m. Existing access into Scoil Mobhi will be maintained. Vehicles delivering to the site are expected to approach from R108 St Mobhi Road via the M50 Motorway. Temporary traffic measures are detailed in the STMP in Appendix A9.5.

Enabling Works include some minor utility works within the playing field and demolition of the sports changing rooms and cafe, as detailed in Section 5.4.9.

Whitehall College is a protected structure (reference 7746). Due to its protected status, the railings to the front of the college will be removed and the entrance to the college, with its gates, gate piers and railings will be taken up and reinstated further back along the access driveway to the college. Furthermore, this site will undergo a thorough archaeological excavation prior to any construction works. See Chapter 26 (Architectural Heritage) for further information.

The construction of the underground Griffith Park Station will be undertaken as detailed in Section 5.5.9 and will include 'top down' construction. The phasing of the works is detailed further in Appendix 5.3 (Construction Sequence Report).

5.10.6 Glasnevin Station and Interchange

The Glasnevin Station development is a complex project with key interfaces with other infrastructure stakeholders. The station development includes the construction of the new Glasnevin Station, platforms for two Iarnród Éireann commuter railways - the Western Commuter Line (old MGWR) and the South Western Commuter Line (old GSWR), and a concourse area to connect all three railways together.

There is a requirement to modify the Iarnród Éireann track layout and alignment at this location as part of the Project works. This will involve lowering a large section of the track by circa 2m and modification to the existing junction. In preparing the construction sequence, a coordinated approach to the track lowering is proposed to avoid closing both railways at the same time for the station construction works. Closure of the Western Commuter Line for a period of approximately 21 months is proposed, re-opening, and then closure of the South Western Commuter Line for 5 months. The overall sequence of works in the Glasnevin Station area has been linked with planned Iarnród Éireann infrastructure works.

Furthermore, there are interfaces with the proposed BusConnects Ballymun/Finglas to City Centre Core Bus Corridor Scheme route at the junction of the R108 Prospect Road and Whitworth Road. Therefore, the construction programme has been programmed to minimise potential environmental impacts at this location.

The construction working hours differ at this location due to the interface with existing Iarnród Éireann infrastructure and live railway line and will require working to be carried out on a 24 hour a day, seven days a week basis for some activities. These have been outlined in Section 5.2.4.

The main Glasnevin Station construction site will be situated on the west side of R108 Prospect Road at the intersection beside the Royal Canal. The site will support the construction of the following main elements (as detailed in Chapter 4 (Description of the MetroLink Project):

- The new underground Glasnevin Station with Iarnród Éireann interchange facilities;
- New Iarnród Éireann station in a retained cutting with the proposed Project interchange facilities; and
- Re-modelled heavy rail tracks to suit specified track and platform gradients with allowance for future electrification as part of the Dart Expansion Programme (Chapter 31 (Cumulative Impacts of Interactions between Other Projects) includes detail on future developments at this location).

The construction area is currently occupied by a furniture retailer, a public house and some office accommodation that will require prior demolition, as detailed in Section 5.4.9. The site is also intersected by two commuter railways

run by Iarnród Éireann. The proposed construction site is very constrained and in order to carry out the works, multiple phasing of activities will be required.

Sensitive receptors in this location include residential properties such as Dalcassian Downs, Shandon Gardens and the Coke Oven Cottages, Saint Vincent's Primary School, commercial premises and the Royal Canal. The residential properties at Dalcassian Downs are of particular sensitivity, bordering the northern boundary of the construction site. Potential impacts and mitigations have been assessed in the relevant environmental chapters throughout this EIAR.

The construction of the underground Glasnevin Station will follow the general principals outlined in Section 5.5.9 and will include 'top down' construction. The detailed construction methodology is provided in Appendix A5.5 and is summarised below.

Access to the construction site will be from the R108 Prospect Road and will be adjusted several times during the phasing of the works. Traffic coming to site from the north will turn right from R108 Prospect Road into site. Most traffic leaving the site will be heading north, towards the M50 Motorway. Temporary traffic measures will be required at the junction on the R108 Prospect Road and Whitworth Road to allow for access and egress to site. Temporary traffic measures are detailed in the STMP in Appendix A9.5.

Enabling Works will include the removal of identified invasive plant species (Section 5.4.3). Enabling Works will also require the demolition of P Hedigans public house (The Brian Boru), Des Kelly Interiors and Prospect House. In addition, as the works are carried out, demolition of existing railway infrastructure including existing tunnels and retaining walls will be undertaken. The approach to demolition will follow the steps outlined in Section 5.4.9. A number of these structures are of protected status and will require careful removal and reinstatement where required (e.g. railings at Dalcassian Downs).

Several utility impacts have been identified and typical construction methodology used for utility works is detailed in Section 5.4.10.

In order to provide the required working area for the scheme it will be necessary to temporarily close the Royal Canal, partially infill a section adjacent to the works and then re-open the canal. It is assumed that part of the canal wall will need to be dismantled and rebuilt on completion. Stakeholder engagement was carried out with Iarnród Éireann as well as Waterways Ireland and local residents to inform the construction methodology.

During construction, vehicular access along Royal Canal Way to Coke Oven Cottages will be severed by the piling works for the station. In mitigation, Enabling Works will include the construction of a temporary bridge crossing the Royal Canal to maintain access into the Coke Oven Cottages and to allow for connectivity along the Royal Canal Way. This will involve the construction of a temporary bridge crossing that will allow vehicular access to Coke Oven Cottages and pedestrians/cyclists to cross the canal and continue along the southern canal towpath to Prospect Road. The bridge will have sufficient clearance to allow canal traffic to operate and pedestrians on the tow path to pass underneath. A temporary widening of the tow path may be required.

Following the completion of the Construction Phase the canal towpath will be fully reinstated on its existing alignment. In order to maintain the existing width along the towpath a permanent cantilever structure will be provided to carry the towpath over the proposed Iarnród Éireann platform serving the Western Commuter Down Line.

The maximum duration of time that the Royal Canal will be impacted by the works is predicted to be 34 months. However, it is considered that the duration of full closure could be limited to approximately 5-6 months, with the canal remaining operational but with restricted width for the remaining time. It will only be necessary to close the canal towpath for a period of 4 weeks while the temporary road bridge is installed.

The existing track will then be lowered by circa 2m and modification to the existing junction which will require the removal of existing retaining walls to construct new platforms. The proposals include the use of a 'bridge slide' technique to reduce the duration required to install support to the South Western Commuter Line tracks. The tracks must be supported so that the station can be built below. The proposal is that a 'bridge' is built off-line and then slid onto preconstructed supports, rather than casting it in-situ and waiting for the concrete to gain strength. The track lowering work will also require the installation of Overhead Line Equipment (OHLE) supports for future electrification of the proposed Dart Expansion Programme.

Diagram 5.51 below shows pictorially the early, mid and later phases of the construction works.

Potential environmental impacts of the construction activities at the Glasnevin Station and Interchange have been assessed within the relevant environmental chapters of this EIAR.

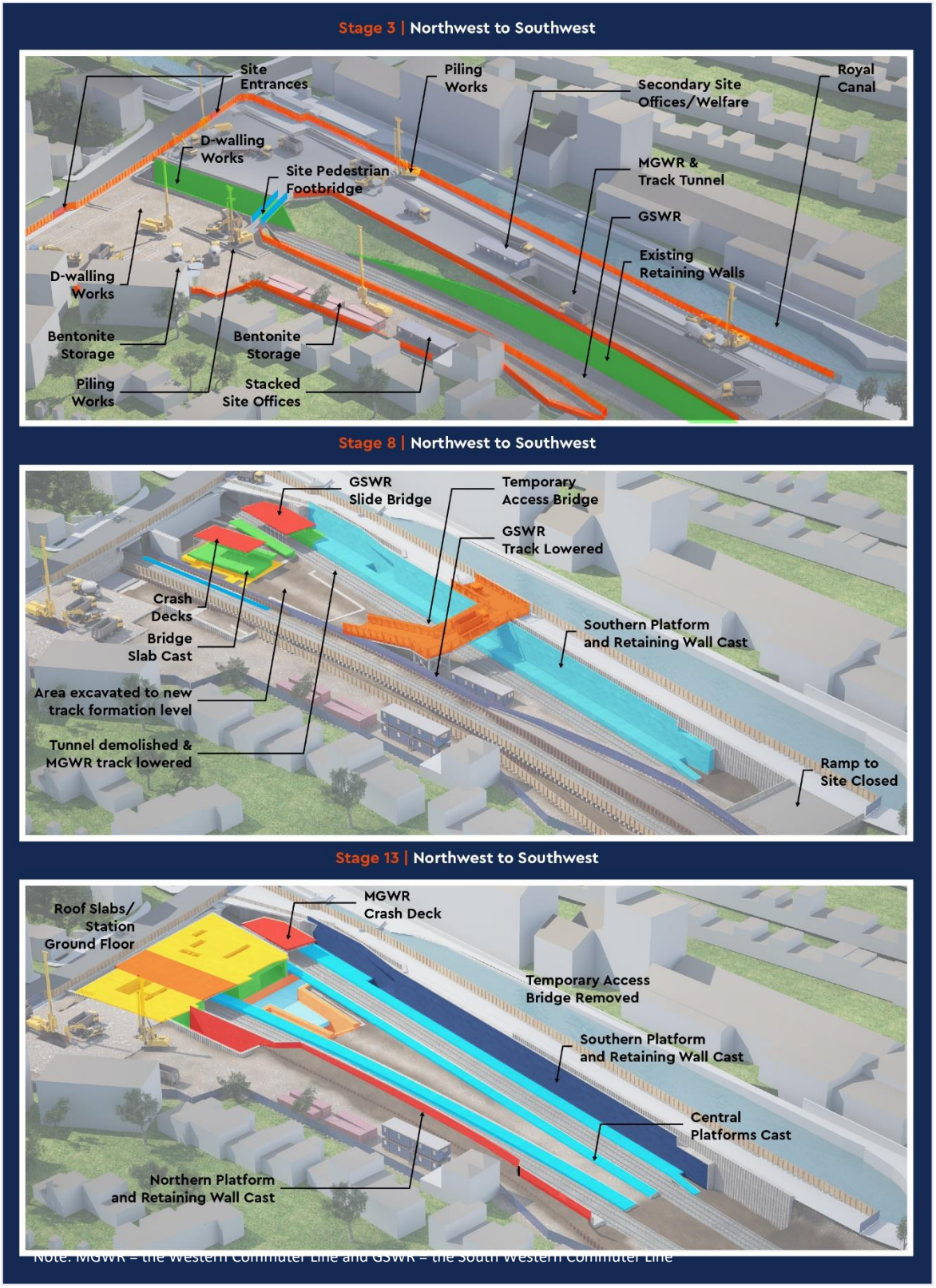


Diagram 5.51: Glasnevin Station Interchange Construction Phasing

5.10.7 Mater Station

The Mater Station construction site will be situated at the Four Masters Park to the north-west of St Joseph's Church on Berkeley Street. As the station footprint extends under both Eccles Street and Berkeley Street, temporary closures and diversions of these roads and footpaths will be required to allow for construction works to take place.

Access to site will be from the north-west end of the works and the exit is onto Berkeley Road near St Joseph Church. However, site access and exit may vary throughout the works. 24-hour access for emergency vehicles to Mater Hospital will be maintained during the Construction Phase. In addition, access will be maintained to St Joseph's Church throughout construction of the Mater Station.

Traffic coming to site will drive east from Junction 6 of the M50 Motorway down the R147 Navan Road, turning left onto the R147 Cabra Road which becomes the R101 North Circular Road and turning right on to Berkeley Road and entering the site. Traffic will leave site turning left onto Berkeley Road and then left again on to Blessington Street. Vehicles will then turn left once more on to Dorset Street Upper (N1) heading North to join the M50 Motorway. Temporary traffic measures are detailed in the STMP in Appendix A9.5 and will be carried out over three phases:

- Phase One – Diversion of foul, water, gas and comms services into a position within the footpath at Eccles Street;
- Phase Two - Diversion of foul, water, gas and comms services at Berkeley Road. These diversions will be staged across Berkeley Road (west to east) to maintain traffic flow; and
- Phase Three – Diversion of Berkeley Road to allow for construction of western vent shaft.

Once the western shaft works have been completed, then utilities will be diverted back onto the original line. Traffic management will include some of the following key measures:

- Access is provided at all times to St Joseph Church; and
- Ensure 24-hour emergency access is provided to the Mater Hospital.

No demolition of existing properties is required at this site. However, there are several items that will need to be removed and stored prior to reinstatement including the existing railings, the Four Masters Memorial Cross and the Healing Hands sculpture. These items are of protected status and are detailed further in Chapter 26 (Architectural Heritage).

Several utility impacts have been identified including, typical construction methodology used for utility works has been detailed in Section 5.4.10.

Further detail on construction phasing at the site is provided in Appendix 5.3. Site establishment will follow the methodology set out in Section 5.4.

The construction of the underground Mater Station will be undertaken as detailed in Section 5.5.9 and will include 'top down' construction. This section will also include the construction of a ventilation shaft under Eccles Street which will follow the methodology detailed in Section 5.5.19.

Given the sensitivity of the Mater Hospital, the methodology for the piling for the construction of the station box to the front of the hospital is to be devised in conjunction with a conservation engineer and is to take into account the nature of the construction of the retaining wall at the front of the hospital and the nature of the hospital building. Vibration monitors are to be provided in the hospital building in the vicinity of the works with alarms to identify any vibration that exceeds acceptable levels. In the event of the alarms being triggered works are to cease until the cause of the vibration is identified and systems modified to prevent recurrence. (Refer to Chapters 13 and 14 of the EIAR for further information on air and groundborne vibration). The potential impacts on the health of patients at Mater Hospital during the construction of the station is considered in Chapter 10 of the EIAR (Human Health).

Mitigation measures will be put in place to control the risk of construction dust entering the Mater Hospital site which utilises passive ventilation on Eccles Street. This will include sealing the windows to the facades that are in close proximity to the hospital. Dust mitigation measures will also be considered as mitigation with respect to Aspergillus as they will minimise the potential for spread of the fungal spores. (Refer to Chapter 16 of the EIAR, Air Quality, for further information on dust management).

5.10.8 O'Connell Street Station

This station will follow two potential construction scenarios due to a potential oversite development at this location. One scenario will include the over site development of a mixed-use quarter by Hammerson that will occur before the construction of the O'Connell Street Station and the second scenario will be based on if the mixed-use quarter does not go ahead. Both construction scenarios have been assessed within this EIAR and are described in Sections 5.10.8.1 and 5.10.8.2 below. Under the first scenario, the MetroLink station box is constructed by the Developer, with the MetroLink contractor(s) completing the station civil and MEP fit-out works.

The main O'Connell Street Station construction site will be on the western side of O'Connell Street Upper. The site is occupied by a variety of three and four storey buildings utilised as retail units at the ground floor along O'Connell Street with offices and back of house facilities above. There is also a cinema (Carlton Cinema).

A number of existing buildings and structures would require demolition to facilitate the development, however, others would be subject to conservation, refurbishment and adaptive reuse. Under Scenario One, these works would be undertaken by the developer at the outset of their own development and prior to the MetroLink works.

There are records of archaeological remains at the O'Connell Street Station site. This includes the remains of brickwork on Moore Lane RMP (DU018-020506). Furthermore, the area is an Architectural Conservation Area and has a number of National Inventory of Architectural Heritage (NIAH) buildings. Construction mitigation for archaeology and cultural heritage is discussed in Chapter 25 (Archaeology & Cultural Heritage) and Chapter 26 (Architectural Heritage). Due to heritage and historical importance some of the existing building facades will be temporarily supported and retained.

A summary of properties to be demolished, maintained and supported (under both Metrolink and the Developer delivered scenarios) is provided below and in Table 5.6:

Commercial properties to be demolished:

- 46-49 O'Connell Street Upper; and
- 55-56 O'Connell Street Upper.

Commercial properties to be partially demolished, maintained and supported:

- 43 O'Connell Street Upper – building façade;
- 44 O'Connell Street Upper – building façade;
- 45 O'Connell Street Upper – building façade;
- 52-54 O'Connell Street Upper – building façade;
- 57 O'Connell Street Upper- building façade; and
- 58 O'Connell Street Upper – building façade.

Commercial properties not for demolition and supported;

- 59 O'Connell Street Upper – whole building;
- 60 O'Connell Street Upper – whole building;
- 19 Henry Place – reading room and associated structure;
- 42 O'Connell Street Upper – whole building; and
- Rear of 55 to 57 O'Connell Street Upper – existing wall onto Moore Lane.

5.10.9 Scenario 1 – Oversite Development

The design of the station will be integrated with a planned commercial development for the site. Dublin Central Limited Partnership (DCLP) has submitted a planning application to Dublin City Council to develop the location known as Dublin Central bordered by O'Connell Street Upper to the east, Moore Lane to the west, Henry Place to the south and Parnell Street to the north. The proposal is to build a mixed-use development, comprising restaurants and cafes, retail units and offices over two to seven storeys, with a basement for parking.

The whole development would be structurally independent of and not prejudicial to the proposals for O'Connell Street Station (i.e. neither the oversite development or the station would be dependent on each other for structural

support). The Developer (Hammerson) construction strategy is to undertake the development in five phases. The development construction would be phased over 9 years.

The MetroLink station will be housed within a structural box provided by the Developer (Hammerson). This structural box would be large enough to accommodate the construction and operation of the station. Once the structural box is in place, and completed to the levels agreed with TII, the oversite development can be constructed over and around the station. The station box would be constructed during Phase 2 of the Development (Metro Enabling Works). The phasing is shown in

Diagram **5.52**.

The structural box has been designed to accommodate the independent construction and operation of the planned station by TII. In addition, the Dublin Central proposed development has made allowance for future integration with the proposed Project, by incorporation of coordinated structures, providing the structural envelope and coordinated voids to accommodate station entrances/exits, ventilation and fire escape shafts.

The basement and foundations for the Dublin Central development are designed to be totally independent of the O'Connell Street Station Enabling Works. Similar to all of the deep stations, the structural box for the station will be formed with D-walls and an in-situ concrete base slab and top slab. The deep excavation to create the structural box will be carried out between the D-walls with temporary props being introduced as excavation progresses. Following completion of the station structural box, the TBM will break in through the north wall, traverse through the station, and break out through the south wall.

In addition to the main station box construction compound established by the developer (Hammerson), two additional compounds (Area 1 and Area 2) will be required for the station civil and MEP fit-out works. Construction Area 1 would be located at the corner of Moore Street and O'Rahilly Parade. Vehicles will come from Parnell Street to Moore Street, turn left on to O'Rahilly Parade, to enter the compound on the right and exit turning left on Moore Lane and then left again on Parnell Street. Area 2 (approximately 150m^2) will be required on O'Connell Street to facilitate MEP/escalator fit-out works towards the end of the construction programme. Vehicle entrance and exit to Area 2 from O'Connell Street should not be required. Areas 1 and 2 are shown in

Diagram **5.52**.

During the station fit out a mobile gantry type crane or similar will be required for lifting equipment and materials down the access hatches/voids to the concourse, mezzanine and platform levels. There will be two access points; one via Moore Lane and the other via O'Connell Street. For the Moore Lane access point, night-time closures of Moore Lane will be required to allow unlimited lifting of materials and equipment. In addition, some daytime lifting will be required, with traffic held by traffic marshals in both directions. For the O'Connell Street access point, deliveries will be weekday nights and weekends only. The frequency and duration of all closures for lifting will be agreed with DCC.

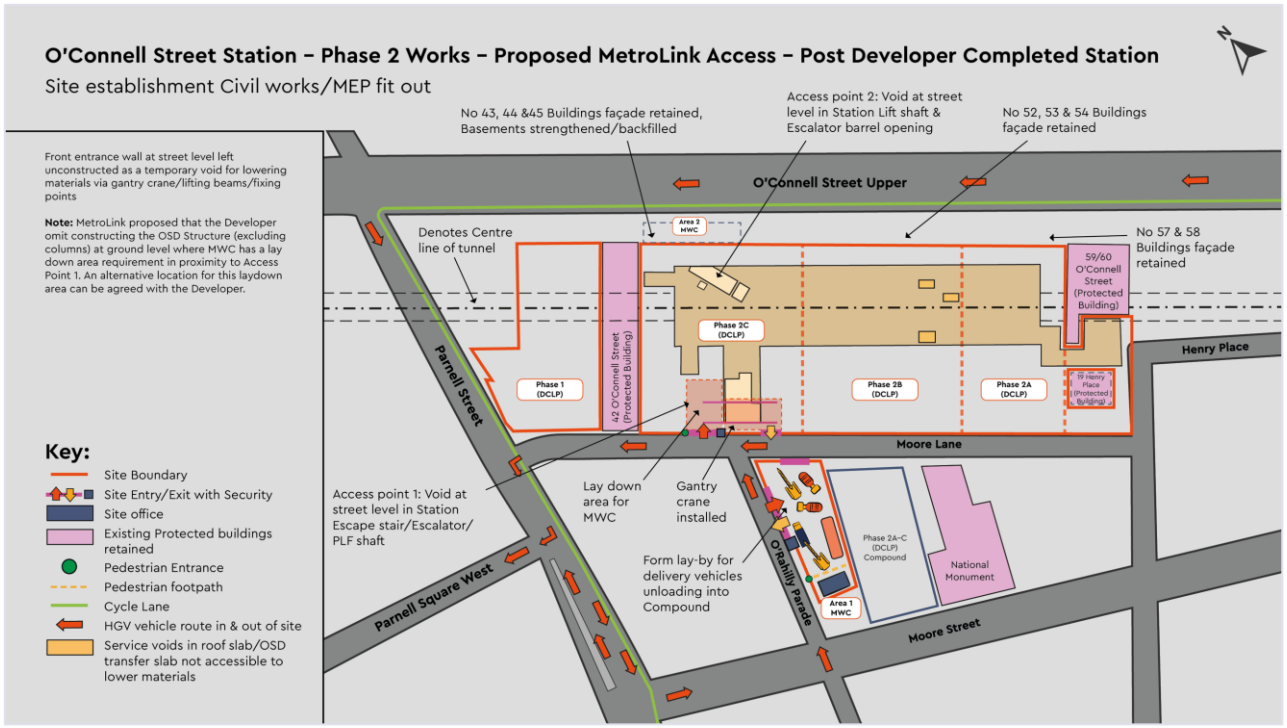


Diagram 5.52: O'Connell Street Station Construction Phasing - Oversite Development Scenario

5.10.10 Scenario 2 – No Oversite Development

If the Dublin Central Site 2 scheme does not obtain planning consent or is not progressed for any other reason, the station development will proceed with the below ground structural box being constructed by the appointed contractor(s) for the proposed Project. Construction of the structural box would proceed in the same way as that detailed above. The objective under this scenario will be to prepare the site for a future unknown development.

Under this scenario the proposed O'Connell Street Station Main Construction Compound will be located on the western side of O'Connell Street. It will occupy land at the crossroads of the O'Connell Street Upper, Parnell Street and Cavendish Row. A lorry holding area will also be required on a secondary site on the west side of Moore Lane.

Site establishment will follow the methodology set out in Section 5.4.5. Under Scenario Two, the demolition works will be carried out by the appointed contractor(s) for the proposed Project as detailed in Section 5.4.9. The protected facades of the buildings along O'Connell Street would be retained and propped ready to be incorporated into a future development.

Local site access and egress to the construction compound will be from Moore Lane via Parnell Street. There are two options for HGV construction vehicle access to the site. One option would access the site via the N1. Site traffic would take a left turn onto R101 North Circular Road followed by a turn onto R803 Summerhill, and finally a left turn into Moore Lane after approximately 1km. The other option would be to use the Dublin Port Tunnel and then travel westbound along the quays, until turning right onto O'Connell Street at O'Connell Bridge.

Exiting traffic would turn left onto Parnell Street and then right onto Chapel Street via Ryder Row. At the northern end of Chapel Street, vehicles would turn right onto the N1 and then continue in the northbound direction towards the M50 Motorway. Temporary traffic measures are detailed in the STMP in Appendix A9.5.

5.10.11 Tara Station

The main Tara Station construction site will be on the east side of Tara Street between Poolbeg Street and Townsend Street encompassing Luke Street and parallel with the existing Iarnród Éireann Tara Station. The site is located on land currently occupied by residential and commercial premises and some vacant plots. Similar to other sites, a small additional site is likely to be required as a lorry holding area to control the flow of HGVs into site.

Vehicle and pedestrian access into the site will be from Townsend Street and vehicle exit will be onto Tara Street. The proposed site access and egress routes from and to the M50 Motorway will be via the Dublin Port Tunnel. Temporary traffic measures are detailed in the STMP in Appendix A9.5 and includes:

- Luke Street and sections of Poolbeg Street will need to be closed during Enabling Works and the main Construction Phase. This will necessitate the diversion of traffic who would typically use the affected streets;
- Vehicles which would seek to route southbound on Luke Street from the R105 would need to route down the R802, which is parallel to Luke Street in the east. Vehicles seeking to route northbound on Luke Street would be required to use the street parallel to it in the west, the R802;
- Luke Street/Townsend Street junction will be closed on Luke Street arm, and therefore traffic routeing north would be required to make this northbound movement at the Tara Street/Townsend Street junction;
- The section of Townsend Street which is adjacent to the site perimeter will be reduced to a single lane for general traffic to accommodate an offset footway. Access to George's Quay Car Park may be impacted by the south east site boundary. To mitigate this, vehicles may need to use the existing exit on Luke Street as an entry point;
- Vehicles accessing the hotel service area via Poolbeg Street may need to be managed by a site banksman. The hotel's vehicle and bicycle lift on Poolbeg Street will remain accessible; and
- Special consideration will be given to emergency services which would be impacted by the closure of Luke Street. The Dublin Fire Brigade HQ is located directly to the south of Luke Street on Townsend Street. Townsend Street has a one-way system which routes eastbound, and therefore fire trucks wishing to route west would need to take a significant diversion via either Spring Garden Lane or Shaw Street in order to access a road which will allow for westbound movements. As such, a contra-flow lane is proposed for a section of Townsend Street for the fire brigade exit.

Site establishment will follow the methodology set out in Section 5.4. Residential and commercial premises (including disused buildings) and the Markovich Leisure Centre will need to be demolished prior to works commencing. The properties requiring demolition are detailed in Table 5.7, Section 5.4.9 of this chapter.

Due to the constrained space available at the Tara Construction Compound, Appendix A5.9 illustrates the demolition approach at this complex and sensitive location. Demolition has been considered and assessed throughout various environmental chapters of this EIAR, all of which feed into the outline CEMP (Appendix A5.1). Pre-demolition surveys will be undertaken to confirm which of the assessed proposed methodologies will be employed and provide sufficient detail to allow the full management of the demolition and resulting materials.

There are records of archaeological remains at this site, these include the remains of a church RMP (DU018-020648) and hospital (DU018-020061). There are also buildings of architectural heritage with Protected Structure status. Archaeology, cultural heritage and architectural heritage impacts have been assessed in Chapter 25 (Archaeology & Cultural Heritage) and Chapter 26 (Architectural Heritage) of the EIAR. Enabling Works for archaeology is discussed in Section 4.4.4.

Several utility impacts have been identified; typical construction methodology used for utility works has been detailed in Section 5.4.10. A new traction substation will be required at this location.

Due to the nature of the proposed layout at Tara Station, the eastern side of the station box is positioned in close proximity of the existing Tara Street Railway pier foundations. Protection measures will be incorporated into the station box construction methodology to ensure that the integrity of the existing pier foundations is not compromised.

The construction of the underground Tara Station will be undertaken as detailed in Section 5.5.9 and will include 'top down' construction. The phasing of the works is detailed further in Appendix 5.3 (Construction Sequence Report).

5.10.12 St Stephen's Green Station

The main St Stephen's Green Station construction site will be on the east side of St Stephen's Green, taking a portion of land within St Stephen's Green Park and the adjacent footway and carriageway.

Site access and exit will be from St Stephen's Green, R110 Road and access and egress routes from and to the M50 Motorway will be via Dublin Port Tunnel. As the station footprint extends under Stephen's Green East, it will be necessary to arrange temporary closure of one traffic lane to the east of the park. Footpath closures and temporary

pedestrian diversions will also be required. Furthermore, it is anticipated that one lane on Hume Street will be closed to support the utility works and will require suspension of parking bays and possible diversions.

Before construction can start there is a requirement to divert and or protect a series of existing utility services within the construction footprint. These services are prominently positioned within St Stephens Green East, lane one, cycle lane and car parking area. Works will also involve the relocation of an existing gas governor located inside the railings in St Stephen's Green as it is located within the proposed station box footprint. This work will require connections to existing gas mains. Further to utility works, street lighting and street furniture will be removed and stored securely until reinstatement. Typical construction methodology used for utility works has been detailed in Section 5.4.10.

Site establishment will follow the methodology set out in Section 5.4.5. Extensive tree and vegetation clearance is required on this site to facilitate construction which have been assessed in Chapter 27 (Landscape & Visual) and Chapter 15 (Biodiversity).

St Stephen's Green lies within a Conservation Area that includes the park and garden, the surrounding streets and most of the buildings facing the park. The Park itself is a designated National Monument and therefore archaeology, cultural heritage and architectural heritage impacts have been assessed in Chapter 25 (Archaeology & Cultural Heritage) and Chapter 26 (Architectural Heritage). Construction mitigation for impacts will be in line with Chapter 31 (Route Wide Mitigation & Monitoring).

It will be necessary to remove the existing railings that bound the east side of St Stephen's Green and these will be reinstated on completion of the station due to their protected status. The historical kerbstones in St Stephen's Green and paving in Hume Street are also protected and to be retained.

The construction of St Stephen's Green Station will be undertaken as detailed in Section 5.5.9 and will include 'top down' construction. The phasing of the works is detailed further in Appendix 5.3 (Construction Sequence Report).

5.10.13 Charlemont Station

The location for the Charlemont Station is a site bounded by properties on Dartmouth Square to the east, the Luas Green Line to the west, Grand Parade to the north and Dartmouth Road to the south.

The site currently has existing planning permission for a commercial development (Two Grand Parade). Planning permission was granted to Hines in April 2019. The existing permission requires the developer to facilitate the proposed Project by constructing a structural deck founded on bored secant piles which will form the central section of the Charlemont station box roof slab. This oversite development is detailed in Chapter 4 (Description of the MetroLink Project).

The development (comprising a new office block and basement car park) and the refurbishment of an existing office building to be retained, will occupy an area of approximately 3,300m². It is anticipated that the new development and the existing six storey office block fronting on to Grand Parade will be occupied during station construction.

The proposed station construction sequence considers maintaining access from street level to Two Grand Parade basement for car parking, cycle parking and access to plant rooms for service/maintenance. Access will be provided either from Grand Parade, or alternatively from Dartmouth Road, as agreed with the developer. A twenty-four-hour fire escape access from the building must also be maintained.

At this station location, the proposed construction works site and compound includes the full width of Dartmouth Road from the junction with Dartmouth Place to the junction with Cambridge Terrace, and existing parking bays will be suspended along this section. Initially, during utility diversions works, vehicle access to numbers 32 to 35 Dartmouth will be restricted, but during the full road closure for station construction, vehicle access will not be possible to these properties until the station and roof slab are constructed and the road is reinstated. The utility diversions work and subsequent station construction work in Dartmouth Road is anticipated to take up to four years. Number 35 Dartmouth Road and Number 11 Cambridge Terrace will have no driveway or garage access during this period. Pedestrian access will be maintained.

There will be two points of access to the Charlemont construction compound. To the north, access will be via Grand Parade. Temporary traffic works will include the closure of a 40m section of road on Grand Parade's west bound carriageway during periods of construction of the station and will require traffic management at all times to facilitate

safe access and egress to the site. The temporary closure of the westbound carriageway will be mainly during off peak periods, as and when required (i.e. such as offloading major plant items during site set up).

The principal access and egress to the construction compound will be from the south via Dartmouth Road. Dartmouth Road will be partially closed (one way traffic only) for 12 to 18 months for utility diversions and fully closed for between 24 and 30 months for the main station construction works. The movement of HGVs into and out of the compound will be predominantly from and to the west, via Junction 9 of the M50 Motorway, at a distance of approximately 7km to 8km.

A potential support site may also be required to allow for the location of project office and welfare units, workshops and stores. An option has been identified across the Grand Canal, located approximately 100m to the north east of the main work site, at the junction of Charlemont Place and Harcourt Terrace. The existing buildings could provide office and welfare accommodation.

Site establishment will follow the methodology set out in Section 5.4.5. Several utility impacts have been identified at this location. Typical construction methodology used for utility works has been detailed in Section 5.4.10. A new traction substation will be required in this location.

Noise, vibration, air quality and ground movement monitoring will be required for the oversite development due to the proximity to the MetroLink works. This has been detailed further in the relevant environmental chapters and the outline CEMP in Appendix A5.1. Monitoring requirements are summarised in Section 5.12.5.

The construction of the Charlemont Station box will follow the same basic 'top down' construction principles as described in Section 5.5.9 but will be phased accordingly to adapt to the constrained location. The east D-wall will be constructed within 600mm of the rear garden wall of Number 12 to 15 Dartmouth Square and thus the garden wall will require support during the Construction Phase. These properties are Protected Structures and lie within an Architectural Conservation Area. The properties will require protection with the installation of a 3.6m high acoustic barrier erected against the rear garden wall to reduce the impact of noise from the works. Additional protection measures in the form of ground treatment are proposed for the Carrolls Building to minimise any settlement impacts during station box construction.

5.10.14 Charlemont Intervention Tunnel

An intervention tunnel is required running from Charlemont Station, 320m southwards, and will connect to the end of the main City Tunnel. This is a 6.5m diameter tunnel to provide emergency access and ventilation from the TBM termination point 400m south of Charlemont Station to the south-east end of Charlemont Station at mezzanine slab level.

The construction of this tunnel is detailed in Section 5.5.4. Whilst mechanical excavation will be sufficient for many areas, drill and blast is expected to also be required for parts of the tunnel excavation which will result in groundborne noise and vibration. As the tunnel advances, sprayed concrete lining (SCL) works will be required to stabilise and seal the tunnel. Settlement and noise & vibration monitoring will be required during these works as described in the outline CEMP in Appendix A5.1. This has been further assessed in the relevant environmental chapters in the EIAR.

5.11 Construction Health and Safety

5.11.1 Health and Safety

All construction work in connection with the proposed Project will be carried out in accordance with relevant health and safety legislation and best practice, with particular regard to:

- Safety, Health and Welfare at Work Act, 2005;
- Safety, Health and Welfare at Work (Construction) Regulations 2013; and
- Other relevant Irish and EU safety legislation.

As required by the Regulations, a Health and Safety Plan will be formulated which will address health and safety issues from the design stages through to completion of the construction and maintenance phases. The plan will be reviewed as the development progresses. A Project Supervisor Construction Stage (PSCS) will be appointed by TII and a Safety File prepared for the Construction Phase.

The planning, testing and commissioning and operation of the proposed Project will be carried out in accordance with the Railway Safety Act 2005 and with consents and directions issued by the Commission for Railway Regulation under the Act. A safety management system and safety case will be in place for the operation of the proposed Project.

5.11.2 Fire Safety

Fire risk during construction is considered in Chapter 28 of this EIAR (Risk of Major Accidents & Disasters). An Emergency Response Plan will be developed by the appointed Contractor(s), in consultation with the emergency services and other relevant third parties and will be submitted to TII for approval.

5.11.3 Construction Site Management and Security

5.11.3.1 Construction Site Management

There will be a construction management team on-site for the duration of the Construction Phase. The team will supervise the construction of the works including monitoring the performance of the appointed contractor(s) to ensure that the proposed Construction Phase mitigation measures are implemented, and that construction impacts and nuisance are minimised.

5.11.3.2 Emergency Response Provisions

A set of standard emergency response procedures will govern the management of emergency incidents. As part of the detailed CEMP(s), the appointed contractor(s) will be required to detail emergency incident response procedures and to develop an Emergency Response Plan. The requirements of the plan have been detailed in the outline CEMP in Appendix A5.1 and will encompass incidents such as chemical spills, emissions to the air, water contamination, fires, gas leakages and damage to utility services.

Control measures outlined in this EIAR and the outline CEMP in Appendix A5.1 will be required to mitigate such incidents. Some standard control measures are listed below:

- Appropriate site personnel will be trained as first aiders and fire marshals;
- All staff will be trained in environmental issues and spill response procedures;
- Tanks and drums of potentially polluting materials will be stored in secure containers of compounds which will be locked when not in use;
- Secure valves will be provided on oil and fuel storage facilities; and
- Equipment and vehicles will be locked and be stored in secure compounds.

Refer to Chapter 28 (Risk of Major Accidents & Disasters) for further detail on risk.

5.11.3.3 Site Security

The primary function of the site's security team will be to ensure that no unauthorised entry to site occurs. There will be fencing around the sites to minimise the risk of vandalism and unauthorised access. This process will be made easier by all operatives possessing an ID card. ID Cards will only be issued to operatives that have attended the site induction and (if relevant) a medical examination. CCTV and alarm systems will be installed where required.

5.12 Environmental Management and Sustainability

5.12.1 Overview

This Section provides a high-level summary of the standard construction environmental controls to be followed by all appointed contractor(s). It also describes the key sustainability aims for the construction of the proposed Project. In order to provide a framework for these controls, the outline CEMP in Appendix A5.1 has been developed to ensure a consistent approach to environmental management during construction, having regard to the Sustainability Implementation Plan developed by TII.

All appointed contractor(s) will be subject to existing applicable legislation in addition with the conditions set out in this EIAR. Environmental controls and processes contained in this EIAR will provide the mechanisms for meeting

environmental commitments once the RO has been granted. The nominated undertaker and all appointed contractor(s) for construction will be required to comply with these requirements as outlined in the outline CEMP.

The outline CEMP will be further developed to take account of the requirements of the RO. The proposed Project extends across two Local Authority areas and will potentially impact a large number of stakeholders, necessitating engagement with all potentially impacted individuals and bodies. The outline CEMP in Appendix A5.1 is, therefore, intended to provide a framework to ensure a consistent approach.

5.12.2 Purpose of the outline CEMP

The outline CEMP in Appendix A5.1 provides an outline construction methodology for the proposed Project. In the event of approval being granted for the proposed Project and prior to commencement of works, the appointed contractor(s) which will be appointed by TII, will prepare a final CEMP. Each Contractor will be required to have their own CEMP.

The outline CEMP will be a key part of the construction contract to ensure that all mitigation measures, which are considered necessary to protect the environment, prior to construction and during construction of the proposed Project, are fulfilled. These plans will be required to incorporate the material elements of the mitigation measures outlined in Chapter 31 (Summary of the Route Wide Mitigation Measures) of this EIAR.

The final CEMP(s) can only be completed post-consent as it will include method statements and work programmes that provide more detailed phasing of work based on the methodologies described in this Chapter, and the mitigation measures contained in this EIAR. The appointed contractor(s) will develop a series of detailed plans for the construction of the infrastructural components associated with the proposed Project, as listed in Chapter 4 (Description of the MetroLink Project).

The detailed contents of the final CEMP produced by the appointed contractor(s) will be agreed with TII and will be prepared in consultation with local and other appropriate authorities, including FCC and DCC, as well as statutory bodies, such as daa, National Parks and Wildlife Service (NPWS), ESBN, Irish Water (IW), OPW, Inland Fisheries Ireland (IFI), Waterways Ireland (WI) and Iarnród Éireann. TII will employ a team to monitor the Construction Phase of the proposed Project and ensure works are being carried out by all appointed contractor(s) in accordance with the final CEMP and agreed method statements, safety procedures and pollution control measures. TII's construction management team will include resident engineers, project managers, surveyors and technicians, as well as project archaeologists, ecologists, agronomists and other specialists to supervise compliance by the contractors with the final CEMP across all the specialist areas of the plan.

It should be noted that while the construction methodology described in this Chapter is based on experience in similar railway infrastructure projects, it also considers the characteristics of the receiving environment in respect of this proposed Project. Any issues specific to the proposed Project, for example specific mitigation measures contained in the EIAR, any planning conditions attached to any approval which the Board may decide to grant, or agreements with stakeholders will be incorporated fully into the scope of works for the appointed contractor(s) and careful supervision and management will be carried out to ensure full compliance.

Key elements included in the outline CEMP assessed in this EIAR include:

- Traffic and transport during construction and mitigation measures assessed in Chapter 9 (Traffic & Transport);
- Noise and vibration sources in construction and mitigation measures assessed in Chapter 13 (Airborne Noise & Vibration) and Chapter 14 (Groundborne Noise & Vibration);
- Management of Invasive Species addressed in Chapter 15 (Biodiversity) and Appendix A15.8 (outline ISMP);
- Dust minimisation addressed in Chapter 16 (Air Quality);
- Mitigation measures for storm water and discharge runoff addressed in Chapter 19 (Hydrology);
- Ground settlement mitigation measures addressed in Chapter 20 (Soils & Geology); and
- Construction Phase waste management addressed in Chapter 24 (Materials & Waste Management).

In addition, guidance on the requirements of the information to be included in the final CEMP can be found in the National Roads Authority Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan, this document has been used as a guide during the development of the outline CEMP.

5.12.3 Environmental Management System

As part of the proposed Project's implementation, all appointed contractor(s) will develop and implement an environmental management system (EMS) in accordance with EN ISO 14001:2015 or the most updated version prior to construction. The scope of the EMS will cover all phases of the proposed Project's construction and will be designed to help the appointed contractor(s) to meet their environmental legislation obligations.

The nominated undertaker and all appointed contractor(s) will be required to be accredited in accordance with EN ISO 14001. The EMS for the proposed Project will provide the process by which environmental management both within its organisation and in relation to its operations is undertaken to ensure that the relevant findings of the EIAR are addressed throughout the Construction Phase. The EMS will set out:

- The procedures to be implemented to plan and monitor compliance with environmental legislation and other relevant requirements;
- The key environmental aspects of the work and how they will be managed;
- Staff competence and awareness of requirements and how these are to be achieved and maintained;
- Record keeping arrangements; and
- The procedure to monitor compliance and the effectiveness of the measures included within the outline CEMP in Appendix A5.1.

5.12.4 Construction Phase Sustainability

The proposed Project has been developed with consideration to TII's Sustainability Implementation Plan principles. These principles are presented in Chapter 4 (Description of the MetroLink Project, Section 4.1), which also articulates how the project team will approach the delivery and operation of the proposed Project to maximise sustainability. Having regard to the TII Sustainability Implementation Plan, the key sustainability aims for the project which will be adopted through the Construction Phase of the proposed Project are as follows:

EN2: Materials and Resources - minimise the use of materials, natural resources and the production of waste

- Implement a Waste Management Plan for Construction and Demolition Waste to minimise disposal to landfill.
- Undertake lifecycle assessments for major asset components and implement recommendations to influence procurement of low carbon/ sustainable materials and equipment.
- Procure materials for major asset components that have verified Environmental Product Declarations (EPD).
- Achieve a reduction in mains water use during construction, through the use of rainwater harvesting, water re-use and efficiency systems and devices at all work sites.
- Zero major pollution incidences during construction and zero accidental or non-consented releases, pollution events.

EN4: Heritage - promote protection of and access to heritage

- Develop and implement an ongoing heritage monitoring strategy.
- Implement measures to retain historic setting of heritage features.

CC1: Skills and Learning - provide opportunities to upskill, learn and develop in the construction and transport sector

- Provide an inclusive approach to recruitment, staff training and rotas to build community relationships and foster a sense of safety.
- Develop and implement a programme of community engagement to raise awareness of sustainability topics linked to the construction of MetroLink.
- Facilitate multidisciplinary workshops (including client, designers, technical specialists and contractor), encouraging collaboration to identify challenges and opportunities of delivering MetroLink.
- Incorporate skills and learning targets into MetroLink's construction contracts and measure and report progress on a monthly basis.

CC2: Community and Engagement – broad and meaningful engagement and consultation with all stakeholders

- Develop and maintain a Stakeholder and Community Engagement Plan, including a centralised complaint reporting line and minimum standards for resolution during construction.

- Provide a dedicated and responsive helpline and social media channels for the community before construction starts.
- Develop and implement a programme of community engagement to raise awareness of sustainability topics linked to the design, construction and operation of MetroLink.

CC3: Safety - deliver and operate MetroLink Safely, leading by example

- Use a universal design approach to design out safety issues in the construction and operational phases of MetroLink.
- Establish a culture of everyone home safe at the end of their shift.
- Develop and include targets for the safe construction of MetroLink.
- Implement and maintain an inclusive operational Emergency Response Action Plan.
- Implement and maintain measures to reduce antisocial behaviour, including provision of real time CCTV and appropriate lighting.

CC4: Health and Wellbeing - demonstrate and deliver health and wellbeing benefits

- Establish the noise and vibration baseline and implement and monitor mitigation measures to reduce impacts during construction.
- Establish an air quality baseline and collaborate with others to deliver reductions in air pollution.
- Deliver construction logistics plans that mitigate the impacts of construction traffic on the communities MetroLink works in.
- Include targets for worker and community health and wellbeing in MetroLink's contracts.

SE2: Productivity - demonstrate increased productivity during construction and associated with the delivery of MetroLink

- Identify innovative technologies and practices that provide value for money and additional benefits to MetroLink users.

SE4: SME and Local Spend - encourage and include local and small and medium-sized companies to engage in tendering opportunities.

- Implement a sustainable procurement strategy, aligned with TII's procurement policies.
- Incorporate sustainability requirements into all tenders to consider local and SME businesses and local employment.
- Use "meet the buyer" events to promote opportunities to supply MetroLink.

The ways in which these key sustainability aims will be implemented during the Construction Phase of the proposed Project are outlined below.

5.12.4.1 Materials and Resources

5.12.4.1.1 Resource Use and Waste Management

The proposed Project will be constructed to be resource efficient, minimising the use of materials, carbon, energy and other resources in order to reduce environmental impacts and costs; and implement a circular approach to the use of materials. Throughout the construction of the proposed Project, solutions will be implemented to minimise the consumption of materials and the generation of waste throughout the lifecycle of the proposed Project.

All waste will be managed in accordance with the waste hierarchy (see Diagram 5.53), as set out in the Waste Framework Directive (2008/98/EC), in such a way as to prevent harm to human health, amenity and the environment. The primary objective in the construction of the proposed Project will be at the top of the waste hierarchy on zero avoidable waste, i.e. preventing waste and reusing waste wherever possible.

Diagram 5.53: Waste Hierarchy

The types and quantities of construction materials required as well as waste to be generated through the construction of the proposed Project have been estimated, along with estimates of the quantities to be reused within the proposed Project and waste recycled/recovered off site. Materials import and waste export during the Construction Phase, of the proposed Project, has been assessed against the assessment criteria detailed within the IEMA Materials and Waste in Environmental Impact Assessment guidance (IEMA 2020). Please refer to Chapter 24 of the EIAR (Materials & Waste Management) for further information.

An outline CEMP (Appendix A5.1) has been developed which details the requirement for the contractor to develop a Construction and Demolition Waste Management Plan (C&D WMP). The C&D WMP will identify how waste arisings are to be controlled and managed during the course of the proposed Project, in particular how waste prevention principles will be applied and how on-site waste will be minimised.

The Contractor(s) will also be responsible for management of the ordering of supplies, ensuring that supplies are ordered as needed to avoid over-ordering or the requirement for long-term storage of materials, thus reducing the potential for damage or expiration of supplies while being stored on site.

An Excavated Materials Management Strategy has been prepared for the proposed Project and included with this EIAR as Appendix A24.1. The overall objective of the Excavated Materials Management Strategy is to provide an initial summary of excavated material arisings that will be generated during the proposed Project and highlight the methods and sites for reuse, recovery, recycling and disposal of the excavated material to ensure that the amount of that material that is disposed of as waste is minimised. This Excavated Material Management Strategy is to be used by the Contractor(s) to develop an Excavated Materials Management Plan to be followed during the excavation phases of the proposed Project. Please refer to Section 5.5.9 for further information on the handling and disposal of excavated materials.

5.12.4.1.2 Water Usage

All contractors will prepare a Water Management Plan. Such a plan will apply commitments made within the proposed Project contract towards the minimisation of water use, conservation of water and water efficiency measures on the proposed Project worksites. To ensure that the Water Management Plan remains relevant, adequate and effective as the works progress it should be reviewed and updated as necessary:

- Following any change that has a significant impact on water usage;
- As instructed by the proposed Project Manager, and
- At least every six months.

The Water Management Plan should set out a number of key objectives and targets towards conserving and minimising water use, as the following examples:

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

- **Substitute** - identify and use alternative 'non-potable' sources and eliminate inappropriate use of drinking (potable) water. Utilise a rainwater harvesting system where possible to collect run off from site temporary accommodation. Assess whether rainwater or grey water can be used for the activity/process;
- **Reduce** - explore options that improve efficiency, e.g., by regular maintenance of water-using equipment (to ensure they are working to maximum efficiency), installing metering and monitoring supplies, and updating fittings and/or processes on a regular basis;
- **Reuse** – identify whether wastewater can be reused in a process or activity, e.g., wheel washing. This would include surplus water extracted from ground dewatering activities which would normally require filtering through settlement or flocculation tanks prior to discharge to sewer. This source could be tankered to other sites for general use; and
- **Disposal** - dispose of excess water legally and responsibly to ensure prevention of flooding, pollution or inconvenience to stakeholders.

Minimisation of the use of water should be considered during planning for each stage of the works, incorporated into relevant procedures and method statements, and with steps to eliminate or minimise water usage incorporated and utilised where possible. Mains water connections will be fitted with meters such that potable water usage is monitored and managed. Where practical and possible, water should be reused on-site. Construction activities on the proposed Project identified as having the potential for high water use should be specifically targeted against opportunities to reduce water use, utilising the hierarchy of objectives listed above. For more detailed information on minimisation of water consumption and specific examples for the construction of piling and D-walls, tunnelling and dust suppression please refer to Appendix A5.12.

5.12.4.2 Power Usage

As far as possible, a mains electricity supply will be established at the construction compounds. However, power for more remote activities such as cuttings and embankments would typically be served by generators. Where generators are expected to be the only option for power supply at intermediate site compounds, then alternatives to diesel powered units will be considered. For example, the use of portable gas-powered generators, solar panels with battery packs, and (potentially) wind generators should be considered as alternatives to diesel power. Hydrogen fuel cells, commonly used for low power activities such as overnight security and lighting, may also be an option here.

Where practical, mains electricity will be provided at the construction compounds during the site setup stage, in preference to the extended usage of electricity generated by diesel power in the early stages of construction. To avoid any unnecessary wastage, permanent power supplies should be brought on-site to supply the construction works at the level of supply required for permanent operations, where possible. However, power for construction at the main tunnelling sites and for the TBMs, in particular, will be well in excess of the power requirements for permanent operations in these locations and will potentially require decommissioning of capacity post completion of the works. Planning for this will form part of the agreement with ESBN during the power application at these locations.

5.12.4.3 Heritage

The proposed Project has the potential to affect areas of heritage as a result of extensive excavation works, demolition of buildings, and construction of stations. Heritage conservation has been a key consideration throughout the design and construction of the proposed Project and the potential impact of the proposed Project has been assessed. Various elements of the Construction Phase have the potential to impact on the archaeological and cultural heritage resource. These impacts are discussed in further detail in Section 27.7.2 of Chapter 25 (Archaeology & Cultural Heritage).

A draft MetroLink Cultural Heritage Strategy has been prepared by TII's Project Archaeologist and Conservation Architect and will be implemented during the Construction Phase (refer to Appendix A25.1 of the EIAR). Archaeological investigation and resolution of archaeological constraints in greenfield land and parklands (where feasible) will be required at various locations and will be included in the Enabling Works programme. These works will comprise a variety of techniques, dependent on the nature of the receiving archaeological constraint and archaeological works already undertaken at the location to date.

The archaeological techniques likely to be used will include archaeological geophysical surveys, underwater and detection surveys, archaeological test excavations, archaeological monitoring and, where necessary, preservation by record (excavation). This work will be carried out by specialist Archaeological Contractors or Archaeological Consultants appointed by the Enabling Works Contractors. During Main Construction Works, archaeological

monitoring and preservation by record (excavation) will be required in areas previously not accessible (e.g. parks or carriageway), or those not fully resolved during the Enabling Works (e.g. utility works), and for which preservation in situ is not possible. These works will be undertaken by the Contractor's Archaeological Consultants.

The MetroLink Project Conservation Architect (PCA) will undertake Structural and Condition Surveys of built and cultural heritage constraints that will require removal to secure storage (followed by conservation and reinstatement) or protection in situ. A specialist Heritage Works Contractor will be appointed to remove, store and conserve these constraints. For example, construction of the station in St Stephen's Green will require the Wolfe Tone monument to be relocated further into the park. This will retain the monument's historic setting and allow greater and safer appreciation of the monument as a sculpture, rather than as a barrier. The existing railings and footpath floor finishes will be preserved, and the station box will be deep enough to guarantee the relocation of trees above, integrating the station with the park setting. The contractor(s) will appoint Consultant Conservation Architects to implement required preservation of in situ works.

Mitigation of impacts on the archaeological and cultural heritage resource that would occur during the Construction Phase of the proposed Project will be a staged approach that will be carried out during the pre-construction, enabling and main infrastructure works phases. Mitigation measures are set out in the outline CEMP (Appendix 5.1 of the EIAR) and Chapter 31 (Route wide Mitigation & Monitoring Proposed).

5.12.4.4 Skills and Learning

The proposed Project is seeking to develop a skills and learning programme that reflects industry skills requirements, local demographics, and the need for a gender-balanced workforce across all fields. The programme will also reflect the regulatory drivers and wider government priorities around skills, employment, diversity and business growth in the construction and transportation sector. This is best achieved by collaboration and the proposed Project is identifying partners to help deliver this. The proposed Project will develop the following opportunities to provide skills and learning to the construction workforce and the supply chain by:

- Mitigating skills shortages and gaps through training and upskilling; and
- Supporting a diverse, gender equal and inclusive workforce.

5.12.4.5 Community and Engagement

A Stakeholder and Community Engagement Plan has been developed which has guided the frequency and means of communication to date. The proposed Project will continue to progress community engagement by:

- Regularly reviewing and updating stakeholder and community engagement plans;
- Actively maintaining partnerships and design focus groups established with the community; and
- Communicating in a timely and open manner.

TII and its appointed contractor(s) will ensure that local residents, occupiers, businesses, local authorities and all other stakeholders affected by the proposed construction works, as outlined in this EIAR, will be informed in advance of work taking place. The notifications will detail the estimated duration of the works, the working hours and the nature of the works. In the case of works required in response to an emergency, the local authority, local residents and businesses will be advised as soon as reasonably practicable. All notifications will include a local helpline number. In addition, information on the works will also be available on the proposed Project website. TII will further develop the Community Engagement Plan to encompass the construction and operational phases of MetroLink.

5.12.4.6 Safety

The proposed Project involves complex engineering and construction techniques. The proposed Project can build on the safe delivery of infrastructure projects by TII and lead by example, considering safety in design and through the procurement of appointed contractor(s).

The proposed Project will comply with all relevant health and safety legislation in its design, construction and operation. TII is committed to following best health and safety practice and reinforcing the importance of safety culture, through leadership, engagement and communication. TII will develop targets for the safe construction of MetroLink and periodically audit the safety performance of its contractors.

5.12.4.7 Health and Wellbeing

The proposed Project has undertaken extensive assessments as part of the EIAR process to understand the potential impacts of noise, air quality and traffic on the communities involved and mitigation measures are in development, which will be implemented through a CEMP. Refer to Chapter 10 (Human Health) for further details on the potential health impacts and benefits of the proposed Project.

5.12.4.8 Productivity

TII will establish a construction productivity benchmark for MetroLink and track progress against this benchmark on a monthly basis.

5.12.4.9 SME and Local Spend

Increased employment during the construction of the proposed Project will have a direct positive impact on the local and regional economy. The proposed Project will create opportunities for local and SME businesses during construction, which will in turn benefit residents and the Irish economy as a whole. TII will encourage contractors to source staff locally and to consider and include underrepresented groups.

5.12.5 Monitoring

All appointed contractor(s) will undertake the necessary monitoring for each environmental factor to comply with the requirements of the EIAR and the outline CEMP in Appendix A5.1, any additional consent requirements and their EMSs. Aspects to be monitored will include the impact of the works and the effectiveness of mitigation measures. Any actions that may be necessary for compliance will be identified.

Effective monitoring for airborne and groundborne noise and vibration will be essential during the construction works. There are no statutory standards in Ireland relating to noise and vibration limit values for construction works. The construction works shall therefore be undertaken within the noise and vibration threshold levels identified in the EIAR for both airborne and groundborne noise and vibration and the limits that will be contained in a RO approval. Noise and vibration monitoring will take the form of:

- Off-site noise and vibration monitoring to demonstrate compliance with limit values (agreed with the local authority and set out in the EIAR);
- On-site surveillance monitoring to demonstrate that the noise and vibration mitigation, methods and assumptions set out in the RO consent are being adopted on-site; and
- Continuous noise and vibration monitoring near sensitive receptors.

Environmental noise and vibration monitoring will only be undertaken by suitably trained and experienced staff.

Monitoring measures specified within each of the EIAR technical assessments is summarised in Chapter 31 (Summary of Route Wide Mitigation & Monitoring).

5.12.6 Staff and Worker Travel

All staff and workforce will be encouraged to make their way to site and home from site by public transport, by project specific transport (e.g. minibuses), by bicycle or on foot. Limited parking spaces will be provided for vehicles required for the construction activity and for employees.

The below principles, regarding mobility to and from site, will be implemented across all construction sites where feasible to reduce the impact of the proposed Project on the local community and wider environment:

- Minimise car use by limiting or removing parking capacity;
- Providing suitable secure cycle storage capacity to promote use;
- Ensure safe and segregated pedestrian access to site;
- Provision of site-specific transportation (e.g. minibuses) to and from local transport hubs (e.g. train station and bus stops);
- Maximising alternative fuel types for any transport provisions provided (e.g. electric minibuses);
- Encouraging schemes to promote ‘green transport’ options (e.g. Cycle to Work Scheme); and

- Encouraging remote working to take place where feasible and limiting unnecessary visits to sites.

5.12.7 Construction Noise, Vibration and Dust

5.12.7.1 Dust Minimisation

The greatest potential impact on air quality during the Construction Phase is from construction dust emissions, and the potential for nuisance dust. Dust is characterised as encompassing particulate matter with a particle size of between 1 and 75 microns (1- 75µm). Deposition typically occurs in close proximity to the source and potential impacts generally occur within 350m of the route used by construction vehicles on the public road, up to 500m from the construction site entrance. The potential magnitude of dust emissions for each construction site are detailed in Chapter 16 (Air Quality).

Construction dust will be controlled and managed in accordance with the CEMP, and a Dust Minimisation Plan will be formulated for the Construction Phase by all appointed contractor(s). The Plan will be based on the draft Dust Management Plan contained in Appendix A16.4 of the EIAR.

The potential for dust to be emitted depends on the type of construction activity being carried out as well as ambient weather conditions including rainfall, wind speed and wind direction. The Dust Minimisation Plan will outline measures for the control of dust for the duration of the project. Such measures are addressed in Chapter 16 (Air Quality).

5.12.7.2 Noise and Vibration

Groundborne noise and vibration may potentially arise due to the following construction activities: excavation of the tunnel using a Tunnel Boring Machine (TBM); excavation of rock and soil from shafts and station boxes by means of drilling and blasting and/or mechanical excavation; insertion of D-walls and/or secant piles at station boxes; and excavation of intervention tunnels. Groundborne noise and vibration is assessed in Chapter 14 (Groundborne Noise & Vibration).

Airborne noise and vibration may arise from the same construction activities but also from surface construction works such as demolition, utility diversions, concrete works, track laying and station fit out. Airborne noise and vibration is assessed in Chapter 13 (Airborne Noise & Vibration).

Construction noise and vibration will be controlled and managed in accordance with the CEMP and will be kept to a minimum in accordance with BS 5228 Noise and Vibration Control on Construction and Open Sites (Parts 1 and 2), (BS 5228, 2009 +A1 2014). The CEMP will encompass a Noise and Vibration Management Plan which will be formulated for the construction phase and used by all contractors based on the mitigation measures outlined in Chapter 13 (Airborne Noise & Vibration), Chapter 14 (Groundborne Noise & Vibration) and the outline CEMP (Appendix A5.1).

The Construction Noise and Vibration Management Plan (CNVMP) for the proposed Project will be a live document. This will involve a detailed investigation of potential noise and vibration impacts associated with each construction compound (including groundborne noise and vibration). The assessment will identify through modelling and calculation, predicted construction noise levels, identification of potential exceedance of construction noise thresholds (CNT) and identification of required noise mitigation measures specific to each work area to minimise noise and vibration impacts so far as is reasonably practicable.

Noise mitigation measures that have been assessed as being required at this stage include physical barriers, comprising a 2.4m tall construction hoarding (to be implemented as standard around all construction compounds and linear work areas along the R132), with an additional 4m tall noise screen required the following locations:

- Construction compound at R125 /Lissenhall Roundabout – west of R132
- Estuary Court – east of R132
- Seatown – east boundary
- Ashley Avenue/ Grove - east of R132
- Lakeshore Drive - east of R132
- R125/R132 Junction - east
- Nevistown West – west and east boundaries
- Dublin Airport - west boundary

- Collins Avenue - east, south and north boundaries
- Griffith Park - east boundary
- Glasnevin - north, south and east boundaries
- Mater Compound - mid-east, south and south west boundaries
- O'Connell Street - north west boundary
- Tara - west and south boundaries
- Charlemont - east, west and southern boundaries.

At Charlemont, a taller 7m noise screen will also be required at the northern boundary.

The following locations will require an enclosed working area to reduce night-time noise impacts:

- At Northwood Portal, an enclosed structure will be constructed around the surface working area prior to the operation of the TBM;
- At Albert College Park, during SCL night-time support works, an acoustically clad steel framed building will be used within the compound to control airborne noise breakout to surrounding sensitive properties;
- At Griffith Park, during track laying first fit concrete works, the batching plant operations will be enclosed within an acoustically clad steel framed building to control airborne noise breakout to surrounding sensitive properties; and
- At Charlemont, during SCL night-time support works, an acoustically clad steel framed building will be used within the compound to control airborne noise breakout to surrounding sensitive properties.

Other mitigation measures to be implemented and detailed in the CNVMP will include:

- A monitoring programme for airborne and groundborne noise and vibration;
- A communication strategy to inform those potentially impacted of upcoming proposed works;
- A programme of noise and vibration control audits;
- Provision of noise insulation at sensitive locations identified as being impacted will be used to avoid and reduce significant effects along the edge of the construction site boundary; and
- Potential short-term temporary rehousing of residents impacted by noise and vibration in the event that it is not practical to mitigate against significant adverse effects on a property.

Further information on noise mitigation measures is provided in Section 13.6 of the Airborne Noise & Vibration Chapter (Chapter 13).

5.12.8 Drainage, Discharge and Wastewater Treatment

Foul water drainage will be installed at the construction sites to collect discharge from office and welfare accommodation. Where possible, this will be connected to mains sewers in local highways, or alternatively to a septic tank for emptying by road tanker.

Generally, the construction sites will be pervious, as they are overlain in stone, which will permit the percolation of surface water through to the underlying subsoil. Surface water drainage will be installed to collect and contain surface water runoff from hardstanding areas, particularly at locations where there is a risk of fuel spillages. Those areas with impervious surfacing will be graded to a fuel/oil separator. The retained contents of the fuel/oil separators will be collected for disposal by licensed operator to a licensed waste disposal/recovery facility. Surface water run-off from the construction compounds will be discharged to ground where soil conditions allow, or to a watercourse or to surface water sewer if of sufficiently good quality.

Construction wastewater will principally be generated from the following activities: groundwater dewatering, washing down (surface, underground (deep stations) and tunnels), dust suppression, concrete batching, wheel washing, TBM cooling and TBM conditioning. Wastewater will be recycled where possible (e.g. for wheel washing and boot washing) or reused (e.g. for dust suppression or grout mixing). Water that cannot be recycled or reused will require disposal by discharge to a foul sewer. Where this is not possible, wastewater will need to be tankered off site to a suitably licensed treatment facility.

Wastewater may require pre-treatment prior to reuse or disposal. On-site treatment may involve settlement, filtration and/or flocculation to remove suspended solids. All wastewater discharges to sewer networks will be classed as trade effluent and will require a Trade Effluent Licence from Irish Water. Pre-connection applications have been

submitted to Irish Water for each construction compound. A Trade Effluent Licence sets out conditions that businesses must comply with. These may include:

- The nature, composition and volume of the trade effluent discharge;
- The method of treatment, the location of discharge and the periods during which discharge may be made;
- The taking and analysis of trade effluent samples and the trade effluent records that must be kept; and
- Applicable charges for discharging trade effluent, as approved by the Commission for Regulation of Utilities (CRU).

Discharging to watercourses requires a wastewater discharge licence or certificate of authorisation from the EPA. There are stringent conditions attached to wastewater discharge licences to ensure the water is of good quality and does not negatively impact on the environment. Monitoring of any discharges will be undertaken in accordance with the licence requirements.

As water usage will vary from site to site, then the volume of wastewater to be disposed of will vary. An approximation of the peak volumes of wastewater that could be required to be discharged from each construction compound is contained in Appendix A5.11.

Further detail on water management is contained in Chapter 18 (Hydrology), the outline CEMP (Appendix A5.1) and Water Management (Appendix A5.11).

Surface water drainage will be installed throughout the alignment, particularly at low points where pumped drain routes will be used to remove any collected water. Mechanical lifting aids will be installed for ease of maintenance access. Drainage systems to be installed as part of the Rail Systems Installation are detailed in Section 5.5.20.

5.12.9 Construction Lighting

Adequate temporary site lighting is necessary for the safety of the workers and for the quality of the work to be executed properly. For construction sites to work effectively and safely, it is important that the site is well lit, either by natural or artificial lighting. There are a wide range of lamps and temporary lighting equipment available to provide artificial lighting. Lighting equipment can be fixed to support poles, scaffolding, temporary structures e.g., hoardings and tower cranes, or it can be put on movable supports.

The general approach that will be taken to construction lighting is set out in Appendix A5.18. A Site Lighting Plan will be prepared by the appointed contactor(s) for each site to detail how health and safety legislative requirements will be met in ensuring adequate levels of lighting for the protection of the employees. The Plans will provide design layouts and demonstrate how the following controls are met by the design.

The Site Lighting Plan will take into consideration the type of work activities to be undertaken, and therefore the associated level of lighting requirements. Site lighting will be provided to ensure safe working conditions and to maintain security on construction sites, having regard to sensitive ecological receptors or occupied residential properties in proximity to the site. At DANP, Dublin Airport Station and DASP sites, the Site Lighting plan will also consider the risk of glare at the airport and measures to prevent this occurring. Where required, and in agreement with the Local Authority, semi-permanent lighting will be provided at site boundaries, temporary bridges, haul routes, site entrances and exits and illumination will be sufficient to create a safe route for passing members of the public and road users.

Light pollution can be a problem on construction sites where new or temporary lighting is installed and large areas flood lit, causing over illumination and nuisance. Lighting will therefore be designed to ensure that any artificial light emitted from a site does not prejudice health or create a nuisance.

Lighting will be positioned and directed so as not to intrude unnecessarily on adjacent buildings and land uses and to avoid unnecessary interference with local residents or passing transport users (e.g. road, rail and river). In relation to the surrounding ecological environment, the lighting design needs to consider effects on:

- Terrestrial ecology; including measures to prevent disturbance to ecologically sensitive areas, notable species and photosensitive species such as bats, otters and voles; and
- The aquatic environment; direct lighting of watercourses shall be avoided, where reasonably practicable, to avoid inhibiting movements of photophobic species such as eel.

Potential lighting effects on biodiversity has been assessed in Chapter 15 (Biodiversity).

To ensure the light levels on construction sites are appropriate, the good practice use of light or lux meters to measure and check actual lighting levels on-site will be adopted. Measured values will be compared with relevant guidance for lighting in the workplace (refer to Appendix 5.18, Construction Lighting). This would ensure that light pollution is mitigated whilst workers are protected with a safe level of lighting.

5.12.10 Extreme Weather Events

The appointed contractor(s) will pay due consideration to the impacts of extreme weather events during the Construction Phase. The appointed contractor(s) will utilise available meteorological forecast data from Met Éireann or other approved provider of meteorological data to inform short-term to medium-term programme management, environmental control and impact mitigation measures. Construction compounds will not be set up on lands designated as Flood Zone A or B, in accordance with the OPW 'Planning System and Flood Risk Management Guidelines' (November 2009). The management of flood risk during construction is detailed in Chapter 18 (Hydrology, Section 18.6.1.3) and in the outline CEMP (Appendix 5.1).

Risks from flooding during the operational phase have been assessed in Chapter 18 (Hydrology) and a Flood Risk Assessment (FRA) was carried out to identify areas at risk along the proposed Project alignment. The FRA is provided as Appendix A18.5. Areas identified as at risk in the Stage 2 FRA include:

- drainage ditches located within the Staffordstown Stream catchment;
- Broadmeadow and Ward Rivers;
- Sluice River and tributary;
- Turnapin Stream; and
- River Liffey.

A Stage 3 Detailed FRA was completed for the following scheme elements to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to the proposed Project:

- Proposed new diversion of a tributary/ditch located in the Staffordstown Watercourse catchment to accommodate construction of the Park and 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 Dardistown Depot (around Ch. 8 + 600); and
- Flood resilience measures associated with the proposed Tara Station (Ch. 17 + 400).

Two watercourse diversions have been proposed to allow for the construction of the proposed Park and 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 the Stage 3 Assessment carried out shows that the diversions have been designed so their banks will not be overtopped by the 0.1% Annual Exceedance Probability (AEP) flood.

Stage 3 qualitative and quantitative analysis completed for the proposed new viaduct over Broadmeadow and Ward Rivers shows that the viaduct will not impact on flood levels for the rivers. This is because the viaduct makes sufficient provision to maintain floodplain flows beneath the alignment.

New culverts have been proposed over Sluice River and its tributary. Qualitative and quantitative analysis completed for the 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.

The 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 flooding, including the provision of demountable defences across each entrance to the station.

The design of the scheme includes a comprehensive programme of Sustainable Urban Drainage Systems (SuDS) measures 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. The design of the scheme also ensures that it is resilient to effects of climate change on fluvial and coastal flood risk. Refer to Chapter 18 (Hydrology) and Appendix 18.5 (Flood Risk Assessment) for further information.

The drainage design proposals incorporate effective attenuation to greenfield run-off rates for new hardstanding areas. The proposed attenuation storage volumes are sized to accommodate any potential increase in surface water run-off rates up to the 100-year return period storm event with an allowance for climate change effects. Attenuation for storm water drainage is provided by a combination of attenuation ponds, collection chambers (StormTech system) and an underground attenuation tank at Dardistown Depot. Refer to Chapter 18 (Hydrology, Section 18.5.4.3).

Risks from extreme weather events during construction, and mitigation measures, are assessed in Chapter 28 (Risk of Major Accidents & Disasters).

5.12.11 Difficulties Encountered

No difficulties were encountered during the planning of this phase.

5.13 Glossary

Term	Meaning
Alignment	Alignment refers to the three-dimensional (3D) route of the railway, considering both the horizontal and vertical alignment.
Construction Compound	An area occupied temporarily for construction-related activities. The main construction compounds will act as strategic hubs for core project management activities (i.e. engineering, planning and construction delivery) and for office-based construction personnel. The main construction compounds will include: offices and welfare facilities, workshops and stores, and storage and laydown areas for materials and equipment (e.g. aggregate, structural steel, and steel reinforcement).
Cut and Cover	Cut and cover construction involves using excavation equipment to dig a large trench or rectangular hole in the ground which is then covered by a concrete roof slab. Once the slab is in place, surface activity can largely resume as construction works continue below.
Diaphragm walls or 'D-walls'	Underground structural elements commonly used as retention systems and permanent foundation walls. Similar to secant piles, in that they are excavated from the surface and then filled with reinforcing steel and concrete. However, they are constructed as rectangular sections of trench, rather than circular piles.
Working strip	During construction, working strips of land will be located along the proposed railway alignment within AZ1 and AZ3 to aid construction of retained cutting, cut and cover, elevated track and surface track sections. These strips of land will range between 10m and 25m wide on either side of the alignment. A portion of these strips will be retained as permanent features for rail maintenance purposes during the Operational Phase.
Enabling Works	These are works to prepare a site in advance of the main construction works, for example; demolition, removal of vegetation, land levelling, utility diversions, establishment of temporary traffic measures.
Hydrofraise	A reverse circulation excavation tool comprising a heavy steel frame with two drive gears attached to cutter wheels at its bottom end. It is used for the construction of diaphragm and cut-off walls in difficult conditions, typically the excavation of rock and hard layers of soil. The hydrofraise is also called a hydromill and trench cutter (or just cutter).
Intervention Shaft	A vertical shaft excavated to provide emergency access/ egress and ventilation between the railway tunnel at depth and the surface.
Intervention Tunnel	A tunnel parallel to the railway tunnel to provide emergency access / egress from the tunnel to the surface.
Logistics Site	During construction logistics sites will be established to help manage the flow of materials to and from the construction sites.
Overhead Conductor Rail	A rigid aluminium contact pole incorporating a contact wire to carry the current to power trains
Overhead Contact System	A system to connect the trains with the source of electrical power consisting of a single contact wire and a single catenary wire supported from a support structure.
Park & Ride Facility	A location usually sited out of the main urban areas comprising a large car park and connected with a mass transit system, in the case of MetroLink an urban metro to attract potential travellers to drive and park at the facility and take the metro into Dublin City Centre and avoid driving into Dublin City Centre
Railway Order	The approval from the planning authority (An Bord Pleanála) for permission to build and operate a Strategic Infrastructure Development (in this case, MetroLink).
Retained Cut	A section of the railway constructed primarily below ground level with vertical retaining walls either side of the alignment and no roof or enclosure overhead.
Retained Cut Station	A railway station constructed primarily below ground level with vertical retaining walls either side of the alignment to reinforce the walls. Canopies provide shelter over the platforms.
Rolling Stock	A generic term referring to all vehicles that run on rails.

Term	Meaning
Satellite Compound	A works compound usually smaller than the main compound which may provide: local office and welfare facilities, local storage for plant and materials, and limited parking for construction vehicles.
Secant Piles	A construction method used to form a retaining wall for ground retention prior to excavation. The walls are formed by boring circular sections from the surface down into the top of the bedrock and filling the resulting opening with steel reinforcing cages surrounded by concrete.
Sprayed Concrete Tunnel	This construction technique involves rapidly spraying the excavated ground with concrete to stabilise it and form the permanent tunnel lining.
Surface Station	A railway station designed at ground level
Underground Stations	A railway station located fully underground with a roof slab over the station to enclose it, with entrances above ground.
U-section	A construction technique involving temporary excavation support with either sheet piles or battered excavations (as opposed to secant piles).
Ventilation Tunnel	A tunnel parallel to the railway tunnel to support the ventilation system in the operational phase.

5.14 References

Dublin City Council Heavy Goods Vehicle (HGV) Management Strategy (DCC, 2007)

S.I. No. 5/2003 – Road Traffic (Construction and Use of Vehicles) Regulations 2003

Guidelines on Maximum Weights and Dimensions of Mechanically Propelled Vehicles and Trailers, Including Manoeuvrability Criteria – Road Safety Authority (RSA), 2020

Section 101D of the Road Traffic Act 1961

Best Practice Guidelines on the Preparation of Resource and Waste Management Plans for Construction and Demolition Projects – Environmental Protection Agency, 2021

Article 27 of the European Communities (Waste Directive) Regulations 2011

Waste Action Plan for a Circular Economy - Department of Communications, Climate Action and the Environment (DCCAE), 2020

Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan - The National Roads Authority (NRA), 2007

Publicly Available Specification (PAS) 2080:2016 Carbon Management in Infrastructure.

The Planning System and Flood Risk Management, Guidelines for Planning Authorities - The Office of Public Works (OPW), November 2009.

5.15 Figures

N

LISSENHALL LITTLE

R132

Ennis Ln

Estuary Station Construction and Logistics Site

Emmaus Retreat Centre

BALHEARY DEMESNE

LISSENHALL LITTLE

Ennis Ln

0 30 60 90 120

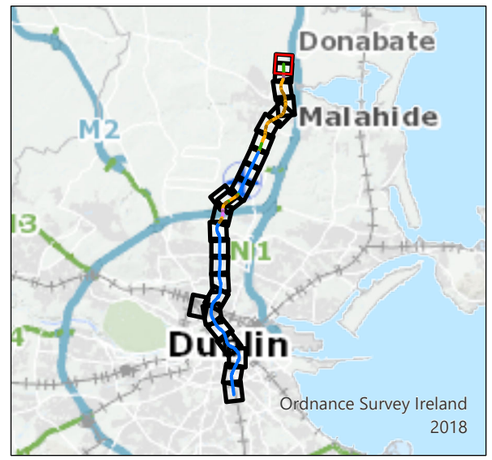
Metres

Ordnance Survey Ireland 2018

Legend

Alignment

- Surface
- Station Locations
- Main construction compound and logistics area



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

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Project: METROLINK

Drawing Title

Figure 5.1 Construction Compounds
Sheet 1 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05002	Rev P02

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Path: \\europe.jacobs.com\Dublin\Data\IT\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\CH 5 - Fig 5.1 Construction Compounds.aprx

N

Estuary Station Construction and Logistics Site

Fingallian Footbridge Site

Lissenhall Industrial Estate

Lissenhall

Estuary Rd

R132

Ennis Ln

BALHEARY DEMESNE

Ward River

Emmaus Retreat Centre

Swords Business Campus

Balheary Industrial Park

Swords Business Campus

Fingallians G.A.A. club

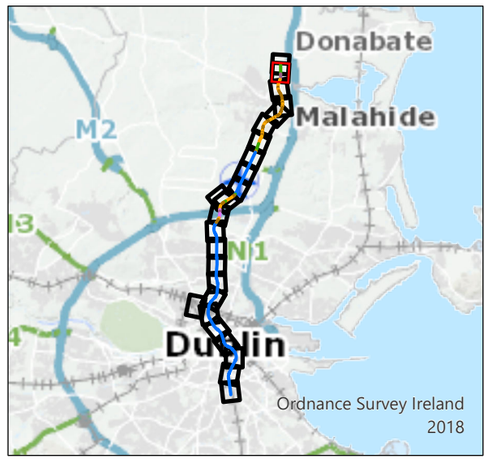
Ordnance Survey Ireland 2018

0 30 60 90 120 Metres

Legend

Alignment

- Retained Cut
- Surface
- Viaduct
- Station Locations
- Main construction compound and logistics area
- Satellite construction compound
- Linear working area



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.1 Construction Compounds Sheet 2 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05003	Rev P02

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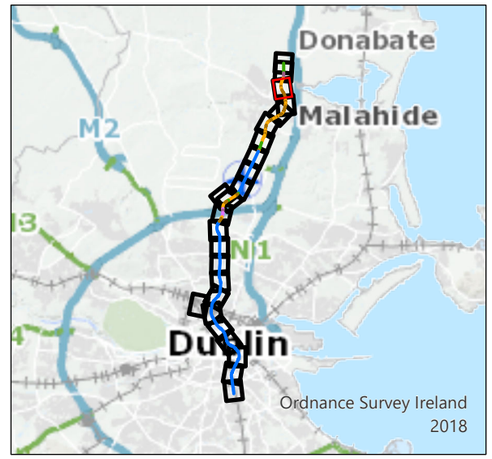
Legend

Alignment

- Cut & Cover
- Retained Cut
- Station Locations
- Main construction compound
- Satellite construction compound
- Linear working area



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: Transport Infrastructure Ireland (Bonneagar Iompair Eireann)

Project: METROLINK

Drawing Title: Figure 5.1 Construction Compounds Sheet 3 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05004	Rev P02

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N

Woodie's

Seatown Station

North Dublin Corporate Park (NDC)

Chapel Lane

Mantua Park

Pavilion's Shopping Centre

Swords Business Park

Tennis Court

SWORDS DEMESNE

Seamount View

Malahide

Clifford's Ln

Chapel Lane

Ashley Grove

Ashley Drive

Foxwood

R106

R132

Ashley Ave

COMMONS EAST

Seatown Rd

Seatown Terrace

Saint Colmcille's Boys National School

Saint Colmcille's Girls National School

Chapel Ln

Castle Pk

Castle Ave

Castle Grove

Castle Drive

Graveyard

Malahide Rd

TOWNPARKS

Fingal Community College

Saint Columcille's Pk

Saint Columcilles Drive

0 30 60 90 120

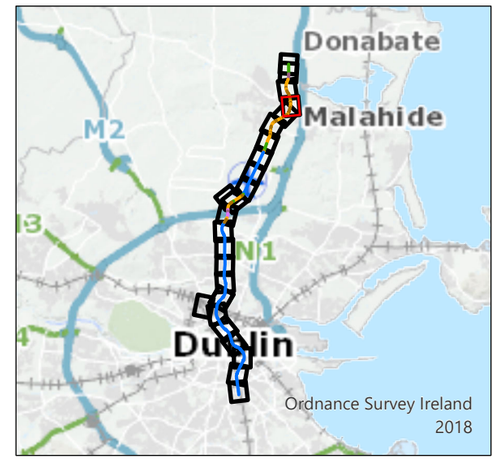
Metres

Ordnance Survey Ireland 2018

Legend

Alignment

- Cut & Cover
- Retained Cut
- Station Locations
- Main construction compound
- Satellite construction compound
- Linear working area



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.1 Construction Compounds Sheet 4 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05005	Rev P02

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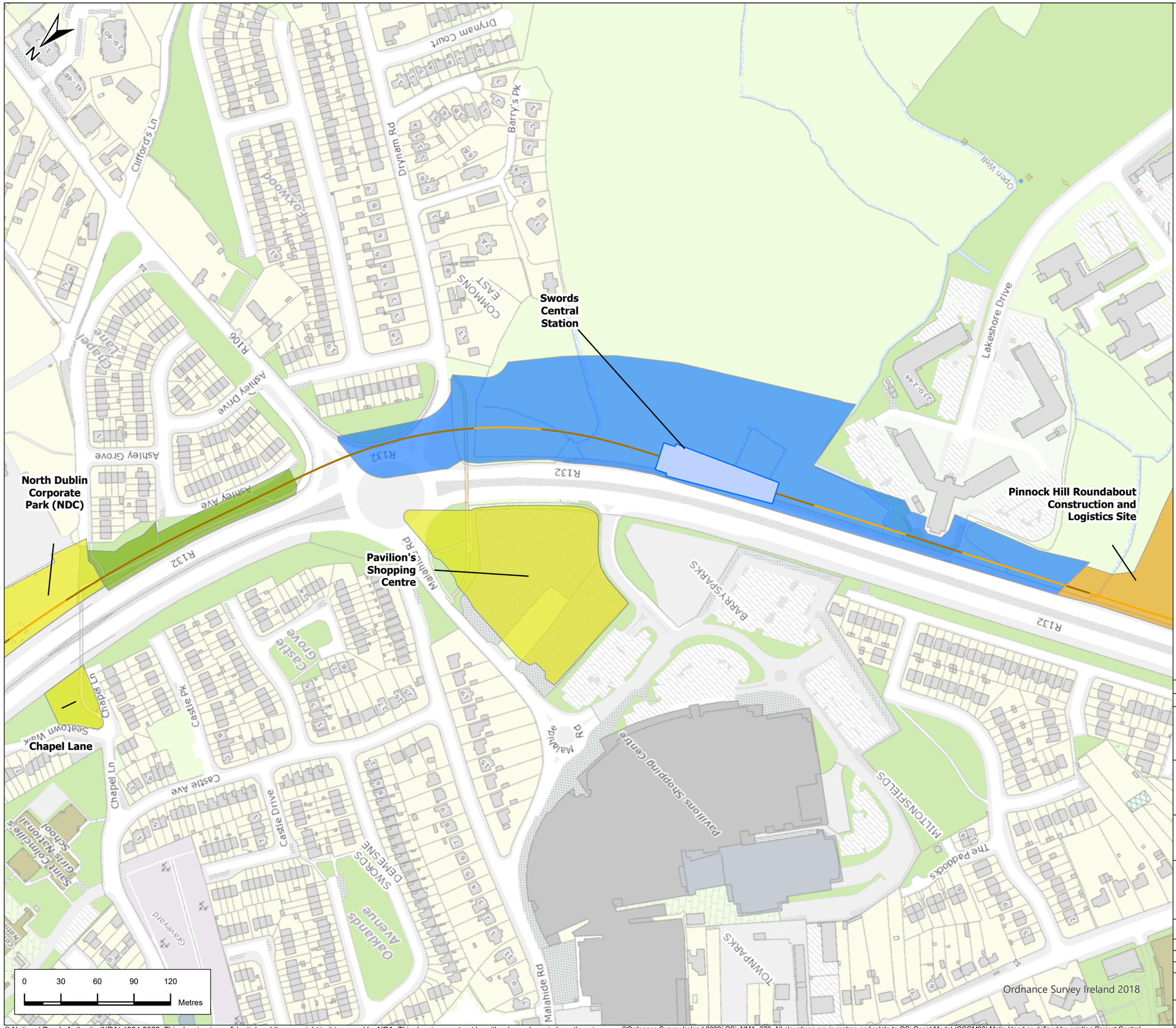
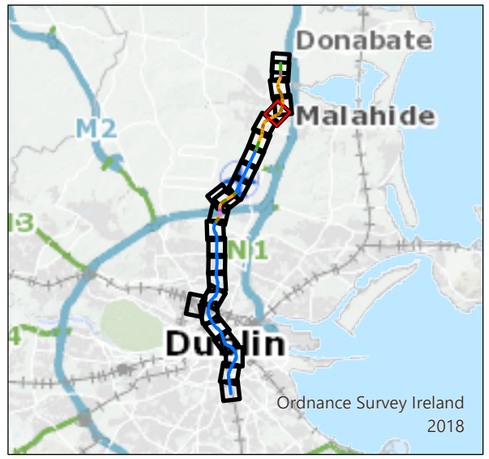


Legend

Alignment

- Cut & Cover
- Retained Cut
- Station Locations
- Main construction compound
- Satellite construction compound
- Satellite construction compound and logistics area
- Linear working area



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.1 Construction Compounds Sheet 5 of 26

Drawing Status	Final	
Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05006	Rev P02

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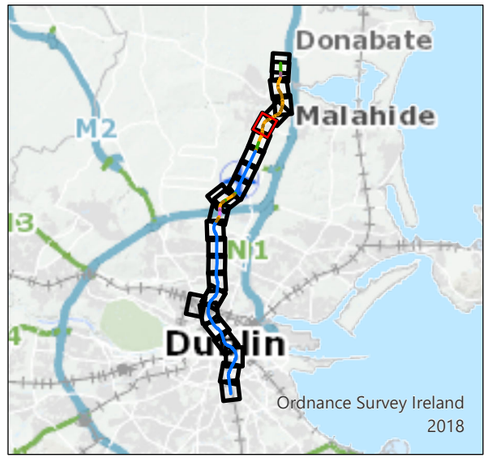
Legend

Alignment

- Cut & Cover
- Retained Cut
- Station Locations
- Main construction compound
- Satellite construction compound
- Satellite construction compound and logistics area
- Linear working area



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.1 Construction Compounds
Sheet 6 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05007	Rev P02

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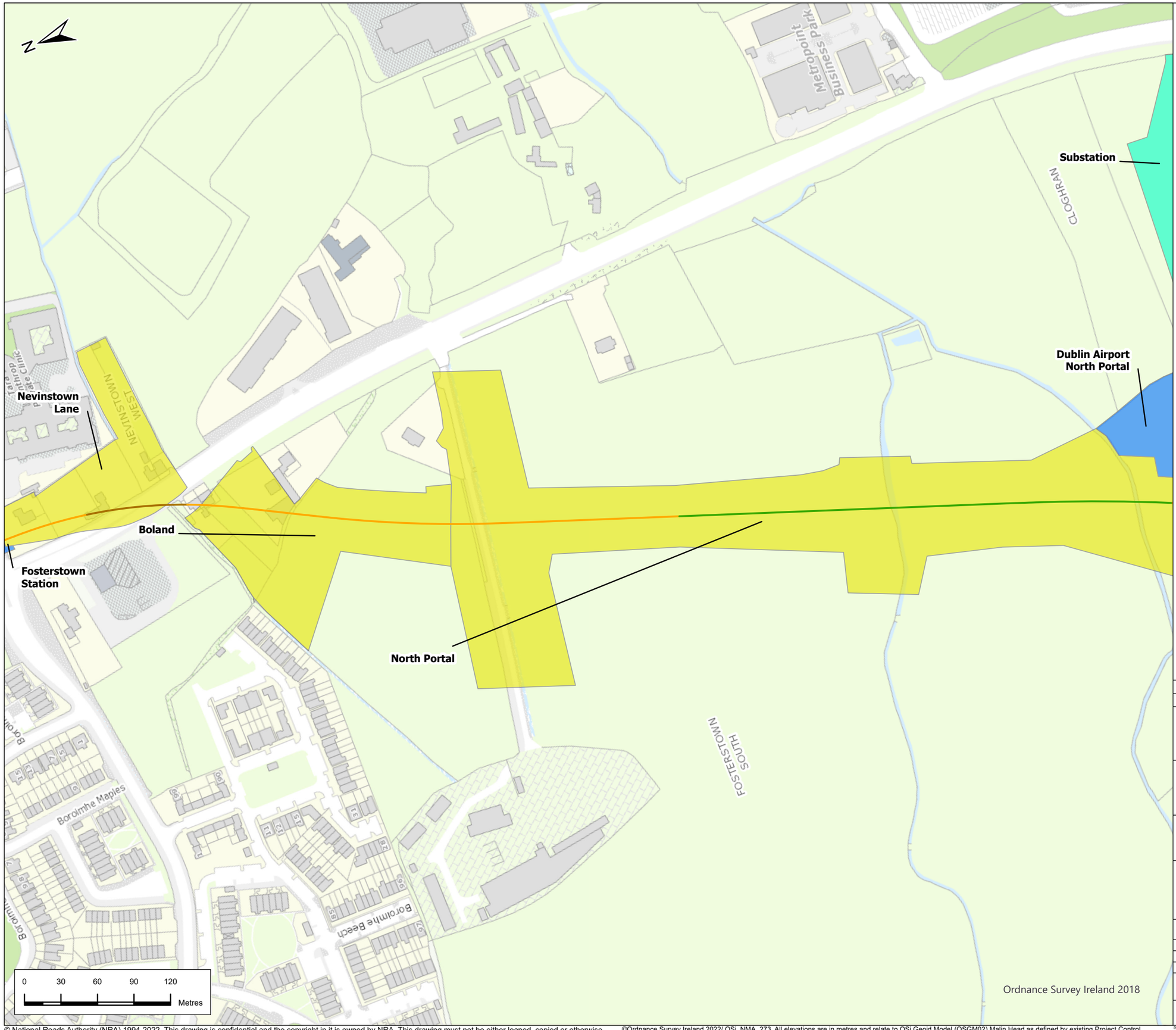
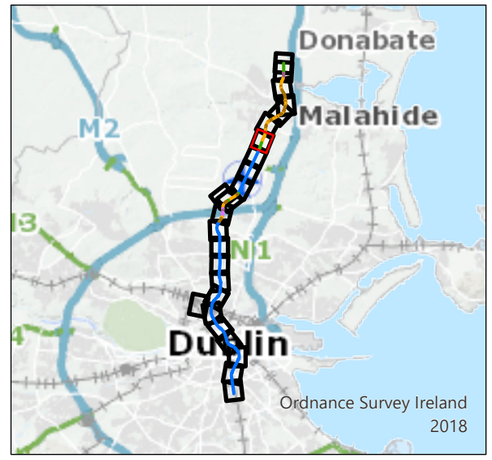


Legend

Alignment

- Cut & Cover
- Retained Cut
- Surface
- Main construction compound
- Satellite construction compound
- Electrical Substation



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.1 Construction Compounds Sheet 7 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05008	Rev P02

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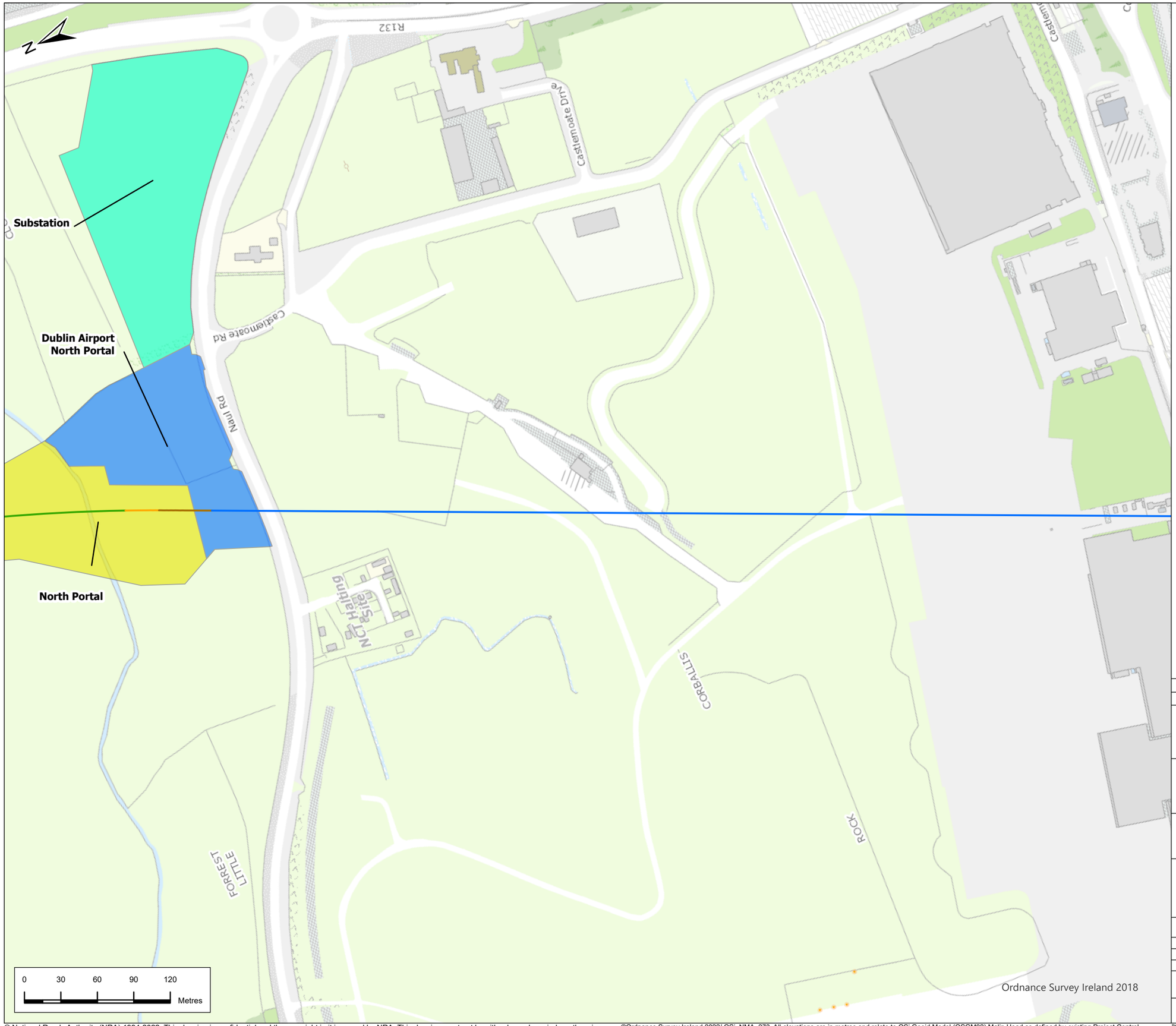
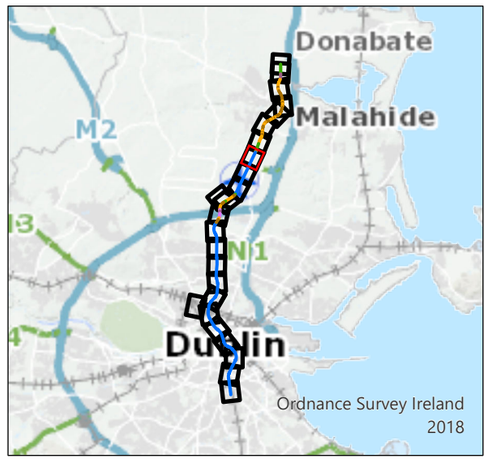
Path: \\europe.jacobs.com\Dublin\Data\JI\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\CH 5 - Fig 5.1 Construction Compounds.aprx



Legend

Alignment

- Cut & Cover
- Retained Cut
- Surface
- Tunnel
- Main construction compound
- Satellite construction compound
- Electrical Substation



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.1 Construction Compounds
Sheet 8 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05009	Rev P02

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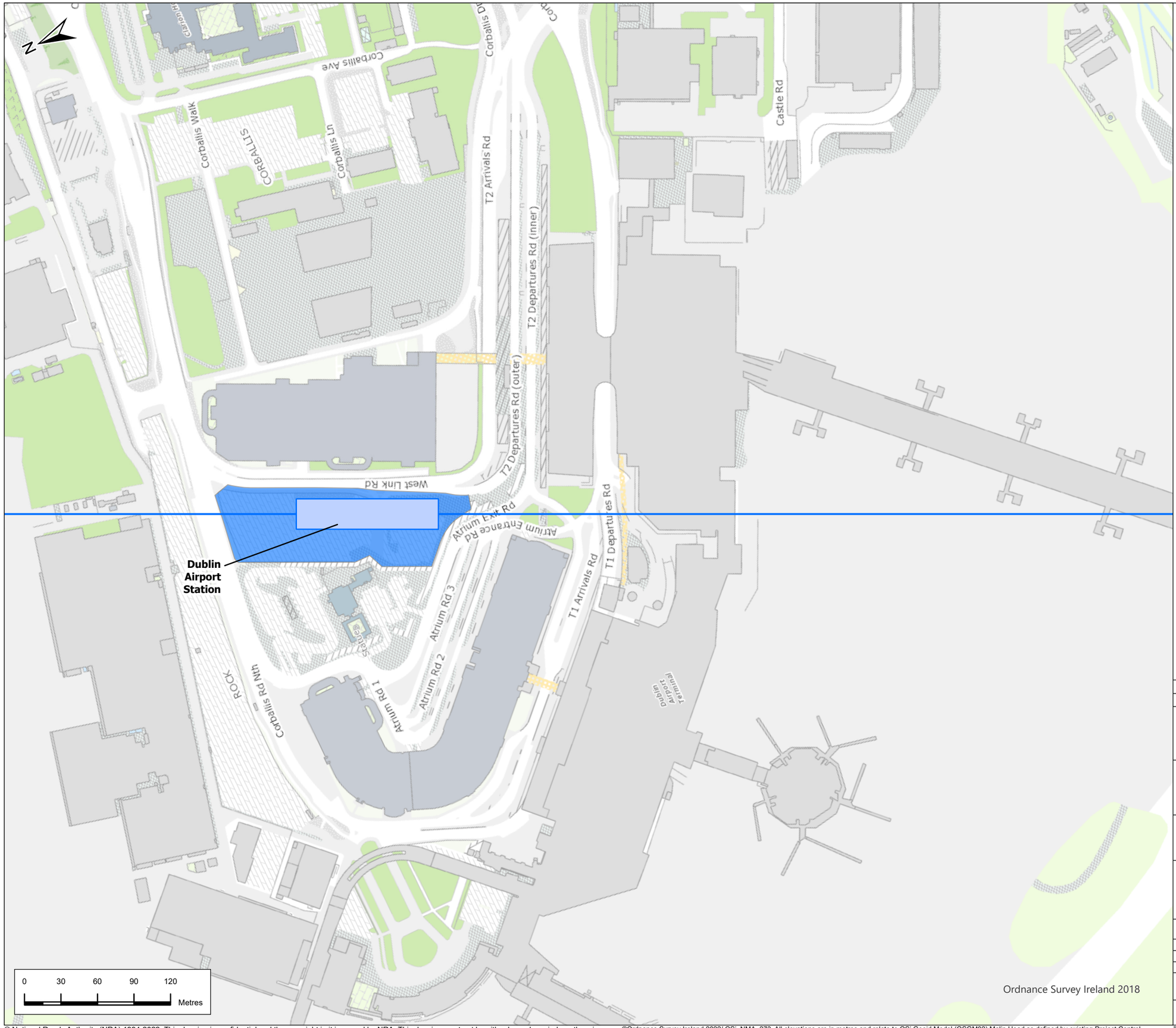
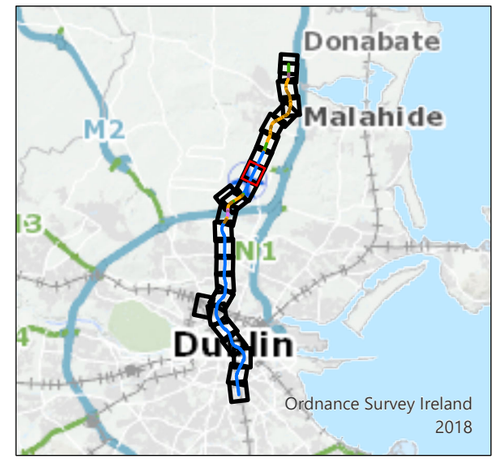


Legend

Alignment

- Tunnel
- Station Locations
- Main construction compound



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann / Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.1 Construction Compounds
Sheet 9 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05010	Rev P02

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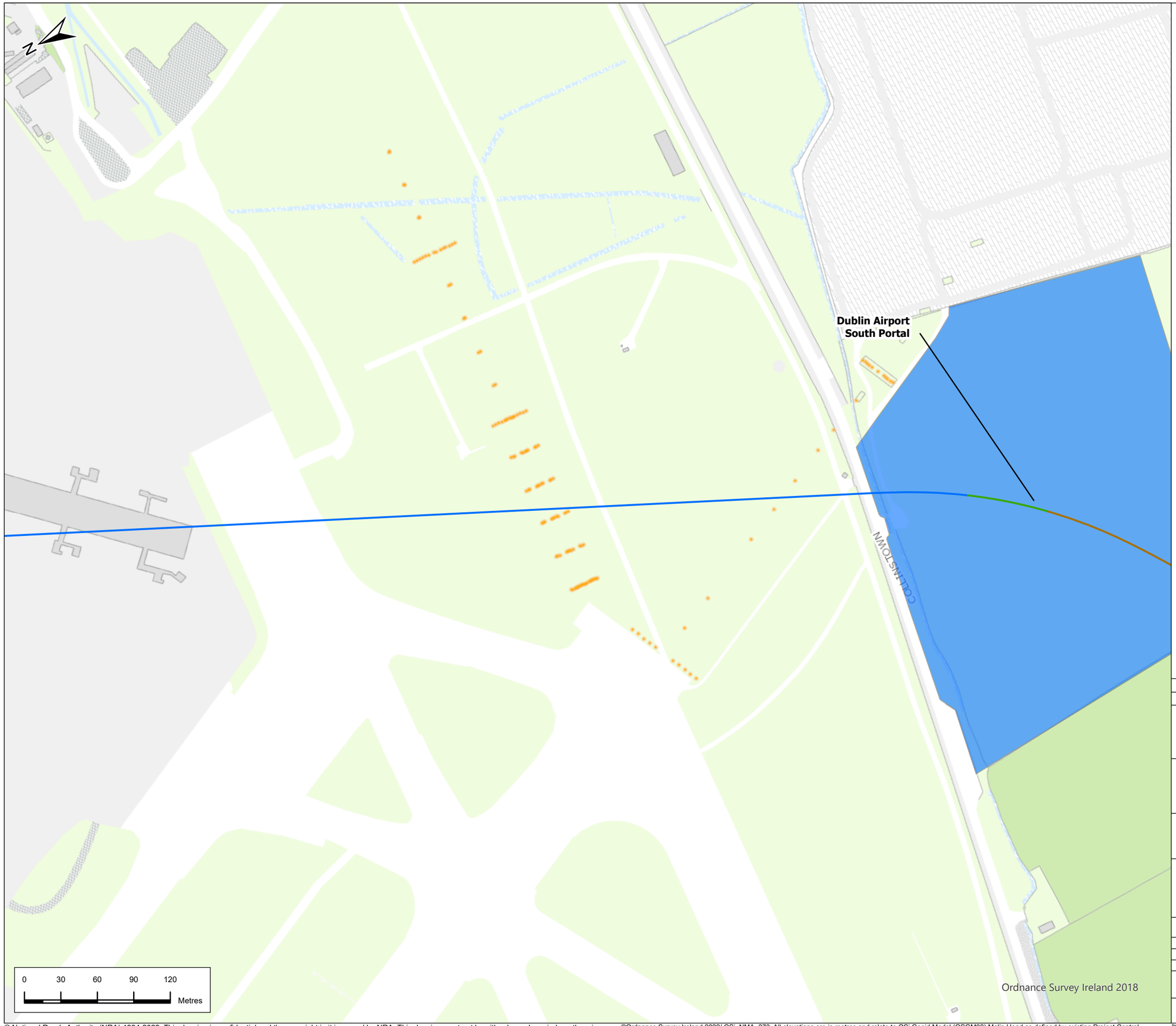
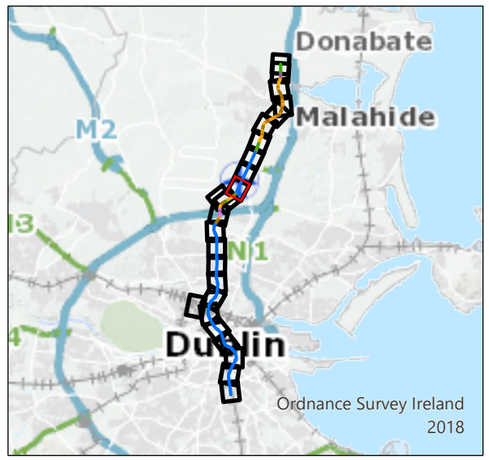


Legend

Alignment

- Cut & Cover
- Surface
- Tunnel

Main construction compound



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann / Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.1 Construction Compounds
Sheet 10 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05011	Rev P02

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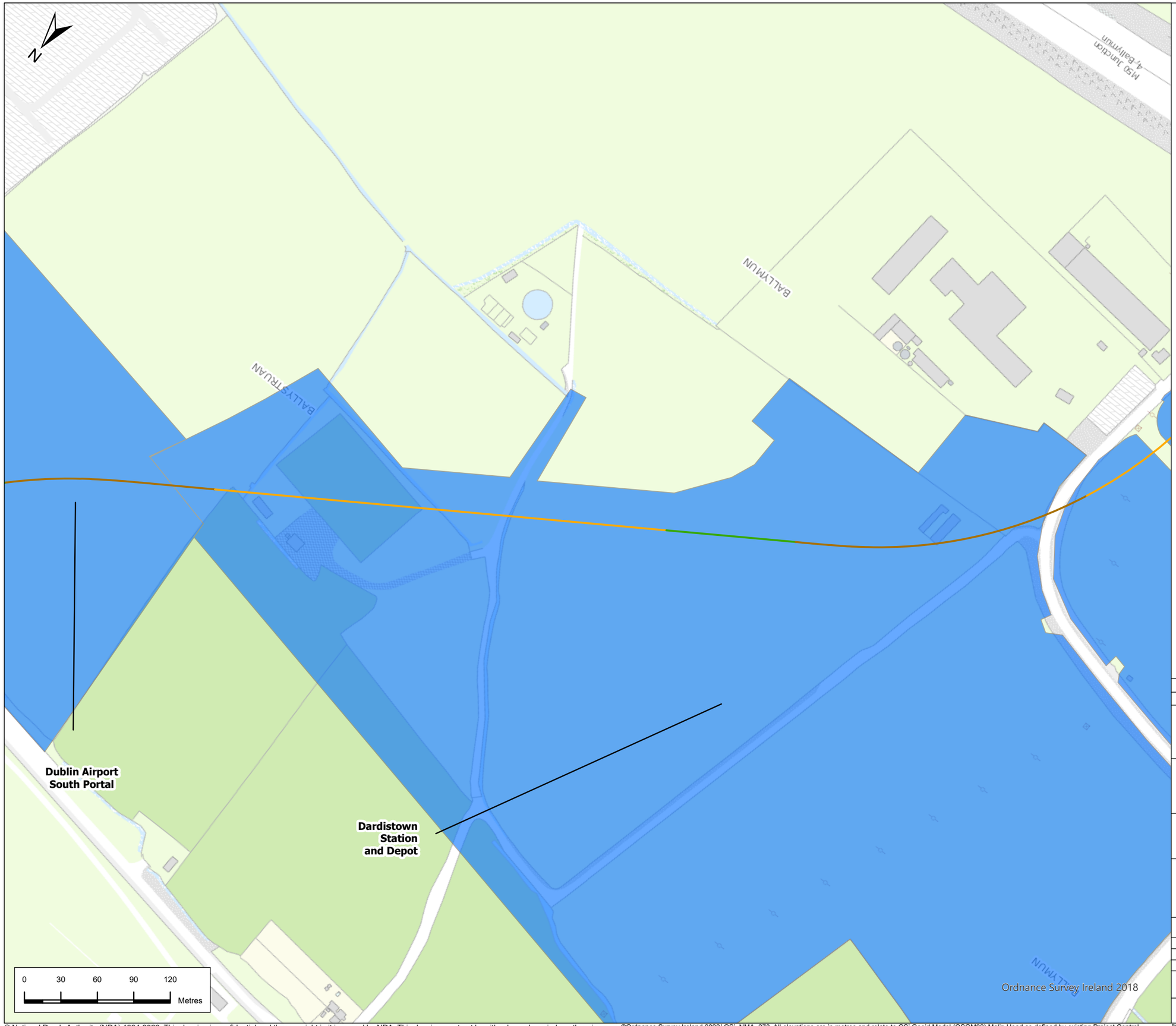
Path: \\europe.jacobs.com\Dublin\Data\IT\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\CH 5 - Fig 5.1 Construction Compounds.aprx

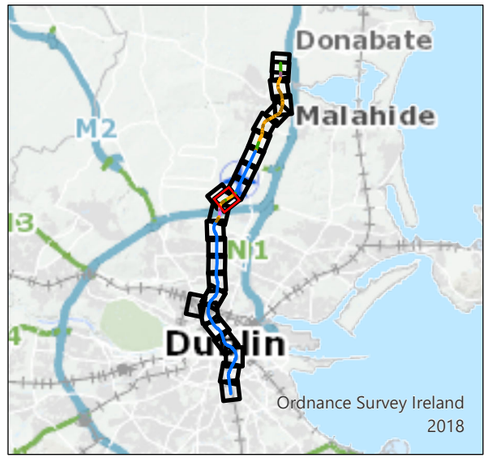


Legend

Alignment

- Cut & Cover
- Retained Cut
- Surface

Main construction compound



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.1 Construction Compounds
Sheet 11 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05012	Rev P02

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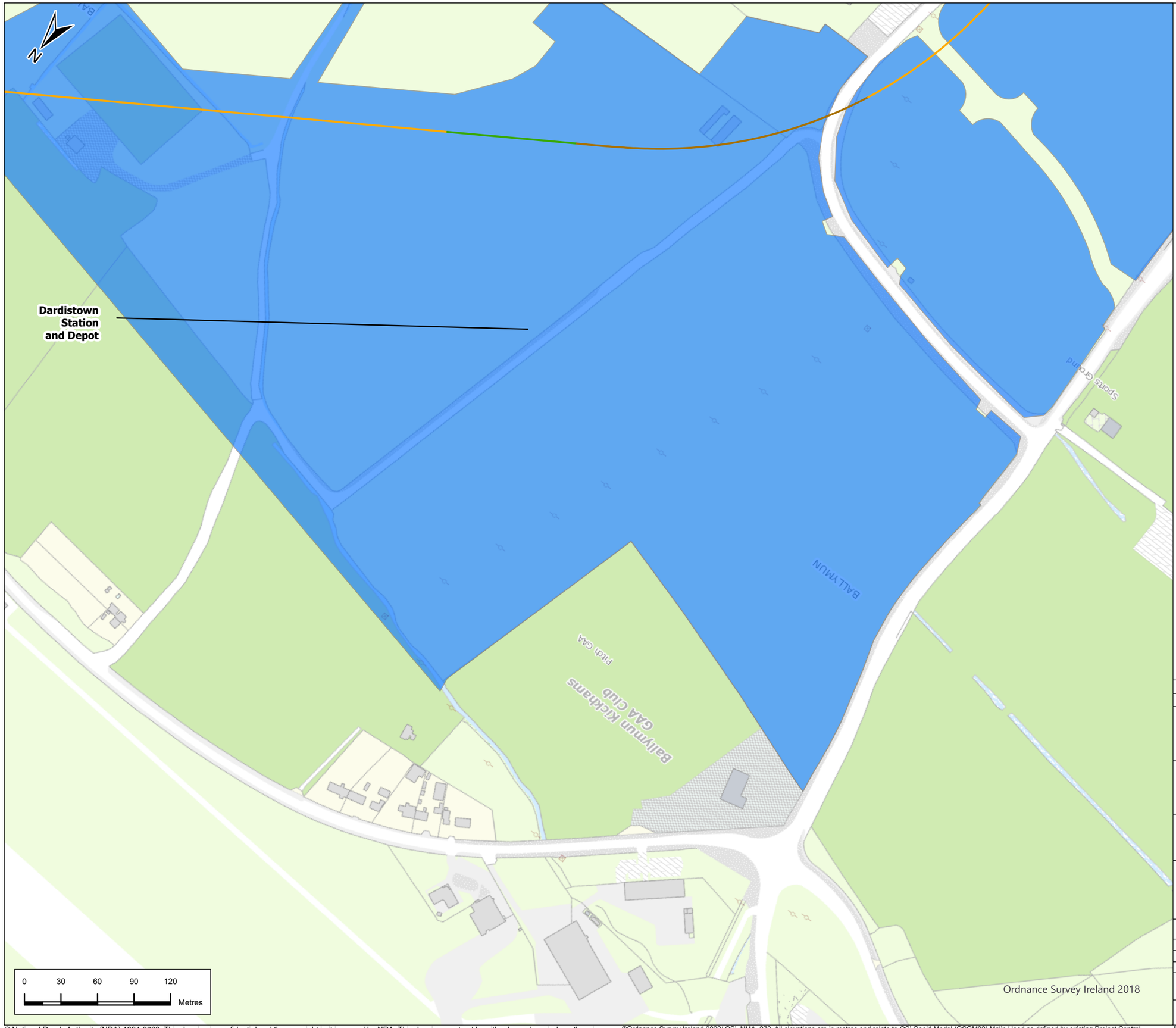
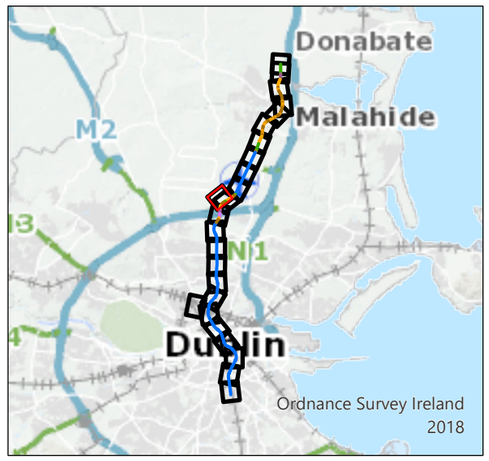


Legend

Alignment

- Cut & Cover
- Retained Cut
- Surface

Main construction compound



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.1 Construction Compounds
Sheet 12 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05013	Rev P02

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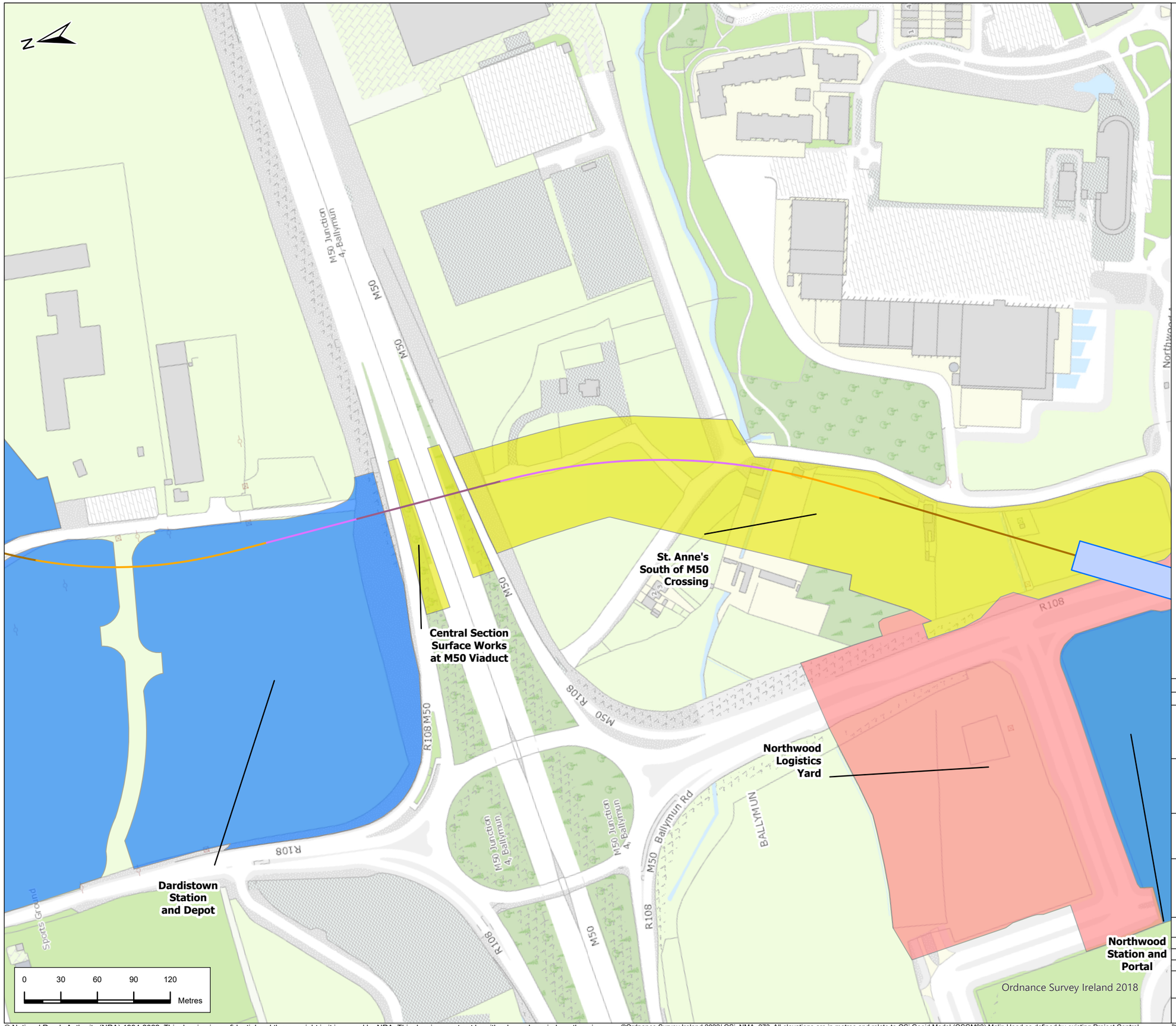
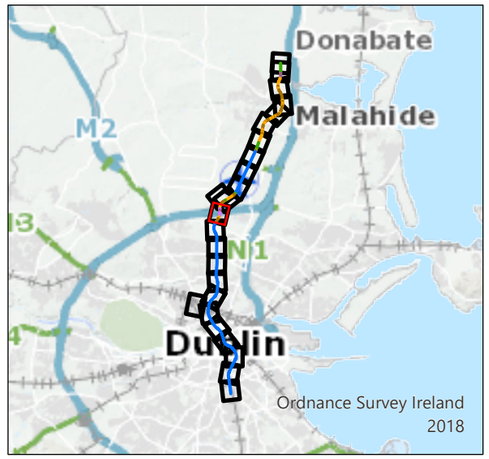
Path: \\europe.jacobs.com\Dublin\Data\JI\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\CH 5 - Fig 5.1 Construction Compounds.aprx



Legend

Alignment

- Cut & Cover
- Incline
- Retained Cut
- Tunnel
- Viaduct
- Station Locations
- Main construction compound
- Satellite construction compound
- Logistics area



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.1 Construction Compounds
Sheet 13 of 26

Drawing Status	Final	
Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05014	Rev P02

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St. Anne's South of M50 Crossing

Northwood Logistics Yard

Northwood Station and Portal

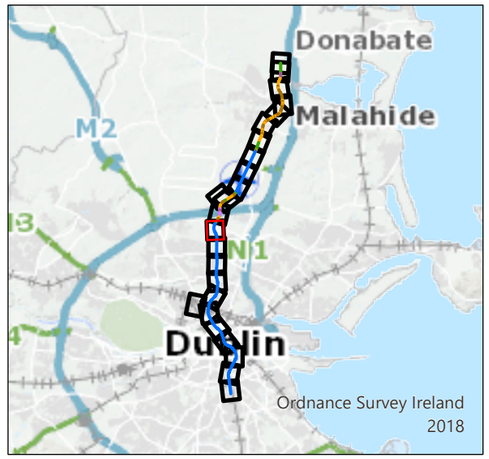
Ballymun Station

0 30 60 90 120 Metres

Legend

Alignment

- Cut & Cover
- Tunnel
- Station Locations
- Main construction compound
- Satellite construction compound
- Logistics area



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.1 Construction Compounds Sheet 14 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05015	Rev P02

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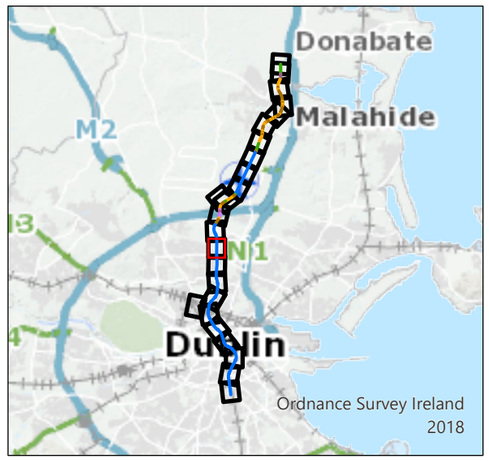
Path: \\europe.jacobs.com\Dublin\Data\JI\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\CH 5 - Fig 5.1 Construction Compounds.aprx

Legend

Alignment

- Tunnel
- Station Locations
- Main construction compound



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.1 Construction Compounds
Sheet 15 of 26

Drawing Status	Final	
Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05016	Rev P02

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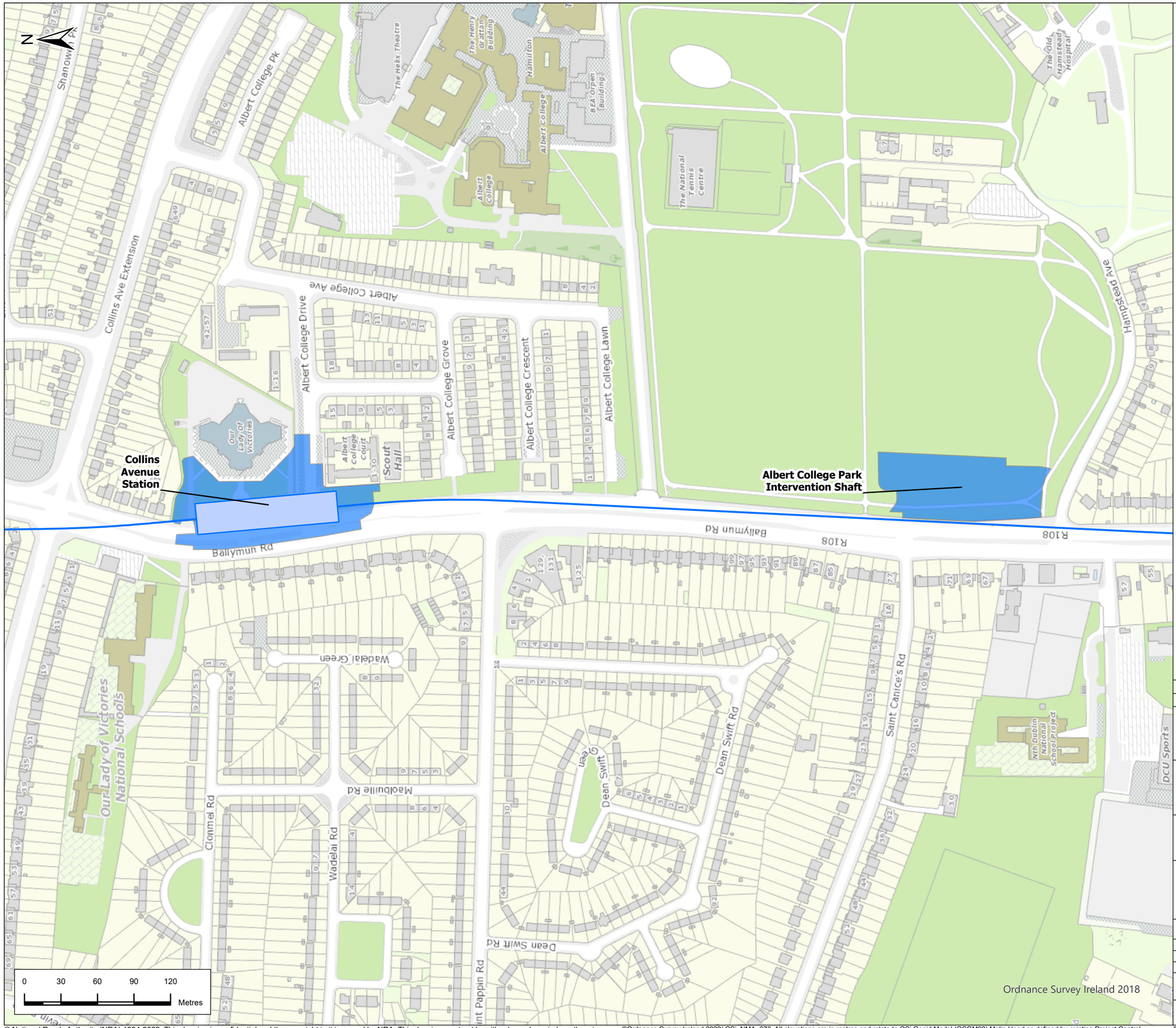
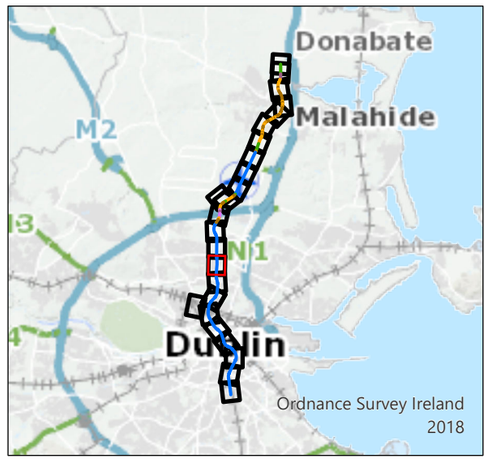
Path: \\europe.jacobs.com\Dublin\Data\JI\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\CH 5 - Fig 5.1 Construction Compounds.aprx



Legend

Alignment

- Tunnel
- Station Locations
- Main construction compound



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: Bonneagar Iompair Eireann, Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.1 Construction Compounds
Sheet 16 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05017	Rev P02

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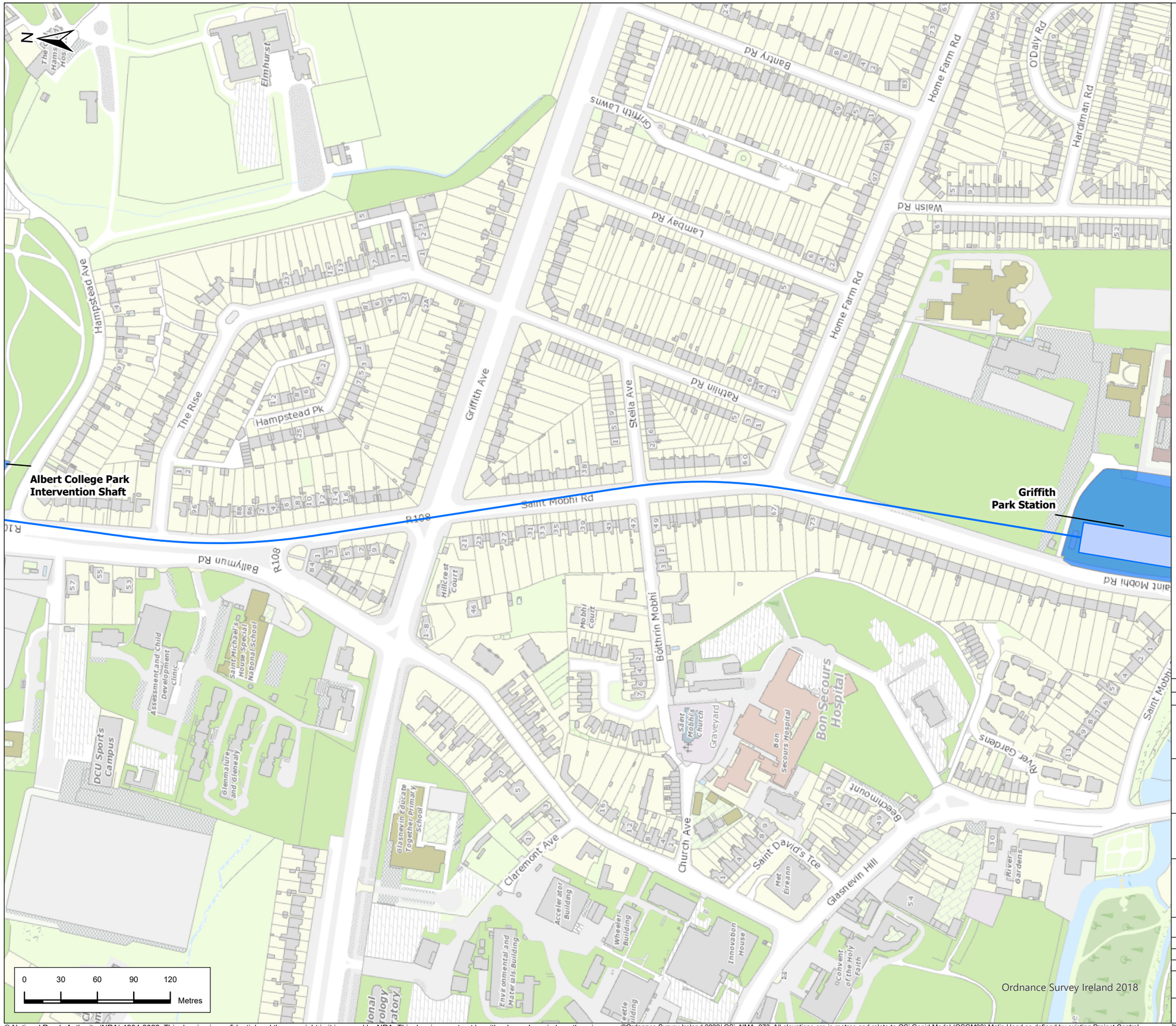
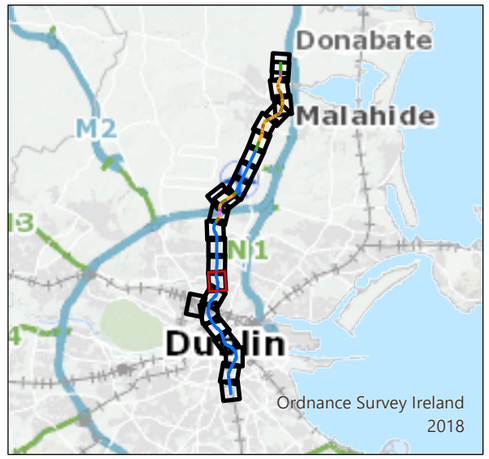
Path: \\europe.jacobs.com\Dublin\Data\JI\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\CH 5 - Fig 5.1 Construction Compounds.aprx



Legend

Alignment

- Tunnel
- Station Locations
- Main construction compound



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS
IDOM

Client: Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.1 Construction Compounds
Sheet 17 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05018	Rev P02

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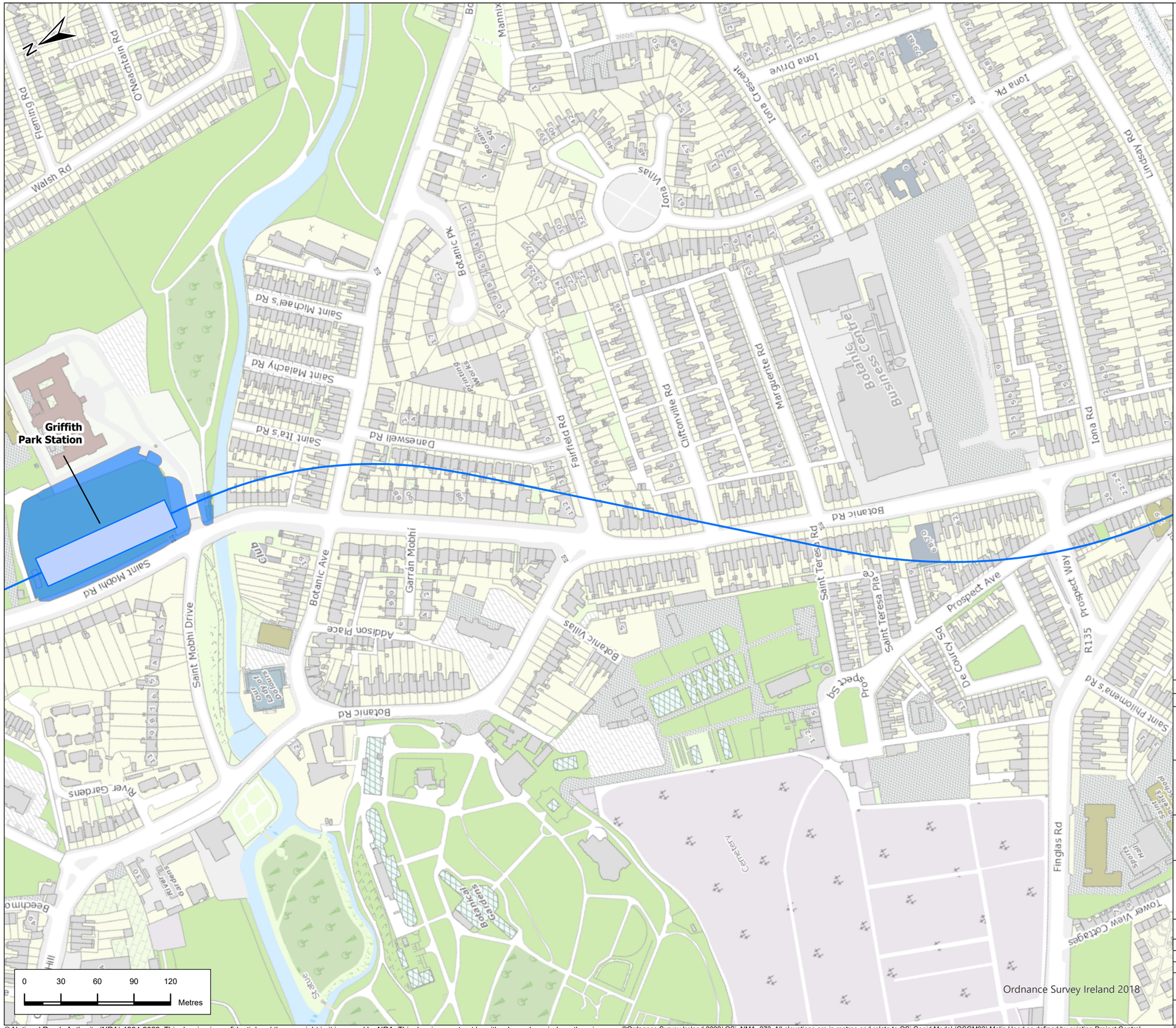
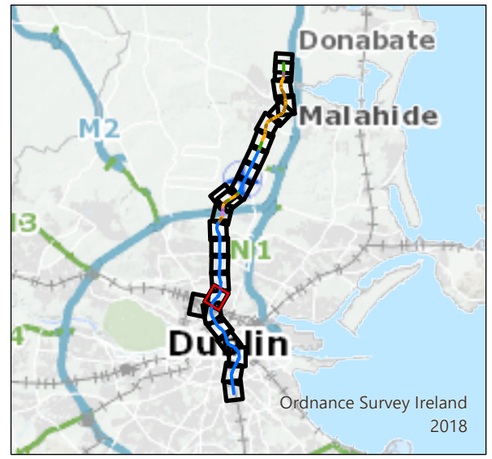
Path: \\europe.jacobs.com\Dublin\Data\JI\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\CH 5 - Fig 5.1 Construction Compounds.aprx



Legend

Alignment

- Tunnel
- Station Locations
- Main construction compound



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.1 Construction Compounds
Sheet 18 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05019	Rev P02

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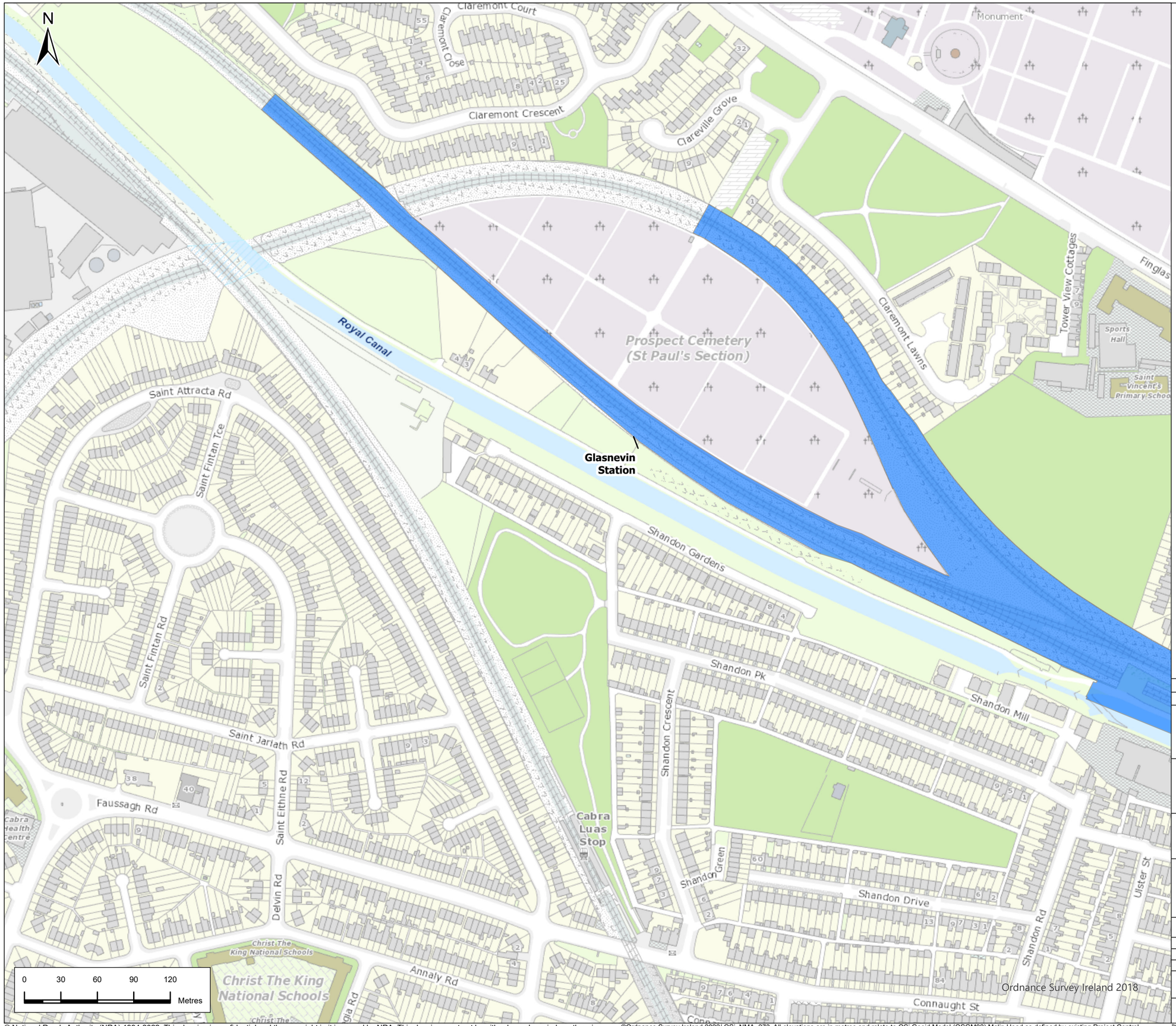
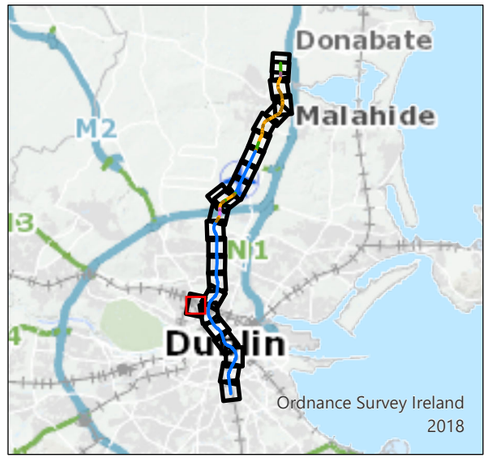
Path: \\europe.jacobs.com\Dublin\Data\JI\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\CH 5 - Fig 5.1 Construction Compounds.aprx



Legend

Main construction compound



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.1 Construction Compounds
Sheet 19 of 26

Drawing Status	Final	
Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05021	Rev P02

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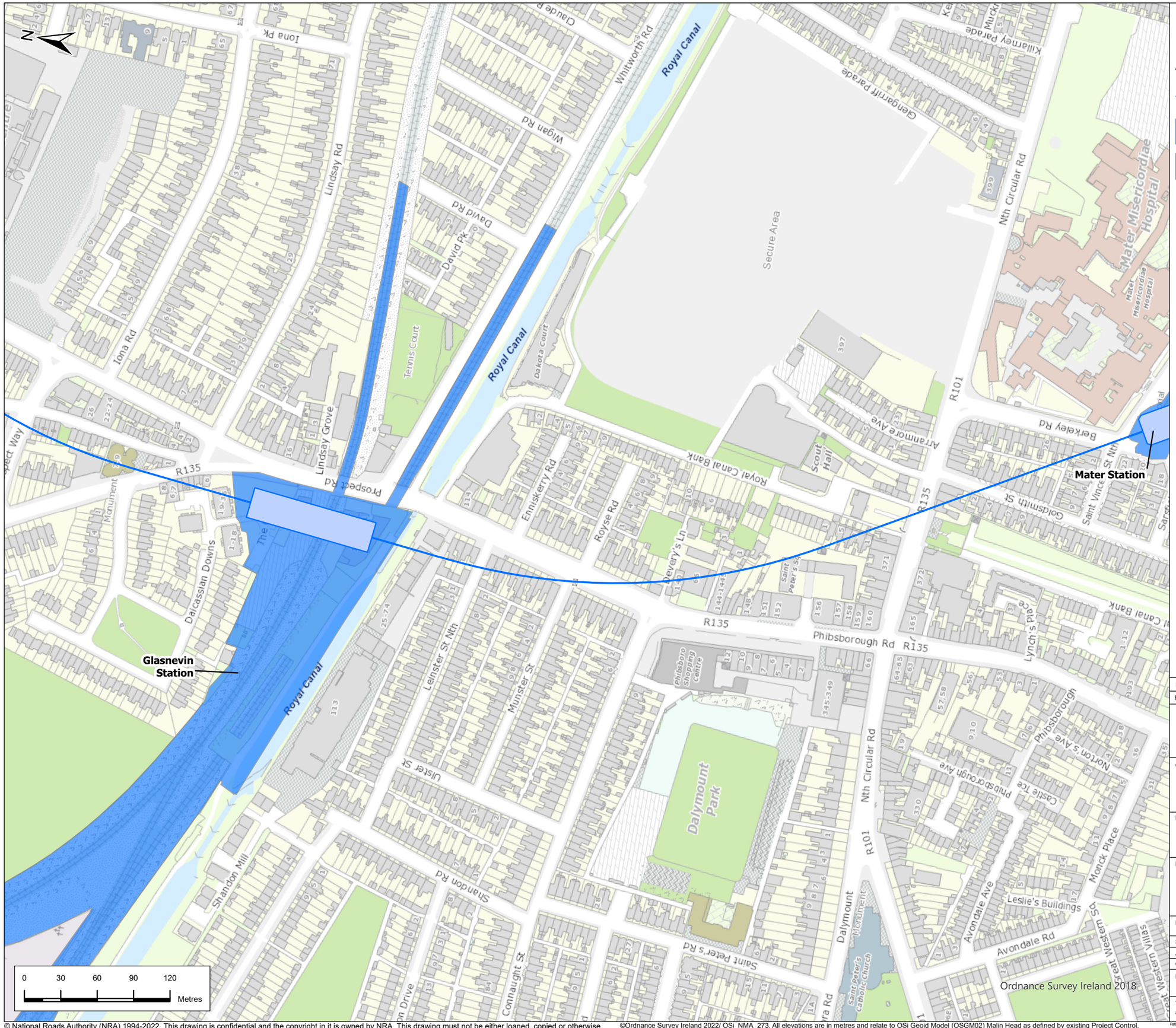
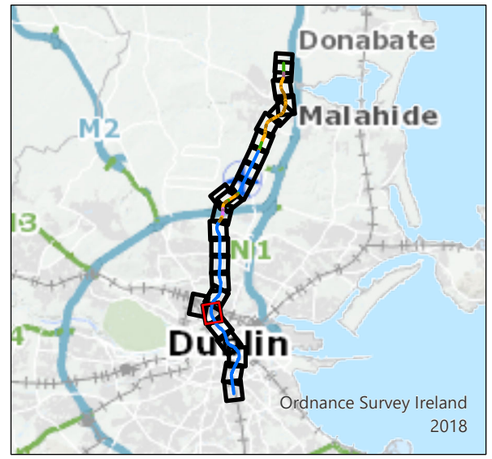
Path: \\europe.jacobs.com\Dublin\Data\JI\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\CH 5 - Fig 5.1 Construction Compounds.aprx



Legend

Alignment

- Tunnel
- Station Locations
- Main construction compound



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.1 Construction Compounds
Sheet 20 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05022	Rev P02

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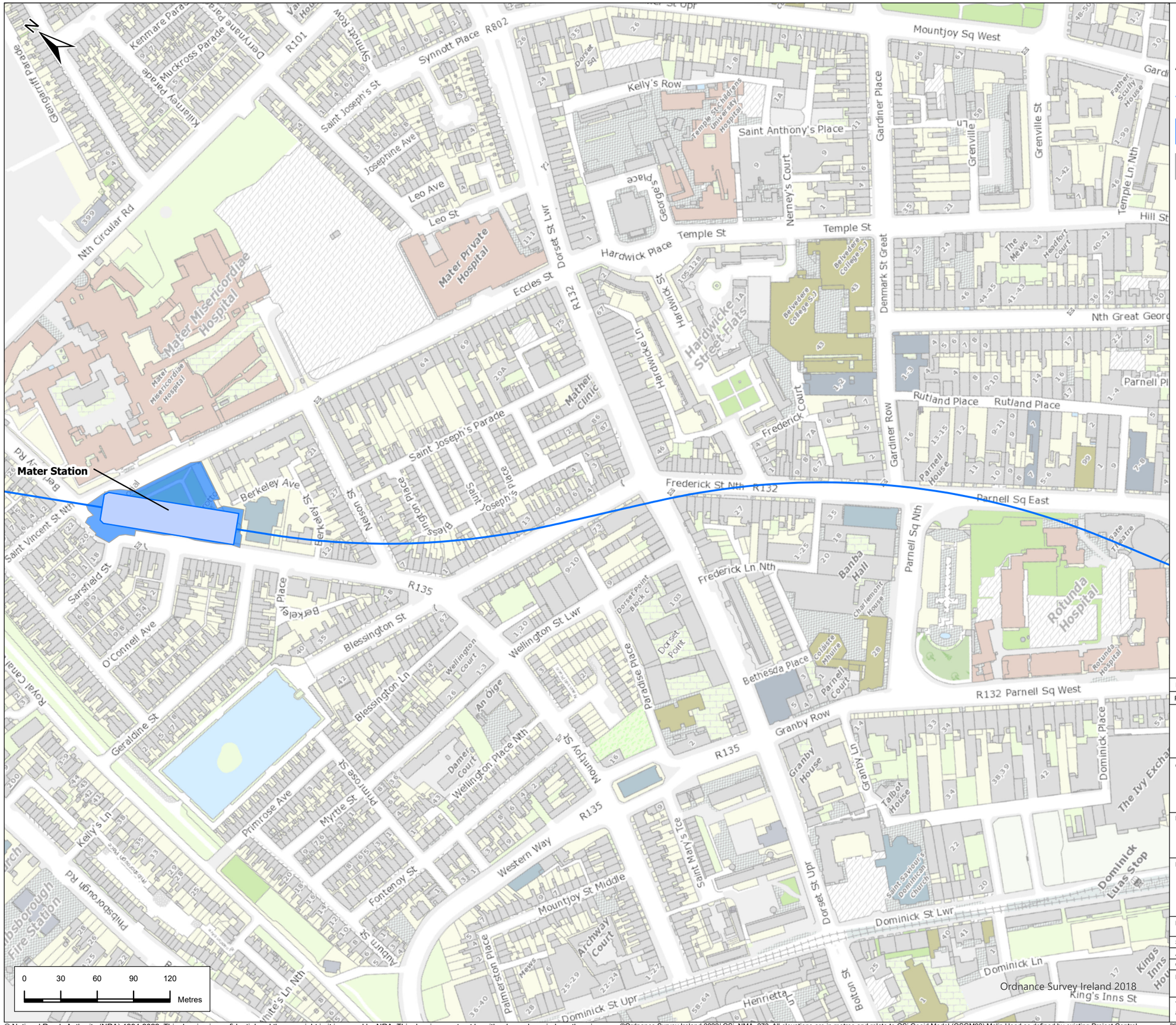
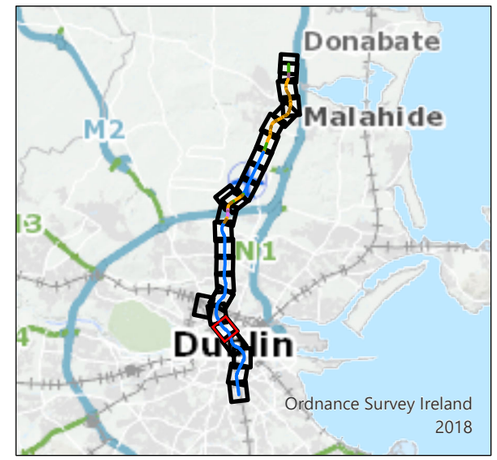
Path: \\europe.jacobs.com\Dublin\Data\IT\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\CH 5 - Fig 5.1 Construction Compounds.aprx



Legend

Alignment

- Tunnel
- Station Locations
- Main construction compound



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.1 Construction Compounds Sheet 21 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05023	Rev P02

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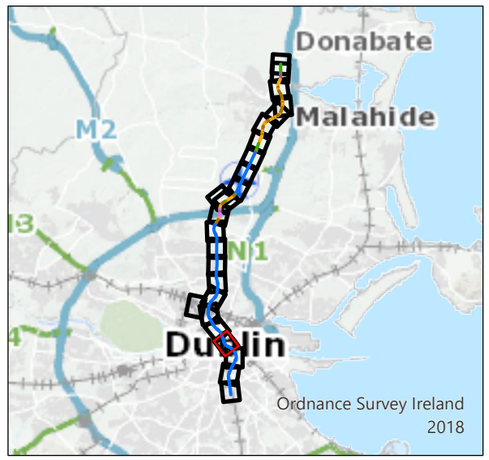
Path: \\europe.jacobs.com\Dublin\Data\IT\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\CH 5 - Fig 5.1 Construction Compounds.aprx

Legend

Alignment

- Tunnel
- Station Locations
- Main construction compound



O'Connell Street Station

Tara Station

Ordnance Survey Ireland 2018

0 30 60 90 120 Metres

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.1 Construction Compounds
Sheet 22 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05024	Rev P02

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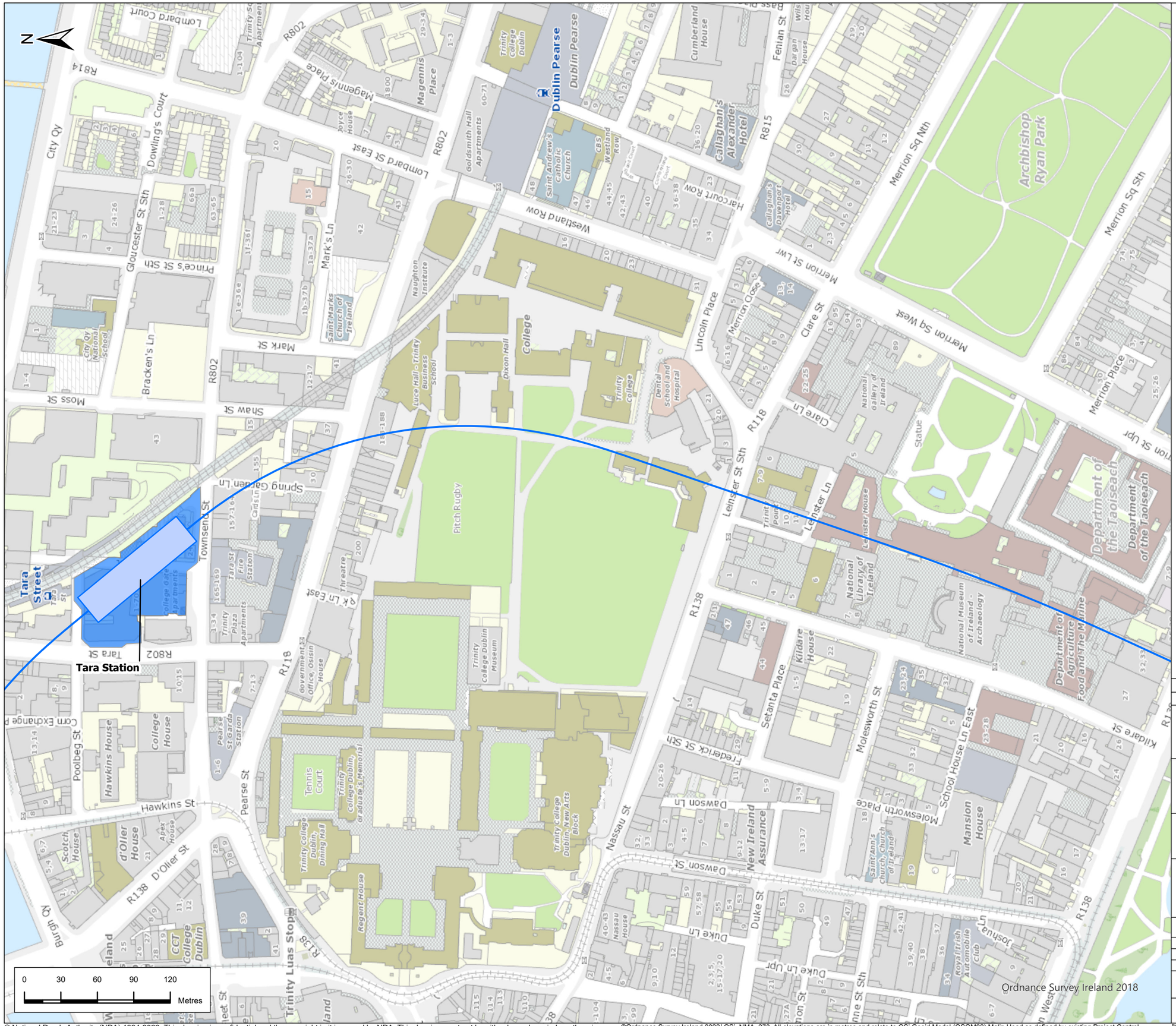
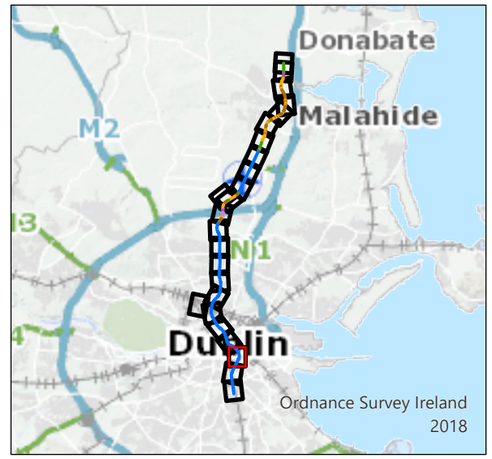
Path: \\europe.jacobs.com\Dublin\Data\JI\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\CH 5 - Fig 5.1 Construction Compounds.aprx



Legend

Alignment

- Tunnel
- Station Locations
- Main construction compound



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.1 Construction Compounds
Sheet 23 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05025	Rev P02

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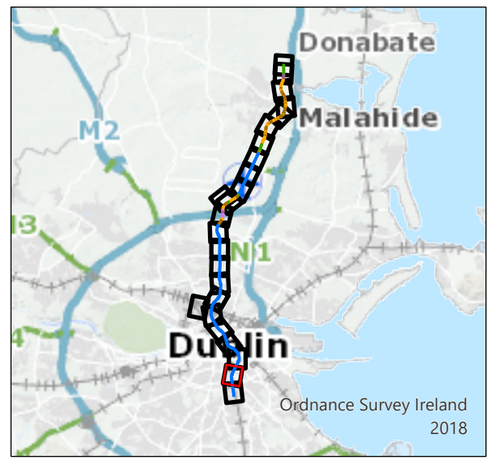
St Stephen's Green Station

0 30 60 90 120 Metres

Legend

Alignment

- Tunnel
- Station Locations
- Main construction compound



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.1 Construction Compounds Sheet 24 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05026	Rev P02

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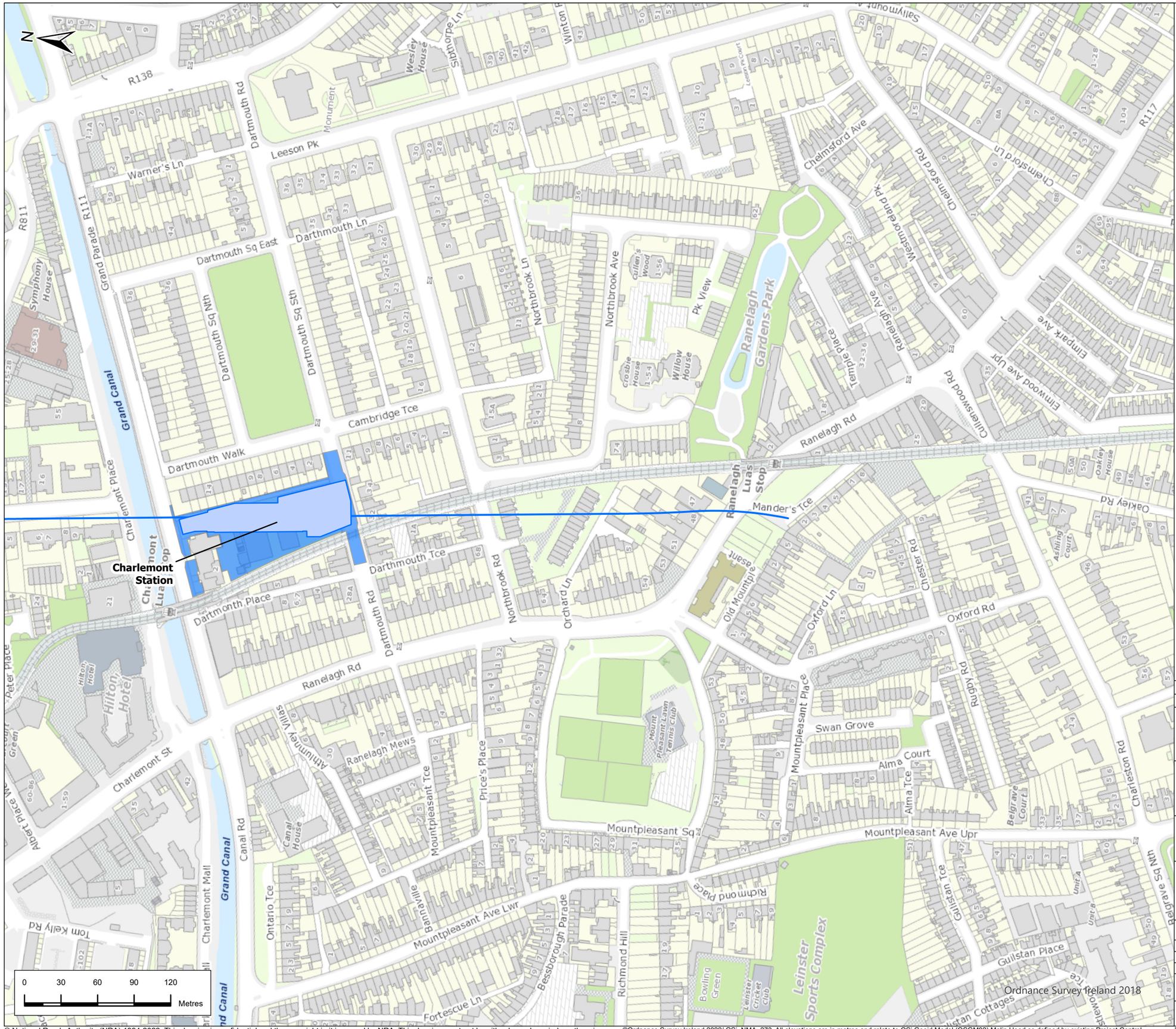
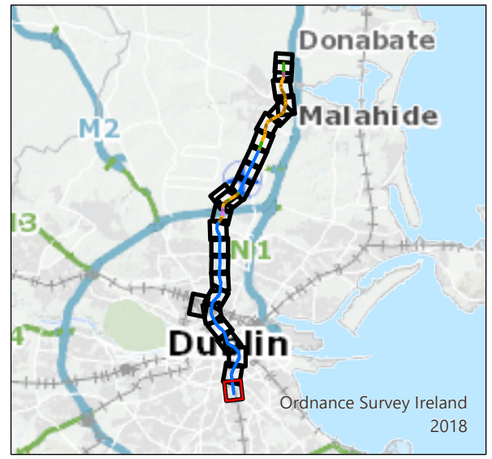
Path: \\europe.jacobs.com\Dublin\Data\IT\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\CH 5 - Fig 5.1 Construction Compounds.aprx



Legend

Alignment

- Tunnel
- Station Locations
- Main construction compound



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	08/7/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: Transport Infrastructure Ireland (Bonneagar Iompair Éireann)

Project: METROLINK

Drawing Title: Figure 5.1 Construction Compounds Sheet 25 of 26

Drawing Status: Final

Scale @ A3	1:3,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05027	Rev P02

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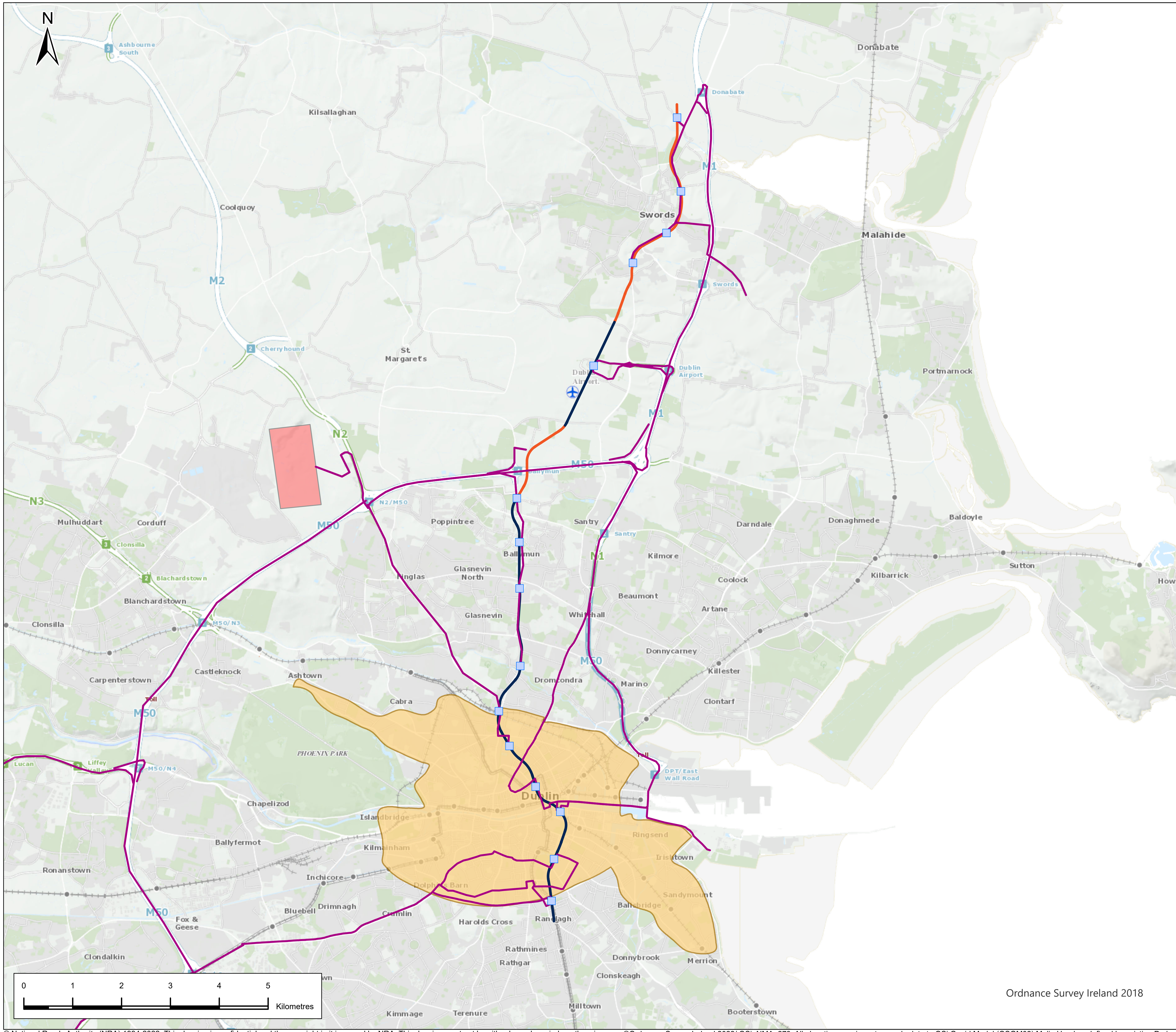
Path: \\europe.jacobs.com\Dublin\Data\JI\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\Ch 5 - Fig 5.1 Construction Compounds.aprx



Legend

Alignment

- Above Ground/Retained Cut/ Cut & Cover
- Tunnel
- Station Locations
- HGV Haul Routes
- HGV Restricted Zone
- Spoil Site

P02	8/6/22	Final Issue	JL	RH	RH	NC
Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd

JACOBS IDOM

Client

TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project

METROLINK

Drawing Title

Figure 5.2 Construction Haul Routes

Drawing Status

FINAL

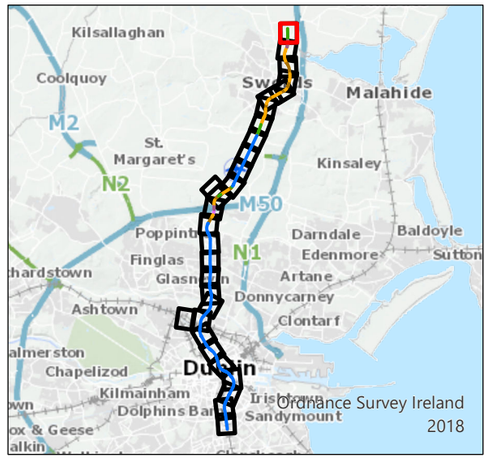
Scale @ A3	1:75,000	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05032	Rev P02

This drawing is not to be used in whole or in part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.

Legend

Alignment

- Surface
- Viaduct
- Station Locations
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 1 of 30

Drawing Status	FINAL	
Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05034	Rev P02

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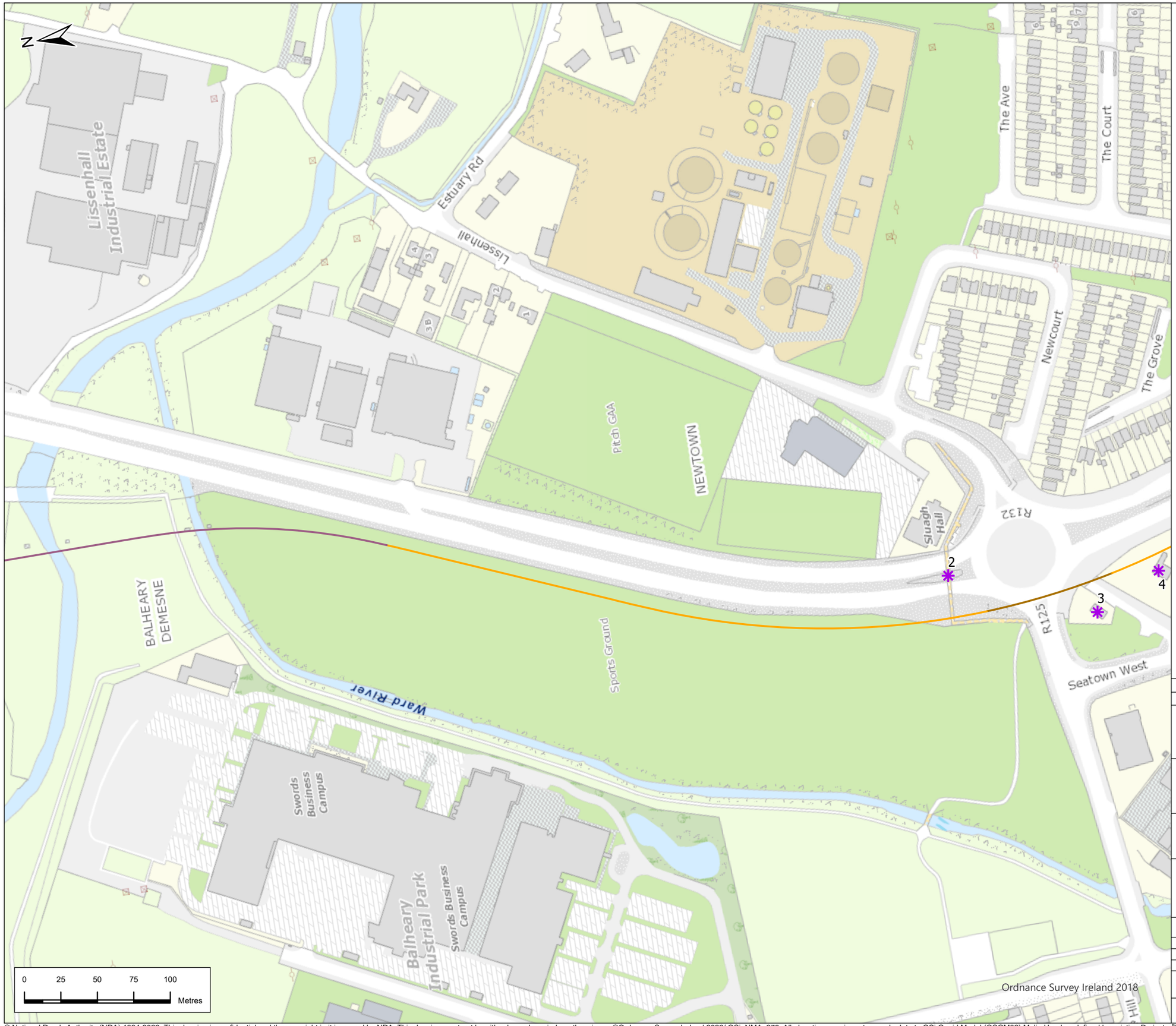
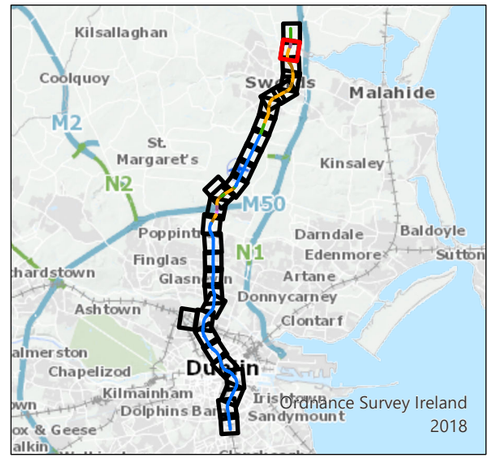
Path: \\europe.jacobs.com\Dublin\Data\JI\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\Ch 5 - Fig 5.3 Properties to be Demolished.aprx



Legend

Alignment

- Cut & Cover
- Retained Cut
- Viaduct
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.3 Properties to be Demolished Sheet 2 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05035	Rev P02

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Path: \\europe.jacobs.com\Dublin\Data\JI\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\CH 5 - Fig 5.3 Properties to be Demolished.aprx

N

Lissen Hall Drive
The Ave
The Court
The Drive
Newcourt
The Grove
The Crescent
MANTUA
Swords Business
Seatown Station
5
R132
Seatown Rd
SWORDS DEMESNE
4
3
Seatown West
Seatown Terrace
TOWNPARKS
Fingal Community College
Carnegie Court
SEATOWN WEST
Saint Fintan's
Saint Columcille's Pk
Saint Columcilles Drive

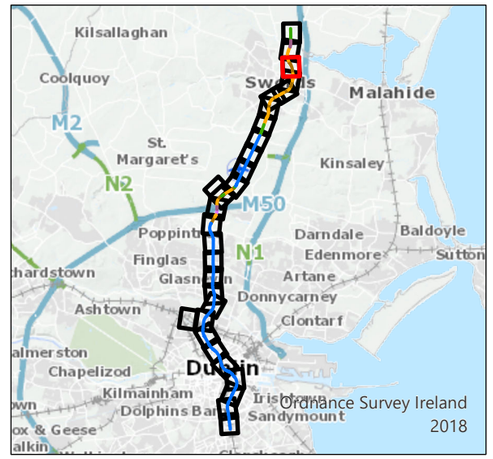
0 25 50 75 100
Metres

Ordnance Survey Ireland 2018

Legend

Alignment

- Cut & Cover
- Retained Cut
- Station Locations
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 3 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05036	Rev P02

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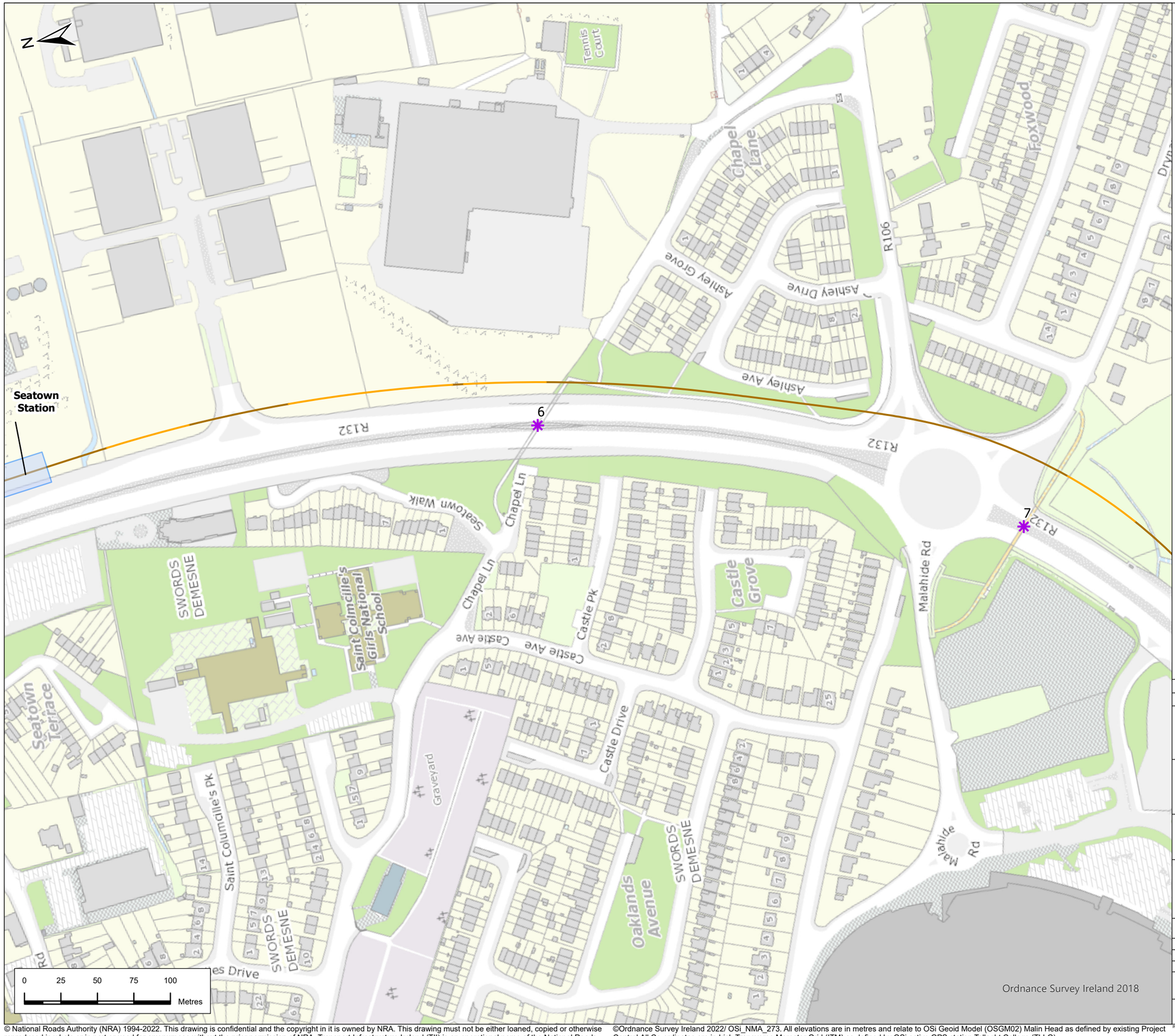
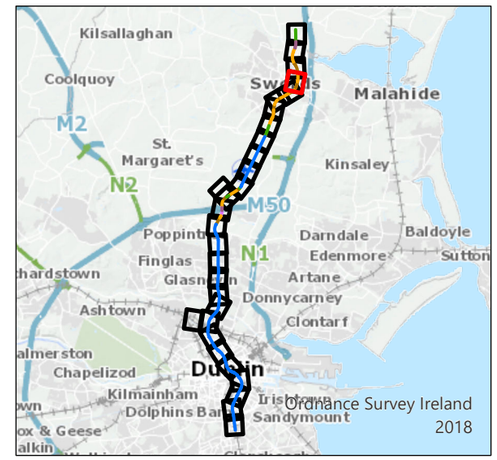
Path: \\europe.jacobs.com\Dublin\Data\JI\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\CH 5 - Fig 5.3 Properties to be Demolished.aprx



Legend

Alignment

- Cut & Cover
- Retained Cut
- Station Locations
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 4 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05037	Rev P02

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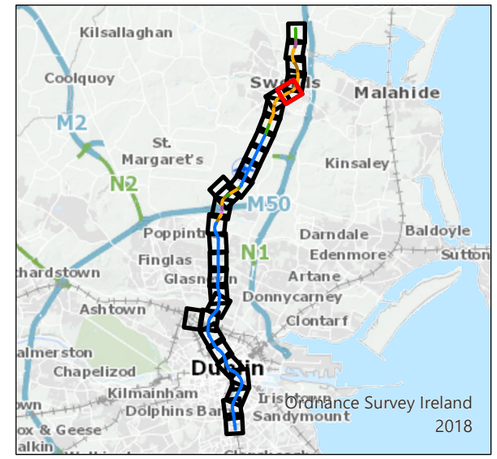
Legend

Alignment

- Cut & Cover
- Retained Cut
- Station Locations
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 5 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05038	Rev P02

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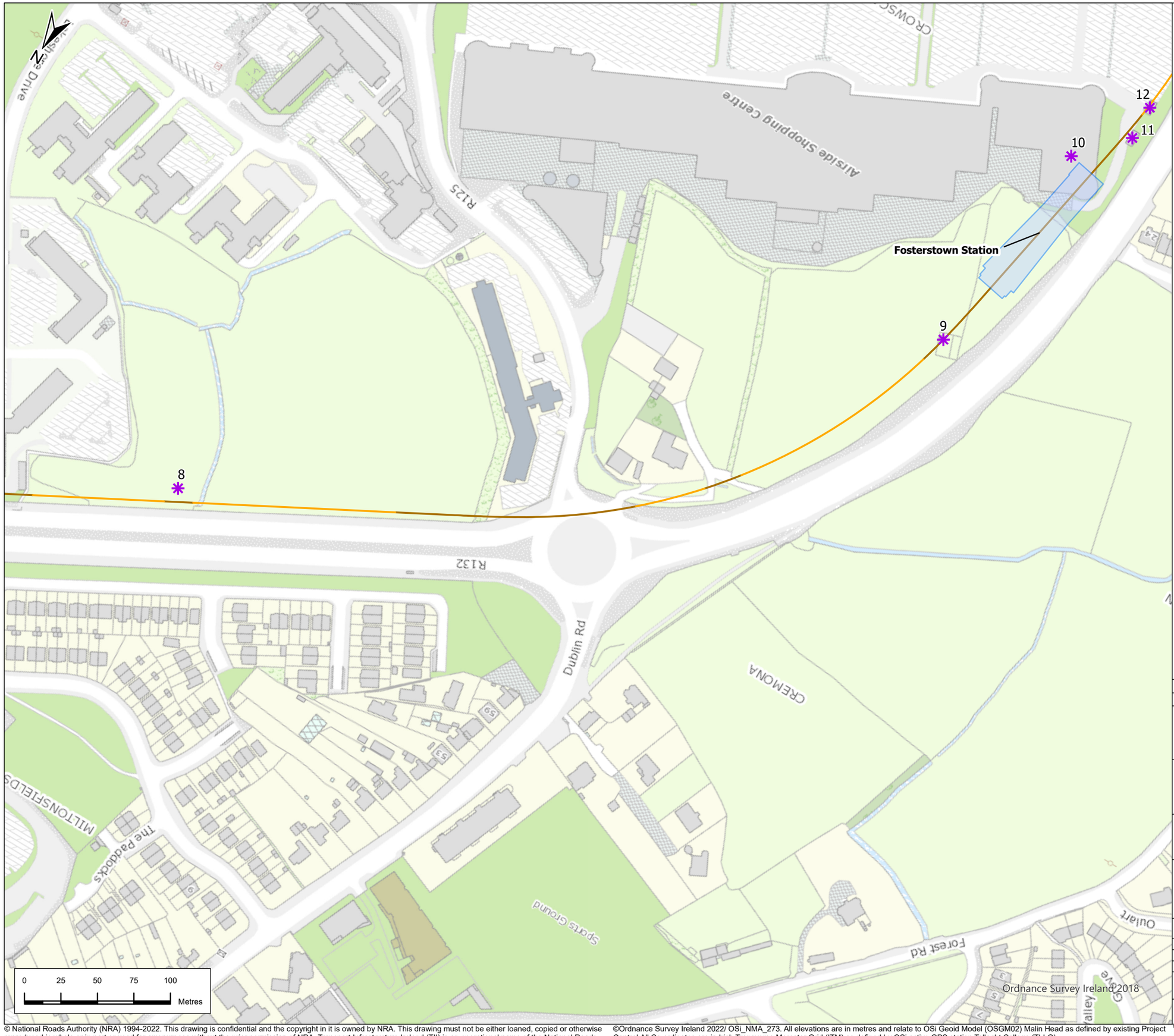
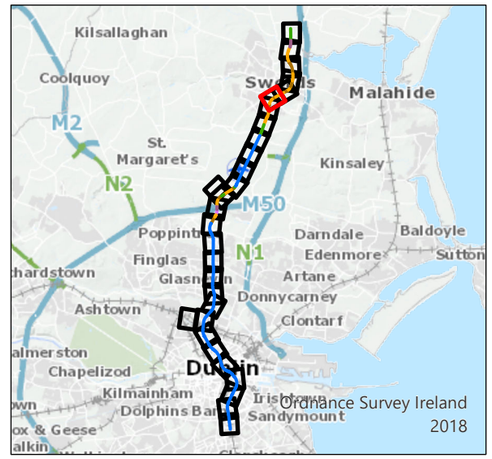


Legend

Alignment

- Cut & Cover
- Retained Cut
- Station Locations
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 6 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05061	Rev P02

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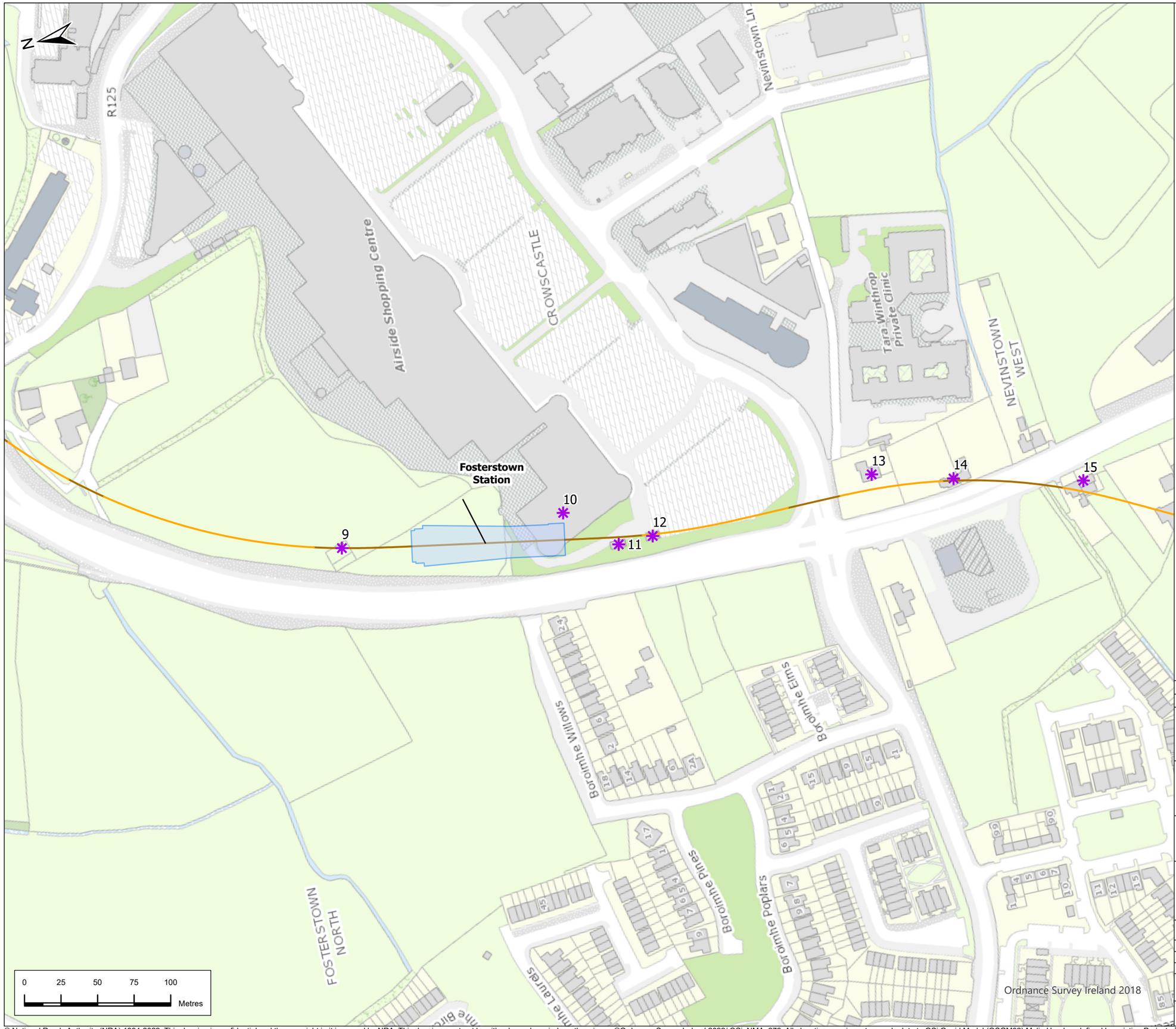
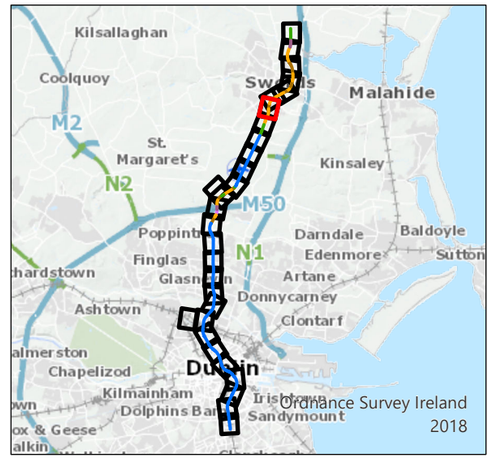


Legend

Alignment

- Cut & Cover
- Retained Cut
- Station Locations
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: Transport Infrastructure Ireland (Bonneagar Iompair Eireann)

Project: METROLINK

Drawing Title: Figure 5.3 Properties to be Demolished
Sheet 7 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05039	Rev P02

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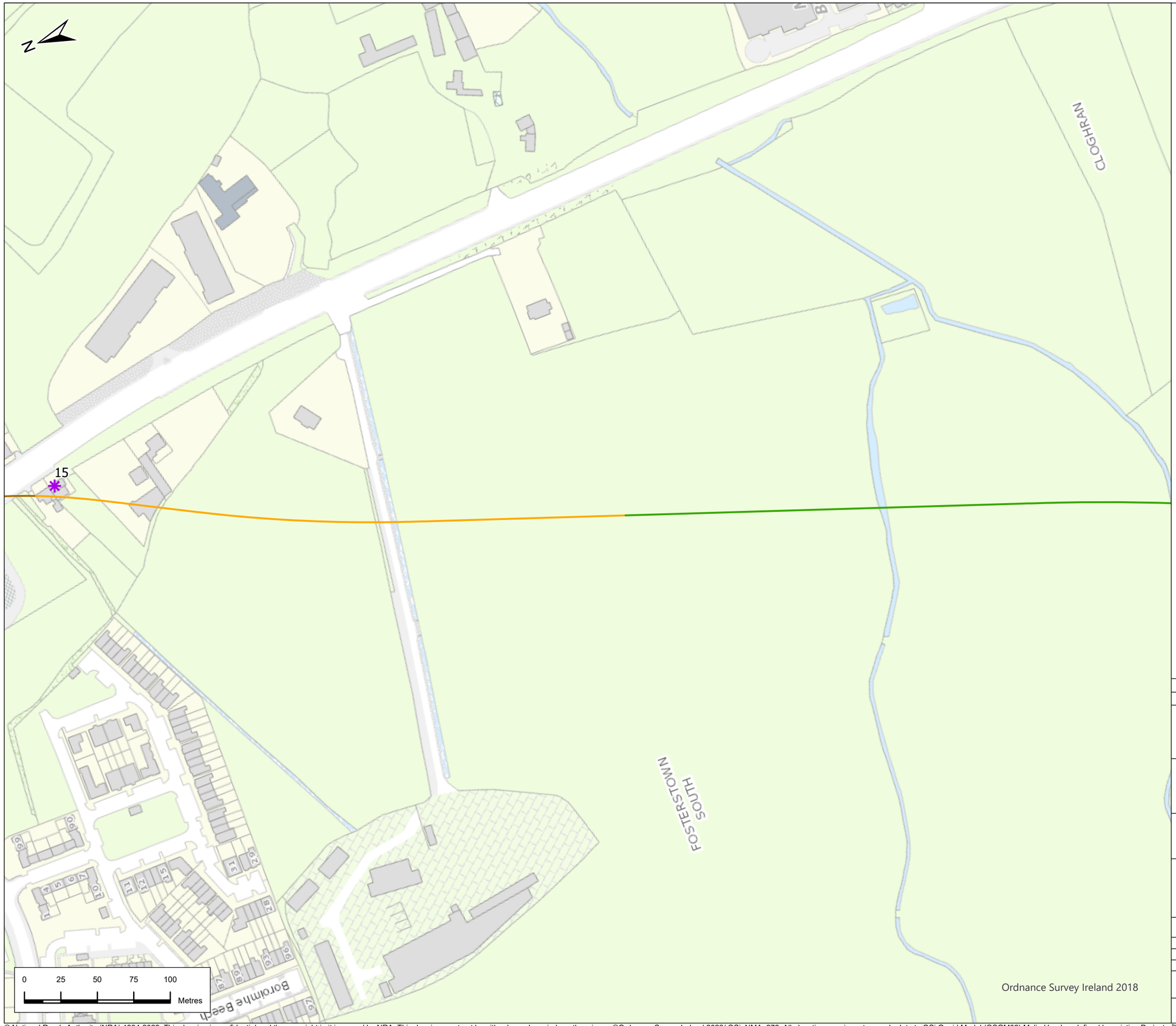
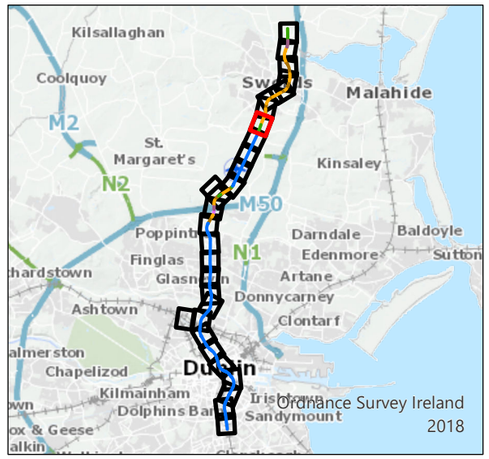


Legend

Alignment

- Cut & Cover
- Retained Cut
- Surface
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 8 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05040	Rev P02

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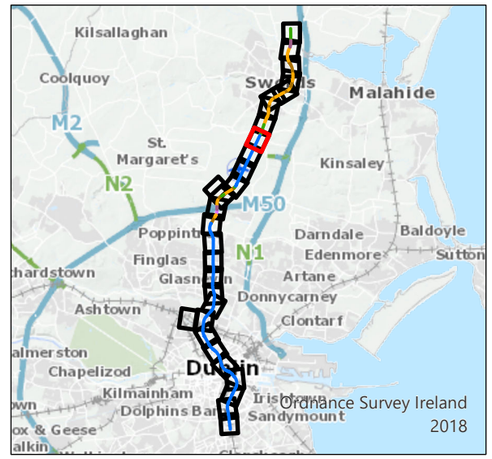
Legend

Alignment

- Cut & Cover
- Retained Cut
- Surface
- Tunnel



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.3 Properties to be Demolished Sheet 9 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05041	Rev P02

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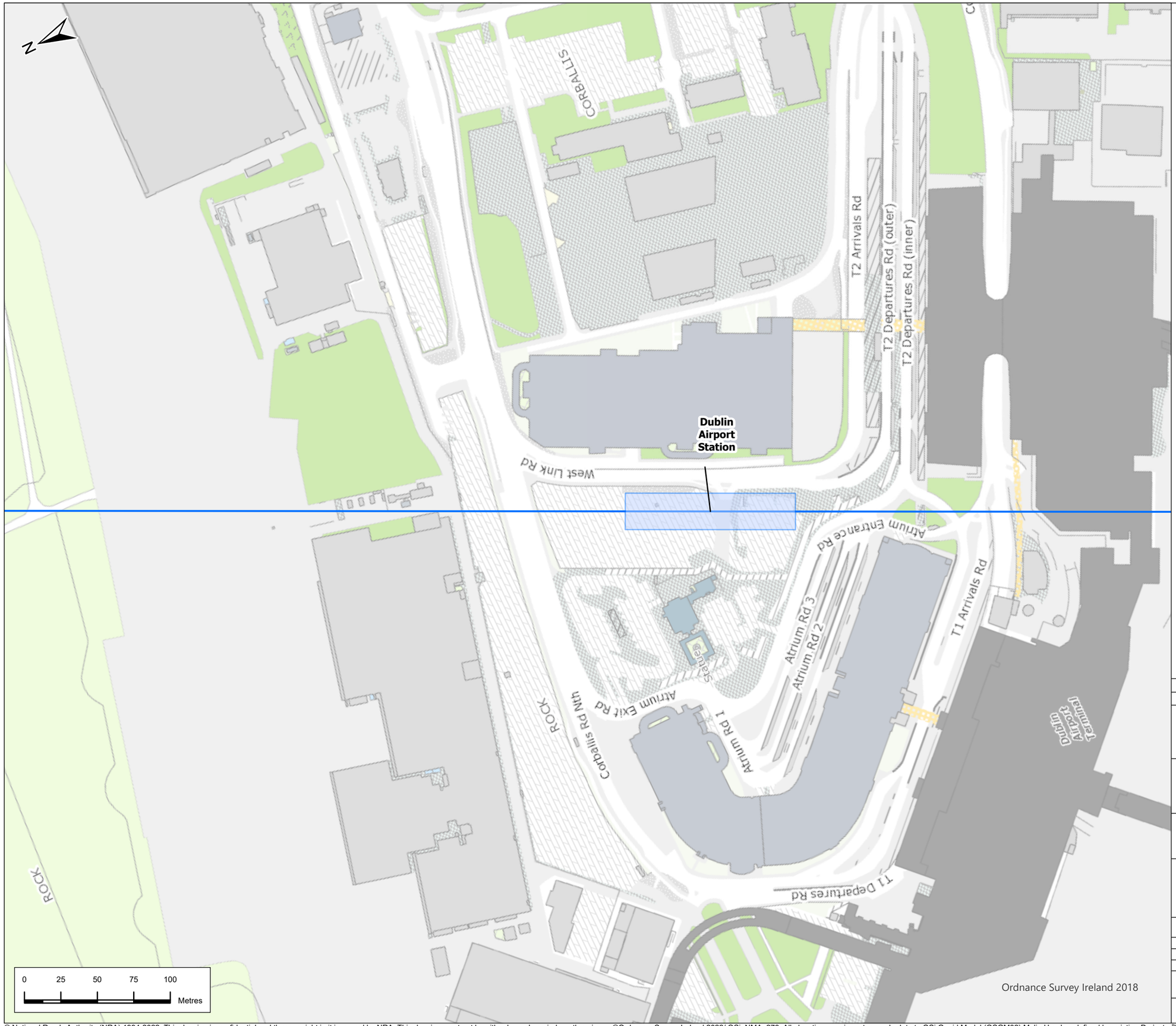
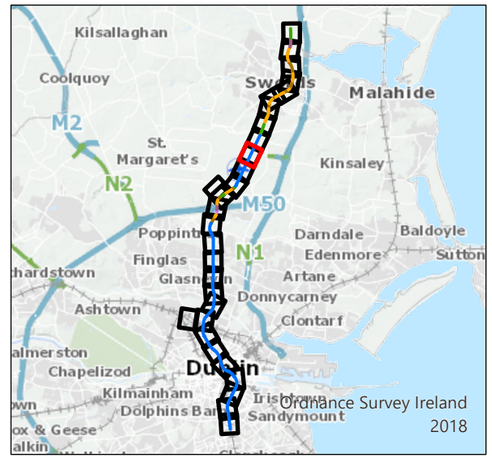


Legend

Alignment

- Tunnel
- Station Locations



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 10 of 30

Drawing Status	FINAL	
Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05042	Rev P02

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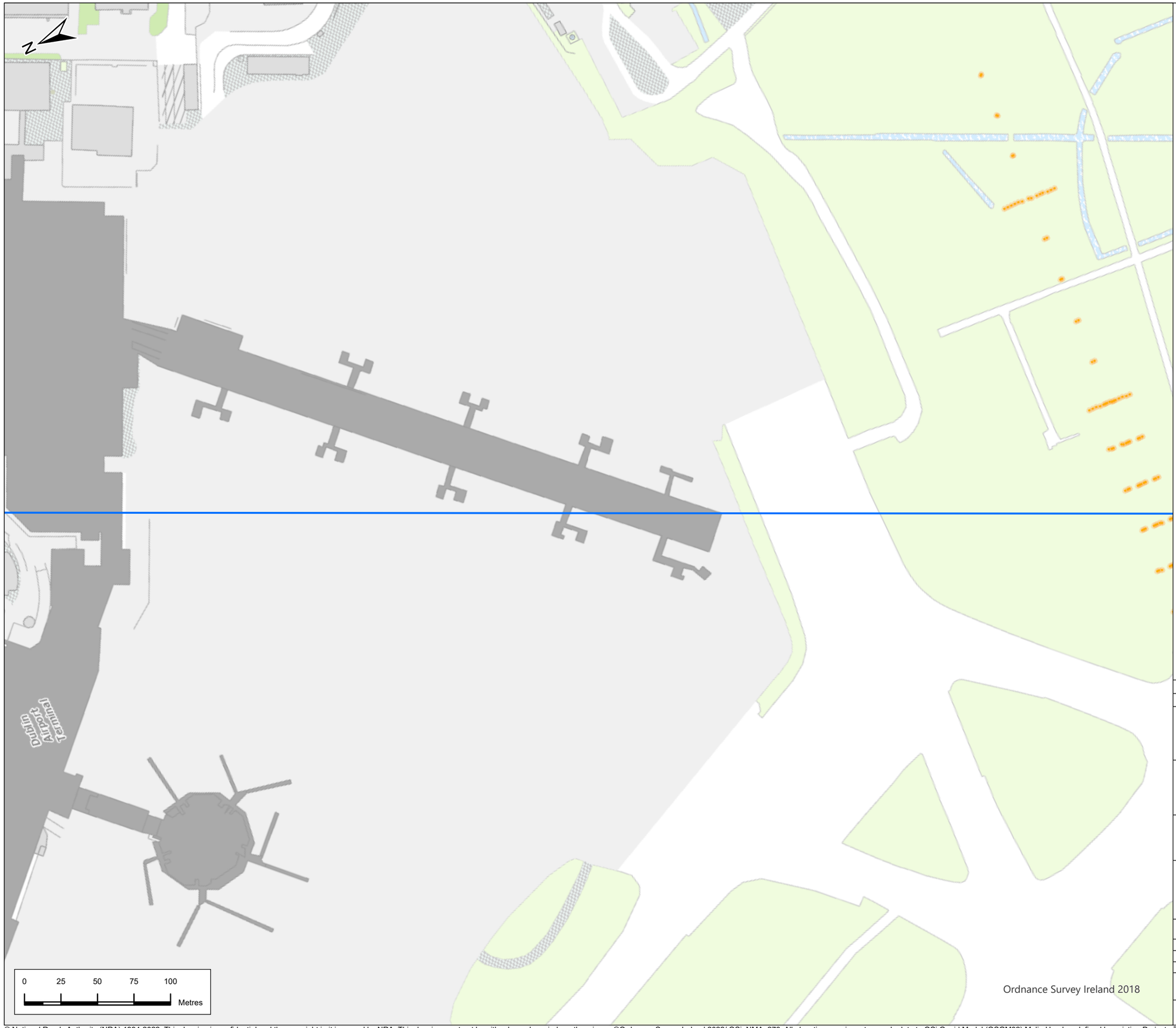
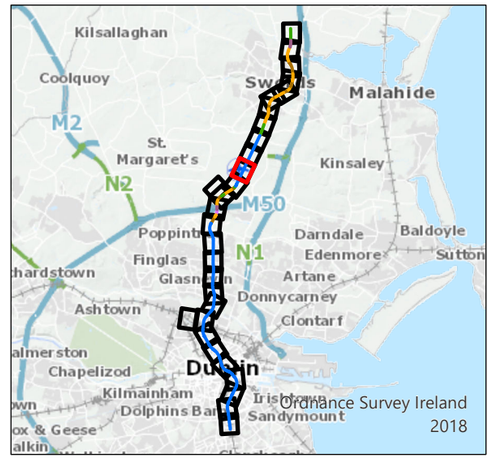


Legend

Alignment

Tunnel



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 11 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05043	Rev P02

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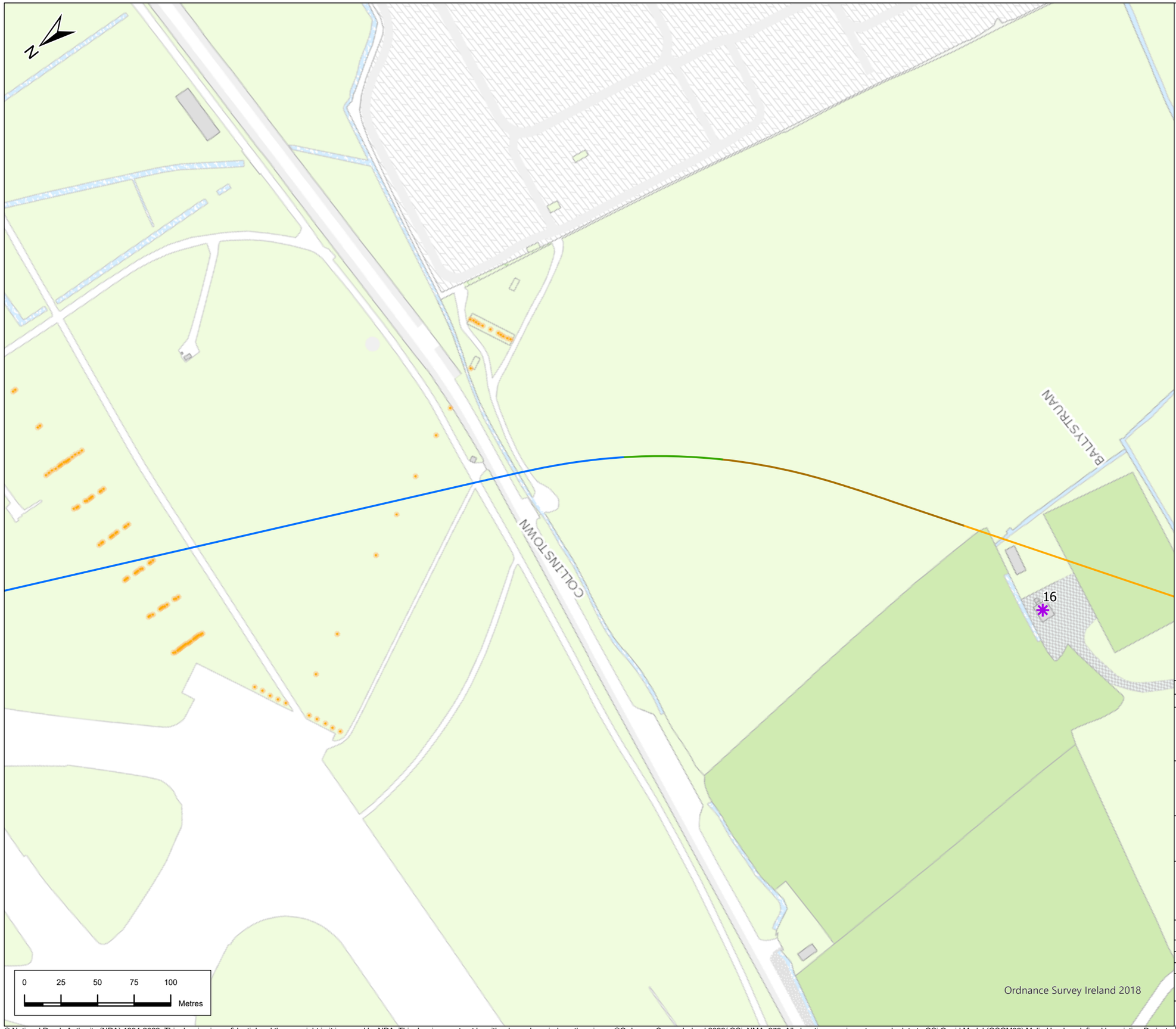
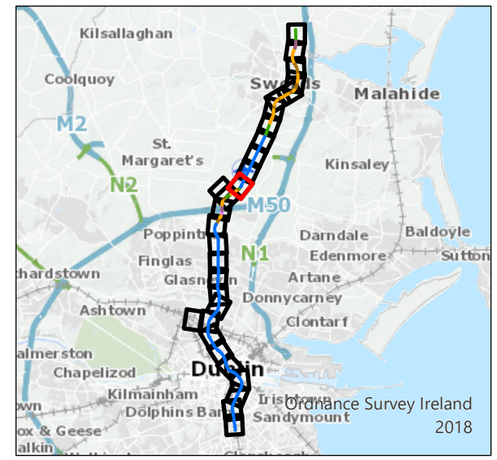


Legend

Alignment

- Cut & Cover
- Retained Cut
- Surface
- Tunnel
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 12 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05044	Rev P02

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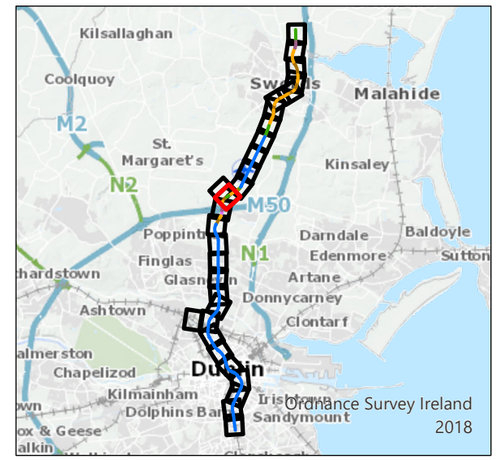
Legend

Alignment

- Cut & Cover
- Retained Cut
- Surface
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 13 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05045	Rev P02

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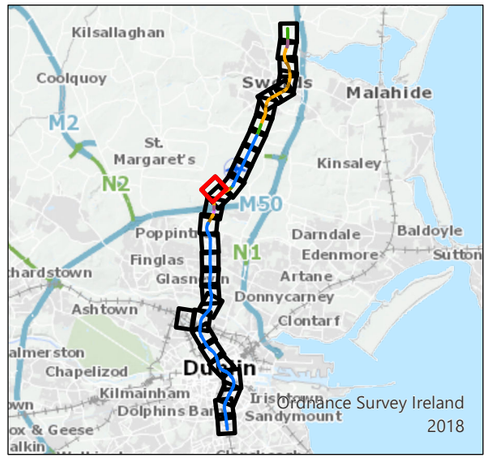
Legend

Alignment

- Cut & Cover
- Surface
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 14 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05062	Rev P02

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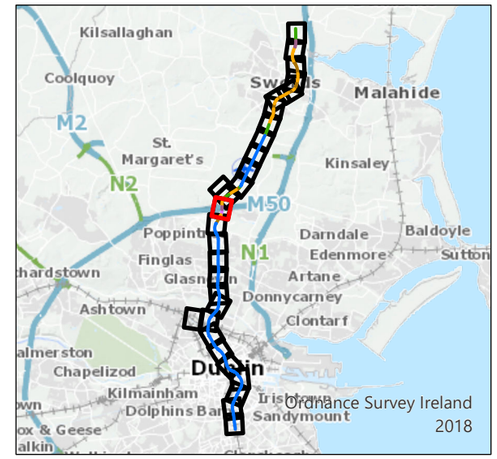
Legend

Alignment

- Cut & Cover
- Incline
- Retained Cut
- Viaduct
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 15 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05046	Rev P02

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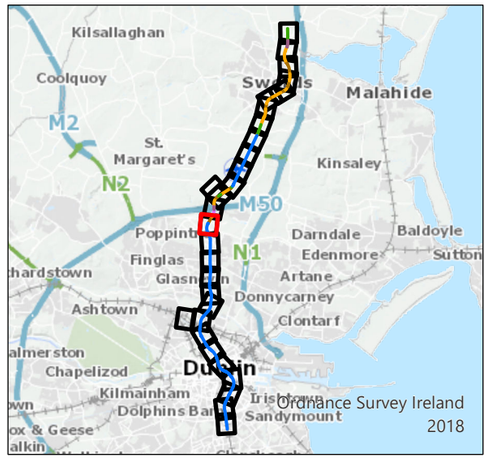
Legend

Alignment

- Cut & Cover
- Retained Cut
- Tunnel
- Station Locations
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 16 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05047	Rev P02

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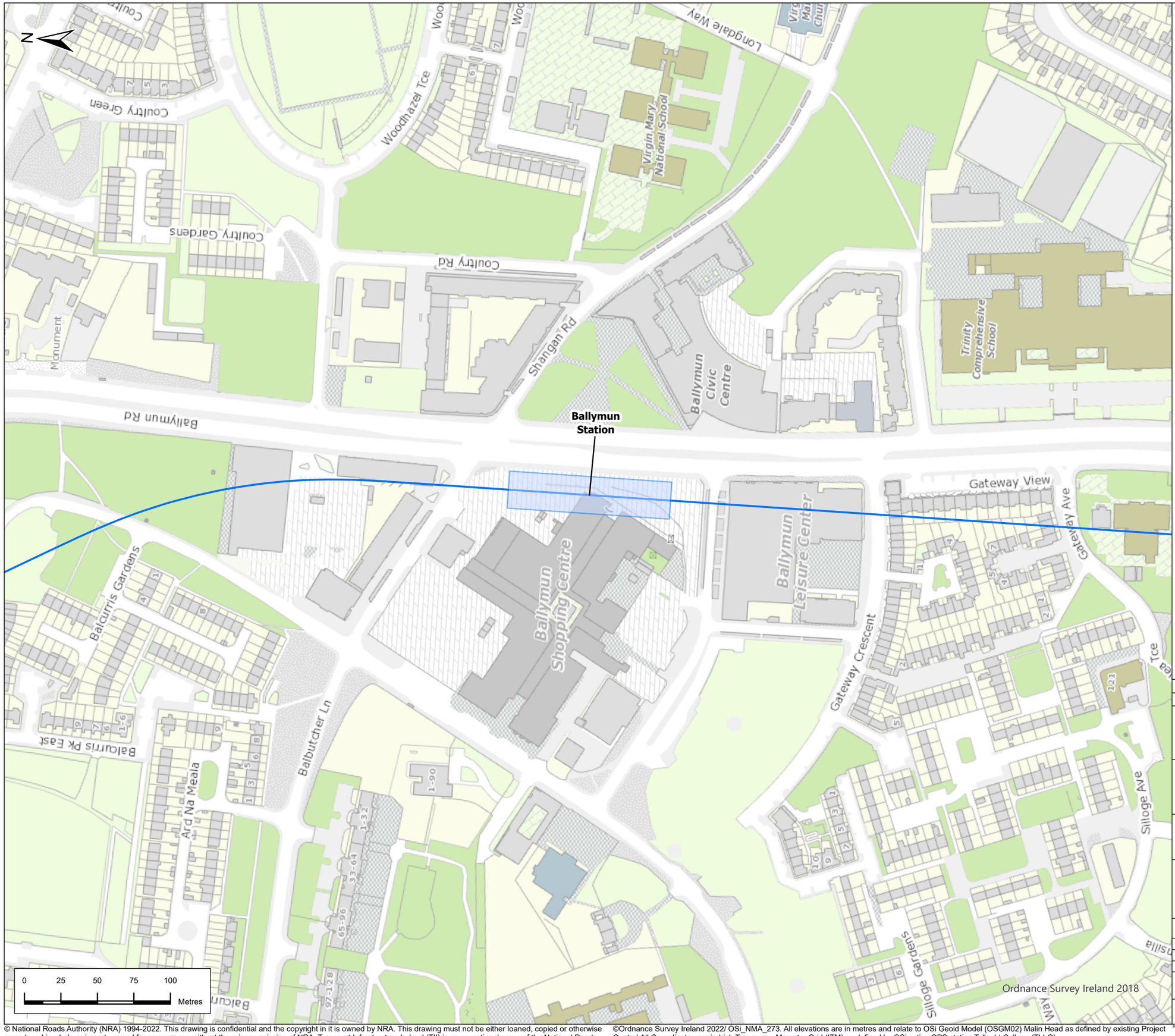
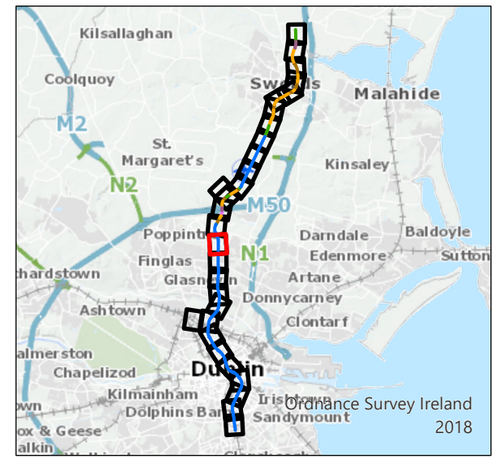


Legend

Alignment

- Tunnel
- Station Locations



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 17 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05048	Rev P02

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N

Oldtown Ave
Shanliss Gardens
Shanard Rd
Shanowen Grove
Shanowen Pk
Collins Ave Extension
Albert College Ave
Albert College Drive
Albert College Grove
Albert College
Shanard Ave
Shanliss Rd
Ballymun Rd
Our Lady Of Victories
Collins Avenue Station
Albert College Court
Scout Hall
R108
Ballymun Library
Tennis Ground
Owensilla Tce
Owensilla Ave
Silloge Ave
Our Lady of Victories National Schools
Clonmel Rd
Wadelai Rd
Maolbuille Rd
Wadelai Green

0 25 50 75 100 Metres

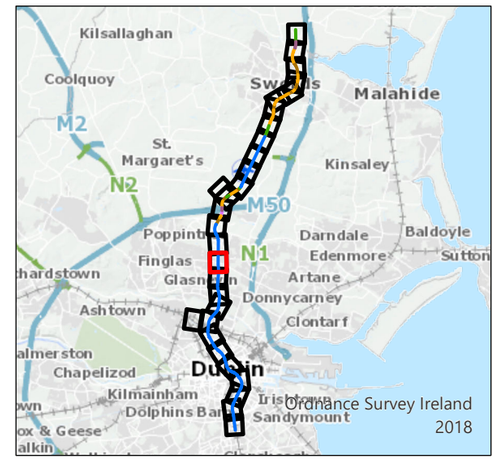
Ordnance Survey Ireland 2018

Legend

Alignment

Tunnel

Station Locations



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 18 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05049	Rev P02

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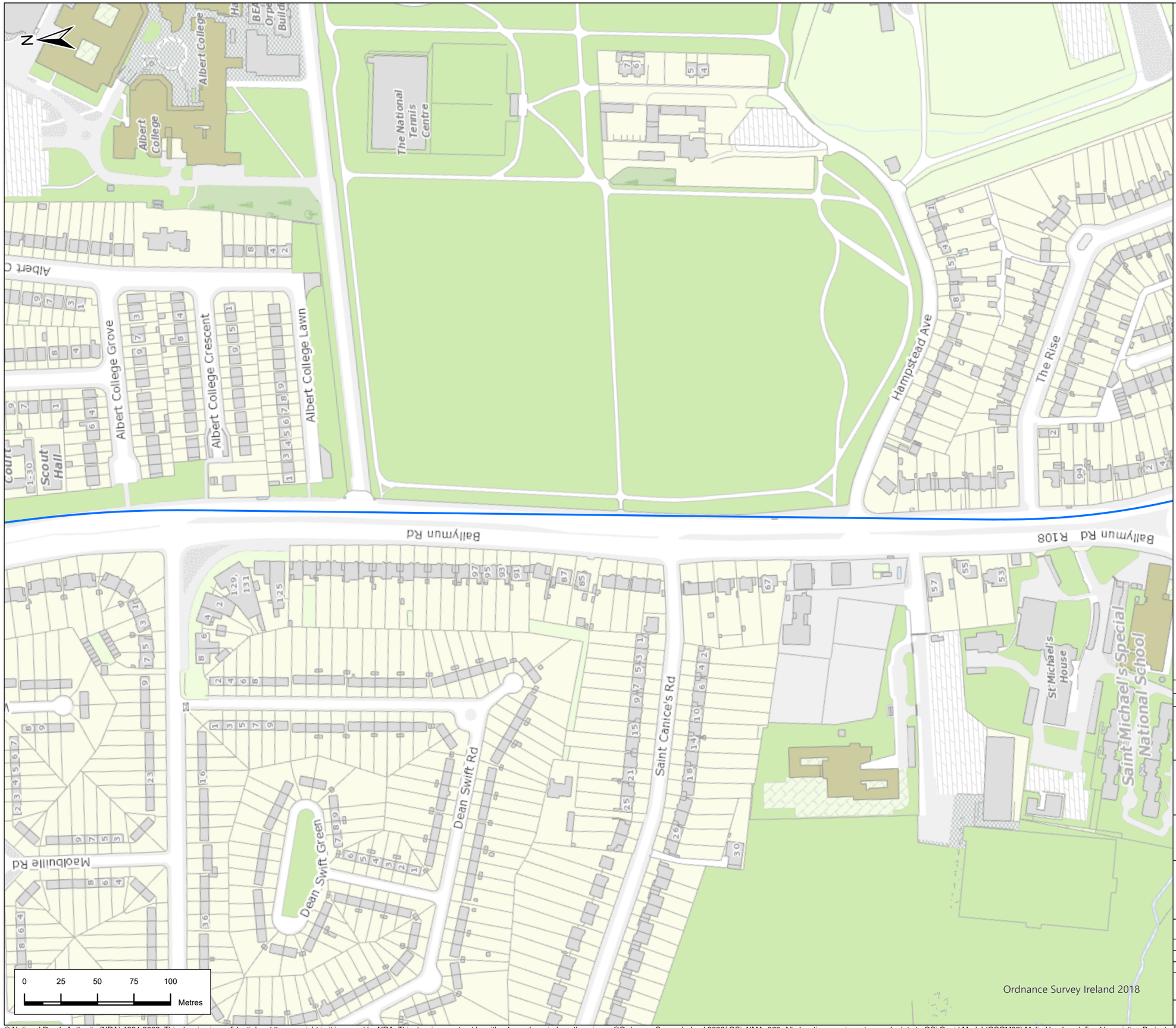
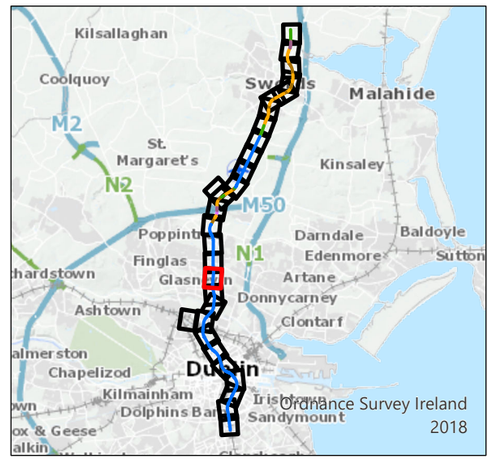
Path: \\europe.jacobs.com\Dublin\Data\IT\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\CH 5 - Fig 5.3 Properties to be Demolished.aprx



Legend

Alignment

Tunnel



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 19 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05050	Rev P02

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N

Griffith Lawns
Woodpark
Lambay Rd
Walsh Rd
Home Farm Rd
The Rise
Hampstead Pk
Griffith Ave
Stella Ave
Rathlin Rd
R108
Saint Mobhi Rd
Ballymun Rd R108
Saint Mobhi Boithirin
22
St Michael's House
Saint Michael's Special National School
Graveyard
Bon Secours Hospital
River Gardens
Glasnevin Educate Together Primary School
Claremont Ave
Church Ave
Saint David's Tce
Beechmount
Glasnevin Hill
Met Eireann
Accelerator Building
River Gardens

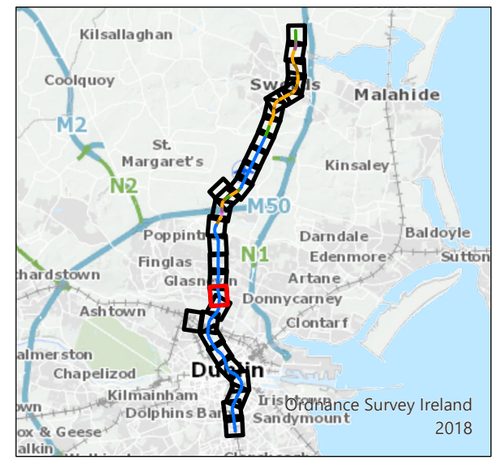
0 25 50 75 100
Metres

Ordnance Survey Ireland 2018

Legend

Alignment

- Tunnel
- Station Locations
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.3 Properties to be Demolished Sheet 20 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05051	Rev P02

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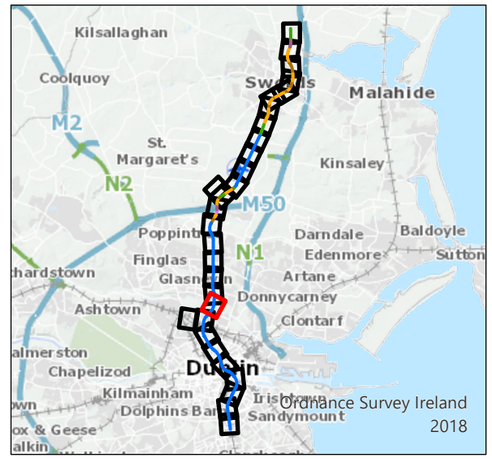
©Ordnance Survey Ireland 2022/ OSi_NMA_273. All elevations are in metres and relate to OSi Geoid Model (OSGM02) Malin Head as defined by existing Project Control.All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active GPS station Tallaght College (TLLG).

Path: \\europe.jacobs.com\Dublin\Data\JI\Sustainable Solutions\Metro North\11 - Mapping\Working\EIAR_Drawings\Ch 5 - Fig 5.3 Properties to be Demolished.aprx

Legend

Alignment

- Tunnel
- Station Locations
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 21 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05052	Rev P02

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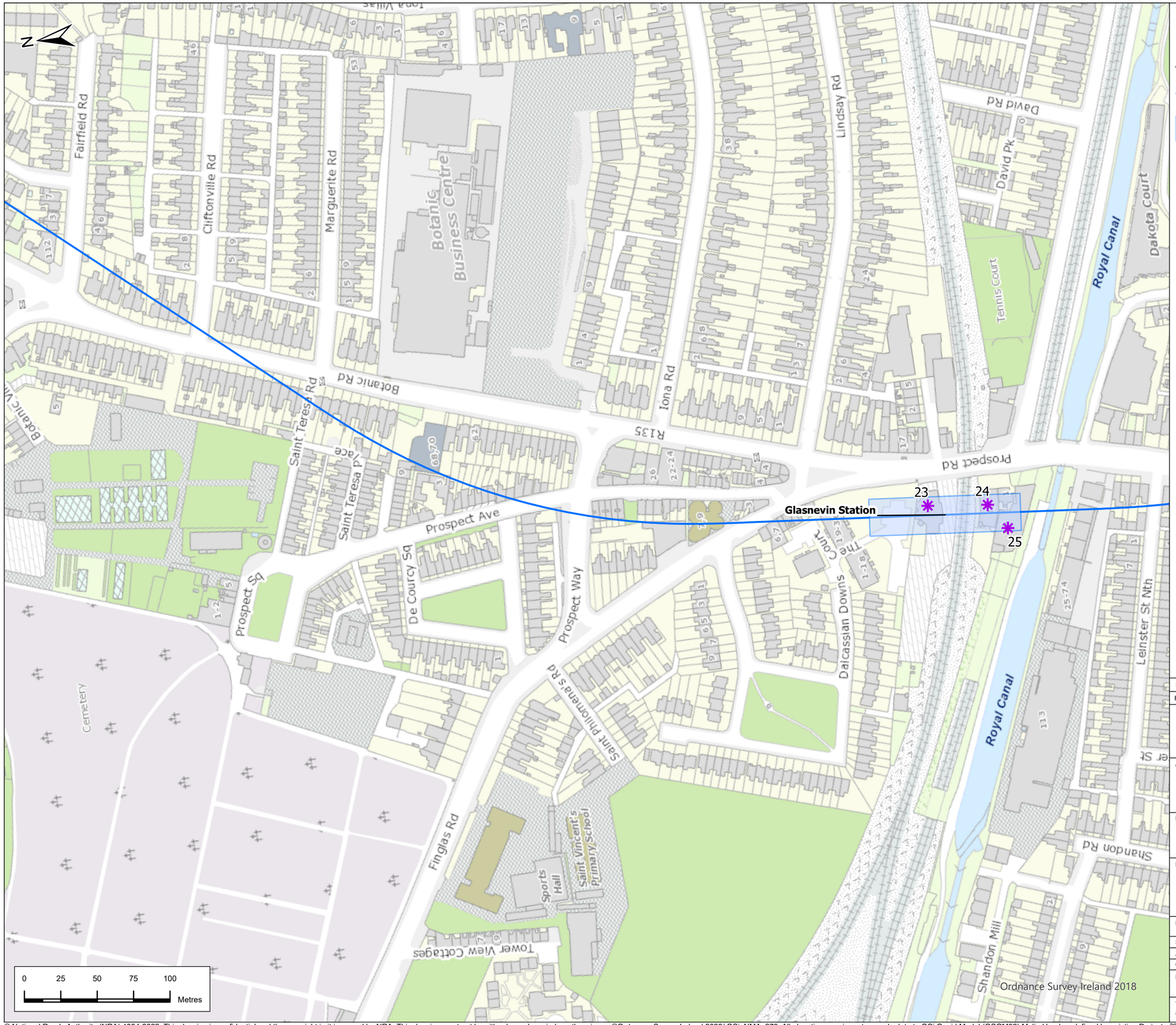
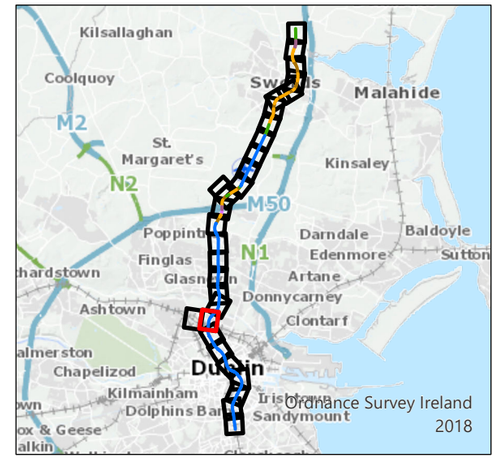


Legend

Alignment

- Tunnel
- Station Locations
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 22 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05053	Rev P02

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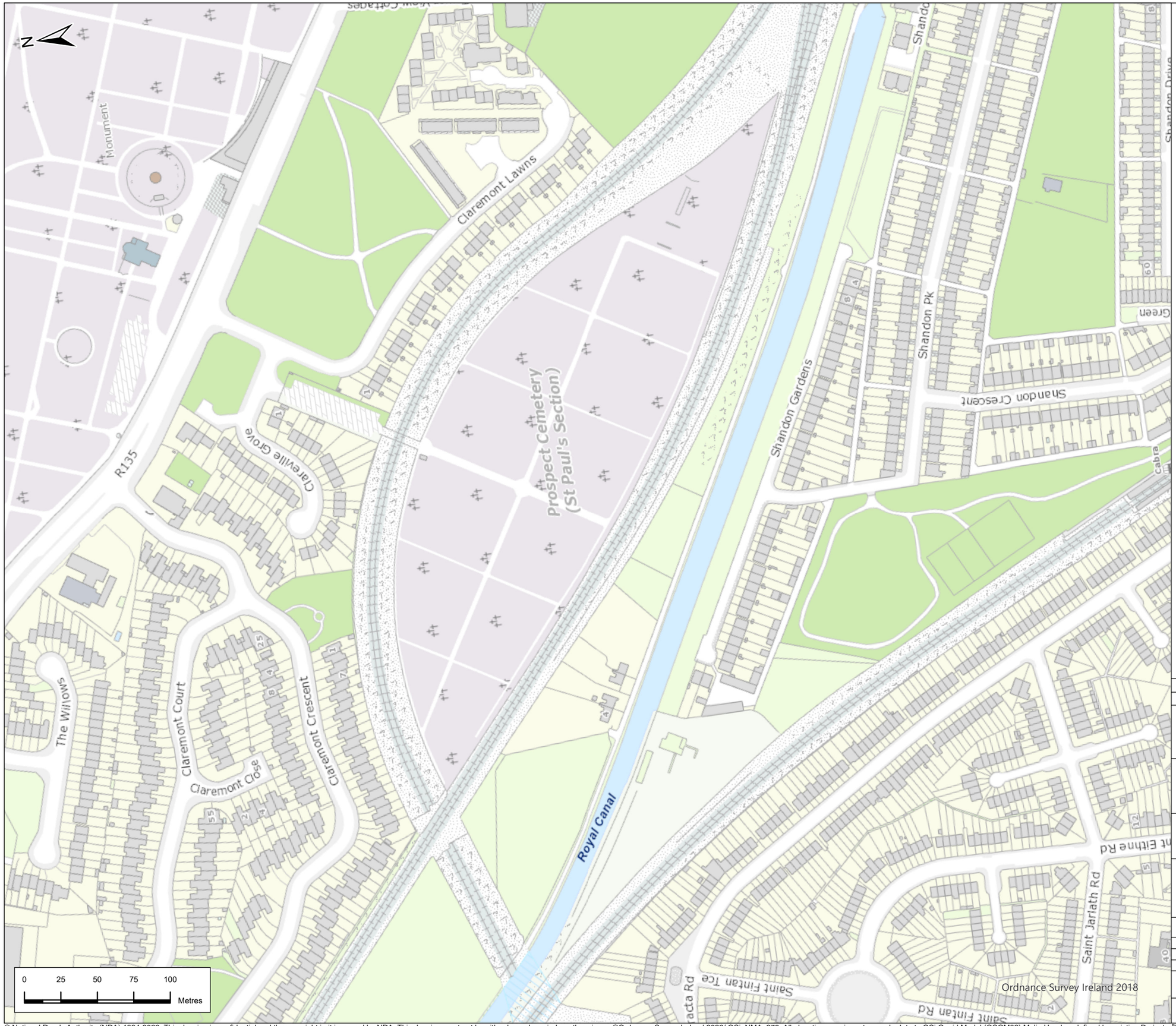
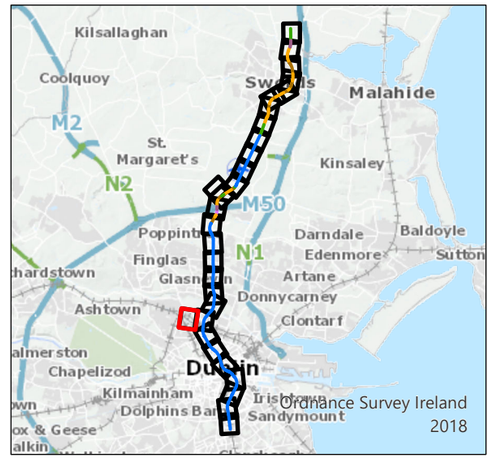


Legend



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 23 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05063	Rev P02

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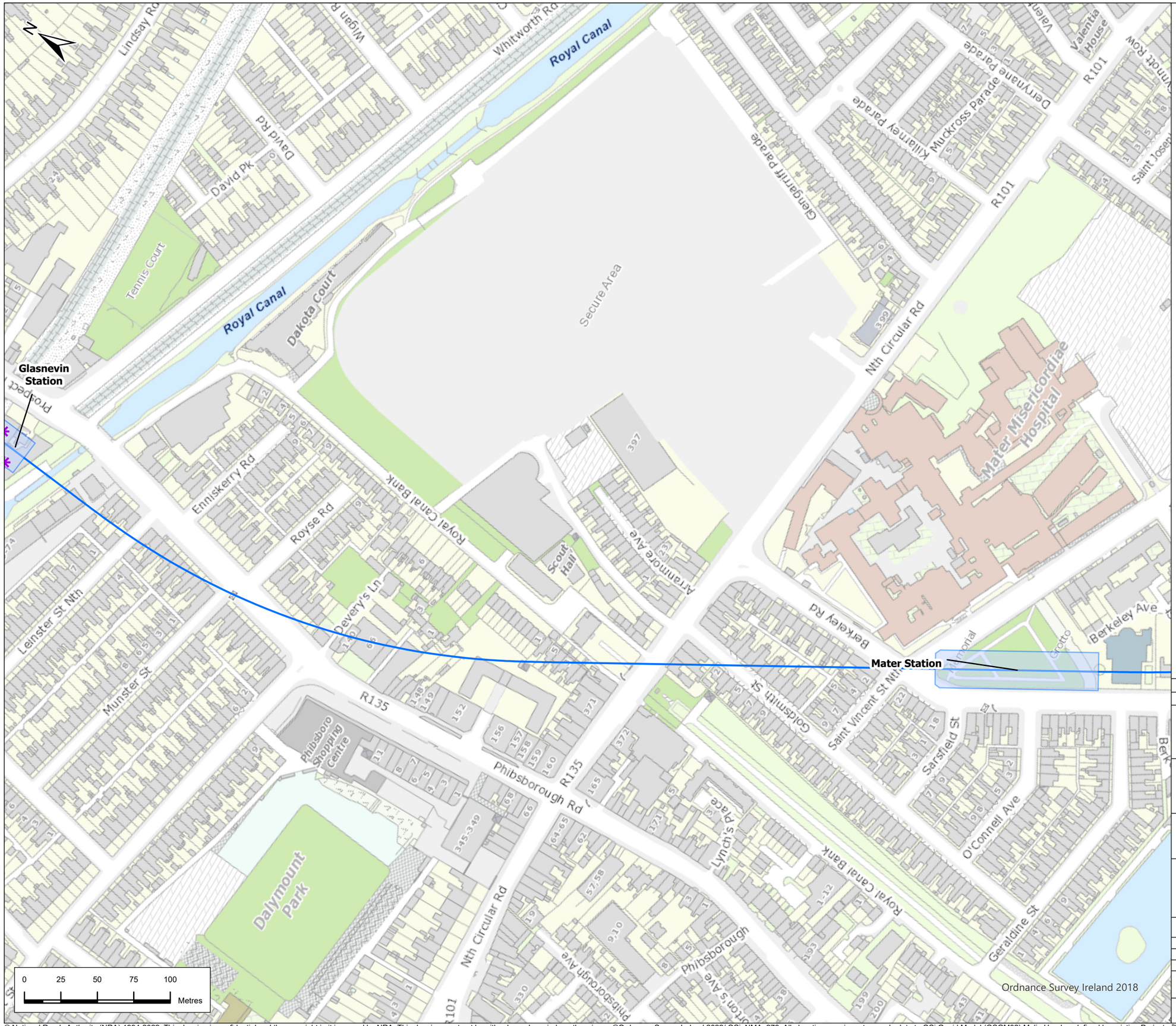
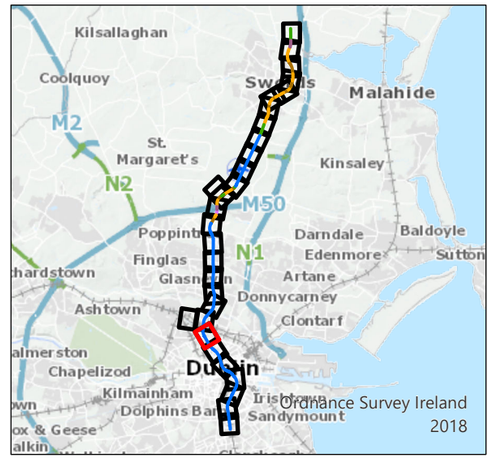


Legend

Alignment

- Tunnel
- Station Locations
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.3 Properties to be Demolished Sheet 24 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05054	Rev P02

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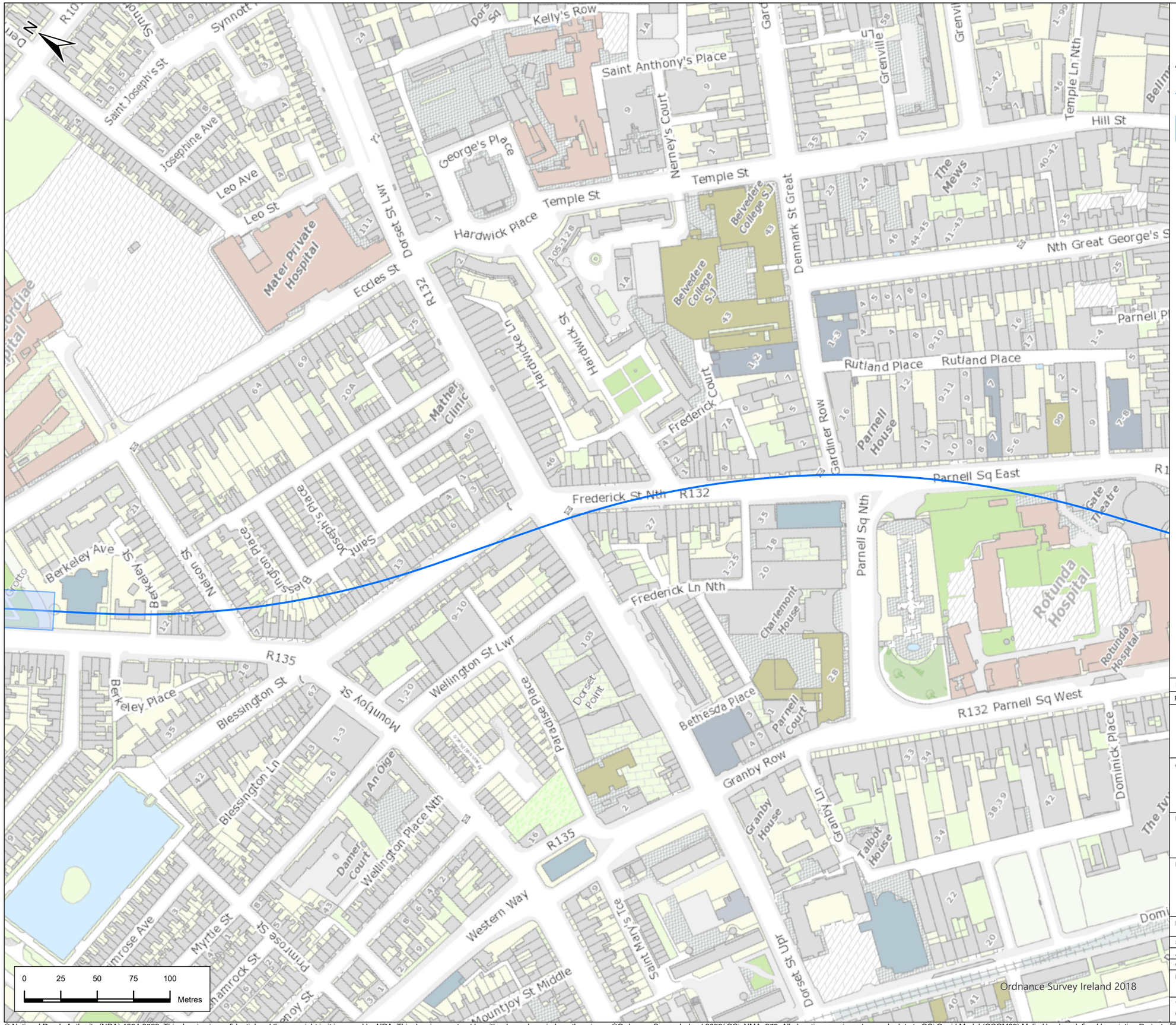
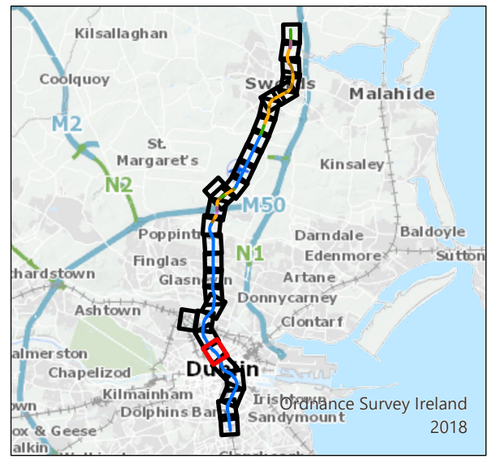


Legend

Alignment

- Tunnel
- Station Locations



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 25 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05055	Rev P02

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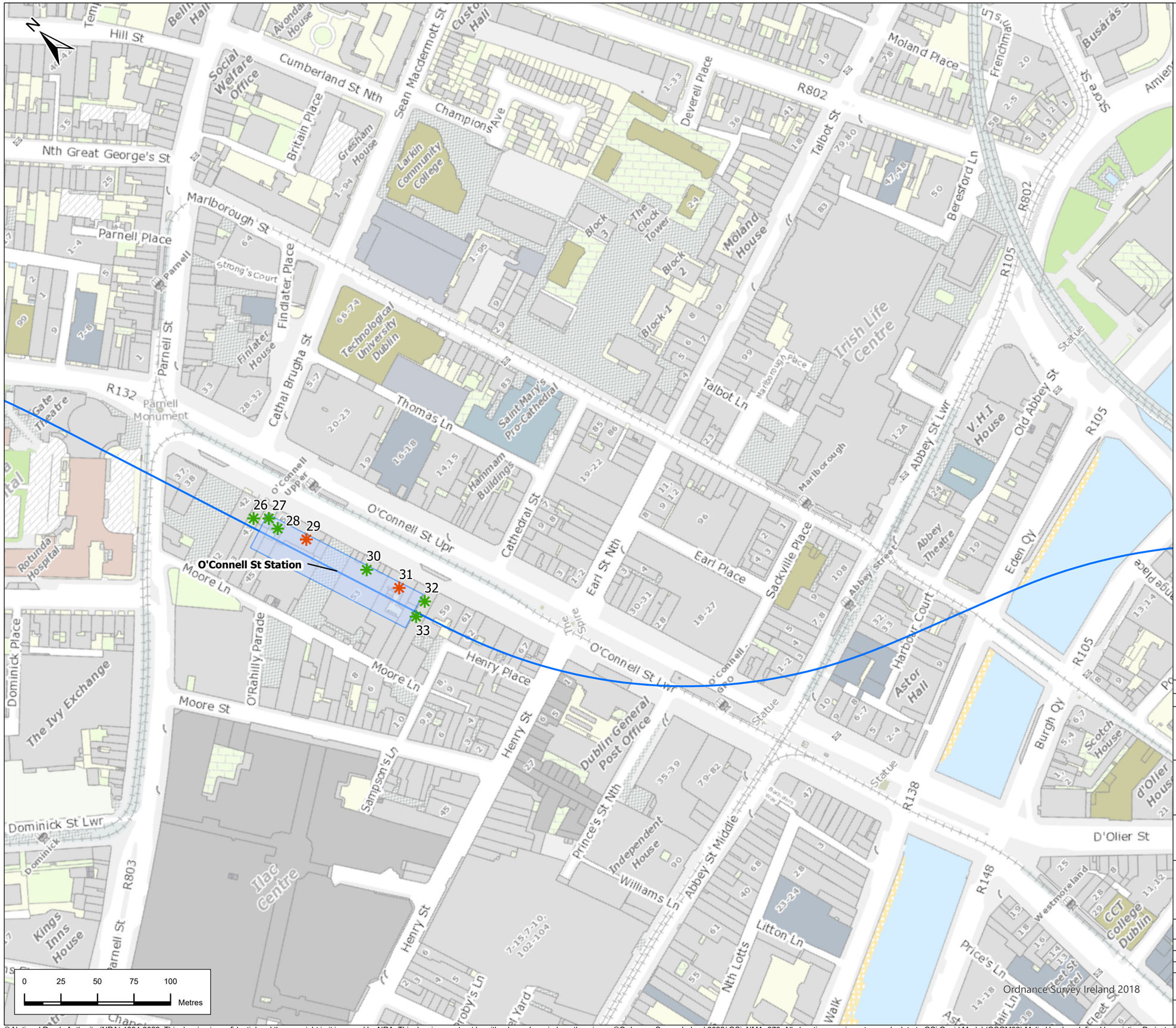
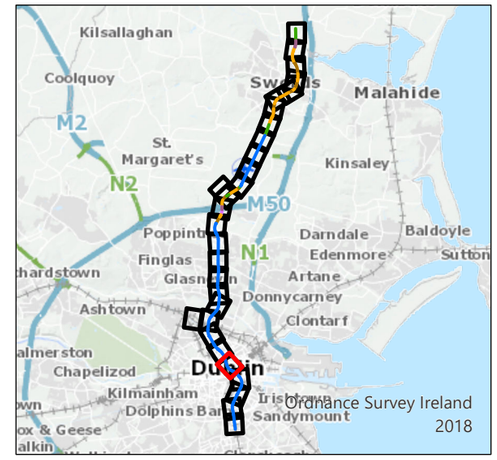


Legend

Alignment

- Tunnel
- Station Locations
- Metrolink and Developer Delivered Scenarios - Commercial properties to be demolished
- Metrolink and Developer Delivered Scenarios - Commercial properties to be partially demolished, maintained and supported



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title: Figure 5.3 Properties to be Demolished Sheet 26 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05056	Rev P02

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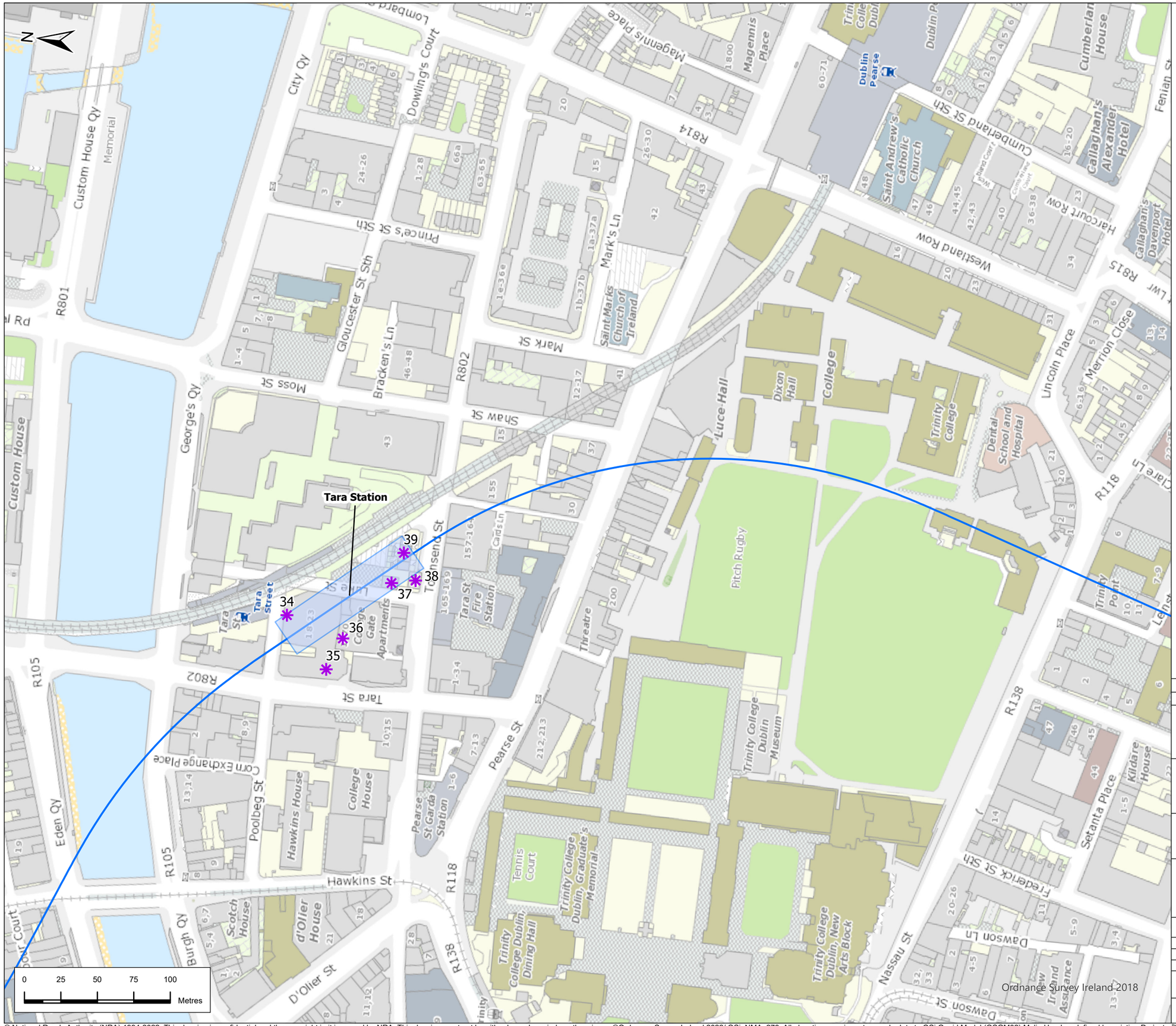
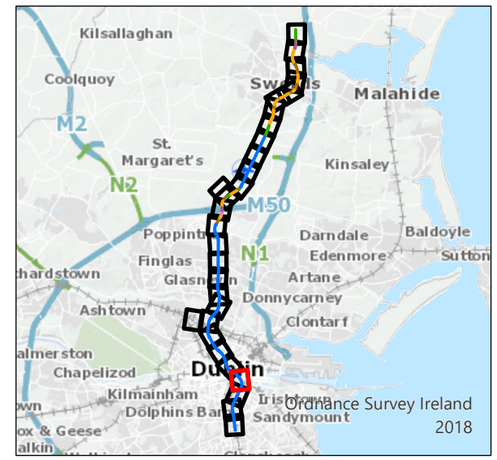


Legend

Alignment

- Tunnel
- Station Locations
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 27 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05057	Rev P02

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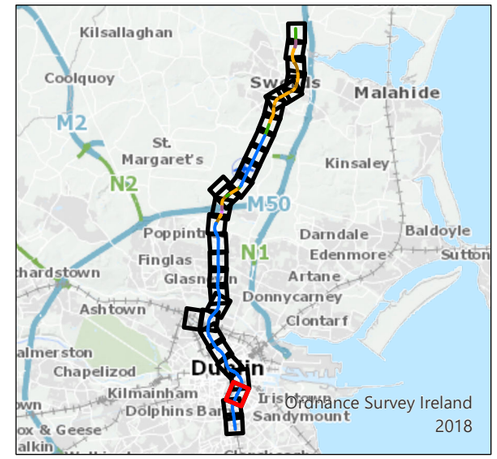
Legend

Alignment

Tunnel

Station Locations



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann / Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 28 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05058	Rev P02

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St Stephens Green Station

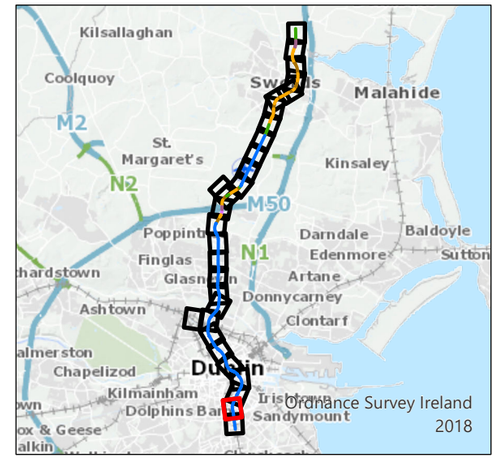
Charlemont Station

Legend

Alignment

Tunnel

Station Locations



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Eireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 29 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05059	Rev P02

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0 25 50 75 100 Metres

Ordnance Survey Ireland 2018

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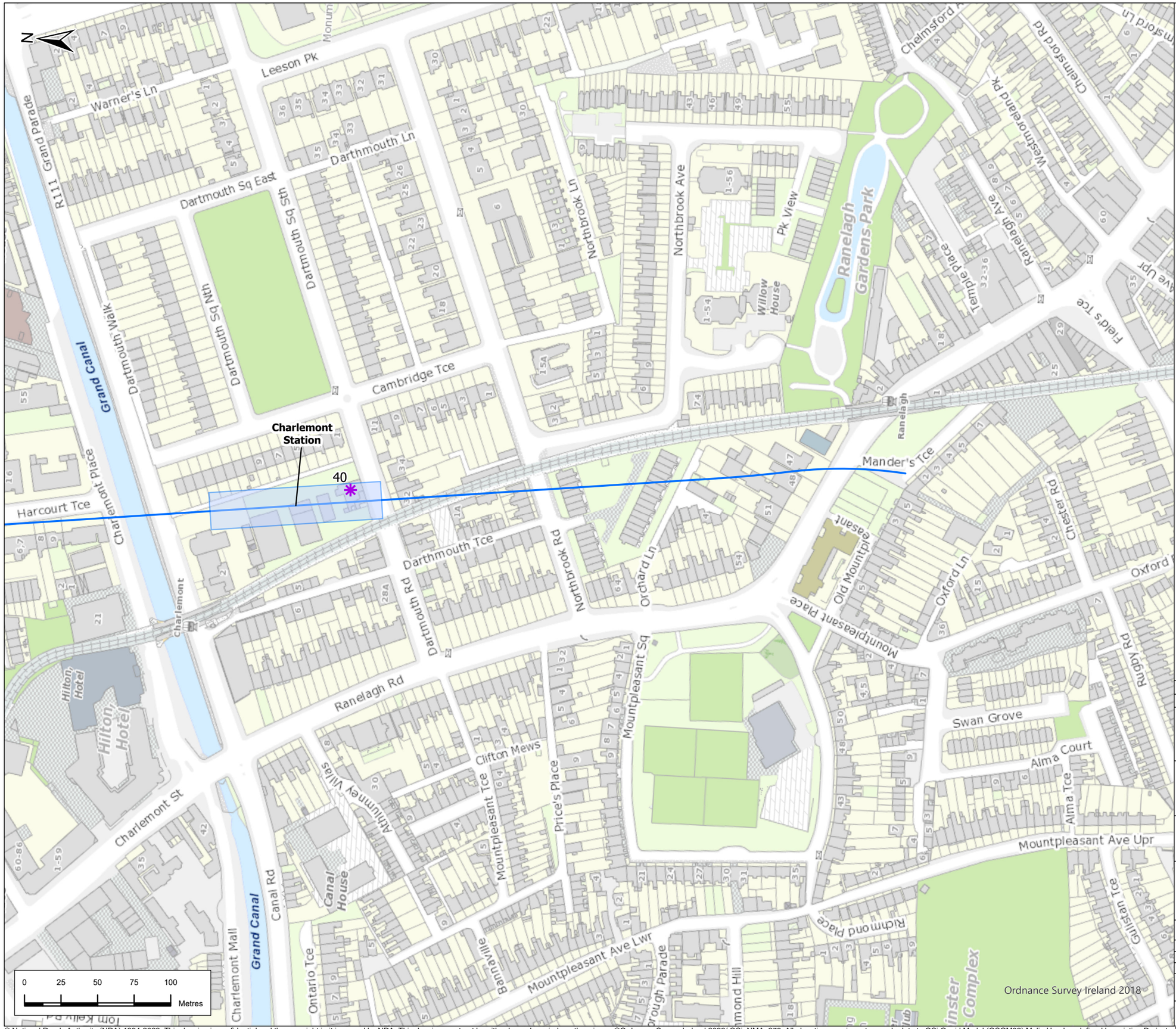
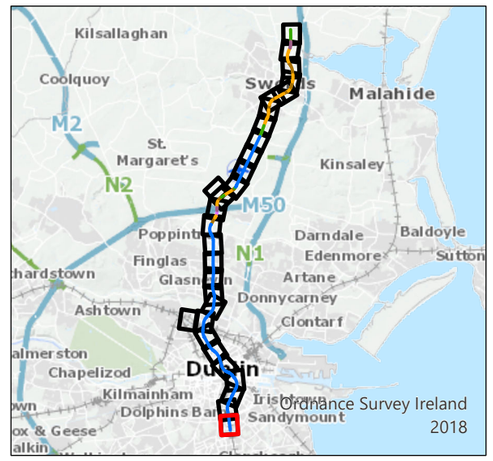


Legend

Alignment

- Tunnel
- Station Locations
- Properties to be demolished



Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P02	21/6/22	Final Issue	JL	RH	RH	NC

JACOBS IDOM

Client: TII Bonneagar Iompair Éireann Transport Infrastructure Ireland

Project: METROLINK

Drawing Title

Figure 5.3 Properties to be Demolished
Sheet 30 of 30

Drawing Status: FINAL

Scale @ A3	1:2,500	DO NOT SCALE
Jacobs No.	32108600	
Client No.		
Drawing No.	ML1-JAI-EIA-ROUT_XX-DR-Y-05060	Rev P02

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