



**METRO NORTH  
ORAL HEARING**

**PROOF OF EVIDENCE**

**Fergal Callaghan**

**Ground Water and Surface Water**

**Wednesday 15th April 2009**



**Metro North Oral Hearing**

**Proof of Evidence**

**Surface Water  
and  
Groundwater**

**Dr Fergal Callaghan**

## 1.0 NAME, QUALIFICATIONS AND ROLE IN PROJECT

1.1 I, Dr. Fergal Callaghan, hold a 2.1 honours degree of Bachelor of Science in Chemistry (1991) from the University of Limerick, where I majored in Environmental Chemistry and a Ph.D. in Environmental Engineering from the University of Birmingham (1998). I am a graduate member of the Chartered Institute of Water and Environmental Management (CIWEM), a member of the IChemE Water Group, a Member of the International Water Association (IWA), a Member of the European Water Association (EWA), a Member of the Royal Society of Chemistry (MRSC), an associate member of the Institute of Chemical Engineers (AMIChemE), a member of the IChemE Environmental Protection Subject Group (EPSG), and a Member of the Institute of Environmental Management and Assessment (IEMA) and am currently on the Irish Committee of this Organisation. It is a requirement of membership of these organisations that I am active in the field of professional water science and engineering and satisfy their requirements with regard to level of qualifications and experience.

1.2 My role on the Metro North project was to complete an assessment of the impacts of the scheme on surface water and groundwater.

## 2.0 EXPERIENCE

2.1 I have been active in the field of water science and engineering for 18 years, the last 12 as an Environmental Consultant. I have considerable experience with respect to the assessment of impacts on the groundwater and surface water environments.

2.2 My recent experience includes:

2.3 Preparation of Water EIR for Docklands Station (2006)

2.4 Preparation of water quality assessments for LUAS (2005-2006)

2.5 Water impact assessments for British Rail projects (1997 – 1998)

2.6 Water quality impact assessment for rail lines in Berkshire area (1991-1992)

- 2.7 Numerous groundwater contamination and impact assessments (2000-2008)
- 2.8 Groundwater contamination assessment, rail line construction (2008)
- 2.9 Groundwater contamination and remediation, Docklands, Dublin (2001-2002)
- 2.10 Larbre Park Waste Facility Oral Hearing, groundwater impacts (2006)
- 2.11 Road Scheme Surface and Groundwater Assessments (N17, N15, N11, R161)

### 3.0 **GENERAL INTRODUCTION**

- 3.1 AWN Consulting Limited was commissioned to assess potential impacts of the Metro North Scheme on the surface water and groundwater environments along the alignment route. The study area included the groundwater and any watercourses and floodplains that are intersected by the alignment within lands five hundred metres either side of the central line of the alignment. Consideration also been given to the catchment area of these watercourses.
- 3.2 In completing the assessment, national and European legislation, and national and regional planning and policy documents were reviewed.
- 3.3 The baseline surface water quality in the study area was characterised with reference to the results of EPA monitoring and chemical and biological water quality sampling undertaken by AWN Consulting Limited. Historical flooding records from the OPW were reviewed together with published studies on flooding and drainage in the study area that predict flood levels. Baseline groundwater quality was characterised by reference to GSI and EPA data and chemical water quality sampling undertaken on behalf of the RPA.
- 3.4 Consideration was given to published guidance and standards issued by the Environmental Protection Agency (EPA), National Roads Authority (NRA) and Institute of Geologists, in addition to the Greater Dublin Strategic Drainage Strategy, in determining suitable means for assessing the potential impact associated with the proposed scheme on the water environment. Potential impacts of the proposed scheme were identified, mitigation measures recommended and residual impacts assessed.

#### 4.0 RECEIVING ENVIRONMENT

- 4.1 The criteria used to categorise surface water features along the alignment were importance, sensitivity and existing adverse effects.
- 4.2 Importance relates to surface water quality and the function of the water body in relation to providing a resource for the ecological community and human life. It also relates to the function of the surface water body and surrounding flood plains in storing floodwaters.
- 4.3 The sensitivity of a surface water body relates to the impact of culverting on flow conditions, discharges of runoff that may contain polluting substances and impact the salmonid status of a river or stream, and the impacts of deepening, realignment or diversion of their natural channel.
- 4.4 Existing adverse effects relates to existing pollution which is reflected in the biological quality (EPA Q-value) of a surface water body. A polluted water body with a low Q-value reflects impacts from surface water runoff including from agricultural land, roads and buildings.
- 4.5 Each surface water body was characterised in terms of a functional value with V being Very High Functional Value and I being Very Low Functional Value.
- 4.6 The study area is located within the Eastern River Basin District, as defined under the EU Water Framework Directive (2000/60EC). There are a number of watercourses within the study area:
- Broadmeadow and Ward Rivers;
  - Sluice River and tributaries;
  - River Mayne;
  - Santry River;
  - River Tolka and its tributaries;
  - Royal Canal;
  - River Liffey;
  - Ponds at St. Stephen's Green (which is fed by the Grand Canal although the Grand Canal is outside of the study area); and
  - Unnamed streams and ditches along the alignment;

- 4.7 Biological sampling was carried out by AWN Consulting Limited in the Broadmeadow, Ward, Mayne, Sluice and Santry Rivers in September/October 2007. Chemical water sampling was carried out by AWN in the Liffey River, Royal Canal, Tolka, Santry, Mayne, Sluice, Ward and Broadmeadow Rivers in April 2008. The RPA provided AWN with the results of chemical analysis carried out on samples taken by White Young Green from ditches at the Belinstown Depot site.
- 4.8 The results of the baseline categorisation of the surface water environment indicated that most Rivers in the Study Area were classed as Medium to Low Functional Value, with the exception of the Royal Canal which was classed as High Functional Value.
- 4.9 In order to assess the sensitivity of the baseline groundwater environment along the proposed route corridor, AWN carried out a comprehensive desktop study, which addressed Aquifer characteristics, Aquifer importance and Aquifer sensitivity.
- 4.10 Functional values were used to categorise the baseline groundwater environment along the route corridor for the proposed scheme. The functional value of the area is determined with reference to the 'importance' and 'sensitivity' of the groundwater, in addition to any 'existing adverse effects' that impact on the groundwater for each particular section of the route. The functional values were determined with reference to the following:
- **Importance** – this concerned the level of importance associated with an aquifer in relation to its productivity and whether it was used as a source of water supply;
  - **Sensitivity** - The "sensitivity" or 'vulnerability' of an aquifer is governed by a number of factors including the groundwater depth, nature and thickness of the overlying geological strata and groundwater quality; and
  - **Existing Adverse Effects** - In some cases, the quality of a groundwater resource may be diminished due to historic and/or current contamination.

4.11 The functional value of the baseline groundwater environment was evaluated by means of a number of specific criteria in order to take account of the importance and sensitivity of the groundwater environment, the full list of criteria used to define the Functional Value for the groundwater is provided in the EIS, range of Functional Values defined was 1 – 5, with 1 being of least importance and 5 being of greatest importance.

4.12 The groundwater along the alignment was classed as being of medium to low functional value.

## 5.0 CHARACTERISTICS OF METRO NORTH WITH RESPECT TO SURFACE WATER AND GROUNDWATER

5.1 The route of the proposed Metro North extends from Belinstown Depot (and Park & Ride facility) at the most northerly part of the line to the terminus at St. Stephen's Green.

5.2 The tracks along the route of Metro North will be constructed as follows:

### 5.3 River Crossing/Culverts

5.4 Belinstown Depot to Lissenhall Several existing ditches at the Belinstown depot site will be culverted to accommodate construction of the depot. In addition, three ditches between the Belinstown and Lissenhall stops, one ditch at the Lissenhall stop and one ditch south of the Lissenhall stop will be culverted to accommodate construction of the tracks. Construction of the culverts listed above will involve carrying out works to the stream/ditch beds and banks.

5.5 Broad Meadow and Ward Rivers The alignment will cross the Broad Meadow River at the existing Lissenhall Bridge and the Ward River at the existing Balheary Bridge. Strengthening works will be carried out on these bridges.

5.6 Drainage Ditches along Fosterstown Accommodation Road The existing drainage ditches along the Fosterstown Accommodation Road will be piped and diverted to the Agricultural Underpass culvert.

5.7 Stream at Forrest Little (Upstream of Sluice River) It is proposed to culvert the two streams at Forrest Little, which are tributaries of the Sluice River. A water channel will be constructed at the agricultural underpass to accommodate an existing stream. A pipe culvert will be constructed south of the agricultural underpass.

5.8 Streams at Dublin Airport The scheme is underground within the airport lands and so will not intersect the streams in this area, however tunnel drainage will be discharged to the Sluice River.

- 5.9 Turnapin River at Dardistown The Turnapin River (a tributary of the Mayne River) will be culverted at Dardistown under the re-aligned access road and further east will also be culverted under the tracks. Tunnel drainage will also discharge to the Turnapin River.
- 5.10 Santry River The route will intersect the Santry River, however the tracks will be constructed over an existing culverted section of the river.
- 5.11 River Tolka The scheme will be constructed underneath the River Tolka at Botanic Avenue/Millmount Avenue using tunnel boring techniques. The route will also (at Collins Avenue) pass beneath the Wad River Culvert, which drains into the Tolka. The Culvert will be replaced where the Metro passes under it. Tunnel drainage will discharge to the Wad River Culvert Overflow (which is normally dry and which drains to the Tolka) and also to the Tolka.
- 5.12 Royal Canal The scheme will be constructed underneath the Royal Canal between the Drumcondra and Mater stops using tunnel boring techniques.
- 5.13 River Liffey At the River Liffey, it will be necessary to temporarily deck over a 30m length downstream of O'Connell Bridge to provide working space for construction of the stop. This will involve temporary piling into the river bed. In addition a temporary bridge will be constructed over the River Liffey from Burgh Quay to Eden Quay, which will also involve piling works into the river bed. This bridge will act as diversion route to alleviate traffic impacts within the city centre.
- 5.14 Other works that have the potential to impact on surface waters in this area include possible sealing of the bed of the River Liffey at the O'Connell Street stop location, tunnel construction and construction of the stops.
- 5.15 St. Stephen Green Ponds At St. Stephen's Green, construction works will involve temporarily draining the pond in the northwest corner of the Green. The pond will be re-instated on completion of construction works. The water supply from the canal to the other pond will be maintained during the construction phase.
- 5.16 The connection between the Grand Canal and the ponds in St. Stephen's Green is fed by gravity in the direction of the Green and therefore the risk of

any water migrating from St. Stephen's Green to the Canal during the construction phase is insignificant.

5.17 The water from the pond will be discharged via its existing outlet subject to agreement with Dublin City Council.

5.18 Construction Phase – Characteristics of the Proposal

5.19 Foul Water

5.20 During the construction phase, construction compounds will be installed at each of the stop locations. Construction compounds will also be installed at a number of locations along the route.

5.21 Where welfare facilities are provided at these compounds, temporary portaloo facilities will be used and foul water generated will be removed and treated off-site by an appropriately licensed contractor.

5.22 At the Airport south portal compound semi-permanent welfare facilities will be provided and the foul water generated will be treated at a local package treatment plant and the effluent will be discharged to the Turnapin River, or may be discharged to sewer, to a percolation area or may be tankered off site. A package treatment plant and percolation area will be installed adjacent to the Dardistown stop.

5.23 Surface Water

5.24 Attenuation ponds will be installed on all outfalls including the Depot outfalls and the outfalls to the Broadmeadow and the Ward River. These ponds will be part of the drainage system for the operational phase.

5.25 Surface water runoff from construction works will be collected and drained to the nearby storm water drainage system or treated and discharged to surface water bodies (if available). Appropriate mitigation measures will be agreed with the Local Authority in advance of any discharge commencing, and where appropriate all waters collected in sumps in open excavations will be treated in silt traps and hydrocarbon interceptors prior to discharge, under an appropriate discharge licence from the Local Authority.

5.26 Surface water runoff (rainfall directly falling on open surfaces in excavation and rainfall migrating by overland flow to the excavation) collected in open excavations in areas where soil may be compacted due to construction works, or where impermeable soils are encountered, will be collected in sumps at low points along the track alignment. From sumps it will be pumped into the nearby storm water drainage system or treated and discharged to surface water bodies (if available). If contaminated, this has the potential to pollute receiving surface water bodies, if it were to remain untreated.

5.27 Groundwater

5.28 Groundwater may be intercepted in cut and cover sections or it may infiltrate tunnelled sections.

5.29 Where possible groundwater will be discharged to surface water bodies, following appropriate treatment. As an alternative, it may be discharged to surface water or foul drain. Discharges to surface water bodies will receive prior treatment. All measures are subject to agreement with the relevant planning authority and to obtaining an appropriate discharge licence.

5.30 Operational Phase – Characteristics of the Proposal

5.31 Belinstown depot

5.32 During the operational phase, storm water runoff at the Belinstown Depot site will be managed on site using a combination of Sustainable Urban Drainage System (SUDS) techniques and conventional pipe drainage systems. The SUDS techniques will be used to help reduce the volume of runoff generated as well as the potential pollution load of runoff discharged from the site.

5.33 Runoff from areas of hardstanding with a low to medium risk of contamination (such as heavy goods vehicles parking and turning areas) will be drained to a Class 1 EN 858 light liquid by-pass separator before discharging to the on-site drainage system. Runoff from areas with a high risk of contamination such as fuel off load and distribution areas, internal inspection pits, skip areas, waste compactor areas shall be fully protected and drained to a separate effluent drainage system which will be connected to an approved Class 1 EN858 full retention oil separator prior to removal to an approved treatment facility.

- 5.34 Pollution control measures will be included in the drainage network to reduce the risk of pollution to receiving water bodies. On-site attenuation will be in the form of geo-cellular underground storage tanks and balancing ponds, which will be sized to accommodate the 1 in 100 year storm with an additional 20% climate change allowance, culverts will also be sized using similar criteria. The performance of the drainage system will be assessed for extreme rainfall events (in excess of the design rainfall) to identify areas at risk of flooding. Measures will be put in place to safely manage the flood water and reduce the risk of damage to lives and properties.
- 5.35 Both trade effluent and domestic sewage will be treated on site at Belinstown to comply with the requirements of Fingal County Council.
- 5.36 A detailed assimilative capacity study will be required as part of a discharge licence application. If this study indicates that a negative impact will result on phosphorus levels then the effluent will be discharged to sewer to ensure that overall there is no negative impact.
- 5.37 Drainage of Areas of Hardstanding
- 5.38 Surface water runoff from areas of hardstanding will be collected, treated and discharged to surface water bodies. All waters collected in this manner will be treated in silt traps and hydrocarbon interceptors prior to discharge. These measures are subject to agreement with Fingal County Council and if necessary to obtaining an appropriate discharge licence.
- 5.39 Drainage of Open Cut Sections
- 5.40 Runoff from the track and adjacent lands at the Lissenhall sections will be collected via a system of swales and filter drains and discharged to nearby field ditches. The filter drains and swales will be designed in accordance with CIRIA guidelines to accommodate the 1 in 30 year storm event with an additional 10% capacity for the effects of climate change. Runoff from the tracks will be attenuated in ponds and within the filter trenches to restrict the discharge to a rate not exceeding the Greenfield Runoff rate of 2 l/s/ha or 6 l/s/ha for impermeable areas as specified by Fingal County Council.

- 5.41 Oil interceptors will be provided at outfalls to treat runoff to acceptable standards and hence reduce the risk of pollution to surface water bodies. Oil separators will be designed to comply with BS EN 858 and the Pollution Prevention Guidelines (PPG3) of the UK Environment Agency. Outfalls to the Broad Meadow and Ward rivers will be designed to be unobtrusive and protective measures will be put in place to prevent the erosion of the river bed and bank. A suitable non-return device will be fitted on all outfall pipes to the main water course as necessary. In addition, berms will be constructed on the ponds adjacent to the Broad Meadow River and Ward River to protect the ponds from the occasional flooding of the rivers.
- 5.42 The drainage strategy for open cut sections during the operation phase involves the provision of cut-off drains at the top of cut-section to intercept runoff flowing towards the cut slope. Filter drains will be provided at the toe of the cut to collect runoff from the track as well as runoff from the cut slope. Runoff collected in filter drains will be discharged to watercourses by a gravity outfall. Where this cannot be achieved filter drains will be connected to the sump at the adjoining underground section from where runoff will be pumped up into a nearby surface drainage system subject to any licensing requirements of Fingal County Council.
- 5.43 Drainage of Stops
- 5.44 The Drainage Reference Design indicates that during the operational phase, the stops along the route will be drained using a linear drainage system that will outfall to the filter drain serving the track.
- 5.45 Drainage of Elevated Sections
- 5.46 Runoff from the Estuary viaduct will be collected through down pipes and discharged to the central reserve of the existing roadway. The runoff will be used to irrigate the grassed central reserve. Narrow filter drains will be provided along one end of the central reserve to collect any excess water for disposal. Using runoff from the elevated sections for watering the grassed central reserve will mimic the existing drainage regime and will help to offset the impact of the additional impervious area introduced by the elevated tram way.

5.47 Runoff from the Pinnock Hill viaduct will be collected through down pipes and discharged to the drainage system.

5.48 Runoff from the M50 viaduct, the Dardistown and Northwood Overbridges will be discharged to the track drains at the bridge abutments.

5.49 Drainage of Park & Ride Facilities

5.50 Runoff from the multi storey car park at Belinstown will be collected through drainage pipes and discharged to a below ground drainage system into an attenuation tank system.

5.51 The Park & Ride facility at Fosterstown will comprise a porous structure overlaying a modular geo-cellular storage tank.

5.52 Drainage and treatment of surface water runoff at the Park & Ride facility at Dardistown will be as described above for the Park & Ride facility at Fosterstown. In relation to foul water generated at the Dardistown car park, it will be connected into the nearby foul drainage system if possible or treated on site.

5.53 All storage systems are designed to accommodate the 1 in 100 year storm with a 20% allowance for climate change.

5.54 Discharge Points

5.55 Surface water discharge points include:

- To four field drains at Lissenhall
- To the Broad Meadow and Ward Rivers
- To an existing ditch at the Seatown Stop
- To a watercourse in the vicinity of Fosterstown Accommodation Bridge
- To the stream at the Agricultural Underpass
- To the stream at Forrest Little (which is upstream of the Sluice River)
- To the Turnapin Stream
- To the Santry River

Tunnel Drainage discharge points are proposed at:

- Sluice River

- Turnapin Stream
- Wad River Overflow Culvert
- Tolka
- Liffey

## 6.0 POTENTIAL IMPACTS OF METRO NORTH

### 6.1 Construction Phase

### 6.2 Potential impacts on hydrodynamics and flooding

6.3 During the construction phase, various activities have the potential to result in increased surface water runoff which could potentially impact local drainage patterns and result in flooding. Other construction activities have the potential to alter the hydraulic flow regimes within watercourses and to lead to flooding. These include:

- The discharge of dewatering liquids from tunnel excavations;
- The construction of watercourse crossing points;
- The installation of drainage discharge points to watercourses and surface water or foul drains;
- The installation of hard standing for temporary construction compounds and access roads
- The construction of surface and elevated structures on existing greenfield sites;
- The installation of surface water drainage discharge points to watercourses and surface water or foul drains.

6.4 Works involving the diversion of ditches and the construction of culverts and bridges have the potential to impact flow regimes in existing watercourses and to lead to flooding of adjacent lands. Culverting has the potential to alter the hydraulic characteristics of the stream.

### 6.5 Potential impacts on water quality

6.6 During construction, potentially contaminated runoff may arise in parking and turning areas, fuel off-load and distribution areas, materials storage areas, skip and waste compactor areas and from on-site trade effluent and sewage

treatment plants. Contaminated runoff has the potential to pollute receiving water bodies.

6.7 During the construction phase, there is also the potential for surface water runoff (rainfall directly falling on open surfaces in excavation and rainfall migrating by overland flow to the excavation) to infiltrate open excavations of the route along this area.

6.8 Furthermore, dewatering of groundwater from sub-surface track and structures that are below the local groundwater table level has the potential to pollute surface water bodies if subsequently discharged to them untreated.

6.9 Works involving the diversion of ditches and the strengthening of bridges also have the potential to impact on surface water quality through deposition of material in the watercourse.

6.10 Operational Phase

6.11 Potential impacts on hydrodynamics and flooding

6.12 During the operational phase, increased surface water runoff will arise from drainage of hard-standing surface areas associated with permanent features (including the depot site and Park & Ride facilities), and from drainage of elevated structures.

6.13 The operation of features associated with drainage of the scheme (including culverts and drainage discharge points to surface water bodies and surface water or foul drains) and new bridge structures constructed to accommodate the scheme has the potential to impact flow regimes in existing watercourses and to lead to flooding of adjacent lands.

6.14 Potential impacts on water quality

6.15 During the operational phase, discharge of untreated wastewater to receiving water-bodies could potentially cause an impact if the wastewater does not receive adequate treatment in advance. Contaminated runoff may arise at the Park & Ride sites and the depot car park, and from vehicle washing runoff at

the depot site. Contaminated runoff has the potential to pollute receiving water bodies.

- 6.16 During the operational phase, dewatered groundwater from tunnelled sections and sub-surface track that is below the local groundwater table may arise and this will be discharged to surface water bodies or surface of foul sewers. There is the potential for pollution of receiving surface water bodies if dewatered groundwater is discharged untreated
- 6.17 During the construction phase, certain activities associated with the proposed Metro North have the potential to impact on the groundwater environment within the study area. A summary of these impacts is as follows:
- 6.18 Localised alteration of the direction of groundwater flow due to tunnelling operations and the construction of cut and cover tunnels and stops;
- 6.19 Temporary lowering of the water table during dewatering operations for tunnelling operations and for the construction of cut and cover tunnels and stops;
- 6.20 The underlying groundwater quality may be impacted during the construction phase due to leakage of fuel from construction vehicles, oil spillages during refuelling or vehicle maintenance operations, leakage from chemical storage areas and inappropriate disposal of chemicals (paints, oils, glues etc). Surface contaminants can migrate towards underlying groundwater sources. Contaminants arising from similar activities during subsurface operations can be released directly into the surrounding aquifer;
- 6.21 The construction of the scheme may result in a localised improvement in groundwater quality along some sections of the route due to the removal of overlying contaminated material (where present);
- 6.22 Developments that extend into underlying aquifers, for example during tunnelling operations, in addition to the construction of cut and cover tunnels and stops, can potentially cause temporary lowering of the water table, if dewatering is required;

- 6.23 Chemical substances such as grout, fuels/oil, glues and solvents will be used during the construction phase of the proposed scheme and to a limited extent during the operational phase. In addition, solid waste and foul water will be generated during the construction and operational phases of the scheme and have the potential to impact on groundwater quality if not appropriately managed;
- 6.24 During the operational phase, certain activities associated with the Metro North have the potential to impact on the groundwater environment within the study area. A summary of these impacts is as follows;
- 6.25 Localised alteration of groundwater flow and depression or elevation of the groundwater levels along sections of the proposed route where tunnels exist;
- 6.26 The replacement of Greenfield areas along sections of the route with areas of hard-standing (stops, rail depots, in addition to Park & Ride facilities) may reduce to some extent the recharge rate into the underlying aquifer;
- 6.27 The migration of surface contaminants (arising from chemical storage areas at depots, wastewater discharge and runoff from car parks, for example) towards the underlying groundwater sources. Due to the fact that the tunnelled sections of the route will comprise sealed structures and all underground pipe-work will include appropriate containment measures, the potential for contamination from underground sections of the route is considered to be low.

## 7.0 REMEDIAL OR MITIGATION MEASURES

### 7.1 Construction Phase

### 7.2 Measures to mitigate potential impacts on hydrodynamics and flooding

7.3 In relation to culverting and bridge strengthening works, the design will be in accordance with the requirements of the Office of Public Works (OPW) and Section 50 of the Arterial Drainage Act, 1945. As such, approval will be sought from the OPW for construction of the culvert, and the OPW's hydraulic design standards will be adhered to. The ERFB Guidelines 2006 will also be adhered to when selecting a culvert design, to ensure minimum negative impact on fish life.

7.4 Runoff collected in cut and cover sections will be collected in sumps located at low points along the track alignment.

### 7.5 Measures to mitigate potential impacts on water quality

7.6 All waters collected in sumps in open excavations during the construction phase will be treated subject to agreement with the appropriate Local Authority and if necessary to obtaining an appropriate discharge licence.

7.7 Any discharges arising from the construction phase of the scheme entering the foul/storm sewer network will be in accordance with the requirements of a discharge licence granted by Dublin City Council/Fingal County Council. Similarly, any water discharge to surface water bodies will be treated in accordance with the requirements of a discharge licence (if required) granted by Dublin City Council/Fingal County Council.

7.8 All discharge points will be fitted with oil separators which will comply with current European Standard EN858.

7.9 Treatment of water produced during the construction phase will involve techniques such as silt removal using a silt trap and hydrocarbon removal using a hydrocarbon interceptor. Contaminated groundwater, if encountered,

may require treatment using more specialised treatment equipment including chemical treatment, activated carbon or other absorbent systems.

7.10 Re-fuelling of construction equipment and the addition of hydraulic oil or lubricants to vehicles/equipment will take place in designated bunded areas within the construction compounds, away from surface water gullies or drains.

7.11 Silt fences will be used during culvert construction and bridge strengthening works to prevent contamination of the watercourses with sediment. Washing of concrete trucks in the vicinity of the watercourses will be prohibited. All contractors will be required to make provision for removal of any concrete wash-waters, no such wash-waters will be permitted to be discharged to the stream under any circumstances.

7.12 The guidelines provided by the Department of the Marine and Natural Resources (1997) and guidelines provided by CIRIA (2001) and the Eastern Regional Fisheries Board (ERFB) (2006) on the prevention of water pollution from construction sites, will be adhered to, in order to ensure that the impact on the water environment during the construction phase of the proposed development is minimised.

7.13 Regular monitoring of water will be conducted during the construction phase prior to discharge to ensure all relevant water quality parameters are within criteria specified by the relevant Local Authority

7.14 Operational Phase

7.15 Measures to mitigate potential impacts on hydrodynamics and flooding

7.16 At Belinstown Depot, storm water runoff will be managed on site using a combination of Sustainable Urban Drainage System (SUDS) techniques and conventional pipe drainage systems.

7.17 On-site attenuation at Belinstown Depot and at the car Park & Ride facilities will be in the form of a geo-cellular underground tanks and balancing ponds, and will be sized to accommodate the 1 in 100 year storm with an additional 20% climate change allowance. On site drainage will incorporate these criteria as a minimum

7.18 The design, installation and maintenance of the drainage system will comply with:

- The Greater Dublin Strategic Drainage Study, Technical Documents Volume 2 & 3
- The Greater Dublin Regional Code of Practice for Drainage Works, and
- Any specific requirements specified by Fingal County Council and Dublin City Council.

7.19 The performance of the drainage system will also be assessed for extreme rainfall events (in excess of the design rainfall) to identify areas at risk of flooding. Adequate measures will be put in place to safely managed the flood water and reduce the risk of damage to lives and properties.

7.20 In relation to ditch diversion at the Belinstown Depot site, all new pipes and culverts will be adequately sized to convey the 1:100 with an additional 20% allowance for the effects of climate change. The diversion works will be carried out in a manner that will not adversely affect the field drainage of adjacent lands.

7.21 In relation to track and road drainage, all filter drains will be designed in accordance with CIRIA 697 and CIRIA 522 to accommodate a 1 in 30 year storm with a 10% climate change factor.

7.22 In relation to metro stops and Park & Ride sites, all storage systems will be designed to accommodate the 100 year storm with a 20% allowance for climate change.

7.23 In relation to culverting and bridge strengthening works, mitigation measures will be implemented during the design stage as detailed for the construction stage.

7.24 Measures to mitigate potential impacts on water quality

7.25 Any discharges arising from the operational phase of the scheme entering the foul/storm sewer network will be in accordance with the requirements of a discharge licence granted by the relevant Local Authority.

7.26 At Belinstown depot, areas of hard-standing with low to medium risk of contamination (HGV parking and turning areas) will be contained and drained

using a pipe and gully system. Runoff from these areas will be passed through an approved Class 1 Light Liquid by-pass Separator before discharging to the on-site drainage system.

- 7.27 Areas of high risk of contamination such as fuel off-load and distribution areas, internal inspection pits, skip area, waste compactor areas shall be fully protected and drained to a separate effluent drainage system which shall be connected to an approved Class 1 full retention oil separation prior to discharge to the on-site package treatment plant.
- 7.28 A geo-cellular system and oil interceptor will be installed at the car Park & Ride facilities and will be regularly checked and maintained in full compliance with the manufacturers' requirements.
- 7.29 All discharge points will be fitted with oil separators which will comply with current European Standard EN858.
- 7.30 Herbicides used during operation will be applied sparingly and in compliance with suppliers' guidance, and will be suitable for use in an environment in which receiving watercourses are present
- 7.31 All of the potential adverse impacts on the groundwater environment, which were identified for the construction phase and operational phase of the scheme were assessed to be of low significance. The following mitigation measures will be implemented in order to ensure protection of the underlying and surrounding groundwater sources.
- 7.32 The following mitigation measures will be implemented during the construction phase of the proposed scheme in order to ensure the protection of groundwater sources:
- 7.33 All groundwater generated by construction activities will be tested for contamination and treated, if required, in accordance with the conditions set in the Trade Effluent Discharge Licence from the relevant Local Authority. Groundwater may be discharged to sewer, surface water drain or to surface water;

- 7.34 Dewatering activities to be undertaken during the construction of underground stop boxes (such as those at O'Connell St or Parnell Square) will be conducted so as to ensure that minimal depression of the water table occurs during construction and that minimal change to groundwater flow or level occurs during operation. The Contractor for the construction of the project will be required to take all necessary measures to ensure no significant change in the water table occurs. These measures could include recharge through a network of wells, grouting to minimise water ingress or the use of cut-off walls to minimise depression of the water table outside of the excavation and techniques such as toe-grouting to ensure the retaining walls maintain a relatively impermeable barrier. It should be noted that the construction methodology for the stop boxes has been chosen to ensure that significant dewatering is not required during construction. The methodology involves the installation of diaphragm walls, grouting to minimise water ingress, excavation of the stop box behind the walls and sealing of the base of the excavation as necessary to minimise water ingress;
- 7.35 The treatment of surface water runoff and groundwater during the construction phase will include as a minimum the use of silt/sediment traps and oil interceptors prior to the release to a recharge system, surface water bodies, surface water drains or foul sewers;
- 7.36 Groundwater pollution will be minimised by the implementation of good construction practices, which will include:
- 7.37 All oils, solvents and paints used during construction will be stored within labelled, sealed containers in specially constructed dedicated, temporary, bunded areas or suitable bunded lockable storage containers within buildings or enclosures (hardstanding) in the construction compounds;
- 7.38 Oil and fuel storage tanks will be bunded to a volume of 110% of the capacity of the largest tank/container present or 25% of the total tank capacity within the bund at the site compounds. Fill and draw off points will be located within the bund. Drainage from the bunded areas will be directed to the foul sewer;
- 7.39 Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles will take place in a designated bunded area of the

construction compound site. The refuelling area will not be situated close to any surface water body or surface water drain. Drip trays will be used during refuelling operations and spills kits will be made available;

7.40 Concrete mixing will only take place at a designated area at the construction compound, which will not be located next to a surface water drain or stream;

7.41 All associated hazardous waste residuals, such as oil, solvent, material used in oil spill clean-ups, glue and solvent based paint containers will be stored within appropriately covered skips prior to removal by a suitable Local Authority or EPA licensed waste management contractor for off-site treatment/recycling/disposal.

7.42 The following good house keeping practices are recommended during the operational phase of the proposed scheme in order to ensure the protection of groundwater sources:

7.43 The potential for the release of chemical substances such as oils/lubricants/solvents used/stored in the vehicle maintenance area in the Belinstown depot into the underlying groundmass will be prevented by the implementation of strict management procedures such as their use by suitably trained personnel, their usage in small quantities, storage in sealed labelled containers and the availability of spill kits;

7.44 With regards to fuel storage tanks and refuelling operations, the mitigation measures previously mentioned for the construction phase will be implemented;

7.45 Substations located at each stop and the Belinstown depot will be bunded and will be regularly checked and maintained to minimise the potential for leakage of oil;

7.46 In accordance with the Waste Management Acts 1996 - 2005 and associated Regulations, waste material generated at the Belinstown depot and the stops will be stored in appropriate containers in a suitably designed waste storage area and collected on a regular basis by a suitably licensed waste collection contractor for disposal at an appropriately licensed waste facility

7.47 The use of permeable paving and hydrocarbon interceptors at Park & Ride facilities will help prevent the release of potentially contaminated surface water towards groundwater sources. Effluent from areas of high risk contamination such as fuel off-load and distribution areas, at the Belinstown depot will be directed through an oil separator prior to removal to an approved treatment facility;

7.48 Both trade effluent and domestic sewage will be treated at an on-site waste water treatment plant at Belinstown to comply with the requirements of Fingal County Council. The integrity of surface and foul sewers, including the oil interceptors, at the Belinstown Depots and the Metro North stops/Park & Ride facilities will be regularly checked and appropriately maintained.

## 8.0 PREDICTED RESIDUAL IMPACTS

### 8.1 Residual Impacts

8.2 Ditches at Belinstown Depot It is proposed to culvert a number of ditches/streams at the Belinstown Depot site to accommodate construction of the depot and several other ditches at Lissenhall to accommodate construction of the tracks. Provided that mitigation is put in place the magnitude of residual impact is low to negligible and the significance is assessed as low to not significant.

8.3 During the operational phase, effluent from the depot site will discharge to an existing stream adjacent to the depot. The magnitude of this potential impact is assessed as low and the significance is assessed as low to not significant.

8.4 Discharge of surface water runoff from the Park & Ride site to storm water sewers or receiving surface water bodies could potentially impact the quality of receiving water bodies if the runoff does not receive adequate treatment in advance. Provided that the mitigation measures specified are put in place, the magnitude of this residual impact is low to negligible.

8.5 Broad Meadow and Ward Rivers The Broadmeadow and Ward Rivers are of medium (III) functional value.

- 8.6 Bridge strengthening works are proposed on the Lissenhall Bridge over the Broad Meadow River and on the Balheary Bridge over the Ward River. These strengthening works have the potential to impact the hydraulic flow regime of the rivers and to contaminate the rivers with sediment and pollutants arising from construction materials.
- 8.7 Measures will be put in place to ensure that channel widths are not reduced; residual impacts are therefore assessed as not significant.
- 8.8 During construction surface water runoff from areas of hard-standing will be collected and drained to the nearby storm water drainage system or treated and discharged to surface water bodies (if available). Provided that mitigation measures are put in place, the magnitude of the residual impact is low to negligible. The significance is assessed as low to not significant.
- 8.9 During the operational phase, surface water discharge points include to the Broad Meadow and Ward Rivers. The baseline study identified that the functional value of the Broad Meadow and Ward River is III (medium). Therefore the impact of discharging surface water runoff (treated as described) is assessed as of low significance.
- 8.10 Sluice River and Stream at Forrest Little During construction, surface water runoff collected in open excavations may be discharged to sewers or receiving surface water bodies. Similarly, during the operation phase, surface water runoff from hardstanding areas may be discharged to sewers or receiving surface water bodies. The significance of this impact is assessed as low to not significant.
- 8.11 Construction of the culvert on the stream at Forrest Little (upstream of the Sluice River) will involve carrying out works to the stream bed and banks. The significance of the impact is assessed as low.
- 8.12 Water channel at Agricultural Underpass at Forest Little Construction of a water channel to accommodate an existing stream at the Agricultural Underpass will also involve carrying out works to the stream bed and banks. Therefore the significance of this impact is assessed as low to not significant.

- 8.13 Streams at Dublin Airport Cumulative impacts on surface water could potentially occur due to the development of the Dublin Airport Terminal 2 and the scheme within the same timeframe. During the construction and operation phases, potential for cumulative impacts to occur depends on nature and quantity of effluent/runoff discharged to surface water bodies. The surface water impacts of the Metro North scheme in this area have been assessed as being of low magnitude and significance and therefore cumulative impacts are also assessed as being of low significance.
- 8.14 Mayne River During construction, surface water runoff collected in open excavations may be discharged to sewers or receiving surface water bodies. The magnitude of impacts during the construction and operational phases of the scheme has been assessed as low and impacts are assessed as not significant.
- 8.15 Turnapin Stream Construction of the culvert on the Turnapin River underneath the tracks east of the Dardistown Stop and underneath the realigned access road to the Park & Ride facility at Dardistown will involve carrying out works to the stream bed and banks. The significance of this impact is assessed as low.
- 8.16 Santry River The baseline study identified that the Santry River has a low (II) functional value. The magnitude of the impact of a fuel spill during the construction phase is assessed as low. The significance of this impact on the Santry River it is assessed as not significant.
- 8.17 River Tolka and Royal Canal The baseline functional value of the River Tolka has been assessed as medium (III) and of the Royal Canal is high (IV). It should be noted it is not proposed to discharge to the Royal Canal.
- 8.18 The significance of impacts on the River Tolka and the Royal Canal is assessed as low.
- 8.19 River Liffey The River Liffey has a medium (III) baseline functional value. Works on the River Liffey including temporary decking, construction of the Bailey Bridge (a temporary bridge) and possible sealing of the river bed have the potential to impact on water quality, on the passage of salmon and on flow regimes, however works will be undertaken in full compliance with the Eastern

Regional Fisheries Board document titled “Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites” with all in-stream works being carried out in the period May to September when salmon are not likely to be present and therefore the impacts on salmon are considered not significant.

8.20 Provided that the mitigation measures specified are put in place, then the magnitude and significance of this impact is assessed as low.

8.21 St. Stephen’s Green Ponds The surface water impact on the pond at St. Stephen’s Green is assessed as not significant

8.22 With respect to groundwater, the following residual impacts are predicted:

8.23 Chemical analysis data indicates that groundwater generated during the Construction Phase would be generally considered suitable for discharge into a surface water body/drain subject to approval by the relevant Local Authority

8.24 It is likely that the discharge of groundwater will be required along some sections of the Metro North route. Unless dewatering operations are suitably controlled, they have the potential to temporarily cause minor reductions in the level of the water table. No significant long-term lowering or raising of the water table will be permitted as a consequence of building the scheme. The Contractor for the construction of the Metro North project will be required to ensure there are no significant impacts on groundwater levels along the route during both construction and operation

8.25 Given that the mitigation measures listed above are to be put in place, the magnitude of the potential impacts on groundwater during the construction phase is Low (II) and the impacts affect an area of Low (II) to Medium (III) functional value. Therefore, the impact is considered to be of Low (II) significance

8.26 With the recommended mitigation measures in place, the magnitude of the potential impacts on groundwater during the operational phase is Low (II) and the impact affects an area of Low (II) to Medium (III) functional value. Therefore, the overall impact is considered to be of Low (II) significance.

## 9.0 RESPONSE TO OBSERVATIONS

### *Surface Water*

- 9.1 The observations relating to surface water relate to two areas along the route, the area around Griffith Avenue and the area around the Belinstown Depot. The observations are listed below, together with our response.
- 9.2 Griffith Avenue and Surrounding Area
- 9.3 Margaret Barry and Victor Barry and others – referring to Metro Station at Griffith Avenue
- 9.4 Submission
- 9.5 “Underground Rivers which the developer has not taken account of” “flooding occurs during periods of heavy rainfall” “the underground water spills over onto the foot-path at the very point at which it is proposed to locate the station”.
- 9.6 Francis Doherty – Dublin Metro North Project
- 9.7 Submission
- 9.8 “Requests that no groundwater be discharged into the local surface water network or into the Tolka River.” “would like to have it confirmed that the RPA will comply with GDSDS and would like to see how RPA plan to comply with GDSDS”
- 9.9 Bernadette, Aiden, Siobhan and Karen Donnelly
- 9.10 Submission
- 9.11 “area prone to flooding, there needs to be an assessment of flood risk to the area, increased paved areas will lead to increased surface water run-off and put pressure on drainage system and local waterbodies”
- 9.12 “in recent years heavy rain has led to floods cascading down from the site onto Home Farm Road”
- 9.13 Griffith Avenue and District Residents Association (GADRA)

9.14 Submission

9.15 “our area experiences considerable run-off from Albert College Park and DCU/Ballymun Direction, GADRA is concerned about cumulative impacts which could exacerbate flooding problems”

9.16 “we request a flood risk assessment”

9.17 Sinn Fein

9.18 Submission

9.19 “the EIS is lacking in detail on surface water management and has no flood risk assessment”

9.20 Hampstead Residents

9.21 Submission

9.22 “water/flood risk – high risk of flooding in Albert College Park/Hampstead Avenue/The Rise, considerable water run-off from Albert College Park, imperative that there is a substantial water management plan put in place to prevent flooding from the Park onto Hampstead Avenue”

9.23 “no map of underground streams included in EIS or impact Metro North will have on them”

9.24 “current culverts are totally inadequate” “account needs to be taken of global warming and related large increase in deluge rainfall”

9.25 Corpus Christi School

9.26 Submission

9.27 “No flood risk assessment in EIS”

9.28 The Doyles at No. 46 Botanic Avenue

9.29 Submission

9.30 “No flood risk assessment of Tolka included in EIS”

- 9.31 Residents on Home Farm Road between Valentia Road and Bantry Road
- 9.32 Submission
- 9.33 Home Farm Road prone to flooding during periods of heavy rain, the storm drain in our area does not have capacity to deal with heavy rains at present and the development of the Greenfield site on Griffith Ave for the Metro Station will add to the surface water run-off”
- 9.34 “ponding occurs in our area and surface water/sewage flows up out of drains into our homes”
- 9.35 “EIS does not carry out a flood risk assessment for our area and gives no details on surface water management plans
- 9.36 Response
- 9.37 It is acknowledged that the residents of the area (Griffith Avenue/Home Farm Rd/Hampstead Avenue/The Rise) have experienced problems due to the apparent inability of the existing surface water system to convey surface water run-off away from the area during rainfall events which exhibit high rainfall intensity.
- 9.38 A flood risk assessment is not required for this area, such an assessment could be conducted if a development were to be located on an existing flood plain and if that development had the potential to significantly reduce the capacity of that flood plain. This clearly is not the case for the Griffith Avenue Metro Stop.
- 9.39 It is important to note that the Metro North project will not cause the surface water situation to deteriorate any further and any surface water discharges from the Stop will be mitigated in full compliance with the requirements of the GSDS.
- 9.40 Belinstown Depot
- 9.41 Patrick and Helen McGonagle – referring to Park & Ride and Belinstown Depot
- 9.42 Submission

- 9.43 “little or no information on flooding in the area of the Depot”
- 9.44 Stephen and Heather Joynt – RPA Belinstown Facility
- 9.45 Submission
- 9.46 “Flooding Risk – development is directly on a flood plain”
- 9.47 John and Ann Graham
- 9.48 Submission
- 9.49 “no flood study done for Broadmeadow Flood Plain”
- 9.50 John Flemming, Belinstown, Swords, Co. Dublin
- 9.51 Submission
- 9.52 “Adjacent roads are at present liable to flooding, there is a danger of flooding due to construction”
- 9.53 Michael Jones, Magillstown
- 9.54 Submission
- 9.55 “concerned about flooding, which already occurs along Batter Lane – which is prone to flash flooding – and farm land along the Turvey Stream, halting area, Park & Ride and ancillary roads will produce a lot of surface water run-off, would like written clarification from RPA on what stream or river will receive surface water run-off from the Depot, as far as I am aware the Turvey Stream is the only watercourse north of the site under the M1 motorway which any surface water is likely to be directed to and I do not believe it will be adequate to cope with the surface water run-off”
- 9.56 M and J Bond, Belinstown
- 9.57 Submission
- 9.58 “Flooding occurs where Magillstown Road meets Batter Lane, the drains fill and flood the fields and roads. Flooding occurs at the All Weather Pitch on the

Balheary Road, the Magillstown Road going northwards to Ennis Lane junction is underwater every time it rains, the Educate Together School at Balheary Cottages floods when the river bursts its banks”.

9.59 “The R132 between the Blakes Cross intersection and the Turvey Road floods regularly, the most recent being May 2008”.

9.60 “the reason for the flooding is the tides and the Broadmeadow River, it has become worse lately possibly as a result of the M1 and new housing estates on the banks of the Broadmeadow, provision should be made to take the water away, storm drains similar to those in America”

9.61 Response

9.62 The Depot will be designed to the requirements and principles of the GSDSDS and will not lead to the generation of excess surface water run-off. The installation of a new drainage system along Batter Lane will actually lead to an improvement in the local surface water drainage network. Some of the rainwater falling on the Depot site will be re-used for train washing activities, further decreasing the impacts of surface water run-off from the Depot site#

#### *Groundwater*

9.63 Bernadette and Karen Donnelly

9.64 Submission

9.65 “Culverted river runs beneath their house – no. 368 Griffith Avenue, concern there may be alteration to direction of flow or depletion of the groundwater in the area, ”

9.66 “the river runs diagonally beneath the house, there is already settlement in my house to the front and a section of the path has sunk considerably

9.67 GADRA

9.68 Submission

9.69 “we did not notice much mention of underground streams in the area, apart from the Santry River” “some residents have turloughs in their gardens which appear in wet conditions and disappear in dry conditions” “ we are concerned about the impact on flow and direction of underground streams and possible resulting impacts on the Tolka and on properties”

9.70 Response

9.71 A number of what were once streams in the Drumcondra/Glasnevin/Griffith Avenue area have in the past been extensively culverted and piped such that they effectively have become part of the Dublin City Surface Water Drainage pipe network.

9.72 The construction of the proposed Metro stop will not impact on the surface water network and therefore there will be no alteration of the flow of these piped/culverted streams.

9.73 There are no turloughs in Drumcondra. A turlough is defined as: “A topographic depression in karst which is intermittently inundated on an annual basis, mainly from groundwater, and which has a substrate and/or ecological communities characteristic of wetlands”. Karst is limestone which has been extensively altered by the dissolving of layers of soluble rock over time, which creates holes, caves and passage ways in the limestone. Karst is not present in the Drumcondra area and therefore the residents do not have turloughs but may have areas where poorly drained soil is leading to ponding of water during periods of heavy rainfall.

9.74 Corpus Christi School

9.75 Submission

9.76 “the Board would like more detail regarding the displacement of water under the school and how this may cause settlement cracks in the future”

9.77 Response

9.78 My colleagues in the RPA have conducted a full assessment of the displacement effects of tunnelling works and can comment on this issue

9.79 RAILWAY ORDER CHANGES

9.80 Since the publication of the EIS the RPA has made a number of changes to the Railway Order further to discussion and agreement with third parties. I have considered all of these and I can confirm that they will have no impacts on the water environment.

9.81 CLOSING STATEMENT

9.82 I consider that all significant impacts of Metro North on the water environment have been considered and will be mitigated such that the impact on the ground and surface water environments is considered to be Low.

**END OF EVIDENCE**

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