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Construction Environmental Management Plan

Project Title: Large-Scale Residential Development at Greenfields, Swords, Co. Dublin

CLIENT

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Greene
Construction
Limited

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Name	Isabel Gogarty Meade	Chonaill Bradley
Title	Environmental Consultant	Associate (Environmental)
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1. INTRODUCTION

AWN Consulting, a Trinity Consultants Team, has prepared this Construction Environmental Management Plan (CEMP) on behalf of Jackie Greene Construction Limited (the Client) for a Large-Scale Residential Development (LRD) comprising 289 No. residential apartments (60 No. 1-bed, 200 No. 2-bed and 29 No. 3-bed); retail / commercial unit (701 sq m); and crèche (418 sq m) with outdoor play area (42 sq m) (the Proposed Development) at a site of 2.22 Ha at Greenfields, Swords Business Park, Swords, Co. Dublin (the site).

This CEMP explains the construction techniques and methodologies which will be implemented during construction of the Proposed Development.

The CEMP mitigation measures will be implemented to ensure that pollution and nuisances arising from site clearance and construction activities is prevented where possible and managed in accordance with best practice environmental protection.

The CEMP will be implemented and adhered to by the Main Contractor and will be overseen and updated as required if site conditions change by the Project Manager, Environmental Manager, Environmental Clerk of Works and Ecological Clerk of Works where relevant. All personnel working on the site will be trained in the implementation of the procedures.

The Main Contractor will provide a further detailed CEMP to include any subsequent planning conditions relevant to the Proposed Development and set out further detail of the overarching vision of how the Main Contractor of the Proposed Development manage the site in a safe and organised manner.

This CEMP has been prepared to account for activities at the site during the excavation and construction phases of the Proposed Development.

The main issues that have been considered within this document are as follows;

- ▶ Description of works;
- ▶ Construction programme and phasing;
- ▶ Site logistics;
- ▶ Workforce;
- ▶ Public relations and community liaison;
- ▶ Construction traffic and access; and
- ▶ Safety, health and environmental management.

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

The Proposed Development consists of a mixed-use development that constitutes a 'Large-Scale Residential Development' (LRD) at this site of 2.22 Ha principally located at Swords Business Park, Swords, Co. Dublin. The site is principally bound: to the north by an access road and ancillary car park to serve Swords Business Park; to the east by the M1 Motorway; to the south by Mantua Road; and to the west by an access road to serve Swords Business Park. The application site also extends to include parts of: the access road to the north and west for footpath, landscape and foul drainage connection works; Mantua Road to the west for foul drainage connection works; and the green strip to the south at Mantua Road for a pedestrian and cyclist connection.

Permission is sought for a mixed-use development with a gross floor area of 30,358 sq m and principally comprised in 5 No. blocks (A–E), with heights ranging from 1 No. to 9 No. storeys. The proposed block heights are as follows: Block A is 6 No. to 7 No. storeys; Block B is 6 No. to 7 No. storeys; Block C is 6 No. to 7 No. storeys; Block D is 6 No. to 9 No. storeys; and Block E is 1 No. to 9 No. storeys. The development consists of: 289 No. residential apartments (60 No. 1-bed, 200 No. 2-bed and 29 No. 3-bed); retail/commercial unit (701 sq m); and crèche (418 sq m) with outdoor play area (42 sq m).

Permission is also sought for: new multi-modal site entrance to the west; minor relocation of existing northern site entrance to the east; internal road, cycle and footpath network; 132 No. car parking spaces; 13 no. motorcycle parking spaces; cycle parking; hard and soft landscaping, including public open space, communal amenity space (at-grade and as roof gardens atop Block D and Block E) and incidental open space; private amenity space as balconies and terraces facing all directions; public lighting; bin stores; plant rooms; 2 No. sub-stations; green roofs; rooftop plant, PV panels, telecommunications infrastructure, lift overruns and automatic opening vents; and all associated works above and below ground.

3. CONSTRUCTION PROGRAMME AND PHASING

The construction works associated with the Proposed Development will be undertaken in an approximately 24 – 36 months programme.

Subject to detailed planning at the construction stage, it is currently envisaged that the construction compound, offices, staff parking and storage areas will be located at either of the positions indicated in Figure 3.1 below. The site will ultimately be decided by the Main Contractor prior to the commencement of construction works.



Figure 3.1 Proposed Location Options for the Site Construction Compound and Staff Car Park

3.1 Demolition Phase

There is no demolition associated with the Proposed Development.

3.2 Excavation and Construction Phase

The Proposed Development will involve excavations for new foundations, site levelling and excavations for roads and services. The Resource Waste Management Plan prepared by AWN Consulting Ltd (257501.0151WMR01) for the Proposed Development will be updated by the Main Contractor and will be in compliance with the requirements of the *Best Practice Guidelines for the Preparation of Resource and Waste Management Plans for Construction and Demolition Projects*¹ published by the Environmental Protection Agency (2021), which will identify and categorise any waste arising from the Proposed Development.

The Plan will contain the proposals for the minimisation, reuse and recycling of site generated waste. As part of this Plan separate storage areas will be designated on the site for various types of material in order to maximise the re-use and re-cycling potential. Procedure will also be put in place to ensure that all sub-contractors fulfil the requirements of the Waste Management Plan.

The works will include:

- ▶ Site set up, welfare facilities and compound establishment, decommissioning and movement of site compound and facilities as needed;
- ▶ Set up of hoarding around compound and the site boundary; and
- ▶ Erection of safety signage to all areas and implementation of traffic / pedestrian management plan.

4. EXCAVATIONS

4.1 Archaeological and Architectural Heritage

An Archaeological Impact Assessment (AIA) was undertaken by John Cronin & Associates (2026).

The AIA found no potential archaeological or built heritage features from assessment of historic maps. From the review of aerial imagery, no potential archaeological or built heritage features were noted. There are five archaeological sites, as listed in the Archeological Survey of Ireland (ASI), located within 500m of the Proposed Development boundary. However, the assessment concluded that there would be no direct impacts on the recorded archaeological heritage resource of the area as a result of the Proposed Development. Furthermore, the site inspection carried out found that there has been large scale ground disturbance on the site and therefore the lands are not suitable for archaeological geophysical survey.

The AIA has concluded that no evidence for any potential unrecorded archaeological features was noted during the site inspection, and the heavily disturbed state of the site would lead to the conclusion that the potential for archaeological remains to survive here is low to negligible.

John Cronin & Associates have recommended based on the AIA that site development works within the southern and eastern margins of the site be subject to a programme of archaeological monitoring, under licence from the National Monuments Service (NMS) of the Department of Housing, Local Government and Heritage (DoHLGH).

Should archaeological features or material be uncovered during any phase of construction, groundwork will cease immediately, and the NMS will be informed. Time must be allowed for a suitably qualified archaeologist to inspect and assess any material. If it is established that archaeologically significant material is present, the NMS may require that further archaeological mitigation be undertaken.

However, it is noted that the site does not include a Recorded Monument. Furthermore, there are no protected structures or structures listed in the National Inventory of Architectural Heritage present at the site.

Full details of the AIA findings and recommendations can be viewed in the AIA report submitted with this application.

4.2 Ground Conditions

Ground Investigations were undertaken by Site Investigations Ltd (SIL) on the instructions of Roger Mullarkey & Associates (August 2025).

The investigations found that the soakaway tests failed the specification as the water level did not fall sufficiently enough to complete the test.

Ground conditions observed from the soakaway tests included topsoil, clay and Made Ground of grey brown sandy gravelly silty clay with low cobble content and some timber fragments.

In the event that any contaminated material is found on site, this material will need to be segregated from clean/inert material, tested and classified as either non-hazardous or hazardous in accordance with the EPA publication entitled *Waste Classification: List of Waste & Determining if Waste is Hazardous or Non-Hazardous* ² using the *HazWasteOnline* application (or similar approved classification method). The

material will then need to be classified as clean, inert, non-hazardous or hazardous in accordance with the *EC Council Decision 2003/33/EC*³, which establishes the criteria for the acceptance of waste at landfills.

In the event that ACMs are found, the removal will only be carried out by a suitably permitted waste contractor, in accordance with *S.I. No. 386 of 2006 Safety, Health and Welfare at Work (Exposure to Asbestos) Regulations 2006-2010*⁴ and the *Best Practice Guidance for Handling Asbestos (2023)*⁵ All asbestos will be taken to a suitably licensed or permitted facility.

In the event that hazardous soil, or historically deposited waste is encountered during the construction phase, the Main Contractor will notify Fingal County Council (FCC) and provide a Hazardous/Contaminated Soil Management Plan, to include estimated tonnages, description of location, any relevant mitigation, destination for disposal/treatment, in addition to information on the authorised waste collector(s).

5. SITE LOGISTICS

5.1 Site Safety Compliance

The Main Contractor shall be responsible for overall management of the site for the duration of the proposed works and will progress their works with reasonable skill, care, diligence and to proactively manage the works in a manner most likely to ensure the safety and welfare of those carrying out construction works.

The Main Contractor shall comply with all relevant Statutory requirements such as the 2005 Safety Health and Welfare at Work Act, The Construction Regulations (SI 291 of 2013), the General Application Regulations (SI 299 of 2007), etc. (and any amendments thereof).

In addition, the Main Contractor shall comply with all the reasonable safety requirements of the Client, the Project Supervisor for the Design Process and the Project Supervisor for the construction stage.

5.2 Site Establishment and Security

The first activity to be carried out at the site will be the establishment of site facilities and security. It is anticipated that site establishment works will take approximately four weeks. The site office and welfare facilities will be confirmed in advance of the commencement of site works and agreed with FCC. Figures 3.1 and 3.2 shows the proposed locations of the site compound, site storage and staff parking.

All of the sub-contractors as well as the Main Contractor and project managers will occupy offices within the construction compounds. The proposed site parking for all staff, contractors and visitors is envisioned to be located in either of the areas highlighted in Figure 3.1. Carpooling and the use of public transport will be encouraged to reduce pressure on parking in the area.

5.3 Consents and Licenses

All statutory consents and licences required to commence on-site construction activities will be obtained ahead of works commencing, allowing for the appropriate notice period. These will include, but are not limited to:

- ▶ Site notices;
- ▶ Construction commencement notices; and
- ▶ Licence to connect to existing utilities and mains sewers, where required;

5.4 Services and Utilities

Welfare facilities (canteens, toilets etc.) will be available within the construction compound and this will remain in place for the construction of the Proposed Development. The offices and site amenities will initially need to have their own power supply (generator) where necessary, water will be supplied via deliveries until a connection is available to the mains networks and foul water will be collected until the permanent connection is established.

Electrical connections will be made by suitably qualified personnel following consultation with the relevant authorities and will be cognisant of subsequent construction works. High voltage connections will be established for heavy duty equipment and site facilities, as required.

All electrical works, including connection to the ESB network will be carried out by a suitably qualified contractor.

Water supply required for welfare facilities, dust suppression and general construction activities will be sourced from the public water supply, subject to connection to the local mains network.

Prior to connection, water may need to be tankered to the site by a suitably qualified contractor. A reliable and safe water supply will be maintained throughout the construction phase.

Site welfare facilities will be established to provide sanitary facilities for construction workers on site. The main contractor will ensure that sufficient facilities are available at all times to accommodate the number of employees on site. Until the site is connected to the foul sewer, wastewater from the offices and welfare facilities will be collected and removed by a licensed wastewater contractor.

5.5 Material Handling and Storage

Key materials will be ordered by specific order for the Proposed Development, a 'Just in Time' delivery system will operate to minimise storage of materials, the quantities of which are unknown at this stage.

Where possible it is proposed to source general construction materials from the Dublin / Fingal area to minimise transportation distances.

Aggregate materials such as sands and gravels will be stored in clearly marked receptacles in the compound area within the site. Liquid materials will be stored within temporary bunded areas, doubled skinned tanks or bunded containers (all bunds will conform to standard bunding specifications – BS EN 1992-3:2006 ⁶) to prevent spillage.

Construction materials will be brought to site by road. Construction materials will be transported in clean vehicles. Lorries / trucks will be properly enclosed or covered during transportation of friable construction materials and spoil to prevent the escape of material along the public roadway.

The majority of construction waste materials generated will be soil from excavation works. Material will be removed from site regularly to ensure there is minimal need for stockpiling.

5.6 Visitor Management

Visitors will only be allowed to enter the main site compound via the designated pedestrian access gate. A dedicated, secured footpath to the site office is established at the gate for registration and obtaining PPE prior to entering the site. A log will be maintained by security to control access to the site. Visitors will be required to attend a site-specific induction to allow access to the compound and/or construction site unless being accompanied by an inducted member of the site team.

Visitors will then be taken by an inducted member of the construction team to the required area of the site.

5.7 Site Working Hours

Site development and building works will only be carried out between the hours of 07:00 to 19:00 Mondays to Fridays inclusive and between 08:00 and 14:00 hours on Saturdays. There will be no construction works carried out on Sundays or public holidays. Deviation from these times will only take place when written approval is granted by FCC in exceptional circumstances.

5.8 Employment and Management Workforce

It is estimated that there will be approximately 200 staff and contractors on site per day during peak construction periods.

It is anticipated that the key project managers and Main Contractor representatives will maintain a presence on site for the whole duration of the Proposed Development and the labour workforce will be determined by the specialist contractors required on site.

All employees working on the site will be required to have a SafePass Card (or similar approved Construction Health & Safety card), manual handling training and the necessary certificates to operate machinery as required. The details of training required, records maintained, and induction procedures will be outlined in the Main Contractor's Health and Safety Plan(s).

6. CONSTRUCTION TRAFFIC AND SITE ACCESS

The proposed construction vehicle routes for the site will require a traffic management plan to be agreed upon with FCC and Transport Infrastructure Ireland (TII) prior to site workings beginning. A Construction Stage Traffic Plan will be prepared post-planning and prior to construction. Advanced warning signs will be placed at sufficient distances to taper off the entry and exit points. Pedestrian marshals will be used as and when required.

Material deliveries and collections from site will be planned, scheduled and staggered to avoid any unnecessary build-up of construction works related traffic.

The traffic plan will be such that it will minimise the interaction between the construction site and the local residential areas.

Traffic management will be undertaken for the site works in accordance with the principles outlined below and shall comply at all times with the requirements of:

- ▶ Department of Transport Traffic Signs Manual 2010 – Chapter 8 Temporary Traffic Measures and Signs for Roadworks ⁷;
- ▶ Department of Transport Guidance for the Control and Management of Traffic at Road Works (2010) ⁸; and
- ▶ Any additional requirements detailed in Design Manual for Urban Roads & Streets (DMURS) ⁹.

Construction traffic operation would be limited to 07:00 to 19:00 from Monday to Friday and 08:00 to 14:00 on Saturdays for the off-road construction. These times may vary to facilitate specific site requirements and / or construction activities associated with the site. Any variation will be discussed and agreed in advance with FCC.

It should be noted that construction traffic generated during the Construction Phase tends to be outside of peak hours. All construction activities will be agreed with FCC's Roads Department prior to the commencement of the Construction Phase.

In general, the impact of the construction period will be temporary in nature. HGV vehicle movements per hour during the busiest period of construction works are estimated at a peak of 5 HGVs per hour arriving and leaving, but the exact figure will be confirmed by the Main Contractor.

Approved traffic mitigation measures requested by FCC will be submitted with an updated CEMP as part of compliance, prior to the commencement of works.

6.1 Construction Traffic Management

Below is a list of the proposed traffic management measures to be adopted during the construction works. Please note that this is not an exhaustive list, and that it will be the appointed Main Contractor's responsibility to prepare a detailed construction traffic management plan which includes conditions imposed by FCC.

- ▶ Warning signs / Advanced warning signs will be installed at appropriate locations in advance of the construction access locations;
- ▶ Construction and delivery vehicles will be instructed to use only the approved and agreed means of access; and movement of construction vehicles will be restricted to these designated routes;
- ▶ Appropriate vehicles will be used to minimise environmental impacts from transporting construction material, for example the use of dust covers on trucks carrying dust producing material;

- ▶ Speed limits of construction vehicles to be managed by appropriate signage, to promote low vehicular speeds within the site;
- ▶ Parking of site vehicles will be managed and will not be permitted on public road, unless proposed within a designated area that is subject to traffic management measures and agreed with FCC;
- ▶ A road sweeper will be employed to clean the public roads adjacent to the site of any residual debris that may be deposited on the public roads leading away from the construction works;
- ▶ On site wheel washing will be undertaken for construction trucks and vehicles to remove any debris prior to leaving the site, to remove any potential debris on the local roads;
- ▶ All vehicles will be suitably serviced and maintained to avoid any leaks or spillage of oil, petrol or diesel. Spill kits will be available on site. All scheduled maintenance carried out off-site will not be carried out on the public highway;
- ▶ Safe and secure pedestrian facilities are to be provided where construction works obscure any existing pedestrian footways. Alternative pedestrian facilities will be provided in these instances, supported by physical barriers to segregate traffic and pedestrian movements, and to be identified by appropriate signage; and
- ▶ Pedestrian facilities will cater for vulnerable users including mobility impaired persons.

The above mitigation measures will ensure that the presence of construction traffic will not lead to any significant environmental degradation or safety concerns in the vicinity of the proposed works. Furthermore, it is in the interests of the construction programme that deliveries, particularly concrete deliveries are not unduly hampered by traffic congestion, and as a result continuous review of haulage routes, delivery timings and access arrangements will be undertaken as construction progresses to ensure smooth operation.

6.2 Traffic Queueing

Material deliveries and collections from site will be planned, scheduled and staggered to avoid any unnecessary build-up of construction works related traffic.

Deliveries to site shall be booked in advance using a delivery schedule, so as to prevent lorry congestion on the road networks surrounding the site. Alternative safe routeways shall be established for traffic and pedestrians where existing routeways have to be altered, removed or worked on during the Proposed Development.

6.3 Site Hoarding and Security Fencing

All areas of construction will be fenced / hoarded off to prevent unauthorized access. This fencing shall remain closed at all times during construction works and closed and locked after construction work hours / break times.

This fencing shall be erected in accordance with good practice and the Construction Regulations 2013. Fencing arrangements shall be reviewed as the life of the Proposed Development progresses.

7. SAFETY, HEALTH AND ENVIRONMENTAL CONSIDERATIONS DURING CONSTRUCTION WORKS

The appointed Main Contractor will implement a Construction, Health and Safety Plan during the life of the Proposed Development, which contains health and safety measures covering the below items at a minimum:

- ▶ Construction Health and Safety training requirements;
- ▶ Induction procedures;
- ▶ Emergency protocols; and
- ▶ Details of welfare facilities.

7.1 Environmental Management and Emergency Response

The Main Contractor will implement an environmental management approach in accordance with best practice and this CEMP.

Emergency response procedures will be established on-site to respond to environmental incidents including fuel spills, surface water pollution, fire events, and accidental releases. All personnel will be trained in emergency response procedures, and spill kits and relevant equipment will be maintained on-site at all times.

All incidents will be recorded, investigated, and corrective actions implemented to prevent recurrence.

7.2 Construction Lighting

Construction work will generally be confined to daylight hours and lighting will generally not be required for the excavation and construction phase. There will however be occasions where the provision of portable lighting will be required (works on roadways and power floating floors as examples). Where possible and without jeopardising site safety, lights will be pointed down at a 45-degree angle and away from sensitive receptors. The site compound will have external lights for safety and security. These lights will be pointed down at a 45-degree angle and away from sensitive receptors where possible.

The project ecologist, DNV, have recommended the following mitigation measures to be adhered to for construction lighting:

- ▶ As a precautionary measure, no overnight lighting will be directed to the natural habitats bounding the Site. Where overnight lighting cannot be avoided in these areas due to health and safety concerns, the lighting within the Proposed Development will be designed and installed to minimise the impact on local wildlife as agreed with the Ecologist and in accordance with the Bat Conservation Trust guidelines on artificial lighting and bats
- ▶ There will be no light spill to the boundary habitats.
- ▶ All luminaires used will lack UV/IR elements to reduce impact.
- ▶ LED luminaires will be used due to the fact that they are highly directional, lower intensity, good colour rendition and dimming capability.
- ▶ A warm white spectrum (3000 Kelvins will be used to reduce the blue light component of the LED spectrum).
- ▶ Luminaires will feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats.

- ▶ Column heights should be carefully considered to minimise light spill. The shortest column height allowed should be used where possible.
- ▶ Only luminaires with an upward light ratio of 0% and with good optical control will be used.
- ▶ Luminaires will be mounted on the horizontal, i.e., with no upward tilt.
- ▶ Any external security lighting will be set on motion-sensors and short (1min) timers.
- ▶ As a last resort, accessories such as baffles, hoods or louvres will be used to reduce light spill and direct it only to where it is needed.

7.3 Air Quality

This section describes the site policy with regard to dust management and the specific mitigation measures which will be put in place during construction works. The objective of dust control at the site is to ensure that no significant nuisance occurs at nearby sensitive receptors. In order to develop a workable and transparent dust control strategy, the measures set out below have been formulated by drawing on best practice guidance from Ireland, the UK and the US, such as:

- ▶ Department of Environment, Heritage and Local Government (DOEHLG), *Quarries and Ancillary Activities, Guidelines for Planning Authorities* (2004) ¹⁰;
- ▶ US Environment Protection Agency (USEPA), *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition* (periodically updated) (1986) ¹¹;
- ▶ The Scottish Office – Development Department, *Planning Advice Note PAN50 Controlling the Environmental Effects Of Surface Mineral Workings Annex B: The Control of Dust at Surface Mineral Workings* (1996) ¹²; and
- ▶ Institute of Air Quality Management (IAQM), *Guidance on the Assessment of Dust from Demolition and Construction* (2024) ¹³.

7.3.1 Site Management

The site activities will be undertaken with due consideration of the surrounding environment and the close proximity of sensitive receptors such as residents and pedestrians. Dust management during the construction phase will be the most important aspect in terms of minimising the impacts of the Proposed Development on the surrounding air quality. The following measures will also be implemented to ensure impacts are minimised:

- ▶ Complaint registers will be kept detailing all telephone calls and letters of complaint received in connection with construction activities, together with details of any remedial actions carried out;
- ▶ Equipment and vehicles used on site will be in good condition such that emissions from diesel engines etc. are not excessive; and
- ▶ Pre-start checks will be carried out on equipment to ensure they are operating efficiently and that emission controls installed as part of the equipment are functional.

Dust deposition levels will be monitored, if requested by the local authority or if complaints are received, to assess the impact that site activities may have on the local ambient air quality. If requested the following procedure will be implemented:

- ▶ The dust deposition rate will be measured by positioning Bergerhoff Dust Deposit Gauges at strategic locations near the boundaries of the site for a period of 30 (+/- 2) days if required. Monitoring should be conducted as required during periods when the highest levels of dust are expected to be generated i.e., during site preparation works and soil stripping activities.
- ▶ The exact locations will be determined after consideration of the requirements of Method VDI 2119 with respect to the location of the samplers relative to obstructions, height above ground and sample collection and analysis procedures.

- ▶ After each 30 (+/- 2 days) exposure period, the gauges will be removed from the sampling location, sealed and the dust deposits in each gauge will be determined gravimetrically by an accredited laboratory and expressed as a dust deposition rate in mg/m²/day in accordance with the relevant standards.
- ▶ Technical monitoring reports detailing all measurement results, methodologies and assessment of results shall be subsequently prepared and maintained by the Site Manager.

A limit value of 350 mg/m²/day will be used in comparison with recorded values.

7.3.2 Dust Control Measures

The aim is to ensure good site management by avoiding dust becoming airborne at source. This will be done through good design, planning and effective control strategies. The siting of construction activities and the limiting of stockpiling will take note of the location of sensitive receptors and prevailing wind directions in order to minimise the potential for significant dust nuisance. In addition, good site management will include the ability to respond to adverse weather conditions by either restricting operations on-site or using effective control measures quickly before the potential for nuisance occurs.

- ▶ During working hours, technical staff will be available to monitor dust levels as appropriate; and
- ▶ At all times, the dust management procedures put in place will be strictly monitored and assessed.

The dust minimisation measures will be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust generation. In the event of dust nuisance occurring outside the site boundary, site activities will be reviewed, and procedures implemented to rectify the problem. Specific dust control measures to be employed are presented below.

Site Routes

Site access routes (particularly unpaved areas) can be a significant source of fugitive dust from construction sites if control measures are not in place. The most effective means of suppressing dust emissions from unpaved roads is to apply speed restrictions. Studies show that these measures can have a control efficiency ranging from 25% to 80% (USEPA, 1997) ¹⁴.

- ▶ A speed restriction of 20 km/hr will be applied as an effective control measure for dust for on-site vehicles or delivery vehicles within the vicinity of the site;
- ▶ Bowsers will be available during periods of dry weather throughout the construction period. Research shown found that the effect of surface watering is to reduce dust emissions by 50%. The bowser will operate during dry periods to ensure that unpaved areas are kept moist. The required application frequency will vary according to soil type, weather conditions and vehicular use; and
- ▶ Any hard surface roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced areas shall be restricted to essential site traffic only.

Excavation

Excavation works during periods of high winds and dry weather conditions can be a significant source of dust.

- ▶ During dry and windy periods, and when there is a likelihood of dust nuisance, watering shall be conducted to ensure moisture content of materials being moved is high enough to increase the stability of the soil and thus suppress dust;
- ▶ During periods of very high winds (gales), activities likely to generate significant dust emissions should be postponed until the gale has subsided.

The movement of trucks containing materials with potential for dust generation to an off-site location will be enclosed or covered.

Stockpiling

The location and moisture content of stockpiles are important factors which determine their potential for dust emissions. The following measures will be put in place:

- ▶ Overburden material will be protected from exposure to wind by storing the material in sheltered parts of the site, where possible storage piles should be located downwind of sensitive receptors. Regular watering will take place during dry/windy periods to ensure the moisture content is high enough to increase the stability of the soil and suppress dust.

Site Traffic on Public Roads

Spillage and blow-off of debris, aggregates and fine material onto public roads will be reduced to a minimum by employing the following measures:

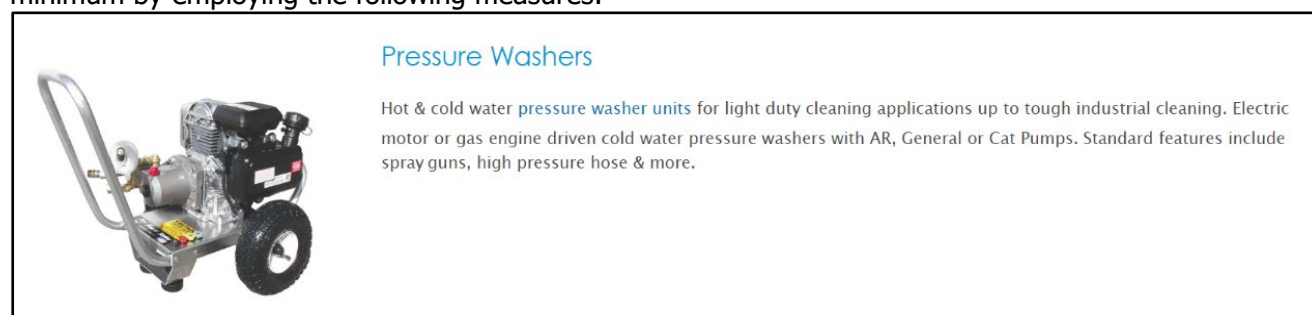


Figure 7.1 Example of Proposed Wheel Cleaning Equipment

- ▶ Vehicles delivering material with potential for dust emissions to an off-site location shall be enclosed or covered at all times to restrict the escape of dust;
- ▶ Any hard surface site roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only;
- ▶ A power washing facility or wheel cleaning facility will be installed near to the site compound for use by vehicles exiting the site when appropriate, and an example of the washing equipment can be seen in Figure 7.1;
- ▶ Road sweepers will be employed to clean the site access route as required.
- ▶ Vehicles will be inspected prior to leaving site to ensure they are not overloaded;
- ▶ Operatives will be made aware of the correct access / egress routes by site management; and
- ▶ Banksman will clear any larger debris immediately.

General

The pro-active control of fugitive dust will ensure that the prevention of significant emissions, rather than an inefficient attempt to control them once they have been released, will contribute towards the satisfactory management of dust by the construction contractor. The key features with respect to control of dust will be:

- ▶ The specification of a site policy on dust and the identification of the site management responsibilities for dust issues;
- ▶ The development of a documented system for managing site practices with regard to dust control;
- ▶ The development of a means by which the performance of the dust minimisation plan can be regularly monitored and assessed; and
- ▶ The specification of effective measures to deal with any complaints received.

7.4 Ecology

An Ecological Impact Assessment (EcIA) was undertaken by the project ecologist DNV (June 2026).

While there are records for 12 invasive plant species within the grid squares that encompass the Proposed Development site from the National Biodiversity Database Centre (NBDC), the field survey conducted on the 14th of March 2025 found no high or medium impact invasive plant species present on the site.

If a Third Schedule Invasive species is found on site, for example Japanese Knotweed, an Invasive Species Management Plan will be prepared which will include an eradication and treatment program to be submitted to FCC. This management plan will be continued as required during the Operational Phase until eradication is complete.

Mitigation measures recommended by DNV are as follows:

Root Protection Zones for Retained Vegetation at the Site

An arborist will oversee works relating to trees and demarcate a suitable buffer for the retained vegetation, such as the stretch of the treeline along the western boundary of the site, and trees within the woodland at the southwest section of the site. This is to be done prior to the commencement of the Construction Phase. Protective tree fencing in compliance with BS 5837:2012 '*Trees in relation to design, demolition and construction – Recommendations*' will be erected prior to any construction works being undertaken to prevent damage to the canopy and root protection areas of existing trees to be retained at the site. The fencing should be signed off by a qualified arborist prior to construction to ensure it has been properly erected. No ground clearance, earthworks, stockpiling or machinery movement will be undertaken within these areas.

Biosecurity

The following best practice site hygiene and biosecurity measures will be in place to avoid the potential introduction of invasive floral species at the site and offsite via movement of materials / staff:

- ▶ All soils/materials being introduced to the site will be sourced from a certified invasive flora-free source site, to ensure no introduction of invasive plant materials to the site occurs.
- ▶ Personnel working on or between sites will ensure their clothing and footwear are cleaned, ensuring they are visually free from soil and organic debris, in order to prevent inadvertent spread of invasive plant material.
- ▶ All vehicles entering or leaving the site will have been suitably checked and pressure washed to ensure no introduction of invasive flora to and from the site. Measures such as a drive through hygiene bath or footbaths will be considered where appropriate.
- ▶ Material/water left after vehicles have been pressure-washed must be contained, collected and disposed of appropriately.

Spill/Emergency Response Plans

- ▶ Robust and appropriate Spill Response Plan and Site Environmental Emergency Plans (SEP) will be implemented for the duration of the works:
 - Identifying fuel storage and refuelling locations on designated areas within the compound, away from drainage ditches / waterbodies (where present), and on substrate underlain with an impermeable liner to prevent contaminants leaching to groundwater;
 - Identifying spill kit locations (spill kits will be required for each piece of heavy equipment (e.g., excavators, loaders, trucks, etc.,) which will be at least 21L drum size each with spill pads, sorbent, small boom, plastic garbage bag and gloves;
 - A specially trained and dedicated Environmental and Emergency Spill Response team will be appointed before the commencement of works on site; and

- Staff will be trained and experienced in using appropriate control measures and spill kits on-site and will be familiar with the location of all spill kit locations and the site layout.
- ▶ A register will be kept of all hazardous substances either used on site or expected to be present. The register shall be available at all times and shall include as a minimum:
 - Valid safety sheets; Health & Safety, environmental controls to be implemented when storing, handling, using and in the event of spillage of materials;
 - Emergency response procedures / precautions for each material; and
 - PPE is required when using the material.

Vegetation Clearance

Vegetation clearance at the site will need to be cognisant of any potentially present fauna. DNV have provided guidance which can be viewed in the EcIA for when vegetation clearance is permissible in relation to wintering, hibernating and breeding fauna. The preferred period for vegetation clearance is within the months of September and October to avoid the main breeding bird season and bat maternity and roosting season as well as mammal hibernation. Where this seasonal restriction cannot be observed, a check for active nests will be carried out immediately prior to any site clearance by an Ecological Clerk of Works (ECoW) and repeated as required to ensure compliance with legislative requirements. Where a breeding bird and an active nest is found, the nest will be protected, and no further works will take place in the vicinity of the nest until the young have fledged. The timing of any vegetation clearance will follow seasonal restrictions as advised by DNV.

Additionally, all vegetation clearance will be carried out in sections working in a consistent direction to prevent entrapment of protected fauna potentially present (e.g., hedgehog, pygmy shrew). A phased cutting approach under the supervision of a suitably qualified ECoW will be used to allow wildlife (small mammals, reptiles and amphibians) to move away from any suitable habitat that will be removed:

- ▶ Phase 1 – Cutting vegetation to 150-200 mm and removing the arisings;
- ▶ Phase 2 – After a minimum of one hour, hand-searching the cut areas (conducted by an ECoW) and removing any sheltering habitat (e.g. logs or debris) then cutting vegetation to ground level and removing the arisings; and
- ▶ Phase 3 – Soil scrape. Should any suitable refugia or day nesting habitats need to be removed, this will be carried out outside the most vulnerable breeding periods for hedgehogs wherever practicable (main hedgehog birthing months June and July) and will be supervised by the ECoW.

Avoidance of Accidental Trapping of Fauna

In order to avoid accidental harm / injury or mortality to mammals during construction all excavations shall have a wooden plank, sloping edge or other means of escape to avoid accidental trapping of mammals. All pipes shall be covered at night.

Full details on the Ecological Impact Assessment and the full mitigation measures recommended can be viewed under the Ecological Impact Assessment Report submitted with this planning application.

The key strategies to be undertaken to minimise impact on the local flora and fauna during site clearing and construction are as follows:

- ▶ All site clearance works will comply with current legislative requirements and best practice;
- ▶ Taking measures to limit the working area during the construction phase will reduce the impacts of the development on adjacent areas. The construction area will be clearly delimited by the site boundary and machinery should operate only within this allocated site area;
- ▶ All re-fuelling of plant, equipment and vehicles will be carried out at designated refuelling areas where possible when within the construction site boundary. All fuels, chemicals, liquid and solid waste will

be stored in areas bunded in accordance with established best practice guidelines at the construction compound; and there will be provision of spill kits around site where refuelling occurs;

- ▶ Provision of a water and sediment management plan, providing for means to ensure that surface water run-off is controlled such that no silt or other pollutants enter local water courses or drains;
- ▶ The measures outlined in Section 8.6 will ensure that silt run-off and potential flooding risks are minimised which will protect any ecological receptors associated with the site; and
- ▶ Construction lighting will be designed so as to be sensitive to the potential presence of bats and should adhere to the following guidance:
 - Bats and Lighting: *Guidance Notes for Planners, Engineers, Architects and Developers* (Bat Conservation Trust, 2010) ¹⁵;
 - *Guidance Notes for the Reduction of Obtrusive Light GN01* (Institute of Lighting Professionals, 2011) ¹⁶;
 - Bats and Artificial Lighting in the UK – *Bats and the Built Environment Series*. Guidance Note 08/18 (Bat Conservation Trust UK, 2018) ¹⁷.

7.5 Noise and Vibration

7.5.1 Noise Criteria

Noise impacts arising from construction activities have the potential to cause annoyance or nuisance to local residents and businesses in the area.

Appropriate criteria relating to permissible construction noise levels for this development are taken from British Standard BS 5228 – 1: 2009 +A1 2014¹⁸: Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise. The approach adopted here calls for the designation of a noise sensitive location into a specific category (A, B or C) based on exiting ambient noise levels in the absence of construction noise.

In accordance with the standard, ambient measured noise levels representative of noise sensitive locations should be rounded to the nearest 5 dB and construction noise limits are then set according to the category definitions above. This then sets a threshold noise value that, if exceeded at this location, indicates a potential significant noise impact is associated with the construction activities depending on context. The approach is summarised in Table 7.1, below.

Table 7.1 Threshold of Potential Significant Effect at Dwellings (BS5228-1)

Assessment Category and Threshold Value Period	Threshold Value (dB)		
	Category A ^{A)}	Category B ^{B)}	Category C ^{C)}
Night Time (23:00-07:00)	45	50	55
Evenings and Weekends D)	55	60	65
Daytime (07:00-19:00) and Saturdays (07:00 – 13:00)	65	70	75

- A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.
- B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.
- C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.
- D) 19:00–23:00 weekdays, 13:00–23:00 Saturdays and 07:00–23:00 Sundays.

7.5.2 Vibration Criteria

Vibration criteria are taken from BS 5228-2:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites- Vibration ¹⁹. This document sets the following vibration limits for transient vibration. For buildings or structures that are structurally unsound, lower vibration magnitudes will apply, typically 50% of those for structurally sound buildings. Protected or historic buildings are not automatically assumed to be more vulnerable to vibration unless they have existing structural defects. The recommended transient vibration thresholds from BS5228-2 for the avoidance of cosmetic damage to light and heavy framed buildings are summarised in Table 7.2, below.

Table 7.2 Transient Vibration Threshold Values for Buildings

Type of Building	Peak component particle velocity in frequency range of predominant pulse Note 1	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings	50mm/s	
Unreinforced or light framed structures. Residential or light commercial buildings.	15 mm/s at 4 Hz Note 2 increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Note 1: Values referred to are at the base of the building.

Note 2: At frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.

7.5.3 General Noise and Vibration Mitigation

Best practice noise and vibration control measures will be employed by the Main Contractor during the construction phase in order to control noise and vibration impacts at the nearest noise sensitive locations. All works on site shall comply with BS 5228 2009+ A1 2014 (Parts 1 & 2) which gives detailed guidance on the control of noise and vibration from construction activities. This includes guidance on several aspects of construction site mitigation measures, including, but not limited to:

- ▶ Selection of quiet plant;
- ▶ Noise control at source;
- ▶ Screening; and
- ▶ Liaison with the Public.

The following key forms of noise control for the site are set out below:

- ▶ Site compounds will be located away from noise sensitive boundaries within the site constraints;
- ▶ For mobile plant items such as cranes, dump trucks, excavators and loaders, the installation of an acoustic exhaust and or maintaining enclosure panels closed during operation can reduce noise levels by up to 10dB. Mobile plant should be switched off when not in use and not left idling;
- ▶ For steady continuous noise, such as that generated by diesel engines, it may be possible to reduce the noise emitted by fitting a more effective exhaust silencer system and avoid idling of engines when not in use;
- ▶ For percussive tools, a number of noise control measures include fitting a muffler or sound reducing equipment to the breaker 'tool' and ensure any leaks in the air lines are sealed. Erection of localised screens around breaker or drill bit when in operation in close proximity to noise sensitive boundaries;

- ▶ The use of a high quality construction site hoarding will be included around all noise sensitive boundaries;
- ▶ For all materials handling, ensure that materials are not dropped from excessive heights, lining drops chutes and dump trucks with resilient materials;
- ▶ All items of plant should be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures; and
- ▶ All site staff shall be briefed on noise mitigation measures and the application of best practicable means to be employed to control noise.

7.5.3.1 Liaison with the Public

The designated environmental liaison officer will be appointed to site during construction works. Any noise complaints will be logged and followed up in a prompt fashion by the liaison officer. In addition, where a particularly noisy construction activity is planned or other works with the potential to generate high levels of noise, or where noisy works are expected to operate outside of normal working hours etc., the liaison officer will inform the nearest noise sensitive locations of the time and expected duration of the noisy works.

Any noise complaints related to activities at the site will be logged and investigated and, where required, measures taken to ameliorate the source of the noise complaint.

7.5.3.2 Monitoring

During the construction phase, spot check noise monitoring may be required where the construction noise thresholds have the potential to be exceeded at noise sensitive locations. The monitoring shall be carried out by the Main Contractor and used to inform the requirement for any control measures on site to reduce construction noise levels.

Noise monitoring will be conducted in accordance with the International Standard ISO 1996-2:2017 - *Description, measurement and assessment of environmental noise - Part 2: Determination of Sound Pressure Levels* (ISO 2017)²⁰.

Where required, or requested by the local authority, unattended external noise monitoring will be undertaken at locations on the site boundary closest to sensitive locations. It is considered that it will be appropriate to amend the monitoring program and location as the works progress. Accordingly, monitors may be added, removed or relocated as necessary.

The noise monitoring terminals should provide the following at minimum:

- ▶ Logging at hourly intervals; and
- ▶ Remote access for information download.

Where required (i.e. where there is potential for exceedance of the vibration thresholds for buildings in Table 7.2), or requested by the local authority, vibration monitoring will be installed at the site boundary to monitor Peak Particle Velocity parameter (PPV, mm/s) in the X, Y and Z directions, in accordance with BS ISO 4866: 2010: *Mechanical vibration and shock – Vibration of fixed structures – Guidelines for the Measurement of Vibrations and Evaluation of their Effects on Structures*²¹.

The mounting of the transducer to the vibrating structure will need to comply with BS EN ISO 5348: 1998: *Mechanical vibration and shock – Mechanical Mounting of Accelerometers*²². In summary, the following ideal mounting conditions apply:

- ▶ The transducer and its mountings should be as rigid as possible;

- ▶ The mounting surfaces should be as clean and flat as possible;
- ▶ Simple symmetric mountings are best; and
- ▶ The mass of the mounting should be small in comparison to that of the structure under test.

7.6 Resource and Waste Management

This section outlines the measures that will be undertaken to minimise the quantity of waste produced at the site and the measures to handle the waste in such a manner as to minimise the effects on the environment. A site-specific RWMP has been prepared by AWN Consulting (257501.0151WMR01) and will be employed to ensure sustainable and effective waste management throughout the excavation and construction phases of the Proposed Development.

Adherence to the RWMP prepared for the construction works will ensure that the management of waste arising is dealt with in compliance with the provisions of the *Waste Management Act 1996* (as amended)²³, and associated Regulations, the *Litter Pollution Act of 1997* (as amended)²⁴ and the *National Waste Management Plan for a Circular Economy 2024 - 2030 (NWMPCE)* (2024)²⁵, and that it will achieve optimum levels of waste reduction, reuse and recycling.

Typical waste materials that will be generated from the construction works will include:

- ▶ Soil and stones;
- ▶ Concrete, bricks, tiles and ceramics;
- ▶ Wood, glass and plastics;
- ▶ Metals;
- ▶ Gypsum-based construction material;
- ▶ Paper and cardboard;
- ▶ Mixed construction waste; and
- ▶ Chemicals (solvents, paints, adhesives, detergents etc.).

The management of all hazardous waste arisings, if they occur, shall be coordinated in liaison with Health and Safety Management.

7.6.1 Waste Minimisation

Waste minimisation measures proposed are summarised as follows:

- ▶ Materials will be ordered on an 'as needed' basis to prevent over supply;
- ▶ Materials will be correctly stored and handled to minimise the generation of damaged materials;
- ▶ Materials will be ordered in appropriate sequence to minimise materials stored on site;
- ▶ A waste tracking log will be established;
- ▶ Sub-contractors will be responsible for similarly managing their wastes; and
- ▶ All wood waste generated by site works will be inspected and examined and will be segregated as re-useable wood and scrap wood waste.

7.6.2 Waste Storage

The main waste storage area will be located in the site compound. A dedicated and secure area containing bins, and /or skips, and storage areas, into which all waste materials generated by construction site activities, will be established within the Proposed Development.

Waste materials generated will be segregated at the site compound, where it is practical. Where the on-site segregation of certain wastes types is not practical, off-site segregation will be carried out. There will be skips and receptacles provided to facilitate segregation at source. All waste receptacles leaving site will

be covered or enclosed. The appointed waste contractor will collect and transfer the wastes as receptacles are filled. There are numerous waste contractors in the Fingal region that provide this service.

The site Resource Manager (RM) will ensure that all staff are informed of the requirements for segregation of waste materials by means of clear signage and verbal instruction. Appointed employees will be made responsible for ensuring good site housekeeping.

7.6.3 Pest Management

A pest control operator will be appointed as required to manage pests onsite during the construction phase of the Proposed Development. Organic and food wastes generated by staff will not be stored in open skips, but in closed waste receptacles. Any waste receptacles will be carefully managed to prevent leaks, odours and pest problems.

7.6.4 Responsibility

It will be the responsibility of the construction manager to ensure that a written record of all quantities and natures of wastes removed from the site are maintained on-site in a waste file (in hardcopy or electronically).

It is the responsibility of the project manager or their delegate, that all contracted waste haulage drivers hold an appropriate waste collection permit for the transport of waste loads and that all waste materials are delivered to an appropriately licensed or permitted waste facility in compliance with the relevant Regulations as will be outlined in the RWMP.

The Main Contractor, as part of regular site inspection audits, will determine the effectiveness of the waste management strategy and will assist the project manager in implementing the measures under the RWMP and in determining the best methods for waste minimisation, reduction, re-use, recycling and disposal as the construction phase progresses and waste materials are generated.

Prior to commencement of the excavation and construction activity and removal of any waste off-site, details of the proposed destination of each waste stream will be provided to FCC, along with waste collection permit numbers.

7.7 Surface Water Management

Care will be taken to ensure that exposed soil surfaces are stable to minimise erosion. All exposed soil surfaces will be within the main excavation area, thereby limiting the potential for any offsite impacts. All run-off will be prevented from directly entering into any water courses, as no construction will be undertaken directly adjacent to open water.

No significant dewatering will be required during the construction phase that would result in the localised lowering of the water table. There may be localised pumping of surface run-off from the excavations during and after heavy rainfall events to ensure that the excavations remain relatively dry.

The following measures will be put in place during the construction phase to ensure protection of surface waterbodies. Construction works are informed by best practice guidance from Inland Fisheries Ireland on the prevention of pollution during development projects:

- ▶ *Control of Water Pollution from construction Sites, Guidance for Consultants and Contractors* (Construction Industry Research and Information Association (CIRIA), C532) ²⁶;
- ▶ *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (Inland Fisheries Ireland (IFI), 2016) ²⁷; and
- ▶ *Environmental Good Practice on Site* (3rd edition) (CIRIA C692) ²⁸.

Where required (i.e., in areas of exposed soil) a temporary drainage system shall be installed prior to the commencement of the construction works to collect surface water runoff by the site during construction. As required, geotextile lined settling basins and temporary mounding's and/or silt fences will be installed to ensure silts do not flow off site during the construction stage. This temporary surface water management facility will throttle runoff and allow suspended solids to be settled out and removed. All inlets to the settling basins will be 'riprapped' to prevent scour and erosion in the vicinity of the inlet.

7.7.1 Pollution Control

Management of Suspended solids in run-off

Any temporary storage of spoil, hardcore, crushed concrete or similar material will be stored as far as possible from any surface water drains and also stored in receptacles where possible. In order to minimise the risk of contamination, the stockpiled material will be removed off-site as soon as possible. Surface water drain gratings in areas near or close to where stockpiles are located will be covered by appropriate durable polyurethane covers or similar.

There will be no direct pumping of silty water from the works to any watercourse. Sediment entrapment facilities will be installed to reduce sediment discharges to downstream properties and receiving waters. All run-off leaving a disturbed area should pass through a sediment entrapment facility before it exits the site and flows downstream such as straw bales, silt fencing, silt barriers and diversion dams.

Concrete Run-off

No wash-down or wash-out of ready-mix concrete vehicles during the construction works will be carried out at the site within 10 metres of an existing surface water drainage point. Wash-outs will only be allowed to take place in designated areas with an impervious surface.

Accidental Spills and Leaks

No bulk chemicals will be stored within the active construction areas. Temporary oil and fuel storage tanks will be kept in the material storage area in suitable containers and will be appropriately banded as required. Refueling of vehicles and the addition of hydraulic oils or lubricants to vehicles will take place in designated areas of the site, where possible, which will be kept away from surface water drains.

Spill protection equipment such as absorbent mats, socks and sand will be available to be used in the event of an accidental release during refueling. Training will be given to appropriate site workers in how to manage a spill event.

The following mitigation measures will be taken at the construction site in order to prevent any spillages to ground of fuels during machinery activities and prevent any resulting soil and / or groundwater quality impacts:

- ▶ Refuelling will be undertaken off site where possible;
- ▶ Where mobile fuel bowzers are used the following measures will be taken:
 - Any flexible pipe, tap or valve will be fitted with a lock and will be secured when not in use;
 - The pump or valve will be fitted with a lock and will be secured when not in use;
 - All bowzers must carry a spill kit;
 - Operatives must have spill response training; and
 - Portable generators or similar fuel containing equipment will be placed on suitable drip trays.

Monitoring

Weekly checks will be carried out to ensure surface water drains are not blocked by silt, or other items, and that all storage is located at least 10m from surface water receptors. A regular log of inspections will

be maintained, and any significant blockage or spill incidents will be recorded for root cause investigation purposes and updating procedures to ensure incidents do not reoccur.

8. SUMMARY

This CEMP sets out the overall management strategy for the excavation and construction works for the Proposed Development. The CEMP aims to ensure the management of construction activity is carried out in a planned, structured and considerate manner which minimises the impacts of the works on the local environment, residents and commercial activities in the vicinity of the site. Due to the nature of construction works, there may be unforeseen events which occur at the site and the project team will actively manage any changes and discuss with the relevant authorities, where required.

The CEMP will be reviewed regularly and will be updated by the construction contractor to account for any subsequent planning conditions issued, any updated guidance released and circumstantial changes at the site as the development progresses.

The project team are committed to ensuring that the construction activities to be carried out are pro-actively managed so as to minimise potential impacts.

9. REFERENCES

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