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Construction Environmental Management Plan

Residential Development, Ballykeeffe, Raheen, Limerick

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Approved By:		
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1.0 INTRODUCTION

1.1 Brief

The following Construction Environmental Management Plan has been prepared by Hutch O'Malley Consulting Engineers to ensure that all construction wastes arising from the proposed development at Ballykeeffe, Raheen, Limerick are dealt with systematically and in accordance with the relevant legislation, ie. Waste Management Act 1996 and subsequent amendments, and has been prepared as per the guidelines for the management and minimization of construction wastes set out in the *'Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects (Department of Environment Heritage and Local Government, July 2006.)*

This Construction Environmental Management Plan has been prepared to provide an assessment of the impacts arising from the generation of waste materials during demolition, construction and operational phase of the proposed development. This document is to accompany the planning application for the above mentioned site.

Please note that this document is a draft for planning submission purposes which is intended to set a clear path and philosophy for the future nominated Contractor in drawing up their own final strategy for Construction and Demolition Management Plan (CEMP). It is intended that this will be updated to include more site specific information once the Construction Management Team is appointed. The CEMP is considered a 'live' document and as such will be reviewed on a regular basis. Updates to the CEMP may be necessary due to any changes in environmental management practices and/or contractors. As explained in more detail in the later sections, the procedures agreed in this CEMP will be audited regularly throughout the construction phase to ensure compliance.

2.0 PROJECT DESCRIPTION.

2.1 Site Description

The proposed "greenfield site" development consists of the construction of 386 dwelling, a creche, internal roads, designated pedestrian and, bicycle routes, ancillary parking facilities, landscaping and all associated site works. The site measures roughly 10.44ha, and is located along the east of the R510 with residential development to the south.

2.2 Development Description

DW Raheen Developments Ltd. are seeking a ten year permission for a strategic housing development consisting of the provision of 384 residential house and apartment units on a ca. 10.44 hectare site located in Ballykeeffe, Raheen, Co. Limerick.

The site is greenfield land that is enclosed by existing residential development to the south and east, the R510 to the west and open land to the north. Access to the site is provided by an existing entrance off a roundabout on the R510 regional road.
The proposed development will provide as follows:

- 202 no. housing units, comprising a variety of forms to include bungalows, detached, semi-detached and terraced houses. A mix of house sizes are proposed to include 20 no. two bedroom houses, 156 no. three bedroom houses and 26 no. four bedroom houses.
- 182 apartment and duplex units across 25 small scale blocks, 2 to 4 storeys in heights, throughout the development. The apartments and duplexes provide a mix of one, two, three and four bed units, comprising of 10 no. four bedroom duplex units, 10 no. three bedroom duplex units, 6 no. two bedroom duplex units, 18 no. three bedroom apartments, 92 no. two bedroom apartments and 46 no. one bedroom apartments.

The proposed development also includes;

- A childcare facility measuring 761.75m2, providing 79 childcare places (55 full time and 24 after school places), located at the south-western edge of the development.
- The provision of 377 no. car parking spaces and 311 secured bicycle parking spaces.
- The provision of 3 no. ESB sub-stations, ancillary services and infrastructure works including foul and surface water drainage, attenuation areas, landscaped public open spaces (approximately 29,500m2, or 28.2% of the total site area), landscaping, lighting, internal roads, cycle paths, and footpaths.

A Natura Impact Statement (NIS) and Environmental Impact Assessment Report (EIAR) have been prepared in respect of the proposed development.

2.3 Project Roles & Responsibilities

The Applicant recognises and seeks to minimise the impacts of its business on the environment. The appointed Main Contractor will be committed to:

- Carrying out the Project in full compliance with all applicable environmental regulations and to other requirements to which we subscribe.
- Implementing good environmental practice as part of designs, e.g. carry out design reviews, risk assessments, etc. on all relevant projects.
- Preventing pollution from activities through a system of operational controls that include written instructions and staff training appropriate to the environmental requirements of their work.
- Continually improving Project environmental performance by setting objectives and targets and implementing them through an environmental programme.
- Informing all Project employees about Environmental Policy and explaining what they should do to protect the environment.
- Implementing this Policy through the successful operation of the CEMP.

This policy will be reviewed periodically, taking into account current and potential future business issues.The assigned environmental roles and responsibilities for the relevant project personnel are detailed below:

2.3.1 Construction Director

The Construction Director will have an overall responsibility for the organisation and execution of all related environmental activities as appropriate, in accordance with regulatory and project environmental requirements. The principal duties and responsibilities of this position will include:

- Overall responsibility for the development and implementation of the CEMP;
- Allocating resources to ensure the implementation of the CEMP;
- Participates in the management review of the CEMP for suitability, adequateness and effectiveness; and
- Sets the focus of environmental policy, objectives and targets for the Contractor.

2.3.2 Construction Manager

The Construction Manager is directly responsible to the Construction Director for the successful execution of the Project. The principal duties and responsibilities of this position will include:

- To report to the Construction Director on the on-going performance of the CEMP;
- To discharge his/her responsibilities as outlined in the CEMP; and
- To support and augment the CMT and the Environmental Officer through the provision of adequate resources and facilities in the implementation of the CEMP.

2.3.3 Environmental Officer

The CMT Environmental Officer will be responsible for, but not limited to, the following activities:

- Ensuring that the requirements of the CEMP are developed and environmental system elements (including procedures, method statements and work instructions) are implemented and adhered to with respect to environmental requirements;
- Reviewing the environmental responsibilities of other managed Contractors in scoping their work and during Contract execution;
- To ensure that advice, guidance and instruction on all CEMP matters are provided to all their managers, employees, construction contractors and visitors on site;
- Report to the Construction Manager on the environmental performance of Line Management, Supervisory Staff, Employees and Contractors; and
- Advise site management (including, but not limited to, the site Construction/Commissioning Manager) on environmental matters.

2.3.4 Project Environmental Consultant

The Project Environmental Consultant will be responsible for, but not limited to, the following activities:

- Advise site management (including, but not limited to, the site Construction/Commissioning Manager) on environmental matters;
- Carry out environmental surveys (data logging (noise, water, dust, etc.)) where necessary;
- Generate reports as required to show environmental data trends and incidents;
- Ensure adherence to the specific measures listed in the Planning Conditions and in the Environmental Impacts Statement (EIS) Mitigation Measures;
- Advise upon the production of written method statements and site environmental rules and on the arrangements to bring these to the attention of the workforce;
- Investigate incidents of significant, potential or actual environmental damage, ensure corrective actions are carried out and recommend means to prevent recurrence; and
- Be responsible for maintaining all environmental related documentation.

2.3.5 Project Archaeologist

The Project Archaeologist will report to the Environmental Officer and is responsible for advising on all archaeological monitoring activities, conducting watching briefs and distributing information relevant to monitoring. The responsibilities and duties of the Project Archaeologist will include the following;

- Monitor all ground disturbance works associated with the construction of the development;
- Ensure the appropriate course of action is taken in the event that archaeological material is discovered during the works;
- Liaison with the CMT throughout the construction phase of the project; and

- Liaison with the Department Applications Unit, National Monuments Service, Department of Arts, Heritage and Gaeltacht and the Limerick City and County Council archaeologist as required.

2.3.6 Project Ecologist

The Project Ecologist will report to the Environmental Officer and is responsible for the protection of sensitive habitats and species encountered during the construction phase of the Project. The responsibilities and duties of the Project Ecologist will include the following;

- Provision of specialist input and supervision, where necessary, of construction activities in relation to habitats and species;
- Provision of specialist advice on ecological monitoring, and conduct surveys, monitoring and site inspections as set out in the Natura Impact Statement and Limerick City and County Council Planning Conditions; and
- Liaison with the National Parks and Wildlife Service (NPWS) as required.

2.3.7 Project Communications Officer

The Project Communications Officer is responsible for conducting all public liaison associated with the construction phase of the Project. The responsibilities and duties of the Project Communications Officer
include the following;

- Responding to any concerns or complaints raised by the public in relation to the construction phase of the Project;
- To liaise with the Environmental Officer on community concerns relating to the environment;
- Ensure the Environmental Officer is informed of any complaints relating to the environment; and
- Keep the public informed of project progress and any construction activities that may cause inconvenience to the local community.

2.3.8 Site Supervisors

CMT Site Supervisors are required to:

- Read, understand and implement the CEMP;
- Know the broad requirements of the relevant law in environmental matters and take whatever action is necessary to achieve compliance. Where necessary seek the advice of the CMT Environmental Officer;
- Ensure that environmental matters are taken into account when considering Contractors' construction methods and materials at all stages;
- Be aware of any potential environmental risks relating to the site, plant or materials to be used on the premises and bring these to the notice of the appropriate management;
- Ensure plant suggested is environmentally suited to the task in hand;

- Co-ordinate environmental planning of CMT activities to comply with environmental authorities requirements and with minimum risk to the environment. Give Contractors precise instructions as to their
- Responsibility to ensure correct working methods where risk of environmental damage exists;
- Where appropriate, ensure Contractors method statements include correct waste disposal methods;
- Be aware of any potential environmental risks relating to the Contractors and bring these to the notice of the appropriate management; and
- Ensure materials/waste register is completed.

2.3.9 Site Personnel

All Contractors, and other site personnel on the Project will adhere to the following principal duties and responsibilities:

- To cooperate fully with the CMT and the Environmental Officer in the implementation and development of the CEMP at the site;
- To conduct all their activities in a manner consistent with regulatory and best environmental practice;
- To participate fully in the environmental training programme and provide management with any necessary feedback to ensure effective environmental management at the site; and
- Adhere fully to the requirements of the site environmental rules.

2.3.10 Keeping of Records

The Construction Manager will ensure that fully detailed records are maintained of any 'incident/event' likely to cause non-compliance and/or harm to the environment. Environmental Incidents/Near Miss Reports are completed and recorded.

Complaints and Follow up Actions on the construction site will be managed by the CMT and contractors will ensure that all complaints are recorded according to CMT requirements.
Each contractor will be responsible for ensuring that a full record and copy of all Safety Data Sheets (SDS) pertaining to their works is kept on file and up to date in their site offices.

Contractors will also retain a duplicate copy of all SDSs held by the contractors. The CMT will be responsible for monitoring the movement and treatment of all waste during the construction phase of the Project. Monitoring will be carried out by the CMT who will record the nature, quantities and off-site destination of wastes.

2.3.11 Monitoring, Audits and Inspections

Periodic inspections by the CMT will address environmental issues including dust, litter, noise, traffic, surface water, waste management and general housekeeping.

An EHS Inspection Audit of the construction site will be carried out by an appointed contractor. Environmental aspects of this audit will be documented. The frequency of these audits (weekly/monthly/other) will be based on the nature of contractor activity.

2.3.12 Non Conformance and Corrective and Preventive Action

Corrective Action Requests (CARs) will be issued to ensure that prompt action is agreed and committed to, with a view to the effective resolution of any deviations from the CEMP requirements or any environmental issues.

CARs may be raised as a result of:

- An internal or external communication;
- An internal audit;
- A regulatory audit or inspection;
- A suggestion for improvement;
- An incident or potential incident.

All corrective action requests will be numbered and logged.

2.2.13 Emergency Planning & Response

A PSCS will be appointed for the project and will ensure that installation works are carried out consistent with all existing emergency response plans and procedures.

The emergency management procedure ensures that emergencies such as fires, explosions, accidents, leaks, sabotage or emergencies caused by force majeure occur as little as possible; if they do, however, occur, it ensures that all countermeasures proceed in a controlled manner so that greater damages are avoided and the possible effects upon persons, the environment and property are avoided or limited.

2.3.14 Environmental Emergency

In the event of an environmental emergency, a procedure for Environmental Emergency Preparedness and Response will be developed prior to commencement of construction and can be implemented by the CMT in order to ensure to minimise environmental impacts. An environmental emergency at the site may include;

- Discovery of a fire within the site boundary
- Uncontained spillage/ leakage/loss of containment action
- Discharge concentration of potential pollutants in excess of environmental trigger levels

The general required emergency response actions will be posted at strategic locations, such as the site entrance, canteen and near the entrances to buildings.

2.3.15 Flora & Fauna

There shall be on-going monitoring of wildlife in the vicinity of the construction site and any unusual species, dead species or damaged habitats should be reported immediately to the Construction Manager and/or Environmental Officer.

Where unexpected ecological habitats are uncovered the habitats protection protocol will be adhered to by site contractors.

Protection Protocol: This protocol is designed to ensure that ALL persons working on the construction site are fully aware of their legal obligations under the Wildlife Act 1976, as amended.

This Act affords protection to a range of wildlife in Ireland including wild birds, animals and plants. Whilst the Project has received permission from the Government to proceed, this does not override certain laws that prevent wilful harm to protected species. What is protected that may be found in the Project Area?

- All wild birds and their eggs, nests and young, with the exception of certain species, are protected under the Wildlife Acts.
- Certain animals including all bat species.
- Surveys of the area may identify where protected species may be present.
- Bats Surveys. Contractors may discover bat roosts and if any bats are found, the Construction Manager and/or Environmental Officer is to be contacted immediately

2.3.16 Environmental Regulatory Requirements

A register of regulatory, legal and other requirements will be developed by the CMT. This will be a summary list of the major environmental legislation and other requirements to which the project must subscribe.

A typical register of environmental legislation is divided into a number of categories, which include:

- General Environmental Legislation
- Flora & Fauna
- Emissions to Air
- Emissions to Water & Groundwater
- Waste Management
- Noise & Vibration

For each piece of legislation the following information is provided:

- Index Number
- Title of Legislation
- Summary of Legislation
- Relevance

All legislation included in this Register can be readily accessed on http://www.irishstatutebook.ie/ or will be available through the Construction Manager's office.

The Register of legislation will be reviewed and updated on a minimum six monthly basis. This is a controlled document and as such will comply with all the requirements of the Contractor document control procedures.

3.0 OUTLINE Construction Environmental Management Plan

3.1 Construction Activities

This section describes the main activities involved in the construction of the proposed development. As the proposed development is located on a filled site with an existing industrial structure, there is demolition works associated with the Project.

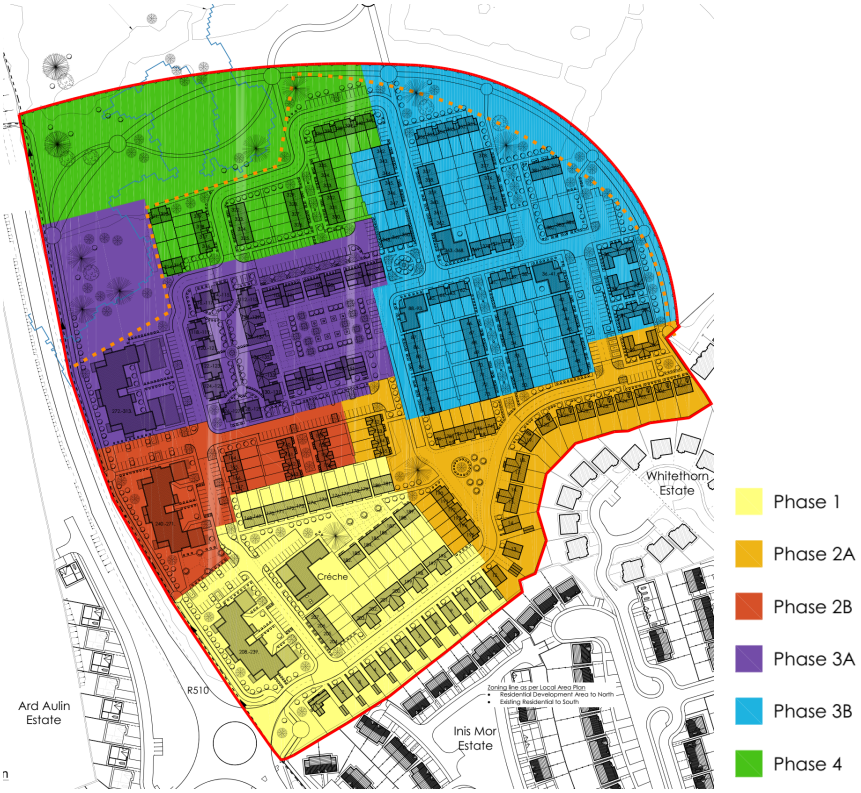
3.2 Construction Schedule and Phasing

The construction period for the development is expected to last 5 years. On completion of each phase, the completed area will be adequately fenced off to prevent unauthorised access to the remainder of the construction site. Appropriate signage will also be erected. The proposed development will involve the following activities:

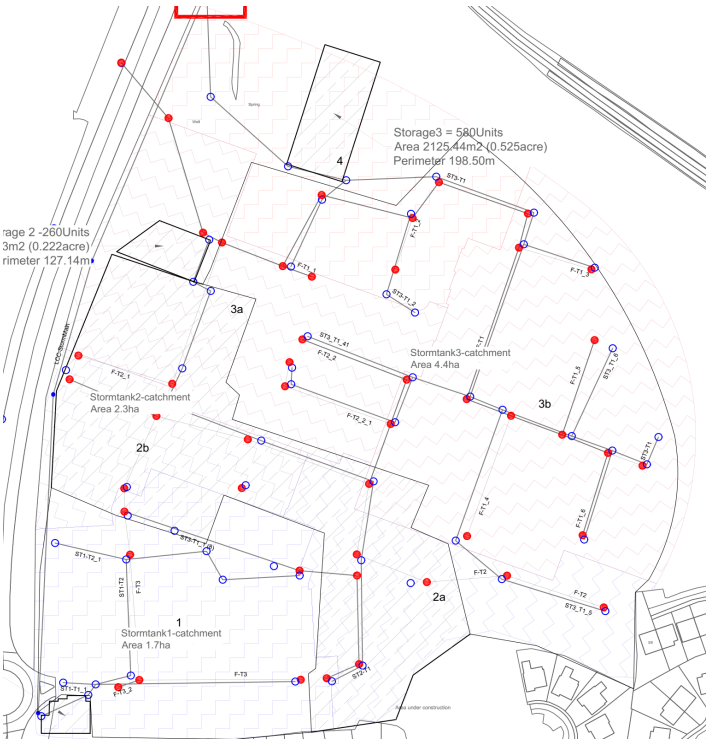
- Installation of site office, and welfare facilities
- Site clearance in stages and the development of access roads in areas where these roads will later be developed as roads in the development.
- Retention and protection of existing boundaries on site.
- Development of Blocks as per Phasing Plan
- Development of a network of roads, drainage, water supply, services, pathways, play areas and landscaped areas within the site.

It is expected that the construction of the proposed development will commence in 2021, subject to planning and other approvals. It is envisaged that the construction activities will be completed in 2026.

Phasing may be subject to market demands and demands for housing mix hence a & b phases are interchangable;



Given the infrastructural requirements and access point the development will begin at the South and progress incrementally North, thus a northern construction road access is logical, see 18112-C37. The R510 crossing will be required at an early stage for the foul and potable water connections. The surface water provision is aligned broadly with the phase plan with the majority of Phase 1 covered by Storage Area 1, Phases 2 a&b and part of Phase 3a by Storage Area 2 and Phases 3b and 4 by Storage Area 3.



3.3 Method Statement for Construction

An Environmental Management Plan and Construction Health and Safety Plan will be developed by the eventual Contractor to include all aspects of the Project.

3.3.1 Site Preparation Works

Initially the site will be securely fenced, and a construction compound will be established. Top soil will be stripped back and either stockpiled on site for pending re-use where feasible in

landscaped areas or removed off site to a permitted or licensed facility as part of a recovery operation. This will be done in accordance with all relevant statutory requirements.

Site stripping will be kept to a minimum in line with the phasing plan. A project programme will be developed for each phase of the project taking cognisance of the recommendations of the NIS.

- Site clearance not to be undertaken during wet conditions when rainfall of more than 1mm/hr is forecast within the next 24 hour period.
- Erosion and sediment traps to be provided as detailed in Section 4 prior to outfall to the drainage channel.
- Fuels, Lubricants, hydraulic fluid, solvents and oils to be carefully handled and spill kits provided.
- Accidental spillages to be immediately contained and contaminated soil removed from site.
- Waste fluids to be collected and removed from site.
- Dedicated wash down area to be provided for concrete trucks.
- All surface water to be treated for the removal of hydrocarbon and grit prior to discharge.

3.3.2 Site Construction Compound

The site compound will be developed, comprising of offices and welfare facilities, for the contractors on site. Temporary works requiring connection for water and sewage will be made to the existing local authority network. The temporary construction compound will include a site office for the construction management team and site facilities for the construction staff. The compound will be serviced with electrical power, water supply and toilet facilities. If not, electrical power would be supplied from a low noise, double bunded diesel generator sited within the compound. If water is not sourced from the local network, then water would be delivered to the site by bowser and sewage/effluent would be stored in designated tanks and removed from site periodically by a licensed waste transport haulier to a Local Authority treatment plant for treatment.

The location of the compound and associated haul roads will be determined and agreed with the Local Authority prior to commencement. The compound will be used as a storage area for the various components, fuels and materials required for construction. Any fuels will be stored in self bunded tanks. The compound will be fenced off to ensure site security is maintained. The compound may be situated in an area of future landscaping within the proposed development so as not to interfere with the areas where housing/roads are to be constructed. Any area used will be reinstated in accordance with the grant of planning at the end of the construction period.

Initial draft location of the compound main is illustrated in drawing 18112-C37. There are likely to be other smaller compounds or storage areas in each phase to complement this main compound. It's location is strategic to ensure access control and to keep the main compound away from occupied phases.

3.3.3 Construction of New Buildings

The development comprises the construction of new apartment blocks, houses and a creche building. In addition to landscaped open green areas, there will be residential play areas for use by residents/public.

All buildings will be constructed in accordance with current building regulations and certified by an appropriated Assigned Certifier during and after construction.

3.3.4 Material Sources and Transportation

Construction materials will be sourced locally where possible. This will be based on the necessary constraints of performance, durability and cost.

3.3.5 Invasive Species Management

A baseline invasive species survey will be carried out at the site to identify the presence and location of any invasive species (listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2015)) by a suitably qualified ecologist. No invasive species were identified.

4.3.5.1 General Best Practice Control Methods

The following general best practice guidelines in the treatment and control of invasive species during construction works are outlined below having regard to guidance documents particularly those issued by the Transport Infrastructure Ireland and The Best Practice Management Guidelines produced by Invasive Species Ireland.

3.3.6 Site Management

Careful preparation of the site and planning of the works is crucial to successful treatment of invasive species. The following list of guidelines, which is not exhaustive, shall be followed by all on-site personnel. Only those who have been inducted into biosecurity measures on-site may enter the contaminated zones within the works areas. Should any risk of contaminated material escaping be observed by the site supervisor, the management plan for the site must be amended by an appropriately qualified person to mitigate against the risk.

3.3.7 Establishing Good Site Hygiene

- A risk assessment and method statement must be provided by the Contractor prior to commencing works.
- Fences will be erected around areas of infestation, as confirmed by test pits and warning signs shall be erected.
- A designated wash-down area will be created, where power-washed material from machinery can be contained, collected and disposed of with other contaminated material. This area will contain a washable membrane or hard surface.
- Stockpile areas will be chosen to minimise movement of contaminated soil.

- Stockpiles will be marked and isolated.
- Contaminated areas which will not be excavated will be protected by a root barrier membrane if they are likely to be disturbed by machinery. Root barrier membranes will be protected by a layer of sand above and below and topped with a layer of hardcore.
- The use of vehicles with caterpillar tracks within contaminated areas will be avoided to minimise the risk of spreading contaminated material.
- A suitably qualified ecologist will be on site to monitor and oversee the implementation of invasive species management plans.

Plant and equipment which is operated within an area for the management of materials in contaminated areas should be decontaminated prior to relocating to a different works area. The decontamination procedures should take account of the following:

- Personnel may only clean down if they are familiar with the plant and rhizome material and can readily identify it.
- Decontamination will only occur within designated wash-down areas.
- Vehicles will be cleaned using stiff-haired brush and pressure washers, paying special attention to any areas that might retain rhizomes e.g. wheel treads and arches.
- All run-off will be isolated and treated as contaminated material. This will be disposed of in already contaminated areas.

3.3.8 Construction of Services

4.3.8.1 Electrical Connections

Power will be required for the construction compound. It is anticipated that power will be required for temporary lighting and temporary signals required during the works. If a connection to the existing network is not available a generator will be used.

3.3.8.2 Surface Water

All surface water shall be treated prior to discharge to receiving waters. Measures to protect surface waters from contamination are outlined in Section 4 of this Plan – Best Management Practices.

The housing development area of the site is generally flat before falling at a reasonable gradient to the North. On a phased basis local detention ponds shall be used to control surface water during construction. As a fail safe a continuous silt fence shall be constructed to the North of the site above the lowlands but at an elevation that will catch any overland flow from the development. The 3m contour is ideal as it captures the entire site and is above the public surface water outfall along the R510. Indicative location is shown on C37 with details of the fence shown on C92.

3.3.8.3 Foul Sewer

As part of the new development a new foul water drainage system will be constructed to collect and convey the foul water flow generated by the development. The foul network will consist of 100 mm diameter uPVC sewers from individual houses laid to falls of minimum 1:40 to connect to a 225 mm uPVC SN8 sewer or as otherwise specified to be within the development's roads or open space areas.

All foul water will discharge to the existing Foul Sewer which runs along the R510 adjacent to the the site – Limerick Main Drainage.

Irish Water has confirmed that the connection of this development to the Irish Water infrastructure is feasible, see appendices to the Civil Engineering Report.

3.3.8.4 Storm Sewer

All surface waters from the development will be conveyed via a gravity collection network and discharged to the chanel to the North at a controlled rate which will assimilate the pre-development run-off rate in accordance with the current principles of stormwater management. All surface waters are to be treated for the removal of contaminates such as floating debris, suspended solids and hydrocarbons prior to eventual discharge to the channel located to the north of the site.

All foul and surface water sewers and manholes will be tested for infiltration through air testing and hydraulic testing prior to commissioning, in accordance with Irish Water Code of Practice.

3.3.8.5 Water Main

A mains water connection will be made to the construction compound for staff welfare facilities and other uses associated with the compound. It is proposed that the watermain connection will be taken from the existing 300mm watermain located on R510 at the proposed entrance to the development site.

3.4 Historic Contamination of Land

3.4.1 Site History

The proposed development area is a mainly a green field site with some filled areas, and its previous known use was agricultural. In the event of evidence of soil contamination being found during work on site, appropriate remediation measures will be employed, in full compliance with all relevant waste legislation. Any work of this nature would be carried out in consultation with, and with the approval of the Environmental Department of Limerick City and County Council. Refer to previous Section 2 and Appendix A for further information.

3.5 Health and Safety

A combination of hoarding and security fencing will be erected along all boundaries of the site with the purpose of restricting access to the work area for security and health and safety reasons. In accordance with the statutory requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013 ("the Regulations), a Health and Safety Plan will be prepared.

This will address health and safety issues from the design stages through to the completion of the construction and maintenance phases. This plan will be reviewed and updated as the development progresses. The contents of the Health and Safety Plan will comply with the requirements of the Regulations. Copies will be held on site for inspection.

Safety on site will be of utmost importance. On appointment of any contractor or subcontractor on site, safety statement, insurances, training records, and method statements/risk assessments of each contractor will be required and in order, prior to any work being undertaken on site. Prior to working on site, each individual will receive a full safety briefing and induction. The Main Contractor and each sub-contractor will be required to provide safe systems of work and relevant safety equipment to the tasks being undertaken for their employees on site. Safety briefings will be held regularly and prior to any onerous or special task. 'Toolbox talks' will be held weekly to ensure all workers are fully aware of the tasks to be undertaken and the parameters required to ensure the task will be successfully and safely completed.

All workers and visitors will be required to wear appropriate personal protective equipment prior to going on to the site and will undergo a safety briefing by a member of the site safety team.

Regular site safety audits will be carried out throughout the construction programme to ensure that the rules and regulations established for the site are complied with at all times.

At any time that a potentially unsafe practice is observed, the site safety manager will have the right as well as the responsibility to halt the work in question, until a safe system of working is again put in place.

3.6 Employment and Accommodation

Through the construction phase there will be some variation in the numbers working on site. It is anticipated that approximately 200 construction workers could be employed during the peak construction periods. Temporary office accommodation and other construction facilities will be installed on site for the construction phase. All temporary units will be of a high standard, as a minimum in accordance with statutory regulations.

The co-ordination of people and materials on-site will be one of the key activities throughout the construction phases. A Construction Environmental Management Plan will be put in

place prior to the commencement of the works. This plan will designate traffic routes, timings and parking arrangements.

Typical working hours during the construction phase would be envisaged as:

Start Finish

- Monday – Friday 07:00 to 19:00
- Saturday 07:00 to 14:00

Currently, there are no significant works foreseen outside of normal working hours. The above measures will minimise the impact on surrounding neighbours.

3.7 Potential Construction Phase Environmental Effects and Control Measures

The construction activities described in Section 3.3 will have a range of effects. This section describes the likely consequences of the works, and outlines the proposed control measures that will minimise negative environmental impacts. The potential construction phase impacts include emissions to air such as dust, noise and vibration, construction traffic, and poorly controlled construction waste. Surface water run-off from the site during periods of heavy rainfall, and leaks or spills from construction plant and equipment, have the potential to impact on the quality of soils, surface water and groundwater.

3.7.1 Noise Generating Activities

During the construction phase, the potential noise and vibration impacts are associated with site preparation works, foundation construction activities, construction activities and construction vehicle movements. Similar to any large construction site, there is potential for noise generation associated with site clearance and construction activities. Currently, there are no noisy works foreseen outside of normal working hours.

Principal sources of noise will include:

- Earthworks plant and equipment.
- Construction plant and equipment.
- Construction traffic.

3.7.2 Proposed Noise Control Measures

With regard to construction activities, reference will be made to BS5228: Noise Control on Construction and Open Sites, which offers detailed guidance on the control of noise and vibration from demolition and construction activities. In particular, it is proposed that various practices be adopted during construction, including:

- Hours will be limited during which noisy site activities are permitted.
- Channels of communication will be established between the Contractor/Developer, Local Authority and residents.
- A Site Representative will be appointed responsible for matters relating to noise.

- Typical levels of noise will be monitored during critical periods and at sensitive locations.
- Plant will be selected with low inherent potential for the generation of noise.
- All site roads will be kept even so as to mitigate the potential for vibration from lorries.
- Barriers will be erected as necessary around items such as generators or high duty compressors.
- Noisy plant will be sited as far away from sensitive properties as permitted by site constraints.
- Engines, vehicles and equipment will be switched off when not in use.
- Significant sources of noise will be enclosed.
- Plant will be used and serviced regularly in accordance with manufacturer's instructions.
- Cranes will be shut down during work periods / throttled to minimum when not in use.
- Machinery having rotating parts will be serviced according to supplier recommendations to prevent friction induced sound.
- Materials should be lowered, not dropped, insofar as practicable and safe.
- All personnel must be made aware that noisy construction activities resulting in significant noise levels must be minimised and made aware of the above control measures.

3.7.3 Dust

3.7.3.1 Dust Generating Activities

Construction activities have the potential to generate some dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with ambient conditions, including rainfall, wind speed and the distance to potentially sensitive locations. There is potential for dust emissions from construction activities associated with the construction of the new buildings. The Main Contractor will ensure that a dust minimisation plan is prepared and implemented by the building contractor during the construction phase of the project. Construction activities are likely to generate some dust emissions, particularly during the site clearance and excavation stages. The following avoidance, remedial or reductive measures will be implemented as part of the dust minimisation plan:

- During very dry periods when dust generation is likely, construction areas will be sprayed with water.
- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be controlled by the contractor through regular servicing of machinery.
- Vehicle speeds will be limited on the construction site.
- Surrounding roads used by trucks to access to and egress from the site will be cleaned regularly using an approved mechanical road sweeper. Roads will be cleaned subject to local authority requirements. Site roads will be cleaned on a daily basis, or more regularly, as required.

- Wheel-wash facilities will be provided with rumble grids to remove excess mud from wheels.
- These facilities will be located at the exit from the site and away from sensitive receptors, where possible.
- The technique adopted for all works shall minimise the release of dust into the atmosphere.
- Daily visual inspections will be carried out at locations around the site boundary as required.
- These inspections will monitor the effectiveness of dust mitigation measures.

3.7.4 Litter and Mud on Public Roads

The following are some of the measures that will be taken to ensure that the site and surroundings are maintained to a high standard of cleanliness:

- Daily inspections will be undertaken to monitor tidiness.
- A regular program of site housekeeping will be established to ensure a safe and orderly site.
- If necessary, scaffolding will have debris netting attached to prevent materials and equipment being scattered by the wind.
- Food waste will be strictly controlled on all parts of the site and source separated.
- Wheel wash facilities will be provided for vehicles exiting the project site.
- Wheel wash runoff will be stored in an onsite storage tank and will be disposed of by licensed waste haulage company and disposed of off-site at a licensed facility.
- In the unlikely event that mud is carried over from the Project Site to the public roads, they will be cleaned regularly as required and will not be allowed to accumulate.
- Loaded lorries and skips will be covered as required.
- Surrounding roads used by trucks for access to and egress from the site will be inspected regularly and cleaned, using an approved mechanical road sweeper, when required. In the event of any fugitive solid waste escaping the site, it will be collected immediately and removed to storage on site, and subsequently disposed of in the normal manner.

3.7.5 Potential Impacts on Soils, Groundwater and Surface Water

There is a water course located adjacent to the west boundary of the site - Stream. During the construction phase, control measures will be put in place to mitigate against nuisance and protect the environment.

3.7.5.1 Proposed Control Measures

The employment of good construction management practices will minimise the risk of pollution of soil, storm water run-off or groundwater. The Construction Industry Research and Information Association (CIRIA) in the UK has issued a guidance note on the control and management of water pollution from construction sites, Control of Water Pollution from Construction Sites, guidance for consultants and contractors (Masters-Williams et al 2001). The guide is written for project promoters, design

engineers and site and construction managers. It addresses the main causes of pollution of soil, groundwater and surface waters from construction sites and describes the protection measures required to prevent pollution of groundwater and surface waters and the emergency response procedures to be put in place so that any pollution, which occurs, can be remedied. The guide addresses developments on green field and potentially contaminated brownfield sites.

The construction management of the site will take account of the recommendations of the CIRIA guidance to minimise as far as possible the risk of soil, groundwater and surface water contamination. Site activities considered in the guidance note include the following:

- Excavation
- Earthmoving
- Concreting operations

Additional specific guidance is provided in the CIRIA technical guidance on Control of Water Pollution from Linear Construction Projects (Murnane et al 2006).

Surface run-off from wheel washing areas can contain pollutants such as:

- detergents
- oil and fuel
- suspended solids
- grease

Measures, as recommended in the guidance above, that will be implemented to minimise the risk of spills and contamination of soils and waters include:

- Careful consideration will be given to the location of any fuel storage facilities. These will be designed in accordance with guidelines produced by CIRIA, and will be fully bunded.
- All vehicles and plant will be regularly inspected for fuel, oil and hydraulic fluid leaks. Suitable equipment to deal with spills will be maintained on site.
- Where at all possible, soil excavation will be completed during dry periods and undertaken with excavators and dump trucks. Topsoil and subsoil will not be mixed together.
- Ensure that all areas where liquids are stored or cleaning is carried out are in a designated impermeable area that is isolated from the surrounding area, e.g. by a roll-over bund, raised kerb, ramps or stepped access.
- Use collection systems to prevent any contaminated drainage entering surface water drains, watercourses or groundwater, or draining onto the land. Minimise the use of cleaning chemicals.
- Use trigger-operated spray guns, with automatic water-supply cut-off.
- Use settlement lagoons or suitable absorbent material such as flocculent to remove suspended solids such as mud and silt.
- Ensure that all staff are trained and follow vehicle cleaning procedures. Post details of the procedures in the work area for easy reference.

- The above measures will be implemented, as appropriate along with the following site specific measures:
- Fuel, oil and chemical storage on site will be secure.
- Site storage will be on an impervious base within a secondary containment system such as a bund.
- A spill kit with sand, earth or commercial products that are approved for the stored materials will be kept close to the storage area. Staff will be trained on how to use spill kits correctly.
- Damaged, leaking or empty drums will be removed from site immediately and disposed of via a registered waste disposal contractor.
- Mobile plant will be refuelled in a designated area, on an impermeable base away from drains or watercourses.
- A wheel wash will be installed for use by all construction vehicles leaving the site.
- A road sweeper will be used to remove dirt and debris from roads.
- Silt traps will be located around the site to collect run off, with settled solids removed regularly and water recycled and reused where possible.
- A filter drain and silt pits will be located at the base of all embankments, settled solids will be removed from the silt pits regularly.

A bypass petrol interceptor will be installed in the car park drainage network prior to connection to the existing drainage network to prevent any hydrocarbon spills from entering the surrounding drainage network.

4.0 WATER POLLUTION CONTROL BEST MANAGEMENT PRACTICES (BMP's)

4.1 Preventative measures

During the construction phase the following procedures shall be adhered to by the contractor in order to protect nearby watercourses from pollutants and general interference.

This section provides a toolbox to aid in proper implementation of water pollution control Best Management Practices (BMPs) on the construction site. This is organised into the following parts:

- Part I: Introduction briefly presents:
    - the principles of erosion and sediment control,
    - common storm water pollutants on the construction site, and
    - guidelines for implementing a proper monitoring and inspection program for the construction site, including the use of the Storm Water Pollution Prevention Plan (SWPPP) or Water Pollution Control Program (WPCP) to ensure an effective water pollution control program.

- Part II: Project Operations and BMPs: identifies typical water pollution control challenges for specific construction operations and the BMPs that are available to meet those challenges.

- Part III: BMP Implementation and Troubleshooting: provides guidance for installing, maintaining and troubleshooting selected BMPs

Best Management Practices (BMPs) refer to a variety of pollution prevention controls implemented throughout a project site at various times of the project. BMPs outlined here are specifically aimed to control pollution in stormwater runoff during the construction phase of a project.

The principal categories of potential pollutants can be broken down into:

- Sediment Control (SE)
- Tracking Control (TC)
- Non-Stormwater (NS)
- Waste and Materials Pollution Control (WM)

4.2 Principles of Erosion and Sediment Control

The greatest water pollution threat from soil-disturbing activities is the introduction of sediment from the construction site into storm drain systems or natural receiving waters. Soil-disturbing activities such as clearing, grubbing, and earthwork increase the exposure of soils to wind, rain, and concentrated flows that cause erosion. On this site there is further risk

of contaminates from the existing imported fill material which will be exposed during the construction phase.

A three-pronged approach is necessary to combat this storm water threat:

- Temporary soil stabilisation practices reduce erosion associated with disturbed soil areas (DSAs).
- Temporary run-on control practices prevent storm water flows (sheet and concentrated) from contacting DSAs.
- Temporary sediment control practices reduce sediment caused by erosion from entering a storm drain system or receiving water.

Soil stabilisation BMPs reduce the erosive impact of rain on exposed soil. Run-on control practices reduce the erosive impacts by preventing storm water flows from contacting DSAs. Sediment control BMPs remove sediment from storm water by ponding and settling, and/or filtering prior to discharge offsite. It is imperative that soil stabilisation and sediment control BMPs are implemented together to reduce the discharge of sediment from the construction site.

The following conditions on construction sites contribute to erosion caused by storm water flows:

- Larger areas of impermeable structures and surfaces reduce natural infiltration resulting in increased storm water flow volume and velocity.
- Changes to surface flow patterns cause storm water flows to be more erosive.
- Concentration of flows to areas that are not naturally subjected to such runoff volume increases erosion.

Proper management of a construction project minimises or prevents soil erosion and sediment discharges. Good construction management for soil conservation requires an understanding of the following basic principles:

Soil Erosion Control – The First Line of Defence: Soil stabilisation is a key component in the control of erosion. By stabilising DSAs with covers or binders, the exposed soils are less likely to erode from the effects of wind or rain.

Prevent Storm Water Flows from Contacting DSAs - The Second Line of Defense: Another key component in the control of erosion is the diversion of storm water flows around DSAs or the conveyance of flows through DSAs in a non-erosive manner.

Sediment Control – The Last Line of Defence: Storm water runoff may originate from active or inactive DSAs whether or not proper erosion and/or run-on controls have been implemented. Implementing proper sediment control BMPs can reduce sediment amounts in storm water discharges.

Combine Soil Erosion and Sediment Control - Effective Protection: An effective combination of soil erosion and sediment controls should be implemented to prevent sediment from leaving the site and/or entering a storm water drainage system or receiving water.

Soil stabilisation and other erosion control BMPs are not 100 percent effective at preventing erosion. Soil erosion control BMPs must be supported by sediment control BMPs to capture sediment on the construction site. Sediment control BMPs alone are not 100 percent effective primarily due to their capacity limits. To be effective for storm water protection, the amount of sediment must be reduced at the source using soil erosion control BMPs, and then sediment control BMPs are used to further reduce the sediment that leaves the site or enters the storm drain system.

Inspection and Maintenance – Ensure Protection for the Duration of the Project: Inspection and maintenance are required for all BMPs (soil stabilisation, run-on control, and sediment control) to maintain effectiveness for reducing or eliminating the amount of sediment that leaves a site.

4.3 Common Pollutants on the Construction Site

There are a number of potential storm water pollutants that are common to construction sites. The soil-disturbing nature of construction activities and the use of a wide range of construction materials and equipment are the sources of contaminants with the potential to pollute storm water discharges. Common construction activities that increase the potential for polluting storm water with sediment include:

- Clearing and grubbing operations
- Demolition of existing structures
- Grading operations
- Soil importing and stockpiling operations
- Clear water diversions
- Landscaping operations
- Excavation operations

Common construction materials with the potential to contribute pollutants, other than sediment, to storm water include the following:

- Vehicle fluids, including oil, grease, petroleum, and coolants
- Asphalt concrete (AC) and Portland cement concrete (PCC) materials and wastes
- Joint seal materials and concrete curing compounds
- Paints, solvents, and thinners
- Wood products
- Metals and plated products
- Fertilisers, herbicides, and pesticides

Construction-related waste must also be managed to prevent its introduction into storm water. Typical waste on construction sites includes:

- Used vehicle fluids and batteries

- Wastewater from vehicle cleaning operations
- Green waste from vegetation removal
- Non-storm water from dewatering operations
- Trash from materials packaging, employee lunch/meal breaks, etc.
- Contaminated soils
- Slurries from sawing and grinding operations
- Wastewater/waste from concrete washout operations
- Hazardous materials waste
- Sanitary waste

4.4 Monitoring And Inspection Program

The Resident Engineer on site will be responsible for ensuring that all personnel monitor the contractor's water pollution control practices and maintain compliance with the approved project waste management plan. This includes reviewing the contractor's plan, reviewing written inspection reports, and conducting field inspections.

5.0 PROJECT OPERATIONS AND BMPs

5.1 Best Management Practices

Table 2 identifies individual BMPs that are applicable to specific construction operations. The BMPs listed in the table are for general consideration during each phase of construction. The indicated BMPs may not be applicable to every construction operation, nor is every possible BMP listed for each construction operation. The Resident Engineer shall determine the appropriateness of an individual BMP to the construction site.

Table 2 - Storm Water BMPs for Construction Operations Construction Operation BMPs

Mobilisation	TC-1 Stabilised Construction Entrance/Exit TC-2 Stabilised Construction Roadway TC-3 Entrance/Outlet Tire Wash
Clearing/Grubbing	SS-1 Scheduling SS-2 Preservation of Existing Vegetation SS-9 Earth Dikes/Drainage Swales & Lined Ditches SS-10 Outlet Protection/Velocity Dissipation Devices SS-11 Slope Drains
	WE-1 Wind Erosion Control
	NS-1 Water Conservation Practices NS-8 Vehicle and Equipment Cleaning NS-9 Vehicle and Equipment Fueling NS-10 Vehicle and Equipment Maintenance
	NS-1 Water Conservation Practices NS-8 Vehicle and Equipment Cleaning NS-9 Vehicle and Equipment Fueling NS-10 Vehicle and Equipment Maintenance
Earthwork	SS-2 Preservation of Existing Vegetation SS-9 Earth Dikes/Drainage Swales & Lined Ditches SS-10 Outlet Protection/Velocity Dissipation Devices SS-11 Slope Drains
	SC-1 Silt Fence SC-2 Desilting Basin SC-3 Sediment Trap

	SC-4 Check Dam SC-5 Fiber Rolls SC-6 Gravel Bag Berm SC-7 Street Sweeping and Vacuuming SC-8 Sandbag Barrier SC-9 Straw Bale Barrier SC-10 Storm Drain Inlet Protection
	TC-1 Stabilised Construction Entrance/Exit
	WE-1 Wind Erosion Control
	NS-4 Temporary Stream Crossing NS-8 Vehicle and Equipment Cleaning NS-9 Vehicle and Equipment Fueling NS-10 Vehicle and Equipment Maintenance
	WM-7 Contaminated Soil Management
PCC and AC Operations	SC-7 Street Sweeping and Vacuuming
	TC-1 Stabilised Construction Entrance/Exit
	NS-3 Paving and Grinding Operations
	WM-1 Material Delivery and Storage WM-2 Material Use WM-3 Stockpile Management WM-5 Solid Waste Management WM-8 Concrete Waste Management
Dewatering Operations	NS-2 Dewatering Operations
Roadway Construction	WM-1 Material Delivery and Storage WM-2 Material Use WM-3 Stockpile Management WM-5 Solid Waste Management WM-6 Hazardous Waste Management WM-8 Concrete Waste Management WM-10 Liquid Waste Management
Mobile Operations	SC-7 Street Sweeping and Vacuuming SC-10 Storm Drain Inlet Protection
	TC-1 Stabilised Construction Entrance/Exit
	NS-8 Vehicle and Equipment Cleaning

	NS-9 Vehicle and Equipment Fueling NS-10 Vehicle and Equipment Maintenance
	WM-1 Material Delivery and Storage WM-2 Material Use WM-3 Stockpile Management WM-5 Solid Waste Management WM-6 Hazardous Waste Management WM-8 Concrete Waste Management
Trenching Operations	SC-7 Street Sweeping and Vacuuming SC-10 Storm Drain Inlet Protection
	WM-3 Stockpile Management

5.2 Best Management Practice Implementation

5.2.1 Temporary Soil Stabilisation

5.2.1.1 SS-2 Preservation Of Existing Vegetation

Preservation of existing vegetation involves the identification and protection of desired vegetation.

Applications

- Delineate Environmentally Sensitive Areas
- Delineate areas where no construction activities are planned
- Delineate areas where construction activities will occur at a later date
- Delineate areas outside the project right-of-way or boundary

Key Points

Timing: Areas to be protected should be delineated prior to clearing and grubbing operations or other soil disturbing activities. It is also appropriate for areas where no construction activity is planned or where activity is planned for a later date.

Layout: Areas of existing vegetation that are scheduled for preservation should be clearly marked with a temporary fence. Minimise disturbance by locating temporary roadways, storage facilities, and parking areas away from preserved vegetation.

Tree Preservation: Keep equipment away from trees to prevent root and trunk damage. Trenching should be as far away from tree trunks as possible, typically outside the drip line. Trenches should be filled in as soon as possible to avoid root drying. Fill trenches carefully and tamp the soil to fill in air pockets. Never expose roots to the air.

5.2.2.2 SS-9 Earth Dikes, Drainage Swales & Ditches

Earth dikes, drainage swales, and lined ditches are structures that intercept, divert, and convey surface runoff around or through the project site in a non-erosive manner.

Applications

- To convey surface runoff down sloping land
- Along paved surfaces to intercept runoff
- Along the top of slopes to divert surface flow from slopes
- To divert and direct runoff towards stabilised drainage systems
- Below steep grades where runoff begins to concentrate

Key Points

Sediment Control: It may be necessary to use other water pollution control practices such as check dams, plastic sheeting, or blankets to prevent scour and erosion in the swales, dikes, and ditches.

Flow Velocity: Select flow velocity for ditches, swales, and dikes based on careful evaluation of potential risk due to erosion, over topping, flow backup, washout, and drainage flow patterns for each project. In some cases the drainage swale may need to be constructed with asphalt concrete.

Location Selection: Care must be applied to correctly size and locate earth dikes, drainage swales, and lined ditches. Excessively steep, unlined dikes and swales may be subject to erosion and gully formation. Earth dikes, drainage swales and ditches are not suitable as sediment trapping devices.

Inspection and Maintenance: Inspect temporary measures prior to the rainy season, after rainfall events and regularly (approximately once every two weeks) during the rainy season. Inspect channels, embankments, and ditch beds for erosion, washout, and accumulation of sediment and debris. Repair or replace lost riprap, linings, or soil stabilisation as needed.

5.2.2.3 SS-10 Outlet Protection/Velocity Dissipation Devices

This BMP requires the placement of rock, riprap, or other material at pipe outlets to reduce flow velocity of existing storm water and thus prevent scouring.

Applications

- Outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits, or channels
- Outlets located at the bottom of mild to steep slopes
- Outlets subject to intense water flows
- Outlets that carry continuous flows of water points where lined conveyances discharge to
- unlined conveyances.

Key Points
Riprap Selection:. The minimum riprap diameter is determined by the outlet diameter, discharge volume, and apron length. Outlets with slopes greater than 10% need additional protection. Flow rate and local climate may dictate whether loose rock or grouted riprap is appropriate. High flows may wash loose rock away. Grouted riprap may break up in areas of freeze and thaw.

Unprotected Outlets: Flows from unprotected pipe outlets can result in severe erosion. Use a flared end section or riprap at the outlet to reduce flow velocity and erosive potential of concentrated flows.

Installation: Carefully place riprap to prevent damage to underlying filter fabric. Where large riprap is used, the underlying filter fabric may need to be protected with a rock blanket.

Inspection and Maintenance: Inspect temporary velocity dissipation devices prior to the rainy season, after rainfall events and regularly (approximately once every two weeks) during the rainy season. Inspect aprons for riprap displacement or damage to underlying fabric. Inspect for scour beneath the riprap and around the outlets, and repair as needed.

5.2.2.4 SS-11 Slope Drains

A slope drain conveys water down a slope into a stabilised receiving water, trapping device, or stabilised area. Slope drains are used with lined ditches to convey surface flow away from slope areas to protect cut or fill slopes.

Applications
- Where concentrated flows are directed over a slope

Key Points
Limitations: Severe erosion may result if a slope drain fails due to over topping or pipe separation.

Drainage Constraints: Limit the area draining to a slope drain to 4 ha (10 ac) per pipe. Large areas may require the use of a rocklined channel or a series of pipes. The maximum slope gradient is generally limited to 1:2 (V:H), as the ability to dissipate water velocity from steeper slopes is difficult.

Installation: Install slope drains perpendicular to the slope contour. Compact the soil around and under the slope drain inlet, outlet, and along the length of the pipe. Protect the pipe inlet with filter fabric or flared end sections for pipes that are greater than 300mm (12 in) in diameter. Ensure that pipe connections are watertight. Securely anchor and stabilise the pipe and appurtenances into the soil.

Velocity Dissipation: Protect outlet with riprap or velocity dissipation devices. For high-velocity discharges, reinforce riprap with concrete or reinforced concrete devices. It may be necessary to capture discharge and allow sediment to settle out.

Inspection and Maintenance: Inspect before and after each rain event and twice monthly until the tributary drainage area has been stabilised. Inspect outlets for erosion and downstream scour. In the event of scour, reduce the flows going into the channel unless other preventive measures can be implemented.

5.2.3 Temporary Sediment Control

5.2.3.1 SC-1 Silt Fence

Silt fence is a temporary linear barrier that captures sediment by ponding and filtering storm-water runoff to allow sediment to settle out of the runoff water.

Application

- Below the toe of slopes as required
- Down slope of exposed soil areas
- Around temporary stockpiles as required

Key Points

Installation: Install on a relatively level contour. This means the barrier should be installed as close as possible to a level horizontal plane near the toe of the slope. Turn the end of the barrier up the slope to prevent ponded water from escaping around the end.

Setback: A silt fence should be placed with a setback of at least 1 m (3 ft). Where a 1 m (3 ft) setback is not practicable due to site conditions, the fence may be constructed at the toe of slope but should be placed as far from the toe as practicable to increase the ponding area and allow sediment to settle out.

Key In: The bottom of the silt fence must be keyed in or water may flow underneath. A trench should be excavated along the proposed layout line of the fence. After the silt fence stakes have been driven into the trench, backfill over the fence fabric and compact.

Cross Barriers: For silt fence installed on a level contour with long reaches, install cross barriers at a minimum of 150 m (500 ft) intervals. For silt fence not installed on a level contour, install cross barriers, at a minimum, where the change in elevation equals 1/3 the height of the silt fence.

Limitations: Do not install silt fence across intermittent or permanent streams, channels, or any location where concentrated flow is anticipated.

Inspection and Maintenance: Perform inspection before and after rain events, every 24 hours during extended rain events, and weekly throughout the rainy season. Should silt fence fabric

tear or decompose, replace immediately. Remove sediment deposits when the sediment accumulation reaches 1/3 of the barrier height.

5.2.3.2 SC-2 Desilting Basin

A desilting basin is a temporary basin formed by excavation and/or construction of an embankment so that storm-water runoff is temporarily detained, allowing sediment to settle out before the water is discharged.

Applications

- Where storm water can enter a drainage system or receiving water from a construction area
- At outlets of DSAs between 2 and 4 ha (5 and 10 ac) in size.

Key Points

Capacity: Desilting basins shall be designed to have a capacity of 100m3 of storage for every 1 ha (55 yd3 per acre) of contributory area. Basin storage capacity is measured from the top of the basin to the principal outlet. Basins must be designed to drain within 72 hours following storm events.

Configuration: The basin inlet shall be located to maximise travel distance to the basin outlet. The outlet structure should be placed as far away from the inlet structure as possible to maximise travel distance and allow suspended sediment to settle out.

Basin Dimensions: The length of the basin shall be more than twice the width of the basin. Basin depth must not be less than one 1m (3 ft) or greater than 1.5m (5 ft). Check the approved SWPPP for actual dimensions.

Limitations: Basins generally require excavation of large surface areas so that sediment will settle out efficiently. The availability of right-of-way may limit basin size or deployment on construction sites. Basins may not be located in live streams. Basins may require protective fencing to ensure safety.

Inspection and Maintenance: Inspect basins before and after rainfall events, weekly during the rainy season, and at 24 hours intervals during extended storm events. Check inlet and outlet structures and spillways for signs of erosion, damage, or obstructions. Examine basin banks for seepage and structural soundness. Remove accumulated sediment when the basin storage capacity is 1/3 full.

5.2.3.3 SC-3 Sediment Trap

A sediment trap is a temporary basin formed by excavation or by construction of an earthen embankment across a waterway or low drainage area and has a controlled release structure.

Applications

- Permissible where contributing area is less than 2 ha (5 ac)
- Sites where storm water can enter a storm drain or receiving water from a construction area
- As a supplemental control for reducing sediment before it enters a drainage system or receiving water

Key Points
Location Traps: should be excavated in a suitable area or by constructing a low embankment across a swale where failure would not pose a risk to life or property. Traps should provide access for maintenance, including sediment removal.

Configuration: The trap inlet shall be located as far away from the trap outlet to maximise travel distance and allow suspended sediment to settle out (Photo 1).

Dimensions: The length of the trap shall be more than three times the width.

Limitations: Traps generally require excavation of large surface areas to permit settling of sediment. The availability of right-of-way may limit their size or deployment on construction sites. Sediment traps should be limited to drainage areas of 2 ha (5 ac) or less. Traps may not be located in live streams. Traps may require protective fencing to ensure safety.

Inspection and Maintenance: Traps should be inspected before and after rainfall events, weekly during the rainy season, and at 24-hour intervals during extended storm events. Check inlet and outlet structures and spillways for signs of erosion, damage, or obstructions. Examine trap banks for seepage and structural soundness. Remove accumulated sediment when the trap storage capacity is 1/3 full.

5.2.3.5 SC-4 Check Dam

A check dam is a small structure constructed of rock or gravel bags placed across a natural or man-made channel or drainage ditch. Check dams reduce scour and channel erosion by reducing flow velocity and encouraging sediment to settle out.

Applications
- In small open channels that drain 4 ha (10 ac) or less
- In steep channels where storm-water runoff velocities exceed 1.5 m/s (5 ft/s)
- In drainage ditches or channels in which grass linings are being established
- In temporary ditches where a short-term service does not warrant establishment of erosion resistant linings
- In combination with other BMPs such as sediment basins and traps

Key Points
Installation: Install check dams 5m (16 ft) from the outfall device and at regular intervals along the channel based on the erosion characteristics and slope degree of the drainage swale. Swales that are very steep or have a high potential of eroding require check dams placed closer together.

Dimensions: Check dams should be placed at a height and distance as to allow small pools to form behind them but allow high velocity flows (typically a 2-year storm or larger) to safely flow over them without an increase in upstream flooding or damage to the check dam.
Check dams should be constructed to pond runoff flows so that the backwater from the downstream check dam reaches the toe of the upstream dam.

Limitations: Check dams should not be placed in live streams or in channels that are already grass-lined unless erosion is expected, as existing vegetation may be damaged. Check dams are not appropriate in channels that drain areas greater than 4 ha (10 ac).

Inspection and Maintenance: Check dams require extensive maintenance after storm events or high velocity flows to repair damage. Remove sediment when it reaches 1/3 the check dam height.

5.2.3.6 SC-5 Fiber Rolls

A fibre roll consists of straw, flax, or similar material that is rolled and bound into a tight tubular cylinder and placed at regular intervals on a slope face. Fibre rolls intercept runoff, reduce runoff flow velocity, and release the runoff as sheet flow. Fibre rolls are also used as a filter to remove sediment from runoff.

Applications

- Along the top, face, and at grade breaks of exposed and erodible slopes

Key Points
Installation: Proper fibre roll installation is crucial to ensure effectiveness and performance. Fibre rolls should be placed on a level contour in a shallow trench with a maximum depth of 50 mm to 100 mm (2 in to 4 in). The fibre roll should be staked at each end and at regular intervals along its length with a maximum distance of 1.2 m (4 ft) between stakes. If more than one fibre roll is placed in a row, the ends of the adjoining rolls should be tightly abutted together and not overlapped.

Vertical Spacing: When used to create storm water benches on a slope, the vertical spacing of the fibre rolls rows is determined by the inclination and length of the slope. For slopes 1:2 (V:H) and steeper and 15 m (50 ft) and greater, fibre rolls shall be placed at intervals no greater than 7.5 m (25 ft). For slopes between 1:20 (V:H) and 1:2 (V:H) and 30 m (100 ft) and greater, fibre rolls shall be placed at intervals no greater than 15 m (50 ft).

Sediment Control: Fibre rolls are acceptable for use as sediment control and may be used in conjunction with other soil stabilisation methods (soil binders, mulches, etc.) and/or other sediment controls.

Removal: Fibre rolls are typically left in place. If they are removed, dispose of the accumulated sediment and fill in trenches, holes, or depressions to blend in with adjacent ground contours.

Inspection and Maintenance: Inspect fibre rolls prior to and after rain events, and at least daily during prolonged rainfall. Maintenance includes replacing slumping rolls, removing accumulated sediment, and filling in rills. If fibre rolls split, tear (Photo 4), unravel, or become ineffective, replace them immediately.

5.2.3.7 SC-6 Gravel Bag Berm

A gravel bag berm consists of a single row of gravel bags that are installed end-to-end to form a barrier across a slope to intercept runoff, reduce runoff velocity, release runoff as sheet flow, and provide some sediment removal.

Applications

- Along the top, face, and at grade breaks of exposed and erodible slopes.

Key Points

Installation: Proper gravel bag berm installation is crucial to ensure its effectiveness and performance. Gravel bag berms should be placed on a level contour along the slope. Gravel bags should be tightly abutted together and not overlapped.

Bag Design: Bags should be made of a woven polypropylene, polyethylene or polyamide fabric, or burlap material. When full, a bag should be 450 mm (1.5 ft) long, 300 mm (1 ft) wide, and 75 mm (3 in) thick, with a mass of approximately 15 kg (35 lb). Bag dimensions are standardised but may vary based on locally available materials. Alternative bag sizes shall be submitted to the Resident Engineer for approval prior to deployment. Fill material shall be 13 mm to 25 mm (1/2 in to 1 in) class 2 aggregate base that is clean and free from clay and undesirable materials.

Sediment Control: Although gravel bag berms remove some sediment, they should not be used in place of linear sediment barriers.

Limitations: Gravel bags are sensitive to ultraviolet light resulting in a limited durability that may make them unsuitable for long-term projects. Gravel bag berms are labor intensive. Installation, removal, and maintenance costs should be evaluated when considering this BMP.

Inspection and Maintenance: Inspect gravel bag berms weekly and prior to and after rainfall events during the rainy season. Repair or replace broken or ripped bags, and reshape as necessary. Remove accumulated sediment when it reaches 1/3 the height of the berm. Repair washouts and rills as needed.

5.2.3.8 SC-7 Street Sweeping And Vacuuming

Street sweeping and vacuuming are practices to remove tracked sediment from public roads in order to prevent sediment and dirt from entering storm drains or receiving waters. Areas of concern include ingress and egress points, portions of roadway within the project

limits adjacent to a freeway or other public road, and any other paved surface within project limits that is to remain after construction is complete.

Applications

- Where sediment is tracked onto public or private roadways from the project site

Key Points

Sweepers: Sweepers should have vacuum or other mechanical attachments for collecting dirt and sediment (Photo 1). Adjust brooms regularly to maximise efficiency of sweeping operations. Never use kick brooms or sweeper attachments for the implementation of this BMP.

Inspection: Inspect project ingress and egress points and roadways daily for signs of tracked sediment.

Sweeping Waste Disposal: After sweeping is finished, properly dispose of sweeper waste. Sweeper waste that includes trash and debris should be disposed of at an approved dumpsite. For collected sediment that is free of trash and debris, consider incorporating the sediment back into the project's earthwork operations.

Site Entrances and Exit: Designate a limited number of centralised ingress/egress locations for the site and instruct construction personnel to use only those locations for entering/exiting the project.

5.2.3.9 SC-8 Sandbag Barrier

A sandbag barrier is a temporary linear sediment barrier constructed of stacked sandbags. This type of barrier is designed to intercept and slow storm water sheet flow runoff. Sandbag barriers allow sediment in runoff to settle before the water leaves the construction site. Sandbag barriers can also be used to divert and detain moderately concentrated flows associated with ditches, swales, and storm drain inlets.

Applications

- Along the perimeter of a site
- Below the toe of slopes as required
- Down slope of exposed soil areas
- Around temporary stockpiles as required
- Parallel to a roadway to keep sediment from paved areas
- To divert or direct flow

Key Points

Installation: When used as a linear sediment barrier for slopes, sandbags should be placed along a level contour with the end of each row turned up-slope to prevent flow around the ends. Due to the limited sediment holding capacity behind the bags, they should be used in conjunction with other erosion source controls such as soil binders, covers, and/or mulches to provide effective control.

Setback: A sandbag barrier should be placed with a setback of at least 1m (3 ft). Where a 1m (3 ft) setback is not practicable due to site conditions, the barrier may be constructed at the toe of slope but should be placed as far from the toe as practicable to increase the ponding area and allow sediment to settle out.

Configuration: Sandbags should be stacked in a pyramid formation. To do this, the base of the barrier should be the widest, with the width decreasing with each higher row. The joints between bags should be staggered for each row.

Cross Barriers: For sandbag barriers not on a level contour and for longer reaches, install cross barriers at a minimum of 150m (500 ft) intervals to prevent concentrated flow.

Limitations: Sandbag materials are sensitive to ultraviolet light resulting in a limited durability that may make them unsuitable for long-term projects. Sandbag barriers are labour intensive. Installation, removal, and maintenance costs should be evaluated when considering this BMP.

Inspection and Maintenance: Inspect sandbag barriers weekly and prior to and after rainfall events during the rainy season. Repair or replace broken or ripped bags, and reshape as necessary. Remove accumulated sediment when it reaches 1/3 the barrier height. Repair washouts and rills as needed. When no longer needed, remove the barrier and accumulated sediment then clean, re-grade, and stabilise the area.

5.2.3.10 SC-9 Straw Bale Barrier

A straw bale barrier is a temporary linear sediment barrier constructed of straw bales. This type of barrier is designed to intercept and slow storm-water runoff. Straw bale barriers allow sediment in runoff to settle before water leaves the construction site.

Applications

- Along the perimeter of a site
- Below the toe of slopes as required
- Down slope of exposed soil areas
- Around temporary stockpiles as required

Key Points

Installation: When used as a linear sediment barrier for slopes, straw bales should be placed along a level contour with the end of each row turned up-slope to prevent flow around the ends. Bales should be installed in a shallow trench with ends tightly abutted together.

Setback: Straw bales placed at the toe of slopes should be set back at least 1m (3 ft) from the toe. Where a 1m (3 ft) setback is not practicable due to site conditions, the barrier may be constructed at the toe of the slope but should be placed as far from the toe as practicable to increase the ponding area and allow sediment to settle out.

Configuration: Straw bales should be placed in two rows back to back with a half-bale offset to cover the butted ends of the bales.

Cross Barriers: For straw bale barriers not on a level contour and for longer reaches, install cross barriers at a minimum of 150m (500 ft) intervals to prevent concentrated flow.

Application Limitations: Straw bale barriers should not be used in areas subject to highly concentrated flows such as channels or live streams as they may be easily overtaken or washed away. Straw bale barriers should not be used on paved surfaces, in lined ditches, or for drain inlet protection. Consider using sandbag barriers instead.

Durability Limitations: Straw bales fall apart when removed or degrade when left in place for extended periods. They can be labor intensive to install, remove, and maintain.

Inspection and Maintenance: Inspect straw bale barriers weekly and prior to and after rainfall events during the rainy season. Repair or replace broken or damaged bales as necessary. Remove accumulated sediment when it reaches 1/3 the barrier height. Repair washouts or other damage as needed or required. When no longer needed, remove barrier and accumulated sediment then clean, re-grade, and stabilise the area.

5.2.3.11 SC-10 Storm Drain Inlet Protection

Storm drain inlet protection is a practice to reduce sediment from storm-water runoff discharging from the construction site prior to entering the storm drain system. Effective storm drain inlet protection allows sediment to settle out of water or filters sediment from the water before it enters the drain inlet. Storm drain inlet protection is the last line of sediment control defence prior to storm water leaving the construction site.

Applications

- Where storm-water surface runoff can enter a drain inlet
- Where disturbed drainage areas have not yet been permanently stabilised
- Where ponding will not encroach into traffic
- Where the drainage area is 4 ha (10 ac) or less

Key Points

Identify Drain Inlets: Identify existing and/or planned storm drain inlets that have the potential to receive storm water runoff and discharge from the construction site. For those drain inlets that are to be protected, determine the most effective method to use. Consider drain inlet protection for active inlets that are downstream of DSAs.

Sandbag Barriers: A sandbag barrier is the most common type of protection due to the flexibility of its use. Sandbag barriers are constructed by placing the bags around the inlet to create a holding area that allows suspended sediment to settle.

Filter Fence: A filter fabric fence is effective in open areas where sheet flows are low and are not expected to exceed 0.14m3/s (0.5 cfs). Filter fabric fences are installed similarly to silt fences but are constructed to surround the inlet to create an enclosure. Use plastic sheeting or geotextile blankets to stabilise any DSAs within the enclosure to prevent sediment within the enclosed area from entering the inlet.

Sediment Traps: Excavated drop inlet sediment traps are typically used where relatively heavy flows are expected and overflow capacity is needed. A drain inlet sediment trap is constructed by excavating the soils surrounding the inlet to create a temporary trap that detains flows and allows suspended sediments to settle before storm water is discharged from the site.

Inspection: Inspect all inlet protection devices before and after storm events, at 24 hour intervals during extended storms, and weekly during the rest of the rainy season. Check storm drain inlet after several storms to determine if sediment is bypassing inlet protection devices.

Maintenance: Maintenance is critical to ensure that drain inlet protection remains functional. Remove accumulated sediment when it reaches 1/3 the barrier height or 1/3 the holding capacity. For barriers, replace broken or torn bags. For fences, repair/replace fencing material and re-stake fences that are damaged.

5.2.4 Wind Erosion Control

5.2.4.1 WE-1 Wind Erosion Control

Wind erosion control consists of applying water or other dust palliatives to prevent or alleviate dust nuisance. Dust control shall be applied in accordance with Caltrans standard practices.

Applications

- On all exposed soils that are subject to wind erosion

Key Points

Dust Control Operation: Care should be taken when applying water (Photo 1) or palliative to prevent the washing of sediment offsite or into storm drains or receiving waters. Do not apply so much that runoff occurs.

Stockpile and Small Area Management: Cover small stockpiles or small DSAs as an alternative to applying water or dust palliative.

Palliative Application Rates: When applying palliatives or binders as a wind erosion control, refer to the manufacturer's recommendations for guidance.

5.2.5 Tracking Control

5.2.5.1 TC-1 Stabilised Construction Entrance/Exit

Stabilised construction access is a defined point of entrance/exit to a construction site that is stabilised to reduce the tracking of sediment (mud and dirt) onto public roads by construction vehicles. Stabilised construction entrances are an effective method for reducing tracking of sediment from the construction site.

Applications

- As a preventive method instead of a treatment method (e.g., sweeping or dust control)
- Where dirt or mud can be tracked onto public roads
- Adjacent to water bodies
- Where poor soils are encountered

Key Points

Design: Site conditions may dictate the design and need for access points. Design a stabilised construction entrance/exit to support the heaviest vehicles and equipment that will use it. The access point should be at least 15m (50ft) in length or four times the circumference of the largest construction vehicle tire, whichever is greater. Designate access points and require all employees, subcontractors, and others to use them.

Grading: Grade construction entrance/exit points to prevent runoff from leaving the construction site. Route runoff from entrances/exits through a sediment-trapping device before discharge.

Aggregate Characteristics: Stabilise the roadway with aggregate, AC, or PCC, depending on expected usage and site conditions. When access points are constructed from aggregate, aggregate should be 75mm (3 in) to 150mm (6 in) in diameter and at least 300mm (1 ft) in depth. Place aggregate over a geotextile fabric.

Alternative Stabilisation Methods: Alternative stabilisation methods such as manufactured steel plates or steel pipes/gratings require written approval of the Resident Engineer. The use of cold mix asphalt or AC grindings is not allowed.

Inspection and Maintenance: Inspect and maintain stabilised construction entrance/exit points. Routinely check for damage and effectiveness. Remove accumulated sediment and/or replace stabilisation material as needed.

5.2.5.2 TC-2 Stabilised Construction Roadway

A stabilised construction roadway is a temporary access road that connects existing public roads to remote construction areas. For storm water protection, it should be designed to control dust and erosion created by vehicular traffic.

Applications

- Where displacement of soil occurs because of vehicular traffic during wet weather
- Where dust control is a problem during dry weather
- Adjacent to water bodies
- Where poor soils are encountered

Key Points

Design Site: conditions may dictate the design and need for stabilised construction roadways. Design the roadway to support the heaviest vehicles and equipment that will use it. Grade the roadway to prevent runoff from leaving the construction site. This may require the construction of a drainage ditch to collect and convey runoff.

Stabilisation Materials: Stabilise the roadway with aggregate, AC, or concrete, depending on expected usage and site conditions. Aggregate diameter should be between 75mm (3 in) and 150mm (6 in) and at least 300mm (1 ft) in depth. Place aggregate over a geotextile fabric. The use of cold mix asphalt or AC grindings is not allowed.

Inspection and Maintenance: Inspect and maintain the stabilised construction roadway routinely. Re-grade the roadway as necessary. Check for damage and repair as necessary or as directed by the Resident Engineer.

5.2.6 Non-Storm Water Management

5.2.6.1 Ns-1 Water Conservation

Water conservation involves the use of practices that reduce the amount of water used for a given activity. If less water is used, the potential for erosion decreases and the transport of construction- related pollutants offsite is less likely.

Applications

- On all projects where water is used during the course of construction

Key Points

Watering Equipment: Watering equipment should be kept in good working order. Repair leaky watering equipment promptly.

Equipment Washing: Discourage the washing of vehicles and equipment on the construction site. Workers should never wash their personal vehicles on site. Vehicles and equipment that regularly leave the construction site should be washed offsite.

Paved Areas: Paved areas should be swept and vacuumed rather than washed off. Always protect storm drain inlets or receiving waters from sediment or other pollutants susceptible to non-storm water run-off. When possible, direct runoff water to areas where it can percolate into the ground.

Dust Control: When watering for dust control, ensure that watering operations do not cause erosion.

5.2.6.2 NS-2 Dewatering Operations

This BMP is intended to prevent the discharge of pollutants from construction site dewatering operations associated with storm-water (accumulated rain) and non-storm water (groundwater, water from a diversion or cofferdam, etc.). Dewatering effluent that is discharged from the construction site to a storm drain or receiving water is subject to the requirements of the applicable Local Authority Environmental Department requirements.

Applications

- On all projects where the discharge of water is to occur by mechanical means

Key Points

Management Alternatives: If possible, the contractor should consider managing dewatering without discharge to a storm drain or receiving water. Options include: (1) retaining the water on site for construction use or allowing water to evaporate/infiltrate, (2) discharging to the sanitary sewer with permission from the local authority; (3) discharging to an adjacent land or facility with permission of the owner, and (4) having the effluent transported and disposed of offsite using a licensed Transportation, Storage & Disposal contractor. If one of these management options is used, the water is not discharged to a storm drain or receiving water.

Local Authority Notification: If on-site management of the dewatering operation is not the selected option, contact the Local Authority before the dewatering operation commences. Dewatering uncontaminated storm water and minor discharges of non-storm water can be discharged to a storm drain or receiving water. If the effluent is not visibly clear, it must be treated to remove sediment prior to discharge. All records related to the dewatering operation must be maintained with the project safety file and provided to the Local Authority upon request.

5.2.6.3 NS-3 Paving And Grinding Operations

Paving and Grinding Operations include the handling of materials and wastes and the use of equipment associated with pavement preparation, paving, grinding, removal, surfacing, resurfacing, thermoplastic striping, and placing pavement markers.

Application

- During pavement grinding and removal
- During PCC paving
- During AC paving and resurfacing
- During placement of thermoplastic striping and pavement markers

Key Points

Asphalt Concrete (AC): Remove or dispose of grindings and wastes as work progresses. Place AC pieces in embankments above the water table and cover with plastic until they are removed from the site. Remove wastes from the site immediately.

AC Equipment: Coat AC equipment with non-toxic non-foaming products. Clean equipment offsite whenever possible. When paving equipment is kept onsite, place paving equipment on plastic sheeting to capture drips or leaks. Dispose of hardened AC properly.

Wastes: Do not allow wastes, such as AC pieces, PCC grinding residue/slurry (Photo 3), sand/gravel, exposed aggregate concrete residue, or dig-out materials into storm drains or receiving waters. Sweep, vacuum, and collect such wastes and recycle or dispose of properly.

Seal Coats: Do not apply seal coat, tack coat, slurry seal, or fog seal if rain is predicted during the application or curing period. Do not conduct digout operations in the rain. During application of seal coat, tack coat, slurry seal, or fog seal, cover drainage inlets and manhole covers with filter fabrics. Do not apply these materials in the rain.

Thermoplastic Striping: Verify that equipment shut-off valves function properly to avoid thermoplastic leakage. Do not preheat, transfer, or load thermoplastic near storm drains or receiving waters. When filling the pre-heater, leave 150mm (6 in) of space at the top of the container to prevent spills when the equipment is moved. Clean truck beds daily and recycle thermoplastic material when possible.

Raised/Recessed Pavement Markers: Do not transfer or load bituminous materials near storm drains or receiving waters. Verify that all pressure is released before filling the melting tank. When filling the melting tank, leave 150mm (6 in) of space at the top of the container to prevent spills when the equipment is moved.

5.2.6.4 NS-4 Temporary Stream Crossing

A temporary stream crossing is a structure placed across a waterway that allows construction traffic to cross without contacting the water. Typical types include culvert crossings, ford crossings, and bridge crossings. Temporary stream crossings prevent streambed erosion and downstream sedimentation due to construction traffic.

Applications

- Where appropriate permits have been secured
- Where construction equipment or vehicles must cross a waterway

Key Points

Permits: Verify that applicable permits have been obtained before the stream crossing is installed. Verify that applicable pre-installation water sampling/testing has been completed before, and possibly during, installation.

Design: Verify that the structure design has been prepared under the direction of and approval of a registered civil and/or structural engineer. The structure should not constrict waterway flow such that backups or washouts occur during flood events. Culverts are acceptable for perennial or intermittent streams and can accommodate heavy equipment loads.

Installation: Construct crossings during the dry season. Stabilise adjacent construction roadways, work areas, and streambeds to prevent erosion. Minimise disturbance or removal of adjacent vegetation. If riparian vegetation is disturbed for construction of the stream crossing, the vegetation should be cut no lower than ground level and covered with a layer of clean river cobble.

Use: Vehicles are not to be operated, stored, fuelled, or maintained in wet or dry portions of a waterway without authorisation of the Resident Engineer or as authorised by the Local Authority. Drip pans must be placed under all vehicles/equipment on temporary stream crossing structures that remain idle for more than one hour. Being in such close proximity to a watercourse, this BMP, and others implemented with it, must be installed correctly and maintained to prevent any discharge. Any incident of discharge requires submittal of a Notice of Non-Compliance.

Inspection and Maintenance: Inspect temporary stream crossings weekly and after significant rain events for water flow blockage, sediment buildup, trapped debris, structural damage, riprap displacement, or streambed erosion. Verify that sediment buildup is removed regularly and that riprap/aggregate is replaced as needed to prevent erosion and maintain stability of adjacent areas.

Removal: Ensure that temporary stream crossings are removed promptly when no longer needed. Remove river cobble from disturbed riparian vegetation to ensure rapid re-growth.

5.2.6.5 NS-5 Clear Water Diversion

A clear water diversion is a system of structures that intercepts surface water from a running stream or waterway upstream of a project, transports it around the construction site, and discharges it downstream of the site, with minimal water quality impacts. Typical structures used for clear water diversions include diversion ditches, berms, dykes, slope drains, cofferdams, pipes, and drainage and interceptor swales.

Applications

- Where appropriate permits have been secured
- Where work must be performed in an active drainage system, a running stream, or a water body

Key Points

Permits: Verify that applicable permits have been obtained before the diversion is installed.

During Design: The structure should not constrict waterway flow such that backups or washouts occur due to fluctuations in water depth or flow volume. Materials used to construct diversion structures
must be free of potential pollutants such as soil, silt, sand, clay, grease, or oil. At all times during construction, operation, maintenance, and removal, sufficient water flow/volume must be diverted to maintain downstream aquatic life.

During Construction: When possible, construct diversion structures during periods of low or no stream flow. Minimise disturbance and removal of adjacent vegetation. If riparian vegetation is disturbed for construction of the diversion, the vegetation should be cut no lower than ground level and covered with a layer of clean river cobble. The exterior of vehicles and equipment in wet areas of the diversion construction site should be free of petroleum residues and sealed so as to prevent leakage of fuels and oils into the water body if submerged. Only the bucket of an excavator/backhoe may operate in a water
body. The main body of the equipment is not to enter the water portions of the water body except to cross the stream to access the work site.

Operation: Barriers should be installed to prevent muddy water from flowing from adjacent construction activity to the stream. Drip pans must be placed under all stationary equipment and vehicles located over water diversions that remain idle for more than one hour. Being in such close proximity to a watercourse, this BMP, and others implemented with it, must be installed correctly and maintained to prevent any discharge. Any incident of discharge requires submittal of a Notice of Non-Compliance.

Inspection and Maintenance: Inspect diversion structures weekly and after significant rain events for damaged linings, sediment buildup, trapped debris, or reduced slope protection. Ensure that debris is removed and linings are repaired promptly.

5.2.6.6 NS-7 Potable Water/Irrigation

Non-storm water discharges that originate from onsite and offsite sources must be properly managed to reduce the potential for pollutants being discharged from the construction site. Sources of these non-storm waters include broken water lines, landscape irrigation, lawn watering, water line flushing, and fire hydrant flushing.

Applications

- All projects susceptible to the above-listed and other non-storm water discharges from the construction site

Key Points

Divert Flows: Where possible, direct potable/irrigation water originating from offsite sources around the construction site or through the site in a way that minimises contact with construction activities.

Onsite Irrigation: Inspect irrigated areas on the construction site for excessive watering. Adjust watering schedules to ensure landscaping receives adequate water but minimises associated runoff. Promptly shut off water to broken lines, sprinklers, or valves and repair as needed.

Water Conservation: Reuse water from line flushing for landscape irrigation.

5.2.6.7 NS-8 Vehicle And Equipment Cleaning

Wash water from vehicle and equipment cleaning is not to be discharged from construction sites because the rinse water may contain contaminates such as sediment, petroleum/lubricant residues, soaps, or solvents that could enter storm drain systems or receiving waters.

Applications

- All construction sites

Key Points

Offsite Cleaning: Equipment/vehicle cleaning should be conducted offsite. All vehicles that regularly enter and leave the construction site must be cleaned offsite.

Onsite Cleaning: For equipment that must be cleaned on site, the Resident Engineer must be notified in advance. All waste from onsite cleaning operations must be fully contained and disposed of on site and not allowed to discharge into the public sewers or onto the public road.

Wash Area Requirements: The vehicle wash area must be properly identified by sign and located away from storm drain inlets, drainage facilities, and watercourses. It must be paved with concrete or asphalt and have a berm to contain runoff and prevent run-on. It must be equipped with a sump for the collection and disposal of wash water.

Water Conservation: Use as little water as possible and use a positive shut-off valve to conserve on water usage.

5.2.6.8 NS-9 Vehicle And Equipment Fuelling

Potential fuel spills and leaks from vehicle/equipment fuelling operations must be prevented from entering storm drain systems or receiving waters.

Applications

- All construction sites

Key Points

Fuel Offsite: All vehicles and equipment that regularly enter and leave the construction site should be fuelled offsite.

Fuelling Area Location: Designated fuelling areas are selected by the contractor and approved by the Resident Engineer. The fuelling area should be on level grade and must be at least 15m (50 ft) downstream of storm drain facilities or receiving waters. The fuelling area should be protected by a berm or dike to prevent storm water run-on and to prevent storm water from leaving the fuelling area.

Spill Response: Absorbent spill clean-up materials and spill kits must be available in fuelling areas and on fuelling trucks. Spills should be cleaned up immediately. Absorbent materials should be used on small spills. All used absorbent materials must be disposed of properly.
Leak Containment: Drip pans or absorbent pads must be placed under vehicles/equipment if being fuelled in areas other than a dedicated fuelling area with an impermeable surface.

Fuelling Guidelines: Fuelling operations are not to be left unattended. Fuel tanks are not to be topped off. Mobile fuelling trucks must also follow BMP guidelines.

Fuel Nozzles: Fuel nozzles are to be equipped with automatic shut-off to control drips. Where required by Air Quality Management Districts, vapour recovery nozzles shall be used.

5.2.6.9 NS-10 Vehicle And Equipment Maintenance

Petroleum products, lubricants, solvents, and other pollutants related to vehicle/equipment maintenance must be prevented from entering storm drain systems or receiving waters.

Applications

- All construction sites

Key Points
Offsite: Storage and Maintenance All vehicles and equipment that regularly enter and leave the construction site should be maintained offsite.

Maintenance Area Design: Designated vehicle maintenance areas must be at least 15m (50ft) downstream of storm drain facilities or receiving waters. For long-term projects, a portable tent or cover over the maintenance area is recommended.

Maintenance Operations: For maintenance involving fluids, place drip pans or absorbent pads under the vehicle unless the work is being done in a dedicated maintenance area constructed over an impermeable surface.

Spill Prevention/Cleanup: All fluid and oil leaks must be cleaned up immediately. The maintenance area must be equipped with appropriate absorbent spill clean-up materials.

Waste Disposal: All used absorbents must be disposed of properly. Waste fluids must be placed in appropriate leak-free containers with secondary containment. All used maintenance materials should be disposed of properly off the construction site. Used fluids, tires, batteries, etc. are not to be dumped or buried on the construction site.

5.2.6.10 NS-11 Pile Driving Operations

Proper control and use of equipment, materials, and waste products from pile driving operations will reduce the discharge of potential pollutants to the storm drain system or watercourses.

Applications

- All construction sites near or adjacent to a watercourse or groundwater where permanent and temporary pile driving operations take place.

Key Points

Be Prepared: Use drip pans or absorbent pads at all times. However, the equipment should be as leak-free as possible. Have spill kits and clean-up materials available at all pile driving locations. Implement other BMPs as applicable.

Equipment Use: Park equipment over plastic sheeting or equivalent. Plastic sheeting is not a substitute for drop pans or absorbent pads. Use less hazardous products, e.g. vegetable oil, when practicable.

Equipment Storage: Store pile driving equipment away from flow lines, drainage courses, and inlets. Protect hammers and other hydraulic attachments from run-on by placing them on plywood. Cover them with plastic when rain is forecast.

Inspection and Maintenance: Inspect entire pile driving areas and equipment for leaks and spills on a daily basis. Inspect equipment routinely for damage and repair equipment as needed.

5.2.6.11 NS-12 Concrete Curing

Following proper procedures in the use of cure, chemical or water, during construction of concrete structures will minimise pollution through run-off.

Applications

- All construction sites where concrete structures are subject to curing requirements.

Key Points

Use of Chemical Cure: Protect drain inlets prior to application of cure. Use proper storage and handling techniques at all times and have spill kits available at the location of curing. Avoid over-spraying cure, allowing it to become airborne.

Use of Water Cure: Ensure cure water does not flow to inlets or watercourses but rather to collection areas for infiltration or other means of removal approved by the Resident Engineer and in accordance with all applicable permits.

Inspection and Maintenance: Ensure that cure is stored, handled, and used properly. Ensure that the Contractor keeps cure containers leak-free and spray nozzles clean.

5.2.6.12 NS-13 Material And Equipment Use On Water

Following proper procedures in the use, storage, and disposal of materials and equipment on barges, boats, docks, temporary construction pads, or similar location will minimise or eliminate the discharge of potential pollutants to a watercourse.

Applications

- All sites where materials and equipment are used on barges, boats, docks, and other platforms over or adjacent to a watercourse.

Key Points

Be Prepared: Use drip pans and absorbent materials under equipment and vehicles expected to be idle more than one hour. Ensure that an adequate supply of spill clean-up materials is available. Identify types of spill control measures to be employed, including the storage of necessary clean-up materials and equipment.

Be Aware: Ensure NS-10 is implemented. If repairs cannot be made, remove the equipment from over the water. Ensure compliance with all other permits associated with the project.

Secure the Area: Provide watertight curbs or toe boards to contain spills and prevent materials, tools, and debris from leaving the barge, platform, dock, etc. Secure all materials to prevent discharge to the watercourse via wind.

Inspection and Maintenance: Ensure timely and proper removal of accumulated waste. Inspect equipment for leaks and spills on a daily basis and ensure necessary repairs are done. Ensure proper procedures of storage and use of materials and equipment are being followed. Inspect and maintain all associated BMPs and perimeter controls to ensure continuous protection of the watercourse.

5.2.6.13 Ns-14 Concrete Finishing

Following proper procedures in performing concrete finishing methods will minimise the impact of potential pollutants on runoff.

Applications

- All sites where concrete finishing operations are performed.

Key Points

Containment: Ensure containment of all waste materials from high-pressure water blasting, sandblasting, grinding, etc. Without containment or water suppression of particles, these operations can become problems.

Disposal: Refer to NS-2, "Dewatering" and the Dewatering Manual for options. Ensure disposal method is approved by the RE and is in compliance with applicable permits in advance of disposal.

Secure the Area: Protect all inlets that may be affected by any concrete finishing work. Direct any water, through none-rodible methods, to collection areas for infiltration or other disposal means.

Inspection and Maintenance: Inspect containment structures prior to use, during use, and prior to rainfall. If any repairs are required, ensure these are done in a timely manner and especially before a rain event. After use or at the end of the shift, ensure containment structures and general work area are clean and the wastes are disposed of properly.

5.2.6.14 NS-15 Structure Demolition/Removal Over Or Adjacent To Water

Following proper procedures during structure demolition or removal operations will protect watercourses from debris and wastes associated with these operations.

Applications

- All construction projects with full or partial structure demolition or removal, e.g., bridge widenings, concrete channel removal, etc.

Key Point

Containment: Use attachments on construction equipment to catch debris or use covers or platforms to collect debris and prevent it from falling into the watercourse. Debris catching devices must be emptied regularly and the debris stored away from the watercourse and protected until removal.

Disposal: Dispose of accumulated debris in a timely manner and at an approved disposal site. For hazardous waste disposal, refer to WM-6.

Inspection and Maintenance: Inspect equipment and any debris catching devices on a daily basis. Ensure any stockpiles are protected and disposed of properly. Any discharge must be reported to the RE immediately.

5.2.6.15 NS-16 Temporary Batch Plants

Proper control and use of equipment, materials, and waste products from temporary batch plant facilities will reduce the potential of pollutant discharges to storm drain systems and/or watercourses, reduce air emissions, and mitigate noise impacts.

Applications

- Construction projects where temporary batch plant facilities are used. Batch plants may be on or off site.

Key Points

Planning: A Notice of Intent (NOI) must be submitted to the Local Authority for construction and operation of a temporary batch plant. Consideration for minimising nuisance noise and impacts to air and water quality should be observed during construction and operation. Appropriate BMPs must be implemented within the boundaries of the batch plant.

Layout and Design: Batch plants should be located at least 300 ft away from any recreational area, school, residence, or other structure not associated with the construction project. AC or PCC berms should be constructed around plant equipment to facilitate proper containment and cleanup. Runoff should be directed to a collection area or baker tank.

Operational Procedures: Designate a concrete washout area in accordance with WM-8. All operations should be conducted so as to have no visible emissions including fabric or cartridge type filters for dry material transfers, dust-tight service hatches on silos and auxiliary bulk storage trailers, wet suppression systems at all transfer points, and covered conveyors and transporting vehicles. All plant roads shall be stabilised, watered, treated, or paved so as to control dust and tracking. All entrances and exits shall likewise be stabilised.

Materials Storage and Disposal: Refer to WM-1, "Material Delivery and Storage" as well as WM-2, "Material Use" for proper handling procedures and secondary containment requirements. All stockpiles within the batch plant boundaries shall be in accordance with WM-3, "Stockpile Management." Refer to WM-4, 5, 8, and 10 for further discussion of handling and disposal of wastes. Inspection and Maintenance: Inspect batch plant equipment, components, and BMPs daily during construction and operation.

5.2.6.16 NS-17 Streambank Stabilisation

Proper planning and procedures for work in and around streams and channels can reduce the potential for discharge of sediment and other pollutants and minimise the impacts of construction activities on watercourses and habitat.

Applications

- Construction projects that disturb or occur within stream channels and associated riparian areas.

Key Points

Planning: Planning should consider scheduling, avoidance of in-stream construction, minimising disturbance area and construction time, using pre-disturbed areas, selecting crossing location, and selecting equipment.

Associated BMP Selection for Streambanks: Preservation of existing vegetation (SS-2) in a streambank provides water quality protection, streambank stabilisation, and riparian habitat. Hydraulic mulch (SS-3), hydroseeding (SS-4), soil binders (SS-5), straw mulch (SS-6), or a combination may be used on disturbed streambanks to provide temporary soil stabilisation. Be sure to review the limitations of each so that a selection of the most appropriate one for the given conditions may be made. Also consider possible use of other soil stabilisation and

sediment control BMPs provided the application is appropriate and the limitations are not applicable.

In-stream Sediment Control: The primary goal while working in a stream is minimising turbidity. There are three general ways to achieve this: construct a water diversion away from the work area, implement a water barrier around the work area, or employ practices that minimise sediment suspension.

Inspection and Maintenance: Inspect BMPs and equipment daily and ensure necessary repairs for both are done in a timely manner. If a piece of equipment leaks, remove it from the stream immediately for repairs.

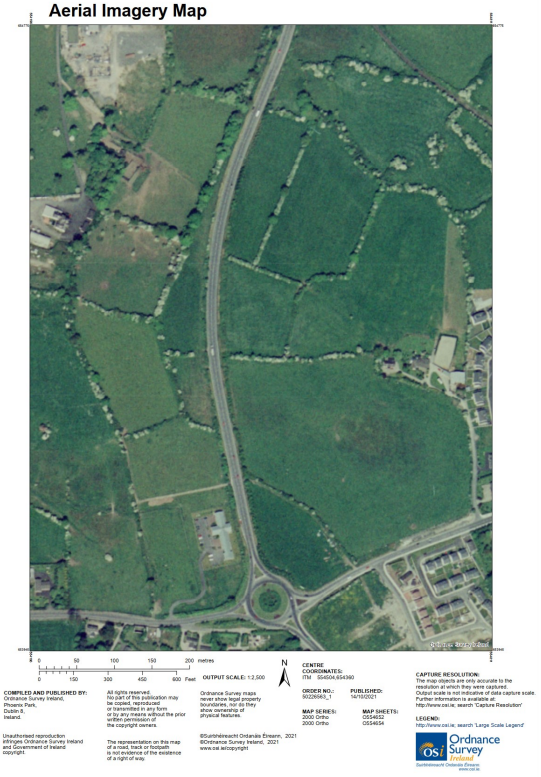
Appendix A - History of Site re-grading

This site has been modified and worked on over the past 30yrs. While full details of each element of works are not know the following primary works did modified the topology of the site in question;

- Expansion of the R510.
- Construction of the adjoining site to the South (Inis Mór).
- Construction of the catchment surface water pipeline.
- Creation of roundabout at the site entrance.

Thankfully old survey data has been retrieved to illustrate the historic topology and inform new design levels along with sources of on site mounds. This survey shows elevated levels and significant banking along the R510;

It is apparent that this survey was in the period between construction of the widened R510 and development of the adjoining estates, likely in the period 1995-2000. The elevated topology near the R510 was moved during the 2000-2005 period;



1

2

The construction of the public surface water line (running from South to North along the R510) and the construction access and compound to the Inis Mór estate can be seen to have altered the topology in the area where the roundabout is now constructed;

[1] 2000 Aerial Image
[2] 2005 Aerial Image

 [3]

This re-grading was ongoing up to 2014 when the roundabout was in place;

[3] 2005 Aerial Image near site entrance

Aerial Imagery Map

0 50 100 150 200 metres
0 150 300 450 600 Feet

OUTPUT SCALE: 1:2,500

N

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Roundabout was completed prior to the construction of Ard Aulinn across the road

The timeline of event supposes that the spoil material on the site occurred in the 2000-2014 period and based on information from the site investigation it is fair to characterise the majority of the spoil as re-grading works within the site.

There are 4 distinct "mounds" of inert material on the site. While the exact sources are not confirmed they are summarised as follows;

	Cut (m3)	Fill (m3)	Nett (m3)	Area	Source/action
Area 1		6,000		5,300	Primarily from road cut?
Area 2				226	Road planning to be removed.
Area 3		375		787	Stripped soil for roads?
Area 4	100	13,400		9,113	Excavated from trench for public surface water?