Design Risk Assessment for Wastewater Infrastructure Codes of Practice

Connections and Developer Services

Design and Construction Requirements for Self-Lay Developments
July 2020 (Revision 1)

Document IW-CDS-5030-04

UISCE ÉIREANN : IRISH WATER

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Background

Technical Documentation has been developed by Irish Water's Connection and Developer Services (CDS) which outlines Irish Water's requirements for water services infrastructure within developments.

The Technical Documentation comprises Codes of Practice and Standard Details. These provide guidance to developers in the provision of water and wastewater infrastructure that is to be installed by Self-Lay methods in developments and that will be connected to Irish Water's networks and subsequently vested in Irish Water.

The Technical Documentation outlines design and construction requirements to ensure consistency in the provision of materials, equipment, workmanship, etc. They will also provide the basis for developers detailed design proposals for water and wastewater infrastructure, leading to the provision of infrastructure that is suitable for connection to Irish Water's networks and easy operation and maintenance.

The Technical Documents are based on best practice within the water industry. They take account of the experience of Local Authorities in the provision of these services to new developments.

The Standard Details for Wastewater (IW-CDS-5030-01) and its associated Design Risk Assessment (IW-CDS-5030-02) are available at www.water.ie. The Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03) is available also at www.water.ie.

This Design Risk Assessment (DRA) (IW CDS-5030-04) has been prepared to outline the residual health and safety responsibilities of developers and their designers/contractors in the provision of infrastructure in accordance with the Code of Practice for Wastewater Infrastructure (IW-CDS-5030-03). The residual risks outlined herein shall be taken into account in the detailed design of water infrastructure.

Design Risk Assessment for the Code of Practice for Wastewater Infrastructure

The Code of Practice for Wastewater Infrastructure describes acceptable requirements and provides guidance on the minimum standards that are required by Irish Water for the provision of wastewater pipes and related infrastructure in Self-Lay developments which are to be connected to the Irish Water Network. The wastewater pipes and related infrastructure to be put in place within Self-Lay developments shall comply fully with the Code of Practice for Wastewater Infrastructure. The Code of Practice for Wastewater Infrastructure shall be used in conjunction with this Design Risk Assessment which identifies the risks that designers shall take into account in the detailed design of the wastewater pipes and related infrastructure. Ultimate responsibility (including, but not limited to, any losses, costs, demands, damages, actions, expenses, negligence and claims) for the detailed design, construction and provision of such pipes and related infrastructure shall rest entirely with the Developer, his/her Designer(s), Contractor(s) or other related parties. Irish Water assumes no responsibility for and gives no guarantees, undertakings or warranties in relation to the pipes and related infrastructure to be provided in accordance with the Code of Practice for Wastewater Infrastructure.

Revision	Reason for Revision	Approved By	Issue Date
0	Initial Issue	T. O'Connor	23/04/2018
1	General Amendments	T. O'Connor	17/07/2020

Irish Water

Connection and Developer Services

Design Risk Assessment associated with Code of Practice for Wastewater Infrastructure

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
	Enter the Activity	Enter the hazard	List persons or groups at risk	Give details of existing control measures in place	1-5 (select from list)	1-5 (select from list)	Prob. x Conseq.	Low, Medium or High	Give details of additional control measures proposed	1-5 (select from list)	1-5 (select from list)	Prob. x Conseq.	Low, Medium, High
	SEWERAGE CODE OF PRACTICE						0					0	
1	Connection of new infrastructure to existing Irish Water asset and subsequent vesting of this infrastructure.	Damage to other utility company assets Damage to environment due to defective infrastructure Safety risk to construction personnel. Impact on service to customers.	Construction Personnel Public Other utility companies.	**Section 1.8 Application for a Conformance Certificate** Irish Water's field engineers will undertake site inspections on the Works in line with the Quality Assurance Field Inspection Requirements attached to the Connection Agreement during and throughout the construction of the Works. The Developer's site staff shall retain on the site of the Works a Quality Assurance Folder to include information on, as well as on-site quality assurance records of the Works installation. The document shall be updated as required and made available on request to the Irish Water field engineer for inspection. This document shall be used to facilitate the collation of the Final Documents as referred to below. A CCTV survey of the pipework and a SUS25 survey of the Manhole chambers shall be undertaken by the Developer at the end of the construction phase and this is to be witnessed by the field engineer during a separate site visit. Final site inspections will be carried out after the submission by the Developer of an application for the issuing of a Conformance Certificate. The Conformance Certificate is a document that will be issued by Irish Water to the Developer indicating compliance of the Works with Irish Water's requirements following: • Inspection of the constructed infrastructure confirming that it is constructed in accordance with the Code of Practice and Standard Details. (If minor corrections are required to the infrastructure (snags) a 'Defects Report' will be issued with the Conformance Certificate outlining these minor defects); and • The Developer's submission of Final Documents The issuance of a Conformance Certificate marks the commencement of the Defects Liability Period The Final Documents shall comprise at least but not limited to the folscope of documentation: • Confirmation by a Chartered Engineer in writing that the Works has been installed in accordance with the design submitted in the Connection Application; • Confirmation by a Chartered Engineer tin writing that the Works has been installed in accordance with the Codes of Practice and Standard Details; • Confirmation by a Chartered Engineer in writing indicating that the Works have undergone appropriate on-site testing, off-site testing and commissioning and provision of associated test result certificates. The requisite site tests for the Works include, but are not limited to, the following; • Air tests and water tests of gravity sewers; • Water retaining tests completion results for manholes, chambers and pumping station structures; • Testing completion results of pumping plant (if appropriate); • Pressure testing completion results of Rising Mains complete with a hard copy print out from the logger (in the required format) of the relaxation curve as proof of the outcome of the test; • A printout of the joint details, with a GPS location of each joint; • Visual inspection completion results of manholes; • CCTV report of the Works shall conform to Irish Water CCTV Survey requirements • Commissioning reports; • "As-Constructed" drawings and records of the constructed Works in hard and soft copy to the Irish Water field engineers in accordance with Sub-Section 1.18.4 below; • "As Constructed" record to be included in the drawings of service pipe installation completion (including link to House Numbers within the Development); • Safety File in accordance with the current Safety and Health Construction Regulations; • Operation and Maintenance Manuals for pumping plant (if such provided) in accordance with Section 5.24 including full pump details, performance curves and power ratings, estimate of energy use, parts' replacement schedule, maintenance requirements (as well as estimated costs for these), etc., and all warranty documentation for the installed equipment as well as drawings of the pump station demonstrating the Area Classification of the pump station or otherwise the absence of zoning; • Deeds of Grant of Wayleave and Easement and associated PRA Compliant Map(s) in accordance with the Connection Agreement; • Proof of ownership of the Development in the form of Deed/Solicitor letter; • Confirmation by a Chartered Engineer of compliance with the Building Regulations and the Building Control (Amendment) Regulations, in particular evidence of compliance with the Building Regulations to ensure plumbing systems compliance and no risk of contamination; • A construction stage hydraulic model (if relevant); • "As Constructed" Record Drawings (provided in hard copy and digital format) shall show the location, layout plans, longitudinal sections and details of the Works and the Development in full. Plan scales should be in common use, i.e., 1:200, 1:500, 1:1000 or 1:2500 as appropriate. Drawings should be prepared using an electronic system and submitted in "CAD compatible (dwg/dxf)" file format. These drawings shall contain the following information: • Manhole, pipe, pump station, service connection and inspection chamber locations, (to Irish National Grid coordinates (ING)) to +/- 500mm accuracy in the horizontal plane, with dimensions relating to fixed Ordnance Survey co-ordinates; • Cover level and invert levels of Manholes relating to fixed Ordnance Survey Datum (Malin Head) to an accuracy of +/- 40mm as well as the level of all connecting pipework thereto; • Longitudinal sections, to an exaggerated vertical scale, (such as 1:1000 horizontal and 1:100 vertical) showing pipe installed levels, finished ground levels, pipe invert levels, pipe sizes, bedding type, haunch and surround details, backfill details, together with Manhole locations, fitting and inspection chamber locations, chainages, gradients, pipe materials, etc. All Manholes should be identified and provided with a location to an Irish National Grid co-ordinate (Information in Tabular Format on a Schedule of Manholes); • Dwelling and building numbers; • Construction details of pump station as well as mechanical, electrical and instrumentation equipment details; • Details of any services and structures on the site, existing and proposed, especially those in close proximity to the Works including offset measurement to the Wastewater collection and water supply systems.	3	3	9	**Medium**	All relevant documents to be vetted by CDS Team before Conformance Certifcicate is issued and connection is allowed to IW Asset. All new connections of the wastewater infrastructure to the Irish Water Network will be made by Irish Water personnel or its agents. The final connection of the main shall only be allowed following: • Satisfactory test results (air test for sewers & water retaining tests for manholes, chambers and pumping station structures) • Provision of as-constructed drawings and records. • Confirmation that the installation is completed in accordance with all design documentation, etc. IW Field Engineers will inspect all documentation & installed wastewater infrastructure & if adequate, will make a recommendation for issue of a Conformance Certificate.	2	2	4	**Low**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
2	Maintenance and other works being carried out on the system	Inadequate or non existant consents/ permissions	Irish Water Assets Operation and Maintenance personnel Contractors carrying out works in the future	**Section 1.16 - Statutory and Other Consents** The Developer shall obtain all necessary Requisite Consents and other permissions for the proposed Development, including the Works.	2	4	8	**Medium**	Developers are required to have all necessary consents in place and CDS Design Team will carry out a vetting of each submission to ensure compliance.	2	2	4	**Low**
3	Design and Construction	Failure to appoint competent bodies to undertake design & construction activities.	Construction Personnel Public Operation and Maintenance Personnel Environment	**Section 2.2 General Design Requirements** The design shall incorporate a risk assessment to ensure that risks to both the local community and operators of the Works are minimised. The provisions of the Safety, Health and Welfare at Work Act 2005 and associated Safety, Health and Welfare at Work (Construction) Regulations shall apply in respect of the appointment of competent designers, Project Supervisor Design Process (PSDP) and Project Supervisor Construction Stage (PSCS). The Developer or his/her designer shall certify that the design complies with the Code of Practice and Standard Details and accepts liability for compliance through their professional indemnity insurance, which shall be kept in place for a period of 6 years after the issue of the Completion Certificate. The Developer shall ensure that this professional indemnity insurance is retained and that evidence of this is made available to Irish Water in accordance with the Connection Agreement. The design responsibilities and liabilities shall not be discharged by Irish Water after the design passes a satisfactory inspection and issue of a Statement of Design Acceptance, if a design submission is provided in advance of a Connection Application, or by a de-facto Statement of Design Acceptance via the Connection Agreement if the design submission is submitted as part of the Connection Application. The design of the Wastewater infrastructure shall be such that a minimum design life is achieved of 50 years for pipework and structures, 25 years for mechanical and electrical plant and 15 years for information, communication and telemetry equipment (ICT).	3	4	12	**High**	It is the responsibility of the Developer to ensure that competent bodies are appointed as PSDP & PSCS as outlined in Health and Safety Legislation. IW CDS Design Team to vet the submitted design and may require its amendment if deemed inadequate.	2	2	4	**Low**
4	Design & Construction	Inadequate design.	Construction Personnel. Public IW operation and maintenance personnel Contractors carrying out works in the future.	**Section 2.4 - Drawings, Calculations and Design Information** Drawings and calculations shall be supplied for the Works, including elements that are not to be vested in Irish Water i.e. Pipes that are not within the Attendant Grounds of the Development. Layout plans shall be prepared with standard legends and symbols as required by Irish Water's Drawing Standard and at least with water services industry norms. The drawings submitted by the Developer should show the precise layout as dictated by the local topography and all necessary detailed information required for guidance. The layout plans should show the site boundary, existing utility apparatus, North point, Ordnance Grid reference for the centre of the site, Ordnance Grid Reference for the Connection Point(s), etc. Location and layout plans, longitudinal sections and details should show the drainage system and the Development in full. Plan scales are required to be shown at either 1:200, 1:250, 1:500, as appropriate, for A1 sheet size. Drawings shall be prepared in a digital format using "CAD (dwg/dxf)" file format and also submitted in PDF. Details to larger scales should be provided where necessary. The drawings submitted should also show the following: • The location of the Development site on an Ordnance Survey Map with the site outlined in red, • Layout roads and properties including plot numbers, phasing of the Development (if relevant); • Layouts of Sewer, outfalls, Manholes, Storm Water Sewer, details of all associated features and external property drainage details, including details of existing services in the case of infill or brownfield sites; • Details of all over ground or underground structures within the Attendant Grounds and especially those that are to be vested by Irish Water; • Contours of existing ground levels, proposed Development ground levels and property floor levels relative to Ordnance Datum (Malin Head); • Longitudinal sections, to an exaggerated vertical scale, showing proposed levels, existing ground levels, existing or proposed buried service crossings, invert levels, pipe sizes, bedding, haunch and surround details, thrust blocks associated with pressure mains, backfill details, together with Manhole locations, chainages, gradients, pipe sizes, pipe materials, etc. All Manholes should be given unique, sequential numbers/letters for identification; • Locations of all natural features, such as trees, streams, rivers, springs, etc., which are in the vicinity of the Works; • Location of manmade features, such as existing structures, buildings, roads, bridges, etc., which are in close proximity to the proposed Works; • An integrated utility layout plan showing the layout of all utility infrastructure (ESB Networks, Gas Networks Ireland, telecommunication provider ducting, etc.) and indicating the relative separation distances between the various utility infrastructure, which shall be in accordance with Irish Water's separation distance requirements; • Layout taking into account possible future developments; • Location of Ordnance Survey (OS) Benchmarks and their value to Malin Head Datum.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. IW CDS Team to vet the submitted design and may require its amendment if deemed inadequate. Developer/ Controller/Designers to ensure adequate designs are carried out and provided to IW for review. IW CDS Field Engineers will undertake site inspections during installation. IW CDS Field Engineers will inspect Final Documents (including as-constructed drawings) & will assess them for adequacy as outlined in Section 1.8 of the Code of Practice for Wastewater Infrastructure.	2	2	4	**Low**
5	Design of the works.	Reliability of wastewater collection system	Public IW operation and maintenance personnel Contractors carrying out works in the future. Construction Personnel.	**Section 3.2 - Reliability and Design Objectives** Pipes shall be free from defects or other features that might cause blockage or otherwise impede the design flow. Gravity Drains, Service Connections and Sewers should have adequate gradient to maintain self-cleansing conditions (full pipe velocity generally greater than 0.6 m/sec). Rising Mains should be sized to achieve self-cleansing velocities and excessive velocities in the Rising Main should be avoided. The range of flow velocity within the Rising Main should be between 0.75 m/sec and 1.8m/sec.	3	3	9	**Medium**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. IW CDS Design Team to vet the submitted design and may require its amendment if deemed inadequate. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure and examine the Final Documents prior to vesting.	2	2	4	**Low**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
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6	Design & construction of the works.	Structural failure during design life.	Public (in the event that structural failure results in loss of service) Maintenance personnel Construction Personnel.	**Section 3.4 - Structural Design and Integrity - Specific Requirements** The Works shall be designed and constructed to ensure structural integrity over their design life. The design shall ensure that: • all connections to existing Sewers are carried out in a manner that do not compromise the structural integrity of the existing Sewer and that the connection to the Sewer does not damage the structural integrity of the pipe; • buried pipes have sufficient depth of cover, as set out in the Codes of Practice, to afford adequate protection from anticipated imposed loading, including loading from the passage of construction plant as well a normal design loading, low temperatures and damage from normal use of the land and where this cannot be achieved, there should be suitable alternative protection measures provided; • Manholes and branch pipework are built into the Works for planned future connections, to the requirements of Irish Water, if requested; • if the depth of cover to the crown of the pipe is less than the values required herein, protection measures are required by, in order of precedence, either the provision of a reinforced concrete slab of C30/35 concrete to IS EN 206, the provision of full concrete surround of C16/20 concrete with flexible joints or the use of a ductile iron pipe for the distance where the depth is below requirements or a combination of these requirements, all details of the protection measures shall be to be agreed with Irish Water; • all pipes have the structural ability to resist the possible incidence of punching shear; • no vertical load is imposed by structures such as shafts onto non-load bearing components such as the pipes; • the Works is resistant to tree root ingress where there is a risk of such intrusion, (e.g. by use of appropriate barriers or pipelines constructed from polyethylene with welded joints, see also Section 3.21 below); • the Works shall be watertight in accordance with test requirements to prevent ingress to and egress, especially at connection locations; • trees and large shrubs shall not be planted over the Works.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. Design to be vetted by IW CDS Design Team and installation of infrastructure will be inspected by Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**
7	Design of wastewater infrastructure layout	Access for maintenance works and repairs to system. Failure of system causing structural damage to near by structures.	Operation and Maintenance personnel Contractors carrying out works in the future Public Construction Personnel.	**Section 3.5 Layout of Works and Manholes** The layout of Gravity Sewers, Rising Mains, Manholes and chambers in the Works shall: • be as simple as possible; • 3.5.2 ensure infrastructure is located so that if there is a structural failure an excavation may be carried out to repair the failure without impairing the integrity of adjacent buildings, other infrastructures or trees/shrub landscaping (See Section 3.5.9 below); 3.5.3 ensure infrastructure is located in pavements, roads or in open spaces (Rising Mains may be located in either roads/areas or in private property, subject to the provision of an Easement giving Irish Water access for maintenance, operational, renewal, replacement and upgrading activities); 3.5.4 ensure infrastructure is designed and constructed in order to provide access for any reasonably foreseeable maintenance, renewal, replacement and upgrading activities 3.5.5 ensure infrastructure is located so that it is safely accessible and apparent to Irish Water or its Agents and that covers are located at finished ground level; 3.5.6 ensure infrastructure is laid on the side of the street/road where the housing density is greatest so that the number of service pipes road crossings are minimised and the lengths of the service connections are minimised; 3.5.7 ensure that a single collection network, as opposed to dual networks, is provided; and 3.5.8 ensure that the maximum distance between Manholes does not exceed 90m for 225mm diameter pipes and above and does not exceed 75m for 150mm diameter pipes (as outlined in Section 3.12.1.3). Alternative routes shall be considered to identify the best achievable route that takes account of whole-life cost arising from a combination of the construction, maintenance, operation and eventual decommissioning of the asset (See also Section 5.2, Pumping Station General Requirements). Sewers shall be located to ensure acceptable clearances between the line of the new Sewer and the proposed property construction and any existing structures and features on the site. Under no circumstances will Irish Water accept Sewer installations under structures, existing or proposed, or in close proximity to existing structures or features that will inhibit access for post installation maintenance and access or future works.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS.Design to be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting. Site specific risks to be assessed & appropriate design mitigation measures to be implemented. The Designer shall provide a detailed method statement for entry procedures to confined spaces during the construction phase & the operation & maintenance phase, including use of gas monitors & breathing apparatus. Designers should prepare an Emergency Plan (including a Traffic Management Plan) to make allowances for emergencies & this should allow for rescue equipment to be used. Where use of man riding harnesses or similar mechanical devices is required, consideration to the design of the manhole should be made to allow for continuous attachment & constant visual contact.	2	2	4	**Low**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
8	Maintenance and other works being carried out on the sewer line.	Access for maintenance works and repairs to system.	Operation and Maintenance personnel Contractors carrying out works in the future Environment Public Construction Personnel.	**Section 3.5 - Layout of Works and Manholes** The following general requirements shall apply to the locations of the Works in new Developments that are covered by this Code of Practice: • The external face of any new Sewer shall be at least 3.0 m or a distance equivalent to the depth of the Sewer below the foundation, whichever is greater, from the external face of any building or Development structure. Modified foundation arrangements do not obviate the need for this separation distance. This is to allow future access for maintenance, operation, future renewal, replacement, upgrading work, etc. of the pipeline. Foundations and basements of adjacent buildings should be designed to ensure that no extra loads are transferred to the pipeline, i.e. the pipe should be located outside the zone of influence of the building foundation. The minimum clear distance shall be increased if the Sewer is greater than 3m deep or if the diameter is greater than 375mm. The minimum clear distances for pipe diameters of 450mm diameter and greater (outside the diameter size covered by this Code of Practice) or depths exceeding 4.0m shall be based on specific consultation with Irish Water. These separation distances also apply to separation from other existing structures, including attenuation structures and swales; • Sewers and service connections shall not be constructed under any building or structure. No building may be constructed over the line of a Sewer, service connection or Drain. This approach is in accordance with Section 29 of the Public Health Act 1878 and the Water Services Act; • Sewers and Rising Main locations shall be agreed with Irish Water and, where practicable, shall be located in areas that are or will in future be maintained by the Local Authority, i.e., road verges, roads and public open space or a space where they are reasonably accessible and visible. Wayleaves and Deeds of Easement shall be provided for all Sewer routes. Sewers shall not be laid in enclosed private land, where there is a practicable alternative route; • Between Manholes, Sewers shall be laid in straight lines in both the vertical alignment (profile) and horizontal alignment (plan). However, long radius bends up to 45 degrees may be laid on 100mm wastewater service connections downstream of the private side inspection chambers to facilitate the transition from horizontal to vertical at the point where the service connection drops into the trench to connect to branch connection on the Network Sewer; • The angle between any inlet pipe to a Manhole and the outlet pipe from the Manhole shall not be less than 90 degrees, i.e., the inlet flow from any inlet pipe should not run counter to the outlet flow direction and suitably profiled benching shall be provided to ensure smooth flow conditions; • Where Wastewater and Storm Water Manholes are adjacent, their positions shall be staggered to allow for crossing over of Sewers. Staggered positioning of Wastewater and Storm Water Manholes is required with a full separation between the Wastewater and Storm Water Sewer systems (Note that Irish Water does not have responsibility for Storm Water Sewer systems.). The external walls of the staggered manholes shall be separated by at least 500mm to allow compaction of backfill material between the structures; • The design of landscaping shall be undertaken at the same time as the design of the Drains and Sewers so that the impact of tree roots on the Works can be considered (see Section 3.21 below). Trees/bushes/shrubs shall not be located closer to the Sewer or Drain than the canopy width at mature height, except where special protection measures are provided. A tree should not be planted directly over Sewers or where excavation onto the Sewer would require removal of the tree; • When in a road or highway (and in addition to Section 3.5.9), the outside of the Sewer to which this Code of Practice applies should be in the vehicle carriageway (not footway) and shall be at least 1.0 m from the kerb line. The external faces of Manholes and chambers should be at least 0.5 m from the kerb line; • A Storm Water sewer or a Wastewater Sewer should generally not be installed to cross over a Water Main. When the surface water or Wastewater Sewer is being installed under a Water Main, adequate structural supports shall be provided to maintain the structural integrity of the Water Main. A method statement for the proposed crossing shall be provided. Where crossing over a Water Main is unavoidable, the surface water or Wastewater Sewer crossings shall not be located directly above the joints in the Water Main. No other utility service should be laid longitudinally directly above the line of the Wastewater Sewer; • Any Sewer crossing of a Water Main shall do so at right angles, or as near to as possible, to avoid prolonged envelopes of influence between the services. Crossings shall be located midway between the Water Main joints with a minimum vertical clear distance of at least 300mm and up to 500mm or more in some instances between the Sewer pipe and the Water Main. All such crossings shall be to Irish Water approval and shall not be undertaken until Irish Water or its agents has examined the work at the crossing point and deemed it fit for backfilling; • Specific vertical separation distances for wastewater service connections and Sewers to other pipework, including utility service pipes and ducts, shall be in accordance with the Table at the end of this Section; • There should be a minimum clear horizontal distance of at least 900mm between the external face of a Gravity Sewer/Rising Main and other pipe/duct utilities running parallel to it, with a clear local horizontal distance of 300mm between the external face of a Gravity Sewer/Rising Main and cabinets, poles, junction boxes, Manholes or chambers; • Specific separation clearance distances in excess of those outlined above shall be provided for services such as gas, electricity, fibre-optic or oil filled cables as the case may be. The particular utility providers shall be consulted to determine these minimum separation distances and evidence of this consultation, with the specified separation distances, shall be provided to Irish Water at design submission stage. For example, the minimum separation distances for Gas Networks Ireland infrastructure shall be in accordance with IS329 'Gas Distribution Mains' and IS328 'Code of Practice for Gas Transmission Mains' as amended/updated; • A Deed of Grant of Easement shall be provided for all Sewers and Rising Mains prior to their construction. Connections to the Irish Water Network will not be permitted without such Easements having been submitted and accepted by Irish Water. Construction and permanent Deed of Grant of Easement, comprising a conditional Burden on the Title, are to be provided complying with particular widths requirements outlined in the Connection Agreement and such Easement should be to the benefit of and registered with Irish Water as the owner following Vesting. The Easement shall not be built upon after the installation of the Sewer or Rising Main. The construction techniques should be selected to ensure that the maximum settlement is within the agreed limits; • Rising Mains shall be laid in straight lines or in gentle curves, to manufacturer's requirements, or using long radius bends. Where bends are used, they should be formed with proprietary bends of suitable material allowing for a fully integrated joint, and securely anchored with thrust blocks, if deemed necessary; • The provision of access points, comprising rodding points and chambers, for pigging, rodding or cleaning of the Rising Main is required along its entire length, especially along long Rising Mains; • Where possible, Rising Mains shall be evenly graded between the intake point and the discharge point. If a continuous rise cannot be achieved, the Rising Main should be fitted with sewage air valves and scour valves as per the hydraulic design of the system. Both of these should be suitable for use with raw Wastewater. The valve locations shall be clearly marked by the provision of indicator plates and posts. • The design of the Rising Main shall take account of the containment of the Wastewater volume during pigging, rodding and cleaning operations at the scouring point and provisions shall be made for ease of collection of the Rising Main contents by vacuum tanker and transportation of this to a suitable point for treatment or reintroduction into the Wastewater collection Network; • The route of Rising Mains should be marked at every field boundary and, where practicable, at every change of direction by marker posts. The marker plates shall be labelled "RM" and the depth to the top of the Rising Main as well as the distance to the main shall also be provided; • Non-degradable marker tape, red or orange in colour, shall be installed 300mm above the crown of the Rising Main. In the case of non-metal pipe material, the marker tape should incorporate a trace wire which is linked to the marker posts and terminating at the Wastewater pumping station and the discharge Manhole. The trace wire shall be tested to ensure that it is continuous and capable of transmitting locating signals;	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by competent PSCS. Design to be vetted by IW CDS Design Team and installation of infrastructure will be inspected by Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting. Site specific risks to be assessed & appropriate design mitigation measures to be implemented. The Designer shall provide a detailed method statement for entry procedures to confined spaces during the construction phase & the operation & maintenance phase, including use of gas monitors & breathing apparatus. Designers should prepare an Emergency Plan (including a Traffic Management Plan) to make allowances for emergencies & this should allow for rescue equipment to be used. Where use of man riding harnesses or similar mechanical devices is required, consideration to the design of the manhole should be made to allow for continuous attachment & constant visual contact.	2			**Low**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
9	Design of Wastewater Infrastructure System	Inadequate hydraulic capacity	Operation and Maintenance personnel Public	**Section 3.6 - Hydraulic Design for Gravity Sewers** Works which carry domestic Wastewater shall be designed to carry a Wastewater volume of between 6 times and 2.5 times the dry weather flow depending on the size of the Development, as outlined in Section 2.2.5 of Appendix B of the Code of Practice for Wastewater Infrastructure. Dry weather flows (DWF) should be taken as 446 litres per dwelling (2.7 persons per house and a per capita Wastewater flow of 150 litres per head per day along with a 10% unit consumption allowance in line with Section 3.6.3 above and Section 2.2.4 of Appendix B of the Code of Practice for Wastewater Infrastructure (rounded up to 450 litres).	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design to be vetted by IW CDS Design Team and installation of infrastructure will be inspected by Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**
10	Design of Wastewater Collection System	Inadequate hydraulic capacity Unacceptable flow velocity Settlement of solids at low flow	Operation and Maintenance personnel Public	**Section 3.6 - Hydraulic Design for Gravity Sewers** The hydraulic design of the Works shall include an allowance for envisaged flows as well as increased flows that might be reasonably foreseeable within the development, based on Local Authority Development Plans or as advised by Irish Water. Gravity Sewers should be designed to convey the projected flows together with an allowance for: • variations in Wastewater flows resulting from increased occupancy or intensification of the development commensurate with the introduction of water saving measures; • increased trade effluent flows resulting from reasonable changes in use or intensification of development of an industrial or commercial development; • where permitted by Irish Water levels of groundwater infiltration that might reasonably be expected over the life of the Drain or Sewer system; • inflow of surface water that might reasonably be expected due to leakage or accidental connection, giving rise to partially separate flows. The Irish Water requirements for the design of wastewater gravity sewers are set out in Appendix B of the Code of Practice for Wastewater Infrastructure. The Works should be watertight to minimise the ingress of groundwater and Surface Water and the egress of of Wastewater. For small numbers of housing units, the use of higher peak flow multipliers may be used for design purposes to reflect the proximity to source and the attenuation that naturally occurs in the Sewerage system. The hydraulic design of the Works shall include an allowance for envisaged flows as well as increased flows that might be reasonably foreseeable within the Development, based on Local Authority Development Plans or as advised by Irish Water. Gravity Sewers should be designed to convey the projected flows together with an allowance for: • variations in Wastewater flows resulting from increased occupancy or intensification of the Development commensurate with the introduction of water saving measures; • increased trade effluent flows resulting from reasonable changes in use or intensification of an industrial or commercial Development, including mixed use Developments; • levels of groundwater infiltration that might reasonably be expected over the life of the Drain or Sewer system; • inflow of surface water that might reasonably be expected due to leakage or accidental connection, giving rise to partially separate flows. The Irish Water requirements for the design of wastewater gravity sewers are set out in Appendix B of the Codes of Practice for Wastewater. However, for Works in residential Developments, the sewer capacity criteria for a development are considered to be satisfied, without the need for a full Appendix B design assessment, where the pipe size and gradient requirements for the full potential development population corresponds to those in the Table below for the number of dwellings shown. For small numbers of housing units, the use of higher peak flow multipliers may be used for design purposes to reflect the proximity to source and the attenuation that naturally occurs in the Sewerage system. The Works shall be watertight in accordance with the test criteria outlined in Section 4.10 to minimise the ingress of groundwater and Surface Water and the egress of Wastewater. When calculating emergency storage requirements in accordance with Section 5.2, Section 5.7 and Section 5.11 of of the Codes of Practice for Wastewater , average trade wastewater flows should be used towards the calculation of the storage capacity requirement. The storage capacity requirement shall be between 6 and 24 hours, depending on the size of the Development. Where the trade wastewater flow, as outlined in Section 2.2.8 of Appendix B of the Codes of Practice for Wastewater are used to estimate the maximum trade wastewater flow, these can be converted to an average trade wastewater flow by dividing by a factor of 3. Storage facilities may be required at the Premises site to balance the discharge from the site if requested by Irish Water to limit the effluent discharge so that the allocated capacity of the Irish Water Network is not exceeded. Details of such storage should be provided in the design provided at Connection Application Stage. As a general rule, it is preferable to aim to achieve self-cleansing velocity in the pipe system at least once per day. This varies for pipe sizes with self cleansing velocity of 0.75m/sec for pipes less than 300mm diameter and 0.77m/sec for pipes 375mm and 450mm diameter. The designer should aim to achieve a flow velocity at the design flow (i.e. peak flow) of between the required self cleansing velocity (using 0.75m/sec) and a velocity of 2.0m/s, with an absolute velocity of 2.5m/s as an upper limit.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. Design to be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**
11	Design of Wastewater Collection System	Design resulting in uacceptable flow velocity Settlement of solids at low flow	Operation and Maintenance personnel Public	**Section 3.6 - Hydraulic Design for Gravity Sewers** Subject to the limitations imposed by the foregoing, pipe sizes and gradients shall be selected from approved pipe design tables, based on an approved design approach, such as the use of the Colebrook White equation. To provide a self-cleansing velocity within the Gravity Sewers, the minimum flow velocity should be 0.75m/sec at one-third design flow. Where this requirement cannot be met, the criterion would be considered to be satisfied by the following: • a 150 mm nominal internal diameter Gravity Sewer is laid to a gradient not flatter than 1:150 where there are at least ten dwelling units connected or 1:60 for up to nine connected dwelling units; or • a service connection with a nominal internal diameter of 100 mm laid to a gradient not flatter than 1:80, where there is at least one WC connected and 1:40 if there is no WC connected.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design to be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**
12	Design of Wastewater Collection System	Unacceptable flow velocity Settlement of solids at low flow	Operation and Maintenance personnel Public	**Section 3.6 - Hydraulic Design for Gravity Sewers** These parameters should not be taken as a norm when the topography permits steeper gradients. Hydraulic studies indicate that these requirements may not necessarily achieve a self-cleansing regime. When a choice has to be made between a Gravity Sewer system and pumped pipe system, these criteria should not be regarded as inflexible. The roughness value (ks) for Gravity Sewer design should be chosen to suit the material being proposed and the "long term roughness value" should be chosen. In general, pipes of 100mm diameter should be laid at minimum gradients of between 1:60 and 1:100. Pipes of 150mm diameter should be laid at a minimum gradient of 1:150. Pipes of 225mm diameter should have a minimum gradient of 1:200 and pipes of greater diameter should comply with self cleansing and maximum velocity requirements. Pipe gradients for private side drainage should be constructed in accordance with that indicated in Activity 12 above as a minimum, or with Building Regulations requirements. The maximum allowable gradient for gravity sewers should be chosen so as to achieve a full bore velocity of no greater than 2.5m/s	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design to be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
13	Design of Wastewater Collection System	Design resulting in unacceptable flow velocity Settlement of solids at low flow	Operation and Maintenance personnel Public	**Section 3.7 - Hydraulic Design for Rising Mains** • Diameters of less than 80mm should not be provided and the typical minimum diameter shall be 100mm diameter (Rising Mains of lower diameter might not be taken over by Irish Water). • The roughness value (ks) should be chosen to suit the material being proposed and the "long term roughness value" should be chosen suitable for mean velocities between 1.1 and 1.8m/sec. • The installed minimum gradient shall be 1:500 rising and 1:300 falling with Wastewater type air release valves at the high point to facilitate air removal. • The gradient shall be a continuous rise without air valves where possible. • Where it is proposed to install rising mains with gradients that are steeper than 1:10, the Developer shall advise and seek review by Irish Water's Connections and Developer Services.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design to be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**
14	Design of Wastewater Collection System	Access for maintenance and cleaning works.	Maintenance personnel	**Section 3.7 - Hydraulic Design for Rising Mains** Rising Mains shall comply with the following: • The hydraulic design shall include an allowance for envisaged flows that might be reasonably foreseeable within the Development; • The diameter should be such that the velocity of discharge is in the range 0.75m – 1.8m per second and that any blockages of the pipeline are avoided; • Diameters of less than 80mm should not be provided and the typical minimum diameter should be 100mm diameter (Rising Mains of a lower diameter might not be taken over by Irish Water); • Pipes less than 80mm will only be considered with the use of appropriately sized/type pumps. Such systems are only appropriate for taking low flow volumes and shall be provided with suitable anti-septicity systems; • The roughness value (ks) should be chosen to suit the material being proposed and the "long term roughness value" should be chosen as being suitable for mean velocities between 1.1 and 1.8m/sec; • The installed minimum gradient shall be 1:500 rising and 1:300 falling with Wastewater type air release valves at the high point to facilitate air removal; • The gradient shall be a continuous rise without air valves, where possible; • Where it is proposed to install rising mains with gradients that are steeper than 1:10, the Developer shall advise and seek review by Irish Water's Connection and Developer Services. Alternative gradient proposals may be required in such instances; • 3.7.9 Rising Mains longer than 500m shall have provision for in-line rodding, access and cleaning by the provision of in-line proprietary rodding chambers at centres not exceeding 200m; • Drain and washout facilities at low points should be provided with infrastructure for collection and appropriate treatment of the drained contents in order to ensure protection of the environment during such operations; • Wastewater type air release valves should be provided at high points to counteract air coming into solution; • Rising Mains should be designed to avoid septicity (twin pipe systems if necessary); • Surge analysis, subject to Irish Water approval, should be carried out for all Rising Mains and surge protection should be provided, where deemed necessary, for Rising Mains to protect the pipe from shock. Cyclic fatigue of pressure pipe systems should also be taken into account in the design of the pipeline; • Rising Mains should not discharge directly to a Sewer. In all cases, a separate discharge Manhole or header/stand off chamber shall be provided (see Section 3.15 of the Codes of Practice for Wastewater). This Manhole/chamber will be linked to the receiving Sewer by a short section of Gravity Sewer (minimum of 100mm diameter and sized to carry the peak pumped flow) connected to the receiving Sewer at a Manhole location. A Y branch connection between the gravity discharge pipe and the Sewer shall be used for single house pumped discharges. The discharge Manhole or header chamber shall be sized and designed to avoid turbulence and to achieve a smooth discharge to the Gravity Sewer system. Venting of the header Manhole to a vent-column shall be provided, complete with passive odour control. A pressure sealed Manhole shall also be provided. . • 3.7.15 Scouring arrangement of the Rising Main shall be incorporated in accordance with Section of the Codes of Practice for Wastewater.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design to be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**
15	Design of Wastewater Collection Sysytem	Unacceptable flow velocity Settlement of solids at low flow	Operation and Maintenance personnel Public	**Section 3.8 Pipe Sizes** The minimum size for a Gravity Sewer, subject to the criteria outlined in Section 3.6 of the Code of Practice, should be: • 150mm nominal internal diameter for carrying Wastewater from 20 properties or less; • At least 225mm nominal internal diameter carrying Wastewater from more than 20 properties. The minimum size for a Service Connection shall be 100 mm. The minimum size for Gravity Sewer serving less than 20 properties shall be 150 mm diameter. The minimum pipe size for Gravity Sewer where more than 20 housing units are connected shall be 225mm diameter subject to hydraulic design capacity assessment requirement. A pipe size greater 225mm diameter shall be provided where the design flow exceeds the capacity of the 225mm diameter pipe. The minimum size for a Rising Main should not be less than 80mm internal diameter. Rising Mains less than 80mm will only be considered with the use of appropriately sized/type pumps. Such systems are only appropriate for taking low flow volumes and shall be provided with suitable anti-septicity systems.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design to be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**
16	Construction	Damage to Irish Water Assets Injury to public	Operation and Maintenance personnel Public	**Section 3.9 Depth of Cover** Gravity Sewers and Rising Mains shall be designed in accordance with the requirements of BS 9295. As a general guide the, minimum depth of cover from the finished surface to the crown of pipework without protection should be as follows: a) Areas without any possibility of vehicular access - depth not less than 0.5 m; b) Driveways, footways, parking areas and yards with height restrictions to prevent entry by vehicles with a gross vehicle weight in excess of 7.5 tonnes - depth not less than 0.75 m; c) Driveways, footways, parking areas and narrow streets without footways (e.g. mews developments) with access for vehicles with a gross vehicle weight in excess of 7.5 tonnes - depth not less than 0.9 m; d) Depths of pipes in gated estates shall be as outlined above points a - c; e) Agricultural land and public open space - depth not less than 0.9 m; f) Other roadways, highways and parking areas with unrestricted access to vehicles with a gross vehicle weight in excess of 7.5 tonnes – depth not less than 1.2 m. The depth of cover to pipework can be reduced by the installation of protection measures, but an absolute minimum depth of cover of 500mm in un-trafficked areas and 750mm in trafficked areas shall apply when protection measures are used. Appropriate protection measures are discussed in greater detail below. The depth of cover is also dependent on whether the pipework installation is a rigid or a flexible construction. If the depth of cover to the crown of the pipe is less than the values set out above in Section 3.9.1 to 3.9.6 of the Codes of Practice for Wastewater, protection measures shall be provided. Consultation with Irish Water is required in relation to the provision of these measures. In order of precedence, the protection measures may comprise either the provision of a reinforced concrete slab designed to spread the imposed traffic load away from the pipe, slab to be a minimum of 150mm thickness of reinforced concrete of C30/35 concrete to IS EN 206, or the provision of full concrete surround of C16/20 concrete to the pipe, as described in Section 4.7, complete with flexible joints, where required, or the use of a ductile iron pipe in lieu of the original pipe material, provided there are no service connection in this length of pipe. These alternative protection measures shall extend for the distance where the depth is below the limits outlined above. A combination or a mix of all of these additional protection measures may be required and are to be agreed with Irish Water. However, the primary approach should be to provide the pipe with the required depth of cover as outlined above in Section 3.9.1 to 3.9.6 of the Codes of Practice for Wastewater.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. Design to be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
17	Access to Sewers	Biological Drowning Falls from height Confined Space/Fumes Emergency Escape due to injury	Operation and Maintenance Personnel Members of the Public Construction Personnel.	**Section 3.11 Access to the Works** Access structures to Works shall be located to minimise the risk of damage to buildings or other infrastructures. Such access points are generally provided by way of Manholes or inspection chambers. Inspection chambers (minimum 900mm X 900mm plan area or 900mm diameter) may be provided as access points in the Works to be Vested in Irish Water in the case of small diameter Sewers that are located at shallow depths (less than 900mm cover) subject to Irish Water agreement. Private side inspection chambers on wastewater service connections are described separately in Section 3.11.14 of the Codes of Practice for Wastewater. Manholes and inspection chambers shall be designed to: • Provide reasonable access for equipment to carry out maintenance activities; • Provide safe access and egress in accordance with Health and Safety Authority requirements and in accordance with Health and Safety Legislation; • Have a minimum clear access opening of 600 mm x 600 mm. (However, designers must have regard to safe access/egress requirements to Works by operatives with breathing apparatus in accordance with the Preliminary Safety and Health Plan as prepared by the Project Supervisor Design Process (PSDP) which must include requirements for a safe means of access and egress); • Incorporate an access shaft in situations where the Manhole is of deep construction, with a minimum clear access opening of 600mm x 600mm and minimum internal dimension of 1,200mm x 1,200mm, or 1,200mm diameter;. • Incorporate a smooth flow invert/channel directing the wastewater from the inlet sewer(s) to the outlet sewer with the change in flow direction between the inflow in any of the inlet sewers and the outflow in the outlet sewer not exceeding 90o when measured from a straight through line, i.e. the inlet flow in any inlet sewer should not run counter to the main flow direction in the channel. Access points to the Works shall be located with due regard to public utility services, safety, security and the provision of safe working areas. Access to shallow Sewers via inspection chambers should be provided at maximum intervals of 45m. Access to Sewers via Manholes should be provided at maximum intervals of 90m for Sewers of 225mm diameter and above, and at maximum intervals of 75m where the Sewer size is 150mm diameter, and shall be located in the following positions • At all changes of pipe direction; • At all changes of pipe gradient; • At all changes of pipe material along the Sewer length; • At all changes of pipe diameter; • At the head of all Sewers; • At all Sewer junctions of two or more pipes; • At every junction of a Wastewater Sewer with another Sewer serving three or more properties where the access point is a Manhole; • At the point of connection of the Works to the Network. In addition to the above, the following shall also be adhered to: • An inspection chamber of precast concrete or blockwork construction (600mmX600mm plan area) or proprietary approved plastic unit shall be installed on the Drain on the private side of the boundary of a Premises at or within 1.0m upstream of the Premise Boundary to allow access to the private Drain and the downstream service connection (see additional provisions below) , • The renewal, maintenance and repair of Drains and associated Accessories upstream of the boundary of the Premises is the responsibility of the property owner and shall be constructed in accordance with the Building Regulations subject to the provision of an inspection chamber as above. Access points (Manholes and chambers) shall be located so that they are accessible and apparent to the maintainer at all times for use. They shall avoid rear gardens or enclosed locations and they shall never be overlain with surface dressing, topsoil, etc. Additional access points may be provided in other locations, as long as access is provided to the system from other access points. A safe working space shall be provided and maintained at all times around the Sewer access points. With respect to the private side inspection chamber referred to in the Codes of Practice for Wastewater the following additional provisions will apply: • Inspection chambers, where possible, shall be located within 1m on the private side of property boundary. The maximum depth at this location shall be 1.20m. • Irish Water may facilitate or accommodate a relocation of the inspection chamber where the anticipated or design depth at that location is greater that 1.20 meters. In these instances the chamber may be relocated or moved back towards the dwelling until a depth of 1.20m is achieved, provided the distance of the inspection chamber from the boundary of the Premises does not exceed 2.0m (achieving the 1.20m depth determines the final location for the inspection chamber). This will be subject to Irish Water approval in all instances and shall only apply to specific locations within a Development. It should not be assumed that once approval for the relocation is granted that it applies to all dwellings within the respective Self Lay Development. Where it is envisaged that there is a justifiable engineering reason for re-locating the inspection chambers to achieve the maximum depth of 1.2, Developers shall indicate on a layout plan the location and applicable house numbers within the development where this applies. Relaxation reviews will be assessed on the basis of this submission. • If the depth of the service connection exceeds 1.2m a Manhole (minimum 900mm X 900mm plan area or 900mm diameter) shall be provided. • A proprietary inspection chamber may be used provided the minimum internal chamber dimension is either 600mm x 600mm or 600mm diameter irrespective of depth (up to 1.20 meters). The use of proprietary units is subject to Irish Water's requirements in all instances. • Where there is a justifiable engineering reason such as a physical space restriction or constraint, Irish Water may allow the installation of smaller inspection chambers than the 600mm square or circular units for depths up to 1.0 meters. The dimension of these smaller units shall not be less than 450mm (square or circular). These are subject to specific Irish Water approval in all instances and shall only apply to specific locations within a Development. It should not be assumed that once approval is granted for the smaller sized units that this applies to all dwellings within the respective Self Lay Development. Were it is envisaged that there is a justifiable engineering reason such as a physical restriction or constraint for downsizing the foul inspection chambers, Developers shall indicate on a layout plan, the location and applicable house numbers within the development where this applies. Relaxation reviews will be assessed on the basis of this submission. • In high density developments i.e. Duplex or Terraced housing, wastewater drains from a maximum of two units can be combined into one inspection chamber in instances where there are space constraints. • In high density developments, an inspection chamber shall be located within 1.0m of the private boundary where possible. However, in instances where the property does not have a garden or private parking space (within the curtilage of the property), the inspection chamber should be located in the footway, or, in parking area immediately outside the property subject to approval by Irish Water. In these instances, the inspection chamber should be positioned so as to avoid frequent wheel loading from vehicles. • Covers and frames shall be suitable for the relevant road and traffic conditions and provided in accordance with IS EN 124. • Long radius bends, up to 45 degrees, may be installed on the 100mm service connection downstream of the private side inspection chambers to facilitate the transition from horizontal to vertical to allow the service connection to connect to the branch connection on the Network, in accordance with the requirements of Section 3.5.12 of the Codes of Practice for Wastewater.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. Design to be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting. Entry into confined spaces in extreme circumstances only and to be avoided if possible. Confined Space Entry to be in accordance with Health and Safety Legilsation. Operatives involved in confined space entry to be trained in accordance with Legislation. Site specific risks to be assessed & appropriate design mitigation measures to be implemented. The Designer shall provide a detailed method statement for entry procedures to confined spaces during the construction phase & the operation & maintenance phase, including use of gas monitors & breathing apparatus. Designers should prepare an Emergency Plan (including a Traffic Management Plan) to make allowances for emergencies & this should allow for rescue equipment to be used. Where use of man riding harnesses or similar mechanical devices is required, consideration to the design of the manhole should be made to allow for continuous attachment & constant visual contact. Operatives to provide a back up fall arrest system and standby tripod in the event that there is a malfunction of the working access equipment. Irish Water operations & procedures to be adhered to for confined space entry.	2	2	4	**Low**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
18	Access to Sewers	Biological Drowning Falls from height Confined Space/Fumes Emergency Escape due to injury	Members of the Public Operation and Maintenance personnel Construction Personnel.	**Section 3.12 Manholes** Manholes should generally be provided as the means of access to the Works and particularly where; • the depth from the surface to the crown of the pipe is greater than 900mm; • there are two or more upstream pipes each serving more than one property; or • the distance between manholes would otherwise be greater than 90 m for Sewers of 225mm diameter and above, and 75m where the Sewer size is 150mm diameter. At the head of sewer lengths, inspection chamber access, of 900mm diameter or of 900mm by 900mm plan area, may be acceptable where the pipe is of small diameter, the depth to invert of this pipe is less than 900mm and no part of the pipe is more than 22.5 m from the adjacent access point	3	4	12	**High**	IW CDS DesignTeam to vet the submitted design and may require it's amendment if deemed inadequate. IW CDS Field Engineers will undertake site inspections during installation. IW CDS Field Engineers will vet the final installed infrastructure prior to vesting. Refer to Additional Control Measures above for Section 3.11 in relation to confined space entry.	2	2	4	**Low**
19	Operation	Structural failure of manhole cover. Manhole cover location posing risk to operatives working on manhole from passing traffic,.	Traffic Pedestrians/ Public Road users Operation and Maintenance Personnel Construction Personnel.	**Section 3.12 Manholes** Manhole covers and frames to IS EN 124, with D400 load capacity, should be used where Manholes and inspection chambers are located on roads. If the Manhole location is on a carriageway, a cover with a higher load bearing capacity than the standard IS EN 124, D400 cover, should be used. Covers with E600 rating should be used in heavily trafficked roads, as required on a case by case assessment basis. A Manhole, in general, shall not be located in carriageway situations where traffic frequency and loading is anticipated to be high (e.g., in industrial developments where large numbers of HGV vehicles with a gross vehicle weight in excess of 7.5 tonnes are expected) than would occur on a typical residential estate distributor road.	3	4	1 2	**High**	IW CDS Design Team to vet the submitted design and may require it's amendment if deemed inadequate. IW CDS Field Engineers will undertake site inspections during installation. IW CDS Field Engineers will vet the final installed infrastructure prior to vesting. Refer to Additional Control Measures above for Section 3.11 in relation to confined space entry. The Designer must ensure that the general principles of prevention (as well as all relevant Health & Safety Legislation) are taken into account when selecting & designing manhole covers & frames. Consideration must be given to the following risks relating to cover design: manual handling - means of safely lifting & moving the cover & eliminating / minimising risk of manual handling injury, ope protection (dependant on size) - access / egress - room to safely access rescue - room to safely rescue & also room to safely set-up rescue equipment etc. Proprietary lifting equipment should be provided to allow for safe lifting of chamber covers & this should be consistent to avoid risk of accidents due to misuse.	2	2	4	**Low**
20	Design & Construction	Structural failure of manhole Manual Handling Risk where blockwork manhole construction is specified.	Traffic Pedestrians / Public Road users Operation and Maintenance Personnel Construction Personnel.	**Section 3.12 Manholes** Manholes shall be constructed of the following materials: • In situ concrete, C30/37, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, with a minimum wall and floor thickness of 225mm for Manhole depths up to 3.0m and 300mm or more when the Manhole depth exceeds 3.0m, complete with a cast in situ concrete roof slab, minimum thickness of 225mm, depending on Manhole dimensions, reinforced with high tensile steel bar reinforcement, with a minimum 40mm concrete cover. • Precast concrete Manholes shall only be provided where the water table is low. They shall not be used where there is a perched water table, where the Sewer is located next to a river, lake or other water body and within areas that are identified by the Office of Public Works Catchment Flood Risk Assessment and Management (CFRAM) with a flood risk of 1 in 10 years. The precast wall units shall be provided with rubber sealing ring gaskets between units, complying with the requirements of IS EN 1917 and IS 420, subject to specific approval of Irish Water, complete with a 150mm minimum thickness cast in situ formed concrete surround, C20/25, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620. The precast concrete Manhole shall have either a pre-cast concrete (150mm minimum thickness beneath channel) or a cast in-situ concrete base (225mm minimum thickness beneath channel). It shall be also provided with either a pre-cast (160mm minimum thickness) or cast in-situ concrete roof slab (225mm minimum thickness). Both the base and roof slab shall be constructed of C30/37 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, reinforced with high tensile steel bar reinforcement, with a minimum 40mm concrete cover. The concrete surround to the precast concrete wall units shall only be omitted if the Manhole ring has a wall thickness of 125mm or more and where a proprietary watertight sealing system is provided as an integral part of the Manhole wall system up to a maximum depth of 4.0m. The omission of the concrete surround shall only apply if the wall unit is not penetrated through with proprietary fixings which could result in the water tightness of the unit being compromised. • High density, high strength (20N/mm2), solid concrete block work walls only in circumstances where the depth of the Sewer is less than 1,200mm (the use of block work in deeper Manholes will be considered but such use will require detailed structural design and agreement with Irish Water). The blocks shall be bedded in mortar, minimum M20 strength to IS EN 998-Part 2. Block work, complying with the requirements of IS EN 771 – Part 3, shall be flush pointed and not plastered internally, with internal lining of solid engineering brick to IS EN 771 – Part 3 to a height of 1.0m above the benching, bonded to the concrete block work. The block walls to be supported on a 225mm thick concrete floor with a reinforced concrete roof of 225mm minimum thickness, both cast with in-situ C30/37 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, reinforced with high tensile steel bar reinforcement, with a minimum 40mm concrete cover.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting. Blockwork manholes to be specified only in particular circumstances. Manual handling risk associated with blockwork (if specified) to be design risk assessed. Risk Assessment to be communciated with IW.	2	2	4	**Low**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
21	Operation	Access / Egress Confined Space / Fumes Emergency Escape due to injury	Operation and Maintenance personnel Contractors carrying out works in the future Construction Personnel.	**Section 3.12 Manholes** Manhole Dimensions: Manhole Dimensions depend on the size of the main Sewer and the number of pipes accommodated in the Manhole. The design size shall permit safe access and egress without unduly restricting operating space. All Manholes shall have a minimum internal clear dimension of 1,200mm on Manholes up to 3m depth. The internal dimensions of Manholes will vary with the pipe size, the number of pipes entering the Manhole, the direction of entry of the pipes relative to the outlet pipe, the variation in depth between the inlet and outlet pipes and the depth of the Manhole itself. Manholes shall have an open channel(s) allowing smooth flow between the inlet pipe(s) and the exit pipe. A safety chain shall be fitted on the downstream pipe where it exceeds 450mm diameter, subject to health and safety requirements. Manhole dimensions shall be in accordance with IS EN 752.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting. Designers to eliminate the need to enter confined space. Where elimination is not practical, the Designer should ensure that the level of risk is as low as is reasonably practical. Ensure entry & exit can be achieved with as much ease as possible. Consideration to be given at design stage to the method of rescue in an emergency situation to allow for setting up of rescue equipment. Confined Space Entry to be in accordance with Health and Safety Legilsation. Operatives involved in confined space entry to be trained in accordance with Legislation. Operatives to provide a back up fall arrest system and standby tripod in the event that there is a malfunction of the working access equipment.	2	2	4	**Low**
22	Operation	Access / Egress Confined Space / Fumes Emergency Escape due to injury	Operation and Maintenance personnel Contractors carrying out works in the future Construction Personnel.	**Section 3.12 Manholes** Manhole steps shall be provided in Manholes where the depth from ground to soffit of the sewer does not exceed 3.0m and in shallow chambers. Step rungs are to be provided in manholes where the depth from ground to the soffit of the pipe is up to 3.0m. Fixed ladders are required in manholes where the depth from ground to the soffit of the pipe exceeds a depth of 3.0m and up to 6.0m. A site specific engineering solution shall be provided to Irish Water for review for access arrangements in manholes where the depth between ground and the soffit of the pipe exceeds 6.0m. Site specific risks are to be assessed relating to access to manholes during construction as well as during the operational phase and design mitigation measures implemented as required. All manhole entry and egress is to be carried out using a safety access plan incorporating the use of safety equipment, tripod and winch. The designer must ensure that the general principles of prevention, as well as relevant Health and Safety legislation, are taken into account when selecting manhole covers and frames in respect of manual handling, opening size for access, egress and rescue, etc. Proprietary lifting equipment for covers should be provided to allow safe lifting of covers and this should be consistent to avoid risk of accident due to misuse. Ladders are to be provided in manholes where the depth from ground level to soffit of the sewer pipe exceeds of 3.0m. Such fixed ladders within manholes shall comply with IS EN 14396. The vertical distance between the top of the manhole cover and the first step in the manhole shall not exceed 675mm. The distance between the bottom ladder rung and the benching shall not exceed 300mm. All ladders shall be centred under the access opening in the manhole roof slab. Ladders, where provided, shall be manufactured of low carbon steel complying with IS EN 10025 with hot dipped galvanised finish to IS EN ISO 1461. Ladder stringers shall be 65mm x 12mm, 300mm apart with 20mm solid rungs at 300mm centres. Ladder stringers should be adequately supported from the manhole walls at intervals of not more than 1.5m. Stringers should be bolted to the support cleats to facilitate renewal. Alternatively, stainless steel fixed ladders may be required in accordance with Irish Water's requirements. These shall be fabricated from Grade X5CrNiMo 17-12-2 steel complying with IS EN 10088-3. Aluminium ladders shall not be provided. The base of all ladders shall be positioned on a horizontal landing platform. The tops of ladders shall be provided with proprietary fixings to extend the ladder above ground level, if deemed necessary. The centre line of the ladder rung shall be 150mm from the wall face within the manhole to align it with the roof slab opening. Manholes in excess of 6m depth shall be provided with intermediate landing platform(s) as part of an engineered access solution.Access to manholes is regarded as confined space access and shall be subject to a safety access plan. Manhole Steps are to be provided in manholes with depths up to 2.5m and in shallow chambers. Manhole steps shall comply with the requirements of IS EN 13101, Type D, Class 1. Galvanised mild steel step rungs, 20mm diameter, shall be provided with a plastic encapsulated finish. Steps rungs should be 300mm wide and located 300mm apart vertically. The vertical distance between the top of the manhole cover and the first step in the manhole shall not exceed 675mm. The distance between the bottom step and the benching shall not exceed 300mm. All step irons shall be centred under the access opening in the manhole roof slab. The centre face of the step rung shall be 120mm from the wall face within the manhole to align it with the roof slab opening.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting. Designers to eliminate the need to enter confined space. Where elimination is not practical, the Designer should ensure that the level of risk is as low as is reasonably practical. Ensure entry & exit can be achieved with as much ease as possible. Consideration to be given at design stage to the method of rescue in an emergency situation to allow for setting up of rescue equipment. Operatives to provide a back up fall arrest system and standby tripod in the event that there is a malfunction of the working access equipment. Refer to Additional Control Measures above for Section 3.11 in relation to confined space entry.	2	3	6	**Medium**
23	Design, Construction & Operation	Failure of structural integrity	Public Operation and Maintenance Construction Personnel.	**Section 3.12 Manholes** Manhole bases shall be constructed of cast in situ C30/37 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, with a minimum thickness of 225mm. Thicker Manhole bases are required for Sewers in excess of 3m deep or where the Manhole size is greater than the standard minimum size outlined above. Alternatively, precast concrete bases may be used, incorporating invert channels, benching, etc. in compliance with IS EN 1917 and IS 420, with the base thickness beneath the channel shall be at lease 150mm. Where precast concrete rings are used with cast-in-situ concrete bases, the bottom ring unit shall be cast into the base slab to ensure adequate sealing of the wall/base junction. The Manhole base shall be founded on a 75mm layer of C12/15 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
24	Design, Construction & Operation	Failure of structural integrity	Construction Personnel. Public Operation and Maintenance	**Section 3.12 Manholes** Manhole Walls shall be constructed of cast in situ concrete, C30/37 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, with a minimum thickness of 225mm. Thicker Manhole walls are required for Sewers in excess of 3m deep where the size is greater than the standard minimum size. Cast in situ concrete Manholes shall be used in all locations where there is a perched water table, where the Sewer is located next to a river, lake or other water body and within areas that are identified by the Office of Public Works Catchment Flood Risk Assessment and Management (CFRAM) with a flood risk of 1 in 10 years. Alternatively, precast concrete ring units shall only be used where the water table is low. The precast concrete units shall comply with the requirements of IS EN 1917 and IS 420, complete with a cast in situ formed concrete surround of 150mm minimum thickness of C20/25, 20mm aggregate size. The concrete surround to the precast concrete wall units shall only be omitted if the Manhole ring has a wall thickness of 125mm or more and where a proprietary watertight sealing system is provided as an integral part of the Manhole wall system, up to a maximum depth of 4.0m. The omission of the concrete surround shall only apply if the wall unit is not penetrated through with proprietary fixings which could result in the water tightness of the unit being compromised. In shallow Manholes, less than 1.2m deep, high density, high strength (20N/mm2), solid concrete block work walls may be used. The blocks shall be bedded in mortar, minimum M20 strength to IS EN 998-Part 2.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**
25	Design, Construction & Operation	Failure of structural integrity	Public Operation and Maintenance Construction Personnel.	**Section 3.12 Manholes** Manhole roofs should consist of a reinforced concrete slab of in situ C30/37 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, with a minimum thickness of 225mm, designed to carry all live and dead loads. Alternatively, precast concrete roof slabs, with a minimum thickness of 160mm, may be used in compliance with IS EN 1917 and IS 420. This approach would be the preferable option where pre-cast concrete ring units are used as Manhole walls. An access opening shall be formed in the Manhole roof slabs. The minimum dimensions of the roof opening shall be 600mm by 600mm or 600mm diameter. Circular Manhole openings of 600mm diameter may be used if the Manhole cover is circular. The opening in the roof slab shall be formed over the benching with the widest width at invert level.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**
26	Design, Construction & Operation	Failure of structural integrity	Construction Personnel. Operation and Maintenance	**Section 3.12 Manholes** Manhole inverts should be fitted with smooth flow channels to accommodate the flow from the inlet pipe(s) to the outlet pipe. For straight through Manholes, with similar size inlet and outlet Sewers, an open channel or half round pipe section, bedded in cement sand mortar, may be used. Otherwise, the Manhole invert should be formed with cast in situ concrete, C25/30 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, finished with a 1:3 cement sand mortar. Alternatively, pre-cast concrete bases, incorporating pre-formed channels and benching, may be used. Such units shall be in accordance with the provisions of IS EN 1917 and IS 420. Where pre-cast concrete Manhole inverts units, with multiple channels, are used, any redundant channels shall be blanked by scabbling the channel surfaces, filling with C25/30 concrete and finishing the surface to match the existing invert. Where there is more than one incoming Sewer discharging to the Manhole, the benching shall be so shaped as to guide the flow in the direction of the outgoing Sewer. The benching shall be brought up vertically at the flow channel to the level of the crown of the incoming Sewer. The benching shall slope away from the vertical edge at a slope of 1:30. The soffit crowns of the incoming and outgoing Sewers shall be kept at the same level. The flow channel shall be sloped gradually and evenly between the incoming and outgoing Sewer. Staggered toe-hole rebates, 200mm wide x 150mm high x 150mm deep, shall be provided in vertical invert benching at 300mm centres in channels of sewers of 450mm and greater to allow access from the benching to the channel invert.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**
27	Design, Construction & Operation	Access to confined space from manhole cover opening to the manhole. Failure of structural integrity	Public Construction Personnel. Operation and Maintenance	**Section 3.12 Manholes** Manhole shafts are required in deep Manholes where the Manhole plan dimensions are in excess of 1,200mm x 1,200mm plan area or 1,200mm diameter. The distance between the top of the benching and the soffit of the main roof slab supporting the shaft structure should be not less than 2.1m. The minimum internal dimensions of the access shaft shall be 1,200m by 1,200mm, or 1,200mm diameter. The corresponding opening in the main chamber roof slab shall be at least 1,200m by 1,200mm, or 1,200mm diameter. The walls shall be formed in reinforced C30/37 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, cast monolithic with the main chamber roof slab. The minimum thickness of the shaft walls shall be 225mm. The supporting roof slab shall be formed in reinforced C30/37 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, and shall be 225mm thick. Alternatively, approved precast concrete ring units complying with the requirements of IS EN 1917 and IS 420, may be used as Manhole shafts, complete with a cast in situ concrete formed surround of 150mm minimum thickness of C20/25 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting. Designers to eliminate the need to enter confined space. Where elimination is not practical, the Designer should ensure that the level of risk is as low as is reasonably practical. Ensure entry & exit can be achieved with as much ease as possible. Consideration to be given at design stage to the method of rescue in an emergency situation to allow for setting up of rescue equipment. Refer to Additional Control Measures above for Section 3.11 in relation to confined space entry. Operatives to provide a back up fall arrest system and standby tripod in the event that there is a malfunction of the working access equipment.	2	3	6	**Medium**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
28	Design, Construction & Operation	Failure of structural integrity	Construction Personnel. Operation and Maintenance personnel	**Section 3.12 Manholes** Rocker pipes shall be provided for rigid pipe at the entry to and exit from Manholes to form a flexible joint upstream and downstream of the Manhole structure. The length of rigid pipe stub that is built into the Manhole wall shall extend no further than 600mm from the inner face of the Manhole wall. The length of the next pipe, the rocker pipe, shall be varied in relation to the pipe diameter with lengths of 600mm for pipes of 150mm to 600mm diameter. This Code of Practice relates to pipe size up to 450mm. Where the pipeline is installed in ground which is varied or unstable, multiple rocker pipes may be required. If flexible pipes are being used, rocker pipes are not required.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. Design to be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**
29	Design, Construction & Operation	Failure of structural integrity Manual Handling	Construction Personnel. Public Road users Operation and Maintenance	**Section 3.12 Manholes** Manhole covers and frames shall comply with IS EN 124 and BS 7903 and be of suitable load grade, Class D400 (or E600 for heavy trafficked roads, as required on a case by case assessment basis) with a clear access opening of 600mm (square or circular). Covers shall be selected and designed to prevent the cover unit(s) falling into the chamber. Covers and frames shall be designed to be safely lifted with minimal risk of manual handling injury, suitable for use with lifting equipment and arranged to ensure rescue procedures are not impeded. Frames should be square or circular with a square or circular insert with a minimum clear opening of 600mm diameter/dimension. Class D400 shall either have a 100mm or a 150mm deep frame and Class E600 covers on heavily trafficked roads shall have a 150mm deep frame. All covers shall be of non-rock design and closed keyways shall be provided in each cover. Manhole covers may be single units or double triangular, the double triangular units shall incorporate a closed key in each unit. Hinged Manhole covers shall incorporate a locking mechanism to keep the unit upright when open. Third Party Certification shall be provided for all Manhole covers and frames. Manhole covers shall be set in position flush with the finished ground surface, whether road, pavement or open ground and shall have clear working space around the opening. The frame cover should be supported on Class B solid engineering brick, 215mm in width, to IS EN 771 – Part 2, one course minimum and no more than a maximum of three courses in height, set in mortar, minimum M30 strength to IS EN 998-Part 2:2010. Alternatively, pre-cast reinforced concrete seating rings set in mortar as above and of similar depth to brick courses and of similar concrete strength as the Manhole units may be used instead of brick where precast Manhole units and roof slabs are used. The Manhole cover frame shall be set in rapid hardening cementitious, epoxy resin or polyester resin mortar. The mortar shall have a minimum working time of 15 minutes and shall reach a minimum compressive strength of 30 N/mm2 and minimum tensile strength of 5 N/mm2 within 3 hours of mixing. Standard concrete blocks or bricks shall not be permitted. The cover frame should be installed and set to the manufacturer's instructions. The finish of the road surface around the Chamber cover and frame shall be to the requirements of the relevant Roads Authority for the area.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting. Designer to take account of health & safety in selection, designing & installing manhole covers & frames to address manual handling, access / egress, rescue etc. The Designer must ensure that the general principles of prevention (as well as all relevant Health & Safety Legislation) are taken into account when selecting & designing manhole covers & frames. Consideration must be given to the following risks relating to cover design: manual handling - means of safely lifting & moving the cover & eliminating / minimising risk of manual handling injury, ope protection (dependant on size) - access / egress - room to safely access rescue - room to safely rescue & also room to safely set-up rescue equipment etc. Proprietary lifting equipment should be provided to allow for safe lifting of chamber covers & this should be consistent to avoid risk of accidents due to misuse.	2	3	6	**Medium**
30	Design, Construction & Operation	Failure of structural integrity	Construction Personnel. Public Operation and Maintenance	**Section 3.13 Gravity Sewer Pipe Material Types & Section 3.14 Rising Main Pipe Material Types** The types and fittings outlined herein shall be used in the construction of the Gravity Sewers. Pipe material should not change between manholes. The list below shall not apply to pipes installed by pipe jacking or micro tunnelling. • Concrete; Concrete Sewer pipes with spigot and socket joints and rubber ring fittings shall comply with IS EN 1916 (2002), BS 5911, Part 1 (2002 – 2010) and IS 6 (2004) or equivalent standard, strength Class 120 with minimum crushing loads in accordance with Table 8 of BS 5911-1 (2002-2010). All pipes and fittings shall have gasket type joints of spigot and socket or rebated form. (Pipe diameters 225mm and above) • Thermoplastic Structured Wall Pipes; Thermoplastic structured wall pipes shall comply with the provisions of IS EN 13476 (2007/2009). Pipes shall be of Stiffness Class 8kN/m2 (SN8) and to be capable of demonstrating a jetting resistance of 2,600 psi (180 Bar) without damage when tested in accordance with Section 3.3 of WIS 4-35-01 (2008). (Sewer diameters 150mm up to 450mm, Service Connections of 100mm diameter). Pipe fittings of Stiffness Class 4kN/m2 (SN4) stiffness class, complying to IS EN 13476, will be acceptable if SN8 stiffness class fittings are not manufactured by the pipe manufacturer; • Unplasticised PVC; Unplasticised PVC pipes shall comply with the provisions IS EN 1401 2009/2012. Pipes to be application area code "UD", Stiffness Class 8kN/m2 (SN8). Provision for jetting shall be based on the WRc Sewer Jetting Code of Practice, June 1997. Pipes to be capable of resisting a maximum jetting pump pressure of 2,600psi (180 Bar) without damage. (Sewer diameters 150mm up to 450mm, Service Connections of 100mm diameter). Pipe fittings of SN4 stiffness class, complying to IS EN 1401, will be acceptable if SN8 stiffness class fittings are not manufactured by the pipe manufacturer; • Other; The use of alternative pipe types and materials will require the prior written agreement of Irish Water. The pipes types and fittings outlined herein shall be used in the construction of Rising Mains. Pipe material should not change along the Rising Main length. • Ductile Iron; Ductile iron pipes and fittings for Wastewater shall comply with the requirements of IS EN 598. The pipes and fittings shall be cement lined internally and zinc coated with an approved bituminous coating externally. Ductile iron pipes may require plastic sheeting protection in adverse ground conditions in accordance with BS 6076; • Polyethylene; Polyethylene pipe and fittings for Wastewater shall comply with the requirements of IS EN 12201. Polyethylene fittings, including fusion joints and electro-fusion fittings, shall comply with the provisions of IS EN 12201 – Part 3 Polyethylene pipes shall also conform to the following UK Water Industry Specifications (WIS): WIS 4-32-08 – Specification for the Fusion Jointing of Polyethylene Pressure Pipeline Systems Using PE80 and PE100 materials; IGN 4-32-18 – The Choice of Pressure Rating for Polyethylene Pipe Systems for Water Supply and Sewerage Duties; IGN 4-01-03 – Pressure Testing of Pressure Pipes and Fittings for use by Public Water Supplies.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
31	Design, Construction & Operation	Failure of structural integrity	Construction Personnel. Public Operation and Maintenance	**Section 3.16 Pipe Joints** Pipe joints shall be in accordance with the manufacturer's requirements for the pipe material. Pipe joints will generally be one of the following: • Push in rubber ring joint; • Bolted flanged joint; • Flexible mechanical coupling with protective coating; • Fusion welded joints where the site fusion jointing shall be strictly in accordance with UK WIS 4-32-08, 2016 (Specification for Fusion Jointing of Polyethylene Pressure Pipeline Systems Using PE80 and PE100 Materials) and with BS ISO 21307:2017 (Plastic Pipes and Fittings – Butt Fusion Jointing Procedures for Polyethylene (PE) Piping Systems. • Equipment used for butt fusion and electrofusion welding shall be in accordance with BS ISO 12176 (Plastic Pipe Fittings – Equipment for Fusion Jointing Polyethylene Pipe Systems – Part 1 Butt Fusion, Part 2 Electro Fusion). • Equipment used for butt fusion and electrofusion welding shall have CE Certification and shall be calibrated on a 6-monthly basis. Bolted flanged joints shall have raised face flanges complete with nuts and bolts to IS EN ISO 898 and double metal washers to BS 4320. Nuts, bolts and washers to be protected against corrosion in accordance with WIS 4-52-03. Flange assemblies, including nuts, bolts, washers and gaskets to be designed to meet a working and test pressure of 16 bar and 24 bar respectively. All pipes and joints will be subjected to appropriate pressure tests as outlined in Section 4.10 and Section 4.11 of the Codes of Practice for Wastewater. Each installation team and welding equipment unit will be audited by the Irish Water field engineer prior to commencement of welding on site and on a regular basis thereafter. Where it is deemed necessary by the field engineer, Irish Water may require or instruct the Developer to procure an audit from an independent accredited auditor. The audit reports from this independent auditor shall be provided to the Irish Water field engineer on a regular basis. Each installation and welding team shall also be audited by the Developer's Construction Engineer on a weekly basis or more frequently if required by the Irish Water field engineer. All of these audits will use a standard checklist to ensure that all the correct equipment and working practices are being utilised. Weekly equipment checks and regular supervision of the welding equipment shall be carried out by the Developer and reports on these checks will be inspected by the Irish Water field engineer. The destructive weld testing and analysis shall be carried out by a specialist and accredited testing organisation who will take the samples, deliver the sample for testing, test the joint and report on the result, thus ensuring that a chain of custody is maintained on all test samples. The Developer's contractor shall provide details of his proposed testing organisation to the Irish Water field engineer for review and approval prior to any testing being undertaken. Joint tests complying with WIS 4-32-08, (2016) shall be carried out for each pipe diameter containing electro fusion welds used by the Developer's contractor's personnel and welded by the equipment to be used for Works. These shall be in accordance with ISO 13954 for assembly socket fittings > 90mm, in accordance with ISO 13955 for assembly socket fittings < 90mm and in accordance with ISO 13956 for saddle assemblies. Where possible, at least 6 strips should be taken from a welded coupler for testing with a lower number of strips taken for smaller diameter units. Samples shall be cut from each end of the joint spaced at equidistant intervals around the joint circumference. Similarly, joint tests complying with WIS 4-32-08, (2016) (in accordance with ISO 13953) shall be carried out for each pipe diameter containing butt fusion welds used by the Contractor's personnel and welded by the equipment to be used for Works. The tests shall be undertaken by an independent laboratory accredited by the Irish National Accreditation Board or equivalent. Reports, in a format acceptable to Irish Water, on these tests shall be provided to the Irish Water field engineer for review. Prior to the commencement of polyethylene pipe laying works, pipe joint sample testing shall be carried out for all pipe sizes to be used in the Works. One initial sample test butt-fusion weld per designated butt-fusion crew and one initial sample test electro-fusion weld per designated electro-fusion crew shall be cut and taken for testing. These shall be taken for each pipe size per designated crew on pipes that are to form part of the Works. During the installation of pipework, butt fusion welds and electro-fusion welds shall be cut out from the polyethylene pipes associated with the Works completed and shall be subjected to a destructive test, in accordance with the test procedures in WIS 4-32-08 (2016), as outlined above. The weld joint chosen for testing will be as indicated by the Irish Water field engineer. All weld samples shall be clearly labelled and referenced. The rate of testing of the joints shall be as follows: • A minimum of one butt-fusion weld per designated butt-fusion crew per week and one electrofusion weld per designated electrofusion crew per week shall be cut out from the polyethylene pipes associated with the Works and tested. This minimum frequency of destructive testing shall be increased as directed by the field engineer if recurrent failure rates occur or if issues arise from auditing of welding crews and equipment. The sample test frequency is additional to the works test frequency outlined above. • In addition to the initial and weekly weld joint testing outlined above, testing of the installed pipe joints shall be undertaken on joints as selected by the Irish Water field engineer. The frequency of joints testing on the polyethylene pressure main that has been installed in the Works shall be at least one test per 30 joints made on site, with a minimum of five tests in smaller developments, or as directed by the field engineer. The test joint shall be chosen at random by the Irish Water field engineer. All tests shall be carried out at the expense of the Developer and this shall include for all costs associated with the taking of, testing, analysis of and transportation of samples as well as the required reporting of the test results. All costs associated with auditing shall also be at the expense of the Developer. The Contractor shall arrange for the selected installed joint samples to be tested in accordance with WIS 4-32-08, IS EN 12201 – Part 5, and with ISO 13953, ISO 13954, ISO 13955 and ISO 13956 (as appropriate and listed above) by an accredited laboratory (accreditation by the Irish National Accreditation Board or equivalent) and a test report, in a format required by Irish Water, shall be provided to Irish Water's field inspectors within 1 week of the sample joint being taken. The report should indicate the test result, the failure mode of samples (Wasted Specimens), the specific joint identification data (Welders Name, Joint Number, Weld Date, Machine I.D, Date that the sample joint was received by Testing Facility) on the test report and results, along with clear photos of the joints prior to sampling with the Irish Water field engineer's signature present on the pipe, photos of the tested wasted specimens and in addition particular photos of any individual wasted specimens that were classified as a failure. Where welds have failed, the Contractor shall excavate, cut out, and provide the welds carried out immediately before and immediately after the failed joint for additional testing. The Contractor shall note that if the results of any of these two additional weld tests indicate that a weld is not in compliance with WIS 4-32-08, i.e. a weld failure, then the Developer shall be required, at his/her own expense, to remove and replace all welds from the date of the last verifiable weld test found to be in compliance with WIS 4-32-08, performed by the particular welding machine and designated crew who completed the weld that failed. The welding machine and designated crew shall be prohibited from performing further welds until they have undertaken and passed a second site audit. If any additional work undertaken by designated crew is persistently at fault, they shall be prohibited from undertaking further welds until re-training shall be carried out. All butt fusion joints shall be de-beaded and the bead referenced and kept for inspection. Beads shall be examined upon removal for signs of defects or splitting along the length of the bead joint. For butt fusion welding, completed welds shall be de-beaded and the weld bead shall be inspected on site by the welding crew. Beads shall be labelled, bagged and stored by the Developer's contractor and access shall be provided to the Irish Water field engineer to inspect the weld beads when requested. The provision of the sample and all costs associated with their provision including restoring the pipe to service and reinstatement will be borne by the Developer. Untested sample welds shall be properly catalogued and stored by the Developer until the end of the Defect Liability Period. The sample welds thus stored shall remain the property of Irish Water and shall be made available to the Irish Water's field inspectors at any time for testing should it be so directed. Pipe coils will only be permitted to be used for pipe diameters of 125mm OD and below. Pipe ovality on coiled pipes can have a detrimental effect on the integrity of electrofusion joints on both socket and saddle type fittings. Hydraulic re-rounding clamps and steel re-rounding inserts must be used to permit a straight length of pipe to be electrofusion jointed to the ends of the coil. The pipe profile within the area of the coil to be jointed shall be re-rounded to within the limits of ovality prescribed by BS EN 1201-3. A coil of PE pipe length with a diameter greater than 100mm OD shall require the use three electrofusion couplers to joint any additional PE coil length to it. Two lengths of straight stick PE pipe (min length 500mm) shall be used to join the coils together. A coupler shall join the straight sticks to the ends of each coil, a third coupler shall then be used to electro fuse the straight sticks sections together. Coils of PE pipe lengths with diameter less than 100mm OD shall be joined by using two electrofusion couplers to joint one length of straight stick PE pipe (min length of 500mm) between them. All pipe joints, fittings and accessories shall be free from lead. In advance of commencing pipe installation on site, the Developer shall provide a specific method statement to the Irish Water field engineer for review/assessment outlining the butt fusion and electrofusion jointing processes for polyethylene pipes that will be carried out on site. This shall be additional to the requirements for Method Related Statements as set out in Section 2.3.16 above. . The Developer shall adopt and follow any and all applicable quality control procedures for all joints on polyethylene pipes for both butt fusion and electrofusion as well as for mechanical jointing systems. In addition, the Developer shall also follow the manufacturer's requirements but these shall not take precedence over good site practices. Butt fusion and electro fusion jointing of polyethylene pipes shall only be carried out by appropriately trained and experienced operatives in possession of a current relevant Training Certificate. Training should be certified and equivalent to City and Guilds qualifications. Jointing personnel shall have, and be able to confirm, a minimum of one year's experience in successfully completing pipe welding under "live" construction conditions. Jointing shall be completed using fully automatic or pre-approved jointing machine/rigs in accordance with the manufacturer's instructions. In relation to electro fusion jointing, the jointing machine shall incorporate a remote inspection/monitoring system, which allows for real time inspection of the weld integrity or a data download facility. The identity of the polyethylene (PE80, PE100) pipeline manufacturer shall be made known to Irish Water prior to commencement of the installation. Certification and testing (including independent third party certification) shall be provided to confirm quality assurance compliance. Each joint shall be clearly marked with the joint logged automatically on the jointing machine in a format to the satisfaction of the Irish Water field engineer.. A printout of the joint details, with an as-built drawing complete with GPS location and geo-located photograph of each joint, shall be provided and retained for quality assurance purposes. In addition to the data log report, the welders own record / ledger must also be maintained and provided as part of the quality assurance documentation. All fusion welds shall be undertaken in an enclosure (e.g. tent) to minimise the effects of wind and rain on the jointing process and to prevent contamination from wind borne dust. All personnel carrying out pipe jointing shall have appropriate training in health and safety and shall follow all safety procedures laid down for welding.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
32	Maintenance and other works being carried out on the sewerage line.	Operation	Operation and Maintenance Public	**Section 3.17 Rising Main Fittings + 3.18 Sluice Valve, Scour Valve and Air Valve Chambers** All fittings to Wastewater Rising Mains, including sluice valves, scour valves, air valves and meters shall be operable without the need to enter chambers or other confined spaces. The fittings shall be suitable for use with untreated Wastewater flows. All fittings shall be designed and constructed to the standards outlined within the IW Water Code of Practice for Wastewater Infrastructure, Section 3.17, Rising Main Fittings. Sluice valve, scour valve and air valve chambers for rising mains shall be in accordance with the requirements of the IW Water Code of Practice for Wastewater Infrastructure, Section 3.18.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**
33	Operation	Striking a utility	Operation and Maintenance Public Construction Personnel. Other utility companies including operatives	**Section 3.19 Existing Utilities + Section 4.3 Location of Other Utilities** It is the responsibility of the Developer and / or designer to obtain all current information on the location of other existing utility providers' apparatus prior to the design being carried out. During installation, due diligence should be used when making excavations for Sewers and services and care shall be taken to protect and support all existing services (water, gas, telecommunications, drainage, electricity, etc.) and other works so as not to interfere with the working arrangements and integrity of such utilities. As part of the Design Submission at the Application Stage, the Developer is required to submit an integratged utility layout plan showing the layout of all utility infrastructure and indicating the relative seperation distances between the various utility infrastructure. All available records should be used to identify the location of utility ducts, cables, pipes, etc. Proprietary cable locators shall be used prior to excavation taking place to locate and mark these utilities. Precautions shall be taken when making excavations for pipes and services to ensure no damage is caused to existing services. Care shall also be taken to protect and support all existing services and other works so as not to interfere with the working arrangements of the services.	3	4	12	**High**	It is the responsibility of the Developer and / or designer to obtain all current information on the location of other existing utility or service providers' apparatus prior to the design being carried out. During installation, due diligence should be used when making excavations for wastewater systems and services and care shall be taken to protect and support all existing services (water, gas, telecommunications, drainage, electricity, etc.) and other works so as not to interfere with the working arrangements and integrity of such utilities.	2	2	4	**Low**
34	Design, Construction & Operation	Damage to the Environment	General public	**Section 3.21 Environmental Considerations** The design should take into account the impact of the Works on the environment and the impact of the environment on the Works. Cognisance should be taken of amenity conservation, preservation of access to the public and facilitation of recreation when designing infrastructure. Consideration should also be taken of areas of specific ecological interest such as Special Area of Conservation (SACs), National Heritage Area (NHAs), etc. Developer to provide all statutory and other consents and comply with all Irish Legislation. The design of landscaping works shall be undertaken concurrently and in conjunction with the design of the Works. The collaborative design process shall incorporate and take account of any likely assessed negative impact(s) on the root zones and root protection areas of trees and/or large shrubs on the Works. The design process shall seek to minimise risk to roots and the risk of root ingress to the Works by appropriate separation distances or by the provision of root protection barriers.	2	3	6	**Medium**	It is the responsibility of the Developer and/or designer to obtain all current information on the location of other existing utility or service providers' apparatus prior to the design being carried out. During installation, due diligence should be used when making excavations for wastewater systems and services and care shall be taken to protect and support all existing services (water, gas, telecommunications, drainage, electricity, etc.) and other works so as not to interfere with the working arrangements and integrity of such utilities. The installation of any new pipework or the planting of new tree vegetation within the vicinity of existing pipe systems will need to take account of the provisions of BS 5837 and BS 8545.	2	2	4	**Low**
35	Transportation, Storage, Handling and Use of Materials	Falls from height of materials & persons Being struck by pipes / materials Traffic Management Failure of slings and ropes.	Public Construction Operatives	**Section 4.2 Transportation, Storage, Handling and Use of Materials** Precautions shall be taken to prevent damage to pipes and fittings during transportation, storage, handling and use of materials. Suitable pipe supports shall be used on vehicles transporting pipes to prevent damage to both internal and external coatings by impact, scratching, abrasion, etc. Purpose made wide fabric slings or suitably designed machines for lifting pipes shall be used during offloading and/or laying of pipes (particularly flexible pipes with concrete or cement-mortar linings) to avoid damage and scratches to coatings as well as damage to pipe ends. Damaged pipes shall not be used in the Works. All pipes and fittings shall be stored off the ground in a clean environment to prevent any contamination of the material prior to its use. Timber supports shall be used during transportation and stacking on site. Pressure pipes shall be capped at either end until they are used in the Works to prevent vermin and debris entering them and contaminating the material before their use. All fittings shall be supplied in sealed bags and they shall remain in these bags until immediately prior to installation. All pipes and fittings (and in particular plastic pipes) should be kept clear of fuel oils, and any material which becomes contaminated should be discarded. Materials and components shall be handled in such a manner as to avoid any damage or contamination and in accordance with the applicable recommendations of the manufacturers. Pipes and fittings, including coatings and linings, shall be examined for damage prior to installation in the works. Plastic pipes shall be carefully examined for flaws, in particular for signs of impact damage and scoring. No polyethylene pipe shall be installed with scores or cuts penetrating more than 10% of the wall section thickness. If, after installation, scores or cuts penetrating more than 10% of the wall section thickness are found, the affected pipe length(s) shall be removed and replaced with an undamaged pipe length.	3	4	2	**High**	Risks associated with the transportations, storage, handling and use of materials to be risk assessed at design and construction stage taking into account the particular conditions associated with the site. All works to be carried out in accordance with the Safety, Health and Welfare at Work (Construction) Regulations. All lifting equipment to be certified in line with legislation. Plant operatives to have appropriate training. All design to be carried out by competent designers. Design co-ordination required by competent PSDP. Construction operations to be co-ordinated by competent PSCS. All lifting equipment and accessories to be marked with a safe working load (SWL). All lifting equipment and accessories shall be inspected, tested and certified in accordance with the safety certificate requirements..	2	2	4	**Low**
36	Construction of sewer line	Trench collapse	Construction operatives Public	**Section 4.4 Trench Widths** The trench width shall be kept as narrow as possible but the width must allow adequate room for pipe jointing as well as placing and compaction of pipe bedding, haunch, surround and backfill material. Trench widths at the level of the top of the pipe should generally be as narrow as safe working conditions will allow, with a desirable minimum width of 300mm plus the external diameter of the pipe barrel, or a minimum trench width of 500mm. The trench width should not exceed the pipe diameter by more than 500mm. Trench widths for pipe sizes up to 80mm diameter may be less than 500mm subject to consideration being given to the trench depth, health and safety consideration and access requirements. In ground that contains ashes, chemicals or material that could accelerate corrosion or deterioration of the pipe, contact shall be made with the Environmental Protection Agency in relation to contaminated soil disposal requirements. Edges of trenches in bituminous or concrete roads, footpaths and hard surfaces shall be cut using a concrete saw or other equivalent mechanical means in advance of breaking through the paved surface above the trench position. This shall be carried out in all instances to reduce damage to the remaining hard surface and to restrict over-break of the trench.	3	4	12	**High**	Risks associated with the trench works to be risk assessed at design and construction stage taking into account the particular conditions associated with the site, depth of trench, requirement to use trench boxes, stepping back of trench edges, etc. All works to be carried out in accordance with the Safety, Health and Welfare at Work (Construction) Regulations. All design to be carried out by competent designers. Design co-ordination required by competent PSDP. Construction operations to be co-ordinated by competent PSCS. Excavations shall be carried out in accordance with the requirements of the HSA booklet "A guide to safety in excavations" and the Safety, Health and Welfare at work (construction) regulations 2006. In particular all excavations shall be assessed and appropriate protection against collapse and falling materials shall be put in place.	2	3	6	**Medium**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
37	Construction of sewer line	Trench Settlement Damage to Network	Public Operation and Maintenance Road Users Construction Personnel.	**Section 4.7 Pipe Bedding, Haunch and Surrounds** Pipe bedding, haunch side fill and surround material for buried pipelines shall comply with WIS 4-08-02 and its associated Guidance Note, IGN 4-08-01, UK Water Industry Specifications, both updated in 2008. Granular material shall be 14mm to 5mm (designation d/D 2/14) graded aggregate or 10mm (designation d/D 4/10) single sized aggregate, complying with the requirements of IS EN 13242 and should have a compaction factor value not greater than 0.2 when measured in accordance with IS EN 752. Both the 14mm to 5mm (designation d/D 2/14) graded aggregate and the 10mm (designation d/D 4/10) single sized aggregate may be used for pipe diameters greater than 100mm and up to 300mm. The 10mm (designation d/D 4/10) single sized aggregate should be used with 100mm pipes or less. The 14mm to 5mm (designation d/D 2/14) graded aggregate is to be used for pipe diameters of 350mm and above. Pipes shall not be supported on stones or rock at any point along the pipe trench. Rock shall be excavated to a depth of 150mm below the pipe invert of the trench required and the void backfilled with Clause 804 granular material in accordance with the Transport Infrastructure Ireland (formerly National Roads Authority) Specification for Road Works. The granular bedding material shall be laid above this void backfill material. All Sewer pipes and Rising Mains, either rigid or flexible, shall be laid on a bed of granular material. A minimum bed thickness of 100mm shall be provided for pipes up to 100mm diameter. A minimum bed thickness of 200mm shall be provided for pipe diameters between 150mm and 450mm. Rigid pipes, as a minimum, will be provided with a haunch of granular material to half the pipe diameter height. Flexible pipes shall have a haunch of granular material and an additional surround of granular material from the top of the granular haunch to a minimum depth of 150mm above the crown of the pipe. Bedding and haunch side fill of granular material should be placed uniformly underneath and on either side of the pipe, in layers not exceeding 100mm, each layer being compacted by non-mechanical tamping until the required depth of bedding and side fill has been achieved. Where a full granular pipe surround is required, it should be placed above the side fill material in a similar fashion to bedding and side fill. Surround material shall be installed to the required depth above the pipe crown. The minimum depth of pipe surround material above the external crown of the pipe shall be 150mm at least. This depth shall be increased to 300mm where pipes are located adjacent to trafficked areas or where they are installed along roads and footpaths. Care should be taken that the process of placing of the bedding, side fill and surround material does not displace the pipe from its correct line and level. Where the Sewer or Rising Main is installed along roads and footpaths the minimum cover of granular surround material should be 300mm above the crown of the pipe, irrespective of the pipe being either rigid or flexible. The pipe trench above the granular surround in this instance shall be backfilled in accordance with the requirements of Section 4.8 below for road and footpath areas. If a Water Main is installed in a green field area the minimum cover of granular surround material should be 200mm above the crown of the pipe and the Backfill shall be in accordance with Section 4.8 below for green field areas. Pipe protection measures may be required to address impact from loading in heavily trafficked areas and to address minimum pipe cover situations. The detail shall be subject to submission to and assessment by Irish Water before advancing with the work. If the depth of cover to the crown of the pipe is less than the values set out Section 3.9, protection measures shall be provided. Consultation with Irish Water is required in relation to the provision of these measures. In order of precedence, the protection measures may comprise either the provision of a reinforced concrete slab designed to spread the imposed traffic load away from the pipe, or the provision of full concrete surround, complete with flexible joints, where required, or the use of a ductile iron pipe in lieu of the original pipe material, provided there are no service connection in this length of pipe. These alternative protection measures shall extend for the distance where the depth is below the depth limits outlined above. A combination or a mix of all of these additional protection measures may be required and are to be agreed with Irish Water. However, the primary approach should be to provide the pipe with the required depth of cover as outlined in Section 3.9.1 to 3.9.6 of the Codes of Practice for Wastewater. The protection slab shall be a minimum of 150mm thick and constructed of C20/25 concrete to IS EN 206 and reinforced with high tensile reinforcement to BS 4449. Concrete bed, haunch and surrounds of pipes shall be a minimum thickness of 150mm away from the external wall of the pipe with an absolute minimum depth of cover above the external crown of the pipe of 750mm. The concrete should be C16/20, in accordance with IS EN 206, 20mm aggregate, in accordance with IS EN 12620, with a vertical haunch to the mid-point of the pipe, in the case of bed and haunch and vertical faces to the full surround. The haunch and surrounds shall be formed using formwork to provide a rough cast finish. Expansion joints in the concrete surround shall be provided at all joints to allow for pipe flexibility. The use of a ductile iron pipe in lieu of the original pipe material for the distance where the depth is below limits outlined may also be acceptable, provided the depth above the crown is not less than 750mm. Where soft ground conditions (situations where a California Bearing Ratio (CBR) less than 5 exists) are anticipated or encountered, the soft material shall be excavated and disposed to an approved disposal area, in accordance with the Waste Management Act. Clause 804 granular material, in accordance with the Transport Infrastructure Ireland (formerly National Roads Authority) Specification for Road Works, shall replace the entire extent of the excavated material. Approved geo-textile wrapping shall be provided to this additional backfill. Alternatively, special pipe support arrangements, including piling, beam supports, etc., may be required where the depth of soft material is excessive. Such arrangements relating to soft fill material replacement and/or pipe supports shall be subject to submission to Irish Water of detailed proposals for review and a response from Irish Water indicating agreement is required before advancing with the work.	2	4	12	**High**	IW CDS Design Team to vet the submitted design and may require its amendment if deemed inadequate. All design to be carried out by competent designers. Design co-ordination required by competent PSDP. Construction operations to be co-ordinated by competent PSCS. IW CDS Field Engineers will undertake site inspections during installation. IW CDS Field Engineers will vet the final installed infrastructure prior to vesting. Risks associated with pipe bedding, haunch and surrounds to be risk assessed at design and construction stage taking into account the particular conditions associated with the site. All works to be carried out in accordance with the Safety, Health and Welfare at Work (Construction) Regulations.	2	3	6	**Medium**
38	Construction of sewer line	Settlement of ground surface above the sewer / pipeline	Construction Personnel Public	**Section 4.8 Backfill** Backfill materials shall be placed above the granular surround material described in Clause 4.7 of the Code of Practice for Wastewater Infrastructure up as far as the underside of the road construction. The Backfill material shall comprise Clause 804 granular material, in accordance the TII "Specification for Road Works", and it shall be used where the Water Main is installed along proposed roadways and footpaths in the Development. If the backfill material is within 500mm of a concrete pipe of structure, Clause 808 material shall be used instead of Clause 804 material. The use of Clause 804/808 Backfill material shall also apply where the trench is in green areas running within 500mm of roadways and footways. The Backfill material shall be placed in layers not exceeding 200mm, each layer being compacted to the requirements of the TII Specification for Road Works. The first layer of backfill above the granular surround shall be compacted in 150mm layers. Mechanical compaction equipment shall not be used until there is a minimum of 450mm of compacted material above the crown of the pipe. Alternative Backfill material to that described above (Clause 804 or Clause 808) of the pipe trench will only be allowed by Irish Water where the Roads Authority in whose functional area the Development is located provides written approval to the Developer for the use of such alternative acceptable material. Evidence of this written approval to use alternative acceptable Backfill material shall be provided to Irish Water in advance of the commencement of construction on site or in advance of the issue of the Connection Agreement, provided construction has not commenced on site. The relevant Roads Authority should specify this alternative acceptable Backfill material and this should require compliance with the definition of "acceptable material" as outlined in Clause 601 of the TII "Specification for Roadworks, Series 600 – Earthworks", Table 6/1, with the specific Class of "acceptable material" clearly nominated by the relevant Roads Authority in the written approval. Backfill to the pipe trench above the pipe granular surround material and beneath the road surface in Public Roads shall be to the requirements of "Guidelines for the Opening, Backfilling and Reinstatement of Trenches in Public Roads", Second Edition, or subsequent amendments published by the Department of Transport, Tourism and Sport, unless otherwise specified and to the requirements of the relevant Road's Authority's Road Opening Licence. The opening, backfilling and reinstatement of trenches on National Roads shall be in accordance with the TII "Specification for the Reinstatement of Openings in National Roads" July 2011, unless otherwise specified. In the case of any discrepancy between this Code of Practice and the "Guidelines for the Opening, Backfilling and Reinstatement of Trenches in Public Roads" or the TII "Specification for Road Works" where pipes are located in Public Roads, this Code of Practice and their associated Standard Details shall take precedence. Selected excavated material may be used as trench backfill in green-field areas above the granular pipe surround material with the approval of Irish Water. This selected back fill shall comply with the requirements of "acceptable material" as outlined in Clause 601 of the TII "Specification for Roadworks, Series 600 – Earthworks", Table 6/1, Class 8, Class 2 (Miscellaneous Fill) and is generally referred to as Type B fill. It shall be uniformly compactable material free from clay lumps greater than 75mm, stones greater than 40mm, tree roots, vegetable matter, any kind of building rubbish, etc. This material shall be placed in layers not exceeding 300mm in depth and compacted in accordance with the Transport Infrastructure Ireland (formerly National Roads Authority) Specification for Road Works. Where Sewer pipelines are installed traversing a public road, the backfill material above the granular surround shall comprise cement bound granular material (CBGM), Category B, in accordance with the TII "Specification for Road Works", Series 800.	3	4	12	**High**	All design to be carried out by competent designers. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. IW CDS Design Team will vet the submitted design and may require its amendment if deemed inadequate. IW CDS Field Engineers will undertake site inspections during installation. IW CDS Field Engineers will vet the final installed infrastructure prior to vesting. Risks associated with backfilling the pipe trench to be risk assessed at design and construction stage taking into account the particular conditions associated with the site. All works to be carried out in accordance with the Safety, Health and Welfare at Work (Construction) Regulations.	2	3	6	**Medium**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
39	Construction of rising mains	Failure of rising main under pressure at bends, fittings and accessories.	Construction Personnel Operation and Maintenance personnel Contractors carrying out works in the future Public	**Section 4.9 Anchor/Thrust/Support Blocks for Rising Mains** Gentle curves may be formed in the Rising Main pipeline by angular deflection of the pipe joint. The maximum angular deflection of each joint shall not exceed the manufacturer's recommendation. At the locations detailed below, where pipes need to be restrained against movement under pressure, concrete thrust blocks shall be provided. Concrete thrust blocks shall be positioned symmetrically with respect to the connecting pipe or bend. Appropriate thrust blocks shall be designed and installed on Rising Mains where required. Except where welded polyethylene pipes or self-anchoring joints are used, thrusts from bends and branches in Rising Main shall be resisted by concrete thrust blocks cast in contact with undisturbed ground. The thrust blocks shall be designed in accordance with CIRIA Report 128, "Guide to the Design of Thrust Blocks for Buried Pressure Pipelines". The requirements for thrust blocks for polyethylene pipes shall be based on the manufacturer's advice. Anchor and support blocks shall be constructed with concrete, C20/25, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620. The thrust blocks shall be formed using formwork to provide a rough cast finish. Anchor/thrust blocks shall be provided on Rising Mains at bends of curvature of 11.5 degrees or greater, at both sides of air valve chambers, at any abrupt change in vertical or horizontal direction, at scour fittings and at any location where liquid pressure is likely to distort the pipe line installation or cause disproportionate movement. Plastic and polyethylene pipes shall be wrapped in a compressible filler board, in accordance with IS EN 622-1 and IS EN 622-4, with an outer plastic sheeting having a composition in accordance with BS 6076 before being cast against or into anchor/thrust blocks. Concrete support blocks shall be cast to scour valve tees and air valve fittings installed on polyethylene pipe lines in order to resist torque forces imposed on the fittings during operation. Anti torque support blocks will only be required on sluice valves associated with ductile iron pipe fittings of 150mm and above. Support blocks shall be cast so as not to interfere with the operation and maintenance of the apparatus. In general support blocks shall not cover pipe or fitting joints. Where this is unavoidable, the fittings/bolts shall be wrapped in protective, non-biodegradable, tape. All thrust/anchor/support blocks shall be allowed to develop adequate strength before any internal pressure is applied to the pipeline. Support blocks of concrete grade C25/30, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, or special pipe support arrangements, including piling, beam supports, etc., are required where Rising Main pipes are laid in boggy or swampy conditions. Special support blocks are also required to anchor pipes where gradients are 1:6 or greater. Design of supports, piles, ground beams should be provided to Irish Water for assessment and review and additional information may be required to complete this assessment. Pipe joints shall allow for longitudinal movement due to thermal effects and thrusts due to internal pressure. The Developer shall advise and seek review by Irish Water's Connection and Developer Services where it is proposed to install rising mains with gradients that are steeper than 1:10. Alternative gradient proposals may be required in such instances. While anchorage is required to resist thrust, it is not necessarily required at junctions or bends where a fully integrated fusion weld PE pipe system is in place. However, the provision of suitable anchors at bends in excess of 22.5 degrees on fully integrated fusion weld PE pipe systems shall be provided in accordance with the pipe manufacturer's recommendations and requirements. Compressible filler board, in accordance with the provisions of IS EN 622, Part 1 to Part 4, wrapped in plastic sheeting having a composition in accordance with BS 6076, shall be provided for protection between the concrete and the polyethylene pipe. Bituminous material shall not be allowed come in contact with polyethylene pipes.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. IW CDS Design Team will vet the submitted design and may require it's amendment if deemed inadequate. IW CDS Field Engineers will undertake site inspections during installation. IW CDS Field Engineers will vet the final installed infrastructure prior to vesting.	2	3	6	**Medium**
40	Testing of Sewers and Manholes	Failure of the testing equipment causing personal injury, damage to the sewer, manhole and having an environmental impact.	Construction Personnel Operation and Maintenance personnel Contractors carrying out works in the future Public	**4.10 Testing of Gravity Sewers and Manholes** The Works shall be tested by the Developer as work progresses and on completion of construction of specific pipe lengths. The main pipeline shall be air or water tested in accordance with the requirements of IS EN 752 and IS EN 1610. On completion of the construction works, all pipelines shall be thoroughly cleaned and all deleterious material removed. The test of Gravity Sewers and Manholes shall be conducted in the presence of representatives of Irish Water or its agents. A Gravity Sewer condition survey (CCTV) shall be carried out by a competent inspection contractor in accordance with Section 1.9 above. The pipe test shall be conducted after the Gravity Sewer is installed and jointed and before any concreting or backfilling commences. A further test will be carried out after the backfilling is completed and a further test may be requested after any connections have been made to the Sewer system. The air test shall be carried out in accordance with IS EN 1610, to either LA or LC requirements as outlined in Table 3 of IS EN 1610. The LA air test will generally be applied and involves the pumping in of air to the gravity pipework until a pressure of 100mm of water is indicated on a U-tube connected to the system. The pipe is left to stand for 5 minutes to permit pressure stabilisation before commencement of the test. A drop of less than 25mm over a period of a further 5 to 7 minutes, depending on the pipe diameter, without further pumping, will give rise to a positive test result. An air test to LC standards as outlined in Table 3 of IS EN 1610 will be required where the water table is likely to be high. This involves the pumping in of air to the gravity pipework until a pressure of 1000mm of water is applied. The pipe is left to stand for 5 minutes to permit pressure stabilisation before commencement of the test. A drop of less than 150mm over a period of a further 3 to 4 minutes, depending on the pipe diameter, without further pumping, will give rise to a positive test result. The air test shall be conducted in the presence of an Irish Water field engineer or an Irish Water agent's supervisor. Failure of the air test is not conclusive when failure does occur, a CCTV survey shall be carried out to identify the defect in the Gravity Sewer indicates the repairs required. Following the rectification of the defect, a water test shall be carried out. Acceptance or rejection of the pipe shall be based on the results of the water test. The water is to be carried out in accordance with the requirements of I.S. EN 1610. The water test involves the filling of the pipeline to a depth of 1.0m above the crown at the high end Manhole of the pipe while ensuring that the water level above the crown of the pipe at the lower end does not exceed a depth of 5.0m. Steeply graded pipelines shall be tested in stages in cases where the maximum head, as stated above, would be exceeded if the whole of the section were tested in one length. The pipeline should be filled with water and allowed to stand for a minimum period of one hour after filling to allow absorption, topping up as necessary to the original level, before starting the test. The test shall be conducted for a period of 30 minutes. The rate of water loss shall not exceed 0.15 litres/m2 (m2 refers to the total area of the wetted internal surface) where pipelines are tested on their own. On that basis the maximum water loss for a 100m length of Sewer over the test period would be 7.5 litres for a 150mm pipe, 11.5 litres for a 225mm pipe, 15 litres for a 300mm pipe, etc. This threshold water loss may be interpolated from the above for the various lengths of the Sewer under test between Manholes. Where pipelines and Manholes are tested together, the rate of water loss shall not exceed 0.2 litres/m2 (m2 refers to the total area of the wetted internal surface). The water test shall be conducted in the presence of an Irish Water field engineer or an Irish Water agent's supervisor. Manholes shall be tested after construction by means of a water test for infiltration and exfiltration. The proportion of Manholes to be tested in each Development will be at the discretion of the Irish Water field engineer and will depend on the number of Manholes being provided. The number of Manholes to be tested will be advised by the Irish Water field engineer to the Developer. Manholes shall be substantially watertight with no discernible water loss out of or infiltration into the structure. The exfiltration test requirement for water tightness of Manholes shall be carried out in accordance with IS EN 1610. The test comprises the following: • Filling the Manhole up to the up to the soffit level of the cover slab below ground level of the Manhole, • Allowing the water to set for a period to allow for conditioning, usually 1 hour is sufficient, a longer period may be required in dry weather. • Water test the Manhole for a duration of 30 minutes (+/- I minute) • Test requirement is satisfied if the amount of water added to bring the water level up to its original position is less than 0.4 litres/m2 of wetted internal surface area. The exfiltration test shall be carried out before backfilling of the Manhole and when the cast concrete Manhole or the surround of pre-cast ring Manholes is in place and cured. The infiltration test shall to be carried out in accordance with Clause 7.8 of the Civil Engineering Specification for the Water Industry (CESWI), subject to any amendments outlined below. This test is to be carried out after backfilling around the Manhole. The infiltration test may also be carried out on the pipeline alone or on the Manhole and the pipeline. Again the Manhole and the pipeline shall be backfilled. The test is as follows. • All inlets to the Manhole (or the Manhole and pipeline) are effectively closed off. • For the infiltration test on the Manhole only, the test requirement is satisfied if the amount of water leaking into the Manhole in a 30 minute period does not exceed 0.4 litres per square meter of wetted internal surface area of the Manhole. • For the infiltration test on the pipelines only, the test requirement is satisfied if the amount of water leaking into the pipeline in a 30 minute period does not exceed 0.15 litres per square meter of wetted internal surface area of the pipeline. • If the pipeline and the Manhole are being checked for infiltration, the test requirement is satisfied if the amount of water leaking into the Manhole and pipeline in a 30 minute period does not exceed 0.2 litres per square meter of wetted internal surface area of the pipeline and the Manhole. All visible leaks from or inflow into the Manhole shall be repaired. Remedial works will be required if these results are not achieved and the tests rerun. Following the water test, pipelines and structures shall be emptied and the water disposed in an environmentally safe manner. All water used for testing shall be clean and free from impurities. Discharge of the test water to Network shall not take place without Irish Water's express approval. Pipes not within the Attendant Grounds, which will be the responsibility of individual property owners, should also be tested to achieve a satisfactory air test result in accordance with the relevant section of the Technical Guidance Document associated with the Building Regulations. Pipes not within the Attendant Grounds will be the responsibility of individual owners shall be dye tested to trace the pipe and ensure proper connectivity to the appropriate Networks (Wastewater Drains to the Wastewater Sewer and storm Drains to the Storm Water Sewer). The Irish Water field engineer may instruct the Developer to carry out random inspections and dye surveys (and CCTV surveys, if necessary) to confirm the proper connection of the services to the Networks. These surveys shall be carried out at the Developer's cost and in the presence of the Irish Water field engineer, if deemed necessary. Any misconnection of drains to Sewers shall be rectified and connections made to the proper collection pipework system.	3	4	12	**High**	IW CDS Design Team will vet the submitted design and may require it's amendment if deemed inadequate. IW CDS Field Engineers will undertake site inspections during installation. IW CDS Field Engineers will vet the final installed infrastructure prior to vesting. Risks associated with pressure testing of sewers & hydraulic testing of manholes to be risk assessed at design & construction stages, & to take account of the particular conditions associated with the site. All works to be carried out in accordance with the Safety, Health & Welfare at Work (Construction) Regulations. All testing to be carried out by competent contractors. Works to be risk assessed and co-ordinated by the PSDP (Design) and PSCS (Construction) in accordance with Health and Safety Legislation.	2	3	6	**Medium**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
41	Pressure testing at construction	Catastrophic Failure during testing	Site Operatives Public Road Users Construction Personnel	**Section 4.11 .1 Pressure Testing of Rising Mains** The Rising Main shall be pressure tested following installation of the pressure main on site. The pressure tests shall be conducted by the Developer's contractor experienced in such testing procedures in the presence of an Irish Water's field engineer or an Irish Water agent's supervisor. Rising Mains shall be tested after they are jointed and before full backfilling commences in as far as practicable. During testing, sufficient backfilling material shall be provided above the pipe crown to resist uplift or buckling movement of the pipe and all joints shall be exposed. Testing shall be carried out between suitably supported blank end pieces. Testing between 'live' shut valves will not be accepted. Before testing, valves shall be checked and sealed, the section of Rising Main filled with water and the air released. Water used for testing should be obtained from the existing water supply system. This water will be provided, subject to availability, by Irish Water at the Developer's expense. The following general requirements are relevant: • To avoid airlocks there must be suitable air valves on the pipeline, • Filling must proceed slowly, preferably from the lower side, • The test must be hydrostatic and shall take place between blank flanges; bolted or welded to pipe ends or end caps fully supported by anchor blocks, • All pressure gauges used for the monitoring of tests must be plate sized pressure gauges or digital loggers with an appropriate pressure range consistent with the pressure being measured, properly calibrated with calibration records available for inspection, to ensure that any losses can be adequately monitored. All the exposed parts of the pipeline, including the chambers, shall be visually checked and any leaks or damp spots rectified. Any water used for testing shall be disposed of in a safe and environmentally suitable fashion. All water used for testing shall be clean and free from impurities. Discharge of the test water to Network shall not take place without Irish Water's express approval.	3	4	12	**High**	All works to be carried out in accordance with Safety and Health Legislation. IW CDS Field Engineers will undertake site inspections during installation. IW CDS Field Engineers will vet the final installed infrastructure prior to vesting. Risks associated with pressure testing of rising mains to be risk assessed at design and construction stages taking into account the particular conditions associated with the site. All works to be carried out in accordance with the Safety, Health and Welfare at Work (Construction) Regulations. Testing equipment to be calibrated. Tests to be carried out in accordance with IGN 4 - 01 - 03. All design to be carried out by competent designers. Design co-ordination required by competent PSDP. Construction operations to be co-ordinated by competent PSCS.	2	3	6	**Medium**
42	Design of Pumping Stations	Access / Egress Confined Space Failure of safety / lifting equipment	Operation and Maintenance personnel Public Construction Personnel	**Section 5.3 Specific Minimum Requirements for Pumping Stations** Specific minimum requirements for pumping stations are as follows: • Pump stations to have a minimum of two submersible pumps; • All pipework and fittings within the pump station shall be ductile iron to IS EN 598, with appropriate colour and marking; • Pumps to be provided on a duty/standby control arrangement or if more than two pumps required, the arrangement to be duty/assist/standby; • Plate to be provided in the kiosk to allow nomination of the pumps (e.g. Pump No 1, Pump No 2, etc.); • Electrical, control and telemetry equipment and installation to be carried out in accordance with Section 5.16 to Section 5.27 below; • Electrical and control equipment to be located in a vandal resistant kiosk or structure situated adjacent to but offset from the pumping station; • Emergency Wastewater storage capacity to be provided in all pumping stations and equipped with appropriate self-cleaning wash-down facilities, along septicity and odour mitigation provisions; • Access for operation and maintenance vehicles, including vacuum tanker vehicles, to be provided; • A dedicated, metered, power supply to be provided to the pump station serving only the pump station equipment and associated plant; • The pump station shall be made ready to facilitate the installation of telemetry plant for data reporting to Irish Water central facility; • Alert system and call out emergency response to be provided in the event of plant breakdown or malfunction; • Flow metering facilities to be provided on the Rising Main as appropriate, complete with meter chamber, isolating sluice valves, etc.; • Odour control equipment to be provided to eliminate the risk of odour nuisance arising, comprising a vent-column, complete with passive odour control; • Lifting equipment to be provided for the removal of plant and equipment (See Section 5.30 below); • Safety equipment, comprising lifting davit, safety harness, etc. to be provided for controlled and planned safe access for the wet well; • Pump stations wet well and valve chamber to be provided with pipework, to allow emptying of the Rising Main and wet well by a vacuum tanker: • Suitable safe access to all components of the pump station, including all operational chambers, inlet manhole, wet well, valve chamber and flow meter chamber, for operating, maintenance and possible future replacement; • Safe working areas around the various components of the pumping station, as listed in Section 5.3.17 of the Codes of Practice for Wastewater.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers to vet the final installed infrastructure & examine the final documents prior to vesting.	2	3	6	**Medium**
43	Design	Access / Egress Confined Space Entry Unauthorised Access Unsafe working conditions Access for maintenance and cleaning	Operation and Maintenance Personnel Public	**Section 5.4 Layout of Pumping Station** Subject to Planning Permission requirement, the layout of the pumping station site and access road shall be arranged so that: • There is sufficient space to accommodate a vacuum tanker off road, and a large van or a mobile pump/generator within the site; • There is sufficient space between the various units on the site to enable maintenance operations and equipment replacement to be carried out, especially between the pump station sump/valve chamber and control equipment kiosk or structure; • There is sufficient space to carry out the chosen method of pump maintenance and installation of temporary pumps; • The doors to control kiosk(s) open safely and provide sufficient room for operators to safely carry out maintenance, repairs or replacement; • The need for personnel entry to confined spaces is minimised; • The inlet pipe is above the highest cut in level of the pumping plant units; • 5.4.7 The pump delivery pipework within the wet well is preferably opposite to the inlet Sewer with sufficient baffling facilities, comprising stainless steel baffle plate and stainless steel associated fixings, to protect the pumping plant; • The access is sufficiently wide to accommodate a vacuum tanker, a large van or a mobile pump/generator; • Access is provided to the pumping station site is via the access road suitably designed and constructed for such access with appropriate safe sight distances; • Adequate site security and emergency lighting, using LED, is provided to achieve 100 lux at ground level, with intensity adjustment appropriate for the site location, complete with photoelectric cell controller and over-ride control switch; • No overhead obstructions or electrical cables are located at or near the site that could pose a risk of electrocution, as outlined by a safety risk assessment; • The location of the pumping station is not susceptible to flooding; • Security fencing will not be required except in exceptional circumstances as outlined in Section 5.6 below. The site of the pumping station and access road thereto shall be of sufficient width, gradient and suitably surfaced to ensure reasonable access for Irish Water vehicles, plant and operatives and to facilitate the various maintenance operations, including emptying of contents, provision of stand-by generation plant, etc. Before the location of a pumping station is decided, the Developer shall consult with the electricity and telecommunications providers on the availability and cost of providing the requisite power supply, the supply characteristics, the security of supply and Easement. The Developer shall also carry out a GMS signal strength survey for 3G for the telemetry system at the station can be transmitted from the transmitter and received at the reception point. The electricity and telecommunications supply arrangements and GSM survey shall be the Developer's responsibility and cost and these shall be provided for the exclusive operation of the pumping station. The last access Manhole on the Gravity Sewer system upstream of the pumping station shall be located adjacent to the wet well within the site of the pumping station compound. It shall be designed to allow for over-pumping of the influent. This inlet Manhole upstream of the wet well shall be fitted with a hand operated isolating penstock.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	3	6	**Medium**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
44	Design	Access / Egress to the site Flooding Traffic	Operation and Maintenance Personnel Road Users Public	**Section 5.5 Location of the Pumping Station** Small pumping stations (Type 1) shall be located no closer than 5.0m to a property boundary in order to minimise the risk of odour, noise and vibration nuisance. This distance shall be increased to 10.0m for mid-range sized pumping stations (Type 2) and to 15m for medium sized pumping stations (Type 3). The distance shall be measured from the pumping station site boundary to the boundary of the nearest habitable, commercial, industrial or mixed use property. This distance may be subject to change depending on local circumstances and early discussions with the Planning Authority and Irish Water. Facilities for odour control shall be installed (comprising a vent stack with passive and/or forced odour control systems) to ensure that the pumping station will not create odour nuisance impact due to being located in close proximity to dwellings and public areas. The site layout shall included and indicate the requisite dimensional requirements from adjoining property boundaries, location of odour control unit/vent stack. The pumping station shall not be located within a public or private road, at the end of private driveways, in locations which may be used for vehicle parking, in places where maintenance work may obstruct rights or way, emergency vehicle access or where there is a risk of harm at the pumping station from moving vehicles to operatives carrying out maintenance, renewal, replacement and upgrade activities. The location shall be chosen so as to allow safe and reasonable vehicular access for the purpose of repair and maintenance. Long reversing access ways are not acceptable. Ideally, the access to a pumping station should be from a public road or by the provision of a dedicated access road from the public road. Shared access with domestic driveways is not deemed suitable. The access road gradient shall be as level as possible or within acceptable road gradient appropriate for the maintenance vehicle(s) requiring access to the site. Provision shall be made for access by a tanker to empty the contents of the wet well and any storage facility in the event of failure. The tanker size will depend on that which is available to Irish Water or its agents for emptying of the facility but access for Heavy Goods Vehicles, such as an 18 m3 tanker, shall be provided as a minimum. Access for the provision of stand-by power generation plant shall also be made available. The size of the standby power unit will be dependent on the pumping capacity of the station. The pumping station shall not be located in areas that are susceptible to flooding at a frequency of more than 1:30 year recurrence. The pumping station facility shall be designed for inundation. The finished slab level of the pumping station shall be positioned above the 1:100 year flood level. All electrical control equipment shall be housed in suitably IP rated enclosures and positioned above the 1:200 year flood level. A Flood Risk Assessment confirming compliance with this Section 5.5 of this Code of Practice dealing with flood risk analysis, as required in the Design Submission, if applicable, as outlined in Section 2.3 of the Codes of Practice for Wastewater.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**
45	Design	Unauthorised access	Public Operation and Maintenance	**Section 5.6 Fencing and Boundary Security** It should be noted that the Local Authority Planning Department may determine the requirements for fencing, site layout, control plant kiosk/structure, etc. under the Planning Permission. The pumping station shall be secure in its own right without having to rely on security fencing. Kiosks and access covers shall be locked and secure in their own right. Fencing of pumping stations sites is not required by Irish Water and will only be necessary in exceptional circumstances. Irish Water shall be consulted in relation to the need or otherwise for the fencing of pumping station sites and its decision will be determined having considered public safety, the likelihood of vandalism, the depth of the pumping station structures, the extent and type of pedestrian traffic and whether special activities are taking place on the site. If security fencing is required, it shall comprise a 2.4m high, corrosion resistant palisade fencing. In particular situations, subject to Irish Water approval, wire mesh fencing may be required. The security rating shall be in accordance with Irish Water's security policy and the fence security rating is to be agreed with Irish Water in advance. Palisade fencing, where provided, shall comply with IS EN 1722-12, comprising 17 No, 2.5mm thick, pales, with 95mm gaps, welded to 2 no mild steel rails (50mm x 50mm x 5mm angles). The steel rails shall be fixed to vertical posts (100mm x 55mm RSJ sections), which are provided at 2.7m centres. Fixings shall comprise mild steel anti vandal bolts and nuts. The fencing units shall be hot dipped galvanised to IS EN 1461 (2009) and subsequently electrostatically powder coated in a plant complying to EN 1722 -16. Wire mesh fencing, where provided, shall comply with IS EN 1772-14, comprising an 868 mesh system (200mm x 50mm spacing) with a galvanised and plastic coated finish. The mesh shall be clamp fixed to 60mm x 60mm posts at 2,500mm centres. The fence panels shall be fixed to fence pillars. Corner pillars shall be braced in both directions. All fixing bolts shall be tamper resistant or burred over. The fence, pillars, bracing, runners, diagonals, gate posts and gates, etc. shall be in accordance with the manufacturer's instruction and the designs shall be provided to Irish Water for review and vetting. The gate posts, pillars and bracing shall be supported in concrete bases, Grade C30/37 to IS EN 206, of suitable size to resist imposed loadings. Similar type access gates to the palisade or wire mesh fencing panels, as appropriate, shall be provided. The access gates shall be of sufficient width to accommodate maintenance vehicles, tankers, etc. The access gates shall be provided with slide bolts, shooting bolts and padlocks. If opening outwards, the access gates shall be set back from parking and access areas by the width of the leaf of the gate. Gate hinges shall be designed so that it is impossible to remove the gate by lifting when it is closed and locked in position. Drop bolts shall be fitted to each gate leaf in such a way that they cannot be removed but that they allow the gate to be secured in both the open and closed position. In certain circumstances, a pedestrian gate shall be provided in the security fence if required by Irish Water. Anti-burrow features shall be provided for circumstances where Enhanced Security is required by the provision of a 300mm wide by 150mm deep concrete sill along the base of the fence line. The sill shall be formed using in-situ reinforced concrete, Grade C25/30 to IS EN 206. All fence material and workmanship shall be in accordance with IS EN 1722-14. The colour of the fence, access gates and Accessories shall be holly green 14C39 in accordance with BS 4800. In certain circumstances, a 2.4m high security wall may be deemed adequate so as to match surrounding structures. In this circumstance, a steel access gate shall be provided as outlined above.	3	3	9	**Medium**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**
46	Design	Structural failure of the road surface Access and Egress to site.	Operation and Maintenance Road Users Public	**Section 5.7 On-Site Parking and Hard-Standing** It shall be noted that the Local Authority Planning Department may determine the requirements for on-site parking under the Planning Permission. Small, medium and mid-range sized pumping stations located off public roads with adequate parking or a dedicated lay-by will not require dedicated on-site parking. Where access is from a traffic-sensitive street or other major road or where parking is not available without obstructing the road, provision shall be made for adequate parking (e.g. in a lay-by) for a tanker adjacent to the site. If access is from a public road, the pump station location shall be set back from the edge of the road for a distance of one vehicle length, based on the largest vehicle accessing the site. The maintenance vehicle shall be capable of getting as close as possible to the wet well Chamber. The access provision to and from the pumping station shall enable such access to be achieved without undertaking unsafe vehicle movements. The access shall also be provided to comply with the most up-to-date Local Authority Design Manuals particularly in respect of road curves and turning circles. On-site hardstanding areas shall be surrounded by pre-cast kerb units (255mm x 125mm set in a bed and haunch of Grade C25/30 concrete to IS EN 206) or slip formed concrete kerbing, installed to match the level of the surrounding ground. Such hard-standing may comprise permeable or impermeable surfaces, depending on the water service activities being carried out on the site and on the sub-surface ground conditions at the site. Permeable surfaces shall comprise a 500mm depth of compacted Clause 804 granular material, in accordance with the Transport Infrastructure Ireland (formerly National Roads Authority) Specification for Road Works, with a 75mm layer of 10mm single sized aggregate on a geotextile weed barrier founded on load bearing subgrade material. Impermeable surfaces shall comprise a 500mm depth of compacted Clause 804 granular material, in accordance with the Transport Infrastructure Ireland (formerly National Roads Authority) Specification for Road Works with either a concrete or macadam finish. Where vacuum tanker access is provided or where HGV access is required, the hard-standing shall be designed to carry such vehicles, (including 35/40 tonne ridged or articulate vehicles), and shall comprise a reinforced concrete slab (Grade C28/35 to IS EN 206 - 20mm aggregate to IS EN 1260) on a Clause 804 granular sub-base founded on load bearing subgrade material. For lighter vehicles, a tarmacadam surfaces, comprising 75mm wearing course on a 75mm well compacted regulating course shall be placed on the Clause 804 granular sub-base, shall be provided. Where hard standing areas are located over locations that have been excavated for construction of the wet well, valve chamber, emergency storage tank and other deep components, backfill beneath the hardstanding area shall be carried out with "acceptable material" as outlined in Clause 601 of the TII "Specification for Roadworks, Series 600 – Earthworks", Table 6/1, Class 6F1 or 6F2 material and compacted accordingly to ensure that the sub-base is capable to taking the applied loads.	3	3	9	**Medium**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	2	4	**Low**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
47	Design	Failure of pumping plant Flooding Biological health hazard	Public Operation and maintenance personnel	**Section 5.8 Hydraulic Design of Pumping Stations** The design flow rate of a pumping station will depend on the Wastewater flow rate and volume arriving to it from the Gravity Sewer system. Generally, pumping stations are designed to limit the number of pump starts so that the pumping plant is not damaged by excessive start/stop activity, generally not exceeding 10 starts per hour. The pumping plant shall be fitted with direct on-line starters for motors sizes up to 5 kW. Motors rated 5kW and above shall be provided with star delta starters, soft starters or variable speed drives (VSDs). The VSDs shall be installed in separate Form 4 ventilated enclosures to manufacturers' requirements. Adequate cooling and ventilation shall be provided in the pump station kiosk to ensure that the VSDs operate within the design tolerances with regard to ambient temperature within the space. The pumping duration of a pump unit shall not be less than 60 seconds. The pumping capacity shall ensure that the Wastewater is passed from the wet well and the Rising Main without excessive residence time which might give rise to septic conditions. Generally the combined residence time in the wet well and the Rising Main shall be less than six hours. A pumped flow rate shall be chosen to achieve at least a minimum flow velocity in the Rising Main, as outlined in Section 3.7 of the Codes of Practice for Wastewater The developer is to provide IW with hydraulic calculations as part of his design submission for the proposed pump station, as required in Section 2.3 of the Codes of Practice for Wastewater Generally, pumping plant shall be sized to deliver a minimum peak flow rate of six (6) times the incoming dry weather flow (DWF) but pump delivery of three (3) times the dry weather flow (DWF) may be appropriate if adequate balance storage of the Wastewater is provided. The rate of pumping shall ensure compliance with the rising main velocity range outlined in Section 3.7.2 of the Codes of Practice for Wastewater Where there are limitations on the capacity of the downstream Network to accept the instantaneous design pumped flows, consideration shall be given to adjusting the control philosophy of the pump station to limit the forward flow and, therefore, reduce the risk of negative impact on the downstream network. This may include (but is not limited to) the provision of on-site balance storage, change to proposed pump model or the use of variable speed drives to limit the flow under conditions where the receiving sewer capacity is reduced and the flow is not restricted beyond the six-hour residence time, as set out above. Such proposals, including the proposed control philosophy, shall be provided to Irish Water for review and assessment. Balance storage may be required in association with the pumping station to provide a minimum 10-hour and up to a maximum 24-hour storage capacity. The required storage capacity will depend on the size of the Development. Emergency storage capacity of 24-hour Dry Weather Flow is required for Developments up to 250 units. The balance storage requirement capacity will be reduce for larger Developments in accordance with the requirements of Section 5.11 or with specific advice from Irish Water's Connections and Developer Services. The pumping plant shall have 100% standby capacity. The plant shall be configured to allow future retrofitting with a telemetry outstation to transfer data from the pumping station to an Irish Water control centre as outlined in Section 5.26 of the Codes of Practice for Wastewater. For pumping stations where phased development is anticipated, the pump station structure shall be provided to facilitate the fully developed site. Pipework shall be provided for the ultimate flows. This might involve the installation of pipes within the wet well and provision within the valve chamber for future pump units which are initially not in use. The pumping plant shall be provided to accommodate the likely medium term anticipated flow, provided this does not create a nuisance or septicity problem. In some instances, twin Rising Mains may be required to accommodate the phased flow increase over the life cycle of the pumping facility. Where pump station expansion is proposed for future phased development, the initial Design Submission (See Part 2 Design Requirements and Design Submissions of this Code of Practice) shall include the design calculations for the phasing of the Pumping Station. The pumping plant shall be designed to pump against a design head comprising a combination of the static head and the pipe friction head. The pumping station design static head for the design flow shall be based on the difference in level between the mid-point of the duty pump start level in the wet well and the discharge point at the header Manhole. The design pipe friction head will depend on the pipe size, the pipe fittings, velocity in the pipe as well as the friction factor of the pipe material. The pipework associated with the pumping plant shall be adequately restrained to resist vibration and impact arising from the operation of the pumping plant. The pumping station shall be provided with an ultrasonic level control system with operator adjustable set points for pump unit cut in and cut out as well as top level cut in and low level over-ride cut out. The cut-out level shall be set such that it is above the top of the pump motors. Appropriate set points shall be provided if duty and assist pumping plant is included in the pumping station. Duty and standby pumping plant shall be provided at each pumping station. A standby pump unit shall be provided if a duty/assist pumping arrangement is required. A hard wired high level float switch shall be provided in each pumping station and these shall be linked to the telemetry control system. Automatic duty/standby switch over shall be incorporated into the pump control system. A manual override shall be provided in the pump control system. The pump units shall operate safely and effectively in accordance with the pump manufacturer's instructions such that the pump units do not exhibit damaging cavitation, vibration, air locking or surface vortices. Where there are limitations on the capacity of the downstream Network to accept the instantaneous design pumped flows, consideration shall be given to adjusting the control philosophy of the pump station to limit the forward flow and, therefore, reduce the risk of negative impact on the downstream network. This may include (but is not limited to) the provision of on-site balance storage, change to proposed pump model or the use of variable speed drives to limit the flow under conditions where the receiving sewer capacity is reduced and the flow is not restricted beyond the six-hour residence time, as set out above. Such proposals, including the proposed control philosophy, shall be provided to Irish Water for review and assessment. Balance storage may be required in association with the pumping station to provide a minimum 10-hour and up to a maximum 24-hour storage capacity. The required storage capacity will depend on the size of the Development. Emergency storage capacity of 24-hour Dry Weather Flow is required for Developments up to 250 units. The balance storage requirement capacity will reduced for larger Developments in accordance with the requirements of Section 5.11 or with specific advice from Irish Water's Connections and Developer Services. The pumping plant shall have 100% standby capacity. The plant shall be configured to allow future retrofitting with a telemetry outstation to transfer data from the pumping station to an Irish Water control centre as outlined in Section 5.26 below. For pumping stations where phased development is anticipated, the pump station structure shall be provided to facilitate the fully developed site. Pipework shall be provided for the ultimate flows. This might involve the installation of pipes within the wet well and provision within the valve chamber for future pump units which are initially not in use. The pumping plant should be provided to accommodate the likely medium term anticipated flow, provided this does not create a nuisance or septicity problem. In some instances, twin Rising Mains may be required to accommodate the phased flow increase over the life cycle of the pumping facility. Where pump station expansion is proposed for future phased development, the initial Design Submission (See Part 2 Design Requirements and Design Submissions of this Code of Practice) shall include the design calculations for the phasing of the Pumping Station. The pumping plant should be designed to pump against a design head comprising a combination of the static head and the pipe friction head. The pumping station design static head for the design flow should be based on the difference in level between the mid-point of the duty pump start level in the wet well and the discharge point at the header Manhole. The design pipe friction head will depend on the pipe size, the pipe fittings, velocity in the pipe as well as the friction factor of the pipe material. The pipework associated with the pumping plant shall be adequately restrained to resist vibration and impact arising from the operation of the pumping plant. The pumping station should be provided with an ultrasonic level control system with operator adjustable set points for pump unit cut in and cut out as well as top level cut in and low level over-ride cut out. The cut-out level should be set such that it is above the top of the pump motors. Appropriate set points should be provided if duty and assist pumping plant is included in the pumping station. Duty and standby pumping plant should be provided at each pumping station. A standby pump unit should be provided if a duty/assist pumping arrangement is required. A hard wired high level float switch should be provided in each pumping station and these should be linked to the telemetry control system. Automatic duty/standby switch over should be incorporated into the pump control system. A manual override should be provided in the pump control system. The pump units should operate safely and effectively in accordance with the pump manufacturer's instructions such that the pump units do not exhibit damaging cavitation, vibration, air locking or surface vortices.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	3	6	**Low**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
48	Design & Operation	Explosion Electrocution Fall from Height Access / Egress Confined Space Entry Failure of lifting equipment	Operation and Maintenance Personnel	**Section 5.9 Pumping Plant** Having regard for the provisions of Section 5.8 above in relation to hydraulic design of pumping stations and taking cognisance of phased capacity allowance, the specific minimum requirements for pumping plant are as follows: • Pumping plant shall be of failsafe design; • All plant and equipment shall be suitably Ex-rated in accordance with the Hazardous Area Classification for the pumping station site; • Pumping plant shall be duty and standby arrangement or duty/assist and standby arrangement; • Pumps shall be submersible pumps with automatic decoupling arrangements complete with twin guide rails, easy lift, etc.; • Pumping plant shall be of proven track record; • Automatic selection rotation of the duty/standby or duty/assist/stand-by pumps shall be provided on an hours run basis with manual over-ride; • Pumps to be sized to pump forward a minimum of six (6) times DWF (with a minimum of three (3) times DWF, if storage is provided) provided the velocity in the rising main is within the range outlined in Section 3.7.2 above; • Pumps shall be suitable for pumping unscreened Wastewater containing fibrous material and large solids. Pumps connected to small diameter Rising Mains to be fitted with an anti-blockage/anti-ragging system and additional anti blockage requirements will be required for Rising Mains of 80mm diameter and less; • Pumps shall have, in general, a minimum discharge size of 80mm; • Pump control shall be via ultrasonic level transducers, located above liquid level, in an easily accessible location, while not encroaching or impeding access. • The ultrasonic controller shall be suitable for fascia or panel mounting and shall incorporate a number of relays (minimum of five) to operate the pump units and alarms according to the required control philosophy; • The pump guide system shall be provided to allow the pump units to be automatically coupled shall the outlet pipework and held in place by its own weight; • The guide system shall allow the pump units to be lifted to the top of the wet well without the need to undo any fixing arrangements or to enter the wet well; • Anchor bolts shall be stainless steel, stainless steel and galvanised steel surfaces shall not come into contact with each other; • Pumps to be mounted on a cast iron coupling/duck-foot pedestal, with automatic decoupling arrangements; • Pump arrangement shall be provided to allow easy installation and speedy removal from the sump without need for operator entry to the sump; • Pumps guide rails shall be of stainless steel (grade 316); • Pumps shall be provided with certified, stainless steel lifting chain (designed to IS EN 818 – Part 7), suitably sized and fit for purpose, with 8mm thick links, at least, and large links at not more than 1m intervals; • All statutory inspections shall be undertaken during the Defects Liability Period. In particular, the stainless steel chains are to be subject to 6 month inspection, the lifting chain at the end of the Defects Liability Period shall have a current valid certification for a further period of 3 months; • Discharge pipework within the wet well shall be complete with bends, radial tee-pieces, fittings, etc. to link the wet well pipework to the valve chamber pipework; • Pipework within the valve chamber shall incorporate isolation valves (one per pump installed), non-return valves (one per pump installed), bends, radial tee-pieces, etc.; • Non-return valves shall have removable covers, ductile iron body with resilient seated disc and stainless steel hinge pin, complete with either a lever arm and weight; • Bends shall be swept/slow bends to minimise blockages and pipe friction losses; • Sluice valves shall be provided with removable hand-wheels; • Flange adaptors shall be provided to permit ease of removal of valves from the pipework; • All pipework and valves shall be of ductile iron to IS EN 598, suitable for use with sewage, with PN-16 flanges to BS EN 1092-1, with appropriate colour and designation marking; • Pump motors shall be high efficiency with Class F insulation and IP68 rating and must meet IE3 efficiency standards or better; • Pump efficiency shall be maintained within 15% of its maximum efficiency over the whole of the specified duty range; • Motors shall include stator over-temperature protection in the form of thermistors embedded in each phase of the windings, over-temperature protection shall automatically re-set when the temperature returns to normal and protection from seal leakage shall also be provided; • Pumps shall have a maximum speed of 1500rpm. Pump characteristics shall be stable, non-overloading and shall be such that the pumps shall operate as close to maximum efficiency at the design point (Speeds in excess of this may be allowed in the case of non-clogging macerator pumps, where these are provided); • Pumps shall be provided with indicator plates providing information for the pump, motor, etc. A duplicate stainless steel plate to be provided and mounted in the kiosk or control structure; • Each pump unit shall be supplied and fitted with a cable of suitable length to reach the means of termination which shall be either (a) a control kiosk MCC gland plate and terminals or (b) an intermediate junction box in the valve chamber or (c) an intermediate junction box housed in an intermediate kiosk; • A spare name plate for the pump shall be fixed to the plywood panel support board within the kiosk. It is the responsibility of the Plant Designer to ensure that Area Classification is applied to the design of the pump station and to identify the potential for flammable or explosive atmospheres to develop in or around the pump station. ATEX Directives 1999/92/EC and 1994/9/EC are to be adhered to. IS EN 60079 shall also be adhered to in regard to Area Classification. The drawings submitted and the specification of the pump station shall demonstrate the Area Classification of the pump station or otherwise the absence of zoning.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting. Designer to take account of health & safety in selection, designing & installing manhole covers & frames to address manual handling, access / egress, rescue etc. The Designer must ensure that the general principles of prevention (as well as all relevant Health & Safety Legislation) are taken into account when selecting & designing manhole covers & frames. Consideration must be given to the following risks relating to cover design: manual handling - means of safely lifting & moving the cover & eliminating / minimising risk of manual handling injury, ope protection (dependant on size) - access / egress - room to safely access rescue - room to safely rescue & also room to safely set-up rescue equipment etc. Proprietary lifting equipment should be provided to allow for safe lifting of chamber covers & this should be consistent to avoid risk of accidents due to misuse.	2	3	6	**Medium**
49	Design & Operation	Malfunction of pump to due collection of solids Confined Space Entry	Operation and Maintenance Personnel Public	**Section 5.10 Wet Well** The wet-well of the pumping station can be of rectangular or circular plan section with a minimum 1,800mm x 2,500mm plan or 1,800mm diameter shape. The shape of the wet well shall be such that solid matter does not accumulate in dead spots within the well. The shape of the wet well and its benching as well as the location of the inlet Sewer arrangement shall ensure satisfactory flow conditions to the pump unit to avoid the formation of damaging vortices. This is best achieved by installing the incoming Sewer on the centreline between the submersible pump units at a depth between 0.15m and 1.15 m above the pump highest cut in level. An inlet baffle shall be provided for the Sewer inlet to prevent excessive aeration of the Wastewater or the interference with ultrasonic beams used for level sensing. There shall be a minimum capacity between the start and stop level controls to give a maximum of 10 starts per hour. The depth of the wet well shall be suitable to accommodate the incoming Gravity Sewer, the pumping plant, the minimum pumping storage between cut-in and cut-out, etc. The maximum depth of the wet well shall be 6.0m below ground level. Wet wells of depth greater than 6.0m shall require specific approval of Irish Water and will require the submission of a specific detailed design for review. An inlet collection Manhole shall be provided just upstream of the pump station wet well in all situations. Where there are multiple Sewers draining to the pumping station site, the inlet collection Manhole will combine flow to the wet well in a single inlet pipe. Provision shall be made for isolating the incoming flow by means of a hand-operated valve or penstock. This unit shall be located in the inlet collection Manhole upstream of the wet well and not in the wet well itself. If off-line emergency storage is provided for the wet well, a high-level overflow, completed with a stainless steel baffle to prevent floating solids entering the emergency storage tank, shall be provided. A return flow pipe shall be provided, complete with a flap valve, between the emergency storage tank and the wet well to return stored flows. The overflow and return pipework is detailed in Section 5.11 of the Codes of Practice for Wastewater. Benching in the wet well shall be provided to eliminate “dead zones” within the wet well to prevent siltation or accumulation of debris. The benching shall start no more than 100mm from the pump unit volute or in accordance with the pump manufacturer’s recommendations. The slope of the benching shall be a minimum of 45 degrees. The area under the pump shall be as small as possible to ensure well cleansing and the flat floor area shall be kept to a minimum. The wet well shall be kept to a minimum to reduce the amount of benching that is required. The wet well shall be designed, as far as practicable, to eliminate the need for man-entry for maintenance. No permanent ladder or step irons shall be located within the wet well. If the wet well is deeper than 4m, Irish Water may require additional safety measures to be installed within the well for maintenance purposes. The wet well shall be constructed using in-situ reinforced concrete, Grade C30/37 to IS EN 206, or with pre-cast concrete units. The wet well shall be water tight for both ingress of groundwater and egress of Wastewater. The minimum factor of safety against flotation for the empty structure subject to groundwater pressure shall be 1.2. This shall only be used where the maximum groundwater level is accurately known or, if not reliably known, a groundwater level equivalent to the finished ground level shall be used. The developer shall submit site specific anti-floatation calculations and measures proposed in respect of pump station structures (cast in-situ or pre-cast concrete), as required in Section 2.3.28 of the Codes of Practice for Wastewater. If constructed with in-situ reinforced concrete, the wet well structure shall be designed to IS EN 1992 – Part 3, Design of Concrete Structures - Part 3: (Liquid retaining and containment structures, Tightness Class 2). The surface finish of the internal surface of the wet well shall be fair faced finish (F2 or better) obtained using forms to provide a hard surface with true, clean edges. Only minor surface blemishes are permitted. Fins and other projections shall be removed and the surface made good. The cover slab shall be designed to withstand accidental vehicular wheel loads. Reinforcement used in the wet well structure shall be high yield steel in accordance with BS EN 4449. If precast concrete units are used for wet well construction, they shall conform to IS EN 1917 and IS 420. Joints between the precast components shall provide equivalent water resistance as required in IS EN 1992 – Part 3. The precast units shall be surrounded with at lease a 150mm thickness of C30/37 to IS EN 206, 20mm aggregate size to IS EN 12620. This composite structure shall be designed to IS EN 1992 – Part 3, Design of Concrete Structures - Part 3: (Liquid retaining and containment structures, Tightness Class 2). The use of alternative pre-cast concrete system units may be allowed, subject to Irish Water review, provided that they are deigned to IS EN 1992 – Part 3, Design of Concrete Structures - Part 3: (Liquid retaining and containment structures, Tightness Class 2). These structures shall be partially or fully surrounded in concrete at lease a 150mm thickness of C20/25 to IS EN 206, 20mm aggregate size to IS EN 12620, where required for sealing joints and pipe connection locations unless otherwise agreed with Irish Water. These tanks shall be installed in accordance with the manufacturer’s requirements subject to adherence to good site practice. The pipe manufacturer’s recommendations shall be followed where a Rising Main passes through the wall of a wet well to safeguard against the integrity of the main from differential settlement or movement. If pipes through the wall are installed in box-out openings, subsequent filling of the opening shall be carried out with grade C25/35 to IS EN 206, 20mm aggregate size to IS EN 12620, concrete to ensure a completely watertight structure. The pipe shall be fitted with puddle flanges as they pass through the wall. The Developer shall provide details in all instances of the sealing methodology where the process pipework passes through the wall of a chamber either where the intention is to cast in process pipework after installation or where it is proposed to integrate same in pre-cast units. The building in of pipes through walls, roofs and other concrete structures shall be carried out to prevent liquid leakage into or out of the structure. Puddle flanges shall be provided to prevent such leakage and to ensure watertight construction. Where necessary, thrust flanges shall be provided to resist imbalanced forces acting on the pipe.	3	3	9	**Medium**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting. Site specific risks to be assessed & appropriate design mitigation measures to be implemented. The Designer shall provide a detailed method statement for entry procedures to confined spaces during the construction phase & the operation & maintenance phase, including use of gas monitors & breathing apparatus. Designers to eliminate the need to enter confined space. Where elimination is not practical, the Designer should ensure that the level of risk is as low as is reasonably practical. Ensure entry & exit can be achieved with as much ease as possible. Consideration to be given at design stage to the method of rescue in an emergency situation to allow for setting up of rescue equipment.Designers should prepare an Emergency Plan (including a Traffic Management Plan) to make allowances for emergencies & this should allow for rescue equipment to be used. Where use of man riding harnesses or similar mechanical devices is required, consideration to the design of the wet well should be made to allow for continuous attachment & constant visual contact.	2	2	4	**Low**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
50	Operation	Malfunction of pump to due collection of solids Confined Space Entry	Operation and Maintenance Personnel	**Section 5.10 Wet Well** The wet well should be designed, as far as practicable, to eliminate the need for man-entry for maintenance. No permanent ladder or step irons should be located within the wet well. If the wet well is deeper than 4m, Irish Water may require additional safety measures to be installed within the well for maintenance purposes. The pump station wet well shall be provided with pipework, 80 mm minimum diameter, terminating 100mm from the low side of the sump floor and extending through the wall of the valve chamber. Pipework sizes below 80mm diameter may be allowed in small capacity pumping station installations with the written approval of Irish Water. This pipe system shall be fitted within the valve chamber with a non-return valve and male Bauer coupling in the valve chamber, to allow emptying of the Rising Main by a vacuum tanker. Backfill around the wet well shall be placed so that a 500mm width of Clause 808 material, compacted in 300mm layers, is provided to ensure adequate support beneath any structures or structural surrounds. Free draining granular material, 500mm wide, shall be provided round the wet well close to ground level of the unit.	3	4	2	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers to vet the final installed infrastructure & examine the final documents prior to vesting. Designers to eliminate the need to enter confined space. Where elimination is not practical, the Designer should ensure that the level of risk is as low as is reasonably practical. Ensure entry & exit can be achieved with as much ease as possible. Consideration to be given at design stage to the method of rescue in an emergency situation to allow for setting up of rescue equipment. Confined Space Entry to be in accordance with Health and Safety Legilsation. Operatives involved in confined space entry to be trained in accordance with Legislation. Operatives to provide a back up fall-arrest system and standby tripod in the event that there is a malfunction of the working access equipment.	2	3	6	**Medium**
51	Operation	Access to valves Fall from Height Confined Space	Operation and Maintenance Personnel	**Section 5.12 Valve Chamber** The valve chamber is provided to house valves and fittings associated with the pumping plant. It shall be separate from the wet well but it may be structurally attached to the wet well. The valve chamber shall be fully sealed from the wet well and it shall be provided with a manually operated Drain valve to allow the discharge of liquid from the valve chamber to the wet well. The size of the valve chamber shall be adequate to house all equipment and provide adequate space for maintenance, plant replacement, etc. The valve chamber shall house the following: • Discharge pipework complete with radial bends, radial tee pieces, valves, fittings, etc. to link the wet well pipework to the Rising Main pipe; • A gate valve for each pump unit mounted horizontally in the pump outlet pipework and arranged to isolate the pump unit from the Rising Main; • A non-return valve for each pump unit mounted horizontally in the pump outlet pipework, upstream (wet well side) of the gate valve, and arranged to prevent flow reversal under normal operating conditions in the Rising Main; • A gate valve and 100mm male Bauer coupling mounted vertically on a tee piece in the Rising Main, upstream of the Rising Main gate valve and check valve for pumping out of the Rising Main; The valve chamber shall be provided with a hand operated valve and gravity drain into the wet well. The valve shall be installed in a drain sump at the corner of the valve chamber floor area. The floor of the valve chamber shall slope to the sump to enable collection of any accumulated liquid in the valve chamber. The discharge drain shall be protected to ensure that flows of noxious gas cannot enter the valve chamber from the wet well. The valve chamber shall have a maximum depth of 1.5m from soffit of the roof slab to the floor of the chamber. Appropriately sized covers shall be provided to the openings in the roof slab of the chamber. Adequate clearance shall be provided beneath all pipework to allow safe access to flange bolts for maintenance operations to be carried out. The valve chamber shall be constructed using in-situ reinforced concrete, Grade C30/37 to IS EN 206, or with pre-cast concrete units. The chamber shall be water tight for both ingress of groundwater and egress of Wastewater. The minimum factor of safety against flotation for the empty structure subject to groundwater pressure shall be 1.2. This shall only be used where the maximum groundwater level is accurately known or, if not reliably known, a groundwater level equivalent to the finished ground level shall be used. The developer shall submit site specific anti-floatation calculations and measures proposed in respect of pump station structures (cast in-situ or pre-cast concrete), as required in Section 2.3.28 of the Codes of Practice for Wastewater. If constructed with in-situ reinforced concrete, the valve chamber structure shall be designed to IS EN 1992 – Part 3 Design of Concrete Structures - Part 3: (Liquid retaining and containment structures, Tightness Class 2). The surface finish of the internal surface of the chamber shall be fair faced finish (F2 or better) obtained using forms to provide a hard surface with true, clean edges. Only minor surface blemishes are permitted. Fins and other projections shall be removed and the surface made good. The cover slab shall be designed to withstand accidental vehicular wheel loads. Reinforcement used in the valve chamber structure shall be high yield steel in accordance with BS EN 4449. If precast concrete units are used for valve chamber construction, they shall conform to IS EN 1917. Joints between the precast components shall provide equivalent water resistance as required in IS EN 1992 – Part 3. The precast units shall be surrounded with not less than 150mm thickness of Grade C20/25 to IS EN 206, 20mm aggregate size to IS EN 12620. This composite structure shall be designed to IS EN 1992 – Part 3, Design of Concrete Structures - Part 3: (Liquid retaining and containment structures, Tightness Class 2). The use of other pre-cast concrete units may be allowed, subject to Irish Water review, provided that they are deigned to IS EN 1992 – Part 3, Design of Concrete Structures - Part 3: (Liquid retaining and containment structures, Tightness Class 2). These tanks shall be installed in accordance with the manufacturer's requirements subject to adherence to good site practice. The chamber shall be fitted with Manhole steps to comply with IS EN 13101, Type D, Class 1, galvanised mild steel and plastic encapsulated. Access to the confined space within the chamber shall be by way of a safe access plan. The pipe manufacturer's recommendations shall be followed where pipes pass through the wall of the valve chamber to safeguard against the integrity of the main from differential settlement or movement. If pipes through the wall are installed in box-out openings, subsequent filling of the opening shall be carried out with grade C30/35 to IS EN 206, 20mm aggregate size to IS EN 12620, concrete to ensure a completely watertight structure. The Developer shall provide details in all instances of the sealing methodology where the process pipework passes through the wall of a chamber either where the intention is to cast in process pipework after installation or where it is proposed to integrate same in pre-cast units. The building in of pipes through walls, roofs and other concrete structures shall be carried out to prevent liquid leakage into or out of the structure. Puddle flanges shall be provided to prevent such leakage and to ensure watertight construction. Where necessary, thrust flanges shall be provided to resist imbalanced forces acting on the pipe. Backfill around the wet well shall be placed so that a 500mm width of Clause 808 material, compacted in 300mm layers, is provided to ensure adequate support beneath any structures or structural surrounds. Free draining granular material, 500mm wide, shall be provided round the wet well close to ground level of the unit. Cable ducts into the valve chamber and between the valve chamber and the wet well shall be sealed watertight. Gas tight sealing glands shall be provided between the valve chamber and the wet well and the valve chamber and the kiosk to prevent the migration of gas into the valve chamber and between the wet well and the control kiosk.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting. Site specific risks to be assessed & appropriate design mitigation measures to be implemented. The Designer shall provide a detailed method statement for entry procedures to confined spaces during the construction phase & the operation & maintenance phase, including use of gas monitors & breathing apparatus. Designers should prepare an Emergency Plan (including a Traffic Management Plan) to make allowances for emergencies & this should allow for rescue equipment to be used. Where use of man riding harnesses or similar mechanical devices is required, consideration to the design of the valve chamber should be made to allow for continuous attachment & constant visual contact.	2	3	6	**Medium**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
52	Operation	Access to meter Confined Space Lifting of the roof of the chamber.	Operation and Maintenance Personnel	**Section 5.13 Flow Metering** Flow meters shall be provided to measure and record the Wastewater flow being pumped forward through the Rising Main. Magnetic flow meters, to IP68, shall be provided complete with a digital display showing instantaneous and accumulated flow records. A "no-flow" protection facility shall be provided for the pumps. Flow meter and associated equipment, including calibration test certification, will be required for all pumping stations. The controller for the magnetic flowmeter shall be mounted in the kiosk. The flow meter shall be provided in a separate flow meter chamber, located a sufficient distance from all fittings and bends, to ensure that interference of the measurement does not arise from flow turbulence associated with such fittings. The flow meter chamber shall have minimum plan dimensions of 1500mm x 1500mm. It shall include a flow meter, positioned in accordance with the manufacturer's instructions. Sluice valves shall be provided adjacent to the meter chamber and valve chamber to allow isolation, removal or servicing of the meter. The valve shall be provided after the flowmeter at least a separation distance equivalent to that recommended by the flowmeter manufacture. The pipework within the meter chamber shall incorporate a dismantling joint to allow removal of the flow meter.	3	3	9	**Medium**	Provision to be made for the optional removal of the roof the meter chamber. Means of lifting the roof to be provided during the design and construction stages. All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting. Entry into confined spaces to be in extreme circumstances only and to be avoided if possible.	2	2	4	**Low**
53	Operation	Access / Egress Lifting covers Structural failure Manual Handling Fall from height	Operation and Maintenance Personnel	**Section 5.14 Access to the Wet Wells, Valve Chambers and Other Chambers** The top of the wet well, valve chamber, meter chamber and other associated chambers shall be situated flush with the surrounding paved areas. Where the intention is to use a pre-cast concrete cover slab, The Developers shall in those instances provided details or the proposed cover to the pre-cast concrete manufacturer in advance to ensure that the cover units fit the openings and are flush with the surface of the finished roof slab. The Developer shall also bear in mind that pump station installations are to be designed to prevent inundation. Access covers in the roofs of the wet well, valve chamber and other chambers shall be flush with the roof slab and large enough to allow for pump units, valves and flow meters to be removed easily and safely out of the well/chamber for above ground inspection, maintenance, etc. Openings in all other chambers shall not be smaller than 675mm x 675mm. The opening and access covers for the wet well and valve chamber shall have the following features: • Covers to be secure and capable of providing safe and easy access to the chambers for inspection, maintenance and operation; • Covers to be fabricated from Durbar plate, minimum 4mm thick, galvanised to IS EN 1461 (2009) (minimum zinc coating of 70 microns) with non-slip surface and finished flush with the roof slab of the chamber(higher specification material or finishes may be required in aggressive environments, e.g. coastal sites); • Hinged covers shall be provided as a minimum for single, twin and triple leaf covers; • A factory fitted seal shall be provided between the cover and frame for wet well and overflow chamber covers and each leaf shall also be fitted with and odour control seal; • The minimum allowable access for wet wells and valve chambers to be 1,400mm x 800mm, access openings to Manholes and other infrequent access chambers may be 675mm x 675mm; • Chamber access covers with a clear opening exceeding 1000mm shall conform to BS 9124; • Hinged covers to be used in all openings exceeding 675mm x 675mm; • Hinged cover to incorporate a recessed facility for securing of the cover with an approved padlock; • Covers to be lockable to LPS1175, SR2 using high security locks; • The padlock facility shall have a cover plate which shall automatically fall flush with the surrounding cover lid; • Each cover leaf shall incorporate an auto-locking safety stay; • Each leaf of the cover to have torsion spring assistance to ensure a lifting effort of less than 25kgF; • The location of the hinges and the lift assistance sets shall not impinge on the safe entry to the chamber; • For pumping stations wet wells and valve chambers, a hinged, safety, fall protection grid in two sections to be provided below the cover and to be capable of withstanding a 250kg load over the total area of the grid. The lifting effort of the grid shall not exceed 25kgF. When lifted, the grid shall be capable of being secured in the upright position; • In a closed position, the covers shall be capable of withstanding a 6 tonne static wheel load, as a minimum. Where there is a risk of traffic loading on the cover, it shall be capable of withstanding such loadings as a minimum; • Provision to be made within the wet well covers and frames to allow the main cover to be closed while the pump unit and any associated cables are removed; • Closure of the wet well cover to be possible with the pump unit at a minimum height above the frame to provide a safe working platform for maintenance, if so desired; • For large openings, segmental multi cover units shall be provided; • Beams for supporting segmental multi unit assemblies, including associated brackets, to be of steel and post galvanised to IS EN 1461 (minimum zinc coating of 70 microns). These beams must not obstruct access or be easily removed. Covers to meter chambers and other Manhole chambers on the pump station site shall comply with Section 3.12 of the Codes of Practice for Wastewater, and shall be sealed if the site is located in an area which might be prone to flooding. Access to meter chamber, the valve chamber and other chambers (excluding the wet well and the emergency storage tank) shall be by Manhole proprietary rungs built into the walls. They shall comply with the requirements of IS EN 13101 (2002), Type D, Class 1. Galvanised mild steel step rungs, 20mm diameter, shall be provided with plastic encapsulated finish. Steps shall be 300mm wide and located 230mm apart vertically. The vertical distance between the top of the chamber cover and the first step in the chamber shall not exceed 675mm. All step irons shall be centred under the access opening in the Manhole roof slab. Alternatively, galvanised mild steel ladders may be provided, in accordance with Section 3.12 of the Codes of Practice for Wastewater, subject to the requirements of Irish Water or where the depth of the chamber exceeds 3m.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting. Designers to eliminate the need to enter confined space. Where elimination is not practical, the Designer should ensure that the level of risk is as low as is reasonably practical. Ensure entry & exit can be achieved with as much ease as possible. Consideration to be given at design stage to the method of rescue in an emergency situation to allow for setting up of rescue equipment. Confined Space Entry to be in accordance with Health and Safety Legilsation. Operatives involved in confined space entry to be trained in accordance with Legislation. Operatives to provide a back up fall-arrest system and standby tripod in the event that there is a malfunction of the working access equipment. Designer to take account of health & safety in selection, designing & installing chamber covers & frames to address manual handling, access / egress, rescue etc. The Designer must ensure that the general principles of prevention (as well as all relevant Health & Safety Legislation) are taken into account when selecting & designing chamber covers & frames. Consideration must be given to the following risks relating to cover design: manual handling - means of safely lifting & moving the cover & eliminating / minimising risk of manual handling injury, ope protection (dependant on size) - access / egress - room to safely access rescue - room to safely rescue & also room to safely set-up rescue equipment etc. Proprietary lifting equipment should be provided to allow for safe lifting of chamber covers & this should be consistent to avoid risk of accidents due to misuse.	2	3	6	**Medium**
54	Operation	Toxic atmosphere / dangerous gases Odour	Operation and Maintenance Personnel Public	**Section 5.15 Venting of Wet Well and Chambers** The selection of the method of venting of the wet well shall take into account the risk of toxic fumes, dangerous gasses, odour nuisance, etc. Generally, the wet well and the emergency storage tank shall be vented via a duct extending from the 'high points' of the wet well and connected to free-standing vent columns or vent stacks. In odour sensitive areas, passive activated carbon filters shall be provided to vent column(s)/stack(s). The activated carbon filters shall be of robust proprietary manufacture and sized to have a minimum retention time of 3 seconds at maximum flow-rate. Where mechanical ventilation is deemed necessary, it shall be of robust design and all control equipment shall be housed in a separate panel within the control kiosk.	3	4	12	**High**	IW CDS Design Team will vet the submitted design and may require its amendment if deemed inadequate. IW CDS Field Engineers will undertake site supervision and inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting. All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Confined Space Entry to be in accordance with Health and Safety Legilsation. Operatives involved in confined space entry to be trained in accordance with Legislation. Designers to eliminate the need to enter confined space. Where elimination is not practical, the Designer should ensure that the level of risk is as low as is reasonably practical. Ensure entry & exit can be achieved with as much ease as possible. Consideration to be given at design stage to the method of rescue in an emergency situation to allow for setting up of rescue equipment. Site specific risks to be assessed & appropriate design mitigation measures to be implemented. The Designer shall provide a detailed method statement for entry procedures to confined spaces during the construction phase & the operation & maintenance phase, including use of gas monitors & breathing apparatus. Confined Space Entry to be in accordance with Health and Safety Legilsation. Operatives involved in confined space entry to be trained in accordance with Legislation. Operatives to provide a back up fall-arrest system and standby tripod in the event that there is a malfunction of the working access equipment.	2	3	6	**Medium**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
55	Operation	Electroction Explosion	Operation and Maintenance Personnel	**Section 5.16 General Electrical Requirements** Suitably rated electrical and plant control equipment shall be provided at the pumping station to ensure efficient and continuous operation of all plant and equipment. The plant telemetry equipment and installation shall be provided in accordance with Section 5.26 and Section 5.27 of the Codes of Practice .The electrical and control plant and equipment for the pumping station shall be located in a kiosk or structure within the pumping station site. The kiosk(s), including the electrical/control panels, shall be located at least 2m remote from the pumping plant. The incoming electricity supply to the pumping station shall be 400 V, 3-phase and neutral, 4-wire, 50 Hz, with phase failure protection fitted to the incomer phases to prevent motor burnout due to phase failure. All electrical work associated with pumping station shall be carried out to IEE Regulations. The electrical installation work shall be carried out by a Contractor who is included in an approved Register for Electrical Contractors (e.g. RECI, IREC, etc.) and will carry out the works in accordance with this Part 5, which is generally in line with Irish Water's WIMES Electrical Specification. The Developer/Developers Electrical Contractor is responsible to apply to ESB Networks for a dedicated and metered power supply and this shall be provided to the pump station serving only the pump station plant and associated equipment. The Developers Electrical Contractor must comply with requirements of ESB Networks and shall seek approval from ESB Networks for starter arrangement's (Star/Delta). On completion of the electrical installation, the developer shall provide Irish Water with an electrical installation certificate, a signed declaration that the pumping station operates in accordance with the schematic diagrams and the required control philosophy. A separate distribution board for building services shall be provided for an electrical heater, light and a 220V, 16amp, electrical weatherproof socket. Lightening protection shall also be provided. Electrical installations, cables, fittings and equipment shall be provided in accordance with the requirements of Sections 5.17 to 5.21 of the Codes of Practice.	3	4	12	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	3	6	**Medium**

	Activity	Related Hazard	Who is at Risk?	Existing Control Measures	Initial Risk				Additional Control Measures	Residual Risk			
					Probability	Consequence	Risk	Ranking		Probability	Consequence	Risk	Ranking
56	Design and Construction	Electrocution Insufficient space for required plant Insufficient space for operation and maintenance	Operation and Maintenance Personnel Construction Personnel	**5.22 Pumping Station Control Panel Enclosure** A pump station control kiosk enclosure shall be provided to accommodate metering equipment, pump control panels, telemetry equipment, heating and lighting systems, a socket point for a standby generator, a 220V and 110 V external use socket, etc. The power supplier will provide a separate kiosk for the electrical supply. The minimum size of the kiosk for Type 1 and Type 2 pump stations shall be 1,200mm (L) x 1,800mm (H) x 1,200mm (D). The minimum size of kiosk for the Type 3 pump stations shall be 2,000mm (L) x 2,000mm (H) x 1,200mm (D). In all instances there shall be a clear minimum working space between the front of the panel and the plinth edge of 750mm. The roof of the unit shall have a slope front to back. Standard warning notices shall be placed on the kiosk to warn of danger. The size of the power supplier's kiosk shall be to ESB Network's requirements. The kiosk shall be a of a 'walk- in' design with open base and one piece roof that slopes to the rear. The kiosk shall be supported on a reinforced concrete plinth extending 150mm in each direction beyond the external plan dimensions of the kiosk. The plinth shall have a level finish, with 25mm chamfered edges, 150mm above the finished ground level. The kiosk shall be bolted to the plinth through a bottom flange with galvanised mild steel or stainless steel anchor bolts. The bottom flange shall be seated on a neoprene gasket and sealed with mastic to prevent ingress of water. The plinth shall incorporate appropriate ducting to connect into the site power, telemetry and control ducts to facilitate cabling between the kiosk and the various chambers within the pumping station site. Long radius bends shall be incorporated in the ducting, sharp elbows shall not be used. The walls, roof and doors of the kiosk should be constructed from either galvanised mild steel, 3mm minimum thick welded plate, with polyester coated finish, or in stainless steel in severe environments. Metallic kiosks shall be fully bonded and earthed. Alternative forms of kiosk construction other than galvanised mild steel or stainless steel will generally be required in areas subject to vandalism, e.g. enclosure of the kiosk(s) in a block-work or reinforced concrete enclosure with vandal proof doors. The edges of the kiosk doors should be stiffened by steel sections. The rear wall of the kiosk shall be reinforced with stainless steel sections to which a marine plywood board, 18mm thick, is fixed to support the electrical assemblies associated with the pumping plant. The walls of the kiosk shall have turned bottom flanges, with suitably factory formed holes to accommodate the bolts securing the kiosk to the concrete plinth. The bottom holes shall be reinforced with 5mm thick steel plate, welded to the steel wall of steel fabricated kiosks. The holding down bolts shall be galvanised mild steel or stainless steel expanding anchor bolts complete with large washers. The bolts should be located at suitable intervals to prevent bottom flange distortion The control philosophy for the pumping station shall be provided in accordance with Section 5.23 of the Codes of Practice.	3	4	2	**High**	All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	3	6	**Medium**
57	Design, Construction & Operation	Failure of lifting equipment	Operation & Maintenance Personnel Construction Personnel	**Section 5.30 Lifting Equipment** Suitable cast in davit sockets shall be provided in the roof slab of the pumping station. Davit sockets shall be designed and positioned to provide lifting equipment with a vertical pull on the pump unit lifting attachments, to enable pump units to be readily raised or lowered on their guide rails. Cover plates, flush with the top of the surrounding concrete, shall be provided to prevent the ingress of water and debris into the sockets. The davit sockets shall be suitable to accommodate lifting davits and lifting tackle to permit the safe lifting of the pump installation. The minimum rating of the davit, lifting tackle, etc. will be 500kg, safe working load (SWL). Lifting davits, tackle and sockets will be rated to lift twice the weight of each pump unit, subject to a safe working load of 500kg. The davits sockets shall be of stainless steel or galvanised mild steel in accordance with the safety certificate requirements. In some instances, Irish Water may require a permanent lifting gantry instead of a davit arrangement. In these situations, Irish Water shall be consulted in relation to the specific requirements. Such gantries shall be fabricated of galvanised structural steel and shall be permanently fixed on concrete support plinths, suitably sized, through base plates with anchor bolts. Such gantries shall be load tested and certified as outlined above. The manufacturer's name and the SWL of the lifting equipment shall be stamped on a stainless steel plate attached to the equipment. The lifting gantry shall be provided with a block and tackle, which shall be load-tested and rated along with the gantry assembly. Sites with such lifting equipment shall be fenced in accordance with the details outlined in Section 5.6 of the Codes of Practice for Wastewater.	3	4	12	**High**	All Lifting Equipment to be tested and inspected in accordance with current Health and Safety Legislation. All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSDP. Construction operations to be co-ordinated by a competent PSCS. Design will be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW Field Engineers. IW CDS Field Engineers will undertake site inspections during installation. IW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.	2	3	6	**Medium**

Consequence						
	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	**2**	**3**	**4**	**5**
		Probability				

Risk Score	Risk Ranking	Controls Required	Timeline
1 to 4	LOW	Low risk, controlled satisfactorily. No additional controls are required, but activity should be monitored to ensure risk does not increase over time	N/A
5 to 10	MEDIUM	Moderate risk, additional controls may be required. Additional Controls should be put in place to reduce risk.	3 months
12 to 16	HIGH	Serious risk, additional controls must be put in place. Controls should be identified to bring risk level down to as low as is reasonably practicable.	1 week
20 to 25	VERY HIGH	Unacceptable level of risk. The activity should not commence until control measures have been put in place to reduce risk to an acceptable level. Inform relevant business lead immediately	Before works commences / continues

Probability Value	Guidance on each Probability Value
1	**May never happen**. Unlikely to occur - only in exceptional circumstances
2	**Possible**. Considered unlikely – could occur but its doubtful
3	**Probable**. Circumstances can be envisaged when it could happen – some time in the future.
4	**Likely to happen**. Quite conceivable – it probably will occur sometime in the future
5	**Will happen** Likely to occur immediately or within a short period of time; may even be expected to occur frequently.

Consequence Value	Guidance on each Consequence Value	HSQE Element
1	**Insignificant**	
	Minor problem easily handled by normal day to day processes e.g.	
	- injury or ailments not requiring medical treatment	Health & Safety
	- minor errors in systems or processes requiring corrective action, or minor delay without impact on overall operation of a project.	Quality
2	**Minor**	
	Some disruption possible e.g.	
	- minor injury or First Aid Treatment Case.	Health & Safety
	- policy or procedure rule occasionally not met or services do not fully meet needs	Quality
3	**Serious**	
	Significant time and/or resources required e.g.	
	- serious injury resulting in hospitalisation or medical treatment, lost work time and requiring reporting of accident to HSA. General injuries involving employees where a person is injured at a place of work and cannot perform their normal work	Health & Safety
	- one or more key requirements not met. Invonvenient but not detrimental to core IW business or consumer welfare.	Quality
4	**Critical**	
	Operations severely affected or damaged e.g.	
	- life threatening injury or multiple serious injuries causing hospitalisation, leading reporting of dangerous occurance to HSA.	Health & Safety
	- operations consistenty not in line with IW policy or procedures; trends show service is degraded	Quality
5	**Catastrophic**	
	Business survival is at risk or damage e.g.	
	- accident or incident leading to death or multiple life threatening injuries.	Health & Safety
	- critical systems failure, bad policy or on-going non-compliance, IW Business severly affected.	Quality