Irish Water

Connection and Developer Services

Design Risk Assessment associated with Code of Practice for Wastewater Infrastructure

Document Number: IW-CDS-5030-04
April 2018 (Revision 0)
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.

<table>
<thead>
<tr>
<th>Revision</th>
<th>Reason for Revision</th>
<th>Approved By</th>
<th>Issue Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Initial Issue</td>
<td>T. O’Connor</td>
<td>23/04/2018</td>
</tr>
</tbody>
</table>
Irish Water

Connection and Developer Services

Design Risk Assessment associated with Code of Practice for Wastewater Infrastructure
### Section 1.8 Application for a Conformance Certificate

Irish Water’s Field Engineers will undertake site inspections of the Works in line with the Critical Site Inspection Policy during the construction of the Works. The Customer’s site staff shall retain on the site of the Works a Quality Assurance Folder to include information on the following:

- Quality assurance records of the water services infrastructure installation.
- All relevant documents to be vetted by CDS Team before Conformance Certificate is issued and connection is allowed to RI Water.

A CCTV survey of the pipework and a SUS25 survey of the manhole chambers shall be undertaken by the Customer at the end of the construction. The field engineer shall be notified of the application by Irish Water indicating satisfaction with the construction of the Works following:

- Confirmation by a Chartered Engineer that the Works has been installed in accordance with the design submitted in the Connection Application;
- Confirmation by a Chartered Engineer that the Works has been installed in line with the Codes of Practice and Standard Details;
- Confirmation by a Chartered Engineer and test result certificates indicating that the Works has undergone appropriate on-site testing, off-site testing and commissioning. The appropriate site tests for the Works would be, 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 of the relaxation curve as proof of the outcome of the test.

The Final Documents shall comprise the following typical scope of documentation:

- 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 Built Record Drawings shall be provided in hard copy and digital format. Location and layout plans, longitudinal sections and details should show the Works and development in full. Plan scales should be in common use, i.e., 1:500, 1:1000 or 1:2500 as appropriate. Drawings should be provided using appropriate AutoCAD compatible drawing files. These drawings shall contain the following information:
  - Manhole, pipe, pump station, service connection and inspection chamber locations, to Irish National Grid coordinates (IGN) to +/- 100mm accuracy in the horizontal plane, with dimensions relating to fixed Ordnance Survey co-ordinates;
  - Cover level and invert levels relating to fixed Ordnance Survey Datum (Min Height) to an accuracy of +/- 20mm;
  - 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, backfill and surround 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 Irish National Grid co-ordinates (Information in Tabular Format on a Schedule of Manholes);
- Dwelling and building numbers;
- 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.

### Table: Additional Control Measures

<table>
<thead>
<tr>
<th>Activity</th>
<th>Related Hazard</th>
<th>Who is at Risk?</th>
<th>Existing Control Measures</th>
<th>Initial Risk</th>
<th>Consequence Risk Ranking</th>
<th>Additional Control Measures</th>
<th>Minimal Risk</th>
<th>Consequence Risk Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter the Activity</td>
<td>Enter the hazard</td>
<td>list of persons or groups at risk</td>
<td>Give details of existing control measures in place</td>
<td>High</td>
<td>Low, Medium or High</td>
<td>Give details of additional control measures proposed</td>
<td>1-5 (select from list)</td>
<td>1-5 (select from list)</td>
</tr>
</tbody>
</table>

**Notes:**
- Risk: Low, Medium, High
- Consequence Risk Ranking: Low, Medium, High
- Probability: Low, Medium, High

**Examples:**
- Connection of new infrastructure to existing Irish Water asset and subsequent vesting of this infrastructure.
- Safety risk to construction personnel.
- Impact on service to customers.
<table>
<thead>
<tr>
<th>Activity</th>
<th>Related Hazard</th>
<th>Who is at Risk?</th>
<th>Existing Control Measures</th>
<th>Initial Risk</th>
<th>Additional Control Measures</th>
<th>Residual Risk</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 4 8 Medium</td>
<td>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.</td>
<td>2 2 4 Low</td>
</tr>
<tr>
<td>2</td>
<td>Maintenance and other works being carried out on the system</td>
<td>Irish Water Assets, Operation and Maintenance personnel, Contractors carrying out works in the future</td>
<td>Section 1.16 - Statutory and Other Consents</td>
<td>The Customer shall obtain all necessary consents and other permissions for the proposed development, including the Works.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 4 8 Medium</td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td>Design and Construction</td>
<td>Construction Personnel, Public Operation and Maintenance Personnel, Environment</td>
<td>Section 2.2 General Design Requirements</td>
<td>The design should 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 Customer or his 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 completion of the works. The Customer shall ensure that this professional indemnity insurance is retained and that evidence of this is available if requested by Irish Water. The design responsibilities and liabilities shall not be discharged by Irish Water after the design passes a satisfactory inspection and issue of a de-facto statement of no objection via the Connection Agreement.</td>
<td>3 4 12 High</td>
<td>IW CDS Design Team to vet the submitted design and may require its amendment if deemed inadequate.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>2 4 8 Medium</td>
<td></td>
<td></td>
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<tr>
<td>Activity</td>
<td>Related Hazard</td>
<td>Who is at Risk?</td>
<td>Initial Risk</td>
<td>Additional Control Measures</td>
<td>Minimal Risk Probability</td>
<td>Consequence</td>
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<td>4</td>
<td>Inadequate design</td>
<td>Construction Personnel, Public, IW operation and maintenance personnel, Contractors carrying out works in the future</td>
<td>3 4 12 High</td>
<td>W designers to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSSD. W CDS Team to vet the submitted design and may require its amendment if deemed inadequate. W CDS Field Engineers will inspect Final Documents (including as-constructed drawings) and will assess them for adequacy as outlined in Section 1.8 of the Code of Practice for Wastewater Infrastructure.</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Inadequate design</td>
<td>Public, IW operation and maintenance personnel, Contractors carrying out works in the future</td>
<td>3 3 9 Medium</td>
<td>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 PSSD. Construction operations to be co-ordinated by a competent PSSC. W CDS Design Team to vet the submitted design and may require its amendment if deemed inadequate. W CDS Field Engineers will inspect the final installed infrastructure and examine the Final Documents prior to vesting.</td>
<td>Low</td>
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</table>
### 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 Section 3.9 of the Code of Practice for Wastewater Infrastructure, 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 recommended herein, protection measures are provided by a concrete slab, a concrete surround with flexible joints or a ductile iron pipe;
- 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 Sewer system is resistant to tree root ingress where there is a risk of such intuaction, (e.g. by use of appropriate barriers or pipelines constructed from polyethylene with welded joints).

### Risk Assessment

<table>
<thead>
<tr>
<th>Activity</th>
<th>Related Hazard</th>
<th>Who is at Risk?</th>
<th>Existing Control Measures</th>
<th>Initial Risk</th>
<th>Additional Control Measures</th>
<th>Minimal Risk Probability</th>
<th>Consequence Probability</th>
<th>Risk Probability</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Design &amp; construction of the works. Structural failure during design life.</td>
<td>Public (in the event that structural failure results in loss of service) Maintenance personnel Construction Personnel.</td>
<td>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:</td>
<td>3 4 12 High</td>
<td>IW 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 PSSCS. 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 &amp; examine the final documents prior to vesting.</td>
<td>2 2 4</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Design of wastewater infrastructure layout Failure of system causing structural damage to near by structures.</td>
<td>Access for maintenance works and repairs to system. Contractors carrying out works in the future Public Construction Personnel.</td>
<td>Section 3.5 Layout of Works and Manholes The layout of Gravity Sewers, Rising Mains, manholes and chambers in the Works should:</td>
<td>3 4 12 High</td>
<td>IW 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 PSSCS. 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 &amp; examine the final documents prior to vesting. Site specific risks to be assessed &amp; 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 &amp; the operation &amp; maintenance phase, including use of gas monitors &amp; breathing apparatus. Designers should prepare an Emergency Plan including a Traffic Management Plan to make allowances for emergencies &amp; 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 &amp; constant visual contact.</td>
<td>2 2 4</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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 PSED.

Construction operations to be co-ordinated by competent PESC.

Design to be vetted by IW CDS Design Team as described in PESC. The final design will be inspected by Field Engineers.

IW CDS Field Engineers will undertake site inspections during installation.

GW Field Engineers will vet the final installed infrastructure & examine the final documents prior to vesting.

The following general guidance applies to the works and risk assessments to be prepared for all designs. Design co-ordination required by a competent PSED.

Construction operations to be co-ordinated by competent PESC.

Design to be vetted by IW CDS Design Team as described in PESC. The final design will be inspected by Field Engineers.

IW CDS Field Engineers will undertake site inspections during installation.

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### Design of Wastewater Collection System

#### Hydraulics

**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;

- **The Irish Water requirements** for the design of wastewater gravity sewers are set out in Appendix C of the Code of Practice for Wastewater Infrastructure.

- The Works should be watertight to minimise the ingress of groundwater and Surface Water.

- 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.

- Where the Works carry industrial or commercial wastewater, it shall be designed to carry the wastewater flows outlined in Section 1.2.6 to 1.2.9 of Appendix C of the Code of Practice for Wastewater Infrastructure.

- Allowances for flows associated with Section 3.6.4 of the Code of Practice and for Urban Creep, as outlined in Section 1.2.10 of Appendix C of the Code of Practice, shall also be incorporated into the design of the wastewater collection system.

- When calculating emergency storage requirements in accordance with Section 5.2, Section 5.7 and Section 5.11 of the Code of Practice for Design of Wastewater Collection System

- When a choice has to be made between a Gravity Sewer system and pumped pipe system, these criteria should not be regarded as inflexible.

#### Storage

- **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.

#### Design

- **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 PSSC.**

- **Construction operations to be co-ordinated by a competent PSSC.**

- **Design to be vetted by IW CDS Design Team and installation of infrastructure will be inspected by IW CDS 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.**

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<thead>
<tr>
<th>Activity</th>
<th>Related Hazard</th>
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<th>Existing Control Measures</th>
<th>Initial Risk</th>
<th>Additional Control Measures</th>
<th>Minimal Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Inadequate Hydraulic capacity</td>
<td>Operation and Maintenance personnel</td>
<td>Public</td>
<td>Section 3.6 - Hydraulic Design for Gravity Sewers</td>
<td>3 4 12 High</td>
<td>IW designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSSC.</td>
</tr>
<tr>
<td></td>
<td>Unacceptable flow velocity</td>
<td>Settlement of solids at low flow</td>
<td></td>
<td></td>
<td>Construction operations to be co-ordinated by a competent PSSC.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Design resulting in unacceptable flow velocity</td>
<td>Operation and Maintenance personnel</td>
<td>Public</td>
<td>Section 3.6 - Hydraulic Design for Gravity Sewers</td>
<td>3 4 12 High</td>
<td>IW designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSSC.</td>
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<tr>
<td></td>
<td>Formerly</td>
<td></td>
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<td></td>
<td>Construction operations to be co-ordinated by a competent PSSC.</td>
<td></td>
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<tr>
<td>12</td>
<td>An unacceptable flow velocity</td>
<td>Operation and Maintenance personnel</td>
<td>Public</td>
<td>Section 3.6 - Hydraulic Design for Gravity Sewers</td>
<td>3 4 12 High</td>
<td>IW designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination required by a competent PSSC.</td>
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<tr>
<td></td>
<td>Formerly</td>
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<td>Construction operations to be co-ordinated by a competent PSSC.</td>
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</tr>
</tbody>
</table>

IW-CDS-5030-04 Page 6 of 28 Rev. 0 April 2018

![Risk Assessment Table Image](image-url)
Section 3.8 Pipe Sizes

- Diameters of less than 80mm should not be provided and the typical minimum diameter should be 100mm diameter (Rising Mains of lower diameter might not be taken over by Irish Water).
- The roughness value (\(k_s\)) 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 1.6m/sec.

The minimum pipe sizes for Gravity Sewers where more than 20 housing units are connected is 225mm diameter subject to hydraulic design capacity assessment requirement. A pipe size greater than 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-siphon/suction devices.

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. Designs 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.

Section 3.7 - Hydraulic Design for Rising Mains

- Rising Mains longer than 500m in length should have provision for in-line rodding, access and cleaning by the provision of on-line proprietary “hatch boxes.”
- The provision of access points for pigging or rodding the Rising Main is desirable, especially along long Rising Mains. If possible, Rising Mains should be evenly graded between the intake point and the discharge point. If this cannot be achieved, the Rising Main should be fitted with sewage air valves and scour valves. Both of these should be suitable for use with raw Wastewater. Settlement of the Wastewater volume at the scouring point should be accommodated and arrangements made for its collection by vacuum tanker and transportation to a suitable point for treatment or reintroduction into the Wastewater collection network.

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. Designs 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.

Section 3.9 - Depth of Cover

- 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 is 225mm diameter subject to hydraulic design capacity assessment requirement. A pipe size greater than 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-siphon/suction devices.

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. Designs 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.
### Access to Sewers

**Biological Drowning**

- Falls from height
- Confined Space/Fumes
- Emergency Escape due to Injury

**Operation and Maintenance Personnel**

#### Additional Control Measures

<table>
<thead>
<tr>
<th>Activity</th>
<th>Related Hazard</th>
<th>Who is at Risk?</th>
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<th>Minimal Risk</th>
<th>Consequence</th>
<th>Risk</th>
<th>Ranking</th>
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</thead>
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<tr>
<td>17</td>
<td>Access to Sewers</td>
<td>Biological Drowning</td>
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<td>Falls from height</td>
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<td>Confined Space/Fumes</td>
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<td>Emergency Escape due to Injury</td>
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<td>Operation and Maintenance Personnel</td>
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<td>Construction Personnel</td>
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<tr>
<td></td>
<td></td>
<td>Section 3.11 Access to the Works</td>
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<td>Access structures to Works shall be located to minimise the risk of damage to buildings or other infrastructures. Such access points are generally provided through manholes. Inspection chambers may be provided as access points in the case of small diameter Sewers at shallow depths (less than 900mm cover). Manholes should be designed to:</td>
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<td>• Provide reasonable access for equipment to carry out maintenance activities;</td>
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<td>• Provide safe access and egress in accordance with Health and Safety Authority requirements and in accordance with Health and Safety Legislation;</td>
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<td>• Have a minimum clear access 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);</td>
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<td>• 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 1200mm x 1200mm.</td>
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<td>Access points to the Works shall be located with due regard to public utility services, safety and security. 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 in the following positions</td>
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<td>• At all changes of pipe direction;</td>
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<td>• At all Sewer junctions of two or more pipes;</td>
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<td>• At every junction of a Wastewater Sewer with another Sewer serving three or more properties where the access point is a manhole;</td>
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<td>• At the point of connection of the Works to the Network.</td>
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<td>In addition to the above, the following should also be adhered to:</td>
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<td>• An inspection chamber should be installed within the boundary to the Curtilage of a Premises or within 1m of the Premises, if practicable, to allow access to the private Drain and the service connection.</td>
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<td>• Drains and associated Accessories upstream of the point of connection to Works is the responsibility of the property owner and should be constructed in accordance with the Building Regulations subject to the provision of an inspection chamber as above.</td>
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<td>Access points (manholes and chambers) should be located so that they are accessible and apparent to the maintainer at all times for use. They should avoid rear gardens or enclosed locations and they should 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.</td>
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<td>Section 3.11 Manholes</td>
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<td>Manholes should generally be provided as the means of access to the Works and particularly where:</td>
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<td>• the depth from the surface to the crown of the pipe is greater than 900mm;</td>
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<td>• there are two or more upstream pipes each serving more than one property; or</td>
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<td>• the distance between manholes would otherwise be greater than 90m for Sewers of 225mm diameter and above, and 75m where the Sewer size is a 150mm diameter.</td>
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<td>Inspection chamber access 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 inspection chamber (i.e. the distance between the adjacent inspection chambers should be no more than 45 m).</td>
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Footnotes:

- IW-CDS-5030-04 Page 8 of 28 Rev. 0 April 2018
Section 3.12 Manholes

A manhole, in general, should not be located in carriageways situations where traffic loading is anticipated to be heavier (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. Manhole covers and frames to IS EN 124, with D400 load capacity, should be used where manholes 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.

Manholes are to 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. The precast wall units shall be provided with rubber sealing ring gasket between units, complying with the requirements of IS EN 1917 and BS 5911 – Part 1, subject to specific approval of Irish Water. Complete with a 150mm minimum thickness cast in situ concrete surround, C16/20, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620. The precast concrete manhole shall have either pre-cast or cast in-situ concrete base (225mm minimum thickness beneath channel) and pre-cast or cast in-situ concrete roof slab (225mm minimum thickness), both constructed of C20/25 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.

- High density, high strength, 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). Block work to be flush pointed and not plastered internally, complying with the requirements of IS EN 771, with internal lining of solid engineering brick to IS EN 771 to a height of 1.0m above the benching, bonded to the concrete block work, supported on a 225mm thick concrete floor with a reinforced concrete roof of 225mm minimum thickness, both cast 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.

Manhole Dimensions depend on the size of the main Sewer and the number of pipes accommodated in the manhole. The design size should permit safe entry and exit without unduly restricting operating space. All manholes shall have a minimum internal clear diameter 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 allowing smooth flow between the inlet pipe(s) and the exit pipe(s). 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.

Manhole Dimensions:

- Manhole Dimensions depend on the size of the main Sewer and the number of pipes accommodated in the manhole. The design size should permit safe entry and exit without unduly restricting operating space. All manholes shall have a minimum internal clear diameter 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 allowing smooth flow between the inlet pipe(s) and the exit pipe(s). 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.
22 Design, Construction & Operation

Activity: Manhole Bases should 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. Alternatively, approved precast concrete ring units may be used where the water table is low. These units shall comply with the requirements of IS EN 1917 and BS 5911 – Part 3, complete with a cast in situ concrete surround of 150mm minimum thickness of C16/20, 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. In shallow manholes, less than 1.2m deep, high density solid concrete block work walls may be used.

23 Design, Construction & Operation

Activity: Manhole Steps are to be provided in manholes with depths up to 2.5m in and shallow chambers. Manhole steps shall comply with the requirements of IS EN 13011, Type D, Class 1. Galvanised mild steel step rungs, 20mm diameter, shall be provided, with a plastic encapsulated finish. Step rungs should be 200mm wide and located 300mm apart vertically. The vertical distance between the step and the benching shall not exceed 675mm. The distance between the step and the benching shall not exceed 300mm. All step irons shall be positioned 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 with the roof slab opening.

24 Design, Construction & Operation

Activity: Manhole Walls should 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 outlined above. Alternatively, approved precast concrete base modules may be used, incorporating channels, benching, etc., subject to Irish Water approval and compliance with BS 5911, Part 4. 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.

25 Design, Construction & Operation

Activity: Manhole Recess 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, approved precast concrete roof slabs may be used in compliance with BS 5911 – Part 4:2002. This approach would be the preferable option where precast concrete roof slabs are used as manhole roof slabs. An access opening shall be formed in the manhole roof slabs. The minimum dimensions of the roof opening shall be 600mm by 600mm. 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 side at invert level.
**Section 3.12 Manholes**

Manhole invert 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 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 benches, may be used. Such units shall be in accordance with the provisions of IS EN 1917 and BS 5911 – Part 3. Where there is more than one incoming Sewer discharging to the manhole, the benches 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 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 200mm centres in channels of sewers of 600mm and greater to allow access from the benching to the channel invert.

**Additional Control Measures**

- All designs to be carried out by competent designers. Design risk assessments to be prepared for all designs. Design co-ordination as required by a competent PSDP.
- Construction operations to be co-ordinated by a competent PSSC.
- 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.

**Initial Risk**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Related Hazard</th>
<th>Who is at Risk?</th>
<th>Existing Control Measures</th>
<th>Probablity</th>
<th>Consequence</th>
<th>Risk</th>
<th>Ranking</th>
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<tbody>
<tr>
<td>26 Design, Construction &amp; Operation</td>
<td>Failure of Structural Integrity</td>
<td>Construction Personnel</td>
<td>Section 3.12 Manholes</td>
<td>Medium</td>
<td>3</td>
<td>4</td>
<td>12</td>
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<tr>
<td>27 Design, Construction &amp; Operation</td>
<td>Access to confined space from manhole cover opening to the manhole</td>
<td>Public Construction Personnel</td>
<td>Section 3.12 Manholes</td>
<td>Medium</td>
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<td>4</td>
<td>12</td>
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<tr>
<td>28 Design, Construction &amp; Operation</td>
<td>Failure of Structural Integrity</td>
<td>Construction Personnel</td>
<td>Section 3.12 Manholes</td>
<td>High</td>
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<td>4</td>
<td>12</td>
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</table>
### Section 3.12 Manholes

Manhole Covers and Frames shall comply with IS EN 124 and BS 7932 and be of suitable load grade, Class D400 (or E600 for heavy trafficked roads, as required on a case by case assessment basis). 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 linear diameter/dimension of 600mm. 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 two closed keyways shall be provided in each cover. Manhole covers may be single units or double triangular. Third Party Certification shall be provided for all cast iron manhole cover and frames. The frame cover should be supported on Class B solid engineering brick to IS EN 771, one course minimum and no more than a maximum of three courses in height, set in C50/60 mortar. Standard concrete blocks or bricks shall not be permitted. The cover frame should be installed and bedded 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.

### Section 3.13 Gravity Sewer Pipe Material Types & Section 3.14 Rising Main Pipe Material Types

- **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) and with WIS 4-35-01 (2008). Pipes to be of Stiffness Class 8kN/m² and to be capable of demonstrating a jetting resistance of 2,600 psi (180 Bar) without damage when tested in accordance with Section Section 3.3 of WIS 4-35-01 (2008). Sewer diameters 150mm up to 450mm, Service Connections of 100mm diameter;  •    Unplasticised PVC; Unplasticised PVC pipes and fittings shall comply with the provisions IS EN 1401 2009/2012. 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);  •     Other; The use of alternative pipe types and materials will require the prior written agreement of Irish Water.
- **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 4076.
- **Polyethylene:** Polyethylene pipe and fittings for Wastewater shall comply with the requirements of IS EN 12201. Polyethylene fittings, including fusion joints and electrofusion 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):
  - 3.14.3 4-32-06 – Specification for the Fusion Jointing of Polyethylene Pressure Pipeline Systems Using PE80 and PE100 materials;
  - 3.14.5 4-32-18 – The Choice of Pressure Rating for Polyethylene Pipe Systems for Water Supply and Sewerage Duties;
  - 3.14.6 IGN 4-01-03 – Pressure Testing of Pressure Pipes and Fittings for use by Public Water Supplies.
31 Design, Construction & Operation Failure of Structural Integrity Section 3.16 Pipe Joints

Pipe joints shall be in accordance with the manufacturer’s instructions 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, all fusion welding shall be strictly in accordance with UK WIS 4-32-08 (Specification for Fusion Jointing of Polyethylene Pressure Pipeline Systems Using PE80 and PE100 Materials). Equipment used for butt fusion welding shall be in accordance with UK WIS 4-32-16 (Butt Fusion Joining Machines).
- Bolted flanged joint shall have raised face flanges complete with nuts and bolts to IS EN ISO 898 and 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 10 bar and 20 bar respectively.
- Butt fusion welding and electro fusion jointing of pipes shall only be carried out by trained operatives in possession of a current relevant Training Certificate, using fully automatically approved jointing machinery in accordance with the manufacturer’s instructions. In relation to electro fusion jointing, the jointing machinery shall incorporate a remote inspection/monitoring system, which allows for real time inspection of the weld integrity. The identity of the MDPE/HDF/PE100 pipe 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 tagged automatically on the jointing machine. A printout of the joint details, with a GPS location of each joint, shall be provided and retained for quality assurance purposes.
- Prior to the commencement of new laying works a short term burst test (in accordance with Appendix A of WIS 4-32-08) and a joint toughness test (in accordance with Appendix C of WIS 4-32-08) shall be carried out for each pipe diameter containing electro fusible welds used by the Customer’s contractor’s personnel and welded by the equipment to be used for Works.

Similarly, a joint ductility tests (in accordance with Appendix B of WIS 4-32-08) 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. The test shall be carried out at a frequency of 1 test per 30 joints made on site and the test joint shall be chosen at random by the Irish Water Field Engineer. The Contractor shall note that if the results of any of the weld tests (joint toughness or ductility 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 replace all welds, since the last weld found to be in compliance with WIS 4-32-08, performed by the particular welding machine and operator who completed the weld that failed. The welding machine and operator shall be prohibited from performing further welds until they have passed a second site audit.

Pipe coils will only be permitted to be used for pipe diameters of 125mm and below. Where pipe coils are used, suitable re-rounding clamps and seal re-rounding inserts must be used.

All pipe joints, fittings and accessories shall be free from lead. (this sentence is not in this clause of CDP.) Auditing and testing of welded joints in polyethylene pipelines shall be carried out as follows:

- Each installation team and welder will be audited by the Irish Water Field Engineer on a regular basis. The audit will use a standard checklist to ensure that all the correct equipment and working practices are being utilised.
- 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.
- Butt fusion welds and electro fusion welds shall be cut out from the works completed and subjected to a destructive test, as indicated by the Irish Water Field Engineer. All sample welds shall be clearly labelled and referenced. One butt fusion weld per butt fusion joint per week and one electro fusion weld per electro fusion joint per week shall be cut out and taken for testing by the Developer’s contractor. The minimum frequency of destructive testing shall be increased as specified by the Field Engineer if significant failure rates occur.
- For butt welding, completed welds shall be de-beaded and the weld bead shall be inspected on site by the testing crew. Beads shall be labelled, bagged and stored by the Developer’s contractor and access shall be provided to the Field Engineer to inspect the weld beads when requested.

Weekly equipment checks and supervision of the pressure tests shall be carried out by the Developer and those will be inspected by the Field Engineer. However the destructive weld testing and analysis shall be carried out by a specialist and accredited testing organisation. The Developer’s contractor shall provide details of his proposed testing organisation to the Field Engineer for review and approval prior to any testing being undertaken.

The Contractor shall arrange for the selected samples to be tested in accordance with WIS 4-32-08 Appendix B. C and D by an accredited laboratory (by the Irish national Accreditation Board or equivalent) and a test report in accordance with WIS 4-32-08 provided to the Employers Representative within 1 week of the sample joint being taken. The report should indicate the failure mode (above or below 75% ductile failure) and the value (KCI, classification (as above), ductile failure etc.), recommended action. Where welds exhibit <75% Ductility (2<0.7), the Contractor shall evacuate, cut out, and provide the welds cut out immediately before and immediately after failed sample for testing. The provision of the sample and all costs associated with their provision including restoring the main to service and reinstatement will be borne by the Contractor. Unused sample welds shall be properly catalogued and stored by the Contractor until the end of the Defect Period. Welds shall remain the property of the Employer and be made available to the Employer’s Representative at any location for testing should he so direct. The test shall be carried out at the expense of the Customer and this shall include all costs associated with the taking of testing, analysis of and transportation of samples. The frequency of testing shall be one test per 30 joints made on site. The test joint shall be chosen at random by the Irish Water Field Engineer.

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<tr>
<th>Activity</th>
<th>Related Hazard</th>
<th>Who is at risk?</th>
<th>Initial Risk</th>
<th>Additional Control Measures</th>
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<tbody>
<tr>
<td>Design, Construction &amp; Operation</td>
<td>Failure of Structural Integrity</td>
<td>Construction Personnel, Public</td>
<td>Initial Risk</td>
<td>Additional Control Measures</td>
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32 Maintenance and other works being carried out on the sewerage line Section 3.17 Rising Main Fittings + 3.15 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 Irish 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 Irish Water Code of Practice for Wastewater Infrastructure, Section 3.18.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Related Hazard</th>
<th>Who is at risk?</th>
<th>Initial Risk</th>
<th>Additional Control Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance and other works being carried out on the sewerage line</td>
<td></td>
<td></td>
<td>Initial Risk</td>
<td>Additional Control Measures</td>
</tr>
<tr>
<td>Operation and Maintenance</td>
<td></td>
<td></td>
<td>Probabil ity</td>
<td>Consequ enc e</td>
</tr>
<tr>
<td>Risk</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>High</td>
</tr>
<tr>
<td>Risk</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>Low</td>
</tr>
</tbody>
</table>
It is the responsibility of the Customer 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 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.

As part of the Design Submission at the Application Stage, the Developer is required to submit an integrated utility layout plan showing the layout of all utility infrastructure and indicating the relative separation 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.

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 of root ingress to the Works by appropriate separation distances or by the provision of root protection barriers.

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 should 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.

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, fittings, including coatings & 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.

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.
Residual 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 PSCs. Construction operations to be carried out 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 2005. In particular all excavators shall be assessed and appropriate protection against collapse and falling materials shall be put in place.

### Appendix D

#### Trench Width

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 500mm 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 400mm 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.

### Table: Risk Assessment

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>36</td>
<td>Construction of sewer line</td>
<td>French collapse</td>
<td>Construction operatives</td>
<td>Public</td>
<td>Section 4.4 Trench Widths</td>
<td>This 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 500mm 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.</td>
<td>Trench widths for pipe sizes up to 400mm diameter may be less than 500mm subject to consideration being given to the trench depth, health and safety consideration and access requirements.</td>
</tr>
</tbody>
</table>

37 | Construction of sewer line | Trench Settlement | Public | 2 3 6 Medium |

#### Pipe Bedding, Haunch and Surrounds

Pipe bedding, haunch side fill and surround material for buried pipelines shall comply with WBS 4.08-02 and its associated Guidance Note, ION 4.08-01, UK Water Industry Specifications. Granular material shall be to 14mm to 5mm graded aggregate or 15mm single sized aggregate, complying with the requirements of IS 13242 and should have a compaction factor value not greater than 0.2 when measured in accordance with IS EN 752. Such material is generally referred to as Type A Granular Material.

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 Water Service Actual depth of the trench required and the void backfilled with Clause 808 granular material in accordance with the 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, shall 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 lamping until the required depth of bedding and side fill has been achieved. When 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 200mm 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 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 shall be 300mm above the external crown of the pipe. The Sewer trench above the granular surround shall be backfilled with Clause 804 or Clause 808 granular material as described below.

If a Sewer is installed in a green field area, selected backfill may be used above the haunch side fill granite material, in the case of a rigid pipe, and above the granular surround material in the case of a flexible pipe. This selected backfill, generally referred to as Type B. Fill, shall be a uniformly compressible material free from clay lumps greater than 75mm, stones greater than 40mm in size, building rubbish of any kind, tree roots, vegetable matter, etc. Rising Mains in green field areas should always have a minimum cover of 300mm of granular surround material. Concrete beds and surrounds may be required to address impact from loading in heavily trafficked areas and to address granular pipe cover situations. The detail shall be subject to submission to and assessment by Irish Water before advancing with the work. Concrete bed, haunch and surrounds of pipes shall be a minimum thickness of 100mm with an absolute minimum depth of cover above the external crown of the pipe of 170mm. The concrete shall 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 and all joints to allow for pipe flexibility.

Where soft ground conditions (situation where a California Bearing Ratio (CBR) less than 5 exists) are anticipated or encountered, the soft material should be excavated and disposed to an approved disposal area, in accordance with the Waste Management Act. Clause 808 granular material, in accordance with the 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 and assessment by Irish Water before advancing with the work.

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</tr>
</tbody>
</table>

37 | Construction of sewer line | Trench Settlement | Public | 2 3 6 Medium |
Settlement of ground surface above the sewer / pipeline

Construction of sewer line

Backfill materials shall be placed above the granular surround material described in Clause 4.7 of the Code of Practice for Wastewater Infrastructure up to as the underside of the road construction.

Backfill material shall comprise Clause 804 granular material, in accordance with the TI Specifications for Road Works, and it shall be used where the sewer is installed along proposed roadways and footpaths in the development. If the backfill material is within 500mm of a concrete pipe in 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 near roadways and footpaths. The backfill material shall be placed in layers not exceeding 200mm, each layer being compacted to the requirements of the Specification for Road Works. The first layer of backfill above the granular surround shall be compacted in 150mm layers. Mechanical compaction equipment should 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 to use such alternative material. Evidence of this written approval to use alternative Backfill material shall be provided to Irish Water in advance of the issue of the Connection Agreement. The relevant Roads Authority should specify this alternative Backfill material and this should require compliance with the definition of "acceptable material" as outlined in Clause 601 of the TI "Specification for Roadworks, Series 600 - Earthworks".

The opening, backfilling and Reinstatement of trenches on National Roads shall be in accordance with the TI Specification for the Reinstatement of Openings in National Roads, July 2011, unless otherwise specified.

Clause 808 backfill material, in accordance with the "Guidelines for the Opening, Backfilling and Reinstatement of Trenches in Public Roads" and the TI Specification for Road Works where pipes are located in Public Roads, shall be used as backfill where the sewer or Rising Main is installed along roadways and footpaths. This also applies where the trench is in green areas running near roadways and footways. Backfill material shall be placed in layers not exceeding 200mm, each layer being compacted to the requirements of the Specification for Road Works. The first layer of backfill above the granular surround should be compacted in 150mm layers. Mechanical compaction equipment should not be used until there is a minimum of 450mm of compacted material above the crown of the pipe.

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 TI "Specification for Road Works", this Code of Practice and 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, generally referred to as Type B, Fill, 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 200mm in depth and compacted according to the 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 (CIS60, Category B, in accordance with the TI Specification for Road Works, Series 805).

38

39

Construction of rising mains

Nature 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

Appropriate anchor/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.

The 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 block shall be formed using formwork to provide a rough cast finish. Anchor/thrust blocks shall be provided on Rising Mains at bends of curvature greater than 11.5 degrees, at both sides of air valve chambers, at any abrupt change in vertical or horizontal direction, at scour fittings and any location where liquid pressure is likely to disturb the pipe line installation or cause disproportionate movement. Plastic or polyethylene pipes shall be wrapped in plastic sheathing 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 lips and air valve fittings installed on plastic pipe lines in order to resist torque forces imposed on the fittings during support. 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/taps 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, learn supports, etc., are required where Rising Main pipes are laid in boggy or swampy conditions. Support blocks are also required to anchor pipes where gradients are 1:5 or greater. Design of supports, piles, ground beams should be provided to Irish Water for assessment. Pipe joints should allow for longitudinal movement due to thermal effects and thrusts due to internal pressure.

W CDS Design Team will vet the submitted design and may require its amendment if deemed inadequate.

W CDS Field Engineers will undertake site inspections during installation.

W CDS Field Engineers will vet the final installed infrastructure prior to vesting.

Falls associated with backfilling the pipe trench are the 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.

Failure of rising main under pressure at bends, fittings and accessories

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 to as the underside of the road construction.

The backfill material shall comprise Clause 804 granular material, in accordance with the TI Specifications for Road Works, and it shall be used where the sewer is installed along proposed roadways and footpaths in the development. If the backfill material is within 500mm of a concrete pipe in 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 near roadways and footways. The backfill material shall be placed in layers not exceeding 200mm, each layer being compacted to the requirements of the Specification for Road Works. The first layer of backfill above the granular surround should be compacted in 150mm layers. Mechanical compaction equipment should 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 to use such alternative material. Evidence of this written approval to use alternative Backfill material shall be provided to Irish Water in advance of the issue of the Connection Agreement. The relevant Roads Authority should specify this alternative Backfill material and this should require compliance with the definition of "acceptable material" as outlined in Clause 601 of the TI "Specification for Roadworks, Series 600 - Earthworks".

The opening, backfilling and Reinstatement of trenches on National Roads shall be in accordance with the TI Specification for the Reinstatement of Openings in National Roads, July 2011, unless otherwise specified.

Clause 808 backfill material, in accordance with the "Guidelines for the Opening, Backfilling and Reinstatement of Trenches in Public Roads" and the TI Specification for Road Works where pipes are located in Public Roads, shall be used as backfill where the sewer or Rising Main is installed along roadways and footpaths. This also applies where the trench is in green areas running near roadways and footways. Backfill material shall be placed in layers not exceeding 200mm, each layer being compacted to the requirements of the Specification for Road Works. The first layer of backfill above the granular surround should be compacted in 150mm layers. Mechanical compaction equipment should not be used until there is a minimum of 450mm of compacted material above the crown of the pipe.

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 TI "Specification for Road Works", this Code of Practice and 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, generally referred to as Type B, Fill, 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 200mm in depth and compacted according to the 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 (CIS60, Category B, in accordance with the TI Specification for Road Works, Series 805).

W design to be carried out by competent designers. Design co-ordination required by a competent PSC.

Construction operations to be co-ordinated by a competent PSCS.

W CDS Design Team will vet the submitted design and may require its amendment if deemed inadequate.

W CDS Field Engineers will undertake site inspections during installation.

W CDS Field Engineers will vet the final installed infrastructure prior to vesting.

Falls associated with backfilling the pipe trench are the 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.

Risk: High

Risk: Medium
Testing of Sewers and Manholes

4.10 Testing of Gravity Sewers and Manholes

The works shall be tested by the Customer 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. 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 of the Code of Practice for Wastewater Infrastructure.

The air test 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 minutes, 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, & indicate 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 test involves the filling of the pipeline to a depth of 1.2m 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 2.5m. The pipeline should stand for two hours after filling to allow absorption, topping up as necessary, before starting the test. The test shall be conducted for a period of 30 minutes. The rate of water loss shall not exceed one litre per hour, per metre diameter, per metre run of pipe. On that basis the maximum water loss for a 100mm 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.

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 ground level of the manhole (this is varied sometimes to the underside of the roof slab).
- 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 tests for a period of 30 minutes (± 1 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 l/sq.m of wetted internal surface area.

Infiltration tests shall be carried out on all manholes after backfilling. The maximum infiltration should not exceed 0.1 l/sq.m per hour per square metre of internal surface area of the whole manhole. The exfiltration test requirement for water tightness of manholes shall be carried out in accordance with IS EN 1610. The test comprises the following:

- 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 0.1 l/sq.m per square metre of wetted internal surface area of the manhole.

All visible leaks from or inflow to the manhole should be repaired. Remedial works will be required if these results are not achieved and the tests rerun.

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.

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 carry out random inspections and dye surveys (and CCTV surveys, if necessary) to confirm the proper connection of the services to the Networks.

Additional Control Measures

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Testing of Sewers and Manholes</td>
<td>Failure of the testing equipment causing personal injury, damage to the sewer, manhole and having an environmental impact</td>
<td>Construction Personnel, Operation and Maintenance personnel, Contractors carrying out works in the future</td>
<td>The works shall be tested by the Customer 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. 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 of the Code of Practice for Wastewater Infrastructure. The pipe test shall be conducted after the Gravity Sewer is installed and jointed and before any connecting 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 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 minutes, 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, &amp; indicate 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 test involves the filling of the pipeline to a depth of 1.2m 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 2.5m. The pipeline should stand for two hours after filling to allow absorption, topping up as necessary, before starting the test. The test shall be conducted for a period of 30 minutes. The rate of water loss shall not exceed one litre per hour, per metre diameter, per metre run of pipe. On that basis the maximum water loss for a 100mm 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.</td>
<td>High</td>
<td>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. Risk associated with pressure testing of sewers &amp; hydraulic testing of manholes to be risk assessed at design &amp; construction stages. All testing to be carried out in accordance with the Safety, Health &amp; Welfare at Work (Construction) Regulations.</td>
</tr>
</tbody>
</table>
### Section 4.11.1: Pressure Testing of Rising Mains

The Rising Mains shall be pressure tested following installation of the pressure main on site. The pressure tests shall be conducted by the Customers' contractor experienced in such testing procedures in the presence of a representative of Irish Water’s Field Engineer or its agents.

Testing shall be carried out between suitably supported blank end pieces. Testing between 'live' shut valves will not be accepted. Before testing, valves should 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 Customers' 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 should 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 issues can be adequately monitored.

All the exposed parts of the pipeline, including the chambers, should be visually checked and any leaks or damp spots rectified.

Any water used for testing should 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.

### Section 5.3: Specific Minimum Requirements for Pumping Stations

- Pump stations to have a minimum of two submersible pumps;
- 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 near top of wet well chamber to allow nomination of the pumps (e.g. Pump No.1, Pump No.2, etc.);
- Electrical and control equipment to be located in a vandal resistant kiosk or structure situated adjacent to but offset from the pumping station, complete with ammeter for each pump, hours run meter for each pump, socket to accept a power supply from a portable standby generator, etc.;
- Emergency Wastewater storage capacity or emergency overflow facilities to be provided in all pumping stations and equipped with appropriate septicity and odour mitigation provisions;
- Access for operation and maintenance vehicles to be provided;
- Welfare facilities to be provided for plant operatives for Type 3 Pump Stations, including a small wash-hand basin within a separate kiosk or within the kiosk / structure for the plant control equipment subject to health and safety risk assessment;
- Security fencing and access gates to be provided where deemed necessary, (fencing and access gates not required in all cases, see Section 5.6 of the Code of Practice for Wastewater Infrastructure);
- A dedicated, metered, power supply to be provided to the pump station serving only the pump station equipment and associated plant;
- Telemetry outstation to be provided 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;
- Lift out equipment to be provided for the removal of plant and equipment (See Section 5.20 of the Code of Practice for Wastewater Infrastructure);
- Safety equipment to be provided for controlled and planned safe access to the wet well, including gas monitors, tripod and lifting harness, etc.;
- 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.

### Risk Assessment Table

<table>
<thead>
<tr>
<th>Activity</th>
<th>Related Hazard</th>
<th>Who is at Risk?</th>
<th>Existing Control Measures</th>
<th>Probability</th>
<th>Consequence</th>
<th>Risk</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>Pressure testing at construction</td>
<td>Catastrophic</td>
<td>Site Operation, Public, Road Users, Construction Personnel</td>
<td>Section 4.11.1: Pressure Testing of Rising Mains</td>
<td>3 4 12</td>
<td>High</td>
<td>3 4 12</td>
</tr>
<tr>
<td>42</td>
<td>Design of Pumping Stations</td>
<td>Access / Egress Confined Space, Failure of safety lifting equipment</td>
<td>Operation and maintenance personnel, Public, Construction Personnel</td>
<td>Section 5.3: Specific Minimum Requirements for Pumping Stations</td>
<td>3 4 12</td>
<td>High</td>
<td>3 4 12</td>
</tr>
</tbody>
</table>
Section 5.4 Layout of the Pumping Station
Subject to Planning Permission requirement, the layout of the pumping station site and access road should be arranged so that:

- There is sufficient space to accommodate a tanker off-road, and/or a large van and/or a mobile pump/generator within the site;
- There is sufficient space between the various units on the site to enable maintenance operations to be carried out, especially between the pump station sump/pipes chamber and control equipment; and/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 or repairs;
- The need for personnel entry to confined spaces is minimised;
- The inlet pipe is above the highest level of in cut in the final layout of the pumping station;
- Sufficient separation is provided between the various units and the site security fencing to protect the pumping plant;
- The access is sufficiently wide to accommodate a tanker and/or a large van and/or a mobile generator;
- Exclusive access is provided to the pumping station via the access road; and
- The location of the pumping station is not susceptible to flooding.

Section 5.5 Location of the Pumping Station
Small pumping stations (Type 1) should be located no closer than 5.0m to a property boundary in order to minimise the risk of soil, noise and vibration nuisance. This distance should 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 should be measured from the pumping station site boundary to the boundary of the nearest habitable property. This distance may be subject to change depending on local circumstances and early discussions with the Planning Authority and Irish Water. Facilities for soil, noise and vibration should be installed (passive and/or pressurised) if the pumping station is likely to cause unacceptable nuisance impact due to being located in close proximity to dwellings and public areas.

The pumping station should 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, or where there is a risk of harm from moving vehicles to carrying out maintenance activities. The location should 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 should be as level as possible or within acceptable road gradient appropriate for the maintenance vehicle(s) requiring access to the site. Provision should 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 an 18 m³ tanker should be provided as a minimum. Access for the provision of stand-by power generation plant should also be made available. The size of the standby power unit will be dependent on the pumping capacity of the station.

The pumping station should 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. The electrical control equipment shall be water resistant and positioned above the 1:500 year flood level. The size and/or location of a pumping station will determine if Irish Water will deem that security fencing and gates are required to provide a form of boundary or if a wall, fence or hedge is deemed adequate. Irish Water should be consulted in this regard.
45 Design
Unauthorized access

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 should be secure in its own right without having to rely on security fencing. Kiosks and access covers should be locked and secure in their own right. A fenced compound is not always necessary for smaller pumping stations. Irish Water should 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 structure, the extent and type of pedestrian traffic and whether special activities are taking place on the site. Type 2, mid-range, and Type 3, medium sized, pumping stations will generally require site fencing. If security fencing is required, it should comprise 2.4m high, corrosion resistant mild steel mesh fencing, galvanised and plastic coated finish, with similar type access gates complete with v-beam reinforced profile and anti-climb features at the top of the fence. Anti-burrow features shall be provided for circumstances where Enhanced Security is required by the provision of a 125mm 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 ISO EN 1722-14. 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. 

<table>
<thead>
<tr>
<th>Security Rating</th>
<th>Mesh spacing (mm) (Vertical and Horizontal)</th>
<th>Bar Thickness</th>
<th>Height</th>
<th>Additional Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>150 x 50 spacing 4mm thick 2.4m high Anti-Climb</td>
<td>5mm thick</td>
<td>2.4m high Anti-Climb</td>
<td>Anti-Climb</td>
</tr>
<tr>
<td>Enhanced</td>
<td>50 x 50 spacing 4mm thick 2.4m high Anti-Climb and Anti-Burrow</td>
<td>5mm thick</td>
<td>2.4m high Anti-Climb and Anti-Burrow</td>
<td>Anti-Climb and Anti-Burrow</td>
</tr>
</tbody>
</table>

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 bow. The fence, pillars, bracing, runnels, diagonals, gate posts and gates, etc. shall be in accordance with the manufacturer’s instructions 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. The access gates should be of sufficient width to accommodate maintenance vehicles, tankers, etc. The access gates should be provided with slide bolts, shooting bolts and padlocks. If opening outwards, the access gates should 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, pedestrian gates shall be provided in the security fence if required by Irish Water. The colour of the fence, access gates and Accessories shall be highly green 14C39 in accordance with BS 4800.

46 Design

Structural failure of the road surface

Access and Egress to site

Public

Section 5.7 On-Site Parking and Hard-Standing

On-site parking should be provided by hard-standing areas surrounded by 125mm high pre-cast or slip formed concrete kerbing. 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. Impermeable surfaces should comprise a 300mm depth of compacted Clause 804 granular material, in accordance with the National Roads Authority Specification for Road Works, with a 75mm well compacted regulating course. Where tanker access is required or where HGV access is required, the hard-standing should be 200mm thick reinforced concrete (Grades C30/35 to IS EN 206). The impermeable surface should be provided around the wet well of the pumping station to provide a safe working area. This should be 900mm wide where the depth of the wet well is less than 1.5m and it should be 1.5m wide where the depth of the well exceeds 1.5m. A concrete area, 900mm in width, should be provided around other chambers where access is required. A concrete path, 750mm in width, should be provided in front of a kiosk.
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.

Section 5.8 Hydraulic Design of Pumping Stations

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 should be provided with star delta starters or variable speed drives (VSDs). The pumping duration of a pump unit should not be less than 60 seconds. A pumped flow rate should be chosen to achieve at least a minimum flow velocity in the Rising Main, as outlined in Section 3.7 of the Code of Practice. Generally, pumping plant shall be sized to deliver a 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 balance storage requirement capacity will depend on the size of the development. Emergency storage capacity of 24-hour Dry Weather Flow is required for developments up to 275 units. The balance storage requirement capacity will reduce for larger developments in accordance with specific advice from Irish Water.

The pumping plant shall have 100% standby capacity. The plant shall be provided with a telemetry outstation to transfer data from the pumping station to an Irish Water control centre. The data to be transferred to Irish Water Control Centre shall include at least the following:

- Available/Run/Trip status for all pumps;
- Status for all float switches;
- Sump level;
- Instantaneous flow;
- Totalised flow;
- Marine Power Failure;
- UPS Fault/Healthy Status.

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 the Code of Practice) shall include the design calculations for the phasing of the Pumping Station.

The pumping station 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 low level float switch and 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. 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.
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:

- **Operation and Maintenance Personnel**
  - Pumping plant should be of failsafe design;
  - All plant and equipment to be suitably Ex-rated in accordance with the Hazardous Area Classification for the pumping station site;
  - Pumps to be submersible pumps with automatic decoupling arrangements complete with twin guide rails, easy lift, etc.;
  - Pumping plant to be of proven track record;
  - Automatic selection rotation of the duty/standby or duty/assist and standby arrangement;

- **High**
  - Pumps to be sized for a minimum of three (3) times DWF, if storage provided, and six (6) times DWF otherwise;
  - Pumps to 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 less than 100mm diameter;
  - Pumps to have, in general, a minimum discharge size of 80mm;
  - Pump control to be via ultrasonic level transducers, located above liquid level, in an easily accessible location;
  - The pump guide system to be provided to allow the pump units to be automatically coupled to the outlet pipework and held in place by its own weight;
  - The guide system to 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 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;
  - Spare certified stainless steel chains, of similar capacity to the installed chain unit, shall be provided to facilitate regular inspection/replacement of the lifting chain;
  - Anchor bolts to be of stainless steel or galvanised steel suitable for the material being retained (no contact between stainless steel and galvanised steel);
  - Discharge pipework within the wet well to 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 to incorporate isolation valves (one per pump installed), non-return valves (one per pump installed), bends, radial tee-pieces, etc.;
  - Non-return valves to have removable covers, ductile iron body with resilient seated disc and stainless steel hinge pin, complete with either a ball weight or lever arm and weight;
  - Bends to be sweep bends to minimise blockages and pipe friction losses;
  - Sluice valves to be provided with removable hand-wheels;
  - Flange adaptors to be provided to permit ease of removal of valves from the pipework;
  - All pipework and valves to be of ductile iron to IS EN 598, suitable for use with sewage, with PN-16 flanges to BS EN 1092-1;
  - Pumps motors to 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;
  - Motor and motor housing to be bolted to the pump housing, shrink or press fit assemblies will not be accepted;
  - Motors must include stator over-temperature protection in the form of thermistors embedded in each phase of the windings, over-temperature protection should automatically re-set when the temperature returns to normal;
  - 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 to be provided with indicator plates providing information for the pump, motor, etc. A duplicate stainless steel plate to be provided and mounted in the control panel.

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. EN 60079 should also be adhered to in regard to Area Classification. The drawings submitted and the specification of the pump station should demonstrate the Area Classification of the pump station or otherwise the absence of zoning.
<table>
<thead>
<tr>
<th>Activity</th>
<th>Related Hazard</th>
<th>Who is at Risk?</th>
<th>Existing Control Measures</th>
<th>Initial Risk</th>
<th>Minimal Risk</th>
<th>Additional Control Measures</th>
<th>Probabilility</th>
<th>Consequence</th>
<th>Risk</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design &amp; Operation</td>
<td>Malfunction due to collection of solids</td>
<td>Confined Space Entry</td>
<td>Section 5.10 Wet Well</td>
<td>The wet well of the pumping station can be of rectangular or circular plan section with a minimum 1,800mm square 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 location of the inlet sewer arrangement should 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 may 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.</td>
<td>Medium</td>
<td>3 3 9</td>
<td>Medium</td>
<td>2 2 4</td>
<td>Low</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The depth of the wet well shall be suitable to accommodate the incoming Gravity Sewer, the pumping plant, the minimum pumping storage between pump-in and pump-out, etc. A collection manhole shall be provided if there are multiple sewers draining to the pumping station site so that flow enters the wet well in a single inlet pipe. Provision should be made for isolating the incoming flow by means of a hand-operated valve or penstock. This unit should be located in a chamber upstream of the wet well and not in the wet well itself. Benchings in the wet well should be provided to eliminate “dead zones” within the wet well to prevent siltation or accumulation of debris. The benchings should start no more than 100mm from the pump unit inlet or in accordance with the pump manufacturer’s recommendations. The slope of the benching should be a minimum of 45 degrees. The area under the pump should be as small as possible to ensure well cleansing and the flat floor area should be kept to a minimum. The wet well should be kept to a minimum to reduce the amount of benching that is required.</td>
<td>Low</td>
<td>3 3 6</td>
<td>Medium</td>
<td>2 3 6</td>
<td>Medium</td>
<td></td>
</tr>
</tbody>
</table>

IW-CDS-5030-04 Page 23 of 28 Rev. 0 April 2018
<table>
<thead>
<tr>
<th>Activity</th>
<th>Related Hazard</th>
<th>Who is at Risk?</th>
<th>Existing Control Measures</th>
<th>Initial Risk</th>
<th>Additional Control Measures</th>
<th>Minimal Risk Probabilit y Consequ ence Risk Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td>Operation</td>
<td>Access to valves</td>
<td>Operation and Maintenance Personnel</td>
<td>Section 5.12 Valve Chamber</td>
<td>The valve chamber is provided to house valves and fittings associated with the pumping plant. It should 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.</td>
<td>The valve chamber should house the following: - Discharge pipework complete with bends, 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;</td>
</tr>
<tr>
<td>52</td>
<td>Operation</td>
<td>Access to meter</td>
<td>Operation and Maintenance Personnel</td>
<td>Section 5.13 Flow Metering</td>
<td>The flow meter chamber shall have minimum plan dimensions of 1500mm x 1500mm. It should 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 pipework within the meter chamber shall incorporate a dismantling joint to allow removal of the flow meter.</td>
<td>Flow meters shall be provided to measure and record the Wastewater flow being pumped forward through the Rising Main. Magnetic flow meters shall be provided with flow recorders linked to converters in the MCC panel of the control kiosk, complete with a digital display showing instantaneous and accumulated flow records. Flow meter and associated equipment, including calibration test certification, will be required for all pumping stations. The flow meter should 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.</td>
</tr>
</tbody>
</table>
### 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 150mm above the surrounding paved areas. A stainless steel nameplate shall be provided at each chamber designating the title of the chamber.

Access covers in the roofs of the wet well, valve chamber and other chambers should be 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 should 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 lockable, fabricated from steel, galvanised to IS EN 1461 (2009) 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);
- 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 facility for securing a recessed padlock;
- Each leaf of the cover to have assistance to ensure a lifting effort of less than 20kg;
- Double, hinged access covers to be provided with inert gas charged or hydraulic operated springs (or equivalent) suitable for solo lift;
- The location of the hinges and hydraulic acts should not impinge on the safe entry to the chamber;
- For pumping stations with a depth in excess of 1.5m, a hinged safety grid in two sections to be provided below the cover and to be capable of withstanding a 250kg load. When fitted, the grid should be capable of being secured in the upright position;
- In a closed position, the cover should be capable of withstanding a 5 tonne static load. Where there is a risk of traffic loading on the cover, it should be capable of withstanding such loadings as a minimum;
- Provision to be made within the covers and frames to allow the main cover to be closed while the pump unit and any associated cables are removed;
- Closure of the 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;
- The cover frame to be provided with facilities for demountable hand railing which can be erected before any maintenance on the pump units is being undertaken. Chains shall not be used for such barriers;
- The demountable hand rail shall be capable of withstanding an impact load of 125kg from a height of 1.86m through a footprint of 400mm and a horizontal point load of 1.1KN;
- Handrails to be capable of being released to allow access to the equipment from all sides;
- Handrail stanchion sockets provided within the frame should be flush with the concrete slab and be sealed to prevent debris entering when not in use.

Access to the valve chamber, meter chamber and other chambers (excluding the wet well) should 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 should 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 550mm. 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 5.13 of the Code of Practice, subject to the approval of Irish Water.
### 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 gases, odour nuisance, etc. Generally, the wet well should 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 Water Service Activated carbon filters shall be of robust proprietary manufacture and sized to have a minimum retention time of 3 seconds at maximum flow rate.

### Risk and Consequence Assessment

<table>
<thead>
<tr>
<th>Activity</th>
<th>Related Hazard</th>
<th>Who is at Risk?</th>
<th>Existing Control Measures</th>
<th>Initial Risk</th>
<th>Residual Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>54 Operation</td>
<td>Toxic atmosphere / dangerous gases</td>
<td>Operation &amp; Maintenance Personnel / Public</td>
<td>Section 5.15 Venting of Wet Well and Chambers</td>
<td>3 4 12 High</td>
<td>2 3 6 Medium</td>
</tr>
</tbody>
</table>

#### Additional Control Measures

- **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.
- **Field Engineers** will vet the final installed infrastructure and examine the final documents prior to venting.
- 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 Legislation. 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.
- 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 Legislation. 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.
<table>
<thead>
<tr>
<th>Activity</th>
<th>Related Hazard</th>
<th>Who is at Risk?</th>
<th>Existing Control Measures</th>
<th>Probabilty</th>
<th>Consequence</th>
<th>Risk</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
<td>Operation</td>
<td>Electrical</td>
<td>Operation and Maintenance Personnel</td>
<td>Section 5.16 Electrical Requirements</td>
<td>Suitable 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 shall incorporate telemetry equipment to allow remote monitoring of the plant / equipment and to allow call out facilities in the case of emergency, power outage or plant/equipment malfunction (See Section 5.8 of the Code of Practice for Wastewater Infrastructure for details of data to be relayed to Irish Water Control Centre). The electrical and control plant and equipment for the pumping station shall be located in a kiosk or kiosks 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 power supply to the pump installation shall be of three phase power rating with phase failure protection fitted to the pump motors to prevent motor burnout due to phase failure. All electrical work associated with the pumping stations 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.). A dedicated and metered power supply shall be provided to the pump station serving only the pump plant and associated equipment. Pump power cables shall be multicores, flexible cord, vulcanised rubber insulated with tough rubber sheath and outer PVC sheath. All metal equipment at the pumping station (pump guide rails, covers, etc.) shall be bonded to earth, via earth rods located in inspection pits with removable covers, remote from the wet well location. The control panel shall have provision for connection of an external standby generator. The power supplier shall be notified of this installation to allow for an isolation or ‘kill’ switch. The pump control panel for pump plant exceeding 7.5 KW shall be from Form 4 Type manufactured and fabricated to IEE Regulations. Otherwise, the pump panel shall be of Form 2 or better. The control panel shall incorporate, at a minimum, the following: • Spare starter sections for any future pumps should the pump station be designed to be expandable at a future date; • Generator incomer section complete with generator changeover switch interlocked with mains supply incomer isolation switch; • A hand / off / reverse (with spring return) selector for each pump, subject to manufacturer’s approval; • Ammeter and hours run meter for each pump; • Run light and trip lights for each pump (one for temperature and one for seal failure); • Reset button for each pump; • Duty / Assist or Duty / Assist / Standby selector for each set of pumps; • Lockable mains incomer isolator; • Lockable door interlock isolators for all starter sections; • A pump level indicator for recording the Wastewater surface in the pump sump; • Flow Indication – both instantaneous and totalised; • Electrical heater, light 220v and 110v electrical weatherproof socket; • Spare indicator lamp bulbs; • A telemetry system with an UPS (uninterrupted power supply) capable of detecting alarm conditions and issuing pre-programmed messages to selected on-call mobile phones and / or control centres / programmable logic controllers (plc), as appropriate (UPS health / fault status to be available at Irish Water Control Centre via the telemetry system); • Power meter with volts, power factor, Kw, Kwh, power outage for Kwh, etc. displays. Ducts shall be provided between the control panels and the various units of the pumping station which require cable runs for power, telemetry and control. All power and control cable ducts between the pump chamber and the control panel shall be fully sealed to prevent ingress of gas from the pump sump and valve chamber to the kiosk containing the panel. This shall be achieved using non-degradable expandable foam or gas tight sealing glands. Spare drawer space shall be left in all ducts for future use. Pump cables should have sufficient slack and shall be fully wound and secured to a stainless steel hock or bracket under the pump sump cover where they can be easily accessed and will not interfere with the lifting of the pump or become weighed down with debris or rags. Where the kiosk / structure housing the control equipment and wet well are located a convenient distance apart the cabling shall be wired direct from the wet well to the kiosk / structure control panel. All cables shall be installed using a proprietary cable support system and installed in accordance with the manufacturers recommendations. Cable trays shall be fabricated from heavy duty PVC, GRP, heavy duty hot dipped galvanised steel or from stainless steel. Choice shall be made with regard to weight and number of cables. Only heavy duty PVC cable tray will be permitted within wet wells. Cable junction boxes shall not be installed internal to wet wells irrespective of their hazardous area zoning. If junction boxes are to be installed for cabling between the wet well and kiosk / structure housing the control panel, they shall be installed on suitable upstands of galvanised mild steel or stainless steel (grade 316L) or other approved material subject to the site environment.</td>
<td>3</td>
<td>4</td>
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<tr>
<td>Activity</td>
<td>Related Hazard</td>
<td>Who is at Risk?</td>
<td>Initial Risk</td>
<td>Additional Control Measures</td>
<td>Minimal Risk</td>
<td>Consequence</td>
<td>Risk</td>
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<td>56</td>
<td>Design and Construction</td>
<td>Electrocution Insufficient space for required plant Insufficient space for operation and maintenance</td>
<td>Operation and Maintenance Personnel Construction Personnel</td>
<td>Operation and Maintenance Personnel</td>
<td>Risk Ranking Probablility Consequence Risk Ranking</td>
<td>ESB Network Operations &amp; Maintenance Personnel ESB Network Construction Personnel</td>
<td>3</td>
</tr>
<tr>
<td>Consequence</td>
<td>Probability</td>
<td>Risk Score</td>
<td>Risk Ranking</td>
<td>Controls Required</td>
<td>Timeline</td>
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<tr>
<td>1</td>
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<td>1 to 4</td>
<td>LOW</td>
<td>Low risk, controlled satisfactorily. No additional controls are required, but activity should be monitored to ensure risk does not increase over time</td>
<td>N/A</td>
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<td>2</td>
<td>2</td>
<td>5 to 10</td>
<td>MEDIUM</td>
<td>Moderate risk, additional controls may be required. Additional Controls should be put in place to reduce risk.</td>
<td>3 months</td>
<td></td>
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<td>3</td>
<td>3</td>
<td>12 to 16</td>
<td>HIGH</td>
<td>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.</td>
<td>1 week</td>
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<td>4</td>
<td>4</td>
<td>20 to 25</td>
<td>VERY HIGH</td>
<td>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</td>
<td>Before works commences / continues</td>
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<thead>
<tr>
<th>Probability Value</th>
<th>Guidance on each Probability Value</th>
</tr>
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</table>
| 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 |

<table>
<thead>
<tr>
<th>Consequence Value</th>
<th>Guidance on each Consequence Value</th>
<th>HSQE Element</th>
</tr>
</thead>
</table>
| 1                 | **Insignificant.**  
Minor problem easily handled by normal day to day processes e.g. - injury or ailments not requiring medical treatment - minor errors in systems or processes requiring corrective action, or minor delay without impact on overall operation of a project. | Health & Safety |
| 2                 | **Minor.**  
Some disruption possible e.g. - minor injury or First Aid Treatment Case - policy or procedure rule occasionally not met or services do not fully meet needs | Health & Safety |
| 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 - one or more key requirements not met. Inconvenient but not detrimental to core IW business or consumer welfare. | Health & Safety |
| 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 - operations consistently not in line with IW policy or procedures; trends show service is degraded | Health & Safety |
| 5                 | **Catastrophic.**  
Business survival is at risk or damage e.g. - accident or incident leading to death or multiple life threatening injuries - critical systems failure, bad policy or on-going non-compliance, IW Business severely affected. | Health & Safety |