Zero incidents
Zero harm
Zero compromise
Keeping you healthy and safe, every day at work.

ESSENTIAL STANDARD no.31

Entry into sewers behind a point of isolation

Thames Water

KEY MESSAGES

- All works must be carried out in accordance with Thames Water's procedure HSP46 to ensure the safety of employees and other stakeholders. For further information on the contents of the essential standard or HSP46, please contact your Thames Water representative.
- All sewer confined space entry work must go through the Independent Authorising Body (IAB) and be validated with the Waste Operations Control Centre (WOCC).
- Any works behind a point of isolation must be fully validated and authorised by IAB.
- Understand the integrity of both physical and procedural controls that are in place.
- Ensure the consequences of operational failure / worst case scenario are understood and prevented.

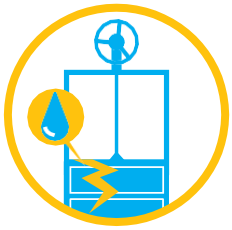
1. Introduction

This essential standard has been developed from Thames Water's internal procedure HSP46 to ensure the safety of employees and other stakeholders working on tasks that require isolation and entry into confined spaces in the sewer network. This standard sets out a range of criteria and controls that must be followed to ensure safe and secure isolation for the protection of people.

The sewerage system was built in the Victorian era with the health and safety practices available at the time. Entry into the sewerage system can be complex due to the nature of working within confined spaces and:

- The size and scale of the system
- Original design constraints
- Volume and changing sewage controls
- Varying asset conditions
- Aggressive substances and environment
- Tidal water, rainfall, surface water and other unplanned ingress
- Unexpected failures of controls and assets like penstocks, pumps and weirs






We must always try to avoid confined space entry if possible; if we can't, then we must ensure the right controls are in place and we understand the consequences if they were to fail, to ensure that robust emergency procedures are put in place.

Key Contacts

Independent Authorising Body - Independent.AuthorisingTeam@thameswater.co.uk - no tel contact

Waste Ops Control Centre - wocc_technical_resource_coordinator@thameswater.co.uk - phone number 0800 0093908 follow option for relevant area of works.

2. Key principles of Safe and Secure Isolation

- Ask yourself: “Can we eliminate the need for confined space entry?”
- Prevent significant heads of water building up in the system behind a point of isolation.
- Where possible, use a combination of independent control measures or points of isolation that can be secured to prevent them from being interfered with, defeated or overridden.
- Identify the likelihood and potential consequences of failure / breach of an isolation point or management controls so that measures can be put in place to minimise the risks.
- Ensure that physical points of isolation or control measures are in good condition to prevent other points of isolation / controls failing further down in the system.
- Identify the likelihood and potential consequence of failure, so that suitable emergency procedures (*warning systems and evacuation time etc.*) for the entrants are built into the Safe System of Work.
- You must be able to prove the effectiveness of the controls and the overall isolation arrangement. All safe and secure isolations must minimise the risk to an acceptable and safe level.
- Ensure that both up and downstream influences have been considered within the Safe system of works.
- Use modelling data or carry out a trial wet run to prove the effectiveness of an isolation arrangement.
- Always ask yourself: “What if this were to fail?”

3. Role of the IAB and WOCC

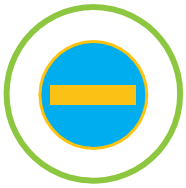
All system entries involving safe and secure isolation or work that will change the way the Sewer Network operates must be independently authorised and coordinated by the Thames Water Independent Authorising Body (IAB) before work starts.

Proposed changes in the wastewater network must be raised as a diversion/isolation request to the IAB. For example, changing the way the system operates could be part of operational or maintenance activities (e.g. electrical works) which could affect flows, pressures or control measures (pumps etc.).

The IAB independently reviews all Safe Systems of Work to ensure all confined space entries have been properly assessed and planned, that all isolations and controls in place are effective and that there are no other works in the area that could impact the activity. The IAB will not be responsible for reviewing the Safe System of Work for the actual physical tasks being undertaken inside the confined space.

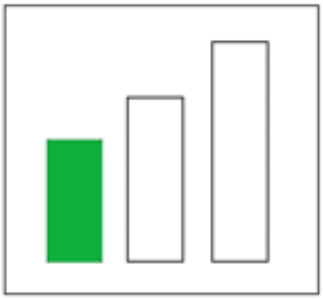
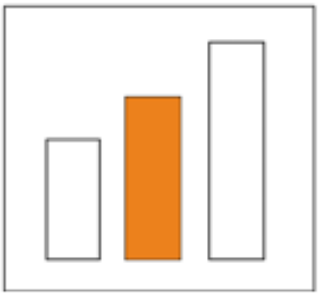
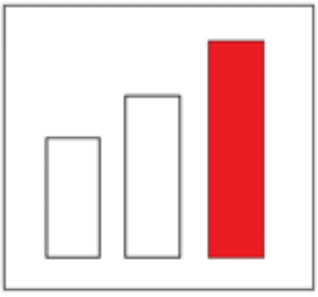
Emergency accesses will need to be assessed, documented and communicated and follow this procedure

Once approved by the IAB, the work is passed onto the Waste Operations Control Centre (WOCC). Immediately before entry, supervisors should contact the WOCC to ensure that controls are in place and no other factors, like rain, will have an effect on the work. Safe exit and status updates must also be communicated to the WOCC.



IAB will provide a list of pre-approved works to the WOCC using an Authorisation Sheet. Works not on the pre-approved list will not be allowed to proceed.

4. The Complexity Table

1. Complexity table	
	This table shows the complexity control levels used when working within confined spaces. Every confined space entry is different and complexity levels should be considered as part of any risk assessment and method statement. You should ensure confined space Hazards are identified, understood and mitigated to provide safe and secure entries and isolations.
 LOW	All Class A Entries which do not involve working behind a flow control device. Any entry involving secondary access up to 18 meters in Depth not protected by a flow control device. Working in flows with shallow depth and low velocities. Hazard rating table to be used where guidance required. Working above the flow level e.g. in a chamber (including Storm Relief sewers) or on a landing or grating above soffit level. Works not involving sewer diversions
 MEDIUM	All entries in excess of 18m depth Working in storm or surface water sewer at flow level Working in close proximity to a pumping station Any diversion or isolation not used for the protection of people * Any diversion or isolations used for the protection of people but not holding back a head of water * Entries requirering a "C" permit for other than a C class sewer.
 HIGH	All entries into a "C" class sewer Any diversion or isolation holding back a head of water NOT in excess of 40% ** Any diversion or isolation holding back a head of water in excess of 40% *** Note: Where the consequence of failure of a flow control device can be demonstrated as low impact to the working party, a full RA and Temporay works design may not be required? In all cases where full temporary works are not required a condition inspection completed by a competent person must be undertaken and agreed as acceptable in its place.
	* (Penstock RA and condition survey / assessment may still be required. If applicable, this must be made available to all parties to consider in their safe system of work and control measures). ** Penstock RA required *** Penstock RA, condition survey and temporary works assessment undertaken.

5. Procedures

When planning entry to wastewater operations, follow the process flow below. When planning any entry, you **must understand / identify** who your key contacts are for project / activity and their roles and responsibilities *e.g. designers, modeling teams etc*.

1. Establish that it is necessary for personnel entry into the wastewater network in order to complete the task.

2. Contact and enlist the help of the relevant Thames Water Operations Team.

3. Identify the complexity of the entry / isolation using the table above. You must confirm that the relevant information has been provided by TWUL
e.g. modeling info, condition assessment etc.

4. If required, select competent contractors and complete RAMs / SSoW / TW Documents for entry / isolation

5. Review the entry / isolation with the local Thames Water Operations Team

6. Local Thames Water Operations Team engages the IAB

7. Set up review sessions with IAB for any entry / isolation assessed to be medium / high complexity.

TWUL responsible person will identify Permits, authorisations and controls required and communicate to those undertaking the works and IAB, confirming date of penstock inspections etc.

8. The entry / isolation will now be accepted or rejected by the IAB.

If it is rejected, recommendations are needed; if accepted /approved, the works requester will receive a Safe Sewer Access Control Form and number. Contractors must request TWOSA from Thames Water Operations Team.

9. On day of the task, the responsible person(s) for the entry / isolation as identified in the IAB approval will confirm all controls / permits are in place and speak to the WOCC, if no entry is to be made then the responsible person should call the WOCC to confirm this

10. Once the task is complete: the responsible person(s) will:

- Confirm with the WOCC
- Sign off with the Thames Water Operational Safety Authority (TWOSA)
- Email IAB

6. Controls

Controls should be unique to the environment, entry and activity taking place. Use the Sewer Hazard Rating Tool, (below), to determine the required controls for the entry.

NOTE: Penstock Risk Assessments (as described in HSP46 Section 4) and / or structural calculations and temporary works designs must be used to prove that flow control devices (penstocks, cloughs, weirs, dams) are effective.

Sewer Hazard Rating Tool

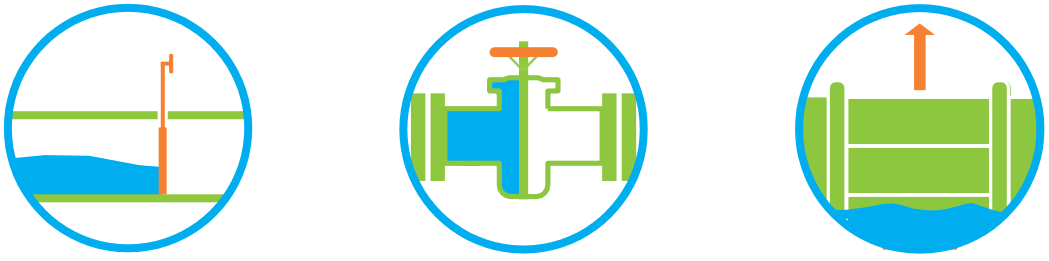
Hazard rating (m2/s)		Velocity (m/s)												
		0	0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3
Flow Depth (m)	1.2	0	>0.3	>0.6	>0.9	>1.2	>1.5	>1.8	>2.1	>2.4	>2.7	>3	>3.3	>3.6
	1.1	0-0.3	0.275-0.6	0.55-0.9	0.825-1.2	1.1-1.5	1.375-1.8	1.65-2.1	1.925-2.4	2.2-2.7	2.475-3	2.75-3.3	3.025-3.6	>3.3
	1	0-0.275	0.25-0.55	0.5-0.825	0.75-1.1	1-1.375	1.25-1.65	1.5-1.925	1.75-2.2	2-2.475	2.25-2.75	2.5-3.025	2.75-3.3	>3
	0.9	0-0.25	0.225-0.5	0.45-0.75	0.675-1	0.9-1.25	1.125-1.5	1.35-1.75	1.575-2	1.8-2.25	2.025-2.5	2.25-2.75	2.475-3	>2.7
	0.8	0-0.225	0.2-0.45	0.4-0.675	0.6-0.9	0.8-1.125	1-1.35	1.2-1.575	1.4-1.8	1.6-2.025	1.8-2.25	2-2.475	2.2-2.7	>2.4
	0.7	0-0.2	0.175-0.4	0.35-0.6	0.525-0.8	0.7-1	0.875-1.2	1.05-1.4	1.225-1.6	1.4-1.8	1.575-2	1.75-2.2	1.925-2.4	>2.1
	0.6	0-0.175	0.15-0.35	0.3-0.525	0.45-0.7	0.6-0.875	0.75-1.05	0.9-1.225	1.05-1.4	1.2-1.575	1.35-1.75	1.5-1.925	1.65-2.1	>1.8
	0.5	0-0.15	0.125-0.3	0.25-0.45	0.375-0.6	0.5-0.75	0.625-0.9	0.75-1.05	0.875-1.2	1-1.35	1.125-1.5	1.25-1.65	1.375-1.8	>1.5
	0.4	0-0.125	0.1-0.25	0.2-0.375	0.3-0.5	0.4-0.625	0.5-0.75	0.6-0.875	0.7-1	0.8-1.125	0.9-1.25	1-1.375	1.1-1.5	>1.2
	0.3	0-0.1	0.075-0.2	0.15-0.3	0.225-0.4	0.3-0.5	0.375-0.6	0.45-0.7	0.525-0.8	0.6-0.9	0.675-1	0.75-1.1	0.825-1.2	>0.9
	0.2	0-0.075	0.05-0.15	0.1-0.225	0.15-0.3	0.2-0.375	0.25-0.45	0.3-0.525	0.35-0.6	0.4-0.675	0.45-0.75	0.5-0.825	0.55-0.9	>0.6
	0.1	0-0.05	0.025-0.1	0.05-0.15	0.075-0.2	0.1-0.25	0.125-0.3	0.15-0.35	0.175-0.4	0.2-0.45	0.225-0.5	0.25-0.55	0.275-0.6	>0.3
	0	0-0.025	0-0.05	0-0.075	0-0.1	0-0.125	0-0.15	0-0.175	0-0.2	0-0.225	0-0.25	0-0.275	0-0.3	0
														max DV

Hazard	No site specific factors	Sewer Traverse	Slipery Surface	High Debris
Low Hazard	Operatives are at a low risk of losing stability in the event of a catastrophic penstock failure.		Operatives are at a low risk of losing stability in the event of a catastrophic penstock failure.	
Moderate Hazard	Operatives are at a medium risk of losing stability. Site specific hydraulic modelling is recommended to estimate flow conditions with better accuracy. Review whether site specific risk factors make working conditions unsafe.	A sewer traverse is proposed which increases the risk. Recommended rating is Medium Hazard: Operatives are at a medium risk of losing stability. Site specific hydraulic modelling is recommended to estimate flow conditions with better accuracy.	Operatives are at a medium risk of losing stability. Site specific hydraulic modelling is recommended to estimate flow conditions with better accuracy. Review whether site specific risk factors make working conditions unsafe.	High debris content in sewer which increases the risk. Recommended rating is Medium Hazard: Operatives are at a medium risk of losing stability. Site specific hydraulic modelling is recommended to estimate flow conditions with better accuracy.
Significant Hazard	STOP. Site specific hydraulic modelling is required. Added safety controls are required and reducing the volume of water retained should be explored.	A sewer traverse is proposed which increases the risk. Recommended rating is Significant Hazard: STOP. Site specific hydraulic modelling is required. Added safety controls are required and reducing the volume of water retained should be explored.	STOP. Site specific hydraulic modelling is required. Added safety controls are required and reducing the volume of water retained should be explored.	High debris content in sewer which increases the risk. Recommended rating is Significant Hazard: STOP. Site specific hydraulic modelling is required. Added safety controls are required and reducing the volume of water retained should be explored.
Extreme Hazard	STOP. Working methodology considered unsafe. Re-consider method statement and repeat assessment.	A sewer traverse is proposed which increases the risk. Recommended rating is Extreme Hazard: STOP. Working methodology considered unsafe. Re-consider method statement and repeat assessment.	STOP. Working methodology considered unsafe. Re-consider method statement and repeat assessment.	High debris content in sewer which increases the risk. Recommended rating is Extreme Hazard: STOP. Working methodology considered unsafe. Re-consider method statement and repeat assessment.

Key: Green Area, Low Hazard / Amber Moderate Hazard / Pink Significant Hazard / Red, Extreme Hazard

6.1 Physical Controls

Physical controls can stop or divert flow for a certain period of time.



When planning for entry, all control equipment, such as penstocks, valves, stop-logs etc. must be assessed.

You must ensure they provide a safe, secure and isolated environment for confined space entry.

When assessing physical controls, you must confirm that the equipment:

6.1.1 Can't be over-topped or by-passed by tides, rain water or other unexpected ingress

6.1.2 Is robust and reliable

6.1.3 Is in good condition

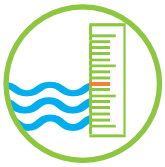
6.1.4 Is adequate for the task

6.1.5 Will not fail during entry

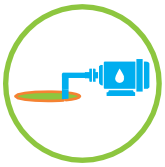
If you can't confirm the above points, then the task must not proceed or additional controls must be put in place. All additional measures should be designed and implemented for every individual situation.

6.2 Non-Physical

Non-physical controls do not hold back flows. They include processes such as:

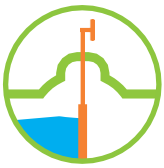


6.2.1 Monitoring flow levels to ensure they stay in safe parameters or so an early warning can be made



6.2.2 Pumping stations to reduce or remove flow levels from the work area

6.2.3 Weather monitoring and forecasts used to provide advanced warnings and allow better planning



6.2.4 Wet/Live testing can be used to prove flow levels and consequences where modelling data is not available

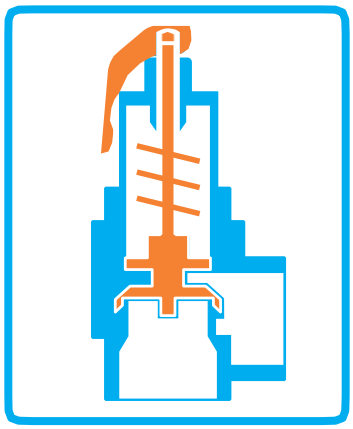
6.2.5 Tide times used to calculate the best periods for safe entry

7 Penstocks, Actuated Valves and River Flaps

7.1 Penstocks

When using penstocks, you must ensure that:

- A penstock risk assessment produced by a third party must be approved by suitably trained and experienced TW person and the IAB prior to being used as part of a safe system of works.
- Temporary solutions / modifications are explored and independently designed and implemented if the penstock is not able to pass the Risk Assessment
- Only use a penstock for water levels greater than 40% of maximum level if there are appropriate temporary / permanent works designs



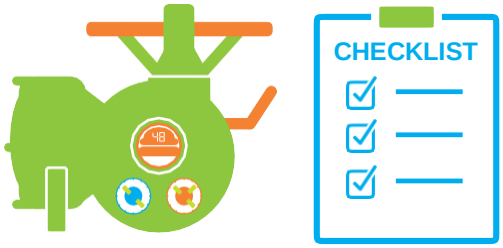
When using high-consequence valves or penstocks for a single isolation above 40%, ensure:

- You complete a structural and mechanical assessment
- An independent inspection and validation has been completed
- You receive sign off that penstock/high-consequence valves are the correct method of isolation for this activity

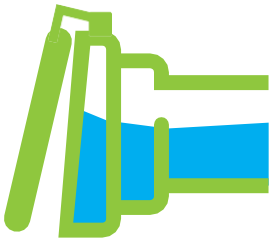
7.2 Actuated Valves

Actuated valves fitted to penstocks must be:

7.2.1	Tested and calibrated prior to use
7.2.2	Limited specifically for the individual penstock
7.2.3	Inspected annually
7.2.4	Used within specified date



7.3 River Flaps



River flaps should only be used as part of an overall safe and secure isolation when combined with additional protective measures.

It's best to work in safe windows where the tidal flows don't reach the level of the river flap. To work outside of safe windows, you must prove that the flows will not present any danger to entrants.

Use modelling data to support your decision to work outside of safe windows or to help you identify additional measures of effective alternatives.

Note: Where Flaps have been specifically designed to be used as a point of isolation for the protection of people they may be considered as part of the overall safe system of works.

8 Flows and Water Pressure

Investigations and analysis must be done as part of planning for entry. This ensures full understanding and documentation of the flows and water pressure that could have an impact on the site while workers are in the confined space.

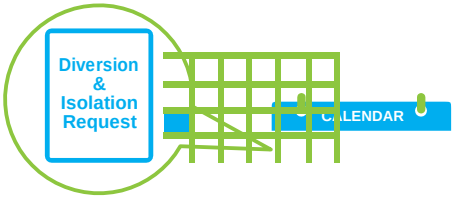
The investigations and analysis must include:

8.1.1 the maximum hydraulic height the water could rise to

8.1.2 the maximum static water pressures that structures and controls could be exerted to

8.1.3 the quantities and dynamic pressures, such as unintended increase in flows, pressures and surges, that could affect the control locations

9 Diversion and Isolation Requests



A member of the Trunk Sewers/Strategic Pumping Team must send a Diversion and Isolation Request Form to the Isolation and Diversion Coordinator (IDC) at least two weeks before the work starts.

Both Diversion notices and approvals are a 14-day strict process to allow for authorisation, coordination and validation of works. Requests outside of this process will require justification and agreement from responsible ML5 manager or above to proceed.

10 Modeling

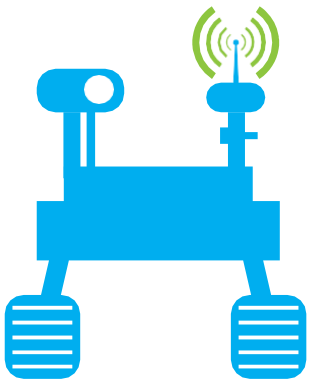
The modelling team uses a series of high-tech modelling tools to provide us with information on the safety conditions surrounding the work area.

Before entry, ask the modeling team the following questions:

- Is there the potential for flooding? If so, how much time do you have?
- What are the consequences of isolation/control failure?
- Is tidal ingress going to impact the work?
- Where and when are the safe working windows?
- Are there any points that need to be critically monitored?
- Are there suitable diversions and are they effective?

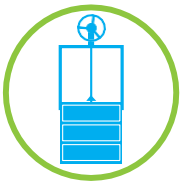
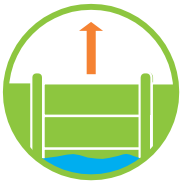
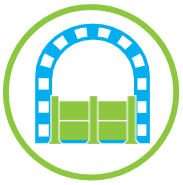
11 Remote Equipment

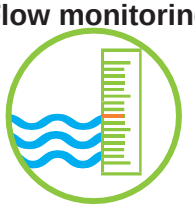
Before deciding on confined space entry, you must always consider whether the job can be done by remote equipment such as Light Detection and Ranging (LiDAR) Technology.



Appendix

Aide Memoire - Selection of isolation controls

Description	Physical/Non-physical	Pros	Cons
Penstock/Valves 	**Physical**	• Fully isolate to dry conditions • If actuated can be quick to open or close, and can be done remotely • Can be used to limit flows not just isolate	• Requires regular maintenance • Increased need for entry to asset • Need to investigate and understand condition • Actuation can risk damage to penstock
Stop logs/Cloughs 	**Physical**	• Specific design for the location • Can be relatively cost effective	• Need to be purposely designed for the span required along with appropriate supports where required • Will not provide a full seal
Temporary bulkheads 	**Physical**	• Specific design for the location	• Specific design for the location • Can take time and be difficult to fit, often requiring entry without physical isolation in place
River flaps/Flap valves 	**Physical**	• Stop back flow into a system, for example against a tidal outfall	• Need to investigate and understand condition • Can leak if seal not maintained or obstructed by debris • Not always visible at all times (tidal on outfalls) • Subject to harsh environment conditions

		Pros	
Weir boards 	**Physical**	• Can be left in position to control	• Requires some form of monitoring to know when weir is close to over-topping
Temporary works solutions, bungs, stoppers, etc. 	**Physical**	• Specific design for the location and requirements • Known condition and safe operating levels	• Relatively new and unfounded technology (large inflatable stoppers) • Requires bespoke design
Flow monitoring 	**Non-physical**	• Can be inserted to monitor remotely at upstream locations • Once installed reduces confined space entry works to monitor levels • Can be used as an advanced confirmation or predictive flows and also provide live data	• Requires entry to system to insert as presently little fixed monitoring exists • Needs maintenance requiring confined space entries • Can become less reliable if not cleaned and maintained
Weather forecast 	**Non-physical**	• Can be used to provide advance forecast, understanding and warning	• Forecasts whilst generally good short range, can change unexpectedly, and rainfall can lead to a deluge on system in a relatively short period of time
Tide times 	**Non-physical**	• Fairly reliable, tides change slowly and timings are known	• Can result in a reduced working window

Glossary of Terms

IAB	Independent Authorising Body
WOCC	Wastewater Operations Control Centre
TC	Technical Coordinator, Networks, Pumping, Trunk sewers etc.
ASM	Area Service Manager, Sewage Treatment works.
TRC	Technical Resource Coordinator, Waste Ops Control Centre.
TWOSA	Thames Water Operational Site Authorisation
C Permit	Thames Water Confined space permit to work
G Permit	Thames Water General Permit to work
SHE4	Thames Water Safety, Health and Environment, Safe Systems of works
SHE13	Thames Water Safety, Health and Environment, Toolbox Talk
SHE21	Thames Water Safety, Health and Environment, G permit and plant release
HSP46	Thames Water Health and Safety Procedure 46 Safe and Secure Isolation
Works Activity	Includes all activities such as isolations, flow diversions and main works