M3 Junction 9 Improvement

Scheme Number: TR010055

6.3 Environmental Statement Appendix 2.1 - Drainage Outfall Methodology Optioneering Report

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 6

November 2022

Infrastructure Planning

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

M3 Junction 9 Improvement
Development Consent Order 202[x]

6.3 ENVIRONMENTAL STATEMENT- APPENDIX 2.1: DRAINAGE OUTFALL METHODOLOGY OPTIONEERING REPORT

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M3 Junction 9 Improvement Scheme

Drainage Outfall Methodology Optioneering Report

Date: 02/09/21

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Author	Tom King
Owner	Stephen Pettifer
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001	28/09/21	Drainage Outfalls in River Itchen Works	Tom King

Reviewer List

Name	Role
David Landeryou	Senior Project Manager
Stephen Pettifer	Design Manager
Jonny Murphy	Principal Environmental Planner

Approvals

Name	Signature	Title	Date of Issue	Version

TABLE OF CONTENTS

PROJECT CONTACT DETAILS

In this section, provide the details of the key personnel on this project, including those that are responsible for, or contributed to, the development of this product.

Name	Role	Organisation	Contact details
John Roose	Senior Project Manager	National Highways	[redacted]
David Landeryou	Senior Project Manager	Volker Fitzpatrick	[redacted]
Amy Attwater	Planning Manager	Volker Fitzpatrick	[redacted]
Stephen Pettifer	Design Manager	Volker Fitzpatrick	[redacted]
Phil Gregson	Health & Safety Manager	Volker Fitzpatrick	[redacted]

1 Introduction

1.1 Purpose and objectives

The purpose of the Drainage Outfalls in River Itchen Methods Optioneering Report is to review safe systems of work (SSoW) for isolating each outfall area including the temporary works which have physical interaction with the River Itchen required to install permanent works which is designated as a Special Area of Conservation (SAC) and within a Site of Special Scientific Interest (SSSI). Impacts on the Public Rights of Way (PRoW's) are also reviewed. The report also considers methods for returning the dewatered area with minimal silt disturbance via use of settlement tanks or similar.

The permanent works include 1no. existing drainage outfall (Outfall 1) which may require modifications / cleaning and 2no. new drainage outfalls (Outfalls 2 and 3). The existing outfall (Outfall 1) sits east of the Kings Worthy Bridge with new Outfall 2 between the Kings Worthy and Itchen Bridge and Outfall 3 to the west of the Itchen Bridge as seen in *Figure.1* below.

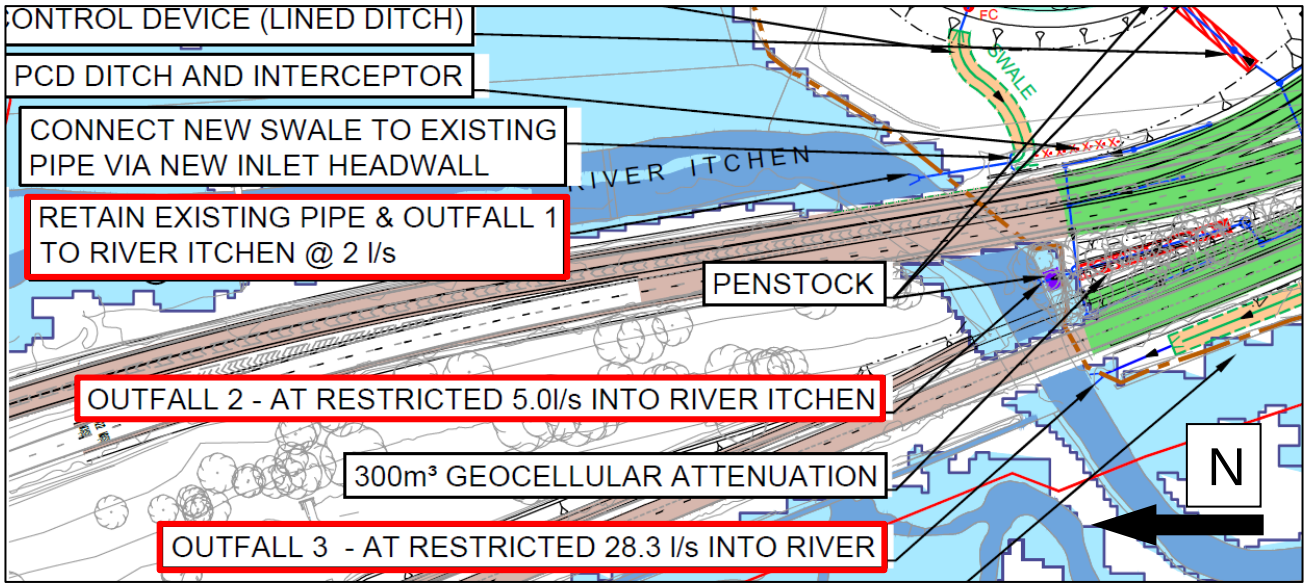


Figure 1 - Drainage Outfall Locations

The outfall locations were visited on 24/08/21 for visual review and findings including photographs have been included in this report.

The specific method will be based around temporary works required for isolating the works area from the River Itchen, dewatering and installation of the permanent works. The typical detail for the drainage outfall can be seen in *Appendix. A*.

The permanent works installation will be fully segregated from the river network via the temporary works so have not been discussed in the report. See assumptions section for effect of construction activities and design.

The methods options shall account for:

- Impact on biodiversity and surface water hydrology
- Impact on PRoW
- Programme for Works
- Cost for Construction

2 Design Constraints and Assumptions

2.1 Assumptions

Location Assumptions

The precise location of the two new outfalls are yet to be identified, however their general location is known (as identified in Figure 1) which is sufficient upon which to determine the likely methods of installation and associated environmental impacts. The precise location for optioneering purposes has been assumed the reasonable worst case to allow a robust consideration of the likely installation techniques (and consideration of associated environmental impacts) to take place.

There is limited information on the finished level and how far these outfalls protrude into the River Itchen. The protrusion may be a driver for the extent of temporary works and working area.

Design of Outfall Structure

The design detail provided in Appendix A is indicative only. Further assessment will be required to confirm pipe sizes and dimensions of structure based on the previous unknowns. These will also affect trench sizes and programme for works. The outfall structure is assumed to be precast with toe founded below river level. This assumption of precast element has been identified as a reasonable worst case for future design development. This is due to the more complex safe system of work required for lifting heavy single items within the given environment.

Ground Assumptions

High Level Geology for the optioneering is based on the Preliminary Environmental Information Report (PEIR) (Stantec 2021) (HE551511-VFK-EGN-X_XXXX_XX-TN-LE-0004):

Geology and Ground Conditions – Published Geology - 9.7.4:

"Along the route of the River Itchen, which traverses the northern part of the M3 J9 Improvement site, the solid geology is overlain by superficial deposits comprising Alluvium. There are also smaller transects of superficial deposits, comprising Head, overlying the solid geology, located to the north and to the south of the existing junction, and in the northern parts of the IAB, including the location of the proposed A33/A34 construction compound."

Substrate and flow habitat on the surface of River Itchen based on: *HE551511-JAC-EGN-0_00_00-DR-GI-0044* provided by Jacobs 05/08/20.

DESIGN AND PERMANENT WORKS CONSTRUCTION ASSUMPTIONS

- The outfall structure is assumed to be precast with toe founded below river level.
- The outfall structure will be precast and wall in-line with the riverbank.
- The area of installation works will be isolated via means of temporary works captured in this report prior to any permanent construction works assumed within 3m stepped back from river edge.
- Noting typical detail in *Appendix A*, a 2m width working area is required with 1.5m offset from riverbank / outfall location. This provides a 3m² working area.

2.2 Unknowns

- At the time of writing the need for electrofishing is unknown and will be determined once more detail of temporary works is available, in consultation with the Environment Agency (EA).

2.3 Constraints

- The River Itchen is designated as a Special Conservation Area (SAC) and a Site of Special Scientific Interest (SSSI) and is legally protected under UK law. Consultation and consent from Natural England will be required.
- Legally protected species including otter are known to be present in the local area. Full consideration of protected species will be required.
- Any isolation may not encroach 50% of river width
- No in river working between 1st October and 15th June inclusive. Note: Timings of restrictions have been provided by the EA and are specific to this river/project. (Note potential that this could tie in with times when the River Itchen PRoW is already closed due to adjacent works such as the new bridge over the River Itchen installation footbridge).

3 Outfall Isolation Method Optioneering

3.1 Framed Cofferdam

SUMMARY OF SYSTEM

A framed Dam Barrier is a propriety temporary dam / cofferdam system designed specifically for holding back water. They are constructed from scaffold or bespoke steel frames and an impermeable PVC membrane. When deployed, the dams create a hydro-static watertight seal using the weight of the water itself as demonstrated in the cross-section below.

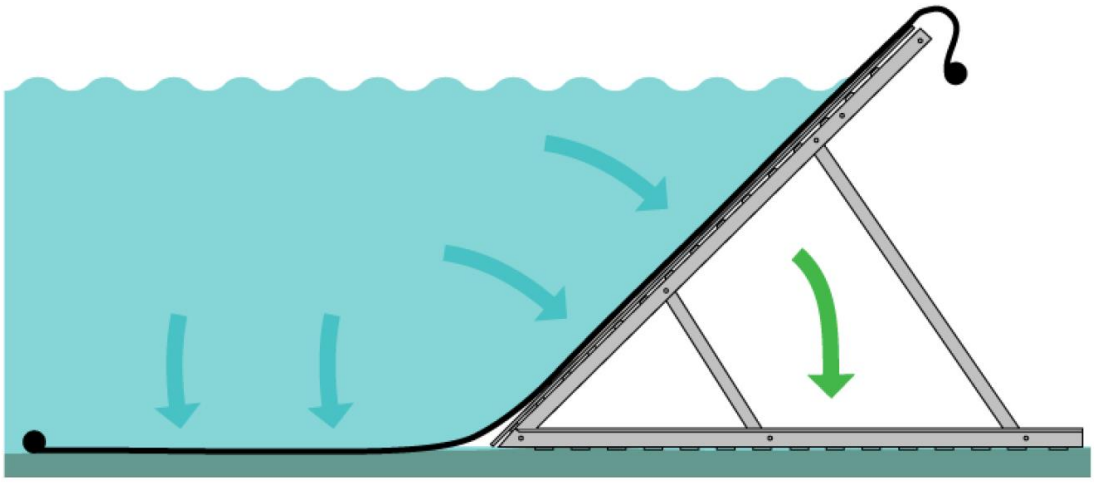


Figure 2 - Framed Dam Cross-Section

The system has previously been consented by the EA on local river network. Also consented by Winchester City Council (WCC) for use on River Itchen weirs section of the maintenance of river framework. See images below in use in central Winchester on River Itchen and outskirts of Winchester in woodland area on River Itchen.

Figure 3 - River Itchen Central Winchester Framed Dam

Figure 4 - River Itchen Woodland Framed Dam

SAFE SYSTEM OF WORK

1. Construct A-frame on landside

Figure 5 - A-frame Assembly

2. Lower and connect barrier sections within watercourse. Note: specialist trained operatives.

Figure 6 - A-frame connections

3. Install steel sheet face

Figure 7 - Steel Sheet Facing

4. Lay polythene membrane using chains to secure the toe and top of the membrane and to prevent movement of the sheet above the waterline from wind action.

Figure 8 - Chain Install

ACCESS REQUIREMENTS

- Equipment man handleable.
- Trained operatives required working in river.
- Area to pre-assemble A-frames required.

FLOOD EVENT REVIEW

- These can be overtopped and still maintain stability until required dry works area has had water pumped out.

ADVANTAGES AND DISADVANTAGES

Advantages	Disadvantages
• Minimal environmental impact as freestanding with no intrusive works required. • Smallest footprint for freestanding barriers. • Man handleable. • Can be constructed to suit environment. • Factor of Safety (FoS) can be applied to height to ensure time to react in flood event. • Can withstand overtopping so may be preferred in flood risk zones where flash floods may occur**.** • **No intrusive works required.** • Already consented by EA on local river network. Also consented by WCC for use on River Itchen. See image above in use in central Winchester on River Itchen.	• Specialist / Supplier only installation costs. • Temporary Works design required • Variety of components suggesting increased time for install in comparison to other modular items. (Some suppliers may provide modular system but still in parts.) • Adequate landside area required for constructing any modular parts such as A-frame. • Design relies on hydrostatic pressures from watercourse so not ideal for slower flowing streams. The seal may require weighing down after further assessment of hydrology and arrangement of temporary works. • Slower to construct than other options

3.2 Water Filled Cofferdam

SUMMARY OF SYSTEM

Water filled dams / cofferdams are a water inflatable temporary damming solution, constructed from woven Geo-textile material outer sleeve and polythene or PVC tube inner liners. When the liners are filled with water the dams create a hydro-static watertight seal using the weight of the water within the polythene tubes. Unlike the framed dams, these are suited for slower flowing rivers as they rely on the pressure inside the liner and not the external hydrostatic pressures from the river. The inflated dam in use can be seen below.

Figure 9 - Water Filled Dam

These are proprietary systems which come in a variety of lengths and heights. Because they are proprietary, they do not require a temporary works design. The system lays on the river bank up to 2m back to seal off embankment. The constraint however is the width which is defined by the height as seen below.

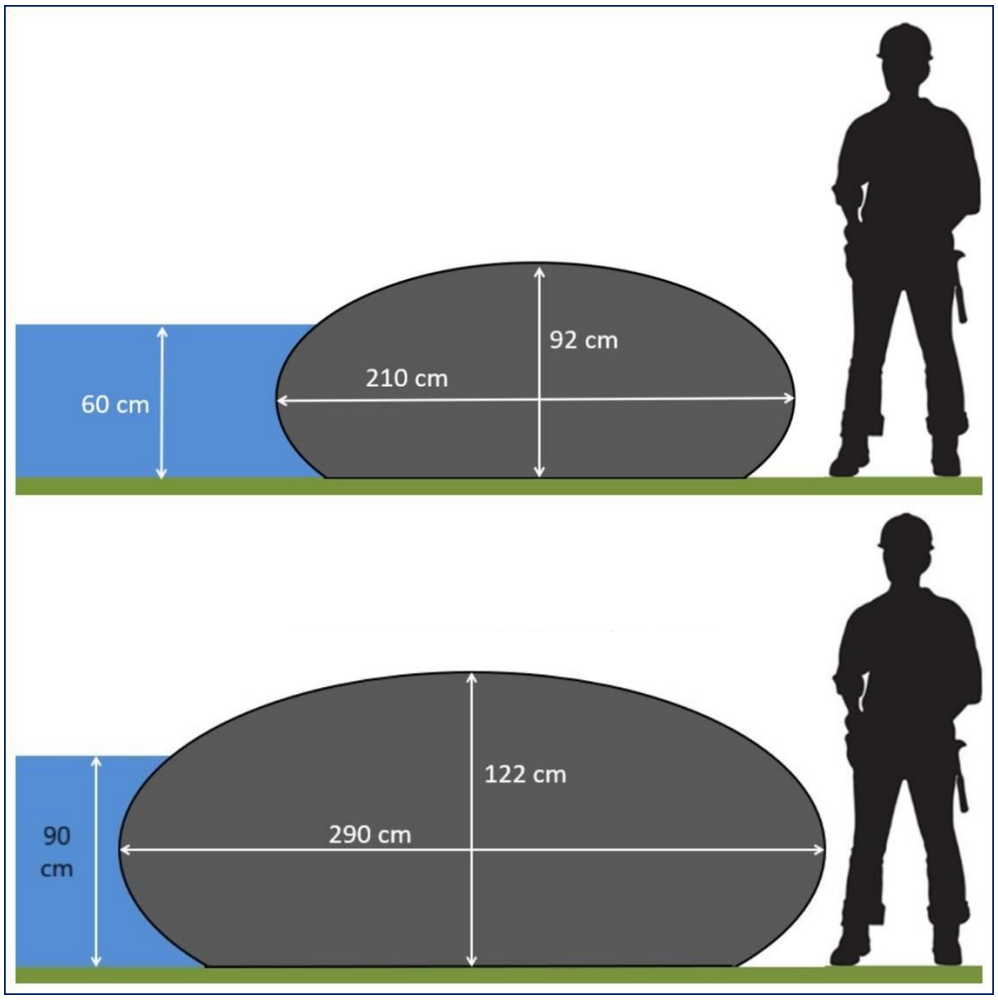


Figure 10 - Example of width constraints

Therefore, for a relatively small working area, the footprint of the dam could increase the area used in the river significantly as demonstrated below.

Figure 11 - Dam Footprint

The footprint can be reduced by forming the dam as a triangle with 2 sides for dam and riverbank as third. There is also the potential of not having a downstream face at all if the flow is not significant. A line of sandbags may be suitable as a non-intrusive option for this.

Unlike the framed dams, the waterfilled dams require a relatively flat surface. There is however, no extreme undulations which would cause concern in the outfall locations identified in Figure 1, as they have evenly spread silt. The system will sink in silt but the suppliers include a FoS for the height of water and depth of silt.

Like the framed dams, the waterfilled dams have been used on the River Itchen in the past with consent from the EA and WCC on projects such as the Durngate Flood Alleviation Works project. The below shows an image of a dam on the Itchen next to Winchester University.

Figure 12 - Water Filled Dam - River Itchen

SAFE SYSTEM OF WORK

The dimensions of waterfilled dam including 90° bends will be configured pre-delivery.

1. Layout waterfilled dam on the embankment.

Figure 13 - Positioning of Deflated Dam

2. Inflate with water and guide with rope from other side of river. Note; water used should have minimal fines so may require pumping through settlement tank if using river water. Also, if using river water to inflate, electrofishing or other means of encouraging wildlife away from pumping location should be implemented.

Figure 14 - Inflating Dam

3. Dewater required dry area.

Figure 15 - Dewatered Working Area

ACCESS REQUIREMENTS

- Equipment can be manually lifted in smaller pieces, but mechanical lifting is preferred.
- The equipment comes in rolls so is compact for fitting along footpaths / access.

FLOOD EVENT REVIEW

- This system is not preferable in areas which are prone to flash floods. The system compresses and deflates when a vertical load is induced. ie overtopping water.

ADVANTAGES AND DISADVANTAGES

Advantages	Disadvantages
• No temporary works design required. • Suited for similar slow flowing rivers to the River Itchen. • Quick and easy installation. • Works well in silt. • Already consented by the EA on local river network. Also consented by WCC for use on River Itchen. See image above in use in central Winchester on River Itchen. • No intrusive works required.	• Width significantly increases footprint of works location. • Not adequate for flash flood risk zones. • Limited in height • Riverbed required to be adequately flat.

3.3 Limpet Cofferdam

SUMMARY OF SYSTEM

A Limpet Dam / cofferdam is a steel structure that can be precisely positioned below the water line beside the site of interest. Water is then removed from the structure, allowing the external pressure to create a watertight seal. It can maintain a dry environment regardless of project time.

Limpet dams are much lower cost than other options and also much quicker to install. They are generally used in deeper waters as there are greater hydrostatic pressures with depth.

A limitation is sealing to the riverbank. These are usually used when butted up to vertical face walls such as that shown in Figure 17. There is however the potential to design bespoke sections which would bear down on to the riverbank and transfer the lateral forces from the hydrostatic pressures.

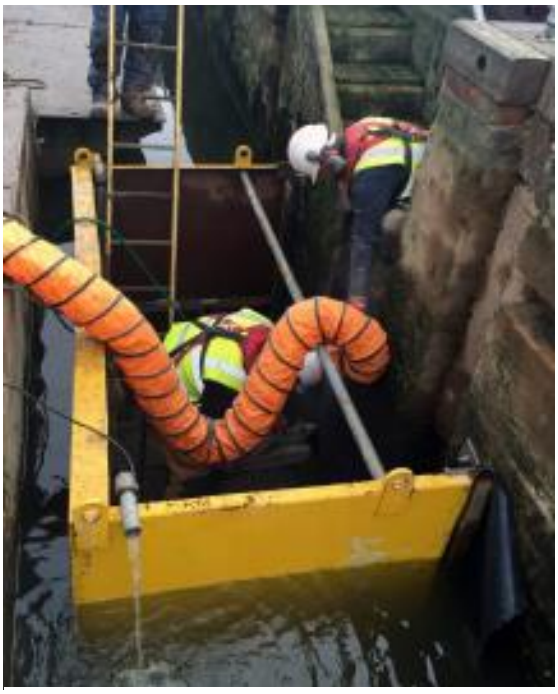


Figure 16 - Limpet Dam

SAFE SYSTEM OF WORK

1. Components constructed offsite with walers and braces to be installed on site.

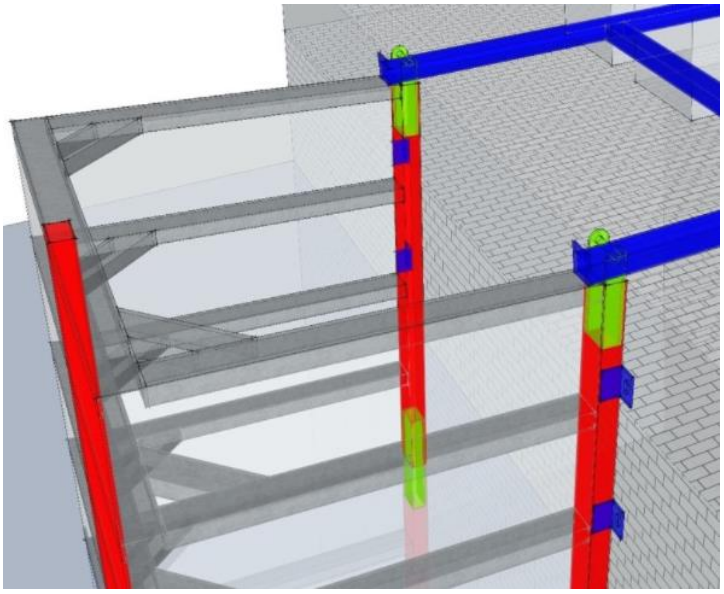


Figure 17 - Limpet Design Components

2. Components to be fixed together on landside.

3. Heavy base designed to sink to bed level. The weighting is designed to combat any buoyancy but not overload riverbed.

4. Fix to wall or bespoke load bearing / sealed system.

Figure 18 - Limpet fixed to wall

5. Dewater for use.

Access Requirements

- For the size of works area and depth at the River Itchen, all materials / components would be man handleable.
- Space required for fabricating system landside.

Flood Event Review

- Heights can be increased to +2m to mitigate any risk of flooding.
- If it does flood, the system would fail as the hydrostatic pressure would be counteracted by the hydrostatic pressure of water on the working area side.

Advantages and Disadvantages

Advantages	Disadvantages
• Simple and quick to install. • Fabricated landside. • Low cost. • Small footprint. • No intrusive works required.	• Mainly used against vertical walls and would require bespoke temporary works design on the foreshore / embankment. • Structure weighted down and is susceptible to compressing silt. • Structure will fail if flooded. • Less suitable in shallower water.

3.4 Sandbags and Flood Protection Sacks

SUMMARY OF SYSTEM

Traditionally sandbags have been used for low level flood protection. The bags can be piled in a particular orientation and height to combat limited head of water as seen below.

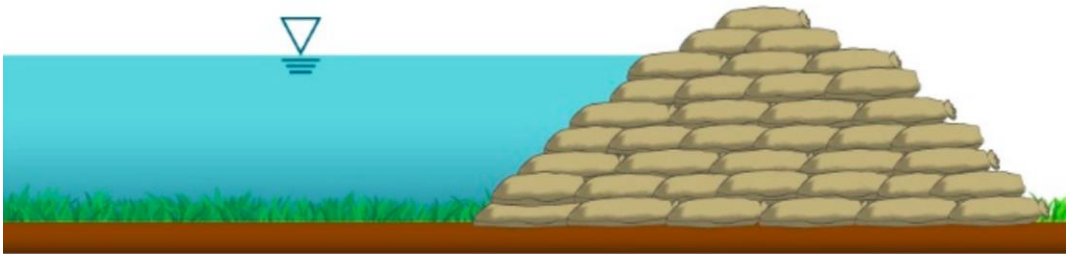


Figure 19 - Sand Bad Pyramid

A Sandbags fabric has the tendency to break, particularly when they are being laid on gravels or other sharp stone. However, there are more robust flood protection sacks now available which can be deployed with reduced risk to breaking.

Figure 20 - Polythene Sealed Sandbags

This form of cofferdam is the simplest and most cost-effective method for forming a dam. They can also be very easily reconfigured to suit the environment for working. They are not however a fully impermeable wall and can burst.

They are limited to height of water inducing hydrostatic pressures. They are freestanding so will topple if overloaded. Any movement may induce breaching and failure of the dam. Covering and fixing polythene to the dam may minimise this risk as seen below.

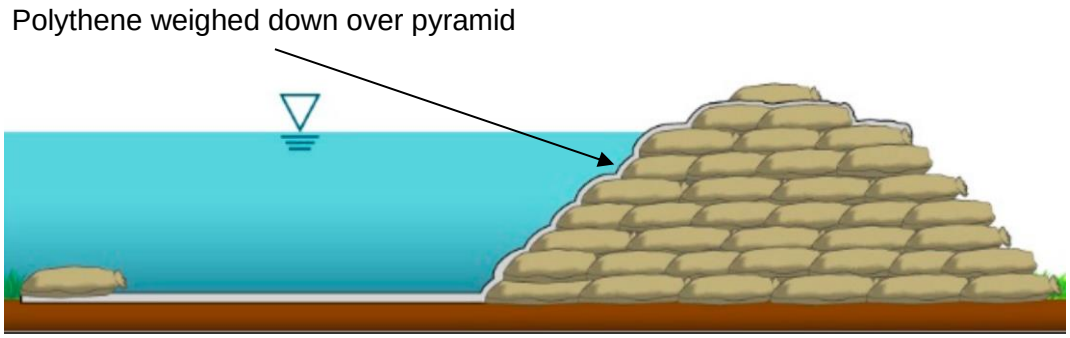


Figure 21 - Polythene Covering Sandbag Pyramid

If breaching is minimal, then constant dewatering using sump pumps or similar can be used alongside.

SAFE SYSTEM OF WORK

1. Stack sandbags in orderly fashion; in a pyramid cross-section and tie into embankment.

2. Seal with polythene or similar.

3. Dewater area.

Figure 22 - Dewatered Working Area

ACCESS REQUIREMENTS

- Sandbags come in a standard size and are easily handleable to work location.

FLOOD EVENT REVIEW

- Heights can be finely adjusted due to size of bags so can be overdesigned to mitigate flood risk.
- The wall is not fully impermeable and can burst under increased head of water.

ADVANTAGES AND DISADVANTAGES

Advantages	Disadvantages
• Low cost. • Basic installation methods. • Quick to install in low depth areas. • Can be shaped to suit environment. • No intrusive works required	• Not fully impermeable and susceptible to bursting. • Depending on height of water head, significant quantity of sandbags required. • Large footprint required if high water level to spread load in pyramid formation. • Sandbags susceptible to breaking and leaking sand. • Recovery of sandbags difficult if deep water.

3.5 Sheet Pile Cofferdam

SUMMARY OF SYSTEM

Steel sheets pressed into the ground by means of pressing, hammer or vibration. This can be done from a piling rig (mini piling rig in this application), machine attached hammer or Giken travelling piling. Machine attached hammer would be the preference for the outfall locations on the River Itchen. Other than a Giken, the piling methods require hardstanding to pile from. Therefore, a pontoon or similar would be required on the river where the foreshore is highly vegetated. The pontoon would need to be assessed to take the machine and transferred impact forces exerted from the piling / movements.

Figure 23 - Machine Attached Piling Hammer

Figure 24 - Mini Excavator on Pontoon

The sheets are interlocked. Once works are complete, the sheet piles can be pulled using lifting equipment and vibrated if necessary. Alternatives to sheet piling include tubular piles and concrete piles. Both are not assessed in this report as they are not applicable for the outfall locations.

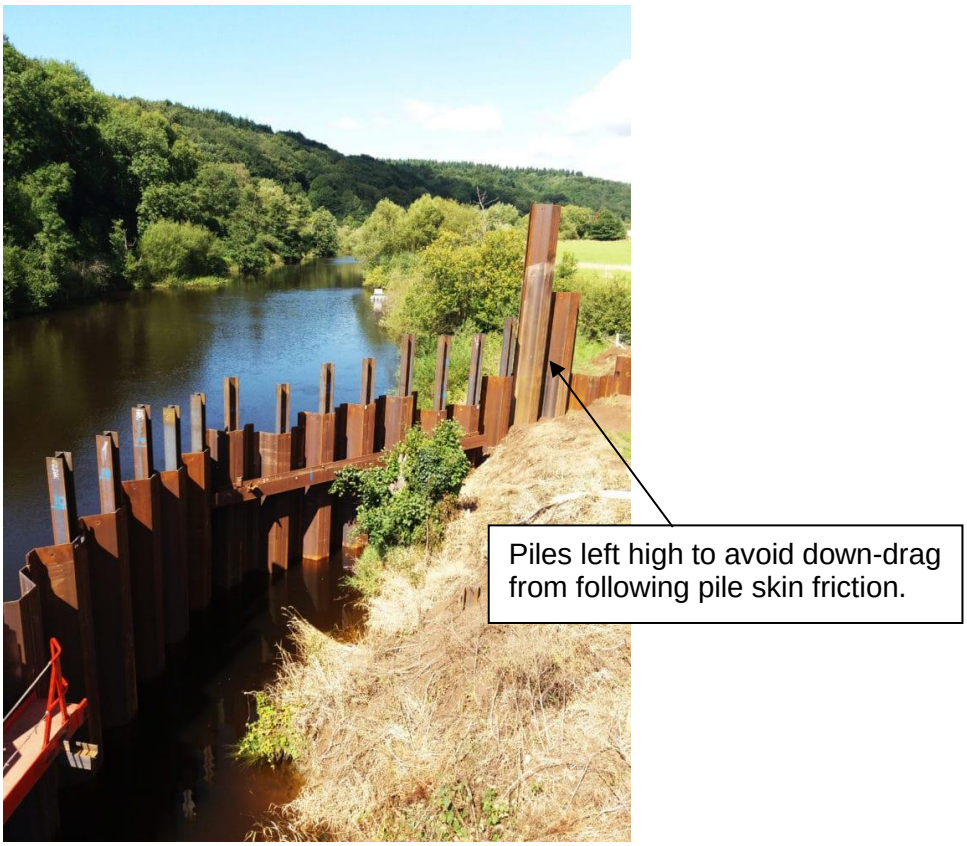
Sheet piling is the only ground penetrating / intrusive method for creating a temporary cofferdam. It does not rely on any hydrostatic pressures for use but properties of embedment material which contribute to stiffening / stabilising the structure. It requires adequate ground makeup information for design of sheets or can alternatively be overdesigned for deep piles. If the ground is weak / silty, there is the potential for them to settle or deflect. If the ground is too rocky then there will be difficulties in driving.

Sheet pile temporary works design will much likely have a longer service life than alternative options. Sheet heights and driving depths are adaptable to the design environment and can therefore be designed to take significantly higher pressures / loads in comparison to other options.

SAFE SYSTEM OF WORK

1. Clear area for machine to drive from and store sheets. If from a pontoon, travel the pontoon to adequate location.

2. Lift sheet pile and drive into riverbed and adequate depth. Note that if vibration piling then the following pile will likely drag the pile down. Therefore, the pile should be left high and returned to later if still protruding above level.



25 - Protruding piles to be driven to correct depth once full perimeter has been installed

3. Once at full depth, lift the next sheet pile and position so it is interlocking with the previously installed and drive to depth.

4. Repeat process until full cofferdam is complete.

ACCESS REQUIREMENTS

- Sheets require machine lifting.
- Sheets require laydown area during works.
- Machine requires dry and level platform to work from.

FLOOD EVENT REVIEW

- Sheet piles can be designed to any height assuming adequate embedment so can be designed for a worst-case flood event.

ADVANTAGES AND DISADVANTAGES

Advantages	Disadvantages
• Robust design. • Smallest footprint of any option. • Can be designed for any head of water / pressure.	• Intrusive works. • Expensive design and procurement of plant / materials. • Substantial area required for plant and materials. • Can have significant environmental impact if vibration piling. • Unless pressed, the piling method will be noisy. • Removal requires reverse of installation. ie remobilising rig, noisy works and offloading piles from site.

4 Dewatering and Silt Removal Method

4.1 Dewatering Requirements

Once the cofferdam has been installed, it requires dewatering. The intention would be to send the retained water back into the main river network via means of over-pumping. Note, that it will be preferable to have a permanent sump pump / pumping system in the dry area throughout works due to any risk of ground water rising into area. Also, they are required if using semi-permeable means of isolation such as sandbags allow some seepage so would also act as a control for this risk. Note that it is assumed at this stage that the permanent works are precast element with a toe to be founded below riverbed level. When it comes to excavating the foundation area, a sump pump is recommended to be left in situ throughout works.

As the works within the isolated area are expected to be carried out in a short period of time, it would be logical to leave the dewatering in place throughout the works. This also acts as a secondary control for risk of flooding. Note that standard sump pumps will work on float switch so will only activate when water in the sump reaches a given height.

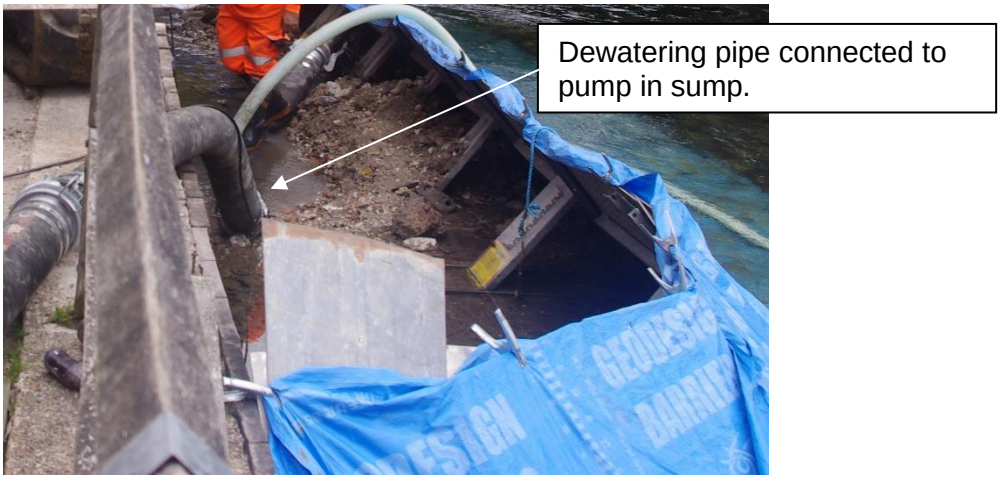


Figure 26 - Dewatering in River Itchen

There are requirements to return the water to the main river course as undisturbed water. Any silt, sediment and suspended solids will be required to be removed. This is a key driver for the methodology used.

The final methods of treatment will be set out in the first iteration Environmental Management Plan (fiEMP) and approved by the Secretary of State.

4.2 Water Treatment Methods

STANDARD SETTLEMENT TANK

Settlement tanks are designed to capture silt and suspended solids and prevent them from being discharged back into the watercourse. Standard units are made from steel and feature a series of integral weir walls which aid effective settlement of the solids. These units also house multiple Bauer quick release couplings.

For the working area in the outfalls it would be expected to use a smaller size tank which would be approx. 1.5m x 1m footprint. Larger ones can be used and they can be connected to provide multi-stage settlement if necessary.

Figure 27 - Standard Settlement Tank

SILTBUSTER

Siltbuster is a brand with patented settlement tank design. It is much more efficient than a standard settlement tank but works on the same principals. It uses lamella plate technology to maintain settlement conditions within the unit. Flow is sent through a feed channel and particles within the water settle on the lamella plates and retained in a sludge storage area within the system and water discharged via gravity back to the watercourse.

They are generally larger than settlement tanks and in particularly taller meaning some tree canopy / vegetation removal would be required. Space may be a driver as to whether this is a preferred option.

It is an expensive alternative but will guarantee a greater removal of particles and at a much quicker rate than a standard tank. These may not be necessary in the application for these smaller areas when the more compact, lower cost alternatives will satisfy requirements.

Figure 28 - Siltbuster Schematic

4.3 Dewatering Sock / Bag

Silt dewatering bags are made of a geotextile material and laid flat on ground near to the dewatered area. The particulate water is transferred into the sock where the geotextile layers capture the fines and release the water through the sides. This is a low-cost method for removal of fines.

Figure 29 - Silt Dewatering Bag

It is limited to 90micron removal of fines. The sizes range from 0.2m x 1m to 6m x 10m and rapidly increase in size by required pumping rates so can take a significant area in comparison to other options depending on requirements.

Figure 30 - Silt Bag Filtering

The seeping cleaned water can be controlled by polythene laid with a small trench creating path back to the water course.

5 Specific Outfall Location Review

5.1 Existing Outfall 1

EXISTING OUTFALL 1 DESCRIPTION

The existing outfall is planned to be retained for connection to basins west of the M3 and maintained at a rate of 2l/s.

Located east of the Kingsworthy Bridge, this location is situated in front of a heavily vegetated area. The PRoW is stepped back from the minimal incline foreshore of the river.

HE551511-JAC-EGN-0_00_00-DR-GI-0044 defines the location as “Silt and slow flow habitat”

There are significantly more sands in the location in comparison to the other outfall locations which consist of 55% sands and 40% gravels. This is likely due to the path of river causing accretion over years and the outfall is stepped back from the river stream as seen in image below.

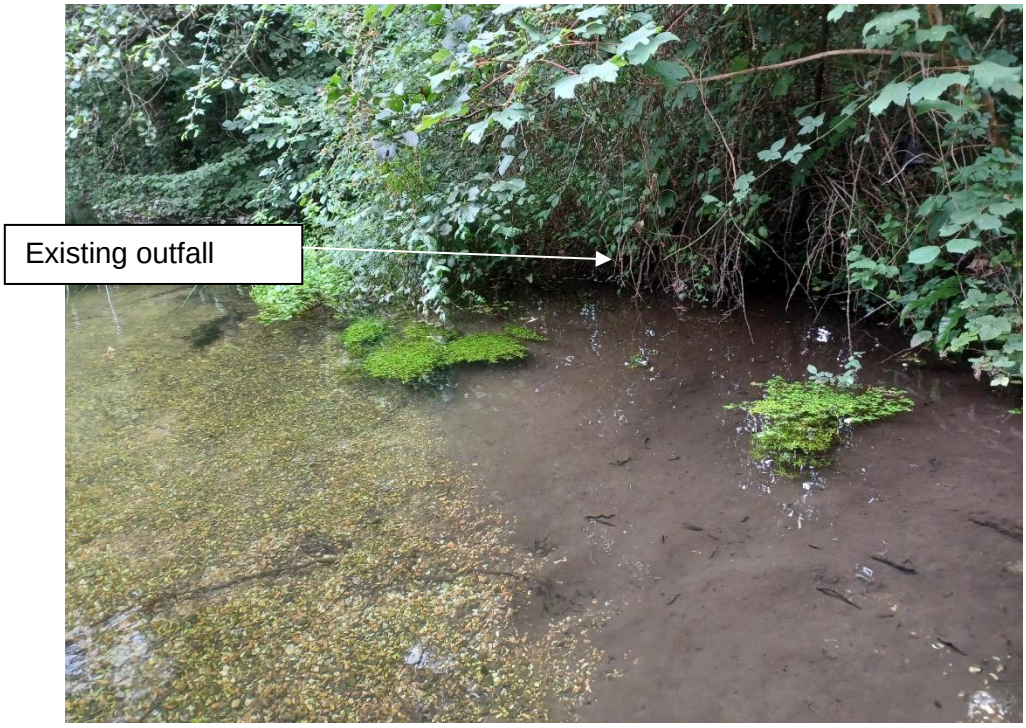


Figure 31 - Existing Outfall Silt Accretion

From site visit and viewing the above image, it is predicted that there is maximum 500mm of silt above the gravel bed.

From site visits, the precise location is difficult to identify without vegetation removal although there is an area in the stagnant foreshore location which indicate fluvial movements bubbling up so is thought to be here as seen in image below.

Figure 32 - Heavily Vegetated Area Over Existing Outfall

Assuming that the location is correct, the depth of river is approx. 400mm.

In comparison to the other outfall locations, this outfall is extremely closed in and locations for any settlement tanks or the likes would require being sent back approx. 10m into the adjacent field.

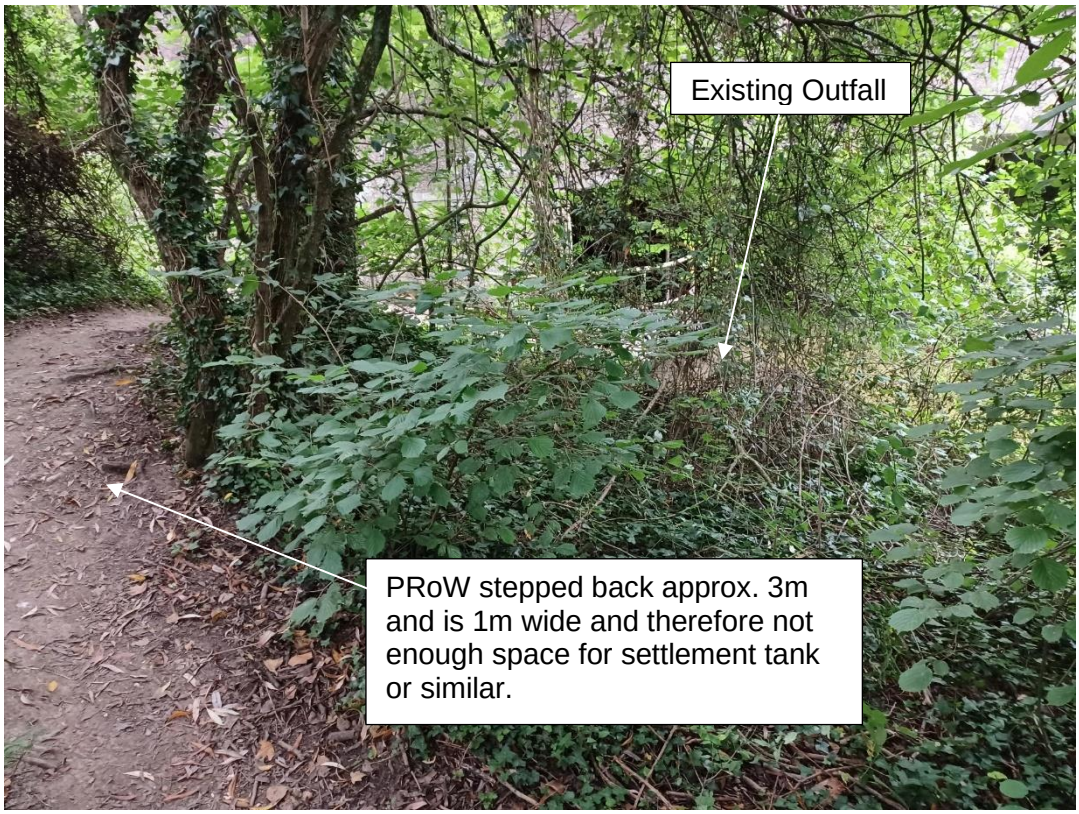


Figure 33 - PRoW at Existing Outfall

The nearest node location for hydrology information on the River Itchen for Outfall 1 has a lowest bed level of 36.72m Above Ordnance Datum (AOD) and a 1-in-2 year flood level of 38.73mAOD so a depth of 2.01m. It should be noted that there is an incline up to the outfall location and the node is in the centre of the river. The lowest bed level is much higher in this location; predicted to be approx. 400mm so assumes an 800mm depth flood event; rising by 400mm from what has been viewed on site. The stream velocity for this event is 0.12m/s.

EXISTING OUTFALL 1 PREFERRED CONSTRUCTION METHOD

Temporary Works

The first stage for isolation here will be to remove overhanging vegetation. This should be done using handheld equipment to a minimum height to avoid unnecessary overcutting of foliage.

Due to the vegetation and slow flow of the river at this location, sheet piling has been omitted. Due to the likely impact to the environment from noise. physical intrusion and required area to be further cleared, this option is less preferable when alternatives are available due to the environmental impact of intrusive works and significant vegetation removal requirements for plant access and setup.

A limpet dam has also been omitted from assessment due to minimal embankment for the element to be pressed against.

The slow flowing nature of the river suggests that a water filled dam would be preferable over a framed dam which are preferred to be used for faster flowing areas. Equipment for a water filled dam can be laid on the foreshore where vegetation has been cleared and inflated. The river is wide enough at approximately 15m that the wider approx. 2.5m width footprint of a waterfilled dam plus 2m working area will not have a significant impact on stream hydrology.

Further assessment would be required of the slope into the river to confirm height of waterfilled dam required as they are supplied to a maximum height of 1.8m which would not satisfy the 1-in-2 year peak water levels at the centre of the river. From site visual inspection of the riverbed, it is expected that restricted heights of waterfilled dams will not be an issue. Also, as the river meanders, the width is increased so the width of a waterfilled dam should not be an issue. If either height or width is an issue, a framed dam can still be implemented.

However, the preference over either the water filled dam or the framed dam at this location will be simple sandbags with polythene seal. This avoids an extended footprint given that the flows and depth are minimal. With programme of works being short for simply cleaning the existing outfall, the area required will likely be smaller as well. Sandbags are comparatively small items compared to the materials and installation requirements of other options, which would require minimal vegetation clearance for access compared with other options.

Silt Management

The PRoW is stepped back and the vegetation overhanging the area is significant, however, there is a clearing on the foreshore a few metres downstream which may suffice for a settlement tank as seen below.

Figure 34 - Cleared Area off PRoW Near Outfall 1

Only a small silt settlement tank would be required and can be man handled down the footpath. However, it would require lifting from the bridge down to the PRoW. No lane closure would be required as there is a wide footpath over the bridge wide enough for vehicle parking as seen below.

Figure 35 - Kings Worthy Bridge Hardstanding / Footpath

The environmental impact of vegetation removal to allow the installation of a Siltbuster would be unnecessary and would require mechanical lifting.

With low risk of sandbags bursting due to minimal height, a filter bag would be preferred.

Construction Method Summary

Simple polythene fixed sandbags would be the preferred option for this location with filter bag for removal.

As a worst case, the proposal is to use a waterfilled dam or framed dam if necessary due to flood risk or river width requirements) and settlement tank on foreshore away from PRoW to minimise footpath closures. No Traffic Management (TM) would be required but a truck mounted crane would be required to lift the settlement tank to footpath level so a temporary footpath closure would be required whilst this is positioned. Some vegetation clearance would be required from ground access only minimising working from height safety risks.

Safe System of Works

NOTE: The works are recommended to be undertaken during footbridge installation and utilise PRoW closures for these works being undertaken downstream.

1. **0.25 days** - Minimal vegetation shall be removed prior to installation of temporary works using strimmers from ground level.
2. **1 day** - The installation of temporary works if worst case is assumed requires a 3-man in-river working team with a martial for managing public interface. Install as per temporary works methodology.
3. **1 day** - Once area is segregated, clear existing outfall. Hand digging will be required for exposing pipe end. Jetting out is not expected to be required but if it is deemed necessary, it is to be carefully managed. Only the drainage pipe can be jetted with clean water. No jetting / disturbing of surrounding environment shall be undertaken.
4. **0.5** days – Removal of temporary works

5.2 Outfall 2

OUTFALL 2 DESCRIPTION

Outfall 2 sits between the Kings Worthy Bridge and Itchen Bridge and connects to highway runoff from the A34 Northbound and WCH route. It is designed to be limited at a flow rate of 5l/s.

The depth at river outfall location is maximum 1m and the river width is approx. 8m.

The location has significant vegetation overhanging the river and is segregated from the PRoW by a chain-link fence. The embankment from the chain-link fence (offset approx. 3m from river) is approx. 2:1 incline.

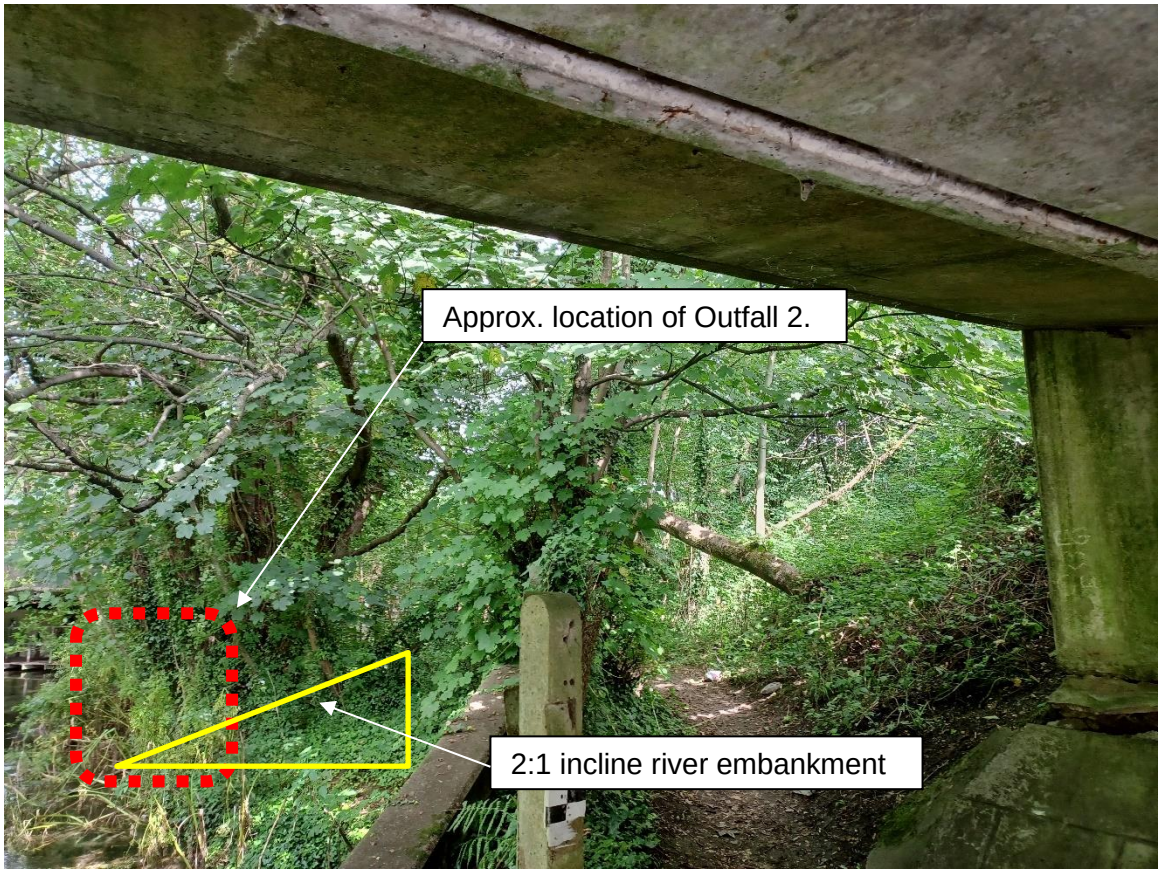


Figure 36 - PRoW View from Itchen Bridge

The PRoW which runs underneath the Itchen Bridge (where photo in above is taken from) is wide enough to fit a settlement tank or similar on for dewatering purposes. The PRoW which runs at the top of the embankment to the location has chain-link fencing and is stepped back by approx. 3m as per below.

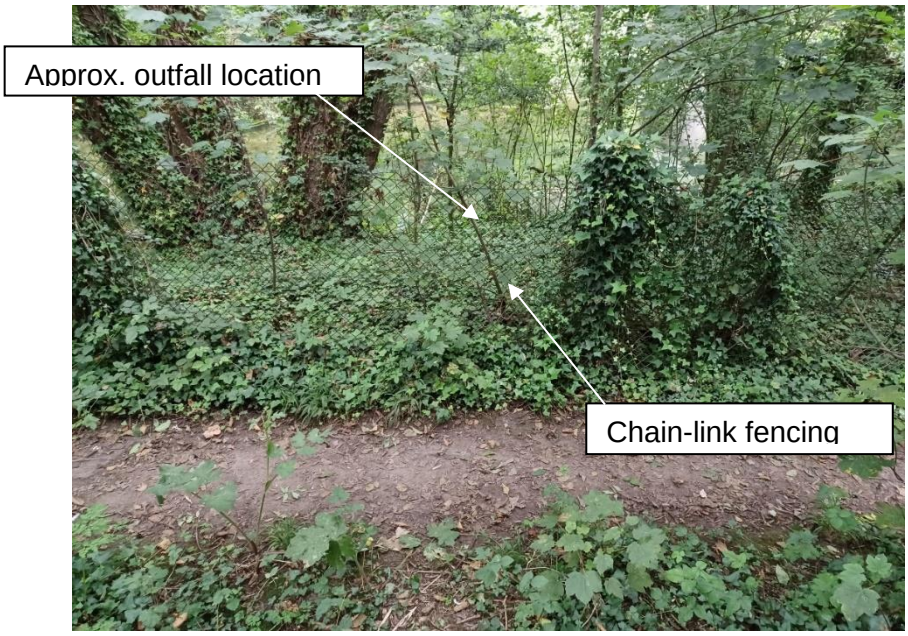


Figure 37 - Outfall 2 PRoW Offset

Assuming the location is central between the A34/A33 SB and A34 NB, the offset from highway is approx. 10m. Noting the canopy and offset, lifting precast permanent works or temporary works from the highway under TM would be difficult. It would therefore be preferable to use man handleable temporary works or working from pontoon if absolutely necessary.

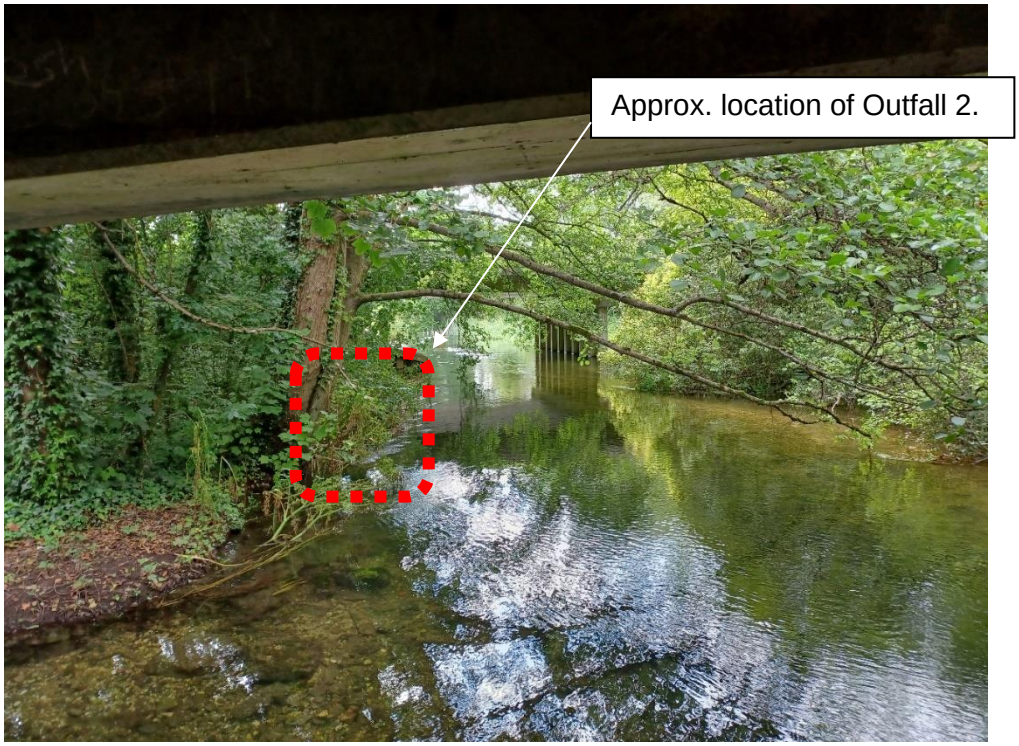


Figure 38 - Outfall 2 View from Kings Worthy Bridge

The nearest nodes locations for hydrology information on the River Itchen for Outfall 2 have a lowest bed levels of 36.72mAOD and 36.88mAOD. An interpolated node between these at the outfall location has a 1-in-2 year flood level of 37.67mAOD so a depth of 950mm has been assumed. The stream velocity for this event is 0.58m/s.

OUTFALL 2 PREFERRED CONSTRUCTION METHOD

Temporary Works

The ProW at this section would require closure throughout the works for installation of trench to outfall location and could be timed in with the footbridge installation. However, with the PRoW stepped back from the outfall location, there is the potential that the temporary works can be installed with the PRoW open adjacent. Adequate public segregation would be required (Chain-link fencing will be replaced). Once the outfall precast element has been lifted in place from landside, it can then again be reopened to complete works.

There is no level ground for sheet piling so installation works would have to be undertaken from a pontoon. With alternative options available (with lower environmental impacts) sheet piling has been omitted from further consideration at this location.

The river is too deep for sandbags to be managed here so have also been omitted.

There is a slope which a bespoke fixture for a limpet dam could tie into but with the slope being 2:1 and depth of water only being <1m in a flood event, the design costs for a limpet dam have meant this has been omitted.

Both waterfilled dams and framed dams are applicable here. A waterfilled dam would be the preferable option as design can satisfy flood event and relatively slow flowing nature of river makes this suitable. They are also quicker to construct than framed dams. However, the river width is only 8m here and the width of the dam itself would be 2.9m for larger dams and with a 1.5m working area would encroach 50% of river width and therefore not be a feasible option.

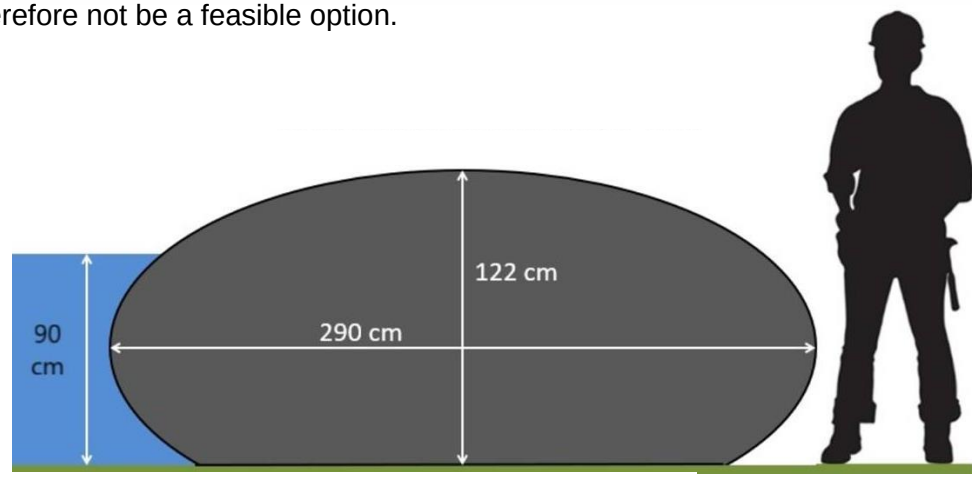


Figure 39 - Large Waterfilled Dam

Figure 40 - Outfall 2 Width

With the waterfilled dam not feasible, a framed dam is the next preferred option. The location is a very similar setup as the central Winchester setup on the River Itchen with similar area as seen in the Framed Dam Methodology section of the report. Although the flows are slightly less, this would not cause the framed dam any issues.

The components are small enough that they can be passed down the slope off of the Kings Worthy Bridge hardstanding / footpath as seen in previous option and carried to location. The PRoW would require temporary / part closure whilst equipment is being carried along the approx. 30m route from the highway.

Silt Management

A silt bag would be the preferred option but would be slow to drain the area if a small one is used and would require further assessment to confirm it can be used. All other options require a larger, clear and flat area.

The footpath underneath the Itchen Bridge is level and wide enough to have a small settlement tank (1.2m width) and PRoW bypassing and segregated. A siltbuster would be too large for the available space. The proposal would be to place at the eastern end of the PRoW flush to the river edge as indicated below looking from west of Itchen Bridge.

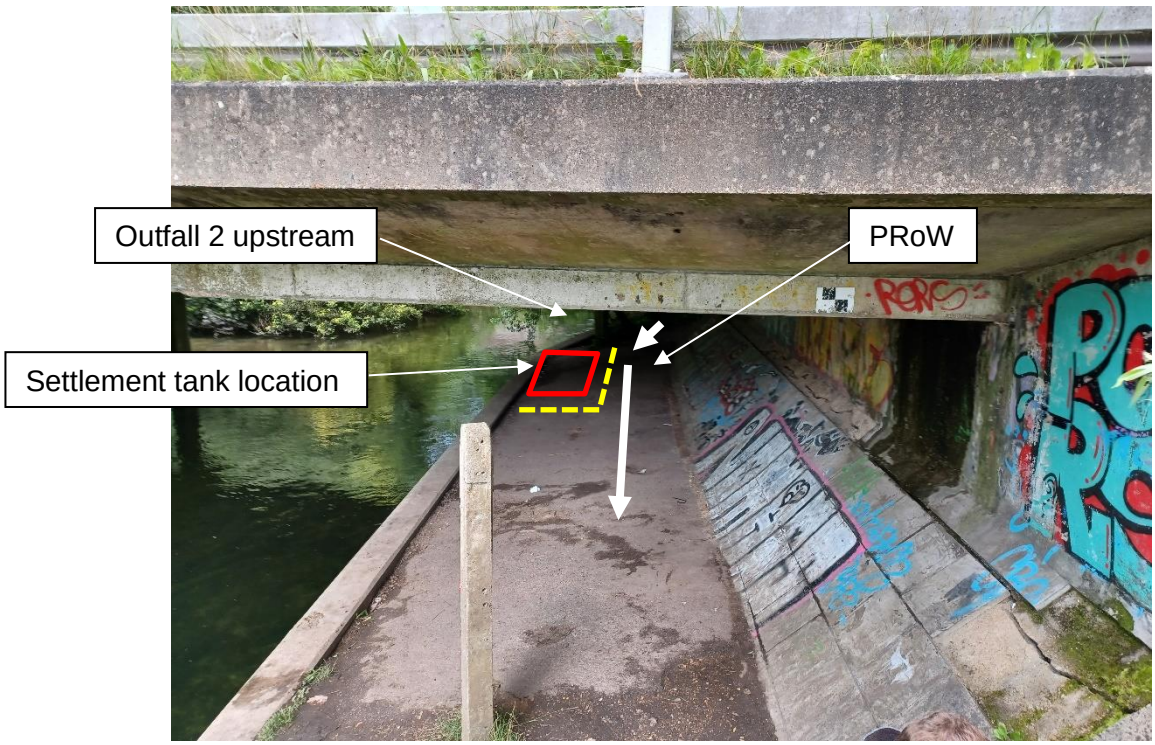


Figure 41 - Outfall 2 Settlement Tank Location

Construction Method Summary

A waterfilled dam would be the preference for temporary works at this location as it doesn't require design and is quick to install, however with width of watercourse constraints, a framed dam is the preferred option. A framed dam also is more suited to floodplain.

A settlement tank located downstream of the location on the widened PRoW hardstanding is the preferred location and setup for silt management.

Safe System of Work

NOTE: The works should be undertaken during or before the footbridge installation. Utilise vegetation clearance for footbridge for access of plant.

NOTE: SSOW assumes starting behind PRoW.

1. **0.2 days** - Remove chain-link fencing and replace with temporary barrier
2. **1 day** – Install temporary works and dewater with 3-man in-river working team. Temporary barrier in place to act as segregation from works area and settlement tank.
3. Implement PRoW diversion.
4. **2 days** – Excavate trench for drainage pipe below PRoW location to isolated area on river. Tracked excavator, banksman, supervisor and groundworker in attendance. (Assumes approx. 2m depth excavation below PRoW from site visit view of ground makeup)
5. **0.5 days** – Install drainage pipe at PRoW location. As per 4. For attendance.
6. **0.5 days** – Excavate below river level for foundation of precast element with sump pump in use for groundwater removal. As per 4. For attendance.
7. **1 day** – Lift and install precast outfall element. As per 4. For attendance. (It is assumed that this has already been lain down upstream of drainage pipe under previous TM.)
8. **2 days** – Backfill location and reinstate PRoW. As per 4. For attendance.
9. Reopen PRoW

5.3 Outfall 3

Outfall 3 Description

Outfall 3 is located west of the Itchen bridge and connects to basins west of the A34 NB. It is designed to be limited at a flow rate of 28.3l/s.

The depth at outfall location is maximum 500mm and river width approx. 10m.

The approx. location is close to the PRoW which is retained by sheet piles as it deviates underneath the Itchen bridge as seen below.

Figure 42 - PRoW Sheet Pile Retaining Structure

Based on the assumption that the outfall is almost flush to this, the river embankment here is significantly stepped back from the main stream and the already slow flowing river has minimal fluvial effects on the location. The stepped back embankment in effect forms a stagnant pool which would be the attended working area as seen below.

Figure 43 - Outfall 3 Location Stepped Back

With the location being so close to the Itchen Bridge and there being minimal vegetation, the location is not as constrained as Outfall 2. It would be envisaged that any materials can be lifted from the A34 NB under a lane closure or carried from A33 SB under the structures with just a footpath closure on the hardstanding.

Further to this, the PRoW which runs under the Itchen Bridge is wide enough to place a sediment tank or similar.

Figure 44 - PRoW Underneath Itchen Bridge

The nearest node location for hydrology information on the River Itchen for Outfall 3 has a lowest bed level of 36.88mAOD and a 1-in-2 year flood level of 37.45mAOD so a depth of 570mm. The stream velocity for this event is 1.07m/s – 1.21m/s; reducing through the flood event.

OUTFALL 3 PREFERRED CONSTRUCTION METHOD

Temporary Works

Unlike the other two outfalls, the PRoW is not stepped back at this location. Therefore, the PRoW will require shutting throughout the duration of permanent works installation. The works should be undertaken during or before the footbridge installation to avoid additional PRoW closure.

This is also the only location where sheet piling can feasibly be undertaken with any plant being lifted directly from the A34 NB under a lane closure and landed on the widened footpath with the PRoW closed for access. The sheets could also be laid on the larger area. However, this option has still be omitted from assessment early due to the adverse environmental effects of piling. The river bed is formed of gravel and will likely require some hammering or vibrating. The minimal depth of water means that the impacts which come with piling are not necessary when simpler alternatives can be used.

There is the possibility that sandbags could be used as the depth is minimal and the site visual inspection indicates a pool off of the main stream. However, with the high velocity of the 1-in-2 year flood event, it has been assumed that there may be some significant effect here. Therefore, this option has been omitted.

Both framed dams and waterfilled dams are applicable here. The river is wider at this location and lower depth so the smaller footprint waterfilled dam could be used. However, the higher velocities of the 1-in-2 year flood event may suggest the framed dam would be preferable. Further assessment would be required to determine the preferred option. Whatever the preferred option, it is suggested to utilise the existing sheet piles which retain the footpath to reduce the area taken in the river as demonstrated below.

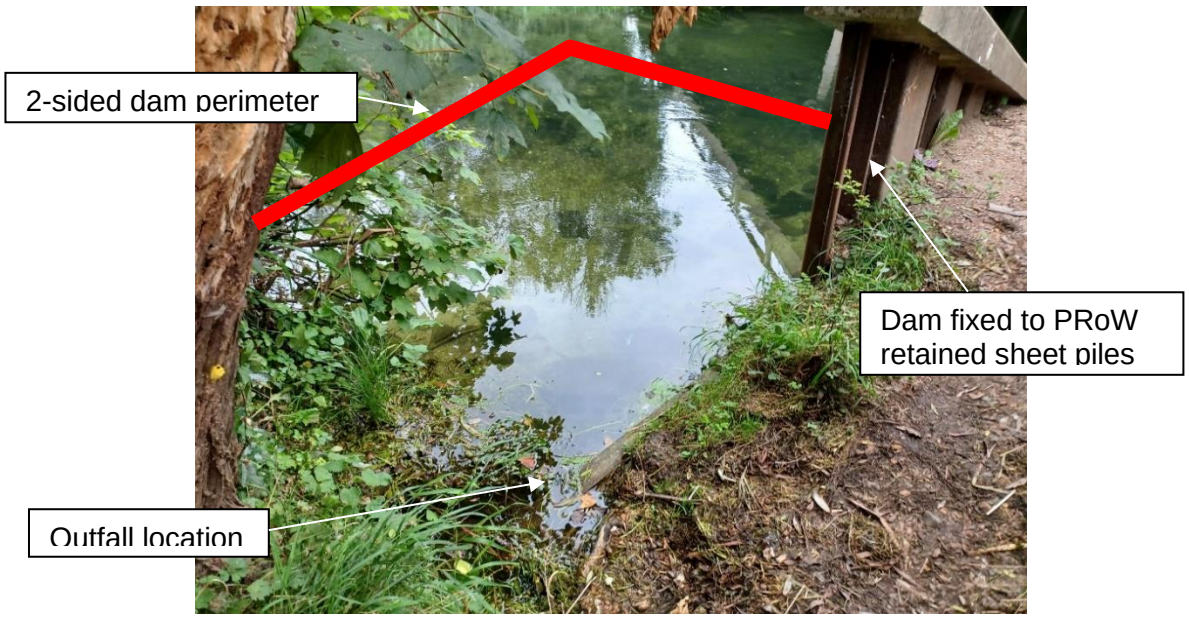


Figure 45 - Outfall 3 Isolation Configuration 1

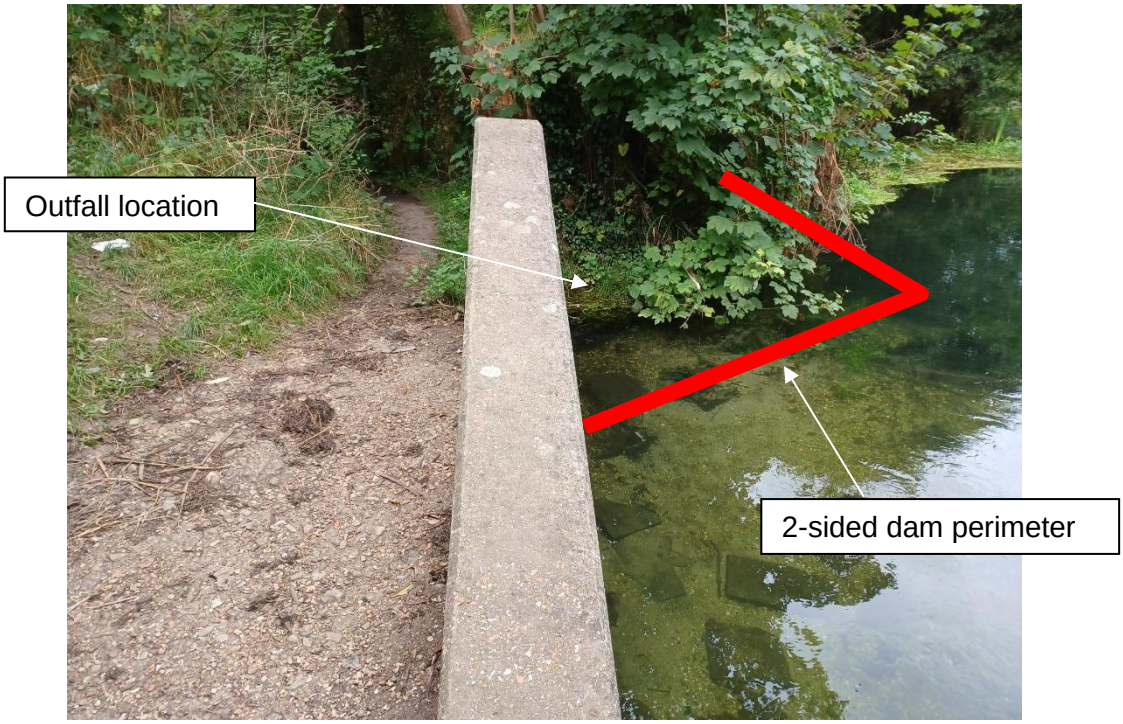


Figure 46 - Outfall 3 Isolation Configuration 2

Figure 47 - Outfall 3 Isolation Configuration 3

Silt Management

With the PRoW shut off, any option for silt management can be implemented as they use similar footprints. A Siltbuster should be avoided as it cannot be lifted manually. Similar to Outfall 2, a settlement tank could be lifted from the Kings Worthy Bridge and placed on the hardstanding but at the west end of the PRoW underneath the Itchen Bridge.

Construction Method Summary

This option will require PRoW closure throughout the works for temporary works installation and permanent works installation. The temporary works however, can be optimised for programme, cost and environmental impact by utilising the existing PRoW retaining sheet piles. Either framed or waterfilled dams can be used pending further assessment.

With the PRoW closed off, any option of silt management can be implemented pending design check for control. Man handleable small settlement tanks would be preferred.

Safe System of Work

NOTE: Assumes access from already installed basins adjacent to highway.

NOTE: SSOW assumes starting behind PRoW.

1. Implement PRoW diversion.
2. **1 day** – Install temporary works and dewater with 3-man in-river working team. Temporary barrier in place to act as segregation from works area and settlement tank.
3. **1 day** – Excavate steep embankment on landside of PRoW as drainage run works approaches river. Tracked excavator, banksman, supervisor and groundworker in attendance.
4. **1 day** – Excavate trench for drainage pipe below PRoW location to isolated area on river. As per 3. For attendance. (Assumes approx. 1m depth excavation below PRoW from site visit view of ground makeup.)
5. **0.5 days** – Install drainage pipe at PRoW location. As per 3. For attendance.
6. **0.5 days** – Excavate below river level for foundation of precast element with sump pump in use for groundwater removal. As per 3. For attendance.
7. **0.5 days** – Lift and install precast outfall element. As per 3. For attendance. (It is assumed that this has already been lain down upstream of drainage pipe under previous TM by tracked excavator lifting and is quicker to install due to open area. If cranage is required to lift, further TM will be required.)
8. **2 days** – Backfill location and reinstate PRoW. As per 3. For attendance.
9. Reopen PRoW

6 Conclusion

Based on the 3no. outfall proposed safe systems of work and reviewing the types of systems used, the temporary works which have physical interaction with the River Itchen can be further optimised to reduce:

- PRoW closures
- Impact and overall programme within vicinity of the SAC/SSSI area
- Costs for plant, resource and materials
- Safety concerns with working close to a highway environment

It is suggested to utilise the framed dam temporary works for all 3 outfall locations and carry out the works sequentially reusing the equipment at each location. The settlement tank can move with the works. Sandbags with durable polythene seal were initially preferred for Option 1 and if after further assessment, sandbags are deemed sufficient for existing outfall 1 then the outfall 1 works can be undertaken during outfall 2 works with an additional settlement tank.

Outfall 1 preliminarily proposes waterfilled dam, but a framed dam was also deemed sufficient. Outfall 3 preliminarily proposes either a framed or waterfilled dam but a framed is logical if it can be reused at each location.

With the use of one system, there would only require to be a short duration of traffic management on the verge for footpath diversion on the Kings Worthy Bridge as the equipment is being offloaded including the settlement tank. The point of diversion would ideally tie in with the footbridge works and temporary works removed under the same lane closure already in use for works on the Itchen Bridge.

It is concluded that sheet piling and other intrusive works should not be assessed further due to the impact on the impact on surrounding environment. Limpet dams should also not be assessed further as their applications are not suited to the outfall locations.

Further assessment should be undertaken of silt management and agreed with stakeholder through the fiEMP. As noted in the methodology, additional settlement tanks can be added or a more efficient system such as a siltbuster can also be used.

7 Appendices

APPENDIX A – TYPICAL DETAIL OF OUTFALL TO WATERCOURS