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BSG
ENGINEERING EXCELLENCE

McAdam
ENHANCING LOCAL COMMUNITIES

MEADOW LANE WwPS & TUNNEL SEWER

PRESENTED BY

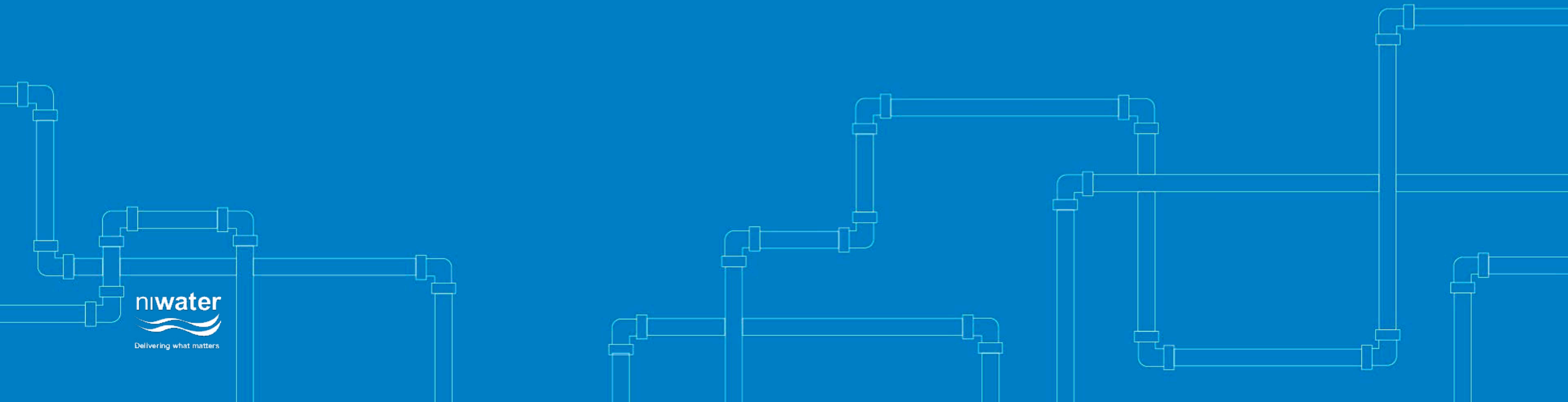
John Griffin
Head of Wastewater
Capital Delivery (Infra)
Northern Ireland Water

Conor Ward
Senior Contracts Manager
BSG

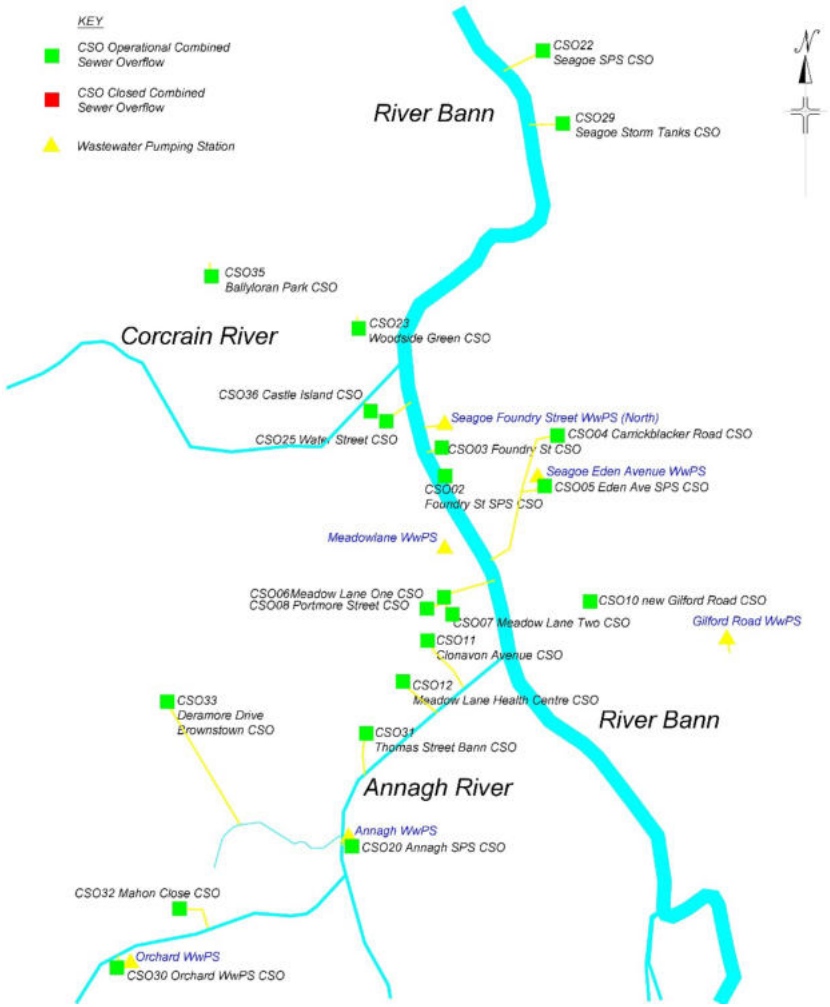
AGENDA

- Background & Need
- Appraisal & ECI
- Main Contract
- Construction Phasing
- Construction Stage Challenges
- Conclusion

BACKGROUND & NEED



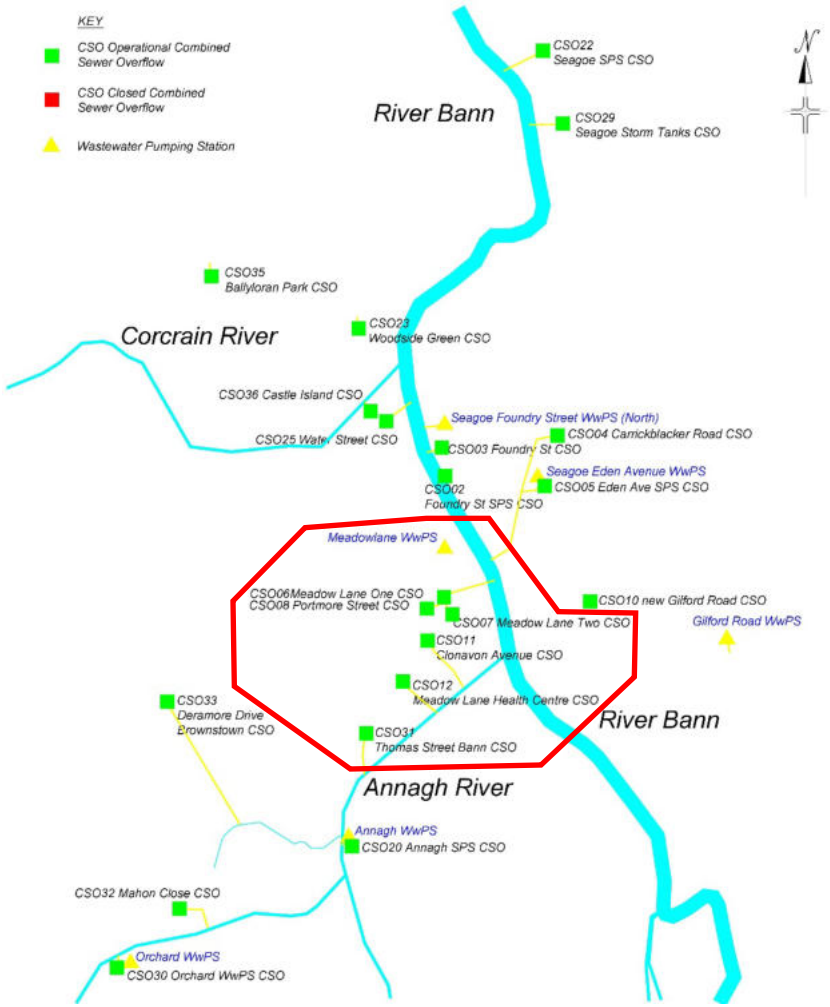
DRAINAGE AREA PLAN



- DAP Completed 2007
- Reverified 2016 and 2020
- Considers full Portadown drainage catchment
- Considers future catchment flows to 2040
- Identifies CSO performance
- Recommends solutions to reduce spills
- Solutions provided on sub-catchment basis

DRAINAGE AREA PLAN

CSO SPILL PERFORMANCE



Pumping Station Catchment	CSO No.	CARID	CSO Name	Existing System 2040 PE Model Total CSO Spills per year
Meadow Lane WwPS Catchment	CSO31	CO000984402	Thomas Street Bann CSO	41.5
	CSO07	CO000984396	Meadow Lane Two CSO	
	CSO06	CO000984397	Meadow Lane One CSO	
	CSO11	CO000984398	Clonavon Avenue CSO	
	CSO08	CO000984399	Portmore Street CSO	
	CSO12	CO000984401	Meadow Lane Health Centre CSO	
	CSO34	SP002022406	Meadow Lane WwPS CSO (New CSO to be added as part of Option)	
Annagh WwPS Catchment	CSO32	CO000984404	Mahon Close CSO	15.6
	CSO30	SP002022432	Orchard WwPS CSO	
	CSO33	CO000984411	Deramore Drive Brownstown CSO	
	CSO20	SP002022420	Annagh SPS CSO (Storage to be added as part of Option)	
Seagoe East Catchment	CSO04	CO000984387	Carrickblacker Rd CSO	79.1
	CSO22	SP002022411	Seagoe SPS CSO	
	CSO29	SP002022411	Seagoe Storm Tanks CSO	
Seagoe Eden Avenue SDAC	CSO05	Eden Ave SPS CSO	Eden Ave SPS CSO	0.10
Seagoe Foundry Street SDAC	CSO03	Foundry St CSO	Foundry St CSO	1.90
	CSO02	Foundry St SPS CSO	Foundry St SPS CSO	
Gilford Road Portadown SDAC	CSO10_New	Gilford Road CSO	Gilford Road CSO	0.10
Seagoe west SDAC	CSO35	Ballyloran Park CSO	Ballyloran Park CSO	18.70
	CSO36	Castle Island CSO	Castle Island CSO	
	CSO25	Water Street CSO	Water Street CSO	
	CSO23	Woodside Green CSO	Woodside Green CSO	
			Totals for CSOs upstream of Seagoe	**157**

DRAINAGE AREA PLAN

CSO SPILL PERFORMANCE

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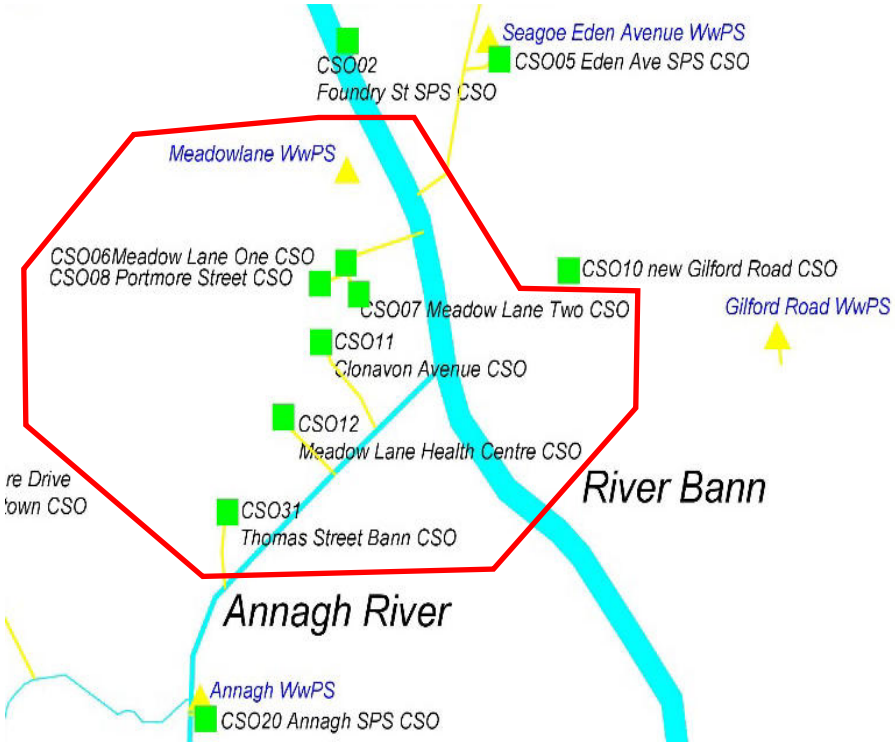
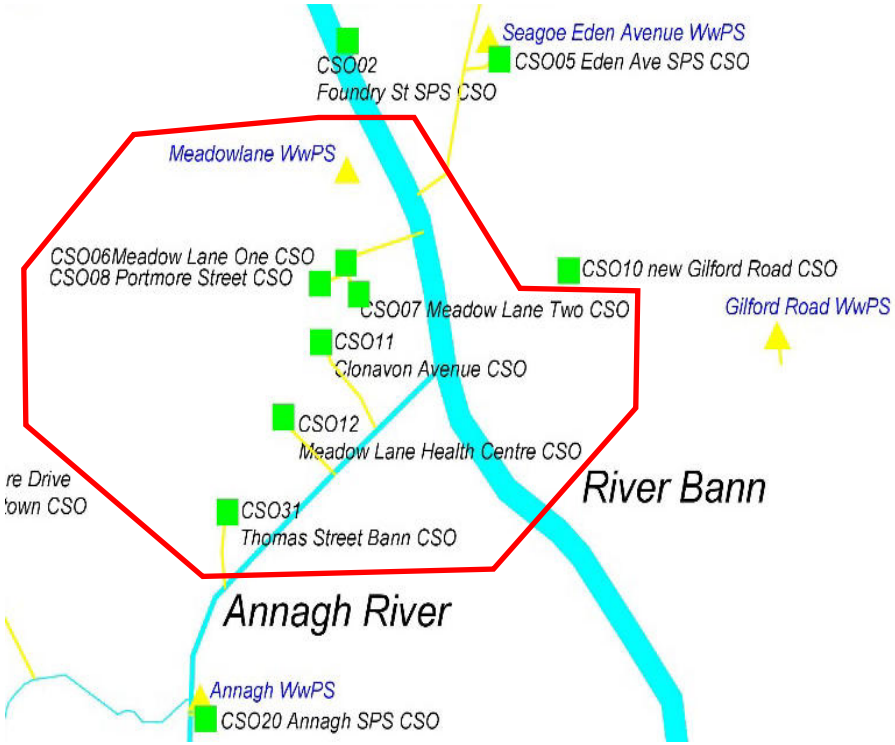


DRAINAGE AREA PLAN

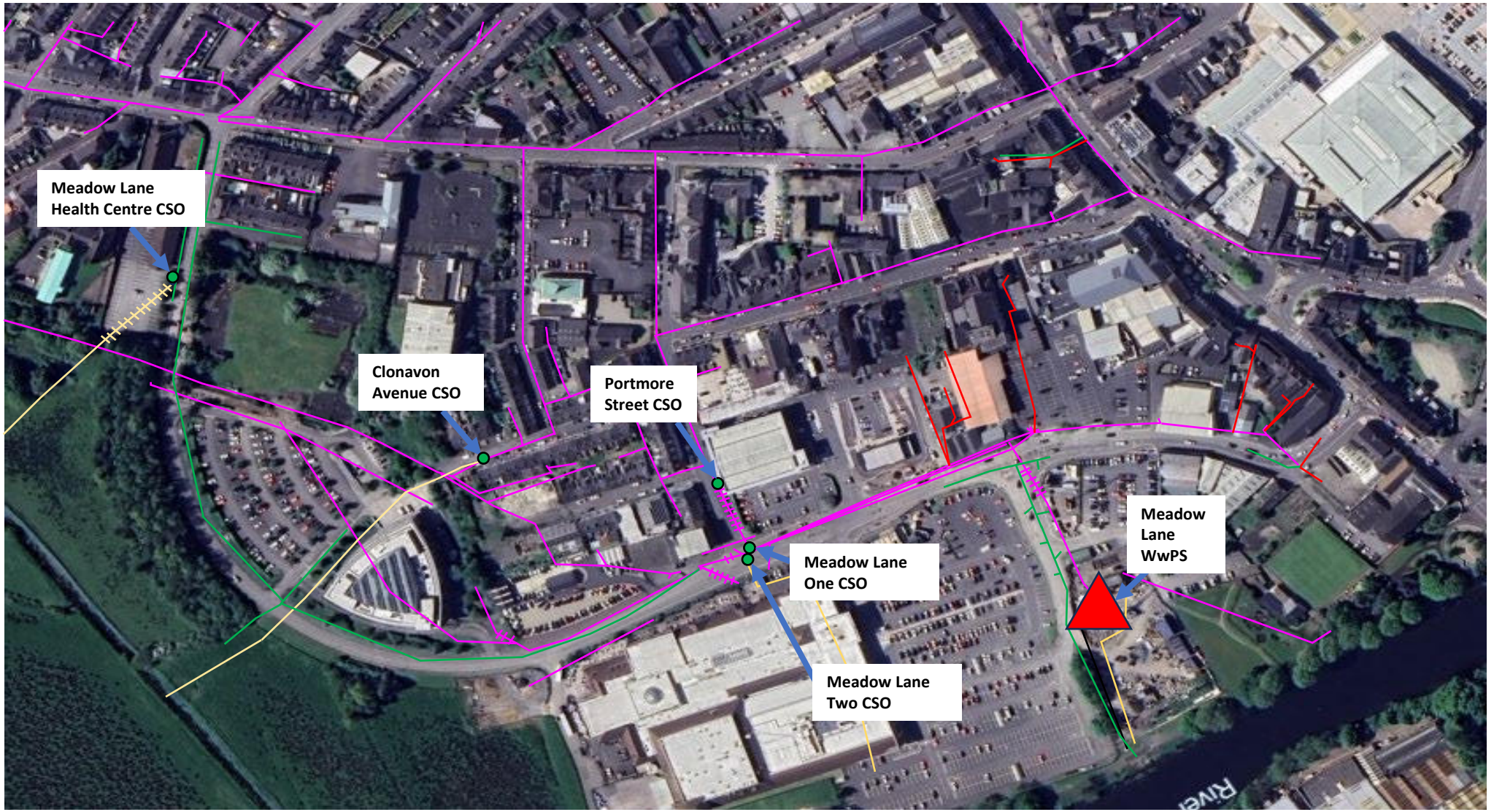
PROPOSED CSO IMPROVEMENTS

Pumping Station Catchment	CSO No.	CARID	CSO Name	Longterm 2040 Option Model Total CSO Spills per year
Meadow Lane WwPS Catchment	CSO31	CO000984402	Thomas Street Bann CSO	9.6
	CSO07	CO000984396	Meadow Lane Two CSO	
	CSO06	CO000984397	Meadow Lane One CSO	
	CSO11	CO000984398	Clonavon Avenue CSO	
	CSO08	CO000984399	Portmore Street CSO	
	CSO12	CO000984401	Meadow Lane Health Centre CSO	
	CSO34	SP002022406	Meadow Lane WwPS CSO (New CSO to be added as part of Option)	



Spill improvement of 3,071m^3 per year

MEADOW LANE WwPS CATCHMENT



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LEGEND

- Existing Combined Sewer
- Existing Storm Sewer
- Existing Foul Sewer
- Overflow
- CSO
- Existing WwPS

MEADOW LANE WwPS

- Constructed in 1966
- Pumps flow to Seagoe WwPS
- Emergency storage volume inadequate
- High OPEX due to aged equipment

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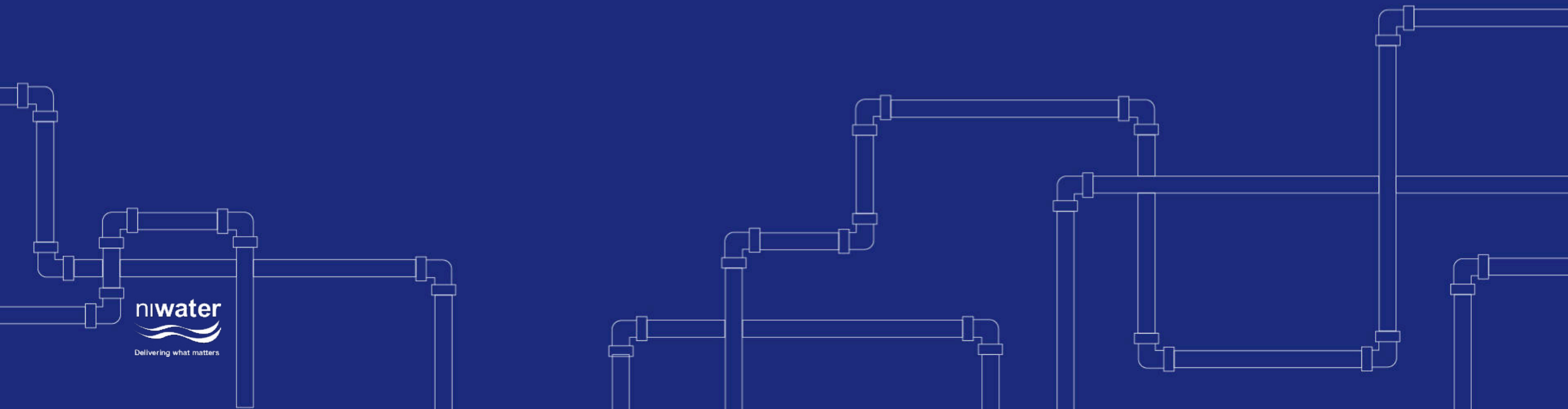
PROJECT DRIVERS

- Resolve five UIDs through the closure of existing CSOs
- Facilitate a further planned scheme at Annagh WwPS to address a further four UIDs
- Resolve internal sewage flooding at three properties
- Resolve external sewage flooding
- Provide a WwPS compliant with NIW Asset Standards

APPRAISAL & ECI



APPRAISAL OVERVIEW

Modelling work by Atkins in 2007 / 2016 / 2020

NI Water appointed McAdam in 2017 to provide professional services and complete a Capital Investment Appraisal for the project.

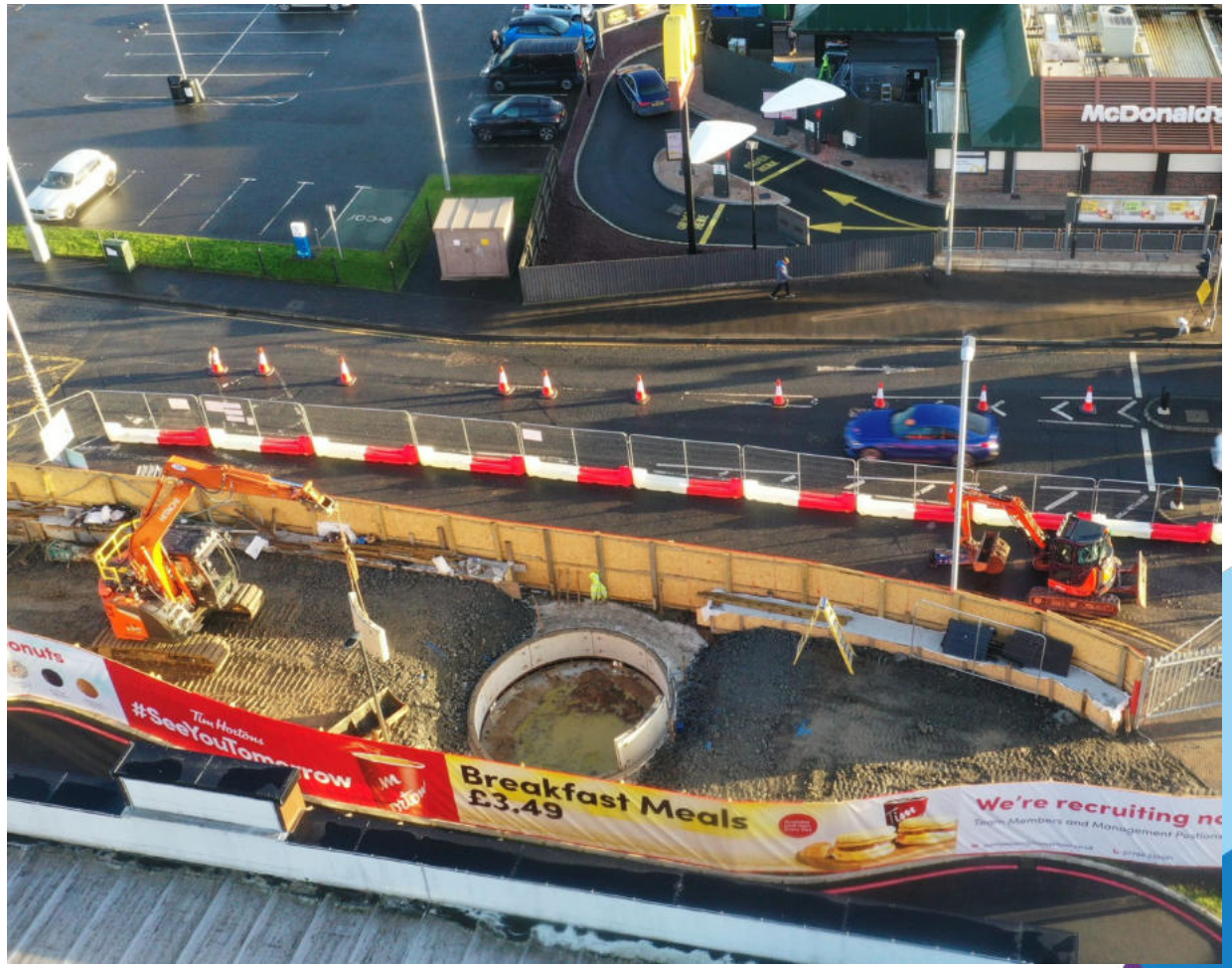
The appraisal confirmed the project needs and drivers, identified as resolution of UIDs, resolution of flooding, base improvements to WwPS

Assessment of a number of options confirmed online network storage, replacement WwPS with increased storage and closure of five CSOs as the preferred solution

APPRAISAL

EARLY CONTRACTOR INVOLVEMENT (ECI)

- Key Parties
  - ❑ PC and PD – BSG
  - ❑ NEC PM – McAdam Design
  - ❑ Client – NI Water
- Scope
  - ❑ Obtaining Historic Information
  - ❑ Key Stakeholder Engagement
  - ❑ Extensive Ground Investigation
  - ❑ Service Identification
  - ❑ Define Scope of Works
  - ❑ Optioneering
  - ❑ Develop flow management proposals
  - ❑ Determine construction methodology
  - ❑ Design development
- Benefits
  - ❑ Enhanced collaboration
  - ❑ Drove innovation
  - ❑ Increased efficiency

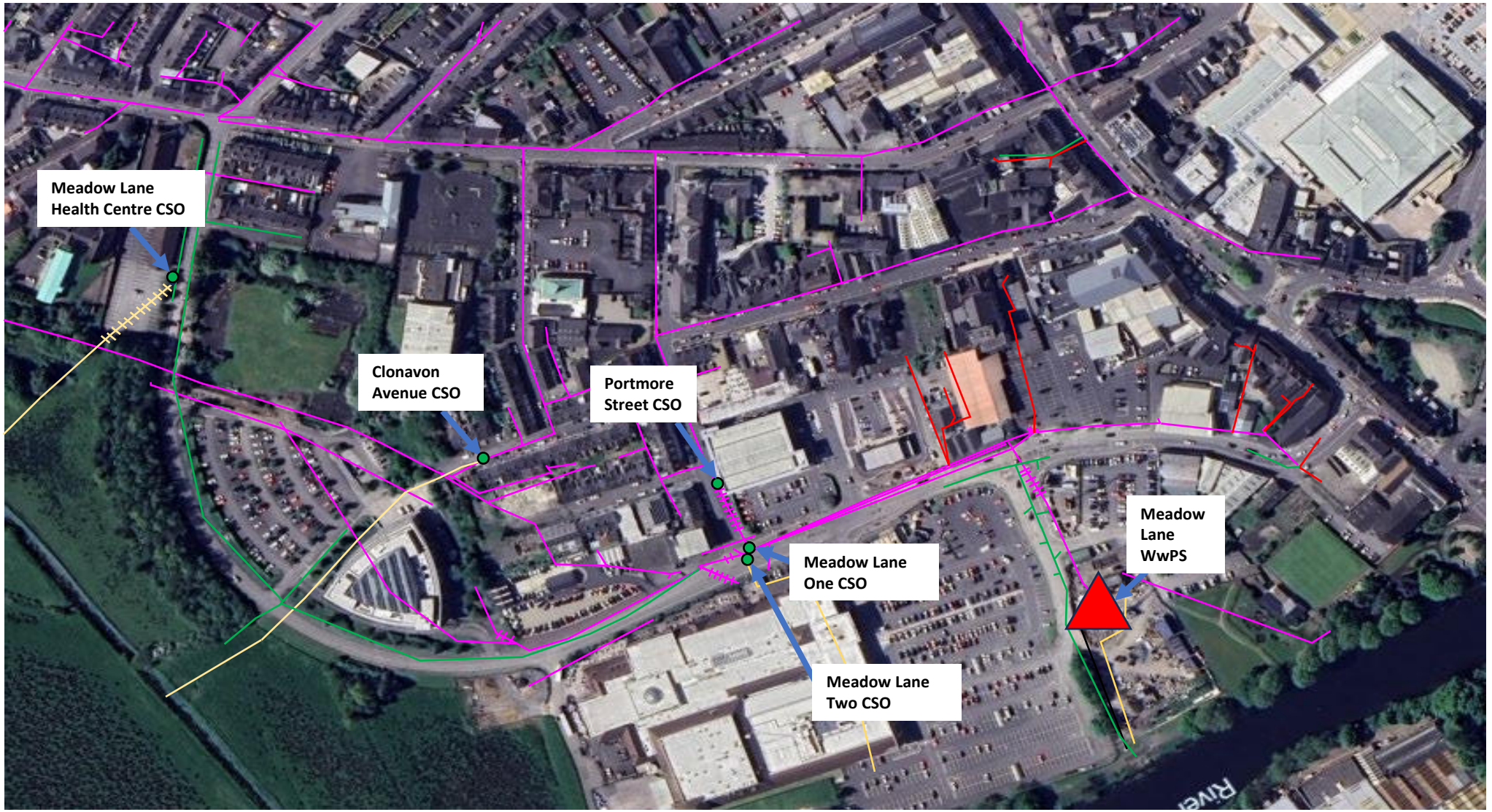


APPRAISAL

KEY ECI OUTPUTS

- WwPS review
  - ❑ Existing pumps insufficient
  - ❑ Existing storage insufficient
  - ❑ Aged assets in need of replacement
  - ❑ Full replacement WwPS proposed
- Large diameter sewer methodology
  - ❑ Open cut reviewed
    - ➢ Extensive services
    - ➢ Significant traffic management
    - ➢ Public disruption
    - ➢ Public safety concerns
    - ➢ Dust & Noise
  - ❑ TBM proposed

APPRAISAL EXISTING CATCHMENT



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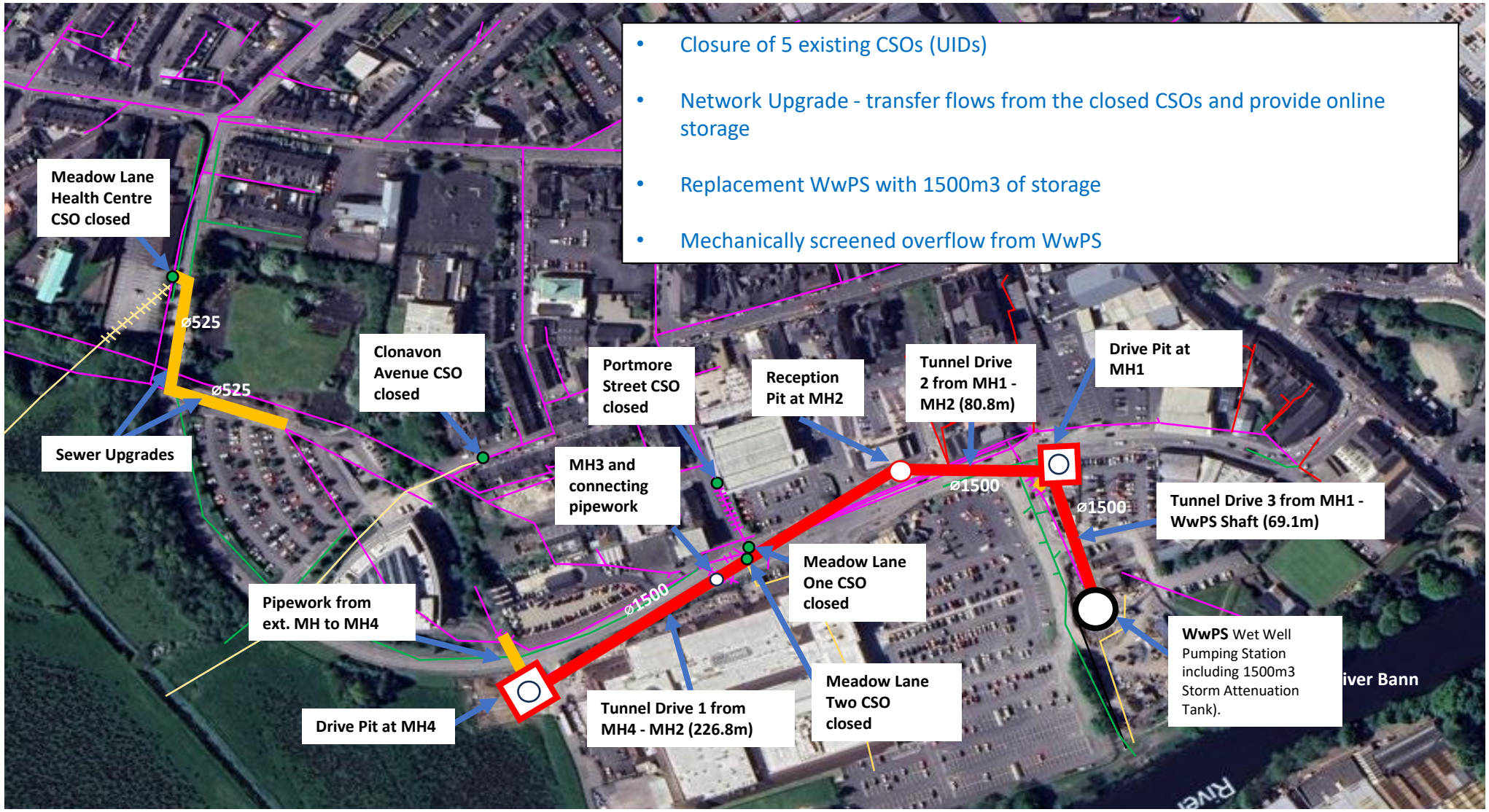
LEGEND

- Existing Combined Sewer
- Existing Storm Sewer
- Existing Foul Sewer
- Overflow
- CSO
- Existing WwPS

APPRAISAL PROPOSED SOLUTION



- Closure of 5 existing CSOs (UIDs)
- Network Upgrade - transfer flows from the closed CSOs and provide online storage
- Replacement WwPS with 1500m3 of storage
- Mechanically screened overflow from WwPS

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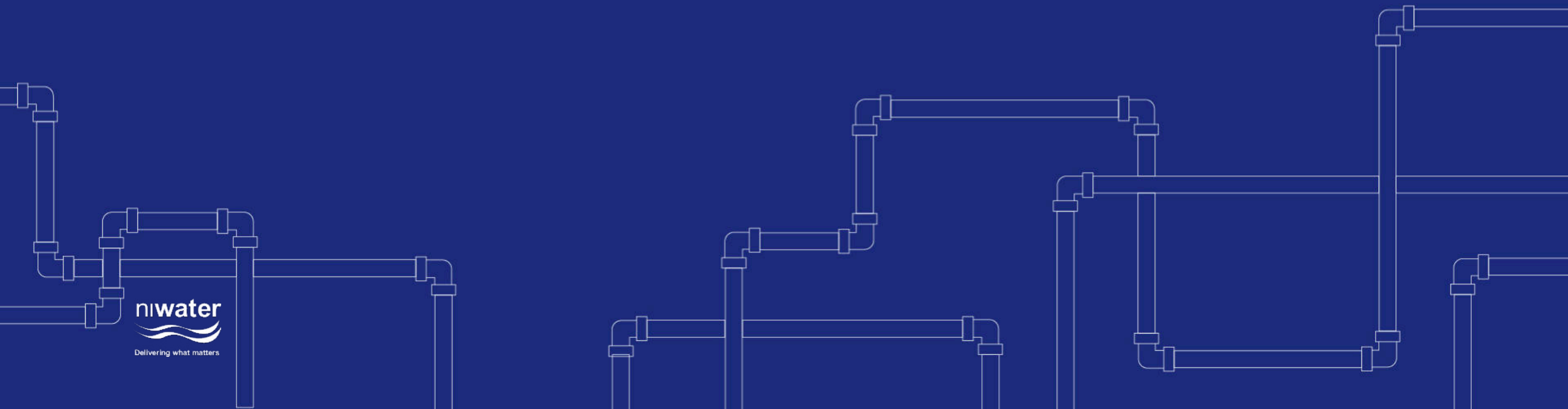
LEGEND

- Existing Combined Sewer
- Existing Storm Sewer
- Existing Foul Sewer
- Emergency Overflow
- WwPS Shaft Construction
- Drive Pit
- Reception Pit
- Manhole
- Tunnel Drive
- Open Cut Sewer
- Overflow

MAIN CONTRACT

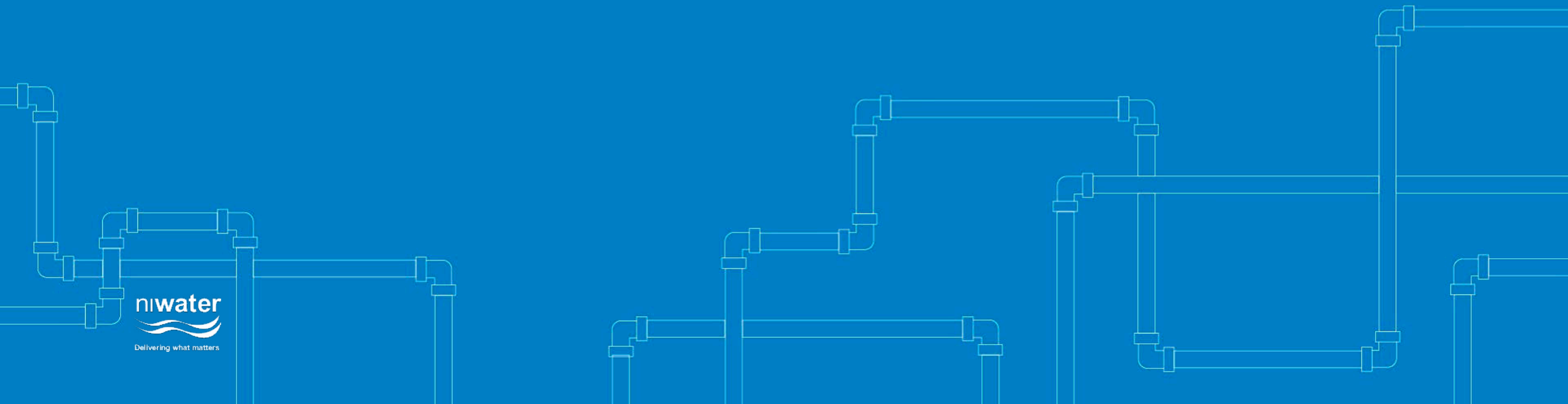


MAIN CONTRACT

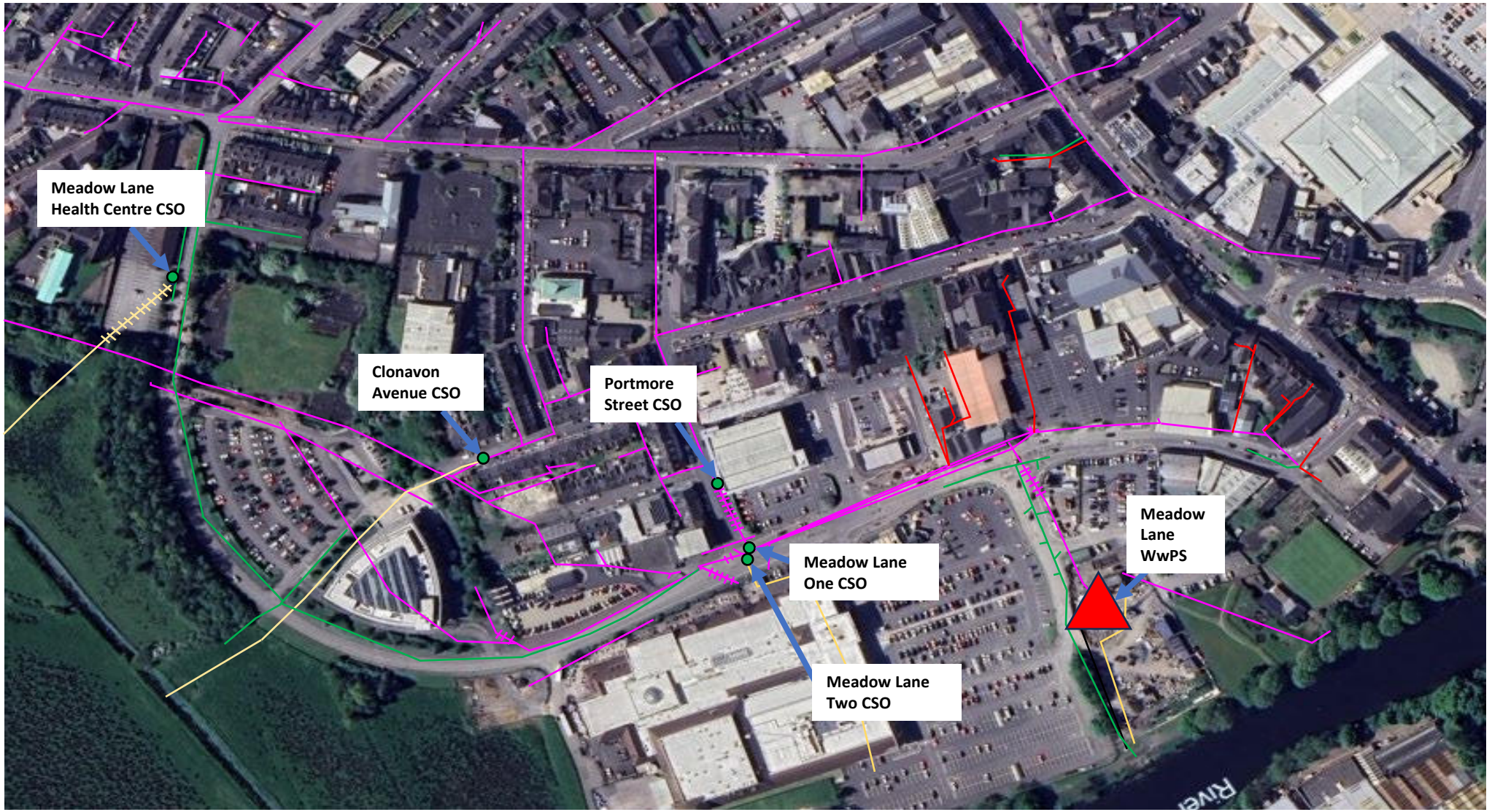
- NEC4 Option A
- Key Parties
  - PC and PD – BSG
  - NEC PM – McAdam Design
  - Client – NI Water
- Scope
  - Design, Construction, Commissioning and Handover of:
    - Large diameter sewer
    - Replacement WwPS
    - CSO Closures
- Design Team
  - Civil & Structural – McAdam Design
  - M&E – BSG
- Key Suppliers / Sub-contractors
  - Tunnelling Contractor - B&W Tunnelling Ltd
  - Jacking Pipe supplier – Tracey Concrete
  - Ancillary Tunnelling materials – Tunnelling Accessories

TBM Installation

CONSTRUCTION PHASING



CONSTRUCTION PHASING EXISTING NIW INFRASTRUCTURE



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LEGEND

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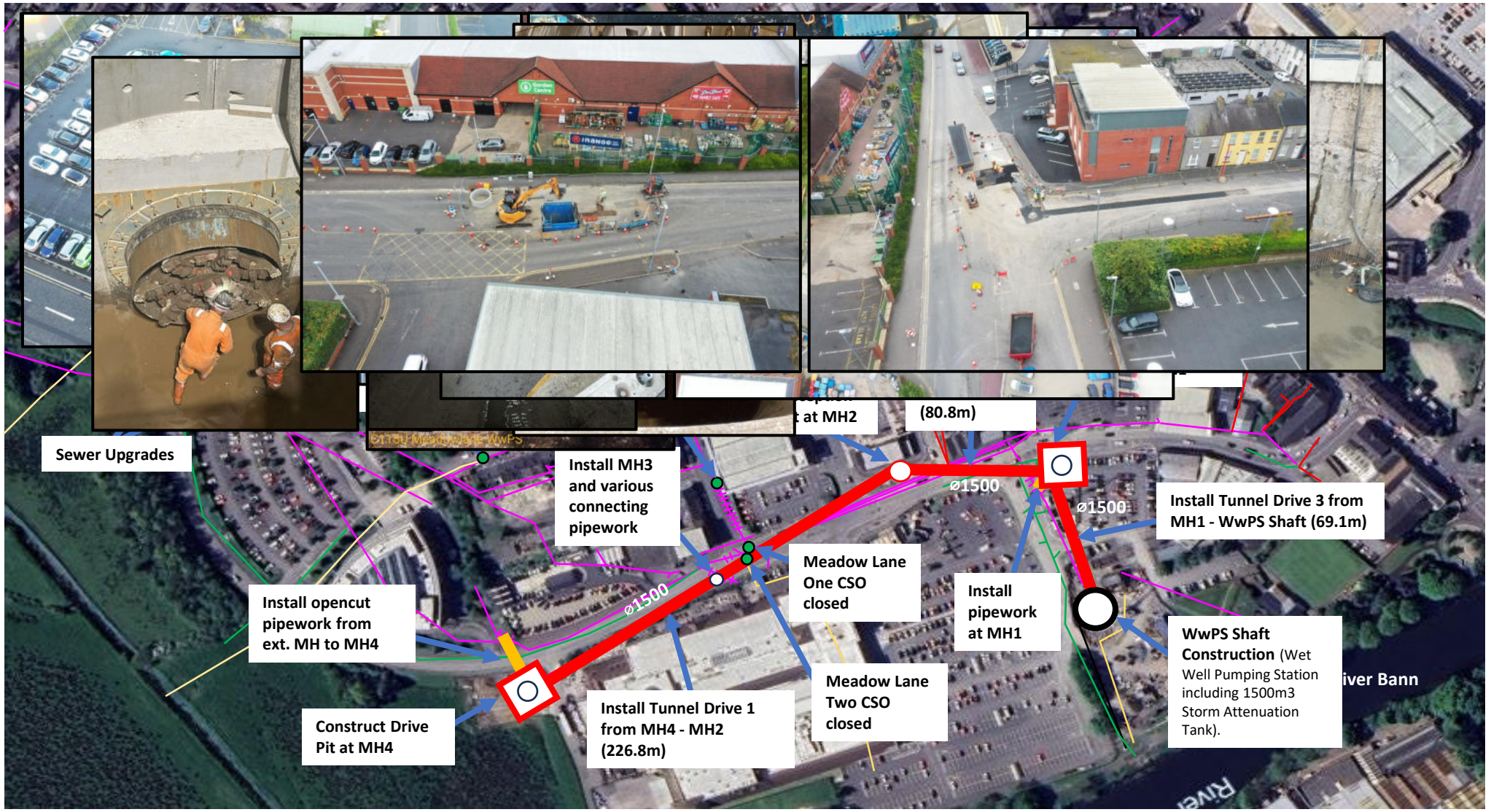
- Overflow
- CSO
- Existing WwPS

CONSTRUCTION PHASING



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- Open Cut Sewer
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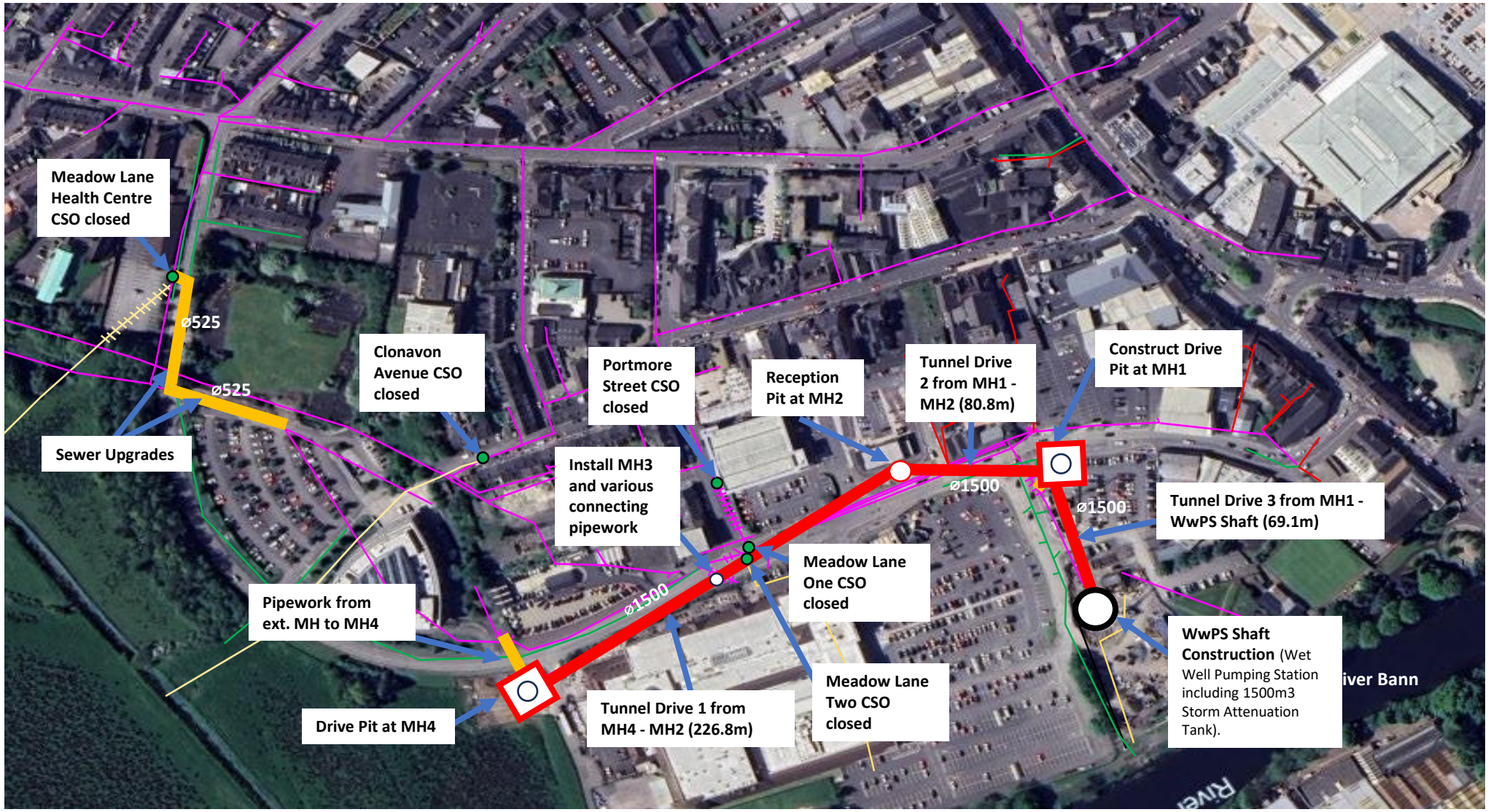
CONSTRUCTION PHASING FINAL SOLUTION



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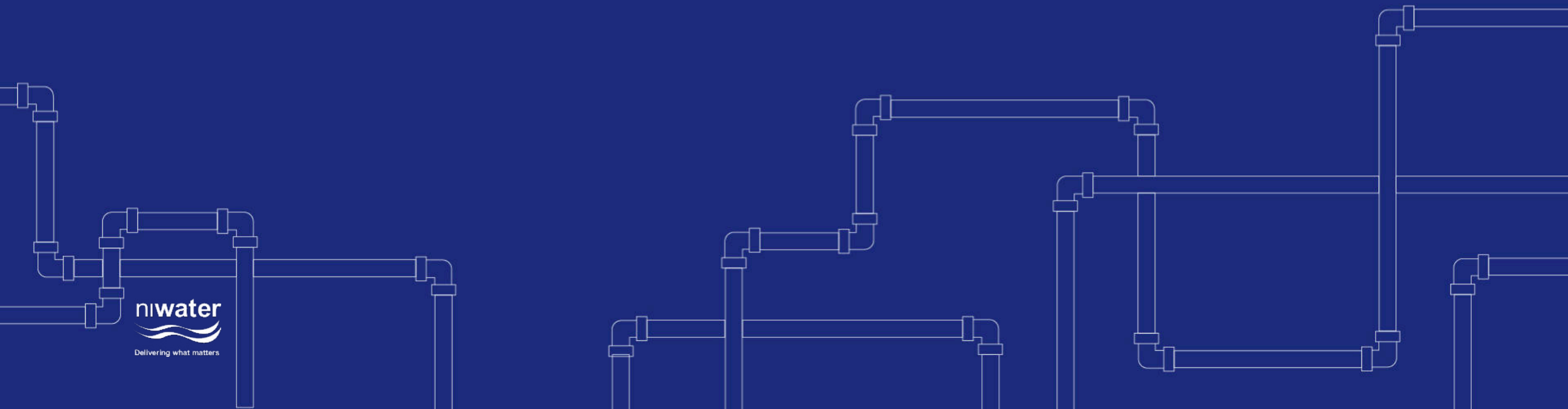
CONSTRUCTION PHASING FINAL SOLUTION

CONSTRUCTION STAGE CHALLENGES

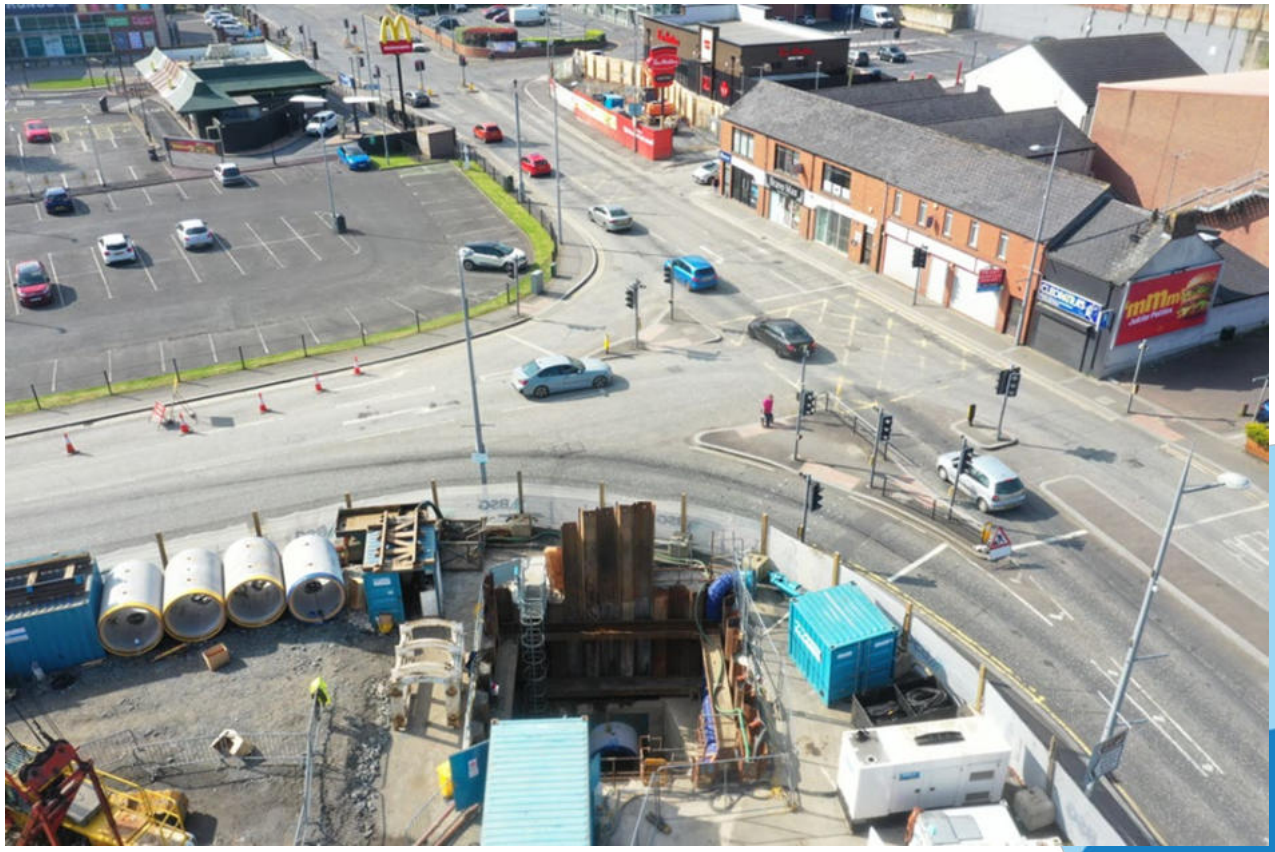


Construction Stage Challenges

Large scale Civils within a Town Centre

- Ensuring safe coordination of Traffic and Pedestrian movements and maintaining:
  - Access to numerous retail and fast-food outlets
  - Access to large carparking areas
  - Access to local Amenities, inc. Bowling green and playground
  - Pedestrian access to Towpath along River Bann

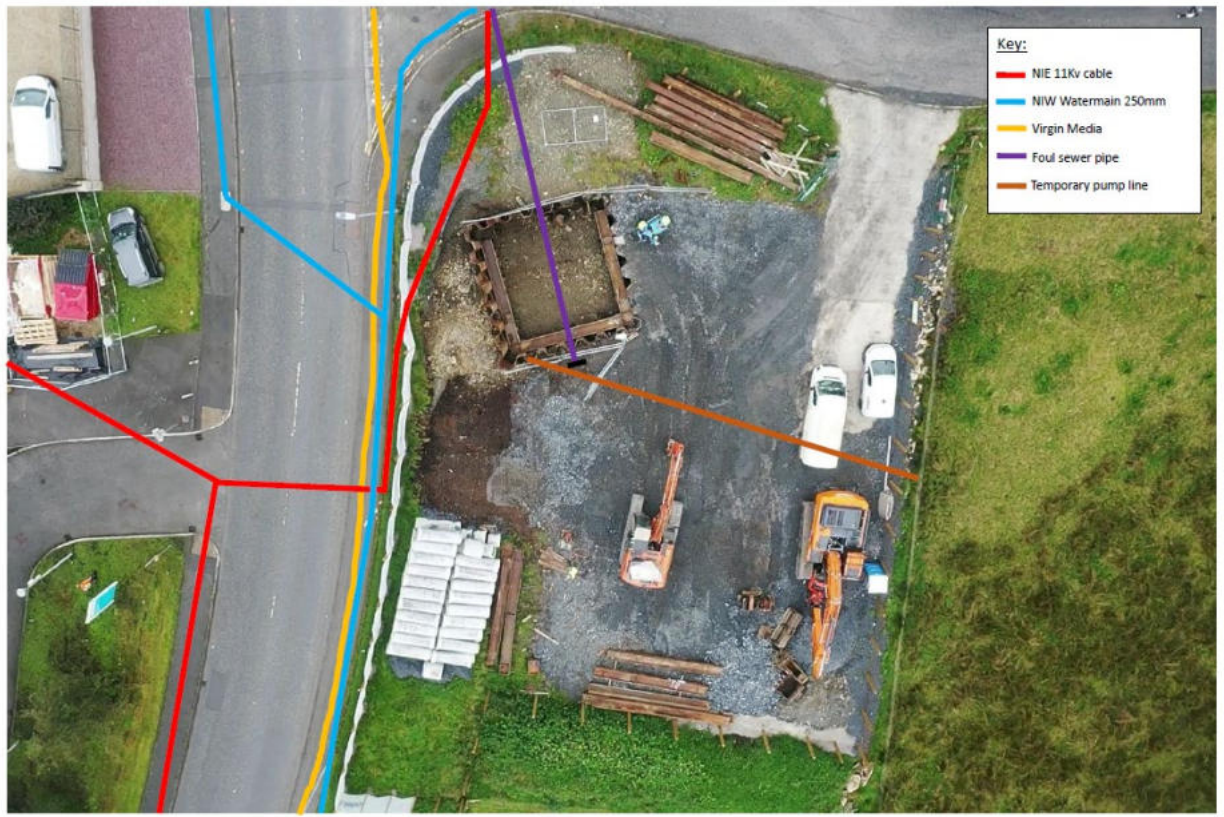
- Regular Liaison with Stakeholders:
  - Information sessions
  - Letter drops
  - Signage
  - Daily/weekly updates as required



Construction Stage Challenges

Working near Services

- Services diversions / Adjacent working:
  - NIW sewer diversions required
  - NIE Watermain diversion required
  - Virgin Media ring main fibre optic cable – near to MH locations
  - NIE buried HV cables – near to MH locations
  - Full range of buried utility crossings in Opencut pipework sections
  - Overhead Power and Comms cables



Construction Stage Challenges

Ground Conditions

- High water table (1-2m below GL)
- Variable ground conditions along route of the Tunnel
  - Stiff clays at Tunnel level at MH4 (Launch pit for Drive 1)
  - Medium dense silty sand at MH2 (Reception Pit at Tim Hortons)
  - Loose silty sand at MH1 (Launch Pit for Drives 2 & 3)
  - Soft to firm silt at WwPS inlet (reception location for Drive 3)
- Adjustments made to the slurry recovery process to manage the differing materials returned to the separation plant for dewatering and leaving the silts, clays & gravels suitable for offsite disposal.

Construction Stage Challenges

SHEQ Considerations

- CPHSP developed for Project and regularly reviewed / updated as required
- RAMS, SSOW, TMP, TWP, LPs developed, reviewed and disseminated to the required personnel
- Delineation plans developed for each setup location
- Public Access Reviews regularly completed at each location
- Emergency Rescue Plans developed for each location
- All Personnel suitably trained
- Daily Briefs
- Toolbox talks
- Site Audits completed By BSG, NIW, NSAI etc
- Mock Rescue undertaken

Construction Stage Challenges

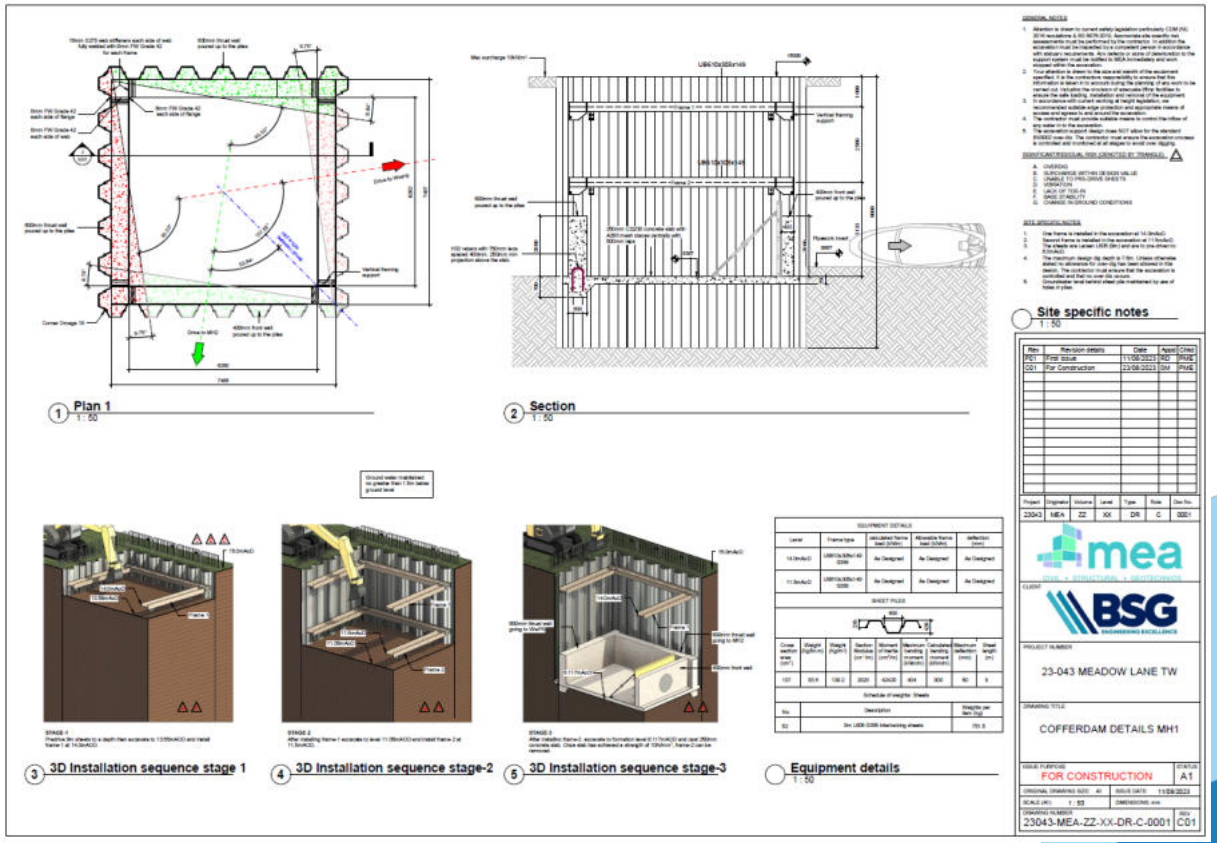
Tunnelling works – Advanced considerations & preparation

- Tunnelling Specialist - selection and appointment
- Determination of the Tunnelling technique (EPBM) & MC/SC Attendances
- Programme considerations for interface with main WwPS construction timescales
- Working area requirements – considerations including:
  - Control cabin and spoil processing kit
  - Craneage requirements to service daily Tunnelling operations & TBM installation / recovery (approx. 20T weight)
  - Set up locations for craneage (inc. 2no. road closures for TBM recoveries at MH2)
  - Access / Egress for articulated delivery trucks
  - Storage space for Pipes and accessories
  - Storage facility for spoil material
  - Safe working room for excavator and tipper lorries

Construction Stage Challenges

Tunnelling works – Advanced considerations & preparation

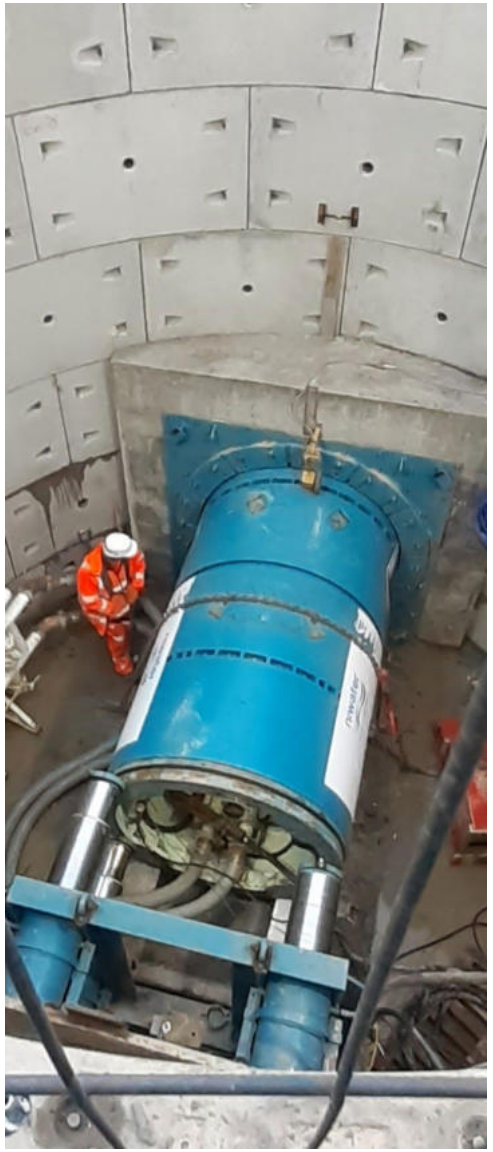
- Liaison with landowners for Tunnelling setup sites – ABC Borough Council & Tim Hortons
- Arranging water supply to the drive pit locations
- Security and emergency arrangements
- Thrust Forces, Settlement & Flotation calculations & Temporary Works Designs
- Determine size of Tunnel Drive & reception pits
- Design of Drive pits , including Thrust wall and Tunnel eye requirements
- Design of Reception pits, including Tunnel eye requirements
- Design of Tunnel eye through secant piled wall of new WwPS structure
- Design of temporary raised reception platform within new WwPS, including Tunnel eye through secant piled wall.
- Lift Plans developed for each location



Construction Stage Challenges

Tunnelling works – Methods Used

- 1500mm ID Iseki Unclemole Earth Pressure Balance Tunnel Boring Machine
- Closed Slurry face
- Remotely Operated
- Laser Guided
- Tunnel Boring Machine (TBM) pushed forward using jacking rams
- 1500mm dia Jacking Pipes added to rear of TBM as it progressed
- Slurry generated at face of TBM pumped back to the Separation plant sited at ground level
- The Separation plant consisted holding tanks and of a series of vibrating screens & hydro cyclones.
- Separated material (clay, silt & gravels) discharged into a muck bay for subsequent off-site disposal
- Recycled water from the separation process was re-used within the Tunnelling operation.



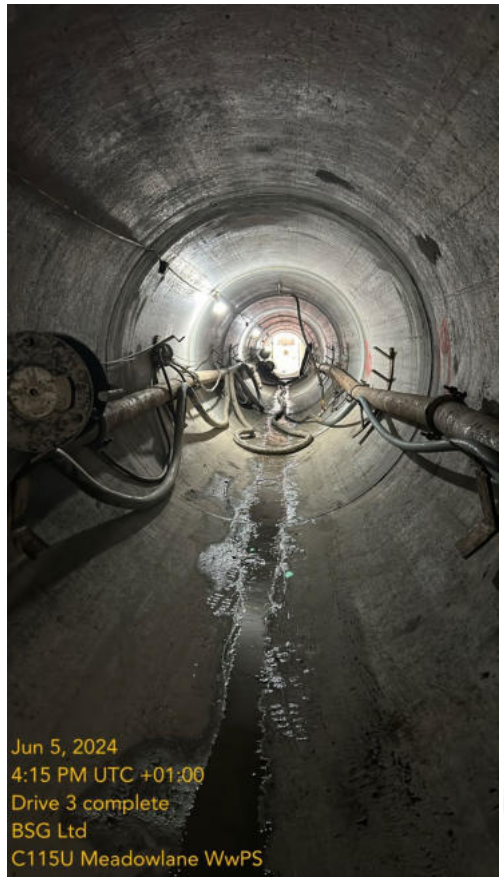
Construction Stage Challenges

Tunnelling works – Onsite progression

- Set up secure compound & welfare
- Mobilise crane and ancillary plant
- Construct drive pits and receptions pits
- Set up of jacking equipment within drive pit
- Set up of control equipment, material separation plant & storage bay
- Installation of TBM
- Coordination of jacking pipe deliveries
- SHEQ management for all works
- Record keeping
- Tunnel alignment and level checks
- Management of spoil removal
- Preparation of tunnel eye at reception pits
- Removal of TBM at reception pits
- Grouting of Tunnel Line, removal of internal cabling and slurry pipework
- Inspection and sign off

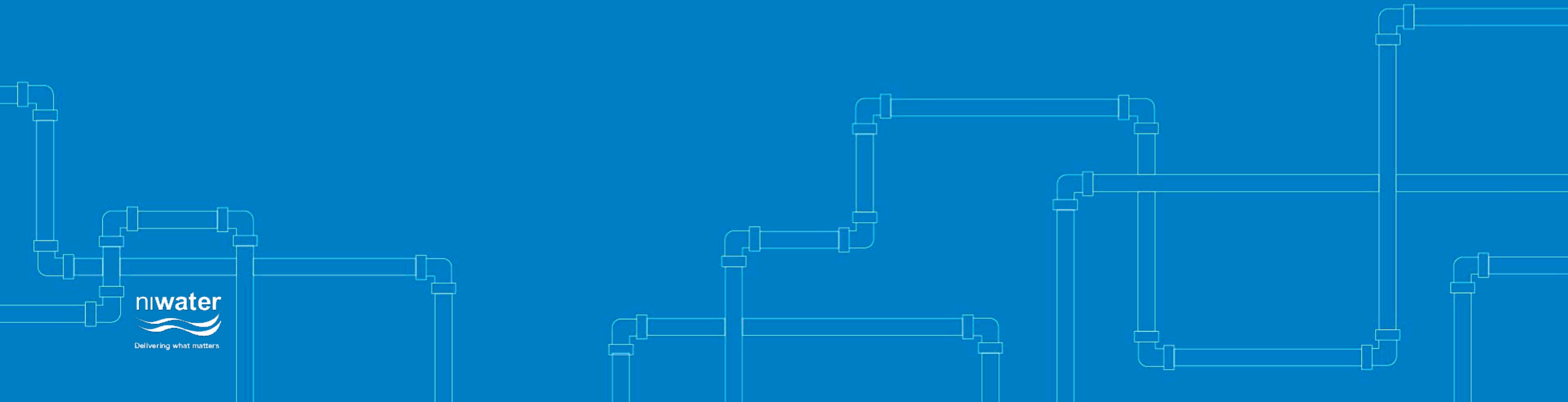
Construction Stage Challenges

Tunnelling Completion



Collaboration was key to the Project success

CONCLUSION



CONCLUSION

The completed project provides environmental improvements, reduces flooding, facilitates economic growth through increased network capacity and provides operational effectiveness and safety at a major WwPS

Early contractor involvement from the outset, and choice of design and build procurement route, ensured the supply chain's experience and capabilities were drawn on and brought to the fore.

Use of tunnel boring significantly reduced disruption in a busy commercial area and greatly reduced project risk associated with interaction with congested services.

THANK YOU

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