Tionscadal Soláthair Uisce
Water Supply Project

Environmental Impact Assessment Report (EIAR)

Volume 6 of 6: Appendices

(Appendix 5.2) Commissioning Strategy

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Uisce Éireann Irish Water

Jacobs

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Contents

Acronyms and Abbreviations

Acronym	Meaning
BPT	Break Pressure Tank
BPS	Booster Pumping Station
CCTV	Closed Circuit Television
CP	Cathodic Protection
EIAR	Environmental Impact Assessment Report
ESB	Electricity Supply Board
FCV	Flow Control Valve
FDS	Functional Design Specification
GDA WRZ	Greater Dublin Area Water Resource Zone
ha	Hectare
HAZOP	Hazard and Operability Study
HLPS	High Lift Pumping Station
HMI	Human Machine Interface
HV	High Voltage
I/O	Input/Output
ISO	International Organization for Standardization
kW	Kilowatt
kWh	Kilowatt-hour
LV	Low Voltage
Ml	Million litres
Mld	Million litres per day
mOD	Metres Above Ordnance Datum
PLC	Programmable Logic Controller
PWWC	Passive Wedge-wire Cylinder
RWBT	Raw Water Balancing Tank
RWI&PS	Raw Water Intake and Pumping Station
RWRM	Raw Water Rising Main
SCADA	Supervisory Control and Data Acquisition
TPR	Termination Point Reservoir
UPS	Uninterruptible Power Supply
UV	Ultraviolet
WTP	Water Treatment Plant

1. Project Overview

1.1 Introduction

1. The Water Supply Project Eastern and Midlands Region (the 'Proposed Project') is a water supply project involving the abstraction and pumping of raw water from the Lower River Shannon at Parteen Basin, treatment of the water nearby at Birdhill, County Tipperary, and pumping of the treated water to a high point near Cloughjordan, County Tipperary. From this high point near Cloughjordan, the treated water would flow by gravity through the Midlands to a termination point at Peamount, in County Dublin (within the administrative area of South Dublin County Council), where it would connect into the existing Greater Dublin Area Water Resource Zone (GDA WRZ) network. Image 1.1 provides an infographic overview of the principal infrastructure and pipeline elements of the Proposed Project.

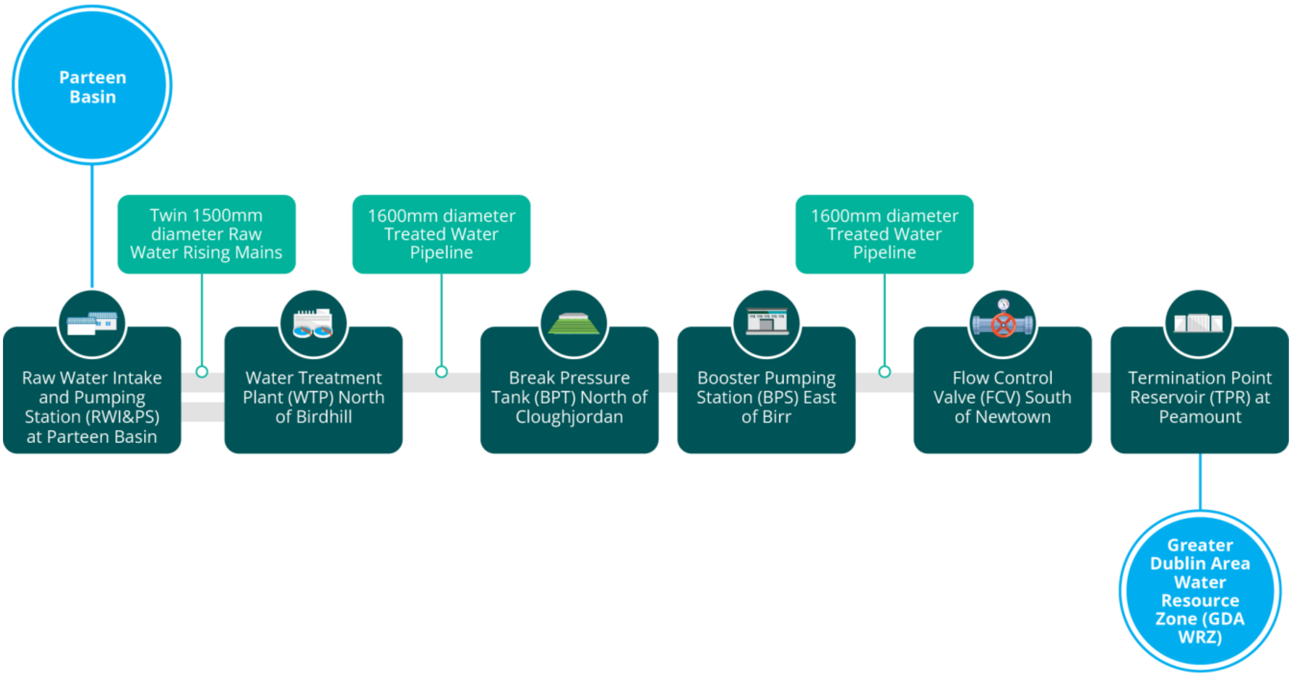


Image 1.1 Infographic Overview of the Principal Infrastructure and Pipeline Elements of the Proposed Project

Table 1.1: Summary of Principal Project Infrastructure

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
Permanent Infrastructure	
Raw Water Intake and Pumping Station (RWI&PS) (Infrastructure Site) County Tipperary	• The RWI&PS would be located on a permanent site of approximately 4ha on the eastern shore of Parteen Basin in the townland of Garrynatineel, County Tipperary. In addition, approximately 1ha of land would be required on a temporary basis during construction. • The RWI&PS has been designed to abstract enough raw water from the River Shannon at Parteen Basin to provide up to 300Mld of treated water by 2050. • The RWI&PS site would include a bankside Inlet Chamber, the Raw Water Pumping Station Building, two Microfiltration Buildings, an Electricity Substation and Power Distribution Building, and Dewatering Settlement Basins. The tallest building on the RWI&PS site would be the Microfiltration Buildings which would be 10.9m above finished ground level. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. • Power for the RWI&PS would be supplied via an underground connection to the existing Birdhill 38 kV electricity substation. • A new permanent access road from the R494 would be constructed to access the proposed RWI&PS site. This access road would be 5m in width and 670m in length. • The RWI&PS site boundary would be fenced with a stock proof fence and a 2.4m high paladin security fence 5m inside the boundary. The site would be landscaped in line with the surrounding environment to reduce its visual impact.
Raw Water Rising Mains (RWRMs) (Pipeline) County Tipperary	• The RWRMs would consist of two 1,500mm underground pipelines made from steel that would carry the raw water approximately 2km from the RWI&PS to the Water Treatment Plant (WTP) at Incha Beg, County Tipperary. The water would be pumped from the pumping station at the RWI&PS to the WTP. • Twin RWRMs have been proposed so that one RWRM can be taken out of service for cleaning and maintenance while still providing an uninterrupted flow of raw water through the other RWRM. • The RWRMs would include Line Valves, a Lay-By, Air Valves and Cathodic Protection. • A 20m wide Permanent Wayleave would provide Uisce Éireann with operational access to the RWRMs.
Water Treatment Plant (WTP) (Infrastructure Site) County Tipperary	• The WTP would be located on a permanent site of approximately 31ha at Incha Beg, County Tipperary, 2.6km north-east of the village of Birdhill, and 2km east of the proposed RWI&PS. In addition, approximately 2.5ha of land would be required on a temporary basis during construction. • The WTP would treat the raw water received from the RWI&PS via the RWRMs. Once treated, the High Lift Pumping Station (HLPS) would deliver the treated water onwards from the WTP to the Break Pressure Tank (BPT) at Knockanacree, County Tipperary, via the Treated Water Pipeline. • The WTP would comprise of a series of tanks and buildings including the Raw Water Balancing Tanks, Water Treatment Module Buildings, Sludge Dewatering Buildings, Sludge Storage Buildings, Clear Water Storage Tanks and HLPS, an Electricity Substation and Power Distribution Building, and the Control Building. The tallest building on the WTP site would be the Water Treatment Module Buildings which would be up to 15.6m above finished ground level. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. • There would also be a potential future water supply connection point at the junction between the permanent access road and the R445. • Power for the WTP would be supplied via an underground connection to the existing Birdhill 38 kV electricity substation. Solar panels would be placed on the roofs of the Chemical Dosing Manifold Building, the Water Treatment Module Buildings, Clear Water Storage Tanks and Sludge Storage Buildings, and at a number of locations on the ground to supplement the mains power supply. • A new permanent access road from the R445 would be constructed and would be 6m in width and 640m in length. • The WTP site boundary would be fenced with a stock proof fence and a 2.4m high palisade security fence 5m inside the boundary. The site would be landscaped in line with the surrounding environment to reduce its visual impact.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
Treated Water Pipeline from the WTP to the BPT (Pipeline) County Tipperary	• The Treated Water Pipeline from the WTP to the BPT would consist of a single 1,600mm underground steel pipeline which would be approximately 37km long. The water would be pumped through this section of the Treated Water Pipeline by the HLPS. • The Treated Water Pipeline would include Line Valves, Washout Valves, Air Valves, Manways, Cathodic Protection and Lay-Bys. • A 20m wide Permanent Wayleave would provide Uisce Éireann with operational access to the pipeline (this Wayleave has been extended to approximately 30m at some Line Valves to provide access between the Lay-Bys and Line Valves). There would be an additional 10m wide Permanent Wayleave at certain locations for operational access to smaller pipes connecting Washout Valves with permanent discharge locations.
Break Pressure Tank (BPT) (Infrastructure Site) County Tipperary	• The BPT would be located on a permanent site of approximately 7ha in the townland of Knockanacree, County Tipperary. In addition, approximately 0.8ha of land would be required on a temporary basis during construction. • The BPT would be located at the highest point of the pipeline. It marks the end of the Treated Water Pipeline from the WTP to the BPT and the start of the Treated Water Pipeline from the BPT to the Termination Point Reservoir (TPR) in the townland of Loughtown Upper, at Peamount, County Dublin. It would act as a balancing tank and would be required to manage the water pressures in the entire Treated Water Pipeline during flow changes, particularly during start-up and shut-down. • The BPT site would include the BPT and a Control Building. The BPT would be a concrete tank divided into three cells covered with an earth embankment. The BPT tanks would be 5m in height and partially buried below finished ground levels. The Control Building would be 7.5m over finished ground level. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. • Access to the BPT site would be via a new permanent access road from the L1064 which would be 5m wide and 794m in length. • Power for the BPT would be supplied via an underground connection from the existing overhead power line. Solar panels would be placed on the south facing side of the control building roof, on the BPT and at ground level to the south of the site to supplement the mains power supply. • The BPT site boundary would be bounded by the existing hedgerow / tree line with a 2.4m high palisade security fence around the permanent infrastructure. The site would be landscaped in line with the surrounding environment to reduce its visual impact.
Treated Water Pipeline from the BPT to the TPR (Pipeline) Counties Tipperary, Offaly, Kildare and Dublin (within the administrative area of South Dublin County Council)	• The Treated Water Pipeline from the BPT to the TPR would consist of a single 1,600mm underground steel pipeline, approximately 133km long. • The water would normally travel through the Treated Water Pipeline by gravity; however, flows greater than approximately 165Mld would require additional pumping from the Booster Pumping Station (BPS) in the townland of Coagh Upper, County Offaly. • The Treated Water Pipeline would include Line Valves, Washout Valves, Air Valves, Manways, Cathodic Protection, Lay-Bys and potential future connection points. • A 20m wide Permanent Wayleave would provide Uisce Éireann with operational access to the pipeline (this Wayleave has been extended to approximately 30m at some Line Valves to provide access between the Lay-Bys and Line Valves). There would be an additional 10m wide Permanent Wayleave at certain locations for operational access to smaller pipes connecting Washout Valves with permanent discharge locations.
Booster Pumping Station (BPS) (Infrastructure Site) County Offaly	• The BPS would be located on a permanent site of approximately 2.6ha in the townland of Coagh Upper, County Offaly. It would be located approximately 30km downstream from the BPT. In addition, approximately 3ha of land would be required on a temporary basis during construction. • The BPS would be required when the demand for water causes the flow through the pipeline to exceed approximately 165Mld. • The BPS site would consist of a single-storey Control Building with a basement below. It would have a finished height of 7.6m above finished ground level. There would also be a separate Electricity Substation and Power Distribution Building. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. • Power to the BPS would be supplied from an existing 38 kV electricity substation at Birr, through cable ducting laid within the public road network. There would be ground mounted solar panels on the southern side of the BPS site to supplement the mains power supply. • The site would be accessed directly from the L3003. • The BPS site boundary would be fenced with a stock proof fence and a 2.4m high palisade security fence between 5m -12m inside the boundary. The site itself would be landscaped in line with the surrounding environment to reduce its visual impact.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
Flow Control Valve (FCV) (Infrastructure Site) County Kildare	• The FCV controls the flows in the Treated Water Pipeline from the BPT to the TPR. It would be a small permanent site of approximately 0.5ha in the townland of Commons Upper in County Kildare. In addition, approximately 0.6ha of land would be required on a temporary basis during construction. • It would consist of three 700mm diameter FCVs and three flow meters installed in parallel with the Line Valve and housed within an underground chamber. • Access to the FCV site would be directly off the L1016 Commons Road Upper. • Power supply to the FCV site would be provided from the existing low voltage network via a combination of overhead lines and buried cables. There would be ground mounted solar panels on the north-eastern side of the site to supplement the mains power supply. • Kiosks at the FCV site would house the Programmable Logic Controller, telemetry and power supply for the Line Valve. There would also be a telemetry mast, the top of which would be 14m above finished ground level. • The site boundary would be fenced with a stock proof fence and a 2.4m high palisade security fence 5m inside the boundary.
Termination Point Reservoir (TPR) (Infrastructure Site) County Dublin (within the administrative area of South Dublin County Council)	• The TPR would be located on a permanent site of approximately 8.3ha adjacent to an existing treated water reservoir in the townland of Loughtown Upper, at Peamount, County Dublin (within the administrative area of South Dublin County Council) and would have capacity for 75Ml of treated water supply. In addition, approximately 1.1ha of land would be required on a temporary basis during construction. • It would be located at the downstream end of the Treated Water Pipeline from the BPT to the TPR and would be the termination point for the Proposed Project. It would be at this location that the Proposed Project would connect to the existing water supply network of the Greater Dublin Area Water Resource Zone (GDA WRZ). • The TPR would consist of an above-ground storage structure, associated underground Scour Water and Overflow Water tanks and a Chlorine Dosing Control Building. The TPR would be a concrete tank divided into three cells and covered with an earth embankment. The top of the TPR would be 11.2m above finished ground level. The Chlorine Dosing Control Building would be 8.4m over finished ground level. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. • Power for the TPR would be supplied via an underground connection to the existing electricity substation at Peamount Reservoir. There would be solar panels on top of a portion of the northern cell of the TPR to supplement the mains power supply. • A new permanent access road from the R120 would be constructed and would be 5m wide and 342m in length. • The TPR site would be bounded by the existing hedgerow to the west and existing fence to the east with a 2.4m high palisade security fence around the permanent infrastructure. The site itself would be landscaped in line with the surrounding environment to reduce its visual impact.
Proposed 38 kV Uprate Works – Power Supply to RWI&PS and WTP	
Proposed 38 kV Uprate Works Ardnacrusha – Birdhill (Power Supply) Counties Clare, Limerick and Tipperary	• The proposed 38 kV Uprate Works would be necessary to deliver adequate electrical power to the RWI&PS and WTP. • The proposed works would include the uprating of the existing Ardnacrusha – Birdhill Line and the replacement of polesets/structures with an underground cable along a section of the Ardnacrusha – Birdhill – Nenagh Line. • There would also be works at the existing Birdhill 38 kV electricity substation including the provision of a new 38 kV modular Gas Insulated Switchgear Modular Building, new electrical equipment and lighting, together with new fencing and associated works.
Temporary Infrastructure – Required for Construction Phase Only	
Construction Working Width Counties Tipperary, Offaly, Kildare and Dublin (within the administrative area of South Dublin County Council)	• A Construction Working Width would be temporarily required for the construction of the RWRMs and the Treated Water Pipeline, and the subsequent reinstatement of the land. • The Construction Working Width would generally be 50m in width but would be locally wider near features such as crossings, access and egress points from the public road network, Construction Compounds and Pipe Storage Depots.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
Construction Compounds Counties Tipperary, Offaly, Kildare and Dublin (within the administrative area of South Dublin County Council)	• Eight Construction Compounds would be temporarily required to facilitate the works to construct the Proposed Project. Five Construction Compounds would be located along the route of the Treated Water Pipeline at the following Infrastructure Sites: RWI&PS, WTP, BPT, BPS and TPR, with an additional three Construction Compounds located at Lisgarriff (County Tipperary), Killananny (County Offaly) and Drummond (County Kildare). Construction Compounds would act as a hub for managing the works including plant/material/worker movement, general storage, administration and logistical support. • The Principal Construction Compound at the WTP would require 30ha of land during construction. • The other three Principal Construction Compounds would require land temporarily during construction ranging between approximately 12ha and 16ha. • The four Satellite Construction Compounds at the other permanent Infrastructure Sites (excluding the FCV) would require land during construction ranging between approximately 3ha and 12ha.
Pipe Storage Depots Counties Tipperary, Offaly and Kildare	• Nine Pipe Storage Depots would be temporarily required to supplement the Construction Compounds and would serve the installation of pipe between the WTP and the TPR. • Pipe Storage Depots would take direct delivery of the pipe for storage before onward journey to the required location along the Construction Working Width. • The Pipe Storage Depots would vary in size and require land temporarily during construction generally ranging between approximately 2ha and 7ha but with one site being larger at 11ha.

* Note all land take numbers in this table are affected by rounding to one decimal place.

2. Commissioning Sequence

2. During the construction of the Proposed Project, testing and commissioning of individual elements of the works would be carried out at suitable stages of progression. Upon works completion, final commissioning of the whole works would be undertaken to confirm that the system responds in accordance with its specified requirements.

3. This section outlines typical approaches to testing and commissioning the individual elements of the works, and final commissioning of the Raw Water Intake and Pumping Station (RWI&PS) at Parteen Basin, the Raw Water Rising Mains (RWRM), and Water Treatment Plant (WTP), and the Treated Water pipelines, including the Break Pressure Tank (BPT), Booster Pumping Station (BPS), Flow Control Valve (FCV) and the Termination Point Reservoir (TPR) in County Dublin.

4. The commissioning is based on there being separate contracts, or at least separate construction teams, for the various elements of the project, as illustrated in Image 2.1.

5. In general, the sequence of commissioning is dictated by the following interdependencies:
   - The microfiltration units at the RWI&PS site must be commissioned fully before water is introduced into the RWRM
   - The RWRM must be tested before the RWI&PS pumps can be fully commissioned
   - Both the RWI&PS and the RWRM must be commissioned and ready before commissioning of the WTP begins
   - WTP Module 1, at least, and the Pipeline from the WTP to the BPT must be commissioned and ready before the HLPS can be commissioned
   - The BPT must be ready before water is fed to it from the WTP
   - The TPR must be tested and ready before water is fed to it from the Treated Water Pipeline.

6. The durations shown in Image 2.1 may change in the actual commissioning of the project as a whole but the sequence would remain.

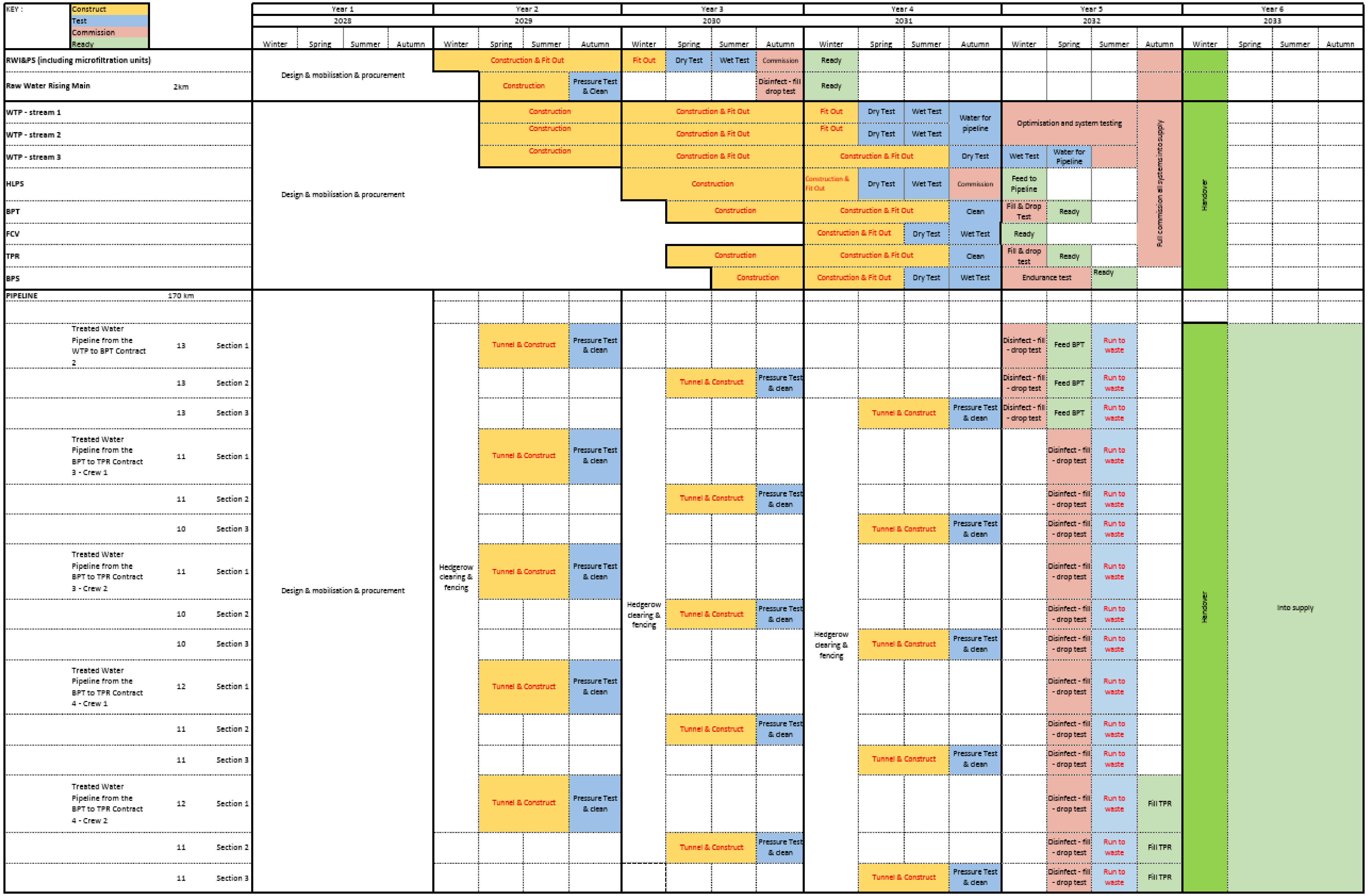


Image 2.1: Indicative Outline Design, Construction, and Testing & Commissioning Sequence

2.1 Pumping Stations

2.1.1 General

7. The main pumping stations within the Proposed Project are:
   - The RWI&PS at Parteen Basin
   - The HLPS at the WTP, which would pump the treated water to the BPT
   - The BPS on the Treated Water Pipeline which would be used to pump water to the TPR at times of peak demand.

2.1.2 Factory Acceptance Testing

8. All pumps and motors, transformers, and High Voltage (HV) and Low Voltage (LV) control panels for each pumping station would require testing at the factory prior to shipping to site.

2.1.3 Bench Testing

9. All control system Programmable Logic Controllers (PLCs) and Input/Output (I/O) panels for the pumping stations would require bench testing with a comprehensive suite of simulated inputs to confirm that the outputs and alarms are in accordance with the detailed Functional Design Specification (FDS) developed from the Control Philosophy during detailed design and subject to rigorous Hazard and Operability (HAZOP) reviews.

2.1.4 Dry Testing

10. Upon completion of construction at each of the pumping stations and after equipment has been installed on site, dry testing would be carried out prior to running up the pumps. This includes testing virtually all instruments, telemetry, PLCs, Human Machine Interfaces (HMIs), emergency stops and switchgear. This would include the high voltage and low voltage elements and the setting and testing of all the relevant trip settings within the switchgear, variable speed drives, cabling and motors.

2.1.5 Wet Testing

11. Once suitable test water is available (from Parteen Basin for the RWI&PS, from the WTP for the HLPS, Treated Water Pipelines, BPT, BPS, FCVs and TPR), further checks would be undertaken for those systems that only work when the water is present. This would include pressure and flow switches, flow meters, water quality monitors and level instruments.

12. At each of the pumping stations, the pumps would be tested first of all individually – initially started against closed valves and then opened up to the RWRM or the Treated Water Pipeline. Speeds would then be increased incrementally across the entire speed range to check for out of balance vibration issues. Tests would be of short duration and only push relatively small volumes up the receiving pipeline.

13. When individual pumps are all performing satisfactorily, combinations of pumps would be tested to check for noise and vibration.

2.1.6 Surge Vessels

14. A significant part of the commissioning of the pumping stations is to validate the theoretical analysis of the transient response of the systems to start-up, shut down and emergency stop/trip.

15. Prior to running the pumps, all the surge vessels at each pumping station, including the compressors and any pressure relief systems, would be commissioned and the Initial Air Volume within the surge system set accurately.

16. Pumping station pipework and valves would be tested at the required maximum test pressure.

17. Only then would the pumps be run with the intent of pumping water into the respective pipelines.

2.1.7 RWI&PS

18. The RWI&PS and the RWRM would need to be the first elements of the project to be tested and commissioned, as the water required for the testing and commissioning of the WTP and HLPS would need to come from Parteen Basin.

2.1.7.1 Source of Commissioning/Test Water

19. The commissioning and test water for the RWI&PS would be taken from Parteen Basin via the intake and inlet chambers structures.

2.1.7.2 Particular RWI&PS Commissioning Procedure

20. Following dry inspection of the Intake, the Passive Wedge Wire Cylinder (PWWC) screens, the penstocks and chambers, the wet wells would be flooded, and the reprofiled area of the Parteen Basin bed, at the Raw Water Intake Basin, would be inspected by divers for integrity of the concrete revetment mats. The revetement mats would be reinspected after commissioning of the intake to ensure they remain undisturbed under maximum intake flow.

21. The Microfiltration units, and the ultraviolet (UV) units on the microfilter washwater return pipes, would be wet commissioned first. Water would be delivered to the microfiltration units from the RWI&PS pump hall by a temporary pump, appropriately sized. Water run through the microfiltration units would run to waste into the RWRM scour tanks, located beneath the microfiltration units buildings. This water would be returned to the raw water inlet chambers and recycled through the microfiltration units until commissioning of those units is complete.

22. Having informed Electricity Supply Board Networks (ESBN) of a time profile of test/commissioning loads, pumps would then be commissioned individually and in parallel.

2.1.7.3 Particular High Lift Pumping Station Commissioning Procedure

23. Prior to the commissioning of the HLPS, other elements of the system would need to be commissioned. The minimum prerequisites are the RWI&PS, the RWRM, the WTP and the Treated Water Pipeline from the WTP to the BPT.

24. The prerequisite for the BPT, Treated Water Pipeline from the BPT to the TPR, and TPR would depend on whether a flow relief loop is provided back to the clear water tank at the WTP.

25. It is highly likely that even a single high lift pump would produce flows that are too high for safe initial charging of the Treated Water Pipelines.

26. Therefore, a smaller variable speed ‘pipeline priming pump’ capable of flows up to around 20Mld would be necessary.

27. Alternatively, a flow relief loop back into the Clear Water Storage Tanks (CWSTs) from the Treated Water Pipeline would be necessary to enable the use of a high lift pump to charge the pipeline. Some of the flow would be used to charge the pipeline while some is bled back to the CWSTs. This is necessary to avoid running the pumps in a highly throttled state for long durations.

28. One of these options needs to be permanently available to operators in the future in the event that the pipeline is ever drained down and requires recharging.

29. When the Treated Water Pipeline from the WTP to the BPT, and BPT are available, short commissioning runs of single pumps may be possible to charge the pipeline (if a flow recirculation loop is provided). Otherwise testing of the pumps would have to wait for the Treated Water Pipeline from the BPT to the TPR, FCV and TPR to be commissioned as well (these are dealt with in Sections 2.3 to 2.7).

2.1.7.4 Particular Booster Pumping Station Commissioning Procedure

30. The BPS can be the final element tested and commissioned. For the BPS to be tested and commissioned the Treated Water Pipeline from the BPT to the TPR, and the TPR would need to be tested and ready to accept flows.

31. The BPS on the Treated Water Pipeline would allow the flows to be increased from circa 165Mld to the design maximum of around 300Mld.

32. Since the pipeline can bypass the BPS, the BPS can be constructed, connected and dry and wet tested without interfering with ongoing operations of the Treated Water Pipeline.

33. Once the BPS has successfully passed all offline testing, including the necessary disinfection, it can be commissioned through the start-up sequence determined by the transient analysis.

34. During start up, the pumps are throttled by the FCV which provides fine control between 165Mld and 300Mld.

35. Individual pumps can be commissioned at up to full speed for short periods against throttled pump delivery valves subject to the pump motor temperatures. In this way the individual pumps can be wet tested for start-up, shut down, vibration, and overheating without affecting the overall flow in the Treated Water Pipeline. Alternatively, pumps can be tested against the throttled FCV.

36. Similarly, once all individual pumps and the surge suppression system have been successfully tested the combined pumped flow can be throttled to match the maximum gravity flow so there is no need to add complexity to flow control on the WTP and HLPS during the initial testing.

37. If a trip or shut down occurs during this initial testing, flows would automatically revert to the maximum gravity flow.

38. Once start up and shut down sequences have been robustly established, flow would be increased incrementally (along with required changes at the WTP and HLPS) up to the maximum design flow.

39. At all times during commissioning, close co-ordination would be required with the production output at other water treatment plants in the GDA WRZ to manage strategic storage levels.

2.2 Water Treatment Plant (WTP)

2.2.1 Commissioning Programme

40. WTP testing and commissioning can only be carried out once the RWI&PS and RWRM have been tested and commissioned.

2.2.2 Source of Commissioning/Test Water

41. Commissioning and test water for the WTP would be provided from Parteen Basin, via the RWI&PS and the RWRM.

2.2.3 WTP Commissioning Procedure

42. All major plant, pumps and motors, transformers, and HV and LV control panels to be installed in the WTP would be witness-tested at their respective places of manufacture prior to shipping to site.

43. All control system PLCs and I/O panels would be bench-tested with a comprehensive suite of simulated inputs to confirm that the outputs and alarms are in accordance with the detailed Functional Design Specification developed from the Control Philosophy during detailed design and subject to rigorous formal safety reviews.

44. Following cleaning and dry inspection of all tanks, penstocks and chambers in the WTP, the Raw Water Balancing Tanks (RWBT) would be filled by forward pumping from the RWI&PS. Once these tanks are tested and passed for water tightness, the water can be used to test the individual tanks and treatment units in the plant and to commission the treatment processes themselves.

45. Initial commissioning of the Treatment works would be carried out incrementally and using only a fraction of the ultimate flow. The process commissioning phase would begin with a single treatment sub-stream within Treatment Module 1, using a single settlement tank with two rapid gravity filters at 50% of their design capacity.

46. Commissioning would be possible at a low rate (approximately 10Mld) and initially the water used in commissioning would be re-circulated through the plant. This would be done by discharging the treated water to one cell of the CWSTs and rather than pumping it forward to the BPT, it would be drained back to the Tank Draindown and Commissioning Lagoons on site and recirculated to the RWBT at the head of the works.

47. When the water quality has reached a sufficient standard, it would be used initially as test water for tanks throughout the WTP site, and finally the through flow would be allowed to discharge forward to the CWSTs, available for testing and commissioning of the HLPS.

48. For the rest of the process commissioning, flows would gradually be increased (by activating further treatment sub-streams within Treatment Module 1) until the full Module is operational.

49. In the second stage of the commissioning process, the flow would be increased from 10Mld to 20Mld and flows at this level would be monitored and increased as required so that the flow from one full treatment module would be available for the commissioning of the Treated Water Pipeline from the WTP to the BPT and the HLPS.

50. The same procedure would be followed with a second and third treatment modules.

51. Having informed ESBN of a time profile of test/commissioning loads at the WTP and HLPS, the Treated Water Pipeline would be swabbed, tested, chlorinated and commissioned, and the high lift pumps would be then commissioned individually and in parallel. The WTP site lagoons have adequate capacity to store the water volume in the Treated Water Pipeline to the first local high point downstream of the WTP.

52. Control systems and telemetry systems between the HLPS, BPT, BPS and TPR would be tested for correct operation.

2.3 Pipeline Infrastructure

53. There are three distinct sections of pipeline:

- RWRM (approximately 2km in length)
- Treated Water Pipeline WTP to BPT (approximately 37km in length)
- Treated Water Pipeline BPT to TPR (approximately 133km in length).

54. The construction of the RWRM, Treated Water Pipeline and the Infrastructure Sites will be subdivided into various geographical sections or work packages as described in Chapter 5 (Construction and Commissioning). However, the testing and commissioning of all the pipelines would follow the same overall procedure and sequence which is described in Pipeline Test and Commissioning Sequence.

55. All along the pipelines, there are Line Valves every 1km to 7km which, once the pipeline is in operation, enable a sub-section of pipeline to be isolated, thus facilitating any planned local maintenance or emergency repairs without requiring the entire pipeline to be drained down.

56. During construction, the sub-section bounded by two Line Valves forms a logical and suitable length of pipeline for hydrostatic pressure testing to prove the leak-tightness of the pipeline. Other logical places are at intermediate road crossing or at tunnel sections.

57. The precise division into sub-sections would be determined during detailed design and in conjunction with the construction schedule of each contractor.

58. The construction of the entire pipeline may take up to three years. Therefore, to enable reinstatement to take place in a timely fashion, it is necessary that sub-sections are tested as they are completed so any remedial works can be completed whilst the contractor is mobilised in the vicinity.

2.3.1 Pipeline Test and Commissioning Sequence

59. The sequence for pipeline testing and commissioning is as follows:

a) Initial clean and internal inspection
b) Low pressure 'air test' – using compressed air
c) Hydrostatic pressure testing with filtered raw water
d) Final swabbing and cleaning
e) Disinfection
f) Filling with potable water
g) Water quality sampling.

60. Items a) to d) would be undertaken as each sub-section of up to 7km is completed.

61. Items e) to g) would be undertaken once the entire pipeline is complete and the HLPS, BPT and TPR are also ready for 'wet' commissioning.

2.3.2 Initial Cleaning

62. Each section of pipeline of up to approximately 7km would be inspected, initially cleaned and tested as construction is completed.

63. The initial clean is undertaken 'dry' and would involve the internal inspection of the pipeline and removal of all significant foreign matter by either personnel entering into the pipeline or by robotic inspection devices.

64. This would be followed by the taking of Closed Circuit Television (CCTV) video of the section to provide a record of the cleanliness prior to testing.

2.3.3 Air Test

65. The air test involves:

a) The capping of all flanged outlets (air valves and washouts) on the test section with blank flanges

b) The temporary installation of special test ends to each end of the test section designed to facilitate air testing, water testing and swabbing

c) Raising the pressure of the test section to around 1 bar with oil-free clean compressed air to check for any leaks

d) Any leaks would be investigated, fixed and the section would be re-tested. On a welded steel pipeline, most leaks are from flanged joints on ancillary appurtenances not being adequately tightened.

2.3.4 Hydrostatic Test

66. Upon achieving a successful air test, the hydrostatic test would follow at a much higher test pressure. Hydrostatic pressure testing is an essential part of commissioning a pressure pipeline. This is undertaken at an elevated pressure to stress the pipeline to prove the welded joints are able to withstand the full operating pressure. Testing with air at high pressures is not a safe practice and not permitted.

67. For practical purposes it is best to undertake testing in short lengths of between 1 and 7 km while the pipeline contractor is still mobilised on the relevant section. Once the test of a section has been successfully completed, three further elements of work can proceed:

- The pipeline section can be drained to prevent it from going stagnant prior to final commissioning
- The pipeline appurtenances (air valves and washouts) can be fitted and their chambers completed
- Reinstatement of the land which would subsequently be handed back to the landowners.

68. Until pressure testing is complete, the hand back of the land to landowners cannot take place.

69. Sources of water for hydrostatic testing of the pipeline for the Proposed Project are limited. Three options were considered in the development of this Strategy:

a) Water from potable water mains that run near to or cross the Proposed Project pipelines

b) Potable water from the WTP once it has been commissioning to provide sufficient treated water

c) Raw water from watercourses close to the pipeline (treated in a temporary mobile water treatment rig prior to use for pressure testing).

70. All options require the water to be discharged through all the washouts to local watercourses and bunds following completion of the pressure test.

71. The advantages and disadvantages of each are set out in Annex A. Raw water from watercourses was selected as the preferred source of water for hydrostatic testing for the reasons set out in Annex A.

72. The watercourses along the length of the pipeline were evaluated and smaller waterbodies with Q95 flow of less than 100l/s were discounted. The term ‘Q95’ relates to the assessed flow in the water body and is the flow rate which is exceeded 95% of the time – meaning the assessment is very conservative and only in exceptional circumstances would water not be available. Eight waterbodies were selected and are set out in Annex B. The rate of abstraction will be kept below that requiring an abstraction licence.

73. Annex C sets out generic management measures to be applied to the environmental risks associated with abstraction and discharge of the water. Annex D identifies specific risks associated with the proposed abstraction from Kilmastulla River and the River Liffey. Annex E sets out the decision tree proposed to be used to determine the choice of discharge of the water once testing is complete.

74. The source of abstracted water would be sampled prior to hydrostatic testing and the required water treatment determined based on a decision tree that covers:

    a) Suspended solids
    b) Invasive species (e.g. Zebra mussels, crayfish plague)
    c) Water chemistry – pH, hardness, conductivity, organics, metals, nutrients, pesticides.

75. A temporary small-scale intake design of circa 2000m^3/day (25 l/s) would be developed, probably in the form of a suspended cage lowered into the mid-stream but not close to the river bed to avoid drawing in aquatic species that prefer the margins. Abstraction velocities would be kept below 0.15m/s through a fine mesh not greater than 3mm aperture.

76. Treatment process would include filtration and disinfection as a minimum to avoid sediment, organisms and seeds entering the pipeline and be modular to allow for treatment commensurate with the abstraction rate available.

77. The treatment process would also ensure that water being discharged from the pipeline after hydrostatic testing would not cause any environmental impact. The sampling of the abstracted water (as described above) would provide information regarding background contaminants and the potential for invasive species and determine the exact treatment required to remove the contaminants. Containerised mobile wastewater treatment plants are available which can provide this service.

78. In addition, sampling of pipeline water prior to discharge would be undertaken to verify this and to determine the treatment(s) required prior to discharge. The same treatment approach would be followed whichever discharge solution is chosen:

    - Dechlorination using recommended products during discharge into settlement pond
    - pH adjustment in the settlement pond
    - Oxygenation on discharge from the settlement pond (if required) using an upturned bellmouth or similar arrangement.

79. A provisional assessment of pipeline sub-sections has been undertaken and suitable local watercourses for discharge of test water identified for each sub-section. In most cases, the watercourse crosses the test section and the section can be fed directly from the source. Occasionally, the sub-section for testing would require an adjacent sub-section to be completed first so that water can be conveyed to the right sub-section.

80. Following a successful completion of the hydrostatic pressure test, the water in the pipeline would, where practicable, be retained and pumped into adjacent sections when they are ready for hydrostatic testing. However, in most instances the water would be drained from the pipeline as far as possible to land within the water catchment area from which it was originally taken. This would avoid any potential issues related to inter-catchment transfer of waters with differing physio-chemical properties.

81. The list of sub-sections for the Treated Water Pipelines and the associated proposed sources of water can be found in the table in Annex B. This gives an assessment of the size of the watercourse and the provisional proposed abstraction rate.

82. Every single washout is likely to be used during commissioning to discharge hydrostatic test water.

83. Since the pipeline would need to be left empty and capped prior to final commissioning (which may be over two years later) it would be necessary to use all washouts to drain the sub-section completely.

84. There is no time restriction on this drain-down process and where suitable watercourses are not available, a bunded temporary soak away area would be created within the construction corridor.

2.3.5 Swab Cleaning

85. Upon completion of the hydrostatic test, cleaning would be carried out by propelling foam swab 'pigs' separated by 'slugs' of potable water through pipeline sections with oil-free compressed air. Typically, two or three pigs at a time are 'blown' through with 50 or 60m^3 of water in front of the first pig and similarly between the other pigs.

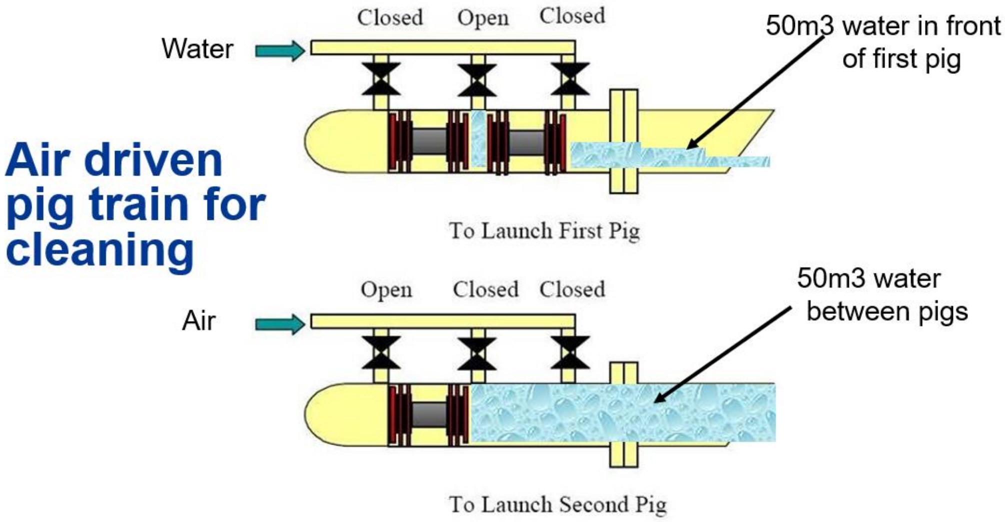


Image 2.2 Hydrostatic Testing by Air Driven Pig Train

86. The process is repeated, as necessary, until the last pig in the pig train is visually clean and the water that precedes it, free from significant contamination.

87. The water used for cleaning would be disposed of via silt-busters and any additional treatment required to an adjacent watercourse or allowed to soak away onto the land.

88. Once cleaned, the pipeline would be temporarily capped and sealed.

2.3.6 Land Reinstatement

89. Once pressure testing and cleaning are complete for any sub-section, surface reinstatement can be undertaken.

90. Early reinstatement is the key advantage of testing in local sub-sections as it permits the return of the vast majority of the land as soon as is practicable to the owners and tenants.

91. If the end points of the sub-section have been chosen to end adjacent to roads, then the construction road along the working width can be taken-up and full reinstatement put in hand. Otherwise it would be necessary to retain the construction road to retain access to the end of the sub-section to facilitate making the joint to the adjacent section when ready.

2.3.7 Joining of Sub-Sections and ‘Golden Joints’

92. When adjacent sub-sections of the pipeline have both been successfully tested and cleaned, the temporary caps on adjacent ends are removed and the two sections joined, typically by the installation of a Line Valve.

93. The joints made between two tested sections are colloquially known as ‘golden joints’ and would not have been subject to full pressure test. As far as possible, access to these ‘golden joint’ locations is retained with the joints exposed so that they can be visually inspected for leaks during later commissioning.

2.4 Pipe Commissioning

2.4.1 Disinfection and Filling of Treated Water Pipeline from WTP to BPT

94. When the entire pressure pipeline is ready for disinfection this would also require:

    a) Potable water to be available from the WTP at a rate of around 150l/s

    b) At least one pump of the HLPS (or a temporary potable pump) to be able to deliver around 150l/s to the BPT head.

95. Disinfection would be carried out by low volume, low-pressure spraying of the internal pipe surface with a mist of sodium hypochlorite solution using a specialist spraying rig inserted through manways.

96. Spraying would work sequentially from the west between Line Valves; and filling of the pipeline with potable water from the WTP should follow as soon as practicable while the next section is being disinfected.

97. In this way the entire Treated Water Pipeline would be disinfected and filled as far as the BPT.

98. A chorine residual in the pipeline (at a level to be determined) would be maintained at all times in all sections that have been filled.

99. Current estimates for the schedule are based on disinfecting around 500m of pipeline a day and would require temporary access to the wayleave to access the manways for a day or two.

100. Since it would take several months before the rest of the pipeline, BPT and TPR are ready for onward flow, to avoid the water becoming stagnant, a sweetening flow would need to be established via a suitable washout on the easternmost section that has been filled.

101. The sweetening flow rate would be determined during detailed design and would depend on the length of pipeline filled to date, the level of chlorine used and the rate of chlorine decay.

102. As a point of reference, a turnover of the entire pipeline every 28 days would require sweetening flow of around 30l/s (3Mld) for the entire 37km long pipeline.

103. The sweetening flow would need to commence prior to the completion of the fill of the entire pipe and this would require careful monitoring of input and discharge flows, such that the rate of fill of the pipeline is within acceptable range and so the pipeline is not accidentally drained.

104. All sweetening flow discharges would be monitored for chlorine residual, and de-chlorinated prior to entering any watercourse.

105. As each section is filled, the 'golden joints', air valves and washout would all be visually inspected to ensure there is no discernible leakage.

2.4.2 Pipeline Drop Test

106. Once the entire Treated Water Pipeline from the WTP to the BPT is filled:

a) The sweetening flow would be temporarily stopped

b) All open washouts would be closed

c) The delivery valves at the HLPS would be closed.

107. The free surface of the Treated Water Pipeline bell mouth within the BPT would be monitored over a period of around 24 hours to confirm the leak tightness of the entire pipeline. The acceptance criteria would be determined during the contract formulation.

108. Once the drop test had been successfully completed, the sweetening flow would be re-established. In the case of a failed drop test sweetening flow would be re-established until any problems had been remedied. The drop test would then be repeated.

2.4.3 Disinfection and Filling of Treated Water Pipeline from BPT to TPR

109. The procedure for disinfecting and filling the Treated Water Pipeline from the BPT to the TPR would be the same as for the Treated Water Pipeline from the WTP to the BPT. Water would either come from the BPT if that had already been commissioned or via temporary by-pass pipework.

110. The sweetening flow would need to be increased as the length of filled pipeline grows to ensure the time to turn-over all the water in the pipeline was less than the prescribed time period. A washout near the end of the section furthest to the east would be used to run the sweetening flow to waste via a suitable dechlorination mechanism to achieve levels less than 0.005 mg/l required by the Salmonid regulations.

111. As a further point of reference, for a turnover of the entire Treated Water Pipelines (170km) every 28 days, a sweetening flow of around 140l/s (12Mld) would be necessary.

2.4.4 Pipeline Drop Test

112. Once the entire Treated Water Pipeline is filled as far as the TPR:

   a) The sweetening flow in the gravity pipeline would be temporarily stopped (it can continue within the Treated Water Pipeline to the BPT)

   b) The valves at the TPR would be closed

   c) All washouts on the pipeline would be closed.

113. The free surface of the pipeline outlet bell mouth within the BPT would be monitored over a period of around 24 hours to confirm the leak tightness of the entire Treated Water Pipeline.

2.4.5 Water Quality Testing

114. Water quality samples would be taken all along the pipeline length to ensure compliance with potable water regulations.

115. Any gross failures need to be investigated thoroughly through further sampling at air valves to pinpoint the problem. In a worst case, a section may need to be drained and CCTV cameras or personnel entry through manways used to investigate the source of the problem.

116. Minor failures may be remedied by adding a higher chlorine dose and/or flushing the section in question to a watercourse (dechlorinating as necessary) and replenishing with fresh water from WTP via the previous sections.

2.4.6 Line Valves

117. Line Valves would be installed and the power supply from ESBN connected.

118. Each valve would be tested (i.e. from fully open to fully closed) both locally and remotely via the Supervisory Control and Data Acquisition (SCADA) system with the bypasses open.

119. Each valve installation also includes pressure monitoring either side of the valve which would be commissioned at the same time and linked to the telemetry.

120. The time to open/close would be confirmed to be within design parameters to avoid unacceptable transient pressures.

2.4.7 Cathodic Protection

121. Commissioning of the impressed current cathodic protection system on the pipeline would be by specialists who would set up the appropriate voltages and currents for each section.

122. All cathodic protection ground beds are located adjacent to Line Valves and the cathodic protection would draw power from the same ESB Networks power supply and use the same telemetry relay station to communicate the status of the system to the central control.

2.5 Break Pressure Tank (BPT)

123. The BPT is an integral component of the Treated Water Pipeline and cannot be fully commissioned in isolation from the other components.

124. In order to commission the BPT:

a) Potable water would need to be available from the WTP

b) The Treated Water Pipeline from the WTP to the BPT would need to be complete, pressure tested, cleaned, disinfected and filled.

125. A means of pumping water from the WTP to the BPT would be required. This does not necessarily have to be the HLPS as temporary pumps may be more expedient within the construction and commissioning schedule to use a temporary pump which can deliver the required commissioning flow rate, which may be less than a single high lift pump can deliver.

2.5.1 Water Ingress Test

126. Prior to filling or cleaning the inside of the BPT, to confirm that there are no leaks into the structure, especially through the roof, a water ingress test would be undertaken.

127. The roof of the structure would be flooded with water pumped from the Treated Water Pipeline from the WTP.

128. The inside of the BPT would then be examined for any water ingress.

2.5.2 Cleaning and Disinfection

129. The internal structure, once the concrete has cured and all joints have been sealed, would be thoroughly cleaned of construction materials, dirt and dust and the ceiling, walls and floor cleaned using high pressure water jets. Wastewater from this process would be collected in the drains and directed to silt-busters or similar, prior to discharge.

130. The most suitable source of water for cleaning would be determined during detailed design but would likely be water from the WTP via the Treated Water Pipeline.

131. Once clean, the internal surfaces of the structure would be disinfected with super-chlorinated water by either brushing or spraying.

2.5.3 Water Retention Test

132. A water retention test would then be undertaken to prove the integrity and water tightness of the BPT structure.

133. The BPT would comprise three cells, and each cell would have to be tested independently. The maximum volume of water required to test an individual cell is around 5Ml.

134. The same water would be used for each of the three cells, being transferred by way of over pumping.

135. The cell would be filled to the overflow level, isolated and then left for an agreed period (not less than 24 hours) and the level re-measured. No drop in level should be observed. If this is not the case then the cause of the loss of water would be investigated and remedied and the test repeated.

136. If is not practicable to re-use the test water to gravitate forward to facilitate hydrostatic testing of the Treated Water Pipeline from the BPT to the TPR, this water would be discharged upon completion of the water retention test through the dechlorination chamber which is to be built as part of the permanent works on the site; ultimately wasted via the soakaway chambers and detention basin which forms part of the site drainage. Consequently, this discharge would be carried out at a controlled rate according to the capacity of the soakaway chamber.

2.5.4 Final Commissioning

137. Final commissioning would take place in conjunction with the WTP, HLPS and the Treated Water Pipeline.

138. All level probes, level switches, water quality monitors, PLCs, HMIs, flow meters, valve actuators, Uninterruptible Power Supplies (UPSs), alarms, security and telemetry systems would be 'dry' commissioned once power from the ESBN has been connected.

139. The tank would be filled via the Treated Water Pipeline.

140. All level probes, level switches, water quality monitors, flow meters, valve actuators would then be 'wet' commissioned.

2.6 Termination Point Reservoir (TPR)

141. The TPR is an integral component of the Treated Water Pipeline and cannot be fully commissioned in isolation from the other components.

142. In order to commission the TPR:
    a) Potable water would need to be available from the WTP
    b) The Treated Water Pipeline from the WTP to the BPT would need to be complete, pressure tested, cleaned, disinfected and filled
    c) The BPT would need to have been retention tested
    d) The Treated Water Pipeline from the BPT to the TPR would need to be complete, pressure tested, cleaned, disinfected and filled
    e) A means of pumping water from the WTP to the BPT would be required. This does not necessarily have to be the HLPS since temporary pumps may be more expedient within the construction and commissioning schedule and a more appropriate smaller size.

143. It should be noted that for the retention test only (see 2.5.3 Water Retention Test) an alternative to using water from the WTP is to obtain water from Peamount Service Reservoir. This is unlikely to prove practicable due to the quantities of water required and existing limitations on the system. However, if water could be made available it would save time on the overall programme.

2.6.1 Water Ingress Test

144. Prior to filling or cleaning the inside of the TPR, to confirm that there are no leaks into the structure, especially through the roof, a water ingress test would be undertaken.

145. The roof of the structure would be flooded with water pumped from the Treated Water Pipeline.

146. The inside of the TPR would then be examined for any water ingress.

2.6.2 Cleaning and Disinfection

147. The internal structure, once the concrete has cured and all joints have been sealed, would be thoroughly cleaned of construction materials, dirt and dust and the ceiling, walls and floor cleaned using high pressure water jets. Wastewater from this process would be collected in the drains and directed to silt-busters or similar, prior to discharge to the local drains or overflow tank.

148. The most suitable source of water for cleaning would be determined during detailed design but would likely be water from the WTP via hydrants off the Treated Water Pipeline.

149. Once clean, the internal surfaces of the structure would be disinfected with super-chlorinated water by either brushing or spraying.

2.6.3 Water Retention Test

150. A water retention test would then be undertaken to prove the integrity and water tightness of the TPR structure.

151. The TPR would comprise three cells, and each cell would have to be tested independently. The maximum volume of water required to test an individual cell is 30Ml.

152. The same water would be used for each of the three cells, being transferred by way of over pumping.

153. The cell would be filled to the overflow level, isolated and then left for an agreed period (not less than 24 hours) and the level re-measured. No drop in level should be observed. If this is not the case then the cause of the loss of water would be investigated and remedied and the test repeated.

154. Upon completion of the various water retention tests, and upon confirmation that water quality is to standard, the water may be forwarded to the existing Peamount Service Reservoir facility.

155. Disinfection procedures would have to be implemented in the event that water quality is sub-standard.

156. Upon satisfactory completion of testing, the retention test water would be disposed at greenfield run-off rates via the scour valves to the attenuation ponds and to the local surface water drainage system over a 3 to 4 week period. If absolutely necessary, water could be diverted to the overflow tank and tankered off-site.

2.6.4 Final Commissioning

157. Final commissioning would take place in conjunction with the WTP, HLPS, Treated Water Pipelines, BPT and FCVs.

158. All level probes, level switches, water quality monitors, PLCs, HMIs, flow meters, valve actuators, UPSs, alarms, security and telemetry systems would be ‘dry’ commissioned once power from the ESBN has been connected.

159. The TPR would be filled from the Treated Water Pipeline under manual control from the cell inlet valves.

160. All level probes, level switches, water quality monitors, flow meters, valve actuators would then be ‘wet’ commissioned.

2.7 Flow Control Valves

161. Commissioning would take place in conjunction with the WTP, HLPS, Treated Water Pipelines, BPT and TPR.

162. Once power from ESB Networks is connected, the PLC, UPS, flow meters, flow control valve, telemetry, security and alarms can be commissioned.

163. Each FCV would be commissioned separately and then in pairs across the full opening range.

164. The final commissioning can only be undertaken as part of the overall system commissioning to put the entire Treated Water system into automatic control mode.

2.8 Overall Control System Commissioning

165. The final element of commissioning brings together all the various elements of the raw and treated systems (as described in Appendix A4.1 Operational Strategy, of the EIAR).

166. All individual elements would need to have been successfully commissioned.

167. The overall system controls would be required to be robustly ‘bench-tested’ with simulated input and outputs to confirm the correct responses of the PLC to each variable and alarm condition.

168. During detailed design, the transient analysis will have determined the precise safe sequence of start-up of the treated water system.

169. A detailed commissioning plan will also be essential to cover every eventuality to allow immediate safe shut down should any element of the system fail to operate as expected during system commissioning.

170. The WTP would initially be running in a mode recirculating at a low rate on one stream.

171. This would be diverted to the CWSTs which provides the suction for the HLPS.

172. Once the water level in the CWSTs is at the required start level, the HLPS would be instructed to start and match the output from the WTP.

173. Subsequently the FCVs would be instructed to go through their start up sequence to control the level within the BPT to a very fine tolerance.

174. The commissioning would monitor all responses, control settings and tolerances at low flow levels to achieve steady state conditions.

175. Only then would the various simulated fault conditions be imposed to test the safe shut down of the system.

176. Once all fault simulations have been successfully passed, the flows would be increased in stages and the start-up, shut down and trip scenarios repeated until maximum gravity flow in the gravity pipeline has been achieved.

177. Throughout this time, all the water produced would be potable and therefore able to be passed forward through the TPR into supply.

178. The strategic storage levels and the production output at other water treatment plants in the GDA WRZ would need to be closely monitored and adjusted accordingly while commissioning is ongoing.

Annex A Options for Sources of Water for Hydrostatic Testing

Table A.1: Sources of Water for Hydrostatic Testing

Option	Advantage	Disadvantage
Potable Water Mains	• Water is already treated so as not to adversely affect the new pipeline. • Following the hydrostatic test the water can be discharged to the environment requiring only simple dechlorination. • The pressure tests can be undertaken immediately each section in completed and thus ensure returning land to landowners is not delayed.	• For the Proposed Project the new pipeline is several orders of magnitude larger than any potable pipeline being crossed and it is a high probability that there is insufficient quantity of water available at the time it is needed to make this option feasible. • A typical test section of new pipeline would require around 10 to 15 million litres of water which would not be feasible through the local distribution system which could not accommodate such a large increase.
Water Treatment Plant	• The quantity and quality of the water available for this option are both adequate for the purposes of the test. • Following the hydrostatic test, the water can be discharged to the environment requiring only simple dechlorination.	• The entire treated water pipeline must be completed in order to convey water from the WTP to the section of pipeline to be tested. This means that pressure testing cannot start until the WTP is producing potable water and the pipeline is complete. This would add over a year to the construction sequence and also mean that hand back of land to landowners would be delayed by up to 3 years.
Raw water abstracted from local water courses	• The testing can proceed as soon as a test section is ready ensuring hand back of land to landowners can be at the earliest opportunity. • The quantity of water can be assured by using only watercourses that are of sufficient size. • Treatment by mobile plant could be used so that the pipeline is not contaminated and that the subsequent water discharged meets all necessary requirements.	• Potential delay associated with this approach as it would need temporary abstraction agreements at the identified watercourses and require abstraction consent. • Temporary mobile treatment rig capable of handling a potentially wide range of different raw water parameters would be required.

Table A.2: Evaluation of Options

Water Source	Sufficient Water?	Water Quality ok?	Enable Early Return of Land to Landowners?	Major Programme Saving?	Overall Conclusion Viable?
Potable Water Mains	No	Yes	Yes	Yes	No
Water Treatment Plant	Yes	Yes	No	No	No
Local river abstraction	Yes	Yes – with mobile plant	Yes	Yes	Yes

Annex B Sources of Water for Hydrostatic Testing of Treated Water Pipelines

Table B.1: Sources of Water for Hydrostatic Testing

Section	LV Chainage	LV Spacing	Section ID	Length (m)	Volume (m3)	Notes on filling	Source of water	Theoretical abstraction in m3/day at 10% of Q95 Flow	Proposed Abstraction rate (m3/day)	Time to fill at 2000m3/day days
PP	TW-6050	6,050	2.1	6,050	12,164	Fill 2.1 from River	Kilmustulla River Chainage TW-2300	1,700	1,700	7.2
PP	TW-9350	3,300	2.2	6,390	12,848	Fill from 2.3	Nenagh River Chainage TW-19450	8,600	2,000	6.4
PP	TW-12440	3,090								
PP	TW-18500	6,060	2.3	8,300	16,688	Fill 2.3 from 2.4 then transfer to 2.2.	Nenagh River Chainage TW-19450	8,600	2,000	8.3
PP	TW-20740	2,240								
PP	TW-22410	1,670	2.4	8,050	16,185	Fill from River then transfer to both 2.3 and 2.5.	Nenagh River Chainage TW-19450	8,600	2,000	8.1
PP	TW-24570	2,160								
PP	TW-28790	4,220								
PP	TW-33480	4,690	2.5	8,060	16,206	Fill from 2.4	Nenagh River Chainage TW-19450	8,600	2,000	8.1
PP	TW-36850 (BPT)	3,370								

Section	LV Chainage	LV Spacing	Section ID	Length (m)	Volume (m3)	Notes on filling	Source of water	Theoretical abstraction in m3/day at 10% of Q95 Flow	Proposed Abstraction rate (m3/day)	Time to fill at 2000m3/day days
A	TWA-0 (BPT)		3.1	4,903	9,858	Fill from 3.2	Little Brosna River Chainage TWA-12900	5,000	2,000	4.9
A	TWA-1345	1,288								
A	TWA-2470	1,125								
A	TWA-4960	2,490								
A	TWA-10640	5,680	3.2	9,145	18,387	Fill from River then transfer to 3.1 and 3.3	Little Brosna River Chainage TWA-12900	5,000	2,000	9.2
A	TWA-14105	3,465	3.2							
A	TWA-16945	2,840	3.3	5,080	10,214	Fill from 3.2	Little Brosna River Chainage TWA-12900	5,000	2,000	5.1
A	TWA-19185	2,240	3.3							
A	TWA-21615	2,430	3.4	5,900	11,863	Fill from 3.3	Little Brosna River Chainage TWA-12900	5,000	2,000	5.9
A	TWA-25085	3,470	3.4							

Section	LV Chainage	LV Spacing	Section ID	Length (m)	Volume (m3)	Notes on filling	Source of water	Theoretical abstraction in m3/day at 10% of Q95 Flow	Proposed Abstraction rate (m3/day)	Time to fill at 2000m3/day days
A	TWA-0 (BPT)		3.1	4,903	9,858	Fill from 3.2	Little Brosna River Chainage TWA-12900	5,000	2,000	4.9
B	TWB-4650	7,656	3.5	7,656	15,393	Partially fill from Camcor River. Partially from 3.4.	Camcor River Chainage TWA-27600	1,400	1,400	10.6
B	TWB-7385	2,735	4.1	8,610	17,311	Fill from River then transfer to 4.2	Silver River Chainage TWB-12600	2,200	2,000	8.7
B	TWB-9310	1,925								
B	TWB-13260	3,950								
B	TWB-15120	1,860	4.2	7,880	15,844	Fill from 4,1	Silver River Chainage TWB-12600	2,200	2,000	7.9
B	TWB-18685	3,565								
B	TWB-21140	2,455								
B	TWB-25155	4,015	4.3	7,376	14,830	Fill from River then transfer to 4.4	Clodiagh River Chainage TWB-24800	1,200	1,200	12.4
C	TWC-350	3,361								

Section	LV Chainage	LV Spacing	Section ID	Length (m)	Volume (m3)	Notes on filling	Source of water	Theoretical abstraction in m3/day at 10% of Q95 Flow	Proposed Abstraction rate (m3/day)	Time to fill at 2000m3/day days
C	TWC-4415	4,065	4.4	8,670	17,432	Fill from 4.3	Clodiagh River Chainage TWB-24800	1,200	1,200	14.5
C	TWC-6680	-87,535								
C	TWC-9020	92,140								
C	TWC-11485	2,465	5.1	8,055	16,196	Fill from 5.2	River Figile Chainage TWD-4000	1,900	1,900	8.7
C	TWC-13375	1,890								
C	TWC-14990	1,615								
C	TWC-17075	2,085								
C	TWC-22930	5,855	5.2	7,645	15,371	Fill from 5.3 then transfer to 5.1	River Figile Chainage TWD-4000	1,900	1,900	8.2
C	TWC-24720	1,790								

Section	LV Chainage	LV Spacing	Section ID	Length (m)	Volume (m3)	Notes on filling	Source of water	Theoretical abstraction in m3/day at 10% of Q95 Flow	Proposed Abstraction rate (m3/day)	Time to fill at 2000m3/day days
D	TWD-3230	3,348	5.3	8,228	16,543	Fill from River	River Figile Chainage TWD-4000	1,900	1,900	8.7
D	TWD-8110	4,880								
D	TWD-12710	4,600	5.4	8,095	16,276	Fill from 5.3	River Figile Chainage TWD-4000	1,900	1,900	8.7
D	TWD-15075	2,365								
D	TWD-16205	1,130								
D	TWD-21465	5,260	6.1	8,305	16,698	Fill from 6.2	River Liffey Chainage TWE-9700 (Revised to TWE-11200 for access)	13,000	2,000	8.35
D	TWD-24510	3,045								
D	TWD-28640	4,130	6.2	9,680	19,463	Fill from 6.3 then transfer to 6.1	River Liffey Chainage TWE-9700 (Revised to TWE-11200 for access)	13,000	2,000	9.73
E	TWE-120	5,550								
E	TWE-5170	5,050	6.3	7,115	14,306	Fill from 6.4 then transfer to 6.2	River Liffey Chainage TWE-9700 (Revised to TWE-11200 for access)	13,000	2,000	7.15
E	TWE-7235	2,065								
E	TWE-12065	4,830	6.4	7,635	15,351	Fill from River then tranfer to 6.3 and 6.5	River Liffey Chainage TWE-9700 (Revised to TWE-11200 for access)	13,000	2,000	7.68
E	TWE-14870	2,805								
E	TWE-17870 (TPR)	3,000	6.5	3,000	6,032	Fill from 6.4	River Liffey Chainage TWE-9700 (Revised to TWE-11200 for access)	13,000	2,000	3.02

Annex C Generic Environmental Risks and Proposed Management and Mitigation Measures for Use of Water in Hydrostatic Testing

Table C.1: Generic Environmental Risks and Mitigation Associated with Abstraction from Watercourses

Abstraction – Generic Risk Management							
Risk	**Variables**	**Environmental Objective**	**Technical Objective**	**Measure**	**Performance Target**	**Mitigation/Prevention Commitment**	**Monitoring**
Loss of resource/lowering water levels.	• Volume of abstraction. • Duration of abstraction.	No reduction in water volume if it would result in a likely significant environmental effect.	Flexibility to abstract increased volumes of water in times of high flow.	• River flow. • River level.	Not abstract more than 10% of Q95 flow if flow during abstraction is between Q80 flow and Q95 (or as otherwise determined by abstraction licence). No abstraction below a Q95 low flow level (to be determined by monitoring and installation of gauge boards based on CFRAM modelling and monitoring cross referenced).	See performance target.	Contractor – monitor flow levels and install gauge board (as per abstraction licence).
Damage to aquatic habitat.	• Location of abstraction pipe. • Velocity of abstraction.	No damage to/loss of habitat.	Flexibility to determine the location of the abstraction pipe on site.	• Extent of habitat loss/ disturbance to river bed.	No additional target – see environmental objective.	Abstraction pipe would not touch the river bed. Citing of abstraction pipe alignment down the bank will be subject to direction of the ECoW in accordance with SWMP.	Ecological Clerk of Works (ECoW) visual inspection of abstraction (frequency to be determined).
Killing of fish/inverts.	• Rate of abstraction. • Size of pipe.	Prevent being sucked into pipe.	No contamination of the pipe.	Identifiable deaths.	Abstraction velocities would be kept below 0.15m/s.	Abstraction through a fine mesh not greater than 3mm aperture.	ECoW visual inspection of abstraction (frequency to be determined).
Transfer of microbiological organisms.	• Treatment. • Type of microbiological organism.	Prevent the transfer of microbiological organisms between waterbodies.	No contamination of the pipe.	None.	None.	UV and chlorination of abstracted water.	Contractor (frequency to be determined).
Spread invasive species and transfer of crayfish plague.	• Type of species.	No spread of invasive species. No spread of crayfish plague.	No contamination of the pipe.	Spread of invasive species.	Treatment method must be sufficient to remove/kill all invasive species.	No additional target – see performance target.	Contractor – quality (as per discharge consent).

Table C.2: Generic Environmental Risks and Mitigation Associated with Discharge to Watercourse

Discharge to waterbody – generic risk management							
Risk	**Variables**	**Environmental Objective**	**Technical Objective**	**Measure**	**Performance Target**	**Mitigation/Prevention Commitment**	**Monitoring**
Loss of habitat due to scour (bank/bed).	• Location of discharge. • Velocity of discharge.	No scour or damage/loss of habitat.	Maximise flexibility in ability to discharge.	Extent of habitat loss.	No scour to occur.	Discharge at less than 20% Qmed Preferential discharge via permanent outfalls (if discharging to waterbodies) as these are designed to prevent scour. Location of temporary discharge locations to be agreed with ECoW in line with IFI guidance to reduce risk of scour.	ECoW visual inspection of discharge (frequency to be determined).
Flooding.	• Water levels. • Volume of water being discharged.	No increase in flood risk/extent.	None.	Flood level.	No increase in flood risk.	Discharge to be restricted to QMed 20%. No discharge in flood event. (to be determined by monitoring and installation of gauge boards based on CFRAM modelling and monitoring cross referenced).	Contractor – monitor flow levels and install gauge board.
Reduced Dissolved Oxygen levels in discharge (DO).	• Duration of storing water in pipes.	No injury/killing of species due to reduced DO.	None.	DO levels in water.	Oxygen in discharge water is the same or greater than that in the river.	Re-oxygenation if required.	Contractor – quality (as per discharge consent) (Portable DO meter).
Water quality of discharge.	• Water chemistry of discharge waters. • Treatment options.	Water quality of sufficient standard that there would be no likely significant environmental effect on the receiving waterbody.	None.	Water quality of discharge	Suspended solids removed; pH adjusted to match receiving water pH; DO at or above level required for Good EQS (>80% and <120%).	Measures could include silt buster/settlement pond, dechlorination products and aeration; adjust pH.	Contractor – quality (as per discharge consent if one is required).
Invasive species.	See abstraction – Table C.1.	Where reasonably practicable only discharge back to same waterbody.	n/a.	Spread of invasive species.	Treatment method must be sufficient to remove/kill all invasive species.	No additional target – see performance target.	Contractor – quality (as per discharge consent).

Table C.3: Generic Environmental Risks and Mitigation Associated with Discharge to Land

Discharge to waterbody – generic risk management							
Risk	**Variables**	**Environmental Objective**	**Technical Objective**	**Measure**	**Performance Target**	**Mitigation/Prevention Commitment**	**Monitoring**
Scour of soils.	• Location of discharge. • Velocity of discharge.	No erosion of soils. Maximise re-use of water.	Maximise flexibility in ability to discharge.	Extent of habitat loss. Erosion of soils	Site specific discharge flow to prevent scour (or flooding). (To be determined by area of land/type of soils/land use/drainage/monitoring and discussion with landowners).	Measures could include retention ponds/controlled discharge from washout. Liaison with landowner.	Contractor – flow.
Flooding of land.	• Surface water levels/volume of water being discharged.	No increase in flood risk/extent.	None.	Flood level.	No increase in flood risk.	Discharge at greenfield rates equivalent to the area of the field subject to the discharge. (to be determined by monitoring and installation of gauge boards based on CFRAM modelling and monitoring cross referenced).	Contractor – monitor flow levels and install gauge board.
Contamination of soils.	• Treatment process – chlorine/Ozonation/UV.	No contamination of soils.	None.	Water quality discharged to land.	Chlorine removed and low suspended solids; pH adjusted to pH 6.5-8.5; TDS less than 800 mg/l.	Measures could include silt buster/settlement pond, dechlorination products and aeration; adjust pH.	Contractor – quality.
Invasive species.	See abstraction – Table C.1.	Where reasonably practicable only discharge back to same waterbody.	n/a.	Spread of invasive species.	Treatment method must be sufficient to remove/kill all invasive species.	No additional target – see performance target.	Contractor – quality (as per discharge consent).

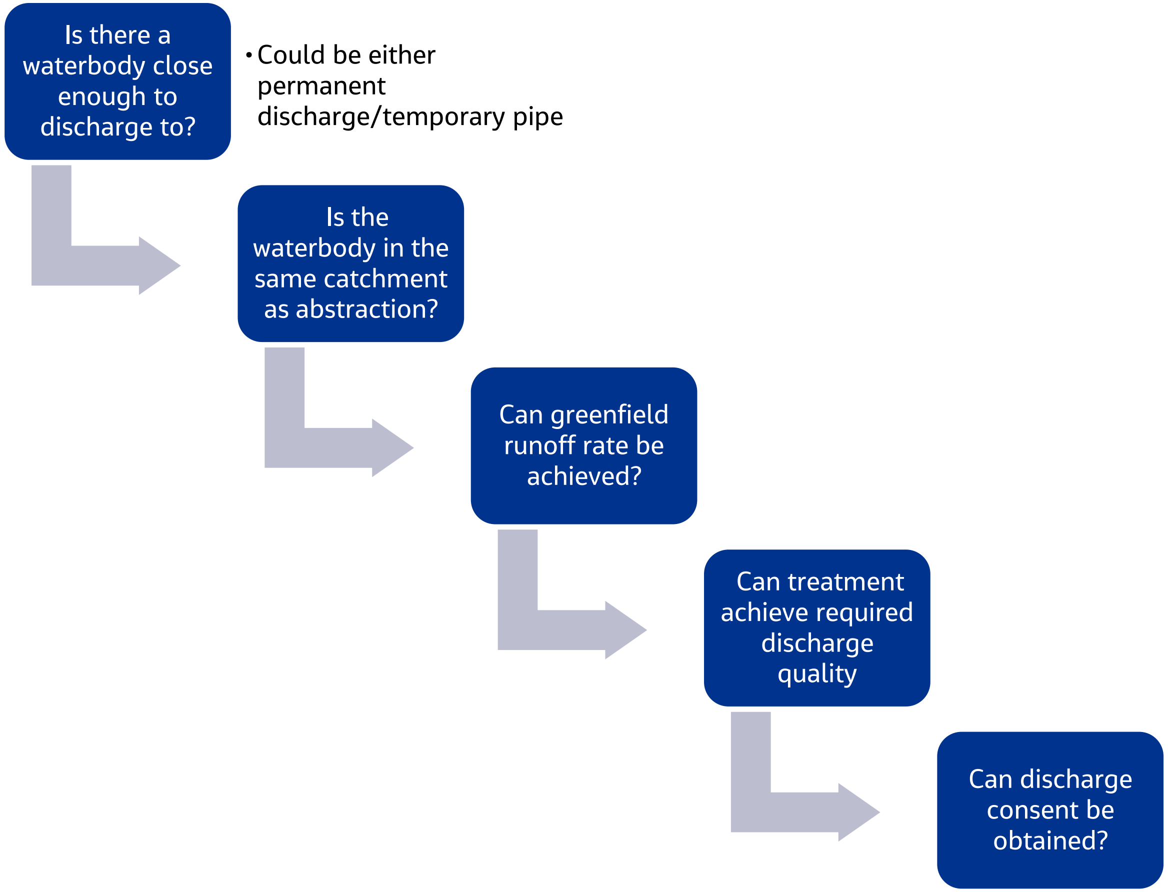
Annex D Specific Environmental Risks and Proposed Management and Mitigation Measures for Use of Water in Hydrostatic Testing

Table D.1: Additional Specific Risks Associated with Waterbodies Identified for Abstraction

Abstraction – Specific Risks			
River	**Specific sensitivities**	**Specific likely effects** **(beyond generic risks in Table C.1)**	**Additional mitigation (beyond generic measures in Table C.1**
Kilmastulla River: Chainage	Heavy metals	Potential to transfer heavy metals to other waterbodies or onto land.	• Testing and treatment, if required, to remove heavy metals at abstraction.
River Liffey	Bord Na Mona land and potential for high sedimentation interference with their PCAS plan.	High levels of silt and possibly nutrients and organic matter.	• Mobile treatment plant should be sufficient (in accordance with generic measures) however needs to be done in consultation with Bord Na Mona.

Annex E Decision Tree for Choice of Discharge of Water Used in Hydrostatic Testing

Step 1: Preferred Option discharge to waterbody



If any are 'No' proceed to Step 2.

Step 2: Is there a waterbody not within the catchment that could be acceptable? If so, repeat sub-steps in Step 1. If no proceed to Step 3.

Step 3: Option to discharge to land

If any are 'No' proceed to Step 4.

Step 4: Disposal/tanker away as a last resort.

Annex F Discharges from Washouts at Line Valves

The Washouts at Line Valves would only be used to discharge the sweetening flows during final filling in the Commissioning Phase. During operation there would be no discharge as the valves would be used to move the water to the next section in the pipe. Therefore, these Washouts (49 no.) are listed in this Commissioning Strategy, in Table F.1. All other Washouts (236 no.) would be used in both commissioning and any operational draindown and these are list in Appendix A4.1 (Operational Strategy).

Some of the Washouts at Line Valves at Washouts would not have a discharge even during Commissioning and therefore, would not have a discharge at all. These Washouts would just be used to move water to the next section of the pipe in both the commissioning phase and in the event of a draindown during operation. These are identified in the final column of Table F.1 as 'Not Used' for a discharge.

All of the other Washout Valves in Table F.1 would have a discharge during commissioning and this would be via either a local discharge / discharge to land. None of these Washouts would have a permanent outfall.

Table F.1: Washouts at Line Valves

Washout ID	Chainage	Washout Type	20% of Qmed (l/s)	Watercourse Reference	Washout Design Flow (l/s)
WO-10	TW-6050	Ditch	3275	100m to Kilmastulla River	2 l/s
WO-16	TW-9430	-	--	-	Not used
WO-20	TW-12440	Watercourse	80.2	40m from WBX014	2 l/s
WO-29	TW-18490	-	-	-	Not used
WO-33	TW-20735	Watercourse	52.6	WCX017	1 l/s
WO-34	TW-22410	-	-	-	Not used
WO-35	TW-24565	-	-	-	Not used
WO-37	TW-28785	Local discharge	Unknown	Temporary soak-away / attenuation pond	4 l/s
WO-42	TW-33470	-	-	-	Not used
WO-47	TWA-1345	-	-	-	Not used
WO-49	TWA-2460	-	-	-	Not used
WO-52	TWA-5000	Watercourse	56.6	150m to WCX022	1 l/s
WO-58	TWA-10690	-	-	-	Not used
WO-61	TWA-14155	Local discharge	Unknown	Temporary soak-away / attenuation pond	3 l/s
WO-66	TWA-16995	-	-	-	Not used
WO-69	TWA-19235	Watercourse	3.5	100m to WBX028	3 l/s
WO-73	TWA-21665	-	-	-	Not used
WO-77	TWA-25140	Watercourse	85.7	230m to WBX037	1 l/s
WO-89	TWB-4655	Watercourse	66.9	WBX038	3 l/s
WO-92	TWB-7400	-	-	-	Not used
WO-95	TWB-9330	-	-	-	Not used
WO-100	TWB-13270	Watercourse	15.4	25m to tributary to Silver River WBP128	2 l/s
WO-104	TWB-15130	-	-	-	Not used
WO-109	TWB-18960	-	-	-	Not used
WO-112	TWB-21205	Watercourse	39.6	WBX048	3 l/s

Washout ID	Chainage	Washout Type	20% of Qmed (l/s)	Watercourse Reference	Washout Design Flow (l/s)
WO-119	TWB-25220	-	-	-	Not used
WO-123	TWC-350	Watercourse	Unknown	330m to WBP309	2 l/s
WO-128	TWC-4415	-	-	-	Not used
WO-133	TWC-6680	-	-	-	Not used
WO-137	TWC-9020	-	-	-	Not used
WO-141	TWC-11485	-	-	-	Not used
WO-146	TWC-13375	-	-	-	Not used
WO-149	TWC-14995	-	-	-	Not used
WO-152	TWC-17145	Ditch	Unknown	BnM drain - WBP343	4 l/s
WO-163	TWC-22915	-	-	-	Not used
WO-167	TWC-24700	Watercourse	Unknown	WBX073 with attenuation pond	4 l/s
WO-173	TWD-3230	-	-	-	Not used
WO-188	TWD-8110	Watercourse	Unknown	WBP093 with attenuation pond	2 l/s
WO-191	TWD-12730	-	-	-	Not used
WO-196	TWD-15095	-	-	-	Not used
WO-198	TWD-16225	Ditch	10.8	WBP097	3 l/s
WO-210	TWD-21575	-	-	-	Not used
WO-215	TWD-24620	Ditch	Unknown	WBP040 with attenuation pond	2 l/s
WO-222	TWD-28775	-	-	-	Not used
WO-229	TWE-120	Ditch	28.4	200m to WBP050	4 l/s
WO-237	TWE-5305	-	-	-	Not used
WO-240	TWE-7315	Watercourse	2.5	WBX086	2.5 l/s
WO-246	TWE-12105	-	-	-	Not used
WO-250	TWE-14910	Ditch	Unknown	WBP215 with attenuation pond	4 l/s