Moa Point WWTP Flood Event Hydraulics Report

Prepared for:
Dentons Kensington Swan

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Prepared by:
Stantec

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Stantec New Zealand

Revision Schedule

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Executive Summary

On 3 February 2026 and 4 February 2026, the Moa Point Wastewater Treatment Plant (WWTP) UV Disinfection channels overflowed and resulted in a full WWTP failure event.

Wellington Water Limited (Wellington Water) engaged Stantec to develop a steady state single phase hydraulic model of the effluent pipelines, bypass system, and ocean outfall with the intention of understanding how the bypass system could be operated during the recovery phase and to understand the hydraulic constraints on the system once the treatment process was brought back online whilst the UV Disinfection system upgrades are progressing.

Through the development of the hydraulic model, review of results and review of wider information provided by Wellington Water, we draw the following conclusions.

1. The Hades steady state single phase modelling does not predict the level of flooding observed. This is a result of the known limitations of the software and the complex hydraulic problems occurring in the pipeline system. Despite the limitations of the software, in our professional opinion, the following can still be concluded from interpretation of the results:
    a. The results of the hydraulic modelling indicate that air can become trapped in the effluent pipeline upstream of the bypass vertical junction.
    b. There is a significant risk that the bypass junction can draw air into the effluent pipeline in the form of two-phase flow (air in water mixture).
    c. This flow regime could cause air to become trapped, increase the required driving head from the UV Disinfection outlet channel, and result in uncontrolled venting towards the UV channel. If this occurred, it would be a likely cause of the flooding.
    d. Considering the observed performance of the bypass system from the 3 February 2026 flood event, and subsequent operation of the bypass system during the recovery phase, it appears that the flow capacity of the bypass system is likely to be substantially less than the stated design capacity from the original Hydraulic Calculations Design Report (Anglian Water).
2. Our professional opinion concerning this likely causal relationship considers the following:
    a. The common variable in the three documented instances of high water levels in the UV Disinfection channels is the large proportion of bypass flow, indicating the problem is likely associated with this junction.
    b. The results of the hydraulic modelling specifically identify the risks of air becoming trapped upstream of the bypass vertical junction.
    c. The results of the hydraulic modelling specifically identify that wastewater flowing down the sloping bypass pipeline reaches a high velocity at the downstream end before it impacts into the wall of the bypass vertical riser and drops into the effluent pipe below. We consider that this will likely initiate two-phase flow in the junction, draw air into the effluent pipeline and prevent air release from the effluent pipeline at this location.
    d. The highlighted risks of air becoming entrained and trapped in the pipeline considers well documented hydraulic phenomena.
    e. Our review of information provided by Wellington Water as documented in this report.
3. One mitigation option for the recovery phase and longer term operation of the pipelines could be to introduce the bypass pipe flow into the effluent pipeline further downstream and downhill from the 10 degree vertical bend at Ch. 57. This would allow the existing riser to act as a vent only, and the hydraulic impact of the bypass connection on the effluent pipeline can likely be significantly reduced and hopefully removed. In addition to the hydraulic requirements, the design of solutions like this will need to consider the site constraints, operational constraints and appropriate safe working methods.
4. The dynamic flow behaviours that we consider to be the likely contributing causes of the flooding event cannot be replicated using Hades or similar steady state hydraulic modelling software. If Wellington Water need to replicate the flooding and likely causal dynamic flow behaviours (two-phase flow, air choking and uncontrolled venting), then methods such as Computational Fluid Dynamic (CFD) or physical models are required. The Hades steady state

single phase modelling has provided an overall understanding of the hydraulic system to best inform the scope of the CFD modelling.

5. We consider that there are opportunities to install additional air release equipment on the bypass and effluent pipelines at specific locations. This is expected to provide some improvement to the issues identified until the design of a new bypass pipeline alignment and connection can be developed and implemented.
6. We have identified other potential risks with the effluent and outfall system that should be investigated by Wellington Water. Wellington Water should address the potential risk of a blockage or debris in the outfall section of the pipe and implement monitoring of operating pressures in the ocean outfall (during the recovery phase at a minimum). Wellington Water should also review the condition of existing air valves and butterfly isolation valves on the effluent pipeline and replace them if required.
7. The CCTV of the steep sections of effluent pipeline identifies erosion of the polyurethane liner and potential degradation of the cement mortar lining at a horizontal bend (and likely further downstream). This has occurred due to high velocity super-critical (shallow and fast) flow impacting on the liner. This flow regime presents risks to the long-term durability of the effluent pipeline liner and structural steel which warrants additional review and investigation.

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Acronyms / Abbreviations

Abbreviation	Full Name
ADF	Average daily flow
CLS	Cement (mortar) lined steel
Ch.	Chainage (m)
HGL	Hydraulic Grade Line
HRT	Hydraulic retention time
ID	Inside Diameter
IPS	Inlet Pump Station
OD	Outside Diameter
PLC	Programmable logic controller
PST	Primary Sedimentation tank
RL	Reduced Level
TWL	Top Water Level
UV	Ultraviolet
WWTP	Wastewater treatment plant

1 Introduction

1.1 Background

On 3 February 2026 and 4 February 2026, the Moa Point Wastewater Treatment Plant (WWTP) UV channels overflowed causing inundation of the lower levels and resulted in a full WWTP failure event.

Wellington Water Limited (Wellington Water) have engaged Stantec to develop a hydraulic model of the effluent pipelines, bypass system, and ocean outfall. This was requested following hydraulic modelling work that Stantec completed in 2025 as outlined in Section 1.3.2. On 5 February 2026 Wellington Water requested responses to the following queries based on the results of the hydraulic model:

1. *"The initial focus should be on the bypass after the inlet screens to where it joins downstream of the UV to determine if there are any constraints on the possible flow there. We are looking to mobilise the outfall without operating the primary and secondary treatment (which will be pumped down to avoid going septic) however there are concerns that the bypass pathway may be only able to take 1500L/s. We are looking to be able to advise on this with urgency."*
2. *"From there another scenario is if there are any flow constrictions when flows are going down both the bypass and UV routes during the UV on-going construction works with the limited flows through UV (I believe there may be 1500L/s going to UV but the UV project team should be able to inform on that)."*
3. *"Adding the outfall pipe into the modelling to determine if that creates any further constraints."*

This report addresses these requests and other related requests received from Wellington Water as referenced within this report.

1.2 Goals

The goals of Stantec's engagement are therefore as follows:

- Build a steady state hydraulic model for the effluent and outfall pipeline system in the Stantec proprietary software Hades.
- Document the hydraulic model build to provide a basis for potential replication of the model in another steady state hydraulic modelling software package or spreadsheet systems by others.
- Run the steady state hydraulic model of the effluent pipeline system under the flow conditions that were likely occurring on the night of the flooding event based on recorded flow data. From these results, and considering the limitations of the modelling software (see Section 2.1), we are able to identify potential factors that could have contributed to the flooding event and provide feedback on Point 2 requested from Wellington Water regarding flow scenarios where flow from both the UV and bypass channel are present.
- Run the steady state hydraulic model of the effluent pipeline system under the expected bypass flow conditions that are occurring during the response phase to provide feedback to Wellington Water about the limits of the system during this recovery phase.
- Review available SCADA data and site observations and identify differences between the observed hydraulic performance and modelled hydraulic performance. Where such differences may exist, we can consider how this may support the review of potential influencing factors.
- Review data and information supplied from Wellington Water covering As Builts, Asset Management data, and recent investigations. Where possible we will at a high level identify other potential factors that may have contributed to the flooding event, or which may pose risks to the future operation of the effluent pipeline and outfall system.
- Offer insights on air transport risks considering the guidance information in the HR Wallingford Report SR 661 (Escarameia, Dabrowski, Gahan, & Lauchlan, 2005)

To address the requests within the 5 February 2026 communication from Dentons/WWL, which considered capacity of the bypass system and effluent pipeline, Stantec has reviewed the results of the hydraulic modelling and broader information provided by Dentons/WWL relevant to hydraulic capacity risks. Through our review of all information provided by Dentons/WWL, we consider it is consistent with our obligations, and necessary for Stantec to discharge our duty of care to provide commentary on potential hydraulic risks and potential causes or contributing factors within the pipeline system. We note that our engagement with Dentons does not specifically request commentary on potential causes or contributing factors that may have led to the flooding event. Stantec commentary on potential cause or contributing factors is purely based on what could be deduced from the hydraulic modelling and study of hydraulic risks to the pipelines which was necessary for our engagement.

1.3 Related Projects

1.3.1 UV Disinfection Upgrade

Separate to the engagement for this hydraulics study, Stantec is also acting as WWL's technical advisor and Engineer to the Contract for the Moa Point WWTP UV Disinfection upgrade project. This Moa Point WWTP UV Upgrade commenced on 30 October 2024, and Possession of Site was granted on 23 September 2025. However, this project is currently in suspension due to the ongoing impacts of the 3 February 2026 flooding event.

1.3.2 Moa Point WWTP Hydraulic Modelling

In December 2023 Wellington Water engaged Stantec to develop a hydraulic model of the Moa Point Wastewater Treatment Plant (WWTP). The scope of work extended from the Inlet Works to the UV Disinfection system. The outfall was excluded from the scope of work. Stantec delivered the Final Hydraulic Report and Hydraulic Profile Drawing to Wellington Water on 23 October 2025.

2 Methodology

2.1 Software

Hades is Stantec's proprietary steady state hydraulic modelling software used extensively around the world by Stantec engineers and modellers, and by other consultants and client organisations.

The following information is extracted from the guidance documentation outlining the application of Hades:

- *"Hades can perform all steady state hydraulics for water, wastewater, mixed liquor, thin biological sludge and other fluids that behave like water.*
- *As well as linear and dendritic (tree-like) systems, in which flow follows clearly defined paths towards a single outlet, Hades also computes flow splits at side weirs and between different flow paths.*
- *Hades computes water surface profiles for supercritical as well as subcritical flow and indicates where hydraulic jumps are likely to occur. "*

What Hades cannot do:

- Hades cannot predict early initiation of hydraulic jumps due to flow swirl (3-D flow) in steep pipes with bends.
- Hades cannot consider time dependent flow behaviour (dynamic flow) and cannot be used for flow buffering type calculations.
- Hades cannot analyse two-phase flow (air in water) behaviour.

2.2 Model Build Summary

2.2.1 General

The components and hydraulic representation of the ocean diffuser, effluent (landside), outfall (seaside) pipeline, and bypass pipeline systems are described in each of the sections below. Assumptions and limitations for the hydraulic model build are also included in the following sections.

The Moa Point WWTP As Built Drawings,1996, were used as a basis to develop the model for elements' dimensions, fittings, and levels. Other reference material for specific locations is referenced in the following model build sections. The model levels and results are in the Wellington 1953 Vertical Datum, which is the same datum as the available As Builts (Works Consultancy Services, 1996).

The full breakdown of how the pipeline and system components have been considered and modelled is also outlined within the attached Hades QA Files, provided in Appendix B.

2.2.1.1 Roughness Scenarios

The Colebrook-White (CW) roughness equation and values have been used for modelling friction loss. Roughness has been based on material type or expected asset component properties, such as erosion of pipe lining.

The following model roughness values have been used:

Table 2-1 Modelled Roughness Scenarios

Material/Model Component	CW Roughness Scenario 1 (mm) 'Poor' Condition	CW Roughness Scenario 2 (mm) 'Normal' Condition
Concrete Channel	3.3	1.5
Effluent Pipeline	0.2	0.06
Outfall Roughness	0.2	0.06
Diffuser Roughness	0.2	0.06

Apart from some short sections of concrete channel within the WWTP itself, the As Built Drawings show that the system is made up of cement lined steel (CLS) pipework with some of the steep downhill pipelines also internally lined with polyurethane. The concrete channel roughness values have been based on the 'poor' and 'normal' CW values nominated in HR Wallingford's Tables for the hydraulic design of pipes, sewers and channels: 8th edition, DIH Barr, 2006, (Wallingford & Barr, 2006). Due to the short lengths considered in the model, the concrete channel roughness is not expected to be critical to the hydraulic assessment.

We have not applied a velocity dependent roughness coefficient to the ocean outfall or diffuser components. Whilst this is typically considered for wastewater pressure mains as per the guidance in Wallingford SR641 (Forty, Lauchlan, & May, 2004), we consider that the high operating velocities in the effluent pipeline and outfall under peak flows of 3,400 L/s will strip slime and so the host material roughness will apply.

A hydraulic roughness of 0.2 mm has been used for CLS pipework, which is slightly conservative for cement or epoxy lined steel and polyurethane lining systems in industry guidance[1]. A conservative value is considered reasonable due to the heavy use of the pipeline under high velocity conditions over the past 30 years. A 'normal' roughness condition scenario has also been used to compare a better friction case in the pipeline and assess the impact and sensitivity of the system to roughness.

2.2.2 Ocean Diffuser

The outfall diffuser has been modelled based on the details provided within the Outfall As Built Drawing Set, dated June 1997, received from Wellington Water on 6 February 2026, and the Moa Point Outfall Diving Inspection Report, dated May 2025 (Undersea Construction Ltd, 2025), received from Wellington Water on 9 February 2026.

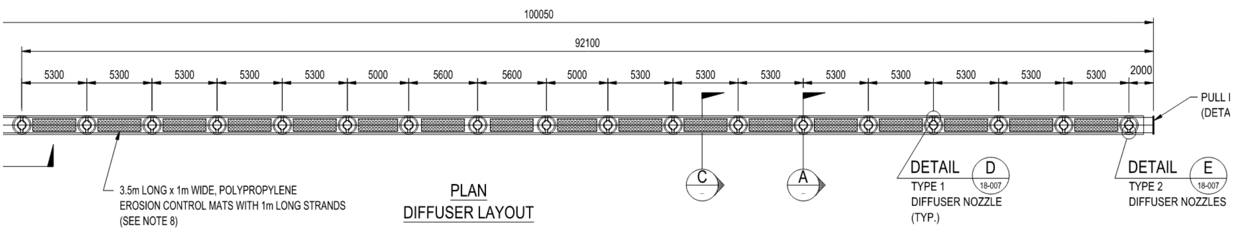

Figure 2-1: Moa Pt Ocean Outfall Diffuser Plan (Extracted from As Built Drawing 951096_18-006 Rev D)

The diffuser section of the outfall consists of a 92 m length of 1200 mm internal diameter (ID) CLS pipe with 18x 585 mm ID vertical risers. Each 585 mm riser can discharge to two nozzles, both of which discharge perpendicularly to the outfall pipeline, a total of 36 nozzles. On one side of the outfall all nozzles are 154 mm ID, whilst on the other side all nozzles are 144 mm ID.

[1] 0.15 is recommended for 'poor' condition epoxy lined steel according to HR Wallingford's Tables for the hydraulic design of pipes, sewers and channels: 8th edition, DIH Barr, 2006, Thomas Telford.

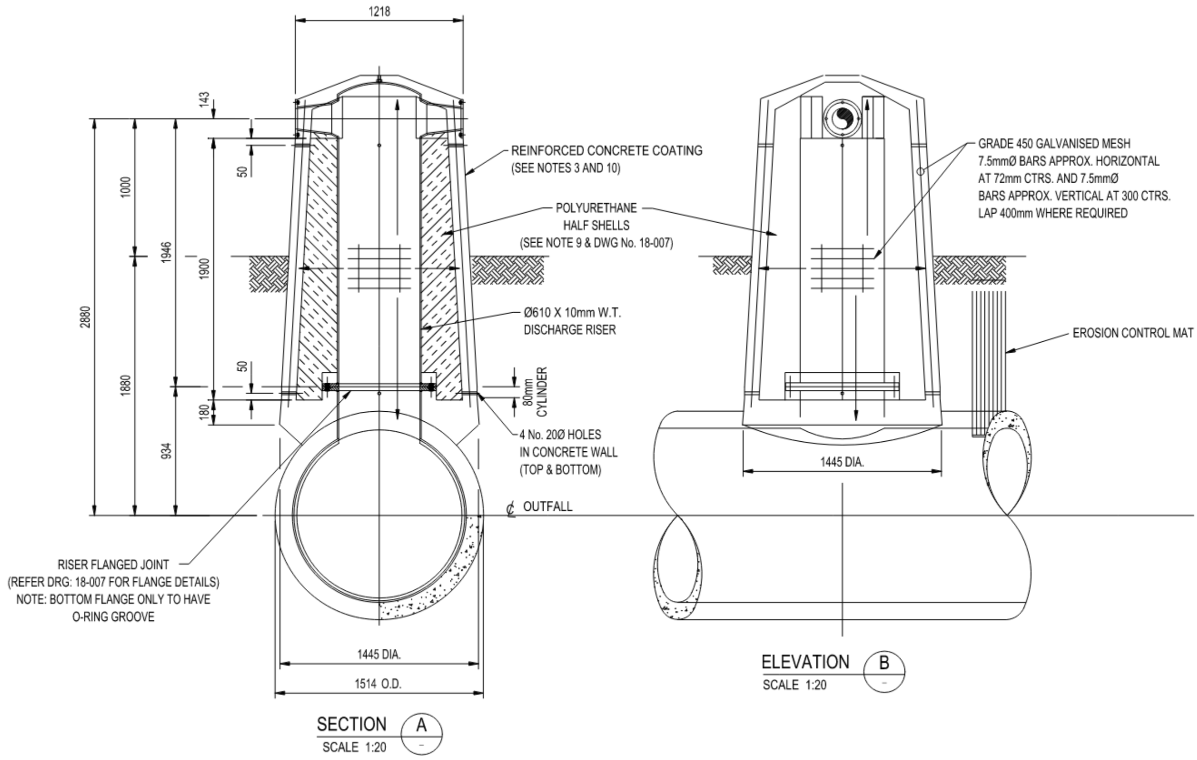

Figure 2-2: Moa Pt Ocean Outfall Diffuser Riser Section and Elevation (Extracted from As Built Drawing 951096_18-006 Rev D)

The Moa Point Outfall Diving Inspection Report dated May 2025 (Undersea Construction Ltd, 2025) records which nozzles were open at the time of inspection. This report indicates that 26 of the total 36 diffuser nozzles were open, with the remaining ports blanked off with blank flanges, examples of the blank flange arrangement are as per the original As Built Details.

Diffuser # from seaward to shoreward	Diffuser Exposed Height out of Seabed (mm)		Open Ports X	
	North face	South face	West	East
1	1650	1600	X	X
2	1650	1700	X	X
3	1750	1650	X	X
4	1650	1600	X	X
5	1700	1600	X	X
6	1600	1600	X	X
7	1650	1600	X	X
8	1750	1700	X	X
9	1700	1650		X
10	1750	1650	X	
11	1700	1600		X
12	1600	1600	X	
13	1650	1600		X
14	1600	1550	X	
15	1550	1500		X
16	1500	1550	X	
17	1450	1400		X
18	1400	1400	X	

Table 4: Exposed heights of diffusers (seabed scour around diffuser positions)
X – Open diffuser ports

Figure 2-3: Moa Pt Ocean Outfall Diffuser Nozzle Inspection record (Table 4 extracted from Outfall Inspection Report (Undersea Construction Ltd, 2025)

The outfall head losses are calculated as follows:

- A series of DN1200x585 tee junctions for each riser branch are included in the model based on calculated internal diameters specified in As Builts. The losses through the tee junctions are calculated in accordance with the methodology outlined in Chapter 12 of DS Miller Internal Flow Systems (Miller, 1996). This considers the relative flow splits between the branch flow and inline flow, and the proportional area of the branch compared to the main line. Several manual iterations are completed between Hades model runs until the flow difference error values reduce to an acceptable level.
- The downstream end of the 585 mm ID vertical riser is modelled as full flow to branch loss coefficient (K=1.2). In addition, a taper loss coefficient is applied for the reduction in diameter as flow transitions from the 585 mm ID riser to 200 mm nominal diameter (DN) portion of the nozzles (this coefficient takes account of one or two nozzles being in service per riser).
- An additional taper loss coefficient is applied as the nozzle reduces from DN210 to DN160 (or DN200 to DN150).
- The hydraulic model of the diffuser has been configured to match the documented diffuser configuration with 26 open and 10 closed nozzles. The correct nozzle diameters are applied in each instance for east facing and west facing nozzles (east facing nozzles are 150 mm and west facing nozzles are 160 mm DN) as documented in the As Builts.
- All internal diameters are calculated reflecting As Built details of OD of the steel pipe, wall thickness, and internal lining thicknesses.
- Figure 2-4 below provides clarity about the portions of the diffuser referenced.

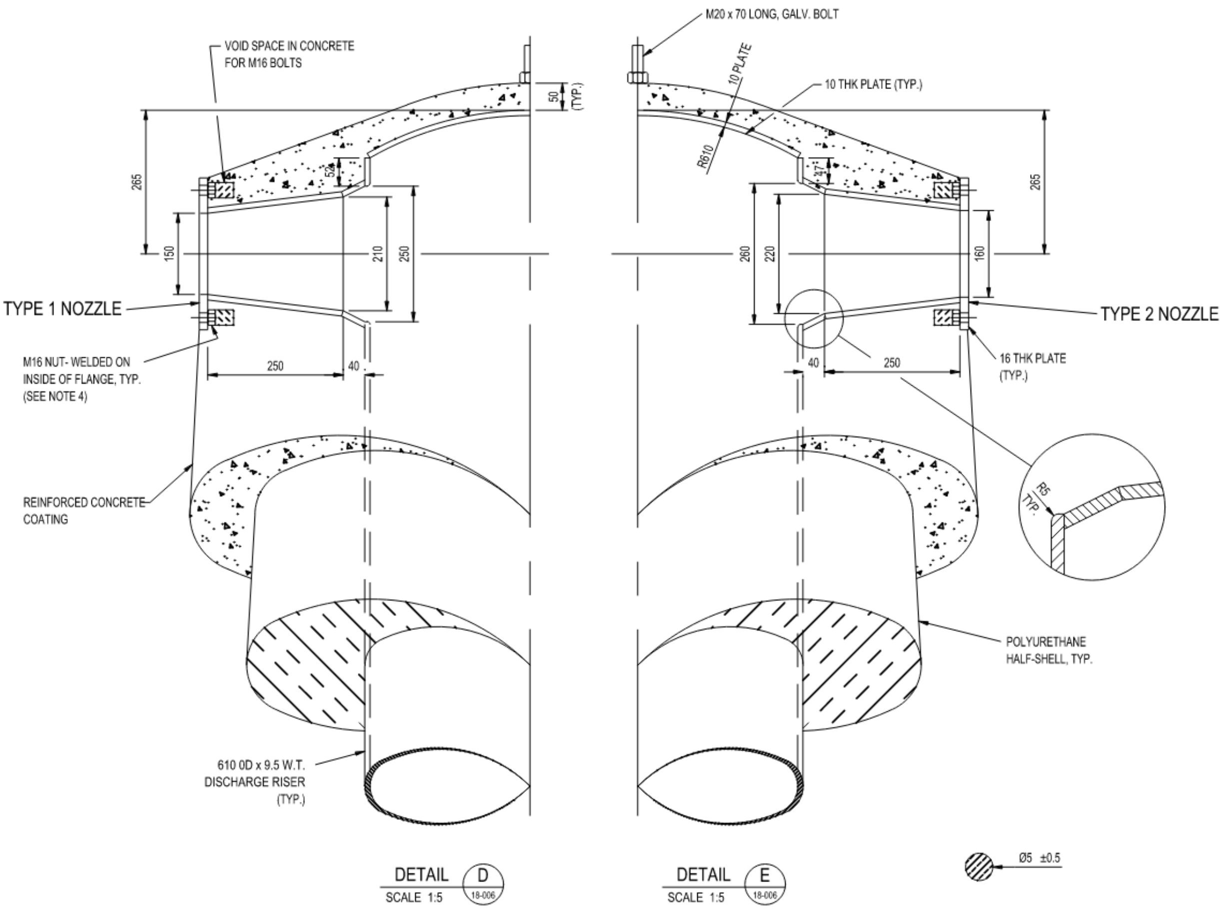

Figure 2-4: Moa Pt WWTP Outfall Diffuser Nozzle Details (Extracted from As Built Drawing 951096_18-007 Rev C)

2.2.2.1 Sea Level

For the purposes of the model, we have considered the High Tide Level as per the MetService highest predicted tide level of 1.7 m (relative to Wellington Port Chart Datum) between February 2026 to March 2026. This level was converted from the Wellington Standard Port Datum (Chart Datum) to Wellington 1953 Vertical Datum, using -0.903 m. The conversion was determined from the Chart Datum zero tide level being defined as 3.565 m below LINZ Benchmark K80/2 (LINZ code ABPC). The LINZ Geodetic Database gives the Wellington 1953 Vertical Datum height of the benchmark as 2.6625 m RL, hence the difference of -0.903 m.

The sea levels have also been adjusted to account for the effect of the specific gravity of sea water. Hence the final discharge water levels used within the model were:

High Tide Level = 1.7 m - 0.903 m = 0.798 m sea level = effective H_2O water level of 1.277 m RL (to Wellington 1953 Vertical Datum).

We have not considered a lower tide level during the flood event, which may otherwise reduce the backpressure on the outfall by up to 1.0 m. Potentially considering a lower tide level in the model would indicate lower risk of flooding in the pipeline, and therefore is unlikely to be a relevant factor considering the flooding observed.

2.2.3 Outfall Pipeline

The outfall pipeline from the on-shore tie in flange to the start of the diffuser pipeline consists of 1,779 m of 1200 ID CLS pipeline. There are vertical and horizontal mitre bends at the start of the pipeline, but otherwise the pipeline follows a straight and consistent vertical alignment from chainage 66 (Ch. 66) to Ch. 1,779 where the outfall pipeline connects to the outfall diffuser. The general arrangement layout of the outfall is depicted in Figure 2-5, Figure 2-6, and Figure 2-7 below.

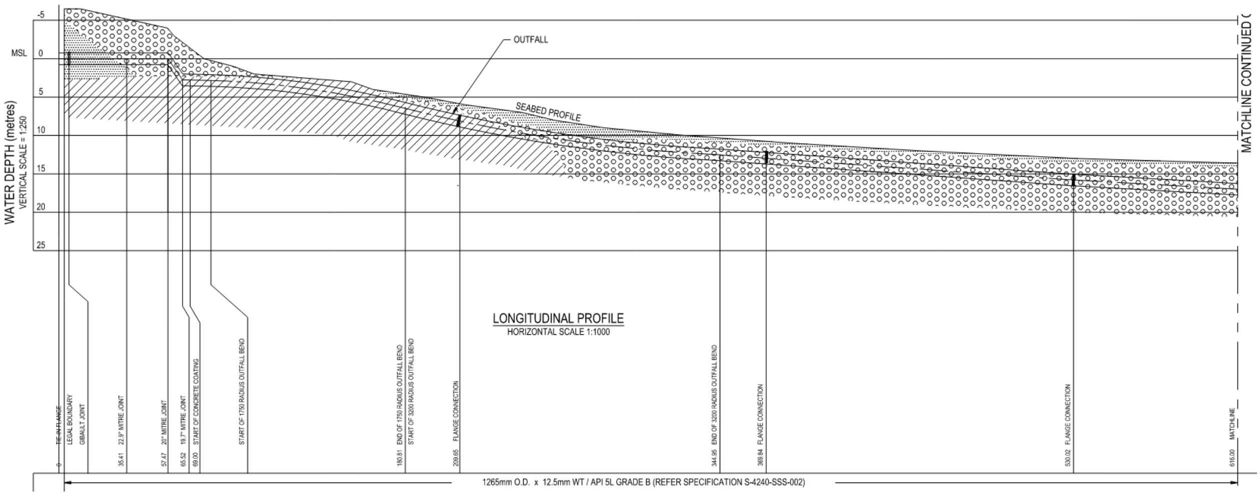

Figure 2-5: Moa Pt WWTP Ocean Outfall Ch. 0 to Ch. 616 (Extracted from As Built Drawing 951096_18-001 Rev E)

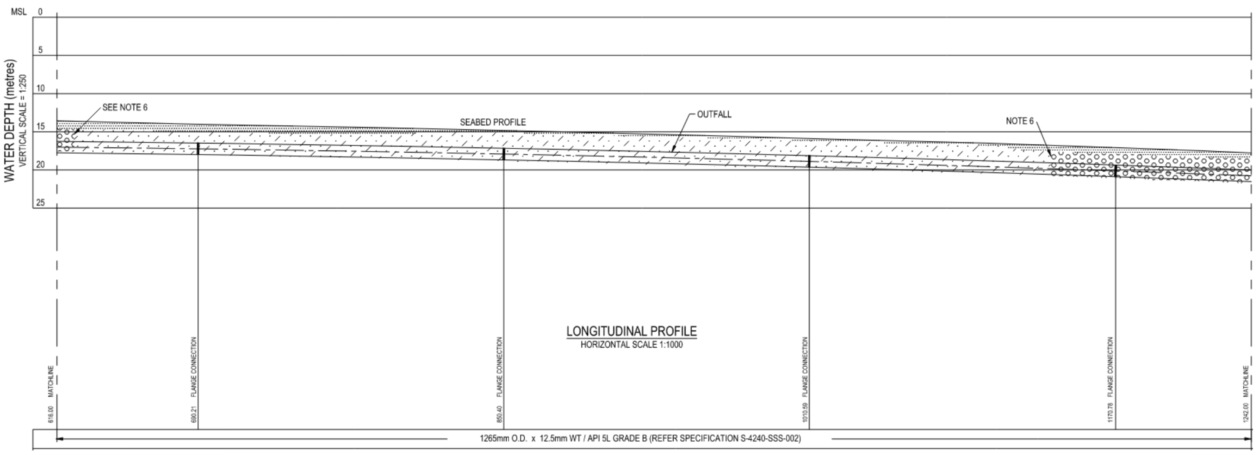

Figure 2-6: Moa Pt WWTP Ocean Outfall Ch. 616 to Ch. 1242 (Extracted from As Built Drawing 951096_18-002 Rev B)

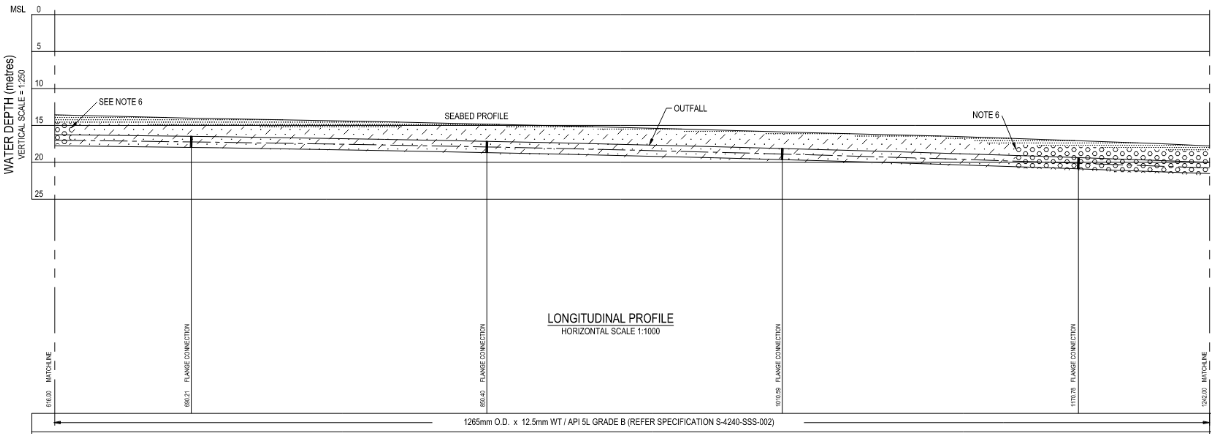

Figure 2-7: Moa Pt WWTP Ocean Outfall Ch. 1242 to Ch. 1870 (Extracted from As Built Drawing 951096_18-003 Rev C)

The horizontal and vertical mitre bends on the outfall pipeline at the beginning of the pipeline are included in the model using Hades recommended local loss coefficients (see Hades export files in Appendix B).

In lieu of any information supporting potential sedimentation in the outfall, we have considered a clean pipe with zero loss of flow area compared to the As Built data. This is considered suitable for a treated effluent pipeline that is subject to high flushing velocities during Wellington’s regular wet weather events. Refer Section 4.9 for consideration of low velocities in portions of the outfall diffuser.

2.2.4 Effluent Pipeline

The effluent pipeline extends from the UV outlet channel, under the Primary Sedimentation Tanks (PSTs), down the hill, down Stewart Duff Drive, and up to the tie in flange of the outfall pipe after the intersection of Stewart Duff Drive and Moa Point Road.

The pipeline has been modelled reflecting the details on the As Built Long Sections, Plans, and Detail Drawings. Extracts of the long sections for these pipelines are shown in Figure 2-8 and Figure 2-9 (As Builts are also provided in Appendix A).

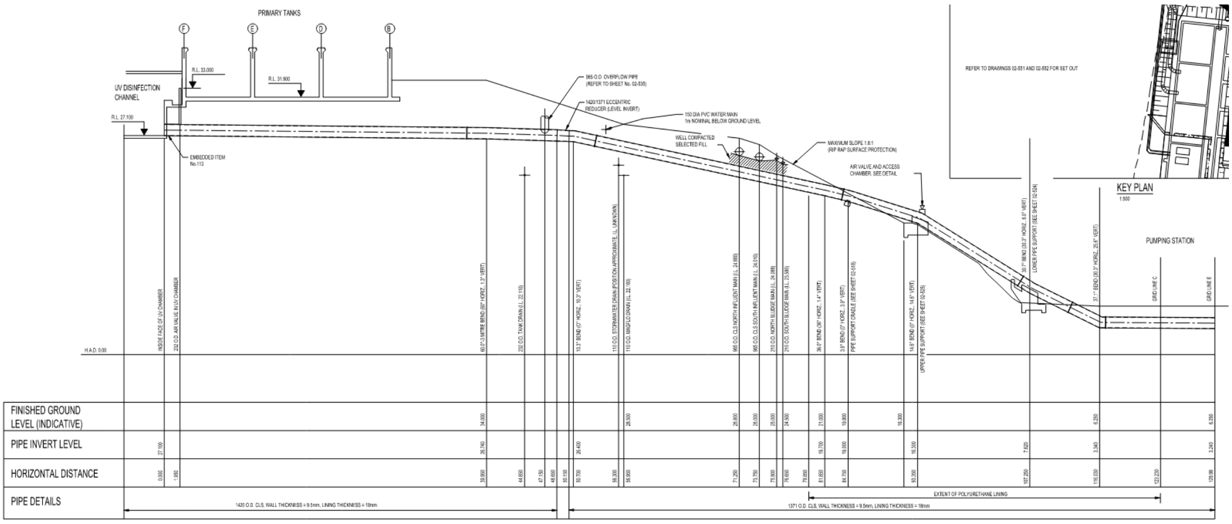

Figure 2-8: Moa Point WWTP Effluent Pipeline Long Section from UV Outlet channel to PS Grid E (from As Built 951092_02-519)

There is no provision for air release where the pipe's gradient steepens near to Ch. 50 m immediately downstream of the bypass pipe vertical tee junction. The risks posed by this are considered in Section 4.6.

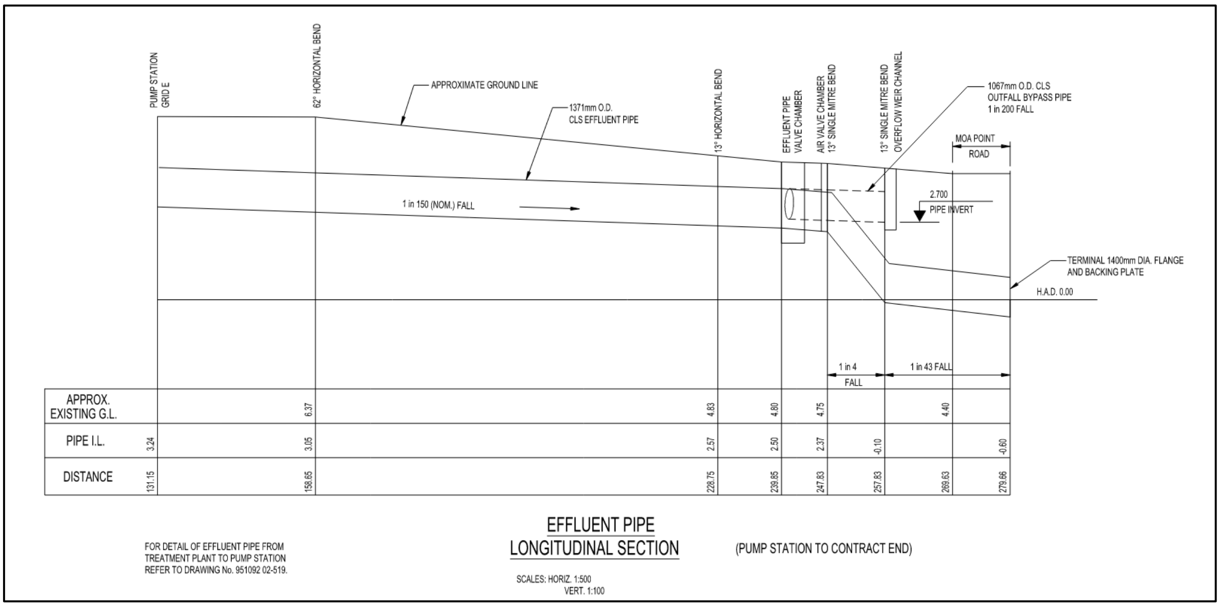

Figure 2-9: Moa Point WWTP Effluent Pipeline Long Section from PS Grid E to Tie-in Flange (from As Built 951092_02-506)

This diagram does indicate an air valve chamber near Ch. 247 at the start of the polyurethane lined section.

The hydraulic representation for the pipeline considers the following:

- Hydraulic model includes hydraulic loss allowances for all pipe bends, tapers, valves, tees, and air valve offtakes as per the available As Built drawings.
- The effluent pipeline details, including locations and types of vertical and horizontal bends, were primarily based on the long sections provided in As Builts 02-506 and 02-519, and plan sections provided in As Builts 02-504, 02-551, and 02-552.

- The pipeline reduces in size twice along its length. First, it reduces from an OD1420 CLS pipe to an OD1371 CLS at a level invert eccentric reducer, shortly downstream of the bypass pipe connection. The second reduction is from the OD1371 CLS pipe down to a OD1219 CLS pipe at a concentric reducer, shortly upstream of the DN1200 butterfly valve in Stewart Duff Drive.
- The hydraulic model assumes the butterfly valve in Stewart Duff Drive is fully open and is clean without any build up from debris/ragging. The relevance of this assumption is discussed further in Section 4.8.
- There are two air valve locations present on the effluent pipeline, which we have modelled with local head loss coefficients K=0.04 reflecting the documented performance of these fittings outlined in Miller (Internal Flow Systems (second edition), 1996).
- The bypass pipe joins at Ch. 47.15 m. The nature of the connection is discussed in Section 2.2.5. A convergence local head loss coefficient was applied to the effluent pipe immediately upstream of the incoming bypass connection as per Miller guidance.
- From the review of the CCTV of the effluent pipe, we have determined that there is an approximate 5 degree vertical bend approximately 2 m upstream of the bypass junction that is not recorded on the As Builts. The head loss arising from a 5 degree bend on this pipeline is negligible and will not substantially affect the hydraulic model.
- The exit portion of the UV channels is included in the model up to immediately upstream of the exit weir. This helps to inform if the exit weir is predicted to be submerged in any of the flow scenarios.

2.2.5 Bypass Pipeline

At the end of the inlet works, in the common grit outlet channel immediately upstream of the primary sedimentation tanks (PSTs), screened and de-gritted wastewater flows which exceed the capacity of the downstream treatment system are diverted over two parallel 1200 mm wide actuated weir penstocks. The diverted wastewater combines before entering the vertical 965 OD CLS bypass pipe. The position of these two weir penstocks relative to the inlet works and the position of the bypass pipe entrance is shown in Figure 2-10 below.

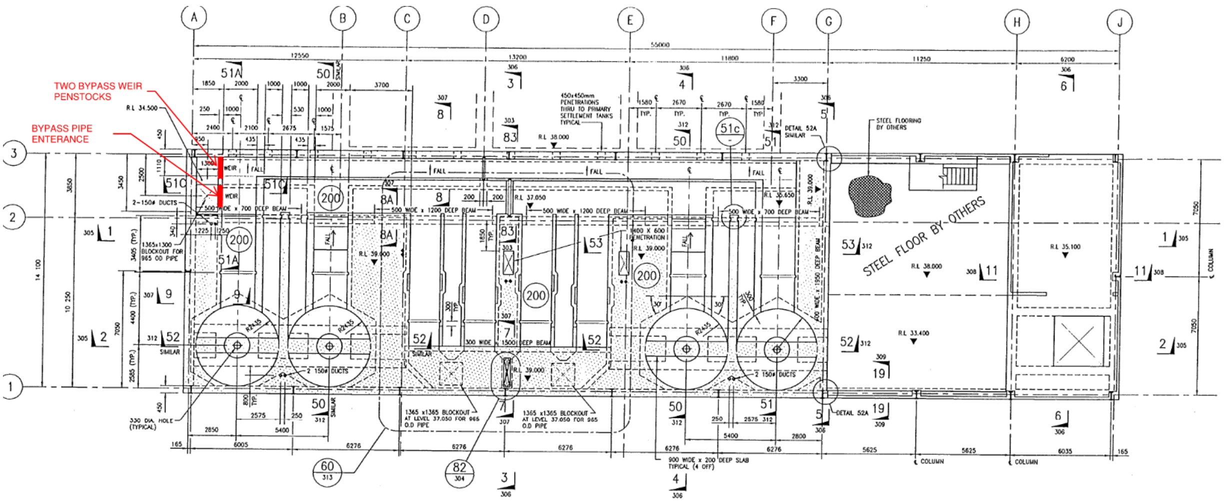

Figure 2-10: Inlet Works Plan Drawing (Extracted from Moa Pt WWTP Upper Floor Plan As Built 951092_02-303)

The 965 OD CLS bypass pipe drops vertically down approximately 2.5 m before turning through a vertical 67 degree bend to transition to a steep sloping section 7.5 m long at a slope of 23 degrees. At the end of the sloping section the bypass pipe connects into the vertical OD1066 CLS riser pipe in a wye junction, where the bypassed screened raw wastewater drops vertically by approximately 2.0 m to enter the common OD1420 effluent pipe in a vertical 90 degree tee junction. The details of this pipework are depicted in the Figure 2-10, Figure 2-11, and

Figure 2-12 below (relevant As Builts are included in Appendix A).

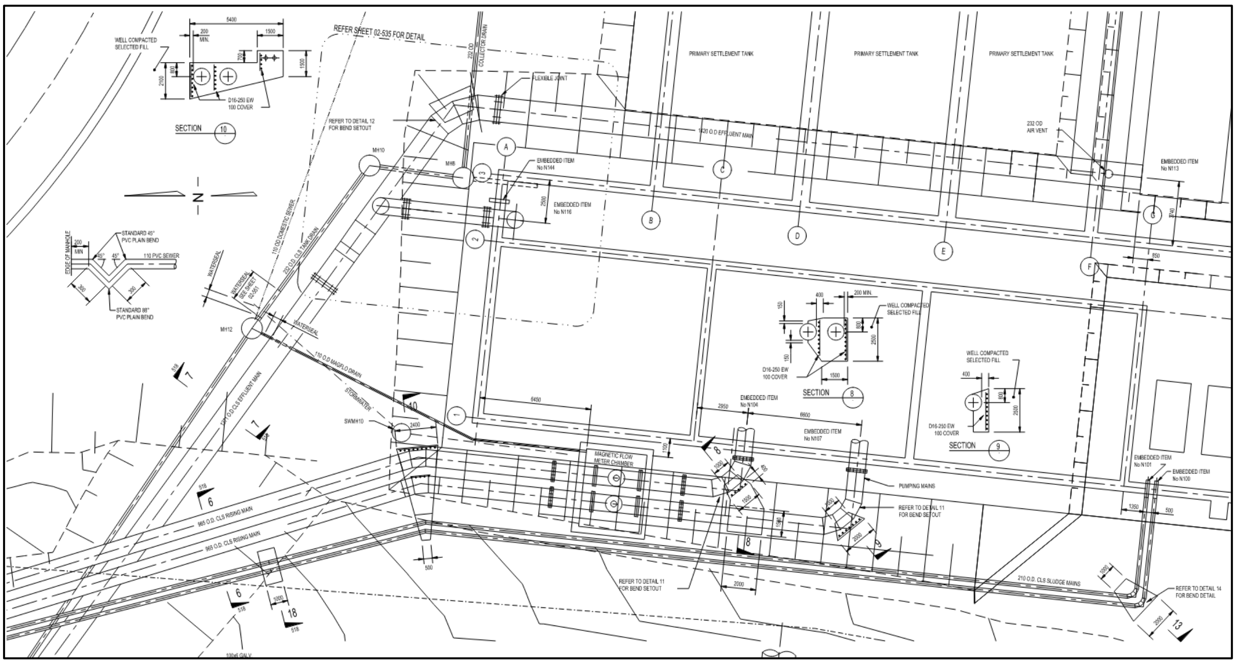

Figure 2-11: Inlet Works Piping Plan (Extracted from Moa Pt WWTP As Built 02-552)

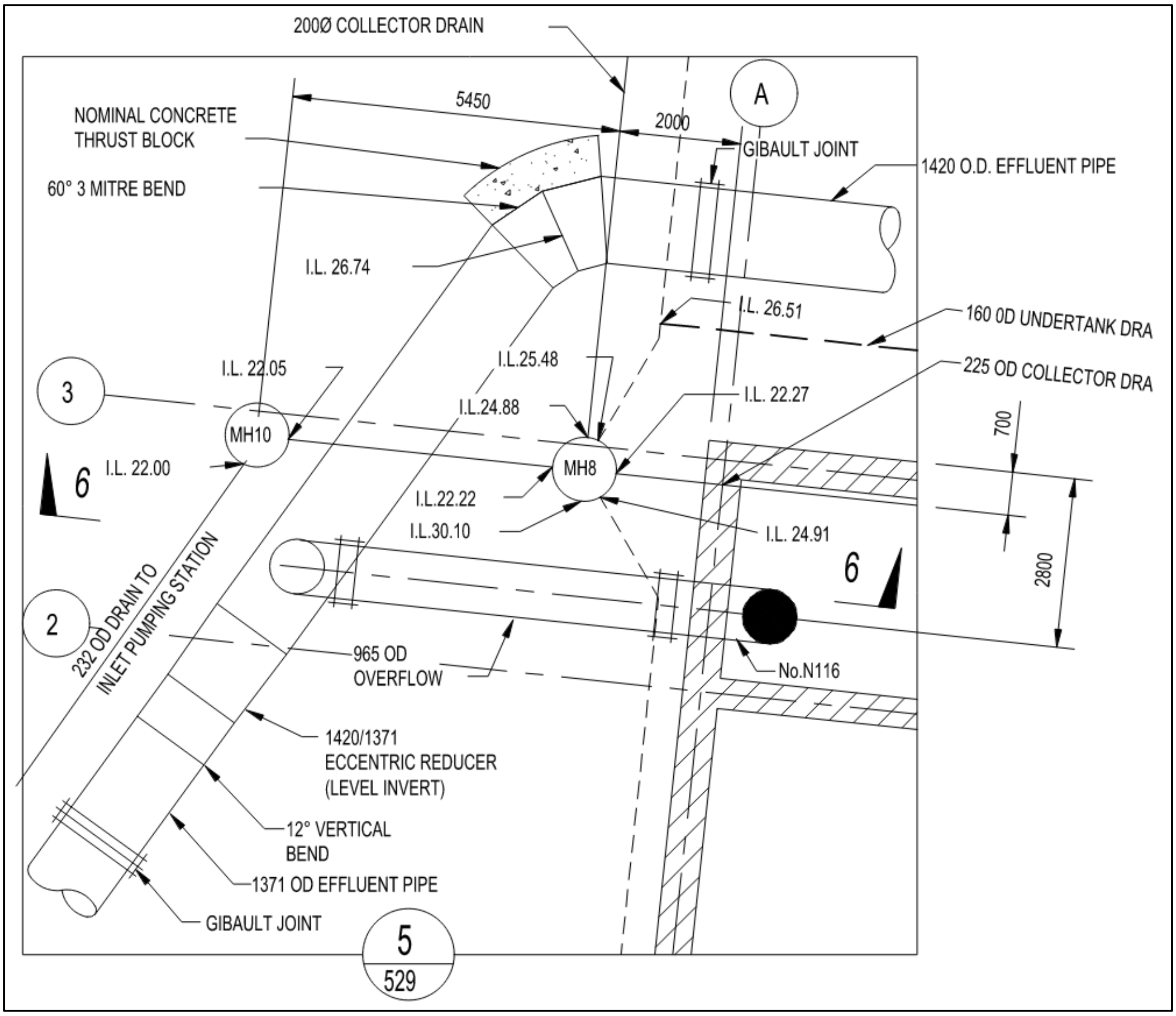

Figure 2-12: Bypass Pipeline Connection to Effluent Pipeline Plan (Extracted from Moa Pt WWTP As Built 02-535)

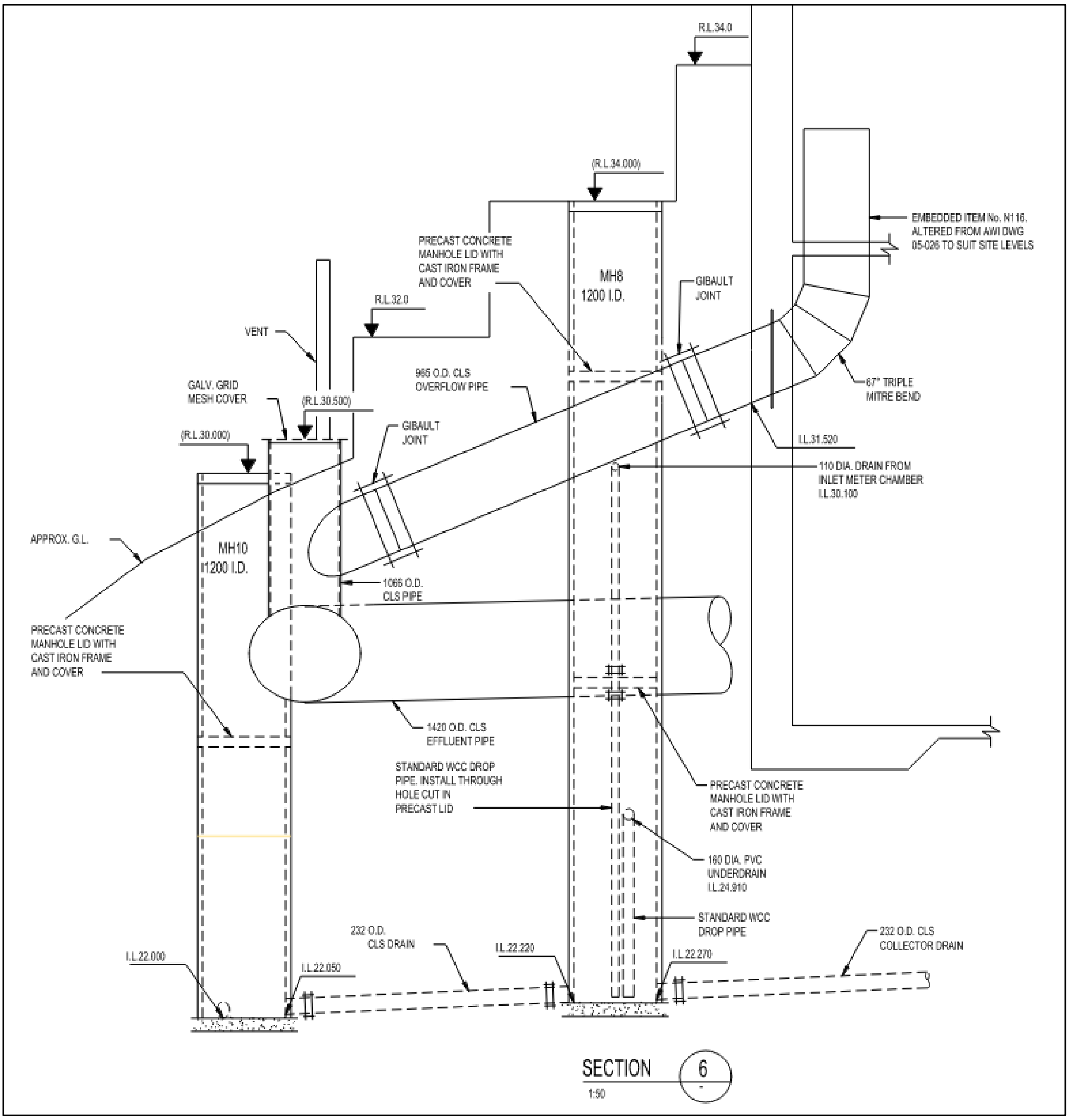

Figure 2-13: Elevation of Bypass Pipeline Connection to Effluent Pipeline (Extracted from Moa Pt WWTP As Built 02-535)

We have represented the bypass pipe system in the model as follows:

- We have not included the inlet works within the model. This is an acceptable simplification as we understand that Wellington Water are primarily interested in the hydraulic conditions downstream of the bypass weirs, in the effluent pipeline and in the UV channels.
- We have set the bypass weir penstocks positions to the low level position of 36.54 m RL (As Built Drawing 951092_05-029) reflecting verbal feedback from Wellington Water provided during the site visit on 10 February 2026 that this was the position the weir was observed by operators to be in its lowest position following the flooding event.

- To ensure that sufficient head is available in the bypass outlet box, and to check that this doesn't affect the water levels in the inlet works, the entrance to the 965 OD bypass pipe has been modelled as an orifice entry, with a full loss of velocity head from the flow approaching horizontally towards the pipe entry. The limitations associated with modelling this pipe entry and the risks posed by this configuration are outlined in Section 4.2.
- The wye junction of the 965 OD sloping pipe connecting to the Vertical OD1066 CLS pipe has been modelled considering local loss coefficients derived from Figure 13.8 of Internal Flow Systems (Miller, 1996) for asymmetrical combining wye junctions, including appropriate adjustment for velocity head differences.
- The Vertical combining tee where the OD1066 CLS bypass pipe drops onto the OD1420 CLS effluent pipe has been modelled using the local loss coefficients derived from Figure 13.11 from Internal Flow Systems (D.S. Miller) for combining 90 degree tee junctions, including appropriate adjustment for velocity head differences. The head loss coefficient for this tee junction is updated in the model for flow scenarios with different proportion flow splits.
- Refer Section 4 for discussion regarding the limitations and challenges of modelling these pipe junctions given the potential for air entrainment and flow bulking along the bypass pipeline.

2.3 Scenarios Considered

2.3.1 Flooding Event

Wellington Water have provided the Infrastructure Data graph documenting the flows to the plant and from the UV system outlet. A snapshot of the last few hours of inflow and outflow leading up to and during the flooding event is depicted in Figure 2-14 below.

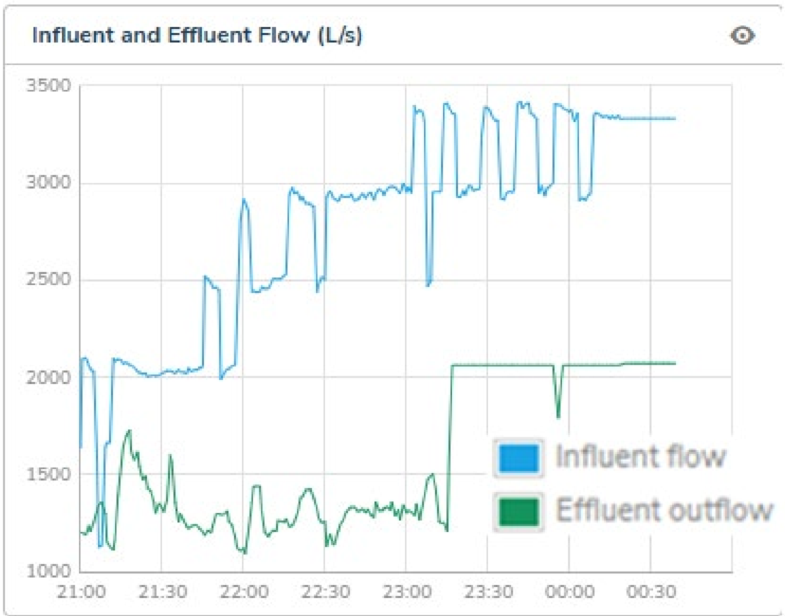

Figure 2-14: Moa Point WWTP Inflows and UV Outflows (source: Wellington Water Infrastructure Data). NB: Inflow is measured by the magnetic flow meters on each of the twin rising mains that discharge to the head of the inlet works. Effluent Flow is calculated from head over the UV channels outlet weir as outlined in UV system P&ID.

The SCADA graph in Figure 2-14 indicates the following.

- From 11 pm onwards on 3 February 2026, measured flows from the Influent Pump Station (IPS) varied between approximately 3,000 L/s and 3,400 L/s. This fluctuation occurs due to the start and stop operation of the assist pump as required to manage inflows to the IPS. These flow rates correspond to seven to eight pumps in operation.

- The Shutdown Plan for the UV upgrade works (Wellington Water, 2025) states *'Flows exceeding 1500 /s will be diverted to the ocean outfall at the step screens. This diversion will be PLC hard coded and controlled under a LOTO permit.*' During the Stantec, Wellington Water and Veolia operator meeting at the Moa Point WWTP on 17 March 2026, the operator confirmed that this is achieved by modulating control of the bypass weir penstocks whereby the weir penstock tries to maintain the water levels in the common outlet channel below the level that is known to result in 1,500 L/s flowing through to the PSTs. This is hard coded in the control system and can't be adjusted by the operator directly from the SCADA system. In Figure 2-14, from 9pm until approximately 11:15 pm on 3 February 2026 the pass forward treatment flows are recorded as approximately 1500 L/s. Then at 11:15 pm the flow measurement suddenly rises and flatlines at approximately 2,050 L/s. Refer to Section 3.3.2 for further interpretation and discussion of the high flow readings in the UV channels and limitations of the instruments.
- Considering that the flow to the UV system was being controlled by the PLC in accordance with the Shutdown Plan (Wellington Water, 2025), and given that we know that the UV outflow is calculated based on water level above the UV outlet weir level, it is likely that the recorded flow of 2,050 L/s out of the UV channel was not indicative of flow through the WWTP. This recorded flow is considered more likely to have occurred due to the downstream flow conditions drowning the weir and increasing water level in the UV channel exceeding the maximum range of measurement of the level sensor.
- The Infrastructure Data for the afternoon of 3 February 2026 indicates that there were periods between 5 pm and 10 pm when the recorded effluent flow from the UV channels exceeded the intended flow control limit of 1,500 L/s as documented within the Shutdown Plan (Wellington Water, 2025). During the Stantec, Wellington Water and Veolia operator meeting at the Moa Point WWTP on 17 March 2026, the operator confirmed that this was due to the relatively fast increase to the inlet flow rate when additional pumps come online compared to a relatively slower response time of the actuated weir penstocks.
- Considering the above, for the Hades modelling of the flood event, we have considered a total inflow at the IPS of 3,400 L/s split between a bypass flow of 1,900 L/s and a UV outlet flow of 1,500 L/s.

2.3.2 Bypass only Scenarios (during recovery)

All flows received at the WWTP are currently diverted to the bypass pipe into the main outfall while recovery works are underway. Wellington Water have requested that the expected bypass flow conditions are tested with the hydraulic model so that the limits of the system during the recovery phase can be assessed. Two bypass flow scenarios have been created for this assessment as follows:

- Bypass (3 Pumps) – Considers 3 pumps running at the IPS with 450 L/s each – Total Inflow – 1,350 L/s
- Bypass (4 Pumps) – Considers 4 pumps running at the IPS with 450 L/s each – Total Inflow – 1,800 L/s

Additional pump scenarios have been excluded from this assessment as more pumped inflow is expected to pose too great a risk of flooding the UV channel based on site observations, see Section 3.3.1.

3 Results

3.1 Flooding Event Scenario

The results of the flooding event scenario within the steady state Hades model are presented in Figure 3-1 below.

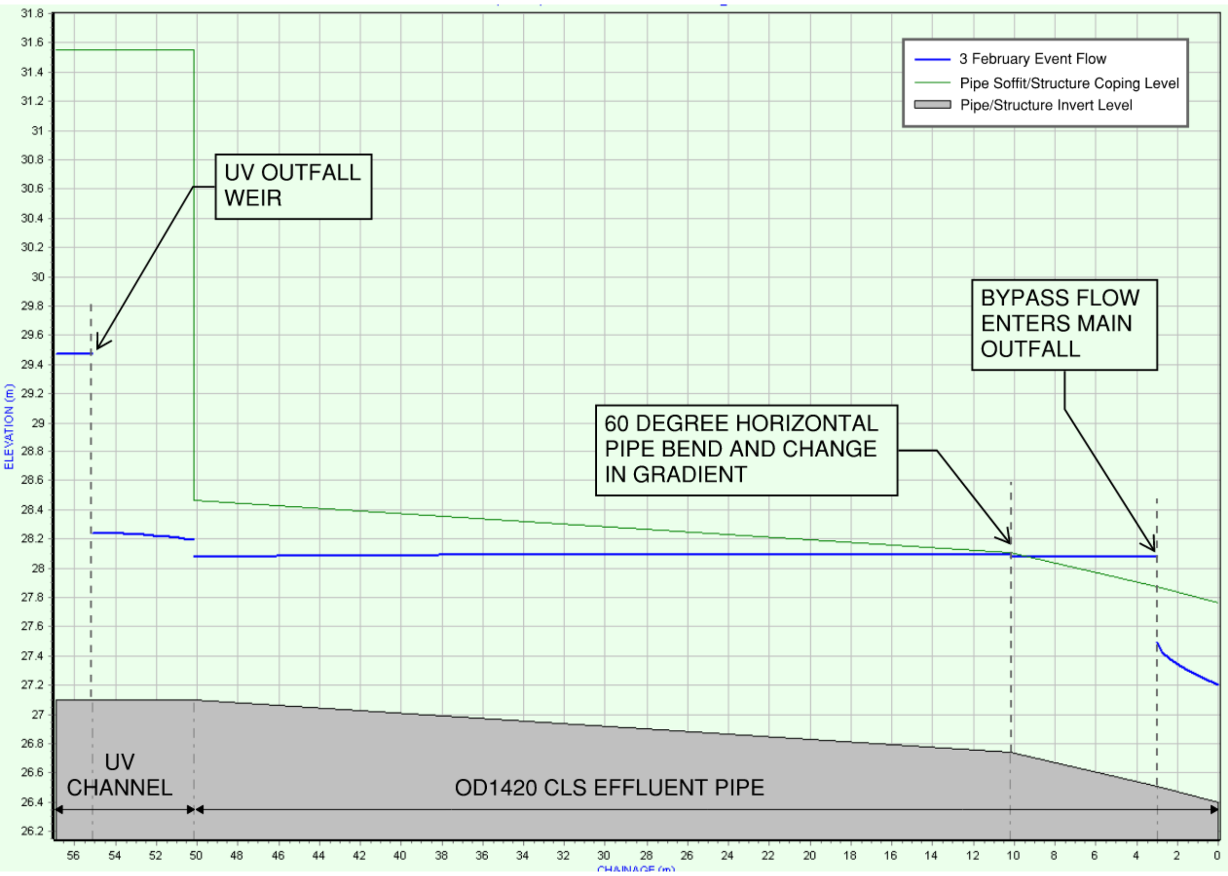

Figure 3-1: Hydraulic Grade Line Flood Event Scenario Effluent Pipeline from UV Outlet Channel to OD1420/OD1371 Reducer

Figure 3-1 shows that the introduction of the bypass flow raises the upstream effluent pipe hydraulic grade line above the soffit level of the effluent pipe. This causes a sub-critical flow regime upstream of the bypass junction. Downstream of the bypass junction, the hydraulic grade line drops below the pipe soffit as the flow transitions to a supercritical flow regime.

The hydraulic model is based on the As Built details and does not include the new information regarding the vertical alignment of the effluent pipeline upstream of the bypass junction that was discovered from the CCTV footage (refer Section 3.3.3). We consider that the presented results and discussion are still valid despite this discrepancy.

The hydraulic model results show the predicted water level as having adequate freeboard within the UV structure which does not match observations relayed by Wellington Water that the flooding occurred from the UV Disinfection channels. The potential reasons for this discrepancy are discussed in Section 4.

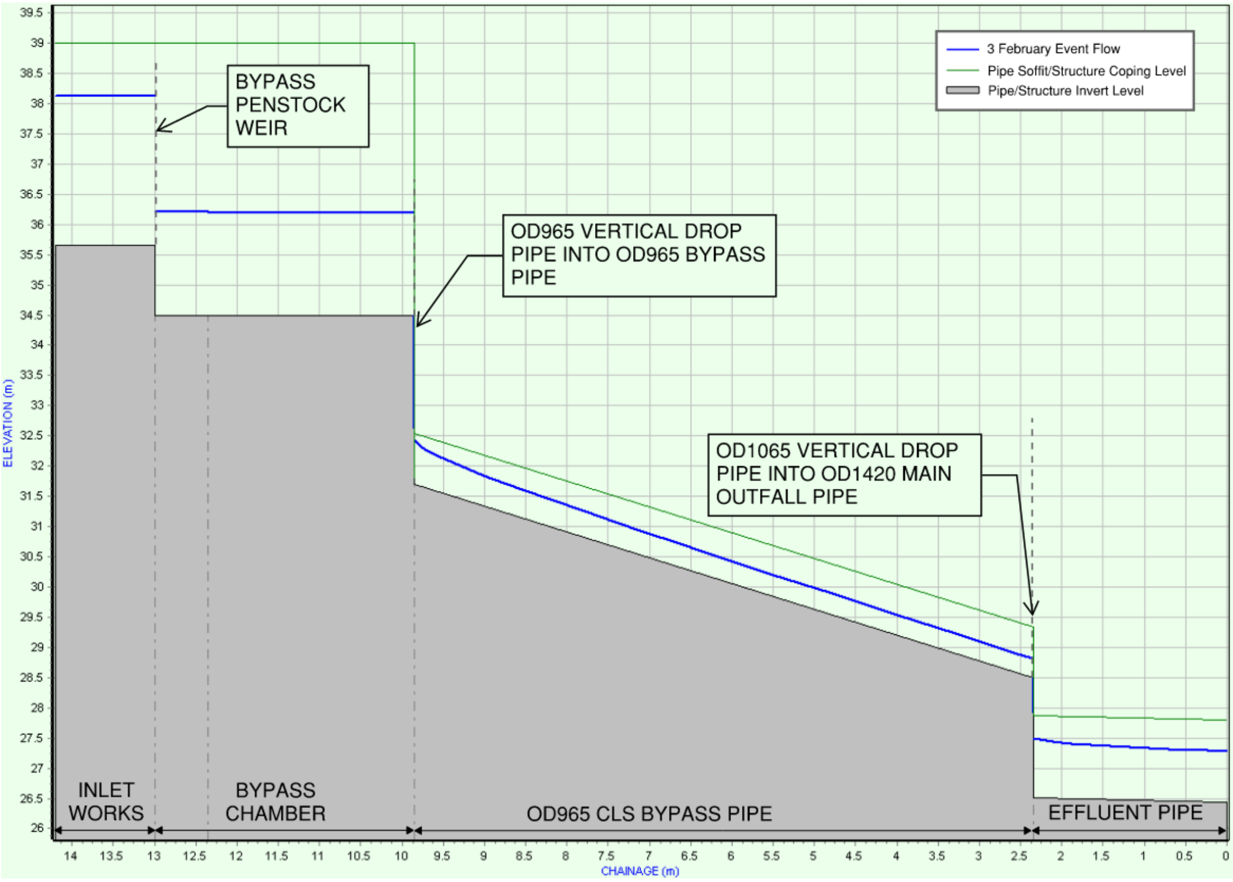

Figure 3-2: Hydraulic Grade Line Flood Event Scenario Bypass Pipeline from Inlet Works Channel to OD1420/OD1371 Reducer

Figure 3-2 shows the predicted hydraulic profile through the bypass pipeline in the flooding event. This indicates super-critical flow through the bypass pipeline due to the steep pipe gradient, with the velocity predicted to reach 8.6 m/s. If the OD1066 vertical riser pipe has an elevated water level, then a hydraulic jump will occur at the downstream end of the bypass pipe. The results indicate that there should have been adequate freeboard within the bypass chamber at the inlet works.

We have used industry good practice guidance to undertake an assessment of the minimum submergence required above the 965 OD outlet pipe within the bypass chamber to prevent air entrainment in the flow leaving the bypass chamber. This indicates that due to the flow velocity under the 1,900 L/s bypass flow and considering the pipe diameter, a minimum submergence of 2.9 m would be required to prevent air entrainment and therefore at a submergence of 1.8 m air entrainment is possible *(Air problems in pipelines. A Design Manual, 2005)*. This calculation does not outline the scale of air entrainment risk. The calculation method just indicates that the risk is present.

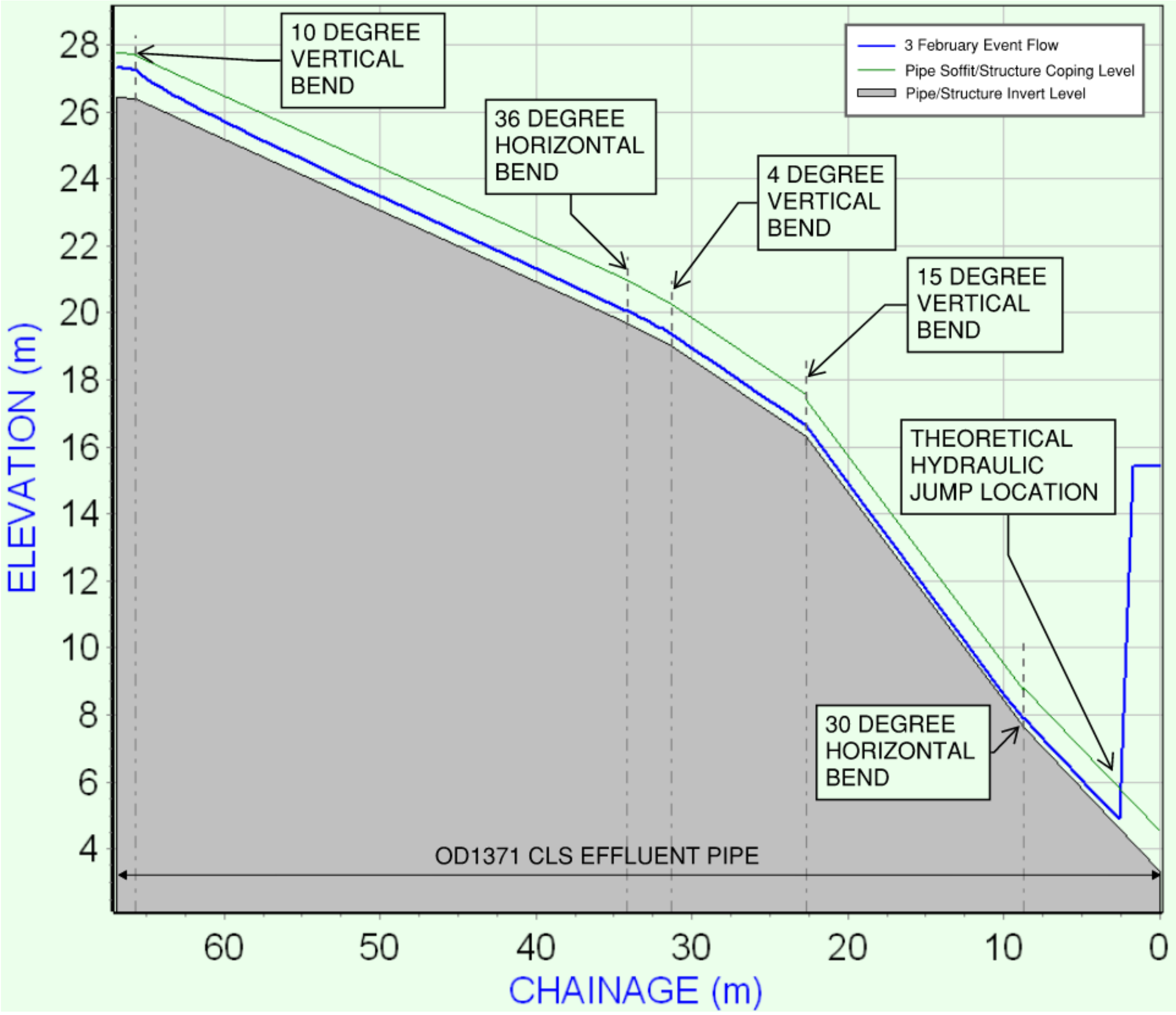

Figure 3-3: Hydraulic Grade Line Flood Event Scenario Effluent Pipeline from OD1420/OD1371 Reducer to bottom of hill

Figure 3-3 shows the wastewater accelerating down the hill in supercritical flow regime until it encounters a hydraulic jump part way down the hill. The exact location of the hydraulic jump cannot be predicted with certainty in Hades but is expected to occur as the supercritical flows meet the elevated hydraulic grade line that has backed up from the ocean outfall and diffusers, creating a submerged pipe with full flow. It is likely that 'white water' flow is occurring due to entrained air which would reduce the specific gravity of the air / water mix and cause the hydraulic jump to form further upstream compared to the predicted location in the Hades "black water" hydraulic model.

The velocity of the flow is predicted to be extremely fast down the hill with the theoretical highest velocity being up to 15.2 m/s. There are potential physical limitations to the flows reaching this speed, due to early initiation of hydraulic jump from horizontal bends causing a wave to break in the pipe. The implications of the expected high velocities will still be relevant and are discussed in Section 4.7.

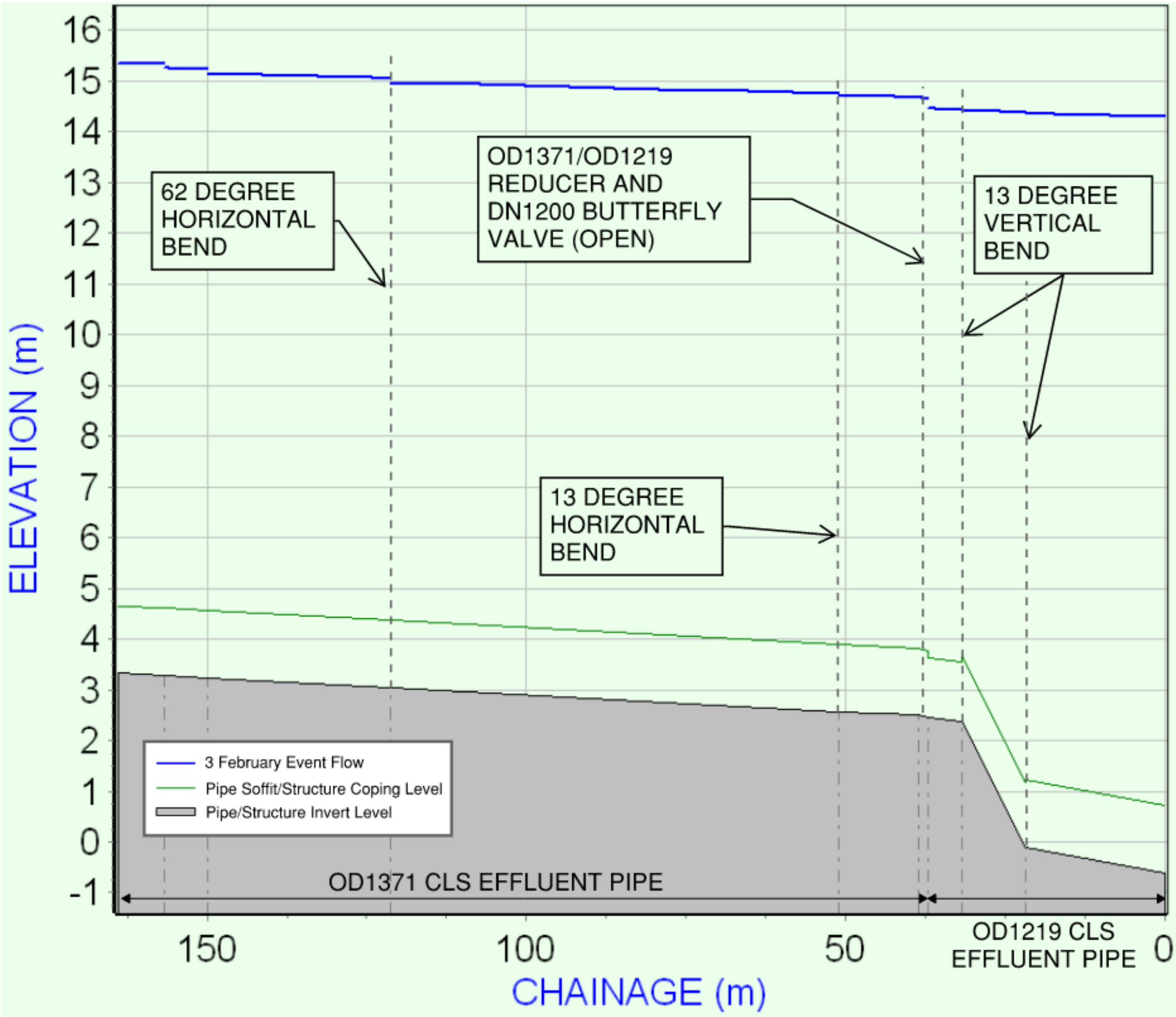

Figure 3-4: Hydraulic Grade Line Flood Event Scenario for the Effluent Pipeline from bottom of hill to tie-in flange (start of ocean outfall)

Figure 3-4 shows the predicted hydraulic level of 14.1 m RL at the tie-in flange near the foreshore. This hydraulic level has backed up from the ocean outfall and diffuser operating in high tide, with 3,400 L/s flow. The grade line increases steadily upstream under full pipe flow without apparent large hydraulic losses. The theoretical water level (HGL) at the bottom of the hill with 3,400 L/s in the pipeline is 15.4 m RL.

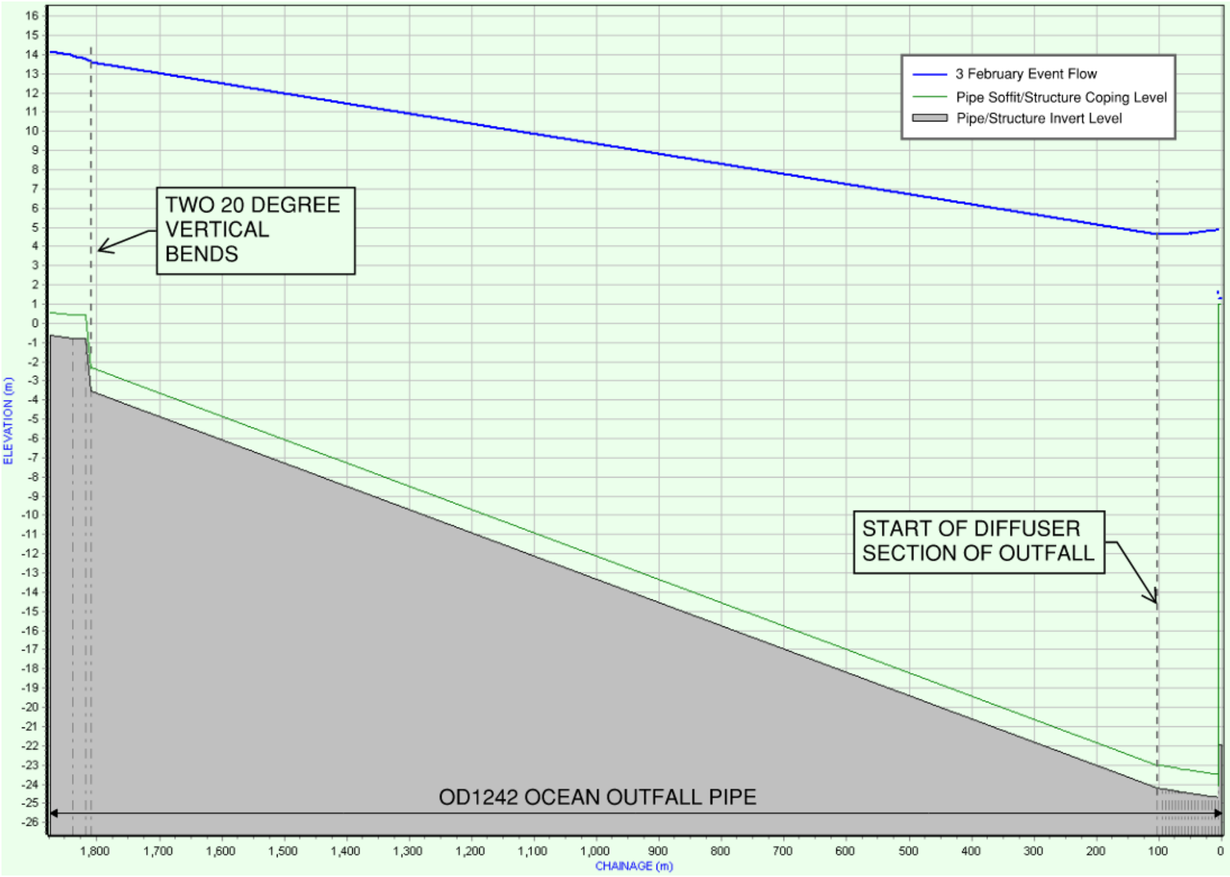

Figure 3-5: Hydraulic Grade Line Flood Event Scenario for the Ocean Outfall and Diffuser

Figure 3-5 shows the outfall and diffuser hydraulic performance. The pipes flow full, which will be the case in all scenarios, and the losses are primarily governed by friction within the 1,800 m long ocean outfall pipe and the discharge losses from the diffuser nozzles. These locations are not predicted to create significant hydraulic risks that would negatively impact the system's operation.

3.1.1 Roughness Comparison

Key locations have been used to compare water levels with the flood event flows between the 'normal' (k_s = 0.06 mm) roughness scenario and the 'poor' (k_s = 0.2 mm) roughness scenario. These results are presented in Table 3-1 below.

Table 3-1: Roughness Scenario Comparison for Flood Event Scenario

Location	Predicted HGL (m RL) under CW Roughness Scenario 1: 'Poor' Condition	Predicted HGL (m RL) under CW Roughness Scenario 2: 'Normal' Condition
UV Channel	28.24	28.24
Bypass Chamber	36.19	36.19
Top of Hill (10 degree vertical bend)	27.27	27.27
Tie-in Flange (start of ocean outfall)	14.35	12.80

The results indicate that the upstream portion of the model is not sensitive to a change in roughness. It is expected that the hydraulics at the top of the hill will be governed mainly by local losses and pipe levels rather than friction losses. There is a larger difference at the tie-in flange. This indicates that the friction losses in the 1,800 m long ocean outfall would govern the hydraulic losses.

3.2 Bypass Scenarios (during recovery)

The hydraulic grade lines for the scenarios where all flows are directed through the bypass pipe to the main outfall are presented in Figure 3-6 through Figure 3-9 below.

The Hades model predicts that the effluent pipe from the UV outlet channel has a stationary water level within the pipe as shown in Figure 3-6. Observations from site as outlined in Section 3.3.1 indicate that water levels in the pipe are higher than what the model predicts.

The weir penstocks in the bypass chamber are predicted to have adequate downstream freeboard and not become submerged in either the three or four pump scenarios.

Velocities are high at the steepest sections of the effluent pipe (Figure 3-8) and in the OD965 bypass pipe (Figure 3-7). The velocities range from 13.4 m/s and 14.0 m/s in the effluent pipe and 8.3 m/s to 8.6 m/s in the bypass pipe.

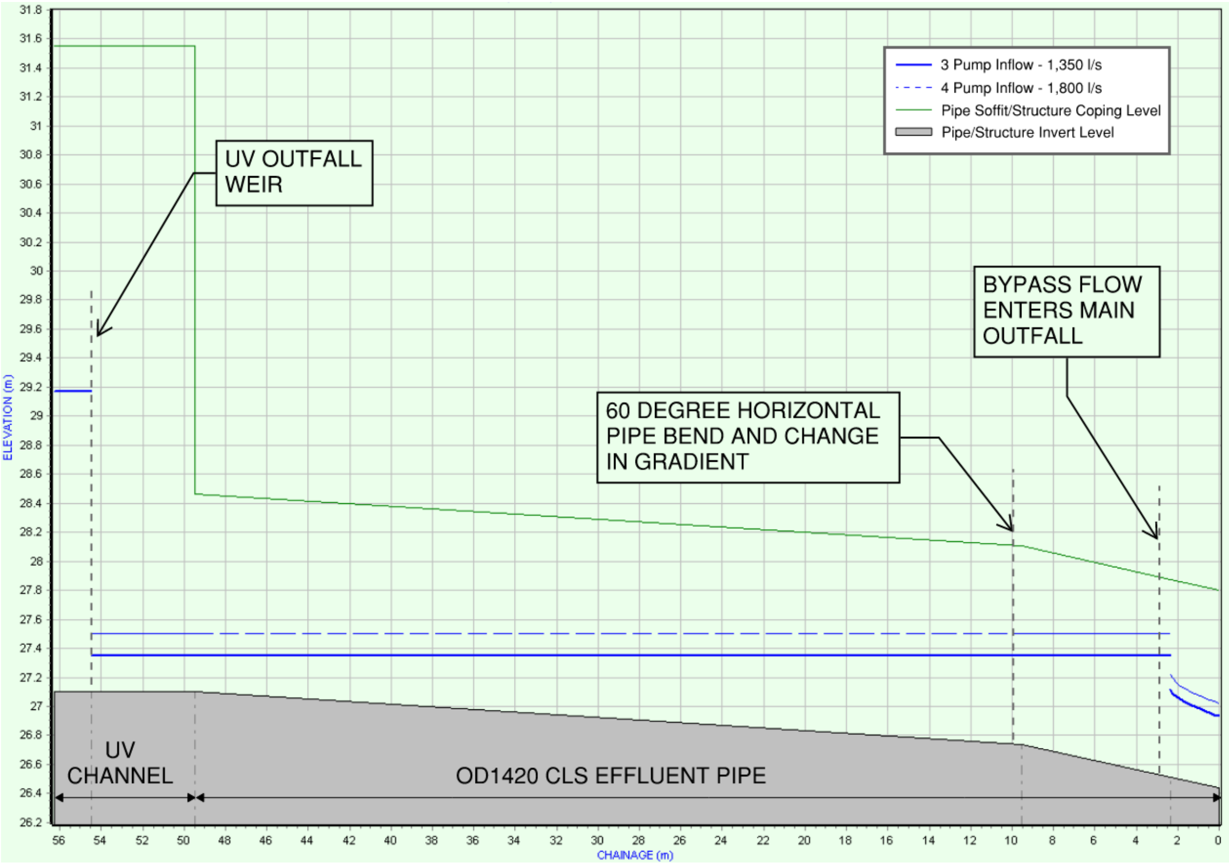

Figure 3-6: Hydraulic Grade line for Bypass Scenarios: Effluent Pipeline UV Outlet to OD1420/OD1371 Reducer

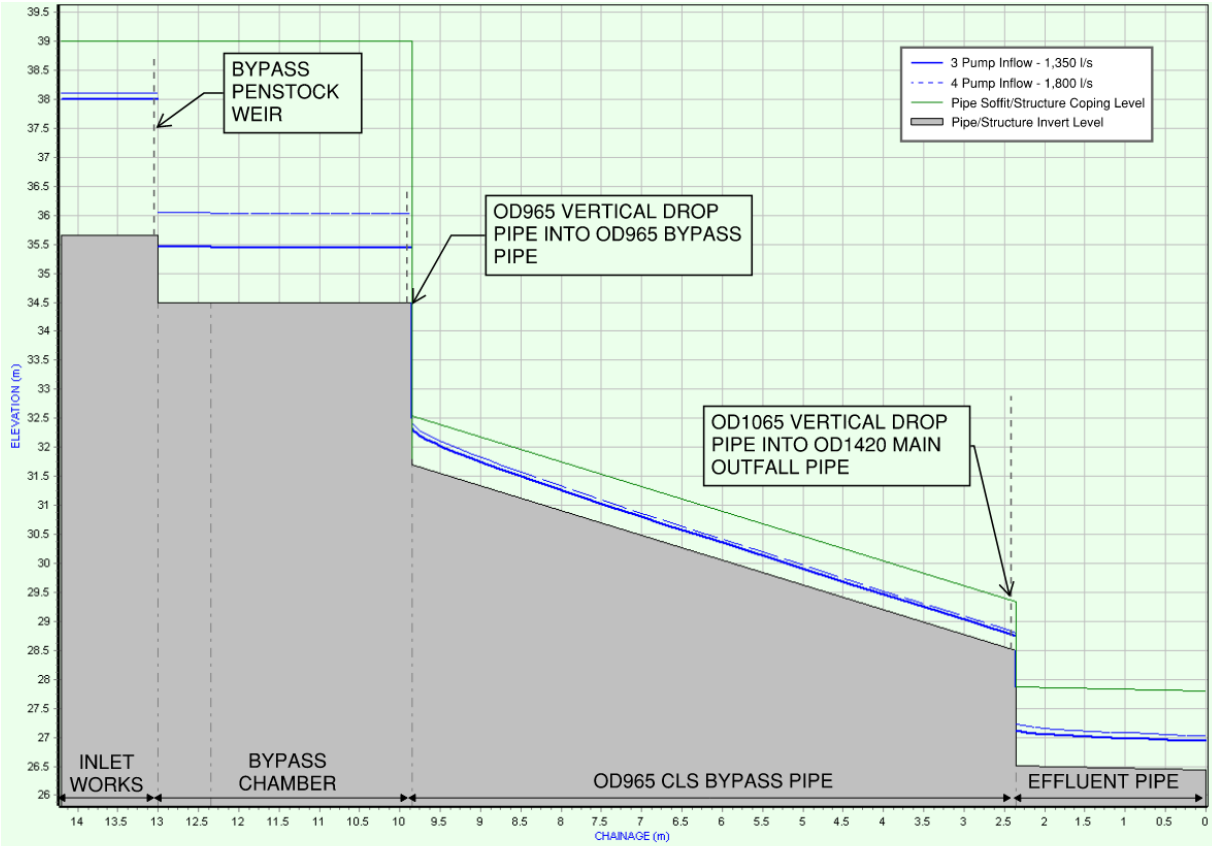

Figure 3-7: Hydraulic Grade Line Bypass Scenarios: Bypass Pipe from Inlet Works to Effluent Pipe

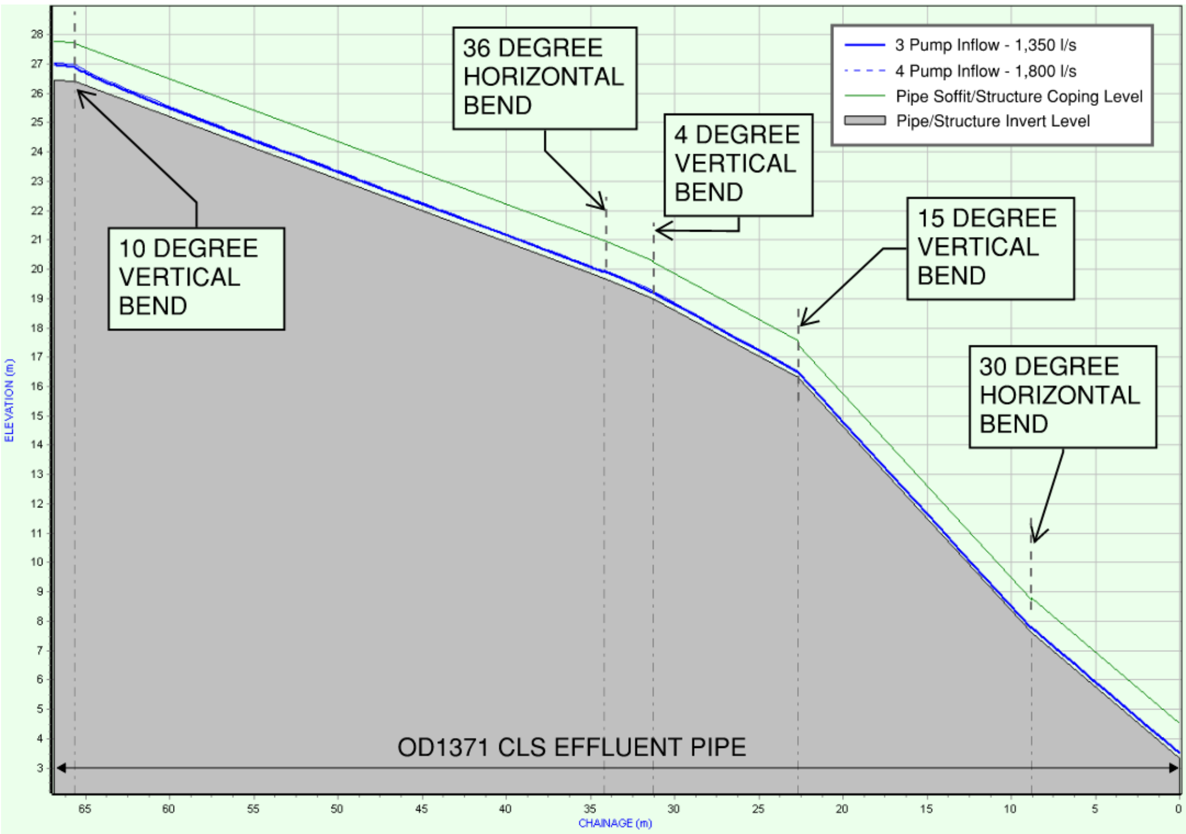

Figure 3-8: Hydraulic Grade Line Bypass Scenarios: Effluent Pipeline from OD1420/OD1371 Reducer to bottom of hill

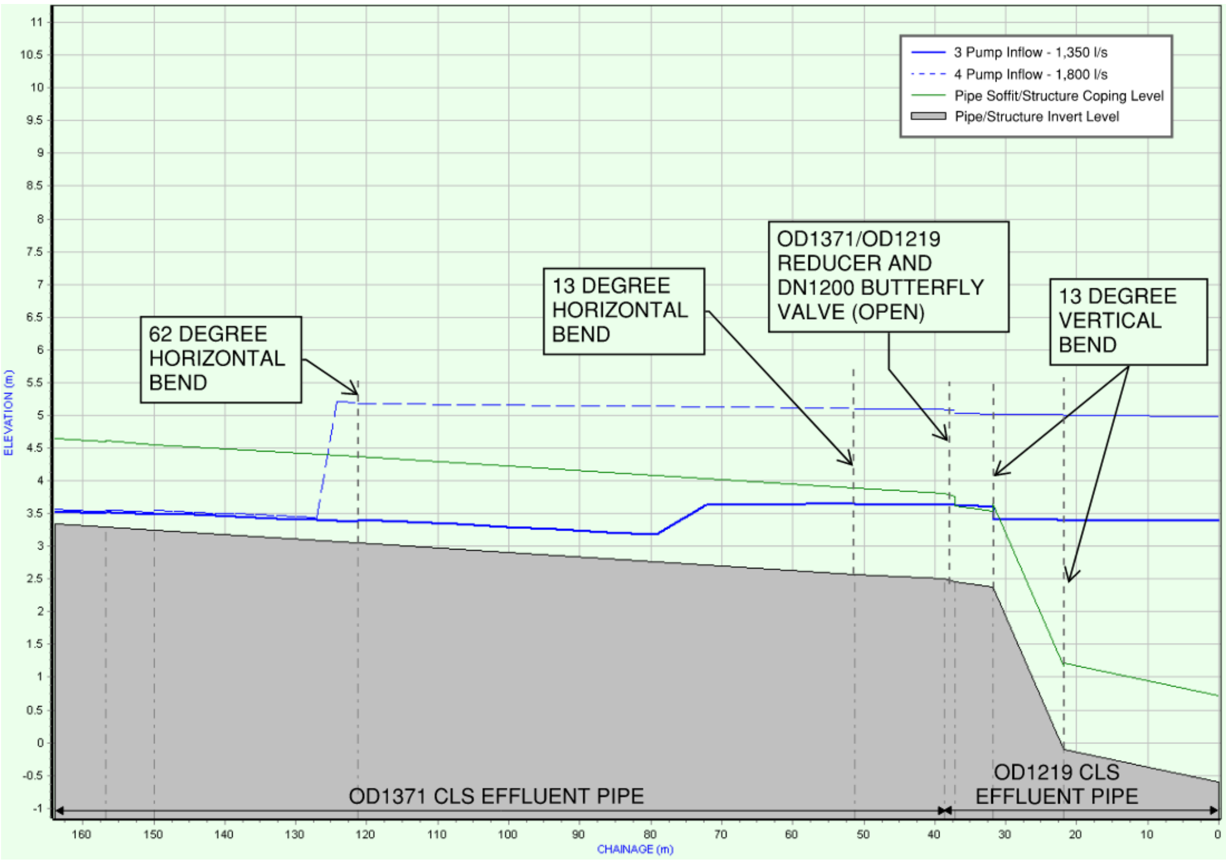

Figure 3-9: Hydraulic Grade Line Bypass Scenarios: Effluent Pipeline from bottom of hill to tie-in flange (start of ocean outfall)

The flow behaviour is largely similar to that of the flood event scenario in the downstream portion of the effluent pipe (at the bottom of the hill along Stewart Duff Drive). Figure 3-9 shows that the driving head for the operation of the outfall and diffuser is substantially lower than the flood event as expected for the lower flow rate.

The location of the hydraulic jump at the bottom of the hill moves further upstream with increasing flows, as would be expected. It is noted that, like the flood event, the actual locations of the hydraulic jumps are likely to be further upstream than the Hades hydraulic profile indicates due to air being entrained at the hydraulic jump.

3.3 Observations from SCADA, Site Reports and CCTV Inspections

3.3.1 Site Observations

Wellington Water have relayed observations from the site operators who were managing the IPS pumps during the wet weather event on 15 February 2026. The following observations were discussed with Stantec at the meeting on 17 February 2026.

- With three IPS pumps operating which is known to deliver approximately 1350 L/s to the WWTP, the water level in the UV outlet channel was observed to be at approximately half the depth of the OD1420 CLS effluent pipe (or approximately 680 mm above the channel invert).

- With four IPS pumps in operation, corresponding to approximately 1800 L/s being pumped to the WWTP, the water level in the UV outlet channel submerged the OD1420 effluent pipe and the water level was observed to fluctuate rapidly. Site operators became concerned with the rapidly rising levels in the UV outlet channel and decided to turn off the fourth IPS pump and hence limit the IPS to only 3 pumps in operation.
- Wellington Water have advised that the site operators have since installed level monitoring in the UV outlet channel to quantify the backwater levels in the UV outlet channel.

A follow up meeting was held with Wellington Water and the WWTP Operator at the WWTP on 17 March 2026. The following was discussed at the meeting:

- The Veolia Operator confirmed that the bypass weirs penstocks are operated and controlled as described in Section 2.3.1.
- During the wet weather event on 3 March 2026 up to four IPS pumps were operated.
  - The operator advised that during this event the water level in the UV outlet channel reached a level just above the upstream common outlet weir and wastewater spilled into the upstream channel. Considering the As Builts of the UV Disinfection channels at this location, it is likely that the wastewater in the channel reached a level of approximately 29 m RL, or approximately 1.5 m higher than the level predicted in the Hades model.
  - The operator advised that during this event they also observed burping of large air pockets and large splashes from the outlet chamber during the initial pumping sequences with four IPS pumps operating. Burping of large air pockets then subsided as the four IPS pump operating regime continued. This indicates that the air release capacity of the OD232 vent pipe downstream of the UV Disinfection outlet channel was exceeded at times during this event.

3.3.2 SCADA and Infrastructure Data Review

Wellington Water has provided Infrastructure Data graphs and SCADA data Excel export to help inform an assessment of the recorded flow behaviour during high flows on 30 April 2025, 4 June 2025, 4 July 2025 and during the flood event on 3 February 2026. The details of the data are discussed below.

Wellington Water have advised that they were not aware of the occurrence of the UV Disinfection Channel high water level event, inferred from Infrastructure Data from 4 July 2025. This high level event did not become apparent to Stantec or Wellington Water until this hydraulic assessment when Stantec requested Infrastructure Data covering wet weather events that had occurred prior to the flooding event when one clarifier was out of service.

The effluent flow monitored at UV Channel 2 during the 3 February 2026 flood event is shown in Figure 3-10. The UV Disinfection P&ID (As Built Drawing 951092_00-015) indicates that the flow sensors and transmitter use level readings to calculate the flow over the individual UV channel outlet weirs. During the event on 3 February 2026, flows through the primary and secondary treatment components (including the UV channels) of the WWTP were limited to approximately 1,500 L/s with additional flows being diverted through the bypass pipe to the main outfall pipe. This can be seen in Figure 3-10 as flows fluctuate below 1,500 L/s up to about 11:10 pm on 3 February 2026. Following 11:10 pm, the sensor’s calculated flowrate rapidly increases and then stays at a little over 2,050 L/s. It is expected that the water level exceeded the maximum measurement limit of the sensor due to the flows backing up from the UV outlet pipe.

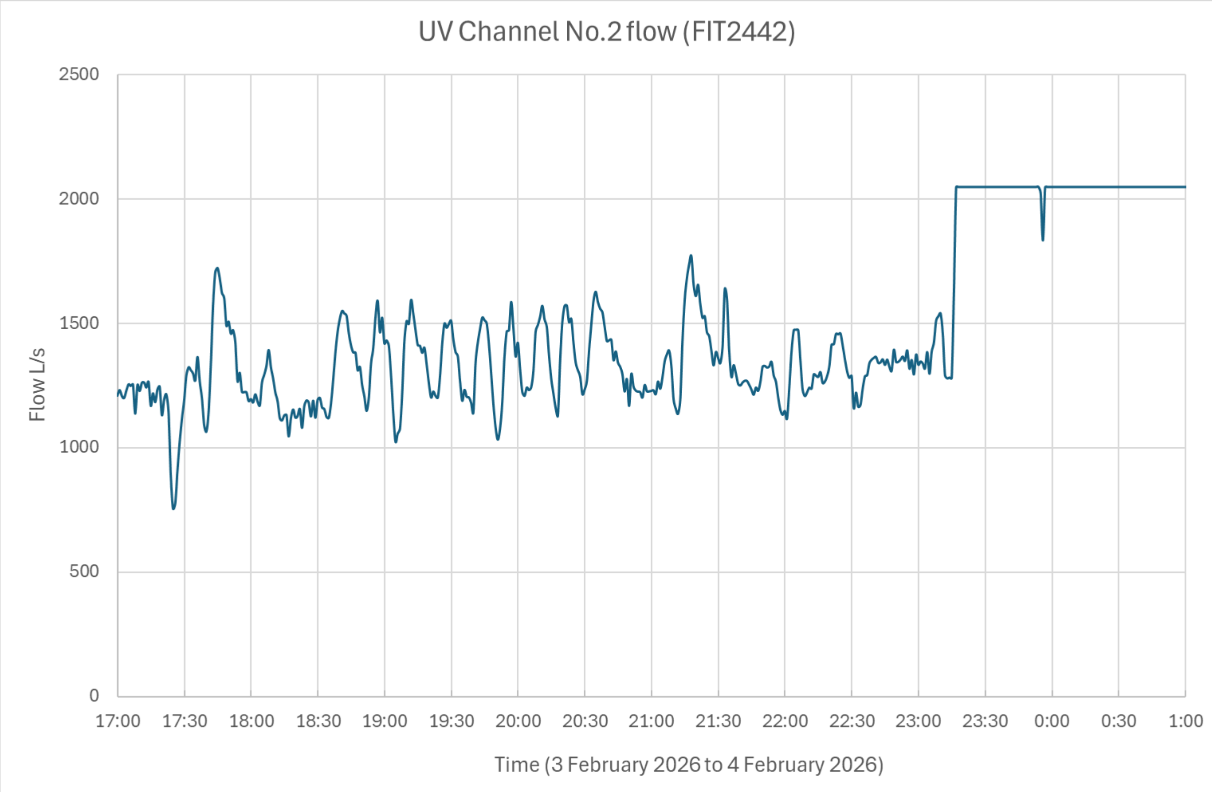

Figure 3-10: Monitored Outflow from UV Channel during 3 February 2026 Flood Event. No flow was recorded from UV Channel No.1. (Source: Wellington Water SCADA Data)

Figure 3-11 shows the combined inflow into the WWTP as recorded from the two rising main flow meters FIT-2200 and FIT2201. In Figure 3-11, shortly after 11pm, an additional pump begins pumping to keep up with incoming flows from the storm event. This indicates that the increase in inflow from ~3,000 L/s to ~3,400L/s triggered the backing up of the UV outlet pipe, but with an approximate 10-minute delay.

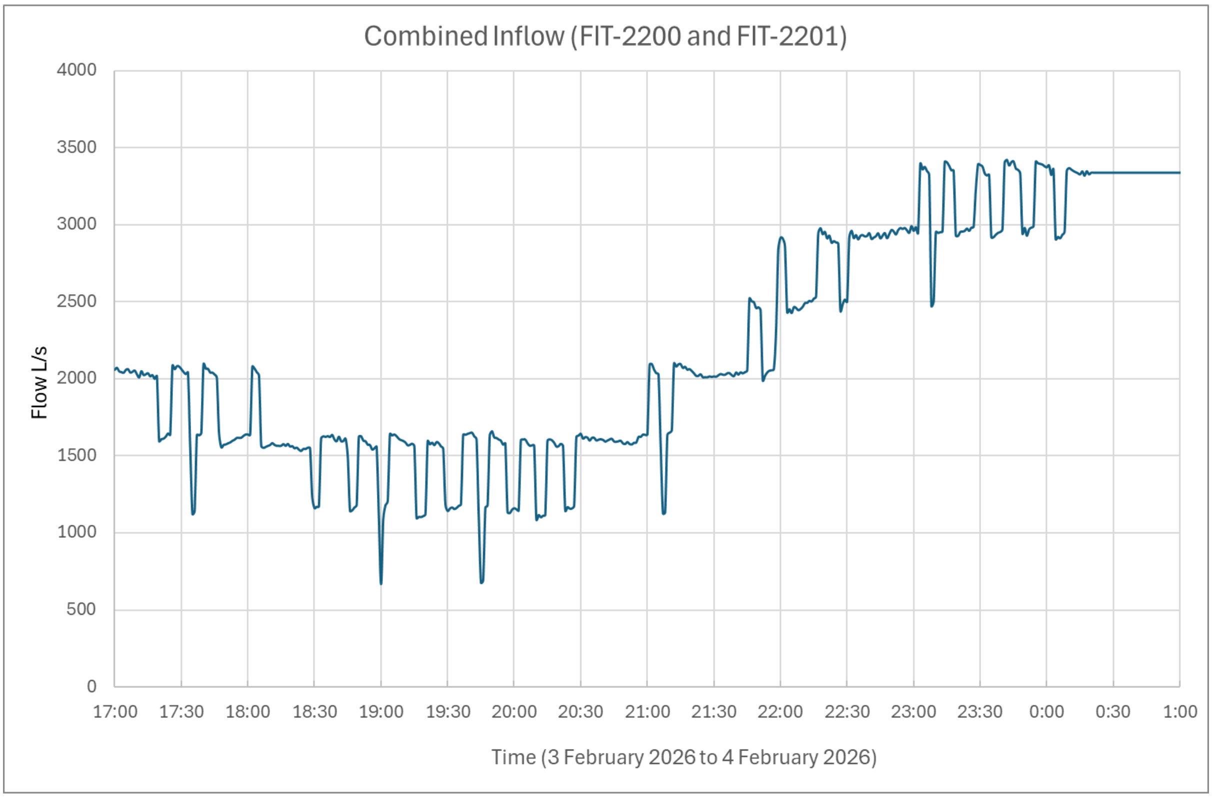

Figure 3-11: Monitored flow leaving the Influent Pump Station (IPS) during 3 February 2026 Flood Event (Source: Wellington Water SCADA Data)

Level monitoring data from LIT2402 within the common grit outlet channel upstream of the PSTs indicates that between 5:00 pm on 3 February 2026 and 12:20 am on 4 February 2026 the variation in level within this channel was consistently between 60% and 65% of the depth range (0.0 to 3.15 m), as shown in Figure 3-12. The general trend of water level fluctuation occurs in response to assist pumps starting or stopping and the modulating weir adjusting to try to limit water levels (and flows to treatment) to below a target level. This general trend is observed to be the same prior to and following the loss of valid flow signals from the UV outflow meter (11:15 pm). Considering this, and with the understanding of the PST hydraulics obtained from our prior Hydraulic modelling engagement, it is likely that the flows to the UV Disinfection channels after 11:15 pm were still in the order of 1500 L/s when the flooding from the UV channels was occurring.

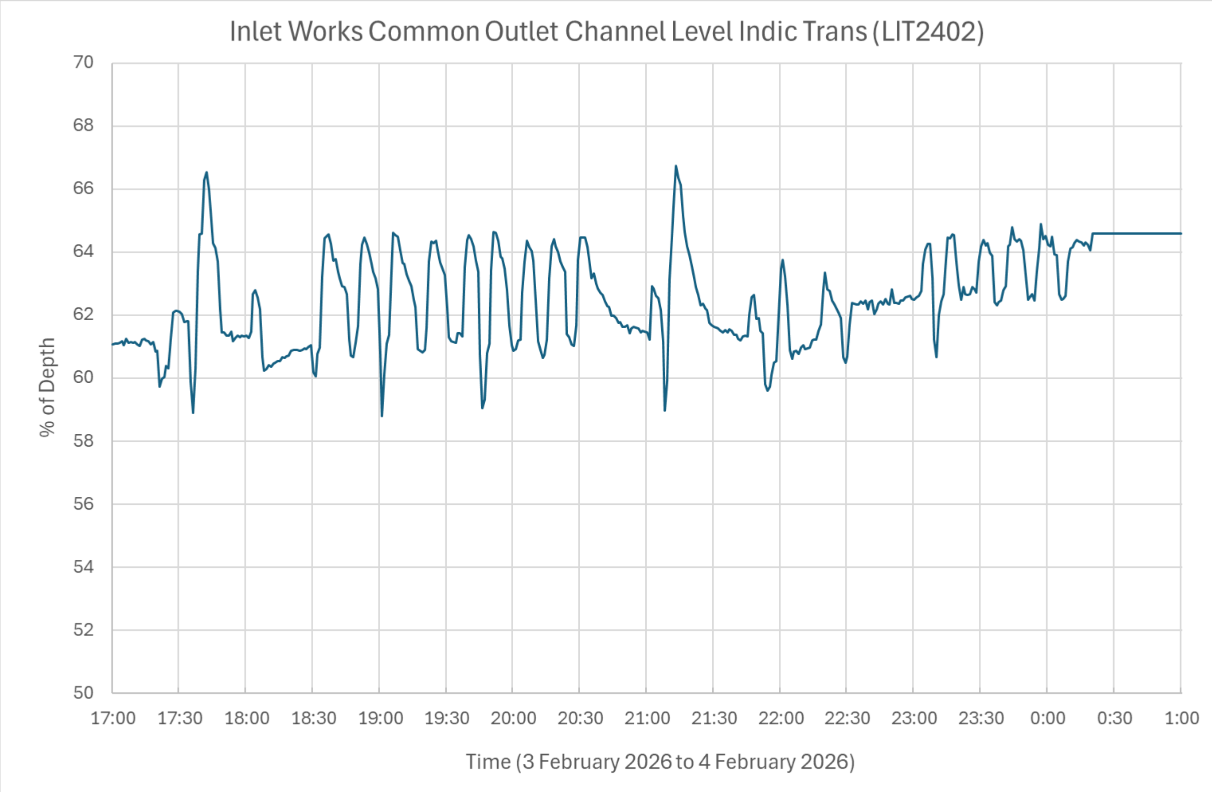

Figure 3-12: Monitored water depth within Inlet Works Common Outlet Channel during 3 February 2026 Flood Event (Source: Wellington Water SCADA Data)

Wellington Water have provided Infrastructure Data records of historic wet weather events to enable a review of peak flow conditions that the Moa Point WWTP was experiencing previously.

On 4 July 2025, there were two UV Disinfection channels in operation, but flows were limited through the primary and secondary treatment components to approximately 2,200 L/s due to one of the clarifiers being out of service. Figure 3-13 shows the Infrastructure Data WWTP recorded inflow and outflow during this storm event. The UV total outflow registers flow up to 4000 L/s which was much more than the inlet flow to the WWTP and the clarifier hydraulic capacity at the time. Considering that the outlet flow is calculated from head over the UV weirs, it is likely that these high flow readings are not indicative of flow through the WWTP. This recorded flow is considered more likely to have occurred due to the water level backing up in the UV outlet pipe, drowning the UV outlet weirs and submerging the maximum depth reading of the sensors.

Wellington Water have advised that they have not received any reports or records of flooding from the UV channels from this 4 July 2025 event.

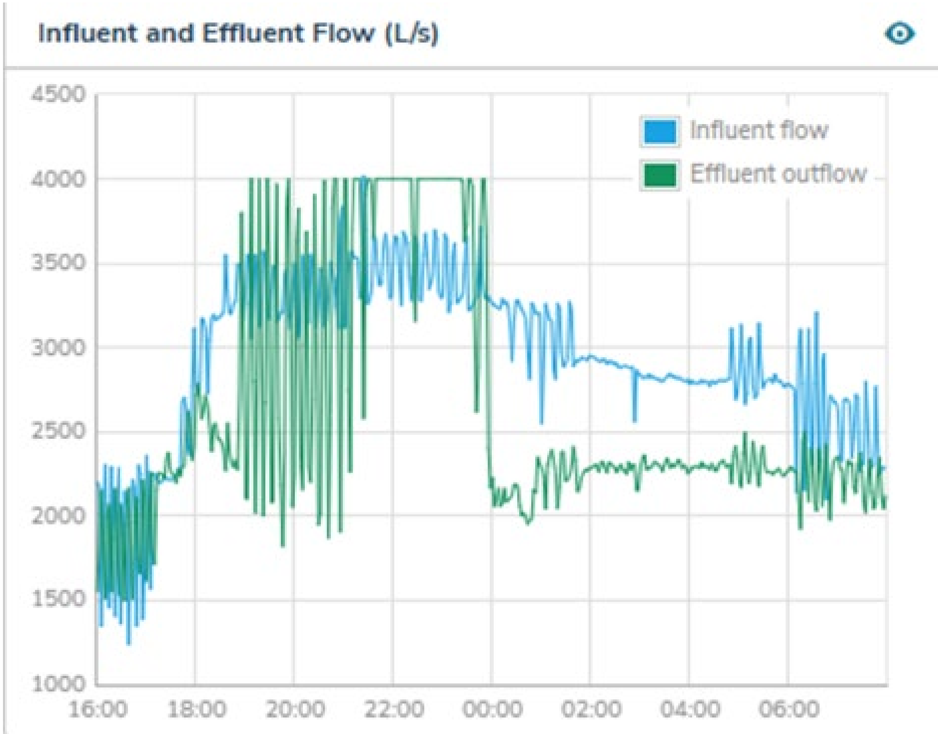

Figure 3-13: Monitored WWTP Inflow and Outflow During 4 July 2025 Storm Event (Source Wellington Water Infrastructure Data)

Two more sets of inflow and outflow data from recent storm events were provided by Wellington Water for review. These are from an event on 30 April 2025, shown in Figure 3-14 below, and from an event on 4 June 2025, shown in Figure 3-15 below. In both events one clarifier was out of service, with flow to the UV Disinfection system limited to approximately 2200 L/s (but both UV channels were in use), and the bypass diversion was being used for excess flows above this limit. The following observations are provided considering this flow data:

- The wet weather events from 30 April 2025 and 4 June 2025 include high total flows similar to the flows reported flowing to the WWTP on the night of 3 February 2026.
- The wet weather event on the 4 June 2025 did indicate some flows above 2,500 L/s which is unlikely considering the known hydraulic capacity limit of the clarifiers of approximately 1100 to 1150 L/s per clarifier (Stantec, 2025).
- Neither of the wet weather events shows an indication that the UV channels experienced raised water levels past the limit of the flow sensor.

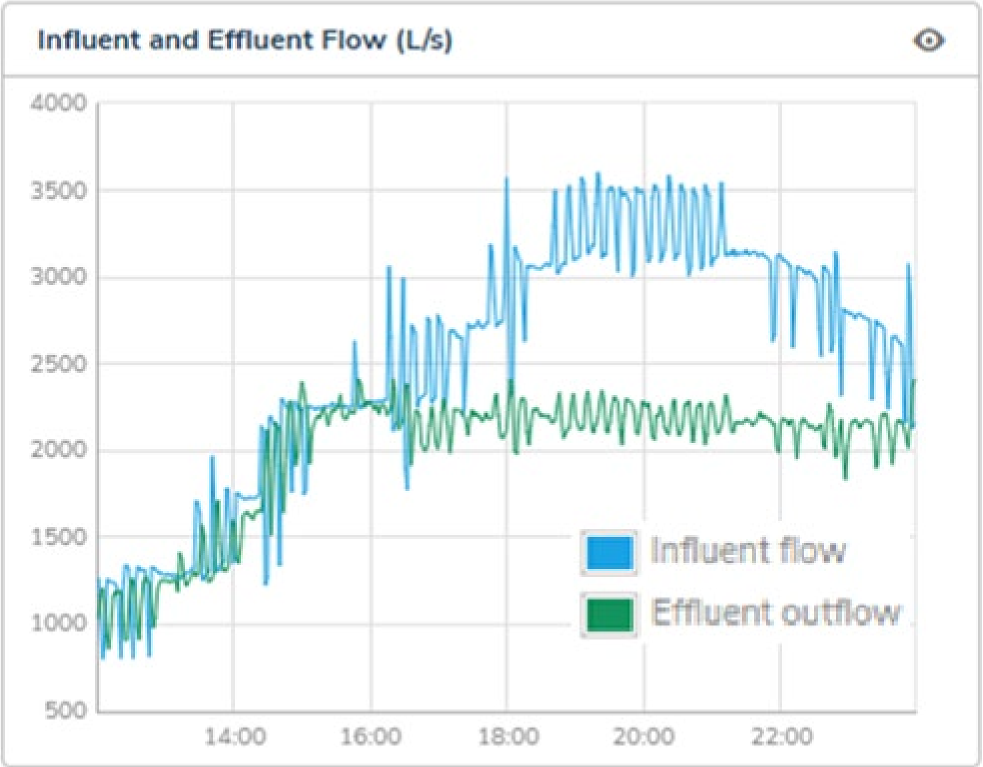

Figure 3-14: Monitored WWTP Inflow and Outflow During 30 April 2025 Storm Event (Source Wellington Water Infrastructure Data)

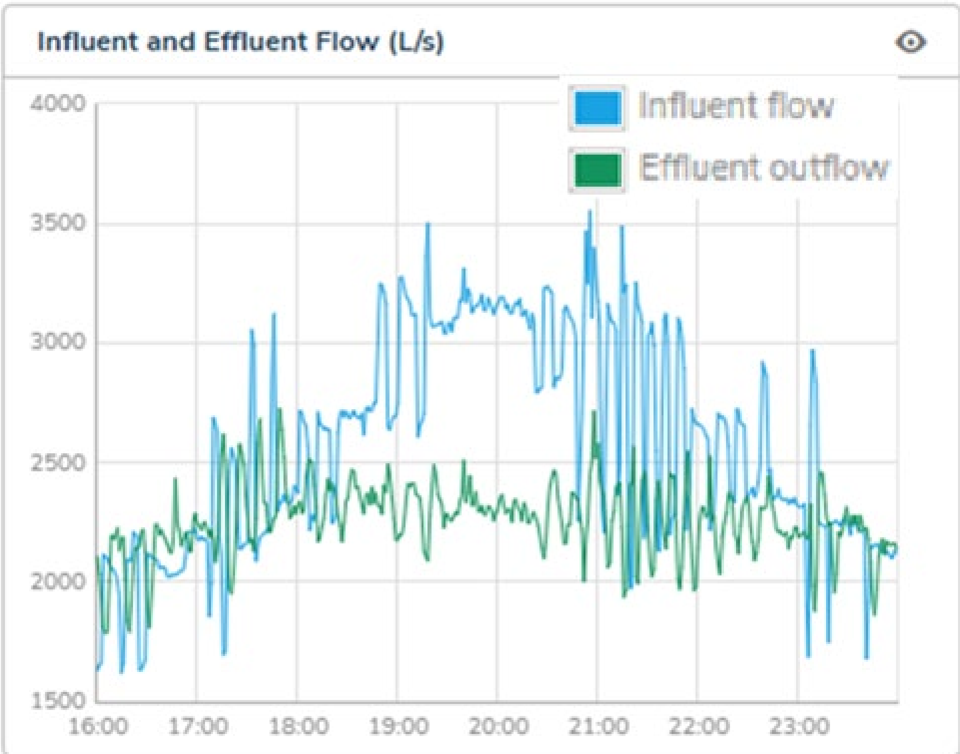

Figure 3-15: Monitored WWTP Inflow and Outflow During 4 June 2025 Storm Event (Source Wellington Water Infrastructure Data)

3.3.3 CCTV Inspection

During the initial shutdown period immediately following the event Veolia completed CCTV inspections on sections of the effluent pipe and bypass pipe as highlighted in the As Built plan below.

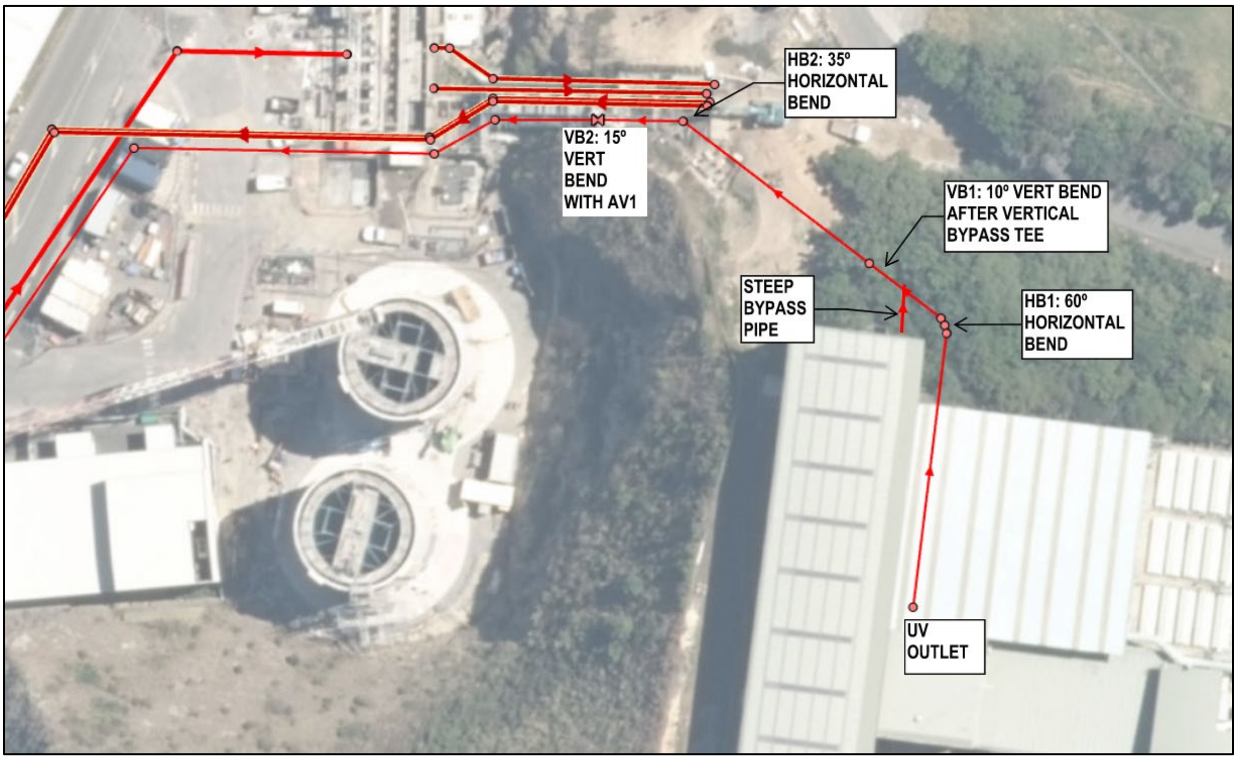

Figure 3-16: Moa Point WWTP CCTV Extent. Indicative Extents. CCTV camera reached the air valve and 15 degree vertical downwards bend.

The key observations from the CCTV are as follows:

- No blockages or evidence of physical impedance to flow.
- CCTV footage in the OD1420 Effluent pipeline in the upstream direction from the bypass vertical tee junction indicates a sharp downward sloping invert transition, likely in the form of vertical bend just upstream of the bypass riser junction (Figure 3-17). It is evident that the As Builts of the pipeline do not reflect this detail. Considering what the CCTV indicates it is likely that a sharp downward 5 degree to 10 degree bend occurs at this location. Accurate pipeline survey, for example via 3D laser scanning, would enable the details of this effluent pipeline in the vicinity of this vertical tee junction to be verified.
- Start of original polyurethane lining occurs 2 m upstream of the 35 degree horizontal bend (HB2 in Figure 3-16). Original polyurethane liner appears to be completely eroded in the invert of the pipe at this location as can be seen in Figure 3-18 below.
- Evidence of potential pitting to cement mortar lining observed however this is inconclusive as the camera does not pan and zoom at these locations (Figure 319 and Figure 3-20 below).
- Evidence of wave roll-over erosion pattern in the polyurethane liner is evident at the 35 degree horizontal bend (bend 2 in Figure 3-16) as shown in Figure 3-20 and Figure 3-21. Erosion of the polyurethane for the full pipe circumference is evident from the downstream side of this bend until the air valve (AV1 in Figure 3-16 and shown in Figure 3-21). This potentially indicates a transition from supercritical open channel flow before the bend to a breaking wave type turbulent flow and potentially two phase flow after the bend (similar to a breaking wave in the ocean).

Figure 3-17: OD1420 Effluent pipe CCTV footage looking in upstream direction from the bypass junction tee towards HB1. Shows steep downward bend immediately upstream of the bypass junction which is not recorded in the As Builts. Grade around HB1 appears consistent.

Figure 3-18: OD1371 Effluent pipe upstream of 35 degree horizontal bend. Shows transition to section with additional polyurethane lining and erosion of polyurethane lining in invert. Inaccuracy in CCTV distance noted.

Figure 319: OD1371 CLS Effluent pipe at 35 degree horizontal bend. Erosion of polyurethane lining is evident up the wall on outside of bend. Potential pitting of cement mortar lining circled in red (camera does not zoom at this location).

Figure 3-20: OD1371 CLS Effluent pipe View downstream of 35 degree horizontal bend. Spiral pattern and staining or erosion of polyurethane lining evident for full circumference downstream of bend.

Figure 3-21: OD1371 CLS Effluent pipe View looking downwards towards air valve tee. Erosion and staining extends high up pipe to soffit level as far as the air valve tee and 15 degree downward bend. Coarser surface roughness in invert is observed here.

3.4 Air Transport

HR Wallingford Report SR 661 (Escarameia, Dabrowski, Gahan, & Lauchlan, 2005) presents the results of experimental and numerical studies on the movement of air in pipelines that convey water. It compares the results of previously published work and derives a formula for the minimum velocity that will move air pockets and entrained bubbles down sloping pipelines. This calculation method applies to air entrained in pressurised pipes with the free water surface (aka hydraulic grade line) above pipe soffit level. The calculations outlined within the SR 661 report have been applied to the downward sloping portions of the bypass and effluent pipelines that are likely flowing full with air entrained within them. The results of these calculations are summarised in Table 3-2.

Table 3-2: Air Transport Calculations for selection of effluent pipe sections (Calculations in accordance with HR Wallingford Report SR 661, Equation 15).

Location (Chainage from and to)	Downward Slope	Internal Diameter	Velocity and flow rate to move small air bubbles forward	Velocity and flow rate to move large bubbles and air pockets forward
Ch. 0 to Ch. 39.95 (UV outlet to bend)	0.5 degree 1:110 grade	1.365 m	1.8 to 2.0 m/s 2,700 to 3,000 L/s	2.4 to 2.7 m/s 3,600 to 3,900 L/s
Ch. 39.95 to Ch. 47.15 (UV Outlet bend to bypass tee)	1.8 degree (As Built Grade) 1:31 grade	1.365 m	2.0 to 2.2 m/s 2,900 to 3,200 L/s	2.6 to 2.9 m/s 3,800 to 4,200 L/s
Assumed Ch. 45.15 to Ch. 47.15	5 degree (inferred / approx.) 1:11 grade	1.365 m	2.3 to 2.5 m/s 3,300 to 3,600 L/s	2.8 to 3.1 m/s 4,200 to 4,600 L/s
Ch. 93.35 to Ch. 107.25 (Above Ground portion at bottom of hill)	26 degree 1:2.3 grade	1.312 m	> 2.9 m/s > 4,000 L/s	> 3.6 m/s > 4,700 L/s
Ch. 116.03 to Ch. 247.85 (Effluent pipe at bottom of hill)	0.4 degree 1:150 grade	1.312 m	1.8 to 2.0 m/s 2,400 to 2,600 L/s	2.4 to 2.6 m/s 3,200 to 3,500 L/s

We have considered a Factor of Safety for Air Transport between 1.0 to 1.1 for this calculation for the purposes of assessing where air may be transported and/or where this air may become trapped.

From the results of the calculations the following observations are provided.

- The calculations indicate that entrained air is unlikely to be transported downstream in the steep pipe sections if they are flowing full (such as the above ground section) and air is instead likely to cycle back to the front of the hydraulic jump. This is supported by the observations provided within HR Wallingford Report SR 661 (Section 5.2.1, April 2005) and as depicted in Figure 3-22.

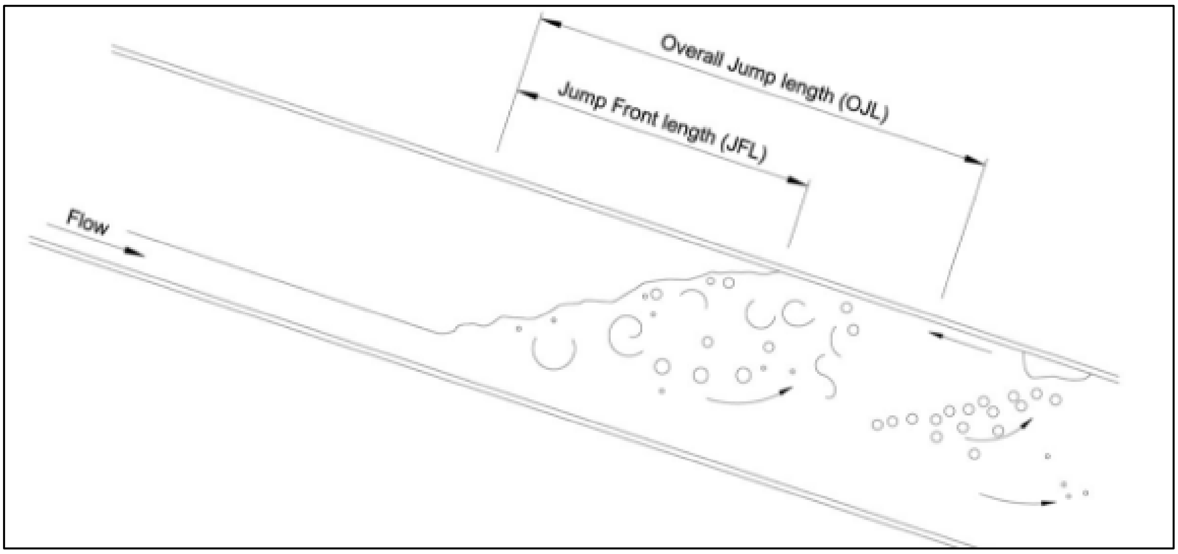

Figure 3-22: Schematic of hydraulic jump in pipe showing air entrainment, air coalescing and transport and release at the front face of the hydraulic jump (Source: HR Wallingfrod SR 661 April 2005, Figure 5)

- The phenomenon depicted in Figure 3-22 may also be occurring in the 23 degree downward sloping portion of the bypass pipe if the supercritical flow meets a submerged outlet due to surcharge of the OD1066 riser pipe.
- The OD1420 Effluent Pipe between the UV outlet and the 10 degree downward bend at Ch. 47.15 is relatively flat. Considering the review of CCTV of this pipeline it is apparent that a sharp downwards bend occurs approximately 2 m upstream of the bypass vertical junction. Considering the inferred distance of this location from the bypass junction and the As Built grade of the UV outlet pipe, we have calculated an inferred slope of 5 degrees for the steep pipe immediately upstream of the bypass vertical junction. We note this information is not accurate given the methods of measurement. Air transport calculations indicate that air accumulating at this vertical bend will likely become trapped at the vertical bend during peak flows or otherwise air may travel back towards to UV Disinfection outlet channel.
- If full pipe flow is occurring within the effluent pipe between the UV outlet channel and the bypass connection, and if air accumulates at this location, throttling of flow will likely occur.
- Under dry weather flows and medium wet weather events, it is likely that pipe velocities in the effluent pipeline at the bottom of the hill are insufficient to carry air downstream to the air valve located at approximate Ch. 248. In this instance as air accumulates in these pipelines, additional pressure losses will arise which will cause the pipeline to back up further up the steep portion which will reduce the likelihood of additional air entrainment.
- In high flow events exceeding 3,500 L/s the air transport calculations indicate that small air bubbles and large air pockets should be carried forward to the air valve at Ch. 248 and be released to atmosphere if this air valve is operating correctly.
- The steep pipe section after the air valve at Ch. 248 should prevent air moving past this air valve. However, if bubbles form in the pipe downstream of this position due to gases coming out of solution, they will become trapped at the sharp downward bend located at Ch. 57.5 on the outfall pipeline.

4 Discussion

4.1 Historic Flows

- We understand that over the 30 yrs of operating history of the WWTP, the bypass has been used many times without incident when wet weather inflow has exceeded the full treatment flow capacity of 3,000 L/s. During these historic events, peak flows down the effluent pipeline and outfall will have likely equalled or even exceeded the total flows that occurred on the night of 3 February 2026.
- During 2025 there were several wet weather events with flows exceeding 3,000 L/s when one of the clarifiers was offline and flow through the full treatment system was limited to approximately 2,200 L/s to prevent flooding from the clarifier scum drains (Stantec, 2025). During these events, bypass flows would have likely been in the order of 1,300 to 1,400 L/s which did not result in any reported flooding from the UV channel. However, the Infrastructure Data of the wet weather event on 4 July 2025 does indicate the UV Disinfection channels were experiencing elevated outlet levels likely due to a high backwater level in the UV Disinfection outlet channels which caused faulty Effluent Flow readings.
- The common factor in the wet weather events from 4 July 2025 and 3 February 2026 which we understand does not apply to other historic high wet weather flows to the WWTP is the higher fraction of flow via the bypass pipe. We consider that the consequences of high flow from the bypass pipe into the effluent pipe warrants greater inspection. Where this is possible within the context of the information and modelling methods employed, we have identified in further detail potential contributing factors associated with the high bypass flow fraction.

4.2 Bypass Weirs

- The original Hydraulic Calculations Design Report (Anglian Water) includes a statement covering the design capacity of the bypass weir penstocks as provided in Figure 4-1. We have calculated that these 1.2 m wide weir penstocks on their own in the lowest position are able to convey the peak design flow of 4,000 L/s each without flooding upstream levels in the inlet works. However, we have not modelled this full bypass flow in the Hades model and there may be issues with the head losses in the bypass pipe at this flow rate considering the 6.1 m/s pipe full flow velocity which may result in predicted flow constriction here. Furthermore, considering the observations from the flooding event and observations of the bypass system during the recovery phase, it appears that the capacity of the bypass system is likely to be substantially less than the design capacity of 4,000 L/s stated in the original Hydraulic Calculations Design Report.

A1.4.5.2 Primary Inlet Channel Overflow Weir which overflows screened Sewage Upstream of the Lamella Tanks.

Two weirs have been adopted to provide a duty/standby arrangement.
Each weir can bypass 4000 l/s in its fully open position, or the two weirs can be operated together.
In order to bypass the full flow the primary tanks must be isolated by closing their penstocks.

Figure 4-1: Bypass System Design Capacity Statement from Anglian Water Hydraulic Calculations Design Report.

4.3 Bypass Pipe Inlet Conditions

- Under low flow scenarios, the way the flow approaches the 965 OD bypass pipe entry is likely to present a barrier to the pipe entry behaving like a weir entry. Flow from one of the weir penstocks will drop adjacent or on to the downward pipe entry and the flow from the other weir approaches the vertical pipe entry from just one direction (flow does not approach the pipe uniformly around the circumference). As a result, we consider that a weir type entry with an air core is unlikely to be present, which would otherwise allow air to escape back up the pipe. As a result, air entrainment may be occurring from this pipe under a range of low flow conditions.
- Under high flows we expect that the 965 OD bypass pipe outlet within the bypass chamber is submerged and the flow will enter the pipe under orifice flow.
- The HR Wallingford Report SR 661 (Wallingford & Barr, 2006) provides guidance on the minimum submergence required to prevent air entrainment in vertical discharge pipes from tanks. Review of the calculation methods provided within this document indicates that air entrainment from vortices formation is potentially occurring across the full range of flows entering the bypass pipe. It is not possible to conclude how this entrained air is subsequently vented. It is possible that considering the hydraulic grade available, this entrained air is released when supercritical flow establishes and a free-surface forms in the downstream pipe.

4.4 Bypass Pipe Air Release Risk

- If free discharge occurs at the downstream end of the bypass pipe at the connection to the OD1066 riser, air entrained from the pipe inlet will be vented to atmosphere. If air pockets are accumulating within the pipe section between the entry point and the discharge to the vertical riser, without the opportunity to vent downstream e.g. due to a drowned outlet, they could surge back up the bypass pipeline into the bypass outlet box which will cause a cyclic flow condition which would be seen as varying water level in the outlet box and surging type air bubbles in the chamber. We have recommended that Wellington Water install level monitoring above the bypass outlet box to assess the presence and scale of this potential phenomenon. In addition, we recommend that the operating conditions within the bypass outlet box during a wet weather event are recorded by video camera if this can be completed safely.
- If significant fluctuation in outflow capacity is observed from the bypass outlet box (as determined from video recording or level monitoring), then higher peak flow rates from the bypass pipe into the OD1420 effluent pipe will cause higher operating water levels in the effluent pipeline and potential influence of the water levels in the UV Disinfection outlet.
- If this is happening with dynamic air release type conditions (burping) in the outlet box, then Wellington Water could consider options to install additional venting capacity on the bypass pipeline uphill from the OD1066 riser pipe.

4.5 Bypass Pipe Vertical Riser Junction

- The 3 February 2026 Hades model predicts that the head loss from the introduction of the bypass flow at the vertical bypass junction causes a subcritical flow regime upstream of this location. The Hades model predicts that the OD1420 effluent pipe upstream of the bypass vertical tee junction is surcharged above soffit level by approximately 200 mm. This effectively creates an air trap at this location. We consider that without the introduction of the bypass flow at this junction, a supercritical flow regime will exist in the otherwise hydraulically steep pipe from the UV Disinfection outlet channel.
- The Hades model predicts that under all flow conditions the free surface within the UV Disinfection outlet channel is below the soffit of the OD1420 outlet pipe.
- We know from multiple events and records (4 July 2025, 3 February 2026 flooding, 15 February 2026 wet weather event and 3 March 2026 wet weather event) that the actual water surface at the UV Disinfection outlet channel is significantly higher than the water levels predicted in the Hades model.

- Under all flow scenarios modelled, the high velocities (up to 8 m/s) predicted to occur at the downstream end of the 23 degree downward sloping bypass pipe are expected to result in significant turbulence and air entrainment as the high energy flow impacts into the rear of the vertical OD1066 riser pipe and drops down into the OD1420 effluent below. We consider that two-phase flow is therefore likely occurring at this location. This can be thought of as an air in water mixture with a low specific gravity. This is similar to aerated seawater from a wave break on the beach.
- It is possible that the flow bulking from air entrainment that may be occurring at the bypass junction increases the head loss through this junction by increasing the required velocity to pass the flow forward. Such an increase in driving head would be translated to higher water levels vertically up the OD1066 riser pipe and back up the OD1420 Effluent pipe towards the UV Disinfection outlet channel. The impacts of two-phase flow at this location cannot be predicted with the available methods in Hades.

4.6 Effluent Pipe Air Release Risks

- The air transport calculations summarised in Section 3.4 indicate air may become trapped within the effluent pipe between the UV Disinfection outlet and the bypass junction under certain flow conditions. It is evident from the CCTV footage of the effluent pipe upstream of the bypass vertical junction, that a much sharper downwards vertical bend occurs immediately upstream of the bypass junction (perhaps as much as 5 degrees). This downward bend will exacerbate the risk of air collecting immediately upstream of the bypass vertical junction.
- Given the steep slope on the upstream side of the bypass junction on the OD1420 effluent pipe, air that is brought into the effluent pipeline from the bypass junction may travel back up the effluent pipe and collect in the pipe soffit at the vertical bend. Furthermore, the regime of flow entering the effluent pipe from the bypass junction may act as a barrier to this air moving downstream. Air trapped upstream of the bypass vertical junction will act as a choke point increasing the required driving head for flow from the UV Disinfection outlet channel and increasing the risks of high water levels in the UV Disinfection channels. This may also vent back up to the UV Disinfection outlet channel creating flow and level surges.
- The Hades model predicts a transition to supercritical flow immediately downstream of the bypass pipe junction due to increase in pipe grade 3 m downstream of the bypass junction. It is likely that air entrained in the flow from the bypass pipe junction is released downstream of this junction into the pipe as the free surface develops and flow accelerates down the pipe. There is no air valve or vent immediately downstream of the bypass junction which would allow for release of this entrained air.
- Considering the potential two-phase flow occurring within the OD1066 riser under high bypass flow events, we consider that the ability of the riser and vent to release air from within the OD1420 effluent pipe is compromised under high bypass flow conditions.
- Given the transition to supercritical flow downstream of the bypass junction, the eccentric level invert reducer may not result in air becoming trapped at this location. Nevertheless, we still consider air release from this portion may be a hydraulic risk considering the current configuration and hydraulic performance predicted in the Hades steady state single phase hydraulic model.
- For all scenarios modelled, the Hades model predicts a flow velocity between 9.6 m/s and 10.8 m/s at the 36° horizontal bend at Ch. 81.85. This high velocity flow approaching the horizontal bend is expected to result in flow swirl in the pipe downstream of this horizontal bend. As outlined in Section 3.3.3, the CCTV of this pipe section shows erosion of the polyurethane in a pattern that flows around the pipe which supports this swirl phenomenon hypothesis. It is possible that the flow swirl following the horizontal bends results in a turbulent wave break within the pipeline between this horizontal bend and the air valve at the 15 degree vertical bend (Ch. 93.35 in long section As Built Drawing 951092_02-519). 'White water' within this portion of the pipeline could be completely surcharging this pipeline section. If this is occurring, the air release capacity of the pipeline may be compromised due to air accumulating in upstream pipe sections not being able to access the air valve at Ch. 93.35. This could result in transient air venting and flow surges within the pipeline.

- The Hades model predicts a hydraulic jump in the effluent pipe at the bottom of the hill based on balancing of the momentum equations. Effectively the force of the high velocity downhill flow pushes the hydraulic jump to this predicted location. The 30 degree horizontal bend at Ch. 107.25 is expected to cause a similar swirl and potential wave break within the pipeline and two-phase flow carrying on in the downstream direction. The lower density of the two-phase flow results in greater driving head required to transport the same mass of water along the pipeline. The air transport calculations summarised within Section 3.4 indicates that in wet weather flows exceeding 3,200 L/s air bubbles and air pockets should be transported downstream towards the air valve at Ch. 248. If this air valve is operating correctly air should be vented here and shouldn't carry on downstream due to the next steep downward bend (see As Builts 951092_02-519 and 951092_02506).
- We understand that Wellington Water are planning to progress replacement of the existing air valves on the effluent pipeline at Ch. 93 and Ch. 248. Wellington Water should consider adopting design details for the air valve replacement works that also accommodate the proposed pressure monitoring installations (as outlined in Section 4.8).

Refer marked up As Built in Figure 4-2 which identifies potential location of two-phase white water in the pipeline and sections where full pipe velocities may be insufficient to transport air downstream. A full page version is included in Appendix C.

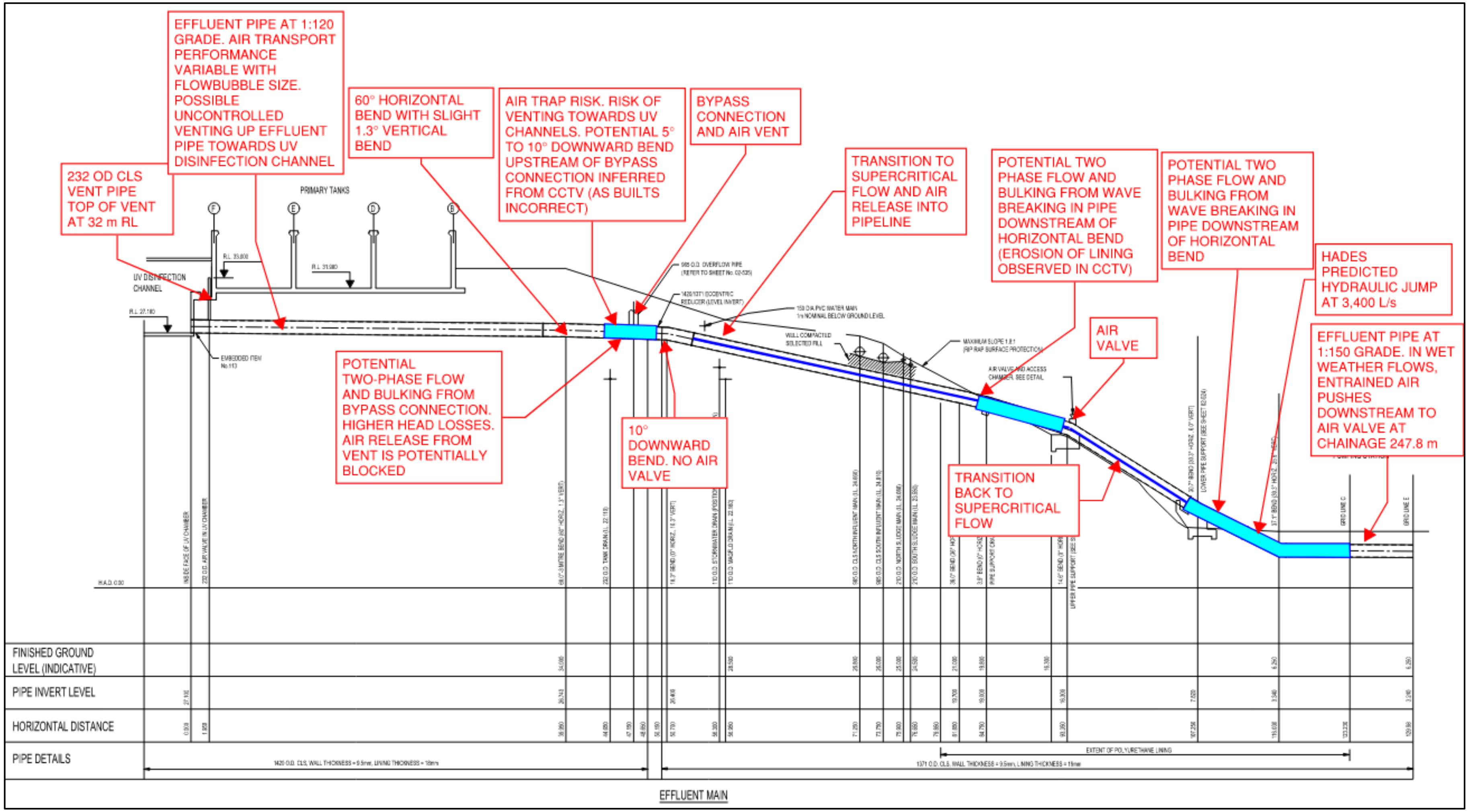

Figure 4-2: Moa Point WWTP Effluent Pipe Long Section with air management apparatus and potential issues identified and zones of potential two-phase flow, or hydraulic jumps indicated in blue. (Source As Built Drg 951092_02-519)

4.7 High Velocity Pipeline Erosion Risks

The high velocities in both the bypass and effluent pipelines could pose a risk of accelerated erosion and undermine the pipes' long-term durability. The CCTV results indicate that erosion has taken place in the effluent pipe, apparently stripping away parts of the original polyurethane liner. This occurs at the same location that the model indicates high velocities are expected to occur. The effluent pipe has experienced heavy use over the past 30 years since its construction and is a critical piece of infrastructure. Consideration should be given to determining its remaining useful life and how rehabilitation works could be completed on the pipework to restore its lining and potentially extend its remaining life.

The bypass pipe has not seen as much heavy use over the past 30 years but is currently under near continuous use during the recovery phase of works. As the bypass pipe is also expected to experience high velocities during this period, it is recommended that its condition is monitored to ensure its durability has not been negatively impacted and will be suitable for future use.

4.8 Butterfly Valve in Stewart Duff Drive

Stantec's review of the pipeline design details identified a DN1200 butterfly valve on the effluent pipeline located at Ch. 240 within a below ground chamber in Stewart Duff Drive. Butterfly valves are not typically specified on wastewater pipelines due to the potential for ragging which can render the valve inoperable or otherwise increase the head loss across the valve. Stantec raised the risk posed by this valve to Wellington Water in email on 12 February 2026 and recommended that Wellington Water investigate if the valve may be ragged and/or seized.

4.9 Ocean Outfall and Diffuser

The hydraulic model results for the outfall and diffuser pipe do not identify any specific hydraulic capacity issues with this asset.

The As-Builts for outfall pipeline include a sharp step in the pipeline invert at Ch. 57.47 from the tie in flange where the pipeline drops down below the foreshore (as shown on Ocean Outfall As Built 951096_18-001). Any air entrained in the flow that is not captured at the upstream air valve at Ch. 247.83 on the effluent pipe (Effluent Pipeline As Built 951096_02-506) will accumulate at this sharp downward bend in the foreshore and could result in flow throttling, especially in peak flow events. Considering the levels of air entrainment possibly occurring in the effluent pipeline due to hydraulic jump conditions, this is a possible risk.

The model indicates that in the common 1200 mm diffuser pipe the pipe velocities reduce incrementally towards the end of the diffuser as flow leaves the common pipe from each riser and set of nozzles. The diffuser velocities in the final two sections of diffuser under the peak modelled flow of 3400 L/s are 0.47 and 0.23 m/s respectively. At these flow velocities sediment/sludge deposition may drop out of the flow and may build up over time at the end of the diffuser. The consequence of this occurring however is not severe as potential solids deposition will reach an equilibrium in time. This risk is mitigated considering that most of transported solids in the pipe will be vented via the risers and diffuser nozzles upstream of this where velocity is sufficient. Observations from diving inspections also haven't indicated this to be a concern.

Wellington Water are proposing to install pressure monitoring equipment on the effluent pipeline within the chamber in Stewart Duff Drive which will enable hydraulic performance of the outfall and diffuser to be assessed in greater detail and to monitor the outfall performance considering potential ongoing risks posed by operating the diffuser with raw screened sewage. Stantec is providing mechanical and electrical engineering input to Wellington Water to enable this pressure monitoring equipment to be correctly specified and installed.

The original design of the outfall diffuser includes a pig launching facility in the form of a removable reducing spool at the shore end of the pipeline and the end of the diffuser includes a removable blank flange. It appears these features could afford the ability to flush and/or pig the outfall if that was deemed to be required, such as following review of the pressure monitoring data. O&M manuals would need to be referred to understand how the pig launching facility was intended to be operated considering the removable spool for this asset is located on the live outfall pipeline. This would involve using the butterfly valves in Stewart Duff Drive to isolate the long outfall and send treated wastewater to the short outfall for the duration of the maintenance activity. The risk that these butterfly valves may be seized and inoperable should be considered.

5 Conclusions

Considering the hydraulic modelling results, the limitations of the software, and other information provided to Stantec by Wellington Water, we provide the following conclusions:

1. With the context of the historic flows received at the WWTP as discussed in Section 4.1, and considering the way the bypass system was operated during the flood, based on our engineering judgement, we consider that the flow characteristics of how the bypass flow enters the effluent pipe and the lack of air release points on the effluent pipe are a significant risk to the hydraulic capacity of the pipeline that will need to be managed during the recovery phase and future operation of the pipeline..
2. The Hades steady state single phase modelling does not predict the level of flooding observed. This is a result of the known limitations of the software and the complex hydraulic problems occurring in the pipeline system. We know from multiple events and records (SCADA Data from 4 July 2025, 3 February 2026 flooding and 15 February 2026 wet weather event) that the actual water surface at the UV Disinfection outlet channel can be significantly higher than the water levels predicted in the Hades model.
3. Given that the hydraulic model predicts that the treated effluent pipeline up the hill at the WWTP is hydraulically separate from the outfall pipeline at the bottom of the hill, and with the context of historic flow information that indicates the bypass flow regime triggered the flooding, it is unlikely that the ocean outfall and effluent pipeline downstream of the steep downhill portion (beyond Ch. 116) significantly contributed to the 3 February 2026 flooding event. Nevertheless, there are opportunities for Wellington Water to investigate and rule out the possibility of the downhill pipeline system potentially negatively affecting the performance of the effluent pipeline. We consider that Conclusion 8 addresses these residual risks.
4. Whilst the Hades steady state single phase modelling does not predict the level of flooding observed nor replicate the hydraulic outcomes of the phenomenon highlighted, the predicted hydraulic profile upstream of the bypass vertical junction does identify that air can become trapped in this effluent pipeline upstream of the bypass vertical junction. The hydraulic modelling results also highlight a significant risk that the bypass junction can draw air into the effluent pipeline in the form of two-phase flow. Considering the effluent pipeline vertical alignment at this location, we consider that this air could accumulate in the pipe which will set up a choke point which together with the two-phase flow in the pipeline will increase the driving head from the UV outlet channel. The potential As Built vertical alignment discrepancy identified from the CCTV footage also exacerbates this choke point risk. Coupled with uncontrolled venting of trapped air towards the UV Disinfection outlet channel, this increase in driving head is a likely cause of the flooding that occurred from the UV Disinfection channels. Our professional opinion concerning this likely causal relationship considers the following:
   a. The common variable in the documented instances of high water levels in the UV Disinfection chamber is the large proportion of bypass flow during wet weather events indicating the problem is likely associated with this junction.
   b. The results of the hydraulic modelling identifies the risks of air becoming trapped upstream of the bypass vertical junction.
   c. The results of the hydraulic modelling identifies that wastewater flowing down the sloping bypass pipeline reaches a high velocity at the downstream end before it impacts the opposite side of the bypass vertical riser and drops into the effluent pipe below. We consider that this will likely initiate two-phase flow in the junction, pump air into the effluent pipeline and prevent air release from the effluent pipeline at this location.
   d. The highlighted risks of air becoming entrained and trapped in the pipeline considers well documented hydraulic phenomena.
   e. Our review of information provided by Wellington Water as documented in this report.
5. One mitigation option for the recovery phase and longer term operation of the pipelines could be to introduce the bypass pipe flow into the effluent pipeline further downstream and downhill from the 10 degree vertical bend at Ch. 57. This would allow the existing riser to act as a vent only, and the hydraulic impact of the bypass connection on the effluent pipeline can likely be significantly reduced and hopefully removed. In addition to the hydraulic requirements, the

design of solutions like this will need to consider the site constraints, operational constraints and appropriate safe working methods.

6. If Wellington Water need to replicate the flooding and dynamic flow behaviours (two-phase flow, air choking and uncontrolled venting) which we consider to be a likely cause, then methods such as Computational Fluid Dynamic (CFD) or physical models are required. The Hades steady state single phase modelling has provided an overall understanding of the hydraulic system to best inform the scope of the CFD modelling.
7. There are opportunities to install additional air release equipment on the bypass and effluent pipelines at specific locations which may improve the performance of the system in the short term until the design of a new bypass pipeline alignment and connection can be developed and implemented.
8. We have identified other potential risks with the effluent and outfall system that should be investigated by Wellington Water. These concern verification and monitoring of operating pressures in the ocean outfall, and review of condition of existing air valves and butterfly isolation valve on the effluent pipeline.
9. The CCTV of the steep sections of effluent pipeline has identified erosion of the polyurethane liner and potential degradation of the cement mortar lining at a horizontal bend. The high velocity supercritical flow on the steep portions of downhill pipeline therefore presents risks to the long-term durability of the effluent pipeline which warrants additional review and investigation.
10. Considering the observed performance of the bypass system from the 3 February 2026 flood event, and subsequent operation of the bypass system during the recovery phase, it appears that the flow capacity of the bypass system is likely to be substantially less than the stated design capacity from the original Anglian Water Hydraulic Calculations Design Report (Anglian Water).

6 Recommendations

Stantec provides the following recommendations considering the conclusions presented within this report.

1. Wellington Water considers solutions available to increase the venting capacity of the bypass and effluent pipelines at specific locations which may improve the performance of the system in the short term until a suitable design solution can be designed and installed.
2. Wellington Water installs level monitoring instruments above the bypass outlet box chamber in the inlet works to review potential surging flow behaviour in this outlet.
3. Wellington Water installs pressure monitoring on the accessible locations of the downhill effluent pipeline to verify the modelled hydraulic performance of the outfall and monitor outfall performance during the recovery phase.
4. Wellington Water reviews the content of this report in detail and provides feedback to refine the observations and conclusions presented.
5. Considering the criticality of this work and the complexity of the issues, Wellington Water should engage a Peer Reviewer to review this report and the supporting information.
6. Wellington Water considers replacing the air valves on the effluent pipeline and installs new isolation valves on the air valve risers as previously communicated by Stantec.
7. Wellington Water reviews the condition of the existing butterfly valve to assess if the valve is ragged and/or seized and if required considers works to replace this isolation valve.
8. Wellington Water progresses a pipeline survey via 3D laser scanning to enable the details of the effluent pipeline in the vicinity of the vertical tee junction to be verified (considering the potential vertical alignment discrepancies identified in the CCTV inspection.
9. Wellington Water considers the potential need to develop a CFD model and if required engages suitably qualified and experienced engineers to progress this work.
10. Wellington Water consider pipeline erosion and cement mortar liner degradation risks as identified from the effluent pipe CCTV. We recommend the condition of this asset is monitored and Wellington Water consider potential works to safeguard the operational life of this asset.

7 References

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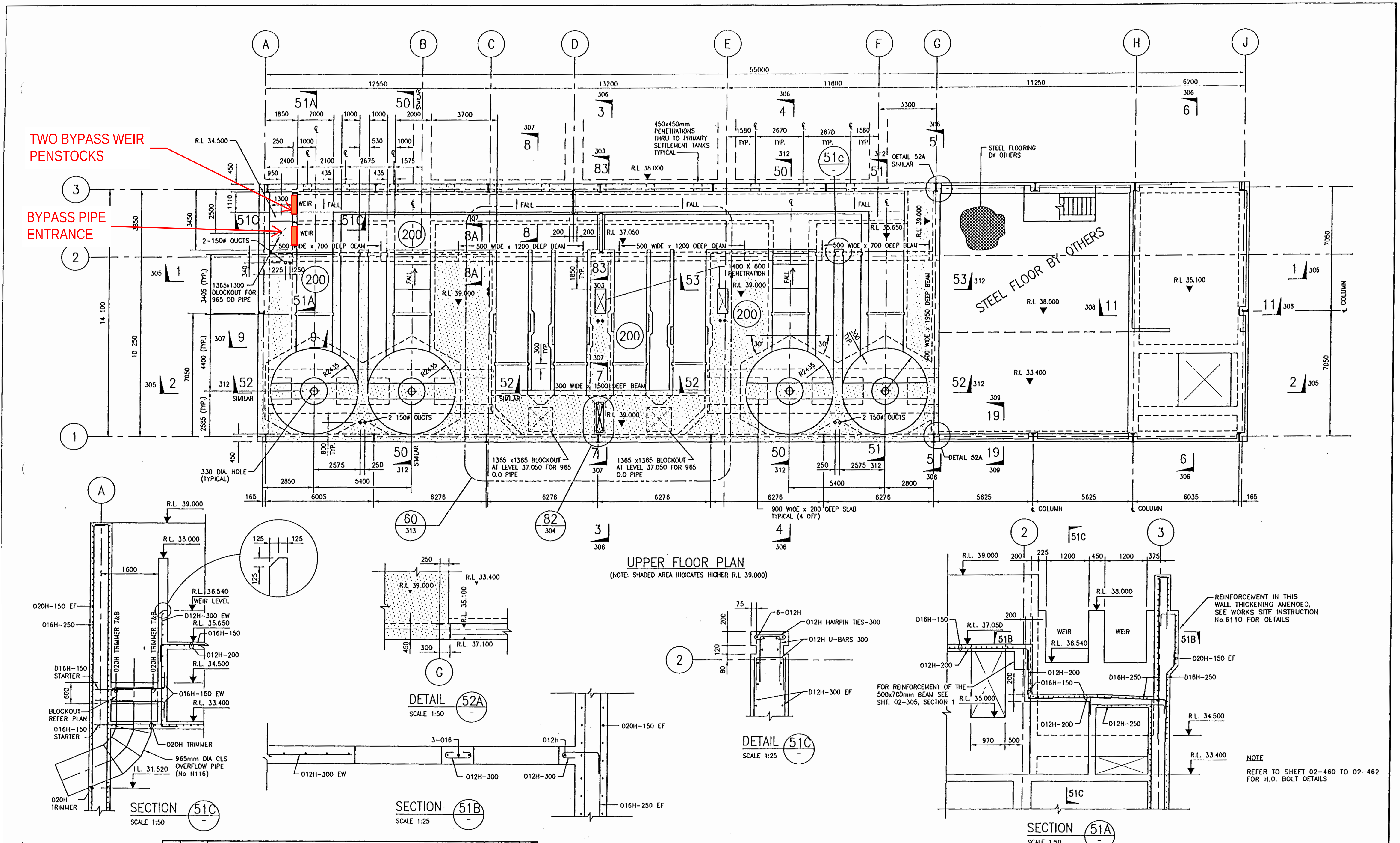
Appendix A

As Builts Extracted from Moa Point As Built Set



REV	DATE	DESCRIPTION	DRN	CHK	APP
Z	30/5/97	AS BUILT	WHE		
K	12/4/96	SECTION 51C ADDED, COLUMN RELOCATED	K.R.B.	RAD	GH
J	22/8/96	STOPBOARD DETAILS ALTERED, REFERENCE FOR DETAIL 82 AND SECTION 83 ADDED	K.J.A.	RAD	GH
H	17/7/96	DETAIL 51C ADDED	WHE	R.A.D.	G.H.
G	27.6.96	PENETRATION ADDED	K.R.B.		
F	24/5/96	STOP BOARD SLOTS MOVED, DUCTS ADDED, GRID 3 WALL OPENINGS MOVED, WEIR DETAIL ADDED	WHE		G.B.H.

	BY	CHECKED	DATE
Survey			
Design	P R SWAN	B J SCHISCHKA	2/96
Drawn	H.J.SCHICKER	R G CLARK	8/95
Recom'd	R G TAYLOR	R L BISHOP	2/96
Approval	G B McFETRIDGE		7/02/96
Status:	AS BUILT		A1

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5/1420/4/7504/4

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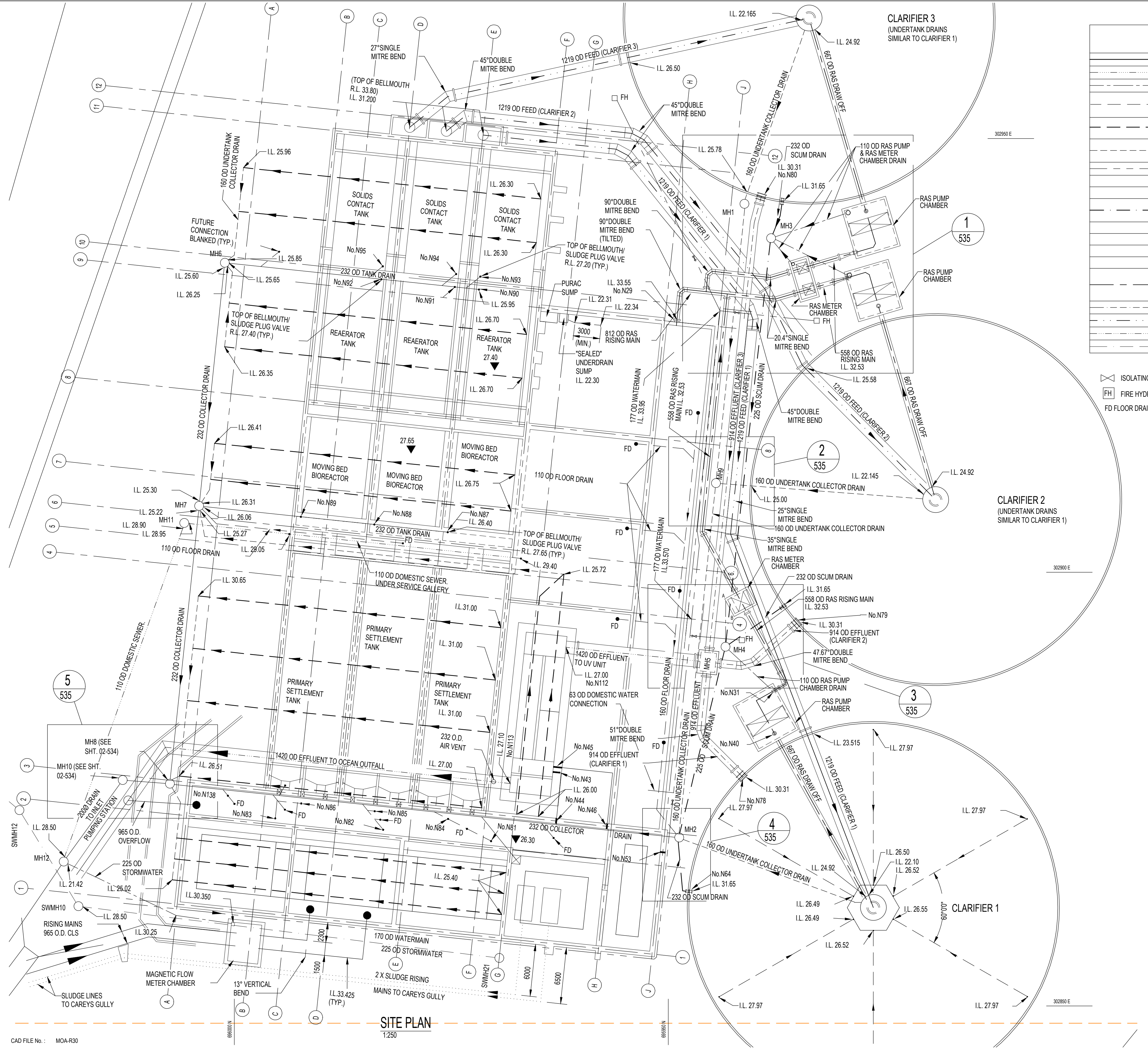
WELLINGTON WASTE WATER PROJECT
MOA POINT TREATMENT PLANT

Title: INLET WORKS
UPPER FLOOR PLAN
RL 37.000 to RL 39.000

Drawing No. 951092
02-303

Scale 1:100 | Sheet 02-303 | REV Z



SITE PLAN
1:250

	PIPE DIAMETER	PIPE DETAILS	PIPE MATERIAL *
	63 OD	DOMESTIC WATER CONNECTION	MDPE
	110 OD	DOMESTIC SANITARY SEWER	PVC SEWER PIPE (HEAVY DUTY)
	110 OD	RAS PUMP AND METER PIT DRAIN	PVC SEWER PIPE (HEAVY DUTY)
	110 OD 160 OD	FLOOR DRAIN FLOOR DRAIN	1. PVC SEWER PIPE (HEAVY DUTY) 2. PVC SEWER PIPE (HEAVY DUTY)
	160 OD	UNDERTANK DRAIN	1. PERFORATED PVC SEWER PIPE (HEAVY DUTY) TO NRB F2 SPECIFICATION) 2. PERFORATED HDPE (SDR 26) TO NRB F2 SPECIFICATION
	160 OD	UNDERTANK COLLECTOR DRAIN	1. PVC SEWER PIPE (HEAVY DUTY) 2. HDPE (SDR 26)
	177 OD	WATERMAIN	BLUE BRUTE PVC CLASS 18
	110 OD	DOMESTIC SEWER	1. PVC SEWER PIPE (HEAVY DUTY)
	225 OD 232OD	SCUM DRAIN SCUM DRAIN	1. PVC PRESSURE PIPE (CLASS B) 1. CONCRETE LINED STEEL
	232 OD	COLLECTOR DRAIN	1. CONCRETE LINED STEEL
	232 OD	TANK DRAIN	CONCRETE LINED STEEL
	558 OD 667 OD 812 OD	RAS RISING MAIN RAS RISING MAIN RAS RISING MAIN	1. CONCRETE LINED STEEL 2. DUCTILE IRON 1. CONCRETE LINED STEEL 2. DUCTILE IRON 1. CONCRETE LINED STEEL 2. DUCTILE IRON
	914 OD	EFFLUENT (FROM CLARIFIERS)	CONCRETE LINED STEEL
	1219 OD	CLARIFIER FEED	CONCRETE LINED STEEL
	1420 OD	EFFLUENT (TO & FROM UV UNIT)	CONCRETE LINED STEEL
	225 OD	STORMWATER	RCRRJ CLASS Y

ISOLATING VALVE
FH FIRE HYDRANT
FD FLOOR DRAIN

* THE DRAINAGE SUB-CONTRACTOR SHALL USE PIPE MATERIALS AS SPECIFIED, WHERE APPROPRIATE, ALTERNATIVE ACCEPTABLE MATERIALS ARE LISTED.
ALL PIPE MATERIALS, MANUFACTURE AND INSTALLATION SHALL BE IN ACCORDANCE WITH THE SPECIFICATION AND RELEVANT CURRENT STANDARDS.

STRUCTURE		NORTHING	EASTING
MH1		302 942.468	695 941.243
MH2		302 869.414	695 948.768
MH3		302 938.502	695 938.173
MH4		302 891.403	695 943.424
MH5		REFER DWG 02-535	
MH6		302 935.675	696 001.108
MH7		302 907.630	696 004.062
MH8		302 875.607	696 007.435
MH9		302 910.256	695 944.537
MH10		302 876.324	696 012.843
MH11		302 905.677	696 005.776
MH12		302 866.927	696 019.644
RAS METER CHAMBER FOR CLARIFIER No.1	A	302 896.929	695 943.503
	B	302 894.900	695 942.419

NOTES:

1. REFER TO SHEET 951092, 02-534 FOR LOCATION OF EMBEDDED ITEMS
2. ALL PIPES TO BE LAID ON UNIFORM GRADIENT BETWEEN INDICATED INVERT LEVELS.
3. REFER TO SHEET 951092, 02-537 FOR TRENCHING DETAILS OF 1420 O.D. EFFLUENT PIPE UNDER THE MAIN PLANT STRUCTURE.
4. FOR EMBEDMENT ITEM DETAILS REFER AWI 05-022 TO 05-026

1:250 0 2 4 6 8 10 12 14 16 18 20 22 24 m

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Wellington

5/1420/15/7504/30

REV	DATE	DESCRIPTION	DRN	CHK	APP
Z	7/98	AS BUILT	K.J.A.		D.O'D.
D	12/95	CLARIFIER PIPEWORK REDESIGNED	G.M.O.		G.M.
C	11/95	EFFLUENT PIPE SIZE CHANGED, SLUDGE PIPES AND RISING MAINS ALTERED	K.J.A.		G.M.
B	10/95	FLOOR DRAINS AND MH10 ADDED, IL's AMENDED, DETAILS TRANSFERED TO 02-535	K.J.A.		G.M.
F	02/07/96	SWMH10 RELOCATED WITH ADDITION OF TIE BACK WALL	K.R.B.		

	BY	CHECKED	DATE
Survey			
Design	V. TAM	J.R. BLACK	09/95
Drawn	K.J. ALEKNA	I.R.T./R.G.C.	9/95
Recom'd	J.R. BLACK	R.L. BISHOP	10/95
Approval	G. McFETRIDGE		10/95
Status:	AS BUILT		A1

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Absolutely Positively Wellington

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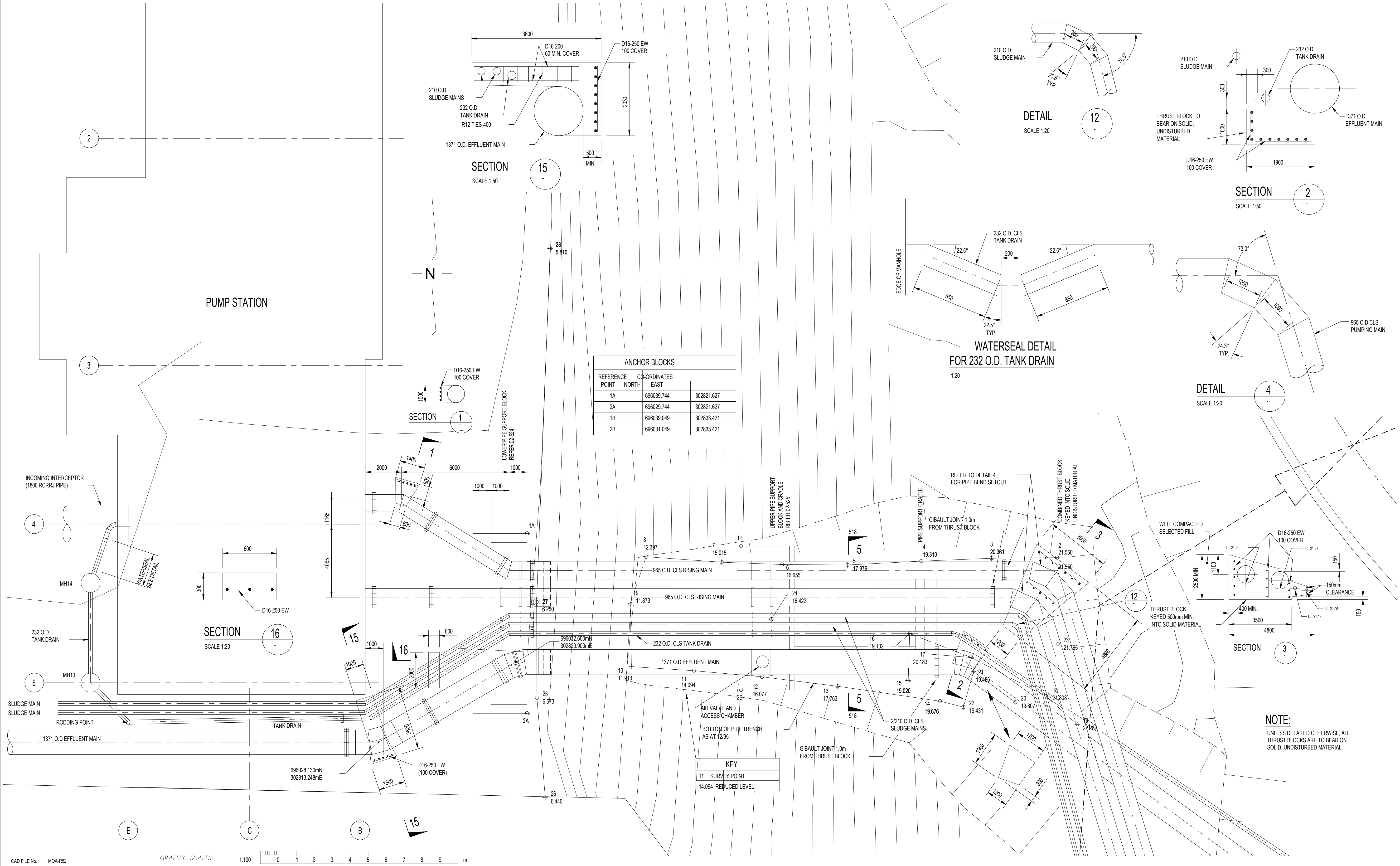
WELLINGTON WASTE WATER PROJECT

MOA POINT TREATMENT PLANT

Title: ENVIRONMENMENTAL ON SITE SERVICES PLAN

Drawing No. 95092 02- 529

Scale 1:250 | Sheet 02-529 | REV Z



ANCHOR BLOCKS

REFERENCE POINT	CO-ORDINATES NORTH	EAST
1A	696039.744	302821.627
2A	696029.744	302821.627
1B	696039.049	302833.421
2B	696031.049	302833.421

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5/1420/15/7504/52

REV	DATE	DESCRIPTION	DRN	CHK	APP
Z	7/98	AS BUILT	WHE		D.O'D
C	14/6/96	ALIGNMENT OF EFFLUENT PIPE AND TANK DRAIN ADJACENT TO PUMP STATION	K.R.B.	GH	GM
B	1/5/96	TANK DRAIN REALIGNED, THRUST BLOCK, SECTION 11, DETAIL 12 ADDED, DETAILS ALTERED	K.J.A.	V.T.	G.B.M.
A	03/96	FOR CONSTRUCTION	K.R.B.		G.M.

	BY	CHECKED	DATE
Survey			
Design	M. PATERSON	V. TAM	03/96
Drawn	S. SEATH	R.G. CLARK	03/96
Recom'd	V. TAM	R.L. BISHOP	03/96
Approval	G.B. McFETRIDGE		15/3/96
Status:	AS BUILT		A1

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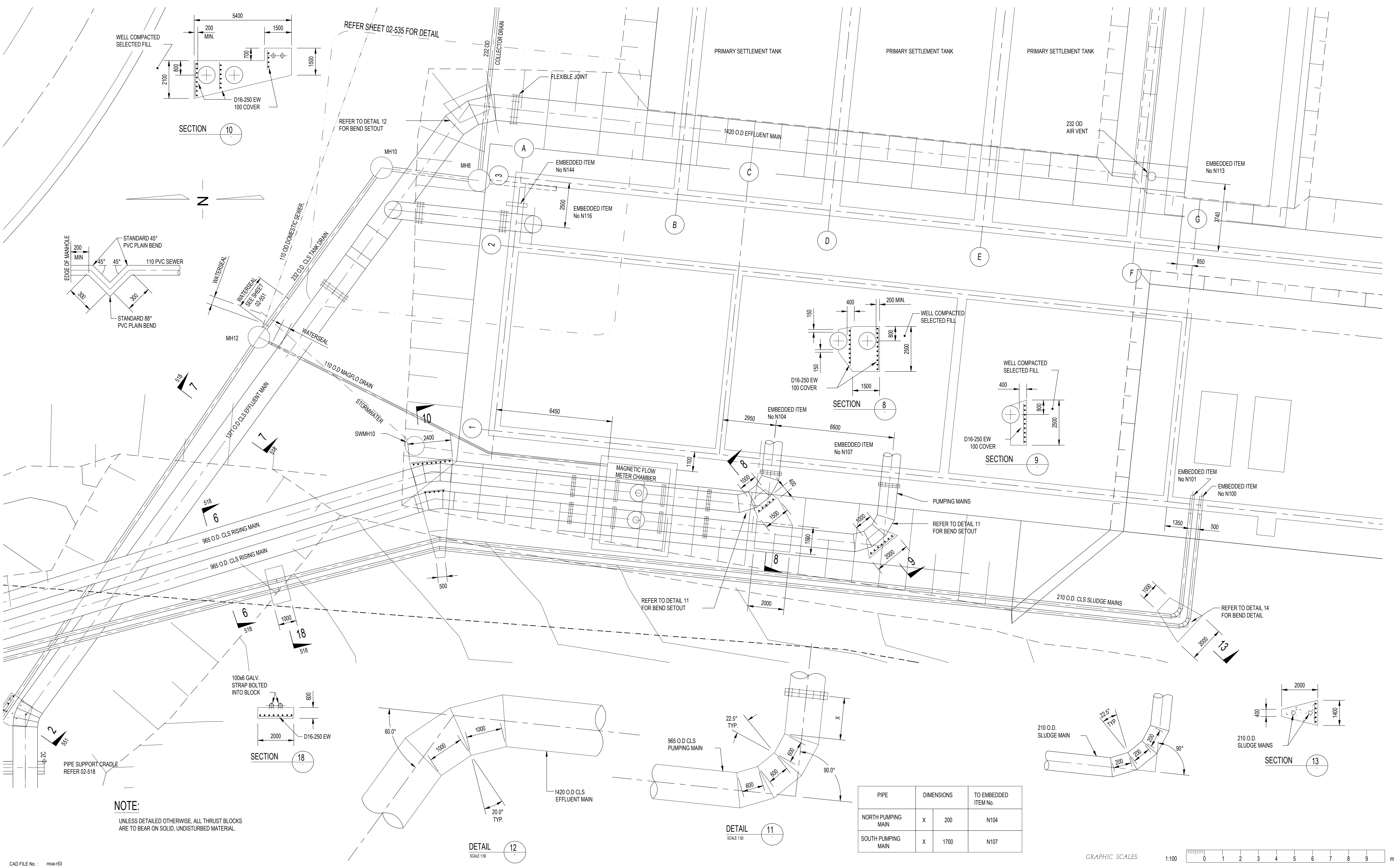
WELLINGTON WASTE WATER PROJECT

MOA POINT TREATMENT PLANT

Title: ENVIRONMENTAL - EFFLUENT MAIN, SLUDGE MAINS, AND PUMPING MAINS PUMP STATION TO CROSS-OVER DETAILS

Drawing No. 951092 02- 551

Scale 1:100 | Sheet 02-551 | REV Z



PIPE	DIMENSIONS		TO EMBEDDED ITEM No.
NORTH PUMPING MAIN	X	200	N104
SOUTH PUMPING MAIN	X	1700	N107

NOTE:

UNLESS DETAILED OTHERWISE, ALL THRUST BLOCKS ARE TO BEAR ON SOLID, UNDISTURBED MATERIAL.

CAD FILE No.: moa-r53

WORKS Consultancy Services Wellington

5/1420/15/7504/53

REV	DATE	DESCRIPTION	DRN	CHK	APP
Z	7/98	AS BUILT	WHE		D O'D
B	2/5/96	THRUST BLOCKS CHANGED, BEND DETAIL AND WATERSEAL ADDED, EMBEDDED ITEMS MOVED	K.J.A.	VT	GM
A	03/96	FOR CONSTRUCTION	K.R.B.		G.M.

	BY	CHECKED	DATE
Survey			
Design	M. PATERSON	V. TAM	03/96
Drawn	K.R. BELL	R.G. CLARK	03/96
Recom'd	V. TAM	R.L. BISHOP	03/96
Approval	G.B. McFETRIDGE		15/3/96
Status:	AS BUILT		A1

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WELLINGTON WASTE WATER PROJECT

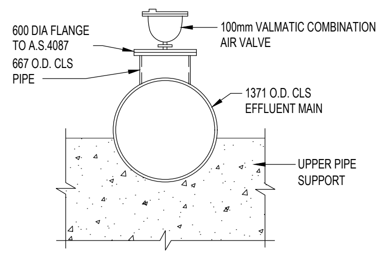
MOA POINT TREATMENT PLANT

Title: ENVIRONMENTAL - EFFLUENT MAIN, SLUDGE MAINS, AND PUMPING MAINS CROSS OVER TO STATION DETAILS

Drawing No. 951092

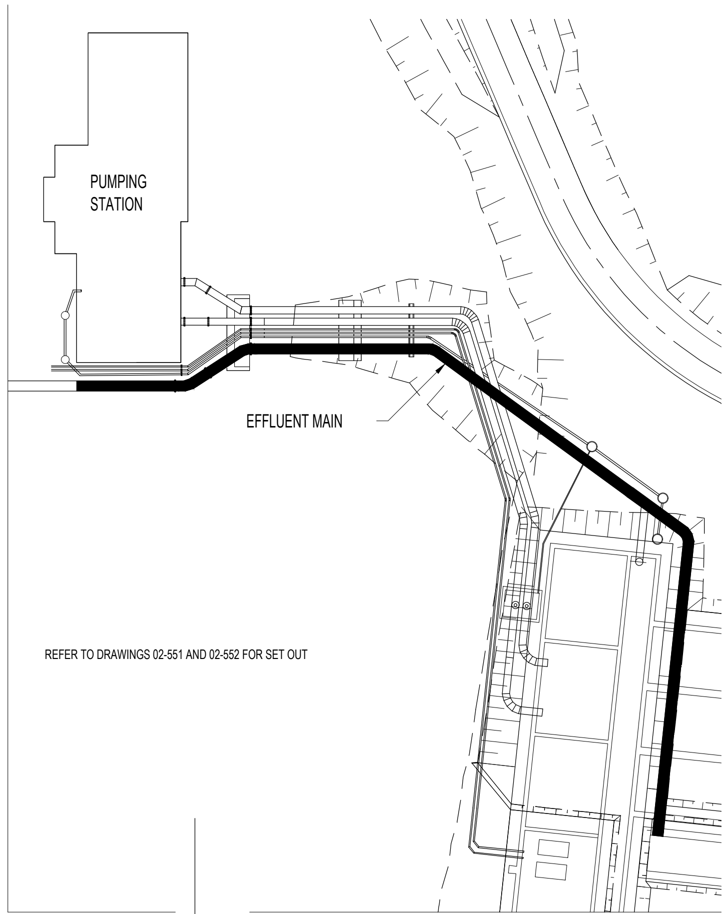
02- 552

Scale 1:100 | Sheet 02-552 | REV Z



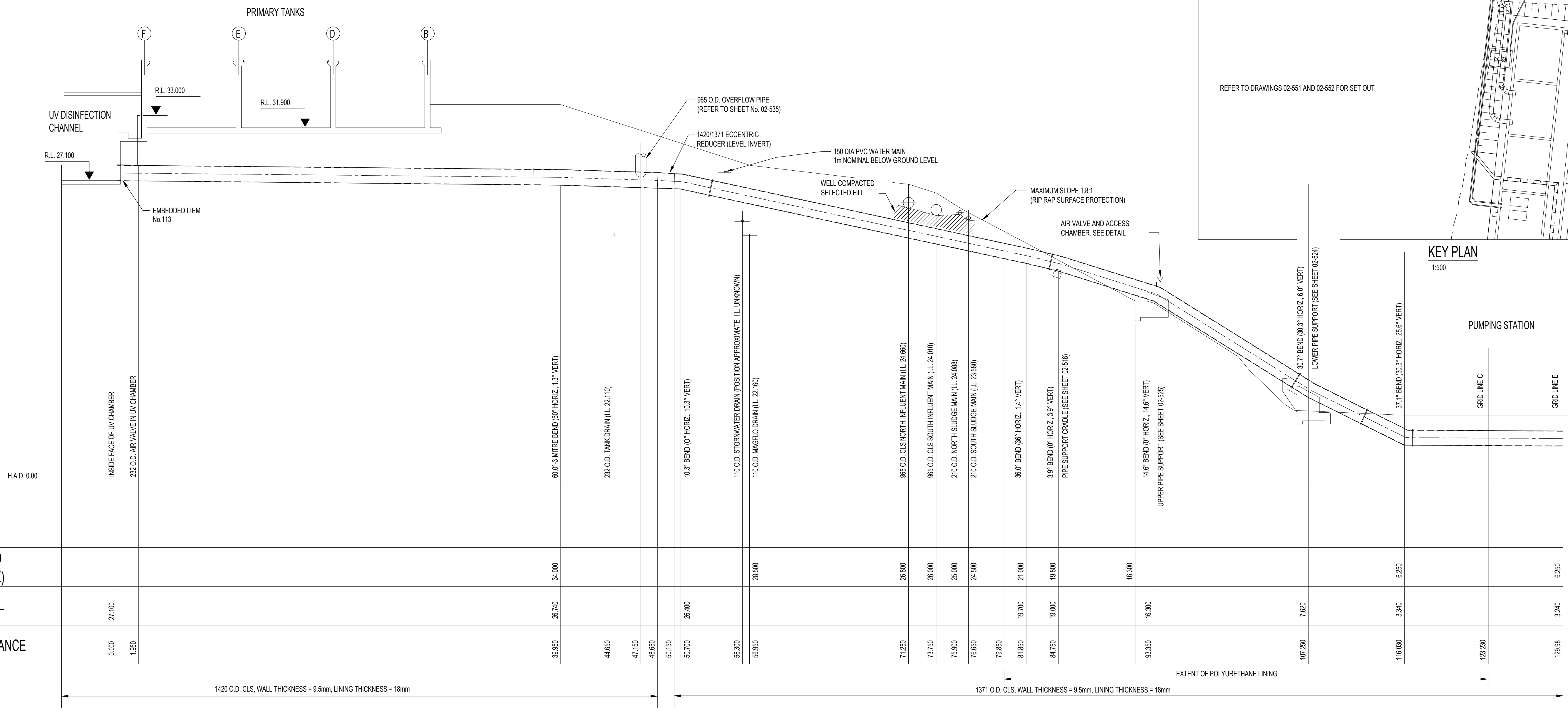
DETAIL OF AIR VALVE/ACCESS CHAMBER ON EFFLUENT MAIN

1:50



KEY PLAN

1:500



EFFLUENT MAIN

CONCRETE LINED STEEL PIPE

CAD FILE No.: MOA-R20

REV	DATE	DESCRIPTION	DRN	CHK	APP
Z	7/98	AS BUILT	K.J.A.		D.O'D.
D	14/6/96	ALIGNMENT OF EFFLUENT PIPE ADJACENT TO PUMP STATION	K.R.B.	V.T.	G.M.
C	27/5/96	POLYURETHANE LINING ADDED	GMO		G.B.M.
B	29/4/96	GROUND LEVEL AMEMDED AND LEVELS ADDED	WHE		G.M.
A	15/3/96	FOR CONSTRUCTION	K.J.A.		G.M.

	BY	CHECKED	DATE
Survey			
Design	M. PATERSON	V. TAM	3/96
Drawn	K.J. ALEKNA	R. CLARK	3/96
Recom'd	V. TAM	R.L. BISHOP	3/96
Approval	G.B. McFETRIDGE		15/3/96
Status:	AS BUILT		A1

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5/1420/15/7504/20

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WELLINGTON WASTE WATER PROJECT

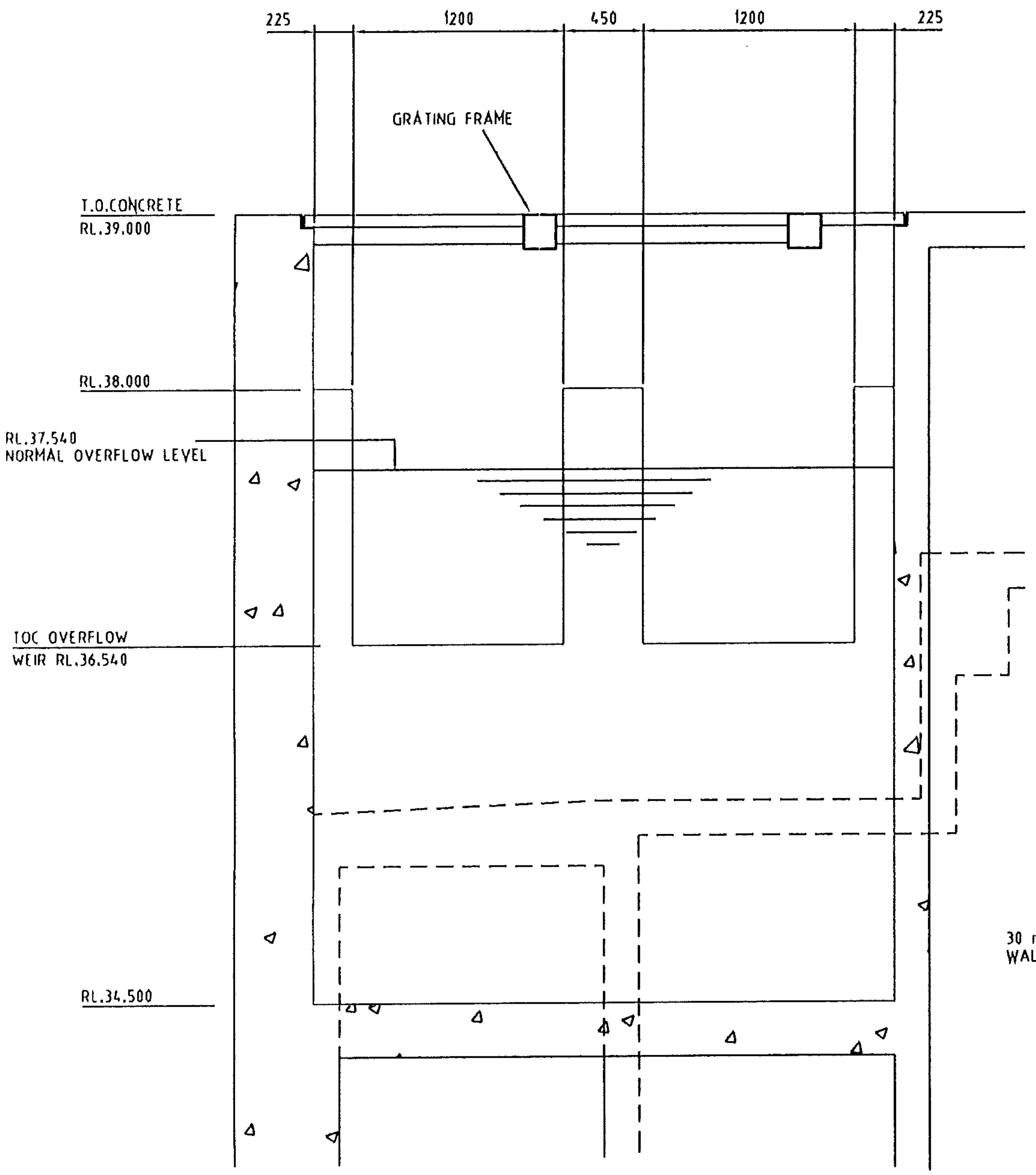
MOA POINT TREATMENT OLANT

Title: ENVIRONMENTAL EFFLUENT MAIN LONGITUDINAL SECTION

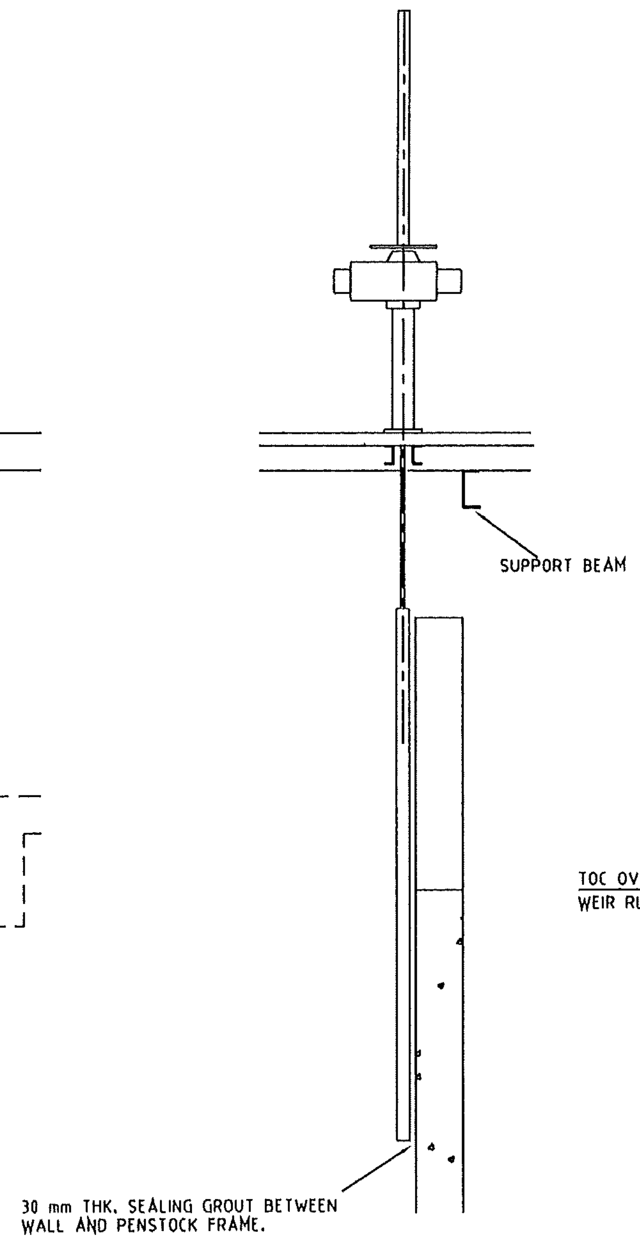
Drawing No. 951092

02- 519

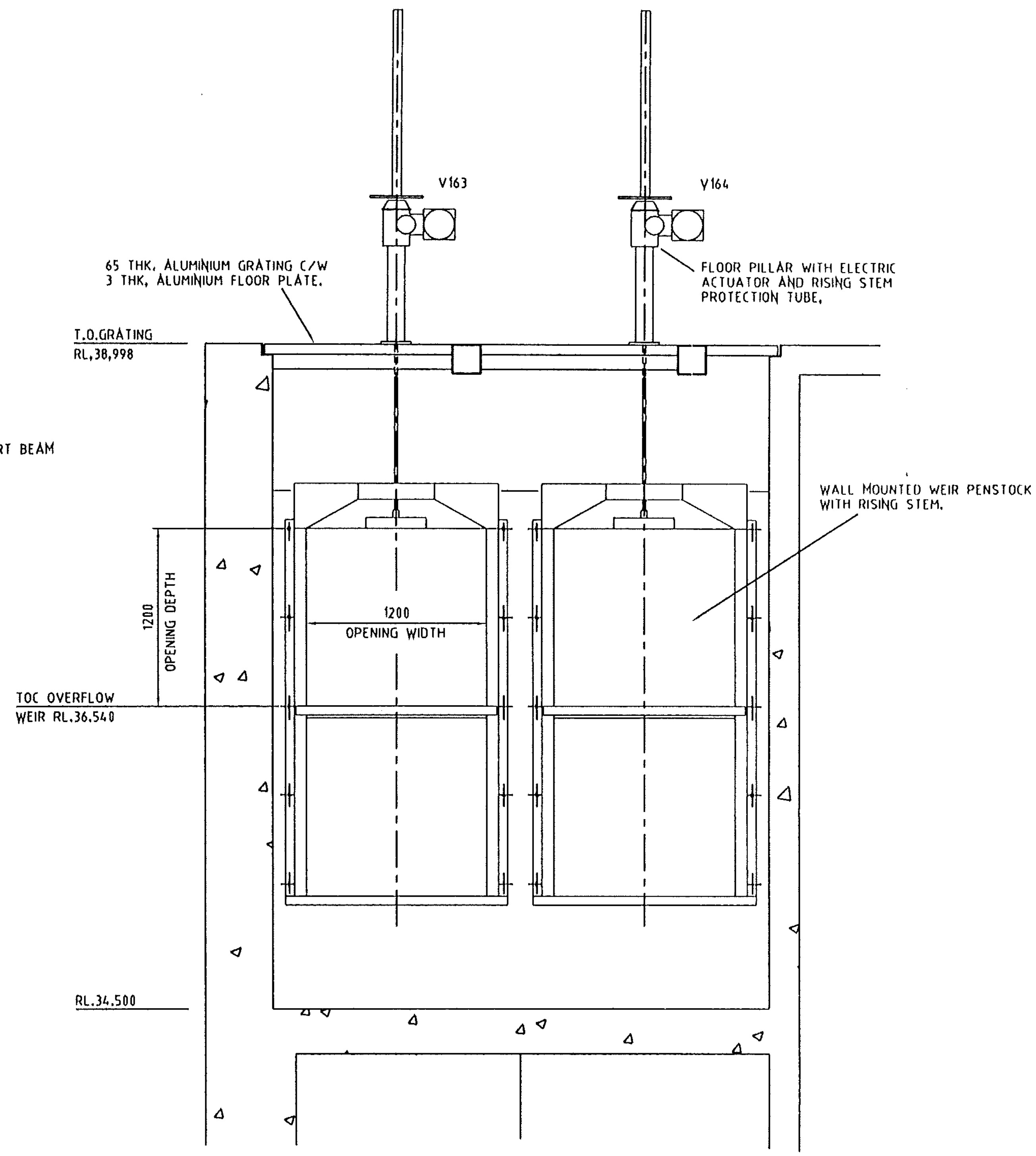
Scale 1:200 | Sheet 02-519 | REV Z



VIEW SHOWING CONCRETE STRUCTURE



END ELEVATION



VIEW SHOWING WEIR PENSTOCKS

NOTE

FOR DETAILS REFER TO REQUISITION No.R602

AS BUILT (B)

FILE No. J:\C_CONTRA\95\092\G\G5\05-029

14-002	GRATING & PLATFORM LAYOUT - PLAN
02-017	CIVIL LAYOUT, SECTIONS - SHEET 2
REFERENCE DRAWINGS	

REV	DATE	DESCRIPTION	DRN	CHK	APP
B	07.05.98	AS BUILT	IS		
A	29.06.96	ISSUED FOR CONSTRUCTION	DB		
1	13.05.96	ISSUED FOR ENQUIRY	DB	GG	

Drawn	D.Butcher	18.12.95	Scale: NTS
Checked	G.GRANT	07.05.96	
Design	T.CHEESMAN	01.02.96	
CERTIFIED FOR CONSTRUCTION			A1

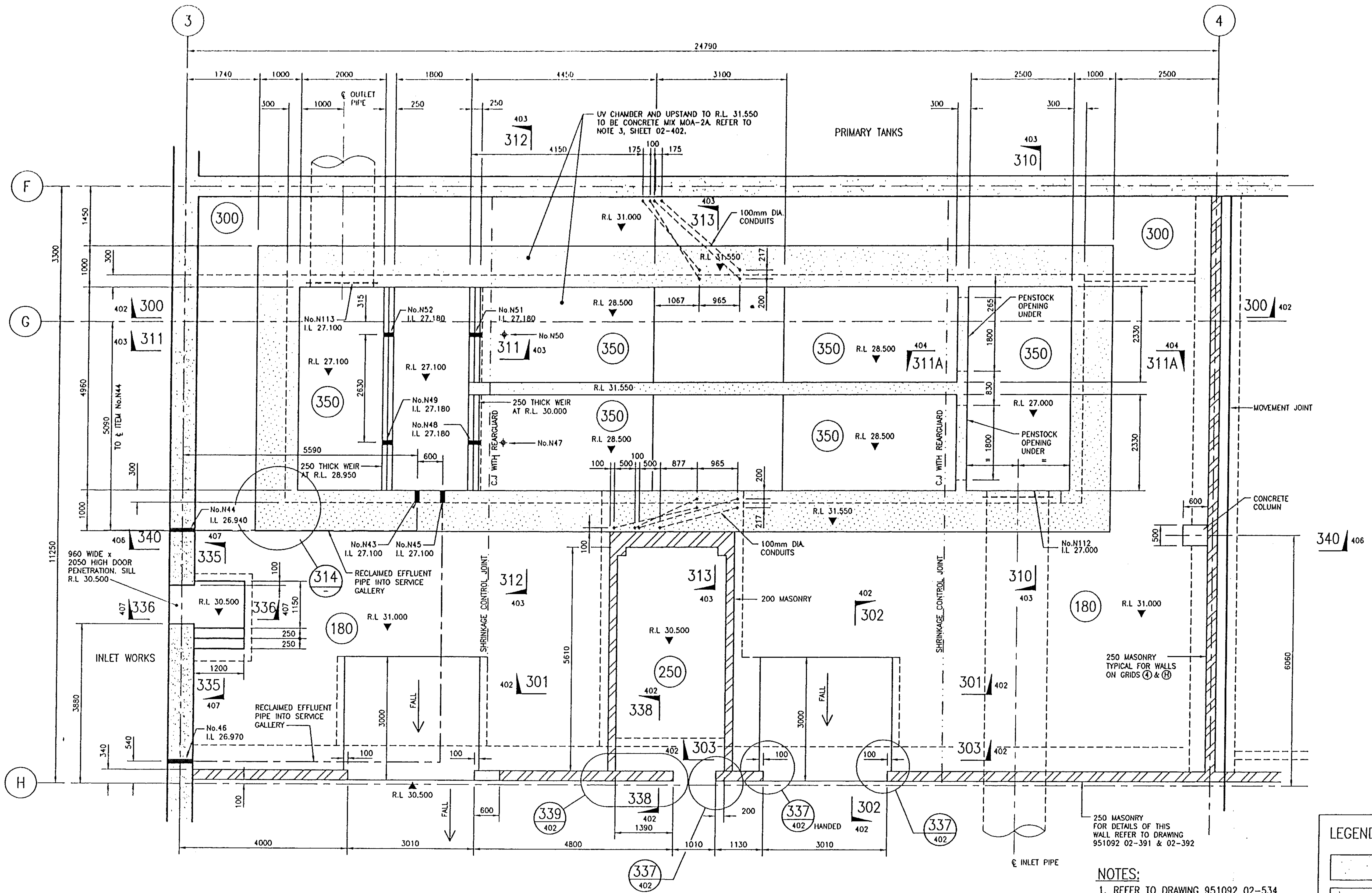
Customer: WELLINGTON CITY COUNCIL

Project: WELLINGTON WASTE WATER PROJECT
MOA POINT TREATMENT PLANT

Title: PENSTOCKS
PLANT OVERFLOW
DETAILS

Anglian Water
INTERNATIONAL PTY LTD
A.C.N. 062 716 572
6-10 BRIDGE ROAD, HORNSBY NSW 2077
TEL (02) 477-6300 FAX (02)477-6066

AWI Contract N°	AWI Drg N°	REV
951092	05-029	B



PLAN AT R.L 32.000

NOTES:

1. REFER TO DRAWING 951092 02-534 FOR EMBEDDED ITEMS IN THE U.V DISINFECTION ROOM.
2. REFER TO DRAWING 951092 02-405 FOR DETAILS OF INLET AND OUTLET PIPES.

LEGEND:

- INDICATES CONCRETE AT UPPER R.L 31.550
- INDICATES CONCRETE IN SECTION
- INDICATES MASONRY

REV	DATE	DESCRIPTION	DRN	CHK	APP
Z	3/6/97	AS BUILT	WHE		
D	12/7/96	REFERENCE TO DETAILS 315 & 316 REMOVED, REBATE REMOVED & CONDUIT DETAILS ADDED	WHE		
C	12/4/96	UV CHAMBER WIDEN, PENSTOCK ADDED	K.R.B.	RAD	GH
B	13/3/96	STAIR ACCESS ADDED	K.J.A.		G.B.H
A	03/96	FOR CONSTRUCTION	MJS	R.A.D.	G.M.

	BY	CHECKED	DATE
Survey			
Design	B. McNAUGHTON	P.D. WRIGHT	2/96
Drawn	M.J.SCHICKER	R.G. CLARK	02/96
Recom'd	R.A. DAVEY	R.L. BISHOP	03/96
Approval	G.B. McFETRIDGE		4/3/96
Status:	AS BUILT		A1

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5/1420/8/7504/1

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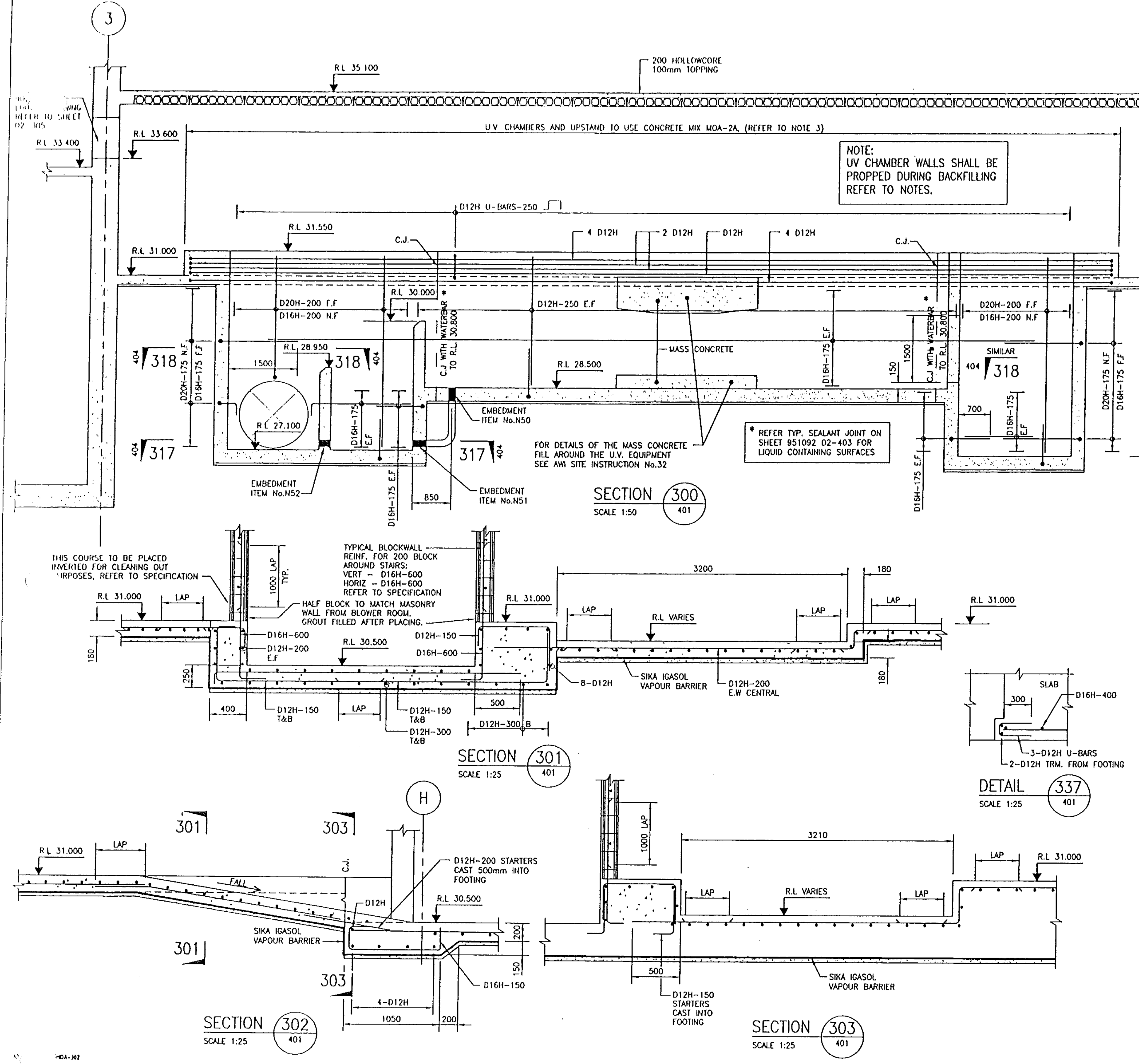
Ph: (04) 499-9182

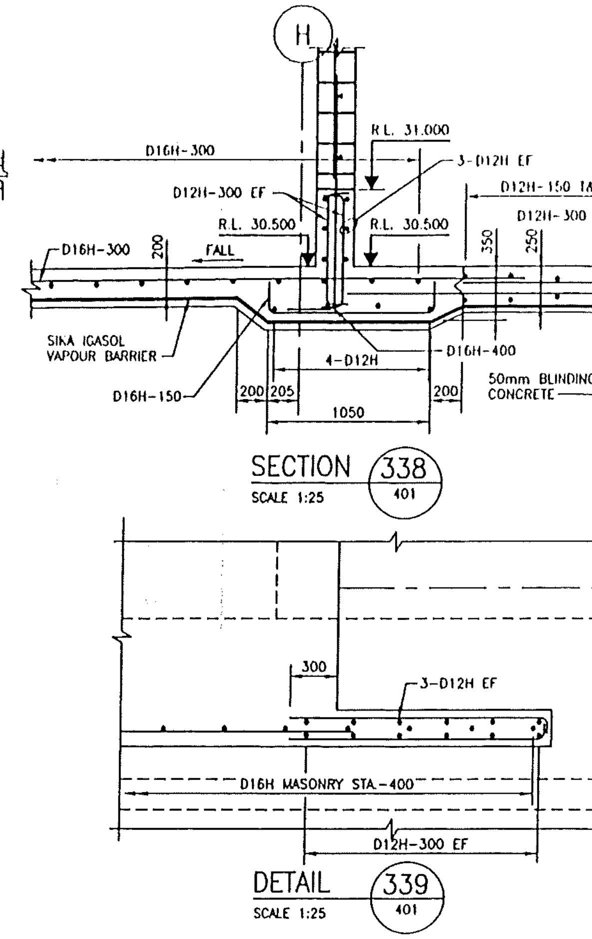
WELLINGTON WASTE WATER PROJECT
MOA POINT TREATMENT PLANT

Title: UV DISINFECTION ROOM PLAN AT R.L 32.000

Drawing No. 951092 02-401

Scale 1:50 | Sheet 02-401 | REV Z





NOTES:

1. REFER TO DRAWINGS 02-401 FOR GEOMETRY.
2. ALL REINFORCEMENT SHALL BE GRADE 430 TO NZS3402
3. CONCRETE FOR UV CHAMBERS AND UPSTAND BETWEEN R.L. 26.650 AND R.L. 31.550 SHALL BE MIX MOA-2A. ALL OTHER CONCRETE SHALL BE MIX MOA-3. REFER TO SPECIFICATION (MOA 101A: 1995)
4. BLINDING CONCRETE STRENGTH SHALL BE 10 MPa.
5. COVER TO REINFORCEMENT SHALL BE 50mm UNLESS SHOWN OTHERWISE ON THE DRAWINGS.
6. ALL VERTICAL AND EXTERNAL HORIZONTAL CORNERS SHALL HAVE A 25mm x 25mm FILLET OR CHAMFER AS APPLICABLE.
7. BARS SHALL BE PLACED IN LONGEST PRACTICABLE LENGTHS. BETWEEN THE LAPS SHOWN THE BARS MAY LAP AT RANDOM PROVIDED LAPS IN ADJACENT BARS ARE STAGGERED.
8. WHERE BARS OF DIFFERENT SIZES LAP, THE LAP LENGTH FOR THE SMALLER BAR SHALL BE USED.
9. ALL EXPOSED CONCRETE SURFACE FINISHES SHALL BE F4 OR U3 AS APPLICABLE, UNLESS SHOWN OTHERWISE ON THE DRAWINGS.
10. ALL HOOKS SHALL BE STANDARD TO NZS3109 UNLESS SHOWN OTHERWISE ON THE DRAWINGS.
11. ALL CONSTRUCTION JOINTS SHALL BE TYPE B TO NZS3109 WITH CONCRETE GREEN CUT UNLESS SHOWN OTHERWISE ON THE DRAWINGS.
12. CONSTRUCTION JOINTS SHALL HAVE WATERBARS OR 150mm REARGUARD WATERSTOPS WHERE SHOWN. ALL WATERBARS SHALL BE 150mm HYDROFOIL WATERSTOP UNLESS SHOWN OTHERWISE ON THE DRAWINGS.
13. ALL HYDROFOIL AND REARGUARD WATERSTOP JOINTS SHALL BE HEAT WELDED IN ACCORDANCE WITH THE WATERSTOP MANUFACTURER'S WRITTEN INSTRUCTIONS.
14. ALL HYDROFOIL TO REARGUARD AND HYDROFOIL TO HYDROFOIL WATERSTOP INTERSECTIONS SHALL USE PREFORMED MOULDED INTERSECTION PIECES MATCHING THE WATERSTOP SECTIONS TO BE JOINED.
15. WALL AND SLAB REINFORCING BAR SPACINGS AT WALL/FLOOR CONSTRUCTION JOINT INTERSECTIONS SHALL BE INCREASED AS REQUIRED TO GIVE BETWEEN 25-50mm CLEARANCE TO THE SIDES OF THE WATERSTOP PASSING BETWEEN THE BARS. THE SAME NUMBER OF BARS SHALL BE INSTALLED AS IF NO ADDITIONAL SPACING WAS REQUIRED. THE MAXIMUM SPACING OF ANY MAIN BARS PASSING HYDROFOILS OR REARGUARD SECTIONS SHALL BE 350mm.
16. ALL CONSTRUCTION JOINTS EXCEPT THOSE IN WALLS WITH WATER ON BOTH SIDES UNDER NORMAL OPERATING CONDITIONS SHALL BE SEALED ON THE INNER (LIQUID RETAINING) FACE WITH FOSROC SECOSEAL 200 FC ELASTOMERIC SEALANT IN A 20x20mm CHASE AS SHOWN ON TYPICAL DETAIL ON SHEET 951092 02-336
17. UV CHAMBER WALLS SHALL BE RIGIDLY PROPPED AT FLOOR LEVEL TO PREVENT MOVEMENT DURING BACKFILLING. PROPS SHALL REMAIN IIN PLACE UNTIL THE FLOOR SLAB IS COMPLETED AND ATTAINED THE DESIGN STRENGTH.
18. HOLLOWCORE ROOF TO BE DESIGNED AND BUILT TO THE FOLLOWING:-
    i) HOLLOWCORE SHALL BE EITHER 300mm OR 200mm FIRTH DY-CORE OR APPROVED EQUIVALENT.
    ii) UNITS SHALL BE STORED, HANDLED, TRANSPORTED AND ERECTED IN ACCORDANCE WITH THE MANUFACTURERS WRITTEN INSTRUCTIONS
    iii) THE TOPPING THICKNESS SHOWN ON THE DRAWINGS IS THE MINIMUM THICKNESS. MAKE ALLOWANCE FOR UNIT CAMBER (AND POSSIBLE VARIATION OF) WHEN INSTALLING UNITS.
    iv) PROVIDE SEATING LENGTH AND MORTAR BEDDING AS RECOMMENDED BY THE MANUFACTURER.
    v) DESIGN LIVE LOAD SHALL BE AS DETAILED IN THE FLOOR LOADING DIAGRAM
19. LAP LENGTHS:

STANDARD LAP LENGTHS - CONCRETE MIX MOA-2A		
BAR SIZE	• VERTICAL BARS IN WALLS • BOTTOM FACE OR CENTRE LAYER BARS IN SLABS AND FOOTINGS GREATER THAN 350 THICK. ALL SLABS LESS THAN 350 THICK.	• HORIZONTAL BARS IN WALLS • TOP FACE BARS IN SLABS AND FOOTINGS GREATER THAN 350 THICK
D12H	300	400
D16H	400	550
D20H	500	650
D24H	700	900
D28H	900	1160
D32H	1150	1500

STANDARD LAP LENGTHS - CONCRETE MIX MOA-3		
BAR SIZE	• VERTICAL BARS IN WALLS • BOTTOM FACE OR CENTRE LAYER BARS IN SLABS AND FOOTINGS GREATER THAN 350 THICK. ALL SLABS LESS THAN 350 THICK.	• HORIZONTAL BARS IN WALLS • TOP FACE BARS IN SLABS AND FOOTINGS GREATER THAN 350 THICK
D12H	350	450
D16H	500	600
D20H	600	750
D24H	800	1050
D28H	1100	1400

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5/1420/8/7504/2

REV	DATE	DESCRIPTION	DRN	CHK	APP
Z	3/6/97	AS BUILT	WHE		
C	29/5/96	900x900 LOURVE OPENING ADDED, LEVELS CHANGED, WEIR ADDED, NOTES CHANGED	V.K.	RAD	GH
B	12/4/96	PENSTOCK ADDED	K.R.B.		G.B.H.
A	3/96	FOR CONSTRUCTION	MJS		G.B.H.

	BY	CHECKED	DATE
Survey			
Design	B McNAUGHTON	P D WRIGHT	02/96
Drawn	M.J.SCHICKER	R G CLARK	1/96
Recom'd	R A DAVEY	R L BISHOP	03/96
Approval	G B McFETRIDGE		04/03/96
Status:	AS BUILT		A1

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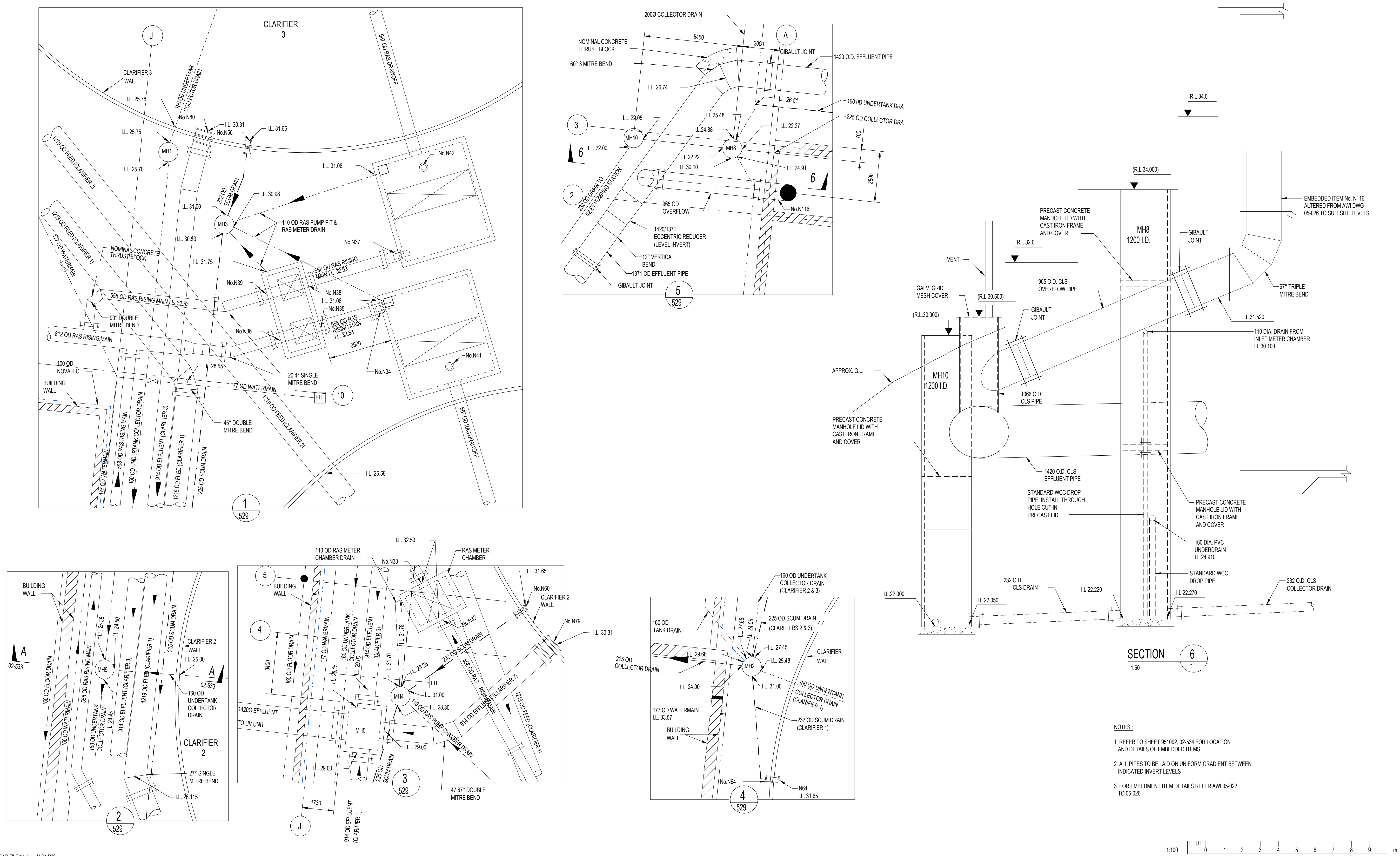
WELLINGTON WASTE WATER PROJECT
MOA POINT TREATMENT PLANT

Title: UV DISINFECTION ROOM
REINFORCEMENT
SHEET 1

Drawing No. 951092
02-402

Scale 1:50 1:25
Sheet 02-402
REV Z



CAD FILE No.: MOA-R36

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5/1420/15/7504/36

REV	DATE	DESCRIPTION	DRN	CHK	APP
Z	7/98	AS BUILT	WHE	V.T.	D O'D
D	12/95	DETAILS 1,2,3,4 & 5 REDRAWN	GMO	R.L.B.	G.B.M
C	11/95	SECTION 6 ADDED	K.J.A.		G.M.
F	02/07/96	SECTION 6 - GROND LEVELS REVISED, MANHOLE HEIGHT REVISED	K.R.B.	RAD	GM

	BY	CHECKED	DATE
Survey			
Design	V. TAM	J.R. BLACK	10/95
Drawn	K.J. ALEKNA	I.R.T./R.G.C.	10/95
Recom'd	J.R. BLACK	R.L. BISHOP	10/95
Approval	G. McFETRIDGE		10.95
Status:	AS BUILT		A1

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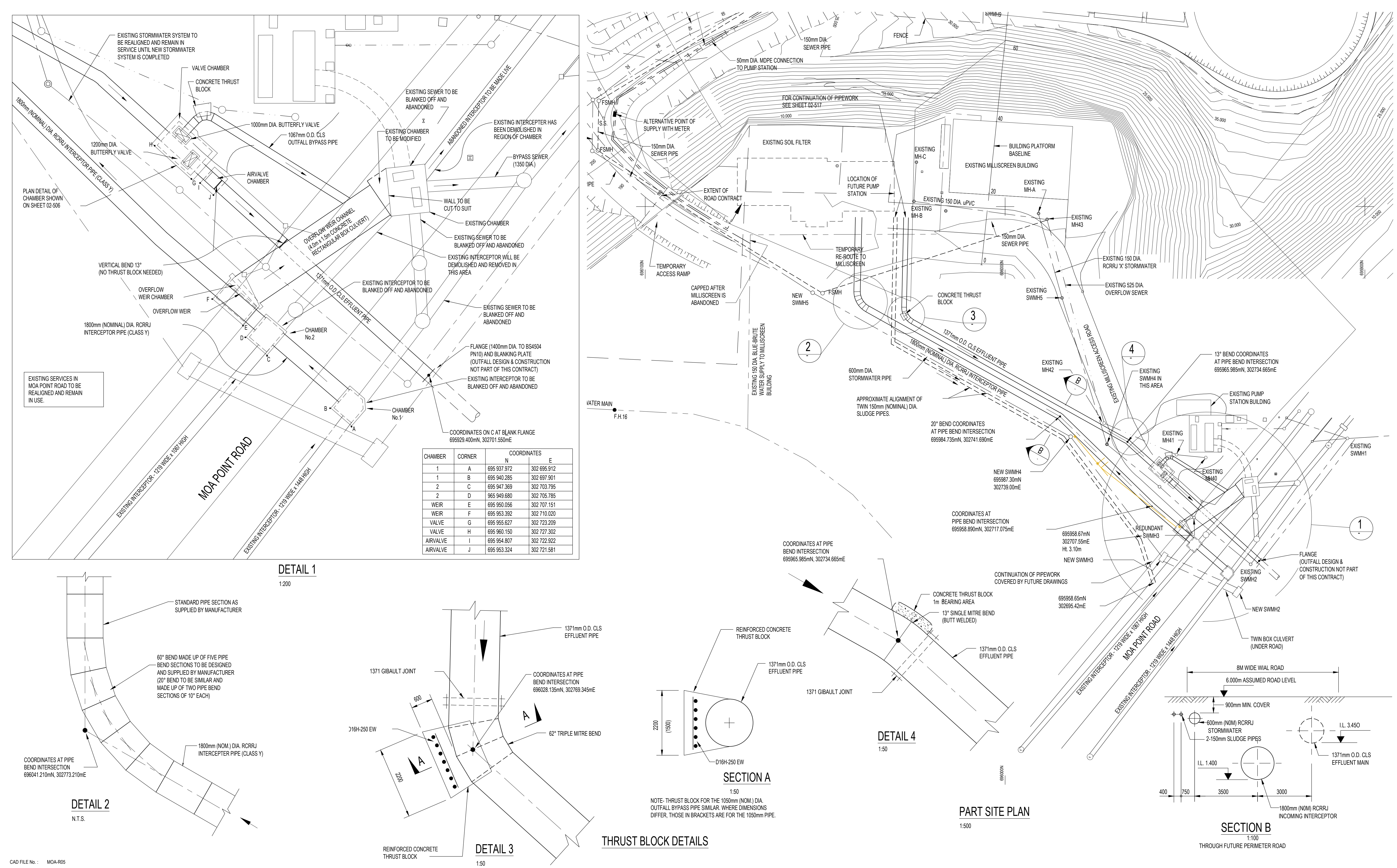
WELLINGTON WASTE WATER PROJECT

MOA POINT TREATMENT PLANT

Title: ENVIRONMENTAL ON SITE SERVICES DETAILS

Drawing No. 951092 02- 535

Scale 1:100 | Sheet 02-535 | REV Z



CHAMBER	CORNER	COORDINATES N	COORDINATES E
1	A	695 937.972	302 695.912
1	B	695 940.285	302 697.901
2	C	695 947.369	302 703.795
2	D	965 949.680	302 705.785
WEIR	E	695 950.056	302 707.151
WEIR	F	695 953.392	302 710.020
VALVE	G	695 955.627	302 723.209
VALVE	H	695 960.150	302 727.302
AIRVALVE	I	695 954.807	302 722.922
AIRVALVE	J	695 953.324	302 721.581

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5/1420/15/7504/5

REV	DATE	DESCRIPTION	DRN	CHK	APP
Z	7/98	AS BUILT	K.J.A.		D.O'D.
C	1/96	VALVE CHAMBER OUTLINE AMENDED, COORDINATES AMENDED	K.J.A.		G.M.
B	12/95	PIPES REALIGNED, CHAMBER AMENDEDAND COORDINATES ADDED	WGH	R.L.B.	G.M.
A	9/95	ISSUED FOR CONSTRUCTION, INTERCEPTOR, EFFLUENT AND SLUDGE PIPES REALIGNED	AC		G.M.

	BY	CHECKED	DATE
Survey			
Design	A.W. WATSON	V. TAM	7/95
Drawn	K.J. ALEKNA	I.R. TAYLOR	7/95
Recom'd	R.L. BISHOP		10/95
Approval	G. McFETRIDGE		18/10/95
Status:	AS BUILT		A1

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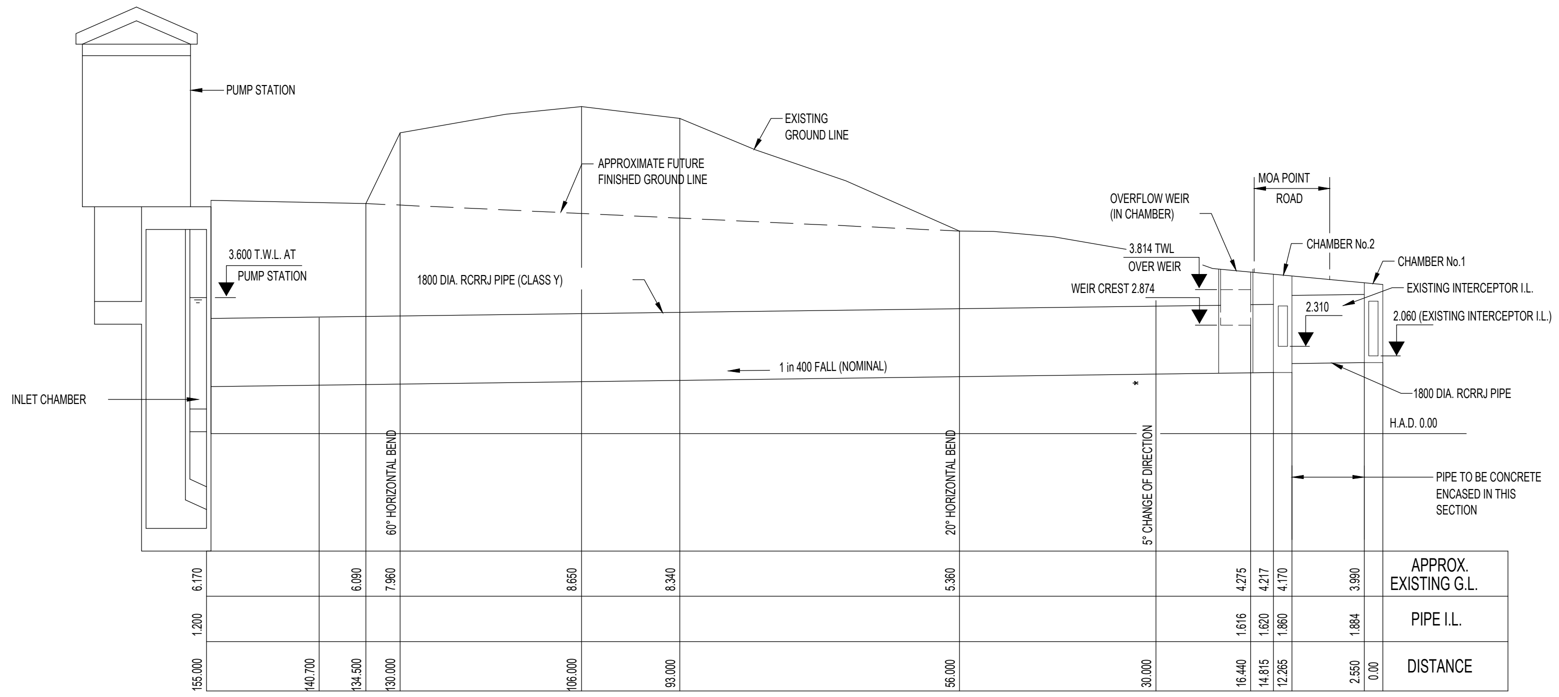
WELLINGTON WASTE WATER PROJECT

MOA POINT TREATMENT PLANT

Title:
ENVIRONMENTAL
INCOMING INTERCEPTOR,
OVERFLOW WEIR & EFFLUENT PIPE ETC

Drawing No. 951092
02- 504

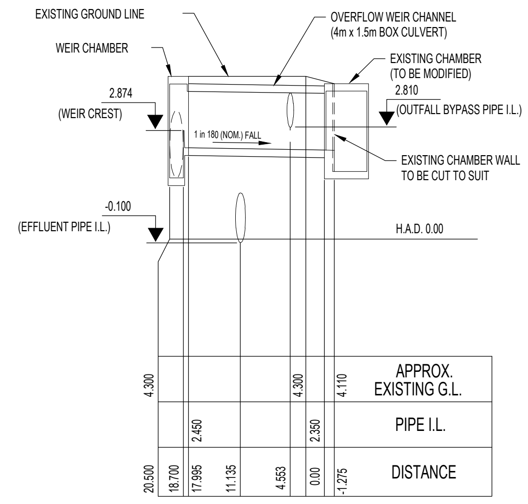
Scale: AS SHOWN
Sheet: 02-504
REV: Z



INCOMING INTERCEPTOR
LONGITUDINAL SECTION

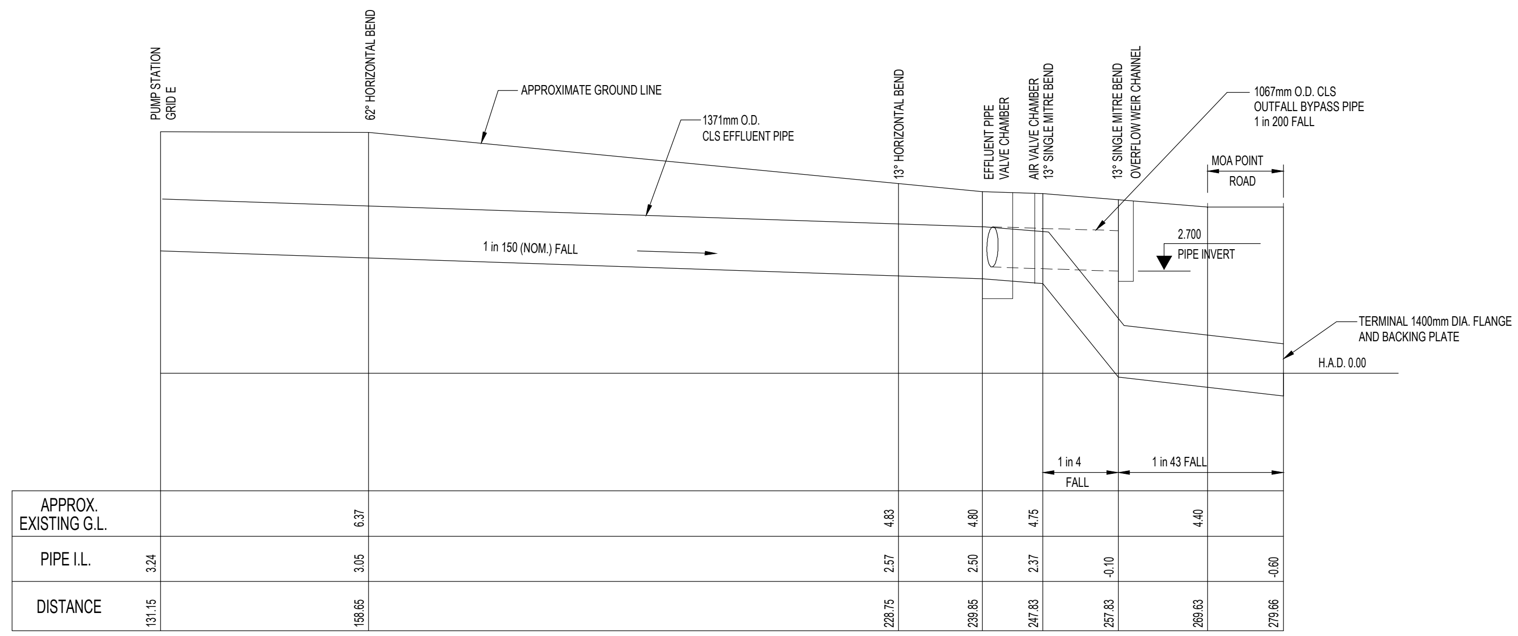
SCALES: HORIZ. 1:500
VERT. 1:100

* 5° CHANGE OF DIRECTION ACHIEVED USING PIPE JOINT FLEXIBILITY



OVERFLOW WEIR CHANNEL
LONGITUDINAL SECTION

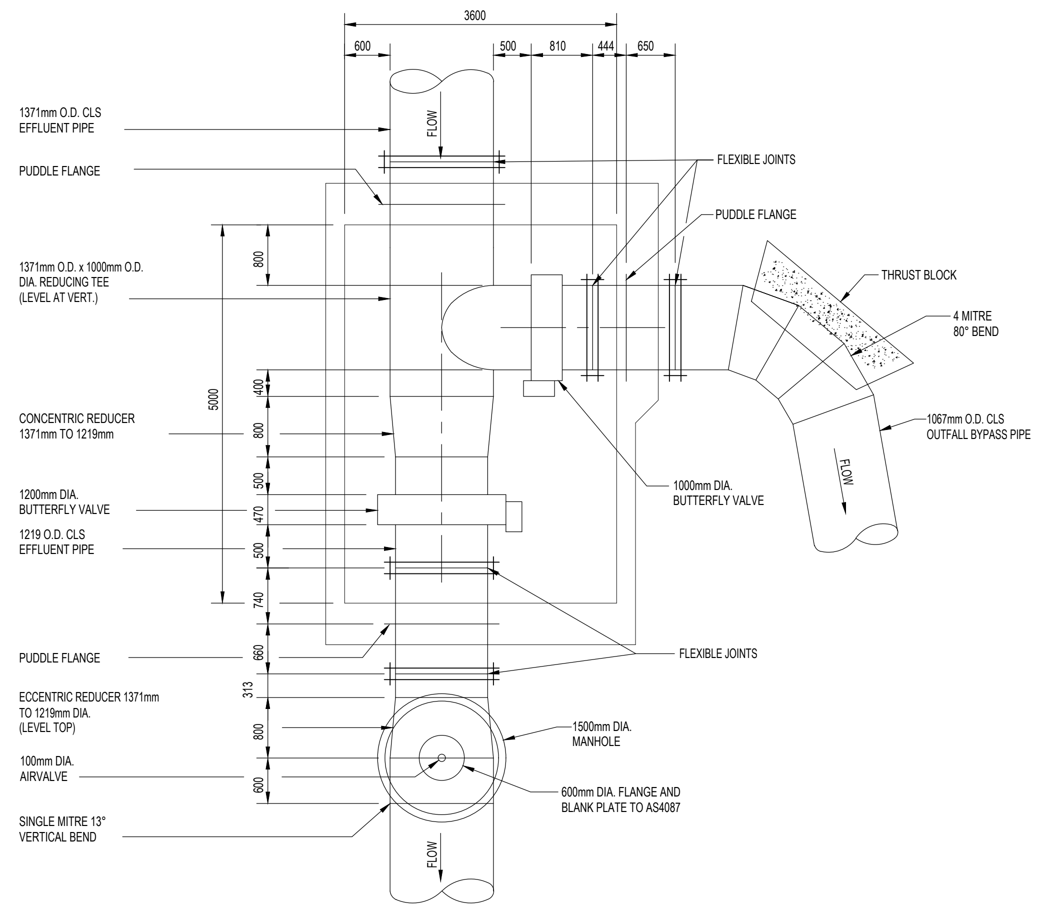
SCALES: HORIZ. 1:500
VERT. 1:100



EFFLUENT PIPE
LONGITUDINAL SECTION (PUMP STATION TO CONTRACT END)

SCALES: HORIZ. 1:500
VERT. 1:100

FOR DETAIL OF EFFLUENT PIPE FROM TREATMENT PLANT TO PUMP STATION REFER TO DRAWING No. 951092 02-519.



PLAN ON EFFLUENT PIPE VALVE CHAMBER

1:50

NOTE:

1. REFER TO SHEET 02-504 FOR POSITION OF EFFLUENT PIPE VALVE CHAMBER
2. FOR STRUCTURAL DETAIL OF CHAMBERS REFER TO DRAWING Nos. 951092 02-520 & 521.

CAD FILE No.: MOA-R07

WORKS Consultancy Services
Wellington

5/1420/15/7504/7

REV	DATE	DESCRIPTION	DRN	CHK	APP
Z	7/98	AS BUILT	K.J.A.		D.O'D.
D	27/5/96	EXTENT OF POLYURETHANE LINING REVISED	GMO		G.M.
C	22/3/95	PLAN ON VALVE CHAMBER AMENDED, EFFLUENT PIPE CHAINAGES REVERSED	MJS		G.M.
B	12/95	EFFLUENT PIPE LONGITUDINAL SECTION AND PLAN REDRAWN	WGH		G.M
A	9/95	ISSUED FOR CONSTRUCTION, SECTIONS ALTERED FOR PIPE REALIGNMENT, DETAIL ADDED	AC		G.M.

	BY	CHECKED	DATE
Survey			
Design	V. TAM	A.W. WATSON	9/95
Drawn	K.J. ALEKNA	I.R.TAYLOR	9/95
Recom'd	V. TAM	R.L. BISHOP	9/95
Approval	G. McFETRIDGE		18/10/95
Status:	AS BUILT		A1

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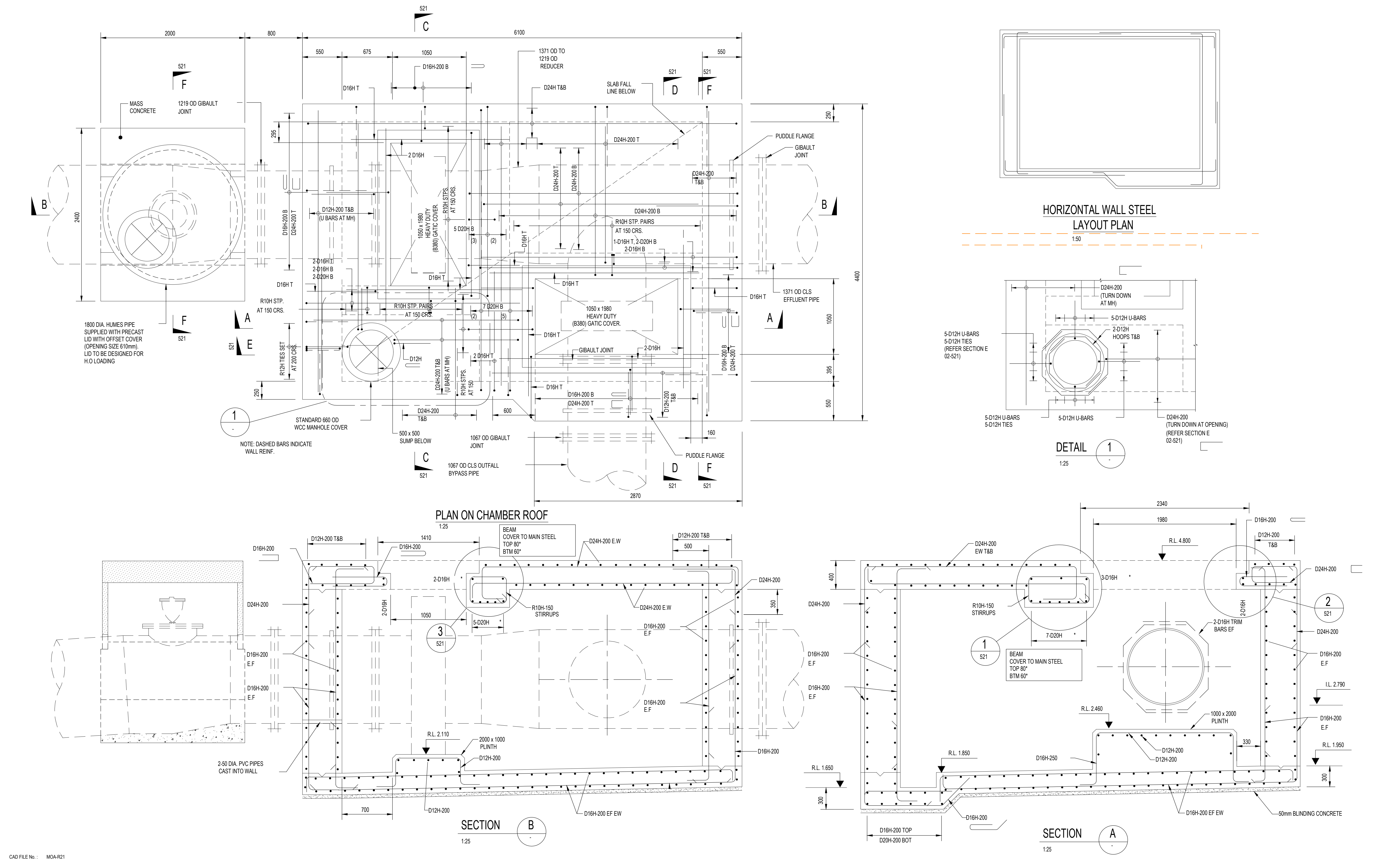
WELLINGTON WASTE WATER PROJECT

MOA POINT TREATMENT PLANT

Title: ENVIRONMENTAL: INCOMING INTERCEPTOR OVERFLOW WEIR & EFFLUENT PIPE ETC LONGITUDINAL SECTIONS AND DETAILS

Drawing No. 951092 02- 506

Scale AS SHOWN | Sheet 02-506 | REV Z



WORKS Consultancy Services
Wellington

5/1420/15/7504/21

REV	DATE	DESCRIPTION	DRN	CHK	APP
Z	7/98	AS BUILT	K.J.A.		D.O'D.
A	02/96	FOR CONSTRUCTION	K.R.B.		G.M.

	BY	CHECKED	DATE
Survey			
Design	R. DRAGON	R.G. TAYLOR	2/96
Drawn	GMO	R.G. CLARK	02/96
Recom'd	R.A. DAVEY	R.L. BISHOP	2/96
Approval	G.B. McFETRIDGE		27/2/96
Status:	AS BUILT		A1

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WELLINGTON WASTE WATER PROJECT

MOA POINT TREATMENT PLANT

Title: ENVIRONMENTAL
EFFLUENT PIPE VALVE CHAMBER
GEOMETRY AND REINFORCEMENT DETAILS

Drawing No. 951092
02- 520

Scale: AS SHOWN
Sheet: 02-520
REV: Z

Appendix A As Builts Extracted from Moa Point As Built Set

Appendix B

Hades QA Files:

310104737_ Moa_ Pt_HADES_Bypass_Scenarios.pdf

310104737_Moa_Pt_HADES_Flood_Event.pdf

Hades

Hydraulic Analysis and Design System

Hades Version: 5.0 Release: 3 Build: 0 Database version: 155
Licensed to: Stantec only, full version with key protection

QA File Name: \\nz4113-ppfss01\shared_projects\310104737\2_Technical\calcs_design\Hades Modelling\310104197_Moa_Pt_HADES_Flood_Event_For_Review.docx
Model File Name: \\nz4113-ppfss01\shared_projects\310104737\2_Technical\calcs_design\Hades Modelling\310104737_Moa_Pt_HADES_Bypass.hmdl
Date/Time of Run: 25-Feb-2026 13:31

Originator:	Print: ..[redacted]...	Date:....27/02/2026 ......
Checked by:	Print: .[redacted]...	Date:....27/02/2026 ......
Reviewed by:	Print: ..[redacted]....	Date:....27/02/2026 ......

Project: Moa Point WWTP Hydraulic Modelling
Project No.: 310104737
Prepared by:[redacted]
Date: February 2026

Purpose: Assess the performance of the Moa Pt WWTP treatment Bypass and effluent pipeline system under different flow scenarios to better understand tthe operating conditions in the pipeline during the 3 February WWTP Flooding and assess the capacity of the bypass system in wet weather for the recovery phase.

Process Description:
From the Inlet pump station (IPS), the wastewater is pumped up the hill to the inlet works via two parallel rising mains. The inlet works consists of four inlet screens and four 180 degree vortex grit traps. At the front of the inlet works flow is split into two streams and then split again into two more channels, each with a step screen. Each pair of step screen channels recombine and split into two channels again each with a grit trap (four grit traps total). Flows leaving the grit trap (GT) channels recombine into a distribution channel from which wastewater flows to three primary settlement tanks (PSTs) and/or can bypass the treatment stream via the bypass connection to the common effluent pipe. This occurs via twin 1200 wide actuated weir penstocks that connect to a common bypass outlet box before entering a 965 OD CLS bypass pipe that connects to the 1420 OD common effluent pipeline. This common 1420 OD effluent pipeline receives flow from the UV outlet channel at it's upstream end. The effluent pipeline goes through a series of diameter reductions and steep inclines and bends to get to the bottom of the Moa Pt hill before connecting to the ocean outfall pipeline in Moa Pt Road and runs approximately 1.8 km out to sea to discharge to the Cook Strait via the outfall diffuser. The Outfall diffuser consists of 26 nozzle ports which branch off 600 mm diameter vertical risers from the outfall pipe.

Under normal operation for inflows within the full treatment capacity of the WWTP: Flows from the primary settlement tanks recombine and split again into three moving bed bioreactors (MBBRs). From the MBBR flows are recombined and split again into three solids contact tanks, where return activated sludge (RAS) flows also enter from three reaeration tanks. RAS flow enter the reaeration tanks from a RAS inlet channel running parallel to the MBBR outlet channel. A portion of the flow goes straight to the solids contact tank from the PSTs' outlet channel through a parallel pipeline bypassing the MBBRs and controlled by an actuated control valve. Flows leaving the solids contact tanks (SCTs) are split between three clarifiers and then recombined at a chamber downstream before being conveyed to the UV disinfection. The flows are split into two channels for UV disinfection and then recombined before going over the UV exit weir and to the system's outfall pipe.

Wellington Water Brief for the modelling is as follows:

"1. The initial focus should be on the bypass after the inlet screens to where it joins downstream of the UV to determine if there are any constraints on the possible flow there. We are looking to mobilise the outfall without operating the primary and secondary

treatment (which will be pumped down to avoid going septic) however there are concerns that the bypass pathway may be only able to take 1500L/s. We are looking to be able to advise on this with urgency.

2 From there another scenario is if there are any flow constrictions when flows are going down both the bypass and UV routes during the UV on-going construction works with the limited flows through UV (I believe there may be 1500L/s going to UV but the UV project team should be able to inform on that).

3 Adding the outfall pipe into the modelling to determine if that creates any further constraints. I have attached a 2012 report, I did on this using some basis hydraulics, before Cardno. I can also send through outfall drawings."

Run scenarios based on Influent flows at:

Recovery Flow scenarios:
- IPS pumps x 3 - 1,350 L/s inflow to bypass
- IPS Pumps x 4 - 1,800 L/s inflow to bypass
- IPS Pumps x 5 - 2,250 L/s inflow to bypass

Inflows assumed as multiples of 450 L/s (at higher flow rates understand the multiple reduces to approximately 430 L/s per pump). Assume this occurs once 6 or more pumps are operating reflecting feedback received from WWL.

We have only considered flows up to 2250 L/s, based on feedback received from WWL that the operators Veolia were not comfortable operating the IPS at 1800 L/s or higher considering the UV outlet channel water level observed via CCTV on Sunday 15 February 2026.

Scenarios to understand flooding event:
- Feb 3 Flooding event. Peak flows from SCADA plot (from WWL 5 February) estimated at 1,500 L/s from UV outlet and 1,900 L/s to bypassing (total of 3,400 L/s).
- Other historic flow scenarios can be considered (such as when the bypass was in use when 1 clarifier was offline during 2025)

For Information Only: Previous modelling scenarios through the WWTP considered are outlined below. Noting that the bypass systems beyond the Inlet works weirs was not part of the scope requested by Wellington Water.
% Peak Full Treatment Flow (PFTF) - 2,000 l/s Inflow, 1,200 l/s RAS flow
% Stage 1 Peak Wet Weather Flow (Stage 1 PWWF) - 3,000 l/s Inflow, 0 l/s RAS flow
% Stage 2 Peak Wet Weather Flow (Stage 2 PWWF) with inlet works overflow penstocks open - 4,000 l/s Inflow, 3,000 through treatment, 1000 L/s Bypass, 0 l/s RAS flow

The following model adjustments may be needed:

Inputs:
- All details from original WWTP As Bults (Dated 1998). The levels of the Outfall As Builts (dated June 1997) align with the levels for the effluent pipeline to within 200 mm (at the tie in flange). As such we have considered that the same datum applies to these two drawings sets.
- Flow splits for the 3 February 2026 event have been modelled based on the SCADA plots supplied by WWL which indicate flows up to 1,900 L/s entering the bypass pipe and flows up to 1,500 L/s were flowing through the single live UV channel.

Assumptions:
- We have included the details of the outfall to review the extent of the backwater effect from the outfall and identify potential location of the hydraulic hump on the downhill pipeline. The method that Hades uses to determine the location of the hydraulic jump considers balancing the momentum equation in a straight pipe run. The steep downhill pipeline includes horizontal bends which may also induce flow swirl and a wave break white water event in the pipeline which can't be analysed in hades.
- The outfall diffuser has been modelled based on the outcomes from the Diffuser diving inspection report May 2025 including correct locations of all nozzles, and nozle sizs based on As Builts.
- A series of DN1200x600 T junctions for each riser branch, the losses through which are calculated in accordance with the methodology outlined in Chapter 12 of DS Miller Internal Flow Systems (ref). This considers the relative flow splits between the branch flow and in line flow and the proportion area of the branch compared to the main line. Several manual iterations are completed between Hades model runs and looking up the loss coefficients until the errors reduce to an acceptable level. The k factors for each tee junction do not need to be changed for different total outfall flow rates as the flow to each riser as a fraction of total flow is the same.
- We have excluded hydraulic details of the rising mains (other than the flows arriving at the WWTP) considering the hydraulic separation between the rising mains and WWTP hydraulics.
- We have excluded the inlet works from this model. This is an acceptable simplification as we are primarily interested in the hydraulic conditions downstream of the Bypass weirs, in the effluent pipeline and in the UV channels. We have modelled the system in this way to reduce the model run times and considering the feedback from WWL to date which has been that the flooding that occurred on 3 and 4 February 2026 occurred from the UV channels. If WWL wish to model the inlet works and these flow spits more accurately, for the purposes of understanding maximum water levels in the inlet works more accurately, then this information can be added into the model as additional work. We note that maximum inlet works water levels are already detailed in the modelling report and hydraulic profile for the plant produced in October 2025 by Stantec (separate scope of work).
- UV outlet channel and common outlet fixed weir is included for the purposes of understanding potential operating levels in this channel and for comparison purposes with reported levels in the UV outlet channel observed during the recovery phase under

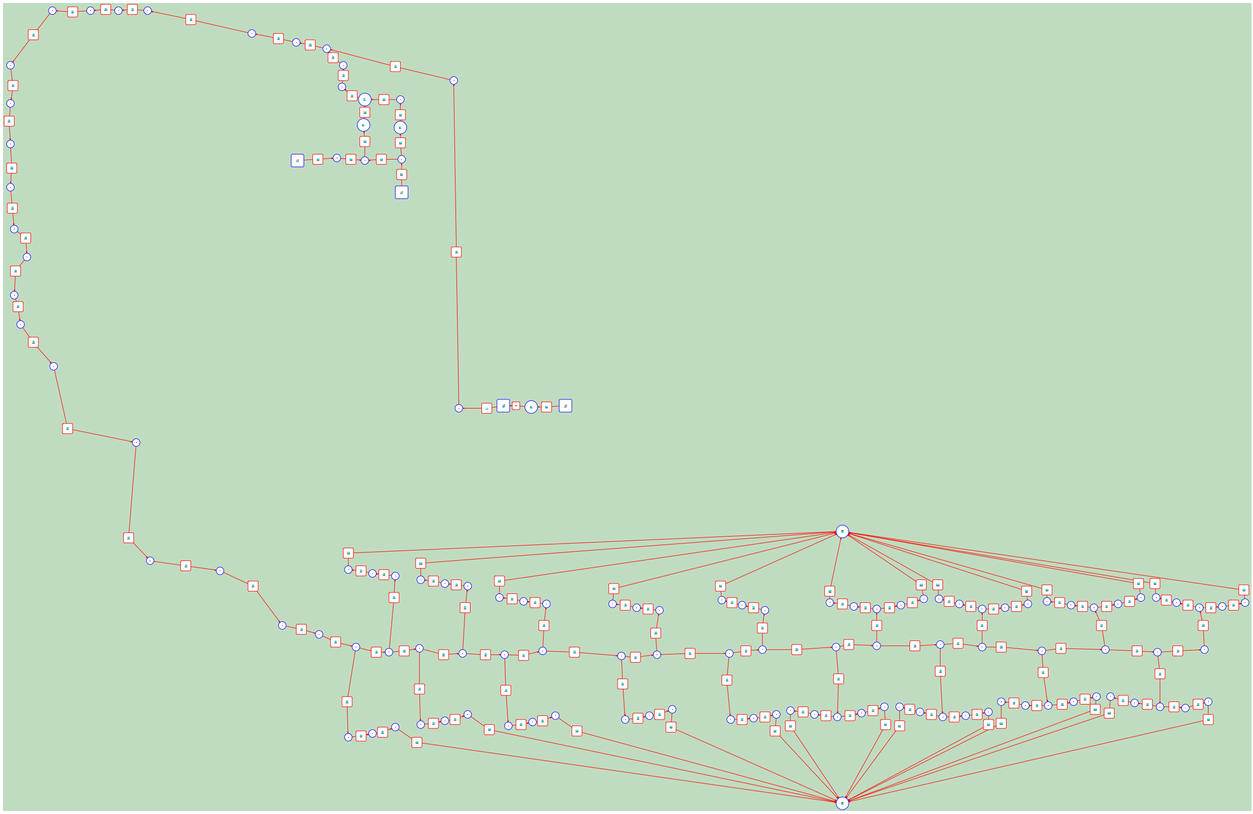
known flow conditions.

Limitations:

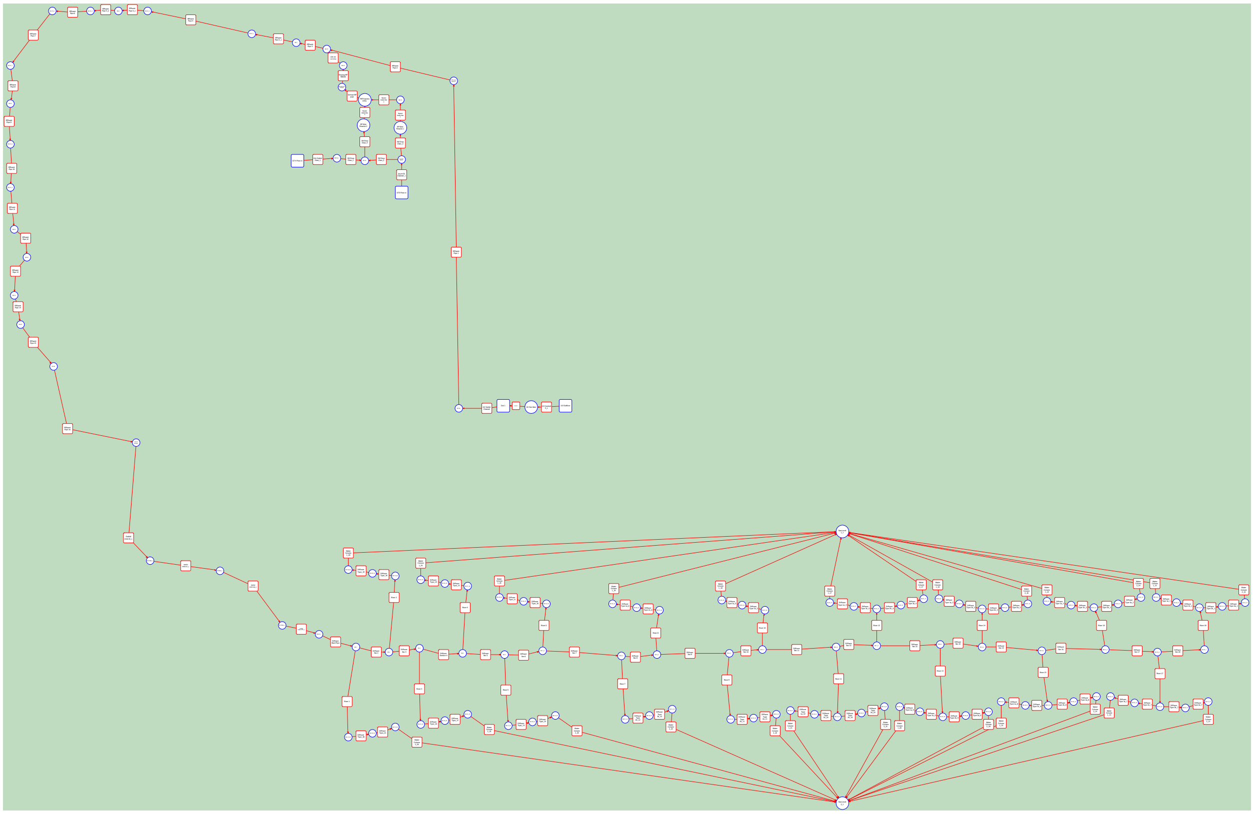
- The head losses arising from the combining 1066x1420 vertical tee where the bypass flow combines with the UV outlet flow has been modelled using the head loss graphs for sharp edge tees from DS Miller (2nd Ed) Chapter 13.2. We note these head loss coefficients consider full pipe flow in pipe junctions without significant impact from upstream discontinuities (bends immediately upstream). As a consequence, Hades is not able to accurately model the dynamics of the flow at this location.

- Hades can not model the effects of air entrained flow (two-phase flow) arising from hydraulic jumps within the pipeline.

MODEL DIAGRAM SHOWING SYMBOLS



MODEL DIAGRAM SHOWING NAMES



NETWORK DATA

SI Units
Acceleration due to gravity, g = 9.806 m/s²
Atmospheric pressure head = 100/g = 10.198 m head of water
Kinematic Viscosity = 1.14E-006 m²/s
Vapour pressure of water 0.213 m head of water
Vapour pressure of water calculated at 15.000 °C
Hardy-Cross convergence tolerance = 0.0005 m
Hardy-Cross under-relaxation factor= 1.5
Hardy-Cross maximum number of iterations = 500
Zero flow threshold = 1E-005 m³/s
Zero depth threshold = 0.0005 m
Open channel flow minimum halved step length = 0.0005 m
Open channel flow factor A, drawdown smoothing = 25%
Open channel flow factor B, transition point = 25%
Output level is summary only

NAMED FLOWS

Name	See Note
Bypass FLow	(1)
UV Out (1 chan OOS)	(2)

(1):

Total flow over the Bypass Weir Penstocks

(2):

Flow out of UV when 1 channel is out of service (ttmnt bypassing modes)

Flow Scenario: Bypass (3 pumps)

Flow to WWTP during response phase. Considers 3xIPS pumps operating and full bypass.

Name	Flow (m³/s)
Bypass FLow	1.35000
UV Out (1 chan OOS)	0.00000

Flow Scenario: Bypass (4 pumps)

Flow to WWTP during response phase. Considers 4xIPS pumps operating and full bypass.

Name	Flow (m³/s)
Bypass FLow	1.80000
UV Out (1 chan OOS)	0.00000

Flow Scenario: Bypass (5 Pumps)

Flow to WWTP during response phase. Considers 5xIPS pumps operating and full bypass.

Name	Flow (m³/s)
Bypass FLow	2.25000
UV Out (1 chan OOS)	0.00000

Flow Scenario: Feb 3 2026 Flood

Flow splits assumed based on the flows recorded in the WWTP SCADA leading up to the flood event on 3 and 4 February 2026.

Name	Flow (m³/s)
Bypass FLow	1.90000
UV Out (1 chan OOS)	1.50000

NAMED FRICTION LOSS SETTINGS

Name	See Note
Concrete channel	
Diffuser Roughness	
Effluent Outfall	(1)
Outfall Roughness	

(1):

Effluent outfall roughness to consider velocities which are expected to influence roughness substantially. Operation of significnat portion of bypass system is also expected to result in roughness performance similar to slimed pipe (velocity dependent roughness).

Roughness Scenario: 'Normal' Roughness

'Normal' roughness values per HR Wallingford

	Equation	Variable Model	Fixed k_s	Manning n
Concrete channel	C-W	Fixed	1.50000	
Diffuser Roughness	C-W	Fixed	0.06000	
Effluent Outfall	C-W	Fixed	0.06000	
Outfall Roughness	C-W	Fixed	0.06000	

Roughness Scenario: 'Poor' Roughness

Higher roughness test at 0.2mm

	Equation	Variable Model	Fixed k_s	Manning n
Concrete channel	C-W	Fixed	3.30000	
Diffuser Roughness	C-W	Fixed	0.20000	
Effluent Outfall	C-W	Fixed	0.20000	
Outfall Roughness	C-W	Fixed	0.20000	

NAMED LEVELS

Name	See Note
Sea Level in Cook St	(1)

(1):

Maximum probable tide from Moa Point WWTP Rising Main and Ocean Outfall Study, 2011, BTO Ltd.

Level Scenario: Prob max high tide

Maximum high tide level from regional monitoring over Summer 2025/2026 is 1.7 m relative to Wellington Port Chart Datum. Conversion to Wellington 1953 datum =Wellington Port Chart Datum - 0.9025 m.

1.7-0.9025 = 0.798m in Well 1953 Datum.

Corrected to HGL at diffuser elevation based on specific gravity of sea water and depth of sea water above diffuser then gives 1.277 m RL.

Name	Level (m)
Sea Level in Cook St	1.27700

RUN SCENARIOS

Run scenario	Mode	Flow scenario	Roughness scenario	Level scenario	See note
3 Feb 2026 Flood	Full	Feb 3 2026 Flood	'Poor' Roughness	Prob max high tide	

Component reference: Sea Level 1_1

Level control node

Elevation set as 'Sea Level in Cook St' = 1.277 m for all run scenarios

Conduit reference: Water Column 1_12

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 20_12

Null node

Conduit reference: Diffuser Type 1a_1

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: NN 26_12

Null node

Conduit reference: Diffuser Type 1b_1

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Additional loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Component reference: NN 27_12

Null node

Conduit reference: **Riser 18**

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		0.500

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

0.500	Upstream discontinuity loss K factor
0.500	Entry, sharp-edged

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Component reference: **NN 31_1**

Null node

Conduit reference: **Diffuser Sec 18**

Circular conduit
Length: 5.300 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.693	1.200	-23.493	1.200		0.000
US	-24.668	1.200	-23.468	1.200		0.120

0.120	Upstream discontinuity loss K factor
0.120	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 11 to diffuser 12
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.6682 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.6933 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3 m

Component reference: **NN 12_6**

Null node

Conduit reference: **Diffuser Sec 17**

Circular conduit
Length: 5.300 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.668	1.200	-23.468	1.200		0.000
US	-24.643	1.200	-23.443	1.200		-0.067

-0.067 Upstream discontinuity loss K factor
-0.067 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 10 to diffuser 11
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.6431 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.6682 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3 m

Component reference: **NN 11_2**

Null node

Conduit reference: **Diffuser Sec 16**

Circular conduit
Length: 5.300 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.643	1.200	-23.443	1.200		0.000
US	-24.618	1.200	-23.418	1.200		-0.062

-0.062 Upstream discontinuity loss K factor
-0.062 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 9 to diffuser 10
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.618 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.6431 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3 m

Component reference: **NN 10_2**

Null node

Conduit reference: **Diffuser Sec 15**

Circular conduit
Length: 5.300 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.618	1.200	-23.418	1.200		0.000
US	-24.593	1.200	-23.393	1.200		-0.054

-0.054 Upstream discontinuity loss K factor
-0.054 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 8 to diffuser 9
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.5929 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.618 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3 m

Component reference: **NN 9_2**

Null node

Conduit reference: **Diffuser Sec 14**

Circular conduit
Length: 5.300 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.593	1.200	-23.393	1.200		0.000
US	-24.568	1.200	-23.368	1.200		-0.043

-0.043 Upstream discontinuity loss K factor
-0.043 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 7 to diffuser 8
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.5678 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.5929 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3 m

Component reference: **NN 8_2**

Null node

Conduit reference: **Diffuser Sec 13**

Circular conduit
Length: 5.300 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.568	1.200	-23.368	1.200		0.000
US	-24.543	1.200	-23.343	1.200		-0.034

-0.034 Upstream discontinuity loss K factor
-0.034 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 6 to diffuser 7
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.5427 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.5678 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3 m

Component reference: **NN 7_2**

Null node

Conduit reference: **Diffuser Sec 12**

Circular conduit
Length: 5.300 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.543	1.200	-23.343	1.200		0.000
US	-24.518	1.200	-23.318	1.200		-0.026

-0.026 Upstream discontinuity loss K factor
-0.026 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 5 to diffuser 6
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.5176 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.5427 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3 m

Component reference: NN 6_4

Null node

Conduit reference: Diffuser Sec 11

Circular conduit
Length: 5.300 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.518	1.200	-23.318	1.200		0.000
US	-24.492	1.200	-23.293	1.200		0.011

0.011 Upstream discontinuity loss K factor
0.011 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 4 to diffuser 5
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.4925 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.5176 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3 m

Component reference: NN 5_2

Null node

Conduit reference: Diffuser Sec 10

Circular conduit
Length: 5.000 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.492	1.200	-23.293	1.200		0.000
US	-24.469	1.200	-23.269	1.200		0.011

0.011 Upstream discontinuity loss K factor
0.011 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 3 to diffuser 4
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.4688 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.4925 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.0 m

Component reference: **NN 4_2**

Null node

Conduit reference: **Diffuser Sec 9**

Circular conduit
Length: 5.600 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.469	1.200	-23.269	1.200		0.000
US	-24.442	1.200	-23.242	1.200		0.017

0.017 Upstream discontinuity loss K factor
0.017 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 2 to diffuser 3
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.4423 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.4688 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.6 m

Component reference: **NN 3_2**

Null node

Conduit reference: **Diffuser Sec 8**

Circular conduit
Length: 5.600 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.442	1.200	-23.242	1.200		0.000
US	-24.416	1.200	-23.216	1.200		0.017

0.017 Upstream discontinuity loss K factor
0.017 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 1 to diffuser 2
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.4158 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.4423 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.6 m

Component reference: **NN 2_2**

Null node

Conduit reference: **Diffuser Sec 7**

Circular conduit
Length: 5.000 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.416	1.200	-23.216	1.200		0.000
US	-24.392	1.200	-23.192	1.200		0.022

0.022 Upstream discontinuity loss K factor
0.022 Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

1265 OD outfall pipe from first section of diffuser with open diffuser points to diffuser 1
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.3921 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.4158 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.0 m

Component reference: **NN 1_3**

Null node

Conduit reference: **Diffuser Sec 6**

Circular conduit
Length: 5.300 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.369	1.200	-23.169	1.200		0.000
US	-24.344	1.200	-23.144	1.200		0.022

0.022 Upstream discontinuity loss K factor
0.022 Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

1265 OD outfall pipe section of diffuser
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.344 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.369 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3

Component reference: **NN 4**

Null node

Conduit reference: **Diffuser Sec 5**

Circular conduit
Length: 5.300 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.344	1.200	-23.144	1.200		0.000
US	-24.319	1.200	-23.119	1.200		0.022

0.022 Upstream discontinuity loss K factor
0.022 Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

1265 OD outfall pipe section of diffuser
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.319 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.344 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3

Component reference: **NN 3**

Null node

Conduit reference: **Diffuser Section 4**

Circular conduit
Length: 5.300 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.319	1.200	-23.119	1.200		0.000
US	-24.294	1.200	-23.094	1.200		0.022

0.022 Upstream discontinuity loss K factor
0.022 Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

1265 OD outfall pipe section of diffuser
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.294 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.319 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3

Component reference: NN 2

Null node

Conduit reference: Diffuser Sec 3

Circular conduit
Length: 5.300 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.294	1.200	-23.094	1.200		0.000
US	-24.269	1.200	-23.069	1.200		0.022

0.022 Upstream discontinuity loss K factor
0.022 Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

1265 OD outfall pipe section of diffuser
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.269 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.294 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3

Component reference: NN 5

Null node

Conduit reference: Diffuser Sec 2

Circular conduit
Length: 5.300 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.269	1.200	-23.069	1.200		0.000
US	-24.244	1.200	-23.044	1.200		0.022

0.022 Upstream discontinuity loss K factor
0.022 Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

1265 OD outfall pipe section of diffuser
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.244 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.269 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3

Component reference: **NN 1**

Null node

Conduit reference: **Diffuser Start Pipe**

Circular conduit
Length: 7.950 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.244	1.200	-23.044	1.200		0.000
US	-24.207	1.200	-23.007	1.200		0.000

1265 OD outfall pipe from start of diffuser pipe to first section of diffuser with open diffuser points
Refer Drgs 18-003,18-006

US invert from drg = -24.207 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.244 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length was calculated from total diffuser length minus the diffuser sections 100.05-92.10 = 7.95 m

Component reference: **NN 32_1**

Null node

Conduit reference: **Outfall CH66-1772_1**

Circular conduit
Length: 1705.990 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.220	1.200	-23.020	1.200		0.000
US	-3.514	1.200	-2.314	1.200		0.000

1265 OD outfall pipe from 19.7 deg vertical mitre bend to start of diffuser pipe
Refer Drgs 18-001, 18-003

US invert from drg = -3.5136 (measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.2196 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length chainage 1771.51-65.52 = 1705.99 m

Component reference: **19.7 Mitre_1**

Null node

Conduit reference: **Outfall CH57-66_1**

Circular conduit
Length: 8.050 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-3.514	1.200	-2.378	1.200		0.150
US	-0.767	1.200	0.368	1.200		0.000

0.150	Downstream discontinuity loss K factor
0.150	Mitre elbow, 2-piece, 22.5°

1265 OD outfall pipe from 20 deg vertical mitre bend to 19.7 deg vertical mitre bend (assumed to be 2-piece)
Refer Drgs 18-001

US invert from drg = -0.7673 (measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -3.5136 (measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length chainage 65.52-57.47 = 8.05 m

Component reference: **20 Mitre_1**

Null node

Conduit reference: **Outfall CH35-57_1**

Circular conduit
Length: 22.060 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-0.767	1.200	0.433	1.200		0.150
US	-0.767	1.200	0.433	1.200		0.000

0.150	Downstream discontinuity loss K factor
0.150	Mitre elbow, 2-piece, 22.5°

1265 OD outfall pipe from 22.9 deg horizontal mitre bend to 20 deg vertical mitre bend (assumed to be 2-piece)
Refer Drgs 18-001

US invert from drg = -0.7673 (measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -0.7673 (measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length chainage 57.47-35.41 = 22.06

Component reference: **22.9 Mitre_1**

Null node

Conduit reference: Outfall CH0-35_1

Circular conduit
Length: 35.410 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-0.767	1.200	0.433	1.200		0.150
US	-0.626	1.200	0.574	1.200		0.005

0.150	Downstream discontinuity loss K factor
0.150	Mitre elbow, 2-piece, 22.5°

0.005	Upstream discontinuity loss K factor
0.005	Small loss applied for 1371 to 1265 OD reducer (1000mm long) at upstream end.

1265 OD outfall pipe from pigging spool reducer adjacent tie-in flange to 22.9 deg horizontal mitre bend (assumed to be 2-piece)
Refer Drgs 18-001

US invert from drg = -0.626 (From On shore tie in drg 18-004)
DS invert from drg = -0.7673 (measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length chainage 35.41 (tie-in flange is at chainage 0)

Component reference: Tie In Flange

Null node

Conduit reference: Effluent Pipe 16

Circular conduit
Length: 21.800 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-0.600	1.316	0.716	1.316		0.000
US	-0.100	1.316	1.216	1.316		0.000

1371 OD effluent pipe from 13 deg vert bend to tie in flange
Refer Drg 02-506

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID

DS invert for tie in flange matches level information from outfall drawing set

Length from chainage 279.66-257.85=21.8

Component reference: NN 36

Null node

Conduit reference: **Effluent Pipe 15**

Circular conduit
Length: 10.000 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-0.100	1.312	1.174	1.312		0.075
US	2.370	1.312	3.644	1.312		0.075

0.075	Downstream discontinuity loss K factor
0.075	Bend, close radius, 11.25°. 13 deg single mitre bend approximated as 11.25 deg close radius bend

0.075	Upstream discontinuity loss K factor
0.075	Bend, close radius, 11.25°. 13 deg single mitre bend approximated as 11.25 deg close radius bend

1371 OD effluent pipe from 13 deg vertical downward bend to 13 deg vertical upward bend
Refer Drg 02-506

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID, plus 2 mm polyurethane lining gives 1312 mm

Length from chainage 257.85-247.85 = 10

Component reference: **NN 35**

Null node

Conduit reference: **Effluent Pipe 14**

Circular conduit
Length: 5.300 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	2.370	1.164	3.534	1.164		0.352
US	2.450	1.164	3.614	1.164		0.000

0.352	Downstream discontinuity loss K factor
0.300	Valve, butterfly, fully open. Fully Open butterfly valve per valve chamber plan
0.052	DS tee for air valve (100 mm branch) using DS miller Figure 13.23 k =0.04 DS tapered enlargement, 1219x1317, 800 long, using pipe flow theory calc method (spreadsheet in folder) gives = 0.012 Total k =0.052

1219 OD CLS effluent pipe from 1371x1219 reducer to 1219x1371 enlargement
Refer Drg 02-506

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.164 m ID

Length summed from valve chamber plan dims 5.3 m

Component reference: **NN 33**

Null node

Conduit reference: **Effluent Pipe 13**

Circular conduit
Length: 1.500 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	2.450	1.316	3.765	1.316		0.000
US	2.500	1.316	3.815	1.316		0.000

0.000 Downstream discontinuity loss K factor
0.000 Negligble headloss noted for tapered reducer from 1371 to 1219 OD pipe.

1371 OD effluent pipe from 1067 OD CLS branch to 1371x1219 reducer
Refer Drg 02-506

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID

Length approximated to 1.5m

Component reference: **NN 34**

Null node

Conduit reference: **Effluent Pipe 12**

Circular conduit
Length: 12.600 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	2.500	1.316	3.816	1.316		0.040
US	2.570	1.316	3.886	1.316		0.000

0.040 Downstream discontinuity loss K factor
0.040 Downstream inline tee with full flow straight through. DS MIller Fig 13.23, gives k=0.05

1371 OD effluent pipe from 15 deg horizontal bend to 1371/1067 OD CLS branch
Refer Drg 02-506

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID

Length from chainage 239.85-228.75 + 1.5 = 12.6

Component reference: **NN 32**

Null node

Conduit reference: **Effluent Pipe 11**

Circular conduit
Length: 70.100 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	2.570	1.316	3.886	1.316		0.100
US	3.050	1.316	4.366	1.316		0.000

0.100	Downstream discontinuity loss K factor
0.100	15 deg horizontal bend assumed approximated between head loss data for 22.5 deg close radius (0.15) and 11.25deg close radius (0.075)

1371 OD effluent pipe from 62 deg horizontal bend to 15 deg horizontal bend
Refer Drg 02-506

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID

Length chainage 228.75-158.65=70.1

Component reference: NN 27_9

Null node

Conduit reference: Effluent Pipe 10

Circular conduit
Length: 28.650 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	3.050	1.316	4.366	1.316		0.250
US	3.240	1.316	4.556	1.316		0.000

0.250	Downstream discontinuity loss K factor
0.250	Mitre elbow, 3-piece, 60°. 62 degree horizontal bend at downstream end (assumed 3 piece mitre)

1371 OD effluent pipe from PS Grid E to 62 deg horizontal bend
Refer Drg 02-506

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID

US invert interpolated

Length chainage 158.65-130.00=28.65

Component reference: NN 27_8

Null node

Conduit reference: Effluent Pipe 9

Circular conduit
Length: 6.750 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	3.240	1.316	4.556	1.316		0.250
US	3.290	1.316	4.606	1.316		0.000

0.250	Downstream discontinuity loss K factor
0.250	37 degree bend at downstream end (30 deg horizontal 25 deg vert). 30 deg is 0.2, 45 deg is 0.3. therefore use k=0.25

1371 OD effluent pipe from PS Grid C point to Grid E
Refer Drgs 02-535, 02-519, 02-529.

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID. (excludes polyurethane liner)

DS invert interpolated 3.29

Length chainage 129.98--123.23=6.75

Component reference: **NN 31**

Null node

Conduit reference: **Effluent Pipe 8**

Circular conduit
Length: 7.200 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	3.290	1.312	4.602	1.312		0.250
US	3.340	1.312	4.652	1.312		0.000

0.250	Downstream discontinuity loss K factor
0.250	37 degree bend at downstream end (30 deg horizontal 25 deg vert). 30 deg is 0.2, 45 deg is 0.3. therefore use k=0.25

1371 OD effluent pipe from 37 deg bend (horizontal and vert combined) to PS Grid C point
Refer Drgs 02-535, 02-519, 02-529.

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID. includes polyurethane lining (later drg indicates 2 mm thickness) gives 1.312 m ID.

DS invert interpolated 3.29

Length chainage 123.23-116.03=7.2

Component reference: **NN 27_7**

Null node

Conduit reference: **Effluent Pipe 7**

Circular conduit
Length: 8.780 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	3.340	1.312	4.519	1.312		0.250
US	7.620	1.312	8.799	1.312		0.000

0.250	Downstream discontinuity loss K factor
0.250	37 degree bend at downstream end (30 deg horizontal 25 deg vert). 30 deg is 0.2, 45 deg is 0.3. therefore use k=0.25

1371 OD effluent pipe from 30 deg horizontal bend to 37 deg bend (horizontal and vert combined)
Refer Drgs 02-535, 02-519, 02-529.

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID. includes polyurethane lining (later drg indicates 2 mm thickness) gives 1.312 m ID.

Length chainage 116.03-107.25=8.78

Component reference: **NN 27_6**

Null node

Conduit reference: **Effluent Pipe 6**

Circular conduit
Length: 13.900 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	7.620	1.312	8.733	1.312		0.200
US	16.300	1.312	17.413	1.312		0.000

0.200	Downstream discontinuity loss K factor
0.200	Mitre elbow, 2-piece, 30°. 35 degree horizontal bend at downstream end modeled as 30 deg bend, (As Builts also indicated 3 piece mitre therefore acceptable conservative)

1371 OD effluent pipe from 15 deg vertical bend to 30 deg horizontal bend
Refer Drgs 02-535, 02-519, 02-529.

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID. includes polyurethane lining (later drg indicates 2 mm thickness) gives 1.312 m ID.

Length chainage 107.25-93.35 = 13.9

Component reference: **NN 27_4**

Null node

Conduit reference: **Effluent Pipe 5_2**

Circular conduit
Length: 8.600 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	16.300	1.312	17.552	1.312		0.150
US	19.000	1.312	20.252	1.312		0.000

0.150	Downstream discontinuity loss K factor
0.150	Bend, close radius, 22.5°. 15 degree vert bend at downstream end considered with 4 deg vert bend just upstream)

1371 OD effluent pipe from 3.9 degree vertical bend to 15 deg vert bend
Refer Drgs 02-535, 02-519, 02-529.

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID. includes polyurethane lining (later drg indicates 2 mm thickness) gives 1.312 m ID.

Length chainage 93.35-84.75 = 8.6

Component reference: **NN 6**

Null node

Conduit reference: **Effluent Pipe 5_1**

Circular conduit
Length: 2.900 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	19.000	1.312	20.275	1.312		0.000
US	19.700	1.312	20.975	1.312		0.000

0.000 Upstream discontinuity loss K factor
0.000 negligible head loss from Taper fitting from 1420 to 1371 pipe

1371 OD effluent pipe from 36 deg horizontal bend to 3.9 deg vertical bend
Refer Drgs 02-535, 02-519, 02-529.

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID. includes polyurethane lining (later drg indicates 2 mm thickness) gives 1.312 m ID.

Length chainage 84.75-81.85 = 2.9

The 4 deg vertical bend is expected to be negligible so has been ignored.

Component reference: NN 27_3

Null node

Conduit reference: Effluent Pipe 4

Circular conduit
Length: 31.500 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	19.700	1.316	20.987	1.316		0.200
US	26.400	1.316	27.687	1.316		0.000

0.200 Downstream discontinuity loss K factor
0.200 Mitre elbow, 2-piece, 30°. 36 degree horizontal bend at downstream end

1371 OD effluent pipe from 1420/1371 reducer to 36 deg horizontal bend
Refer Drgs 02-535, 02-519, 02-529.

US invert from drg = 26.4
US invert from drg = 19.7

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID.

Length chainage 81.65-50.15

Component reference: NN 27_1

Null node

Conduit reference: Effluent Pipe 3_1

Circular conduit
Length: 1.200 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	26.400	1.316	27.715	1.316		0.075
US	26.440	1.316	27.755	1.316		0.000

0.075 Downstream discontinuity loss K factor
0.075 Bend, close radius, 11.25°. 10 vertical bend at top of slope.
0.000 Head loss from long taper reducer can be ignored as this results in negligible headloss

1371 OD effluent pipe from mid point of 1420/1371 reducer to 10 degree vert bend

Refer Drgs 02-535, 02-519, 02-529.

US invert interpolated from drg = 26.51-2.35/3.55*(26.51-26.4)=26.44.

DS invert from drg = 26.4

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID.

Length chainage 50.7-50.15+(50.15-48.85)/2 = 1.2

Component reference: NN 7

Null node

Conduit reference: Effluent Pipe 3

Circular conduit
Length: 2.350 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	26.440	1.365	27.804	1.365		0.000
US	26.510	1.365	27.874	1.365		0.000

1420 OD effluent pipe from vert tee junction with overflow to mid point of 1420/1371 reducer

Refer Drgs 02-535, 02-519, 02-529.

US invert taken as interpolated soffit level in the 1420 OD effluent pipe. invert at junction = 26.74-7.2*(26.74-26.4)/10.75=26.51.

DS invert from drg = 26.51-2.35/3.55*(26.51-26.4)=26.44

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.365 m ID.

Length chainage (50.15-48.85)/2+48.85-47.15 = 2.35

Component reference: NN 27

Null node

Conduit reference: 1065 OD vert drop

Circular conduit
Length: 0.000 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	27.875	1.014	27.875	1.014		1.170
US	28.500	1.014	28.500	1.014		0.000

1.170	Downstream discontinuity loss K factor
1.170	Downstream Tee Junction with enlargement. Enlarges from 1065 OD (1.014 m) to 1420 OD (1.365 m). Using DS Miller Figure 13.10. For bypass only flow scenarios, flow ratio Q1/Q3=1.0, A1/A3=0.55, K13=3.0. After converting for different velocity heads as per DS Miller guidance, k=0.914 For Flood event scenario, Q1/Q3 = 1.9/3.4 = 0.56, A1/A3=0.55 -> K13=1.2. After converting for different velocity heads as per DS Miller guidance, k=1.17 applied at DS end of 1066 OD riser

Vertical 1065 OD CLS pipe that receives flow from 965 OD overflow pipe. vertical pipe sits on top of the 1420 OD effluent pipe.

Dims from As Built 02-535

US invert taken as DS invert of 965 OD sloping pipe = 28.5.
DS invert taken as interpolated soffit level in the 1420 OD effluent pipe. invert at junction = 26.74-7.2*(26.74-26.4)/10.75=26.51, plus ID of effluent pipe (1.365) = 27.875 m RL.

Component reference: **NN 26**

Null node

Conduit reference: **Sloping BP 965OD**

Circular conduit
Length: 7.500 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	28.500	0.915	29.342	0.915		0.730
US	31.700	0.915	32.542	0.915		0.000

0.730	Downstream discontinuity loss K factor
0.730	Downstream wye junction at 67 degrees to vertical 1065OD CLS pipe. 67 deg wye junction includes enlargement from 915 ID to 1014 ID. Using DS Miller Fig 13.8, consider Q1/Q3 of 1.0, Area ratio of 0.81 (0.915^2/1.014^2) gives K13=1.1, after converting for differences in velocity head per DS miller guidance, k=0.73.

Sloping portion of 965OD bypass pipe from inlet works to the dropper shaft sitting above the 1420 OD effluent pipe.

ID=965-2*9.5-2*16=915mm

All dims from As Built 02-535

US invert estimated to replicate angle of pipe based on angle of upstream bend 90 deg - 67 deg = 23 deg. RL 31.7 m which aligns with just below surface level adjacent retained surface at 32 m RL.

DS Invert level scaled from drawing as 2 m below cover level of chamber (cover at 30.5). -> 28.5 m

Length scaled from As Built

Component reference: **965 OD vert 67bend**

Null node

Conduit reference: **Vertical BP pipe**

Circular conduit
Length: 0.000 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	31.800	0.915	31.800	0.915		0.300
US	34.500	0.915	34.500	0.915		0.000

0.300	Downstream discontinuity loss K factor
0.300	Mitre elbow, 4-piece, 90°. 67 degree 4 piece mitre elbow approximated as 4 piece 90 degree, as hades doesn't allow 4 piece 60 deg pieces. Comparatively a 3 peice 60 deg mitre would have k=0.25, so 0.3 is about right.

Levels from As Built 02-303 and 02-535.

US invert from drg 02-303 section through outlet box.
DS Invert scaled from drawing 02-535

965 outer diameter CLS pipe.

Wall thickness assumed 9.5 mm, comparable with NZS4442 Class C, and matching the wall thickness for the 1420 and 1371 OF effluent pipes.
Lining thickness assumed 16 mm per NZS4442, comparable with lining thickness of 18 mm specified for the 1371 OD effluent.

ID=965-2*9.5-2*16=915mm

No upstream entry loss applied as entrance to pipe is modelled as an orifice (allows for conservative losses).

Component reference: **965 bypass entry**

Circular orifice with diameter 0.915 m

No. of Orifices	Orientation	Entrance Type	Elevation of Top m	Orifice Coeff.
1	Horiz.	Sharp	34.500	0.597

Conduit reference: **Bypass Outlet Box 3**

Open rectangular channel
Length: 2.500 m

Friction Loss: 'Concrete channel'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	34.500	4.500	39.000	1.300		1.000
US	34.500	4.500	39.000	1.300		0.000

1.000	Downstream discontinuity loss K factor
1.000	Exit. exist loss in flow approaching the outlet (orifice)

Bypass outlet box flowing towards outlet pipe.

Details from Drg 02-303 and 02-535

Component reference: **NN 20**

Null node

Conduit reference: **Bypass Outlet Box 1**

Open rectangular channel
Length: 0.650 m

Friction Loss: 'Concrete channel'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	34.500	4.500	39.000	1.200		1.250
US	34.500	4.500	39.000	1.200		0.000

1.250	Downstream discontinuity loss K factor
1.250	Mitre elbow, 2-piece, 90°

Narrow portion of outlet box downstream of RHS penstock weir, prior to change in direction to flow towards outlet pipe.

Length based on half width of channel before change in direction

Details from Drg 02-303 and 02-535

Component reference: **BP Weir Penstck 1**

Rectangular sharp-crested weir   Solution type: Kindsvater-Carter

Weir width m	End contractions	Crest elevation m
1.200	n/a	36.540

Run Scenario	Flow m³/s	Discharge Coefficient	Head Over Weir m	Freeboard DS m
3 Feb 2026 Flood	0.953	0.605	0.581	0.324

1 of 2 Bypass Weir Penstocks from common grit outlet channel.

Feedback from WWL is that penstock weirs are in fully open position 36.54 m as per As Built 05=-29.

In high bypass flows, the driving head for the flow entering bypass pipe via orifice flow can affect water levels upstream of the bypass weirs if weirs are in the lowest position.

Can use higher overflow level 37.54 "Normal Overflow Level" considering upstream HGL is still safe in this case.

Drg 05-029

Conduit reference: **IW Drop Chan_3**

Open rectangular channel
Length: 1.200 m

Friction Loss: 'Concrete channel'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	35.650	3.350	39.000	2.000		0.000
US	35.650	3.350	39.000	2.000		0.000

Object Type: Rectangular Conduit

Purpose: Represents dropped channel following the grit trap outlet conduit.

DWG References: Upper Floor Plan DWG 02-303, Inlet Works Cross Sections 1 DWG 02-305, Inlet Works Cross Sections 2 DWG 02-306

Notes / Assumptions:

Component reference: **Grid A3 Bend**

Null node

Conduit reference: **Asym OL Channel_1**

Open user-defined channel shape
Length: 5.300 m

Friction Loss: 'Concrete channel'

Shape: Inlet Works Outlet (asymmetric)
Shape Factors

--------Non-dimensional--------			------------Scaled (m)-----------					
Y	X1	X2	Y	X1	X2	Flow area (m²)	Wetted perim. (m)	Hydr. rad. (m)
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.021	0.000	1.000	0.070	0.000	1.650	0.058	1.722	0.034
0.371	0.000	1.000	1.269	0.000	1.650	2.036	4.119	0.494
0.371	0.000	0.673	1.269	0.000	1.110	2.036	4.119	0.494
1.000	0.000	0.673	3.420	0.000	1.110	4.424	8.961	0.494

	Invert	Height	Soffit	Width	Side Slope	Discont.
	m	m	m	m	x/y	loss K
DS	35.580	3.420	39.000	1.650		0.000
US	35.580	3.420	39.000	1.650		0.000

Object Type: Special Shape Conduit

Purpose: Part of channel series that distributes flows from inlet works to PST inlet offices.

DWG References: Inlet Works Plan DWG 02-303 - Lengths, Inlet Works Y-sections DWG 02-306 - inverts, Inlet Works Reinforcement DWG 02-307 - Shape/dimensions

Notes / Assumptions:

Component reference: GT3 Flow in

Inflow node

Inflow set as 3/4 (75.000%) of 'Bypass FLow' (1.90000 m³/s) = 1.42500 m³/s for all run scenarios

Inflow from the inlet works upstream of the bypass weir penstocks. Considers all four grit traps in service, so 3/4 of inflow comes from the common channel.

For the purpose of the bypass and effluent model, it is not significant that in reality flow may come from 1 or 2 grit channels.

DWG References: N/A

Conduit reference: Bypass Outlet Box 2

Open rectangular channel
Length: 0.650 m

Friction Loss: 'Concrete channel'

	Invert	Height	Soffit	Width	Side Slope	Discont.
	m	m	m	m	x/y	loss K
DS	34.500	4.500	39.000	1.200		1.250
US	34.500	4.500	39.000	1.200		0.000

1.250	Downstream discontinuity loss K factor
1.250	Mitre elbow, 2-piece, 90°. vertical bend in flow approach the outlet (orifice)

Narrow portion of outlet box downstream of LHS penstock weir, prior to discharge to outlet pipe.

Length consdired half of width until entry to vertical outlet pipe.

Details from Drg 02-303 and 02-535

Component reference: BP Weir Penstck 2

Rectangular sharp-crested weir Solution type: Kindsvater-Carter

Weir width	End contractions	Crest elevation
m		m
1.200	n/a	36.540

Run Scenario	Flow	Discharge Coefficient	Head Over Weir	Freeboard DS
	m³/s		m	m
3 Feb 2026 Flood	0.947	0.605	0.578	0.334

2 of 2 Bypass Weir Penstocks from common grit outlet channel.

Feedback from WWL is that penstock weirs are in fully open position 36.54 m as per As Built 05=-29.

In high bypass flows, the driving head for the flow entering bypass pipe via orifice flow can affect water levels upstream of the bypass weirs if weirs are in the lowest position.

Can use higher overflow level 37.54 "Normal Overflow Level" considering upstream HGL is still safe in this case.

Drg 05-029

Conduit reference: IW Drop Chan_4

Open rectangular channel
Length: 1.200 m

Friction Loss: 'Concrete channel'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	35.650	3.350	39.000	2.000		0.000
US	35.650	3.350	39.000	2.000		0.000

Object Type: Rectangular Conduit

Purpose: Represents dropped channel following the grit trap outlet conduit.

DWG References: Upper Floor Plan DWG 02-303, Inlet Works Cross Sections 1 DWG 02-305, Inlet Works Cross Sections 2 DWG 02-306

Notes / Assumptions:

Component reference: NN 21

Null node

Conduit reference: IW Drop Chan_1

Open rectangular channel
Length: 1.200 m

Friction Loss: 'Concrete channel'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	35.650	3.350	39.000	2.000		1.000
US	35.650	3.350	39.000	2.000		0.000

1.000	Downstream discontinuity loss K factor
1.000	Bend, elbow, 90°. 90 change in direction before approach weir.

Object Type: Rectangular Conduit

Purpose: Represents dropped channel following the grit trap outlet conduit.

DWG References: Upper Floor Plan DWG 02-303, Inlet Works Cross Sections 1 DWG 02-305, Inlet Works Cross Sections 2 DWG 02-306

Notes / Assumptions:

Component reference: NN 28_1

Null node

Conduit reference: **Grit Outlet Chan_1**

Open rectangular channel
Length: 5.380 m

Friction Loss: 'Concrete channel'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	37.050	1.950	39.000	2.000		0.000
US	37.050	1.950	39.000	2.000		0.000

Object Type: Rectangular Conduit

Purpose: Represents grit trap outlet conduit.

DWG References: Upper Floor Plan DWG 02-303, Inlet Works Cross Sections 1 DWG 02-305, Inlet Works Cross Sections 2 DWG 02-306

Notes / Assumptions:

Length from GT to RL drop: 10250 - (2*2435) = 5380mm (5.38m) from DWG 02-303

Component reference: **GT 4 Flow in**

Inflow node

Inflow set as 1/4 (25.000%) of 'Bypass FLow' (1.90000 m³/s) = 0.47500 m³/s for all run scenarios

Inflow from the inlet works upstream of the bypass weir penstocks. Considers all four grit traps in service, so 1/4 of inflow comes from the one grit channel that is in line with the weir penstocks.

For the purpose of the bypass and effluent model, it is not significant that in reality flow may come from 1 or 2 grit channels.

Conduit reference: **IW Drop Chan_2**

Open rectangular channel
Length: 1.200 m

Friction Loss: 'Concrete channel'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	35.650	3.350	39.000	2.000		1.000
US	35.650	3.350	39.000	2.000		1.000

1.000	Downstream discontinuity loss K factor
1.000	Bend, elbow, 90°. 90 degree change in flow direction before approaching bypass weir

1.000	Upstream discontinuity loss K factor
1.000	Bend, elbow, 90°. 90 deg bend at Grid A3

Object Type: Rectangular Conduit

Purpose: Represents dropped channel following the grit trap outlet conduit.

DWG References: Upper Floor Plan DWG 02-303, Inlet Works Cross Sections 1 DWG 02-305, Inlet Works Cross Sections 2 DWG 02-306

Notes / Assumptions:

Conduit reference: Effluent Pipe 2

Circular conduit
Length: 7.200 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	26.510	1.365	27.874	1.365		3.237
US	26.740	1.365	28.104	1.365		0.000

3.237 Downstream discontinuity loss K factor
3.237 K23 to be determined, depending on flow condition being considered For Feb 3 flooding scenario: Bypass flow = 1.9 m3/s, UV flow = 1.5 m3/s, total flow = 3.4 m3/s Use the following K23, Using DS Miller Figure 13.11, flow ratio Q1/Q3=0.56, A1/A3=0.55, K23=0.65. After converting for different velocity heads as per DS Miller guidance, k=3.237

1420 OD effluent pipe from 60 degree bend to vertical tee junction with bypass riser.

Refer Drgs 02-535, 02-519, 02-529.

DS invert taken as interpolated from long section:. invert at junction = 26.74-7.2*(26.74-26.4)/10.75=26.51,

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.365 m ID.

Length chainage 47.15-39.95 = 7.2

Component reference: 1420 pipe bend 60

Null node

Conduit reference: Effluent Pipe 1

Circular conduit
Length: 39.950 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	26.740	1.365	28.105	1.365		0.250
US	27.100	1.365	28.465	1.365		0.500

0.250 Downstream discontinuity loss K factor
0.250 Mitre elbow, 3-piece, 60°

0.500 Upstream discontinuity loss K factor
0.500 Entry, sharp-edged. As Built 02-405 indicates chamfered entry however this is only slightly rounded so ignored for conservatism.

1420 OD effluent pipe from UV outlet box to 60 degree bend.

Refer Drgs 02-535, 02-519, 02-529, 02-405

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.365 m ID

Component reference: NN 30

Null node

Conduit reference: **UV Outlet Channel**

Launder channel
Length: 4.960 m

Friction Loss: 'Concrete channel'

Weir Crest elevation: 29.170 m

Inflow set as 'UV Out (1 chan OOS)' = 1.50000 m³/s for all run scenarios

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	27.100	4.450	31.550	2.000	0.000	0.000
US	27.100	4.450	31.550	2.000	0.000	0.000

UV Oultlet Channel as reflected in As Builts 02-401 and 02-402.

Modelled as Launder reflecting flow which progressively joins from the side weir (common UV channel exit weir).

As Builts 02-402 section 300 and 02-403 section 311 indicate two different levels for this weir, the higher level 29.17 has been adopted which aligns with level also indicated on 02-405. This is considered acceptably conservative given it will raise upstream water levels more in peak flows.

Component reference: **Out 1**

Outflow node

Outflow set as upstream flow for all run scenarios

Outflow component required upstream of launder channel (in order for launder channel to be modelled correctly).

Conduit reference: **NL 15**

Null link

Component reference: **UV Out Weir**

Rectangular sharp-crested weir Solution type: Kindsvater-Carter

Weir width m	End contractions	Crest elevation m
4.960	n/a	29.170

Run Scenario	Flow m³/s	Discharge Coefficient	Head Over Weir m	Freeboard DS m
3 Feb 2026 Flood	1.500	0.613	0.302	0.931

Common UV channels outlet exit weir.

As Builts 02-402 section 300 and 02-403 section 311 indicate two different levels for this weir, the higher level 29.17 has been adopted which aligns with level also indicated on 02-405. This is considered acceptably conservative given it will raise upstream water levels more in peak flows.

Conduit reference: **UV Conduit 4_1**

Closed rectangular culvert
Length: 1.800 m

Friction Loss: 'Concrete channel'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	27.100	4.450	31.550	4.960		0.000
US	27.100	4.450	31.550	4.960		0.000

Object Type: Rectangular Conduit

Purpose: Represents combined flow in exit chamber before going over UV Outlet Weir.

DWG References: UV Disinfection Room Plan DWG 02-401 - all dimensions

Notes / Assumptions:
Channels not modelled upstream of this section. This considers that Hades Model does not currently predict the flooding that occurred; so the previously predicted headlosses through the UV channels will not likley be a cause of the flooding experienced. Refer previous Hydraulic report "*Moa Point Wastewater Treatment Plant Hydraulic Modelling,* Stantec, October 2025) and Hydraulic Grade line drawing 310104197-STN-00-410-DR-HY-000001 Rev B

Component reference: **UV Outflow**

Inflow node

Inflow set as 'UV Out (1 chan OOS)' = 1.50000 m³/s for all run scenarios

Placeholder in model to be able to simlulate draining of UV works in future, can be checked against UV outflowweir level 29.17

Conduit reference: **Water Column 1_24**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 20_24**

Null node

Conduit reference: **Diffuser Type_11**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: NN 26_24

Null node

Conduit reference: Diffuser Type_10

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Component reference: NN 27_24

Null node

Conduit reference: Riser 6

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		29.250

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

29.250	Upstream discontinuity loss K factor
29.250	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 6 in Hades corresponds to Riser 13 in the inspection report, which has east nozzle (OD150) open, west nozzle (OD160) closed.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point

Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers.

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: Water Column 1_26

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 20_26

Null node

Conduit reference: Diffuser Type_19

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: NN 26_26

Null node

Conduit reference: **Diffuser Type_18**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Component reference: **NN 27_28**

Null node

Conduit reference: **Riser 2**

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		41.466

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

41.466	Upstream discontinuity loss K factor
41.466	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 2 in Hades corresponds to Riser 17 in the inspection report, which has east nozzle (OD150) open, west nozzle (OD160) closed.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: **Water Column 1_19**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 20_19**

Null node

Conduit reference: **Diffuser Type 1a_6**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: **NN 26_19**

Null node

Conduit reference: **Diffuser Type 1b_6**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Component reference: **NN 27_19**

Null node

Conduit reference: **Riser 8**

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		23.900

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

23.900	Upstream discontinuity loss K factor
23.900	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 8 in Hades corresponds to Riser 11 in the inspection report, which has east nozzle (OD150) open, west nozzle (OD160) closed.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: Water Column 1_18

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 20_18

Null node

Conduit reference: Diffuser Type 1a_5

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: NN 26_18

Null node

Conduit reference: **Diffuser Type 1b_5**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Component reference: **NN 27_18**

Null node

Conduit reference: **Riser 10**

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		19.075

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

19.075	Upstream discontinuity loss K factor
19.075	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 10 in Hades corresponds to Riser 9 in the inspection report, which has east nozzle (OD150) open, west nozzle (OD160) closed.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: **Water Column 2_17**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_17**

Null node

Conduit reference: **Diffuser Type 2a_4**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 154 mm dia, US 214 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 154 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 72% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: **NN 30_17**

Null node

Conduit reference: **Diffuser Type 2b_4**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.150

0.150 Upstream discontinuity loss K factor
0.150 Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: **NN 27_17**

Null node

Conduit reference: **Riser 12**

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		3.343

1.200 Downstream discontinuity loss K factor
1.200 Junction, Tee - flow to or from branch, sharp

3.343 Upstream discontinuity loss K factor
3.343 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: **Water Column 1_17**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 20_17**

Null node

Conduit reference: **Diffuser Type 1a_4**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: **NN 26_17**

Null node

Conduit reference: **Diffuser Type 1b_4**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Conduit reference: Water Column 1_25

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 20_25

Null node

Conduit reference: Diffuser Type_15

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: **NN 26_25**

Null node

Conduit reference: **Diffuser Type_12**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.225

0.225 Upstream discontinuity loss K factor
0.225 Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Component reference: **NN 27_26**

Null node

Conduit reference: **Riser 4**

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		35.110

1.200 Downstream discontinuity loss K factor
1.200 Junction, Tee - flow to or from branch, sharp

35.110 Upstream discontinuity loss K factor
35.110 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 4 in Hades corresponds to Riser 15 in the inspection report, which has east nozzle (OD150) open, west nozzle (OD160) closed.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: Water Column 2_16

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 21_16

Null node

Conduit reference: Diffuser Type 2a_3

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 154 mm dia, US 214 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 154 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 72% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: NN 30_16

Null node

Conduit reference: Diffuser Type 2b_3

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: NN 27_16

Null node

Conduit reference: Riser 14

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		1.856

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

1.856	Upstream discontinuity loss K factor
1.856	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: Water Column 1_16

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 20_16

Null node

Conduit reference: Diffuser Type 1a_3

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: NN 26_16

Null node

Conduit reference: Diffuser Type 1b_3

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Conduit reference: **Water Column 2_14**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_14**

Null node

Conduit reference: **Diffuser Type 2a_2**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: NN 30_14

Null node

Conduit reference: Diffuser Type 2b_2

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.150

0.150 Upstream discontinuity loss K factor
0.150 Taper (fitting), normal, 03:02. Additional loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: NN 27_14

Null node

Conduit reference: Riser 16

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		0.918

1.200 Downstream discontinuity loss K factor
1.200 Junction, Tee - flow to or from branch, sharp

0.918 Upstream discontinuity loss K factor
0.918 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx
DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: **Water Column 1_14**

Closed rectangular culvert
Length: 5.000 m

<u>Friction Loss: 'Diffuser Roughness'</u>

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 20_14**

Null node

Conduit reference: **Diffuser Type 1a_2**

Circular conduit
Length: 0.250 m

<u>Friction Loss: 'Diffuser Roughness'</u>

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: **NN 26_14**

Null node

Conduit reference: **Diffuser Type 1b_2**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Additional loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Conduit reference: **Water Column 2_12**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_12**

Null node

Conduit reference: **Diffuser Type 2a_1**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics

Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: NN 30_12

Null node

Conduit reference: Diffuser Type 2b_1

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Additional loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: Sea Level 2_1

Level control node

Elevation set as 'Sea Level in Cook St' = 1.277 m for all run scenarios

Conduit reference: Water Column 1_13

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 20_13

Null node

Conduit reference: **Diffuser Type 1a_7**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: **NN 26_13**

Null node

Conduit reference: **Diffuser Type 1b_7**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Component reference: **NN 27_13**

Null node

Conduit reference: **Riser 17**

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		0.633

1.200 Downstream discontinuity loss K factor
1.200 Junction, Tee - flow to or from branch, sharp

0.633 Upstream discontinuity loss K factor
0.633 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: **Water Column 2_23**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_23**

Null node

Conduit reference: **Diffuser Type 2a_12**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: **NN 30_23**

Null node

Conduit reference: **Diffuser Type 2b_12**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Lloss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: **NN 27_23**

Null node

Conduit reference: **Riser 7**

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		20.500

1.200 Downstream discontinuity loss K factor
1.200 Junction, Tee - flow to or from branch, sharp

20.500 Upstream discontinuity loss K factor
20.500 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 7 in Hades corresponds to Riser 12 in the inspection report, which has east nozzle (OD150) closed, west nozzle (OD160) open.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: **Water Column 2_26**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_26**

Null node

Conduit reference: **Diffuser Type_21**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: NN 30_26

Null node

Conduit reference: Diffuser Type_20

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: NN 27_29

Null node

Conduit reference: Riser 1

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		34.683

1.200 Downstream discontinuity loss K factor
1.200 Junction, Tee - flow to or from branch, sharp

34.683 Upstream discontinuity loss K factor
34.683 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 1 in Hades corresponds to Riser 18 in the inspection report, which has east nozzle (OD150) closed, west nozzle (OD160) open.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: Water Column 2_22

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 21_22

Null node

Conduit reference: Diffuser Type 2a_11

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: NN 30_22

Null node

Conduit reference: Diffuser Type 2b_11

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: NN 27_22

Null node

Conduit reference: Riser 9

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		16.570

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

16.570	Upstream discontinuity loss K factor
16.570	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 9 in Hades corresponds to Riser 10 in the inspection report, which has east nozzle (OD150) closed, west nozzle (OD160) open.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: Water Column 2_21

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 21_21

Null node

Conduit reference: Diffuser Type 2a_10

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: NN 30_21

Null node

Conduit reference: Diffuser Type 2b_10

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 72% so 4:3 taper used (k=0.1)

Component reference: NN 27_21

Null node

Conduit reference: **Riser 11**

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		4.285

1.200 Downstream discontinuity loss K factor
1.200 Junction, Tee - flow to or from branch, sharp

4.285 Upstream discontinuity loss K factor
4.285 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: **Water Column 1_21**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 20_21**

Null node

Conduit reference: **Diffuser Type 1a_10**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: **NN 26_21**

Null node

Conduit reference: **Diffuser Type 1b_10**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Conduit reference: **Water Column 2_20**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_20**

Null node

Conduit reference: **Diffuser Type 2a_9**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: **NN 30_20**

Null node

Conduit reference: **Diffuser Type 2b_9**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: NN 27_20

Null node

Conduit reference: Riser 13

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		2.479

1.200 Downstream discontinuity loss K factor
1.200 Junction, Tee - flow to or from branch, sharp

2.479 Upstream discontinuity loss K factor
2.479 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: Water Column 1_20

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 20_20

Null node

Conduit reference: Diffuser Type 1a_9

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: NN 26_20

Null node

Conduit reference: Diffuser Type 1b_9

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Conduit reference: **Water Column 2_25**

Closed rectangular culvert
Length: 5.000 m

<u>Friction Loss: 'Diffuser Roughness'</u>

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_25**

Null node

Conduit reference: **Diffuser Type_17**

Circular conduit
Length: 0.250 m

<u>Friction Loss: 'Diffuser Roughness'</u>

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: **NN 30_25**

Null node

Conduit reference: **Diffuser Type_16**

Circular conduit
Length: 0.040 m

<u>Friction Loss: 'Diffuser Roughness'</u>

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: NN 27_27

Null node

Conduit reference: Riser 3

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		29.568

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

29.568	Upstream discontinuity loss K factor
29.568	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx Proportion flow splits are the same at lower total flow rates.

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 3 in Hades corresponds to Riser 16 in the inspection report, which has east nozzle (OD150) closed, west nozzle (OD160) open.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: Water Column 2_15

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 21_15

Null node

Conduit reference: Diffuser Type 2a_8

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: NN 30_15

Null node

Conduit reference: Diffuser Type 2b_8

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: NN 27_15

Null node

Conduit reference: Riser 15

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		1.365

1.200 Downstream discontinuity loss K factor
1.200 Junction, Tee - flow to or from branch, sharp

1.365 Upstream discontinuity loss K factor
1.365 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: Water Column 1_15

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 20_15

Null node

Conduit reference: **Diffuser Type 1a_8**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: **NN 26_15**

Null node

Conduit reference: **Diffuser Type 1b_8**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Conduit reference: Water Column 2_24

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 21_24

Null node

Conduit reference: Diffuser Type_14

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: NN 30_24

Null node

Conduit reference: Diffuser Type_13

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: NN 27_25

Null node

Conduit reference: Riser 5

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		24.837

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

24.837	Upstream discontinuity loss K factor
24.837	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 5 in Hades corresponds to Riser 14 in the inspection report, which has east nozzle (OD150) closed, west nozzle (OD160) open.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: **Water Column 2_13**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_13**

Null node

Conduit reference: **Diffuser Type 2a_7**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: **NN 30_13**

Null node

Conduit reference: **Diffuser Type 2b_7**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

RESULTS SECTION

SCENARIO '3 Feb 2026 Flood'

INFORMATION MESSAGES, WARNINGS AND ERRORS

Topology is Complex

WARNING: DS K factor in conduit 'Bypass Outlet Box 2' should be equal to 1 US of horizontal orifice '965 bypass entry'

Hardy-Cross iteration required

Effluent Pipe 7
Subcritical flow at 1.756 m

Effluent Pipe 3
Supercritical flow at 1.234 m with a hydraulic jump possible further downstream

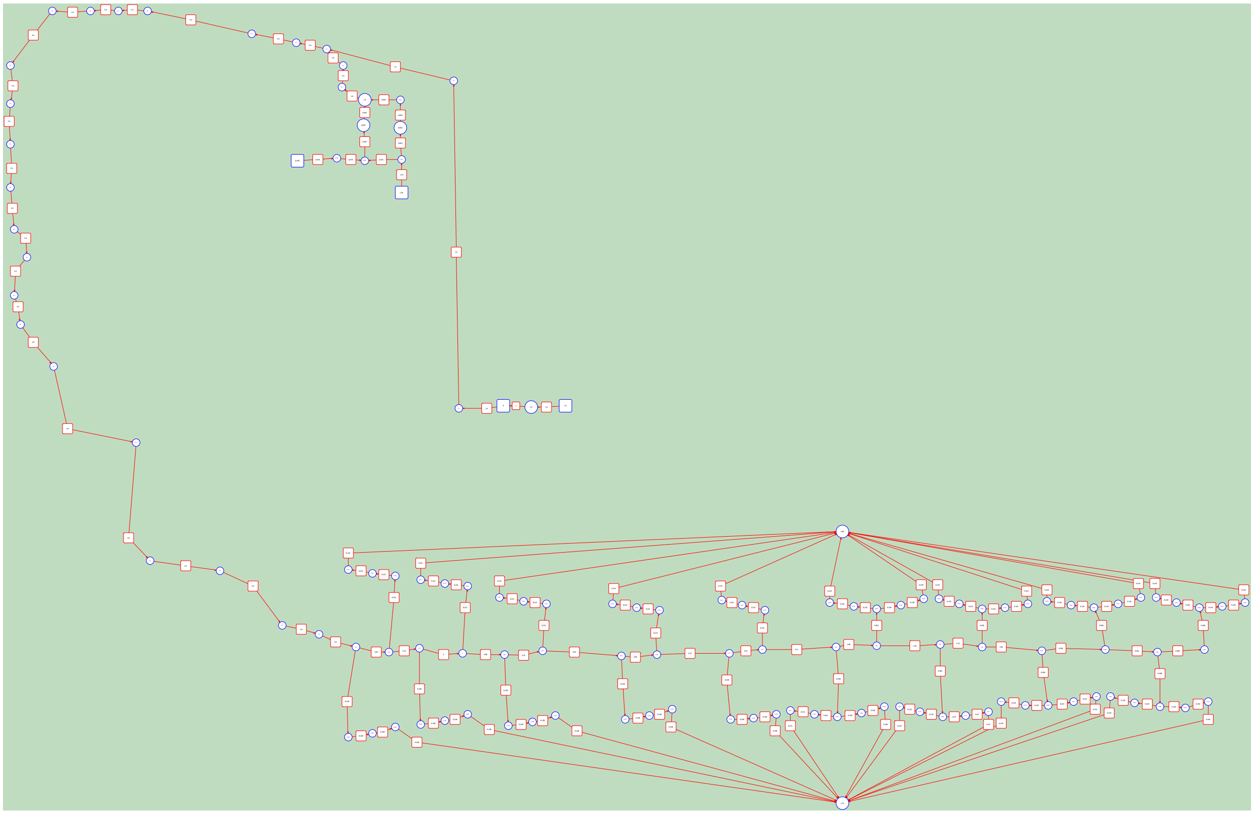
Sloping BP 965OD
Free discharge at DS end
WARNING: Open channel hydraulic profile solution did not converge at chainage 0.001m, failing criterion on change in successive values of depth over critical. Calculation at this point was omitted. For increased resolution try reducing minimum halved step length or increasing profile transition point 'Factor B' to at least 861%

Vertical BP pipe
Free-surface flow commences at 0.833m
WARNING: Open channel hydraulic profile solution did not converge at chainage 0.000m, failing criterion on change in successive values of depth over critical. Calculation at this point was omitted. For increased resolution try reducing minimum halved step length or increasing profile transition point 'Factor B' to at least 2703%
Free discharge at DS end

Grit Outlet Chan_1
Free discharge at DS end

Effluent Pipe 2
Free-surface flow commences at 6.460m

MODEL DIAGRAM SHOWING FLOWS



ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'						
Sea Level 1_1						
Depth control		1.65918	1.277			
Water Column 1_12						
Rect. conduit	0.000	0.12400	1.277	1.277	0.001	0.000
	5.000	0.12400	1.277	1.277	0.001	0.000
NN 20_12						
Null node		0.12400	1.277			
Diffuser Type 1a_1						
Circular conduit	0.000	0.12400	4.528	1.573	7.614	2.956
	0.250	0.12400	4.639	1.683	7.614	2.956
NN 26_12						
Null node		0.12400	4.639			
Diffuser Type 1b_1						
Circular conduit	0.000	0.12400	4.639	3.905	3.794	0.734
	0.040	0.12400	4.752	3.908	3.794	0.734
NN 27_12						
Null node		0.26582	4.752			
Riser 18						
Circular conduit	0.000	0.26582	4.812	4.762	0.989	0.050
	0.000	0.26582	4.841	4.766	0.989	0.050

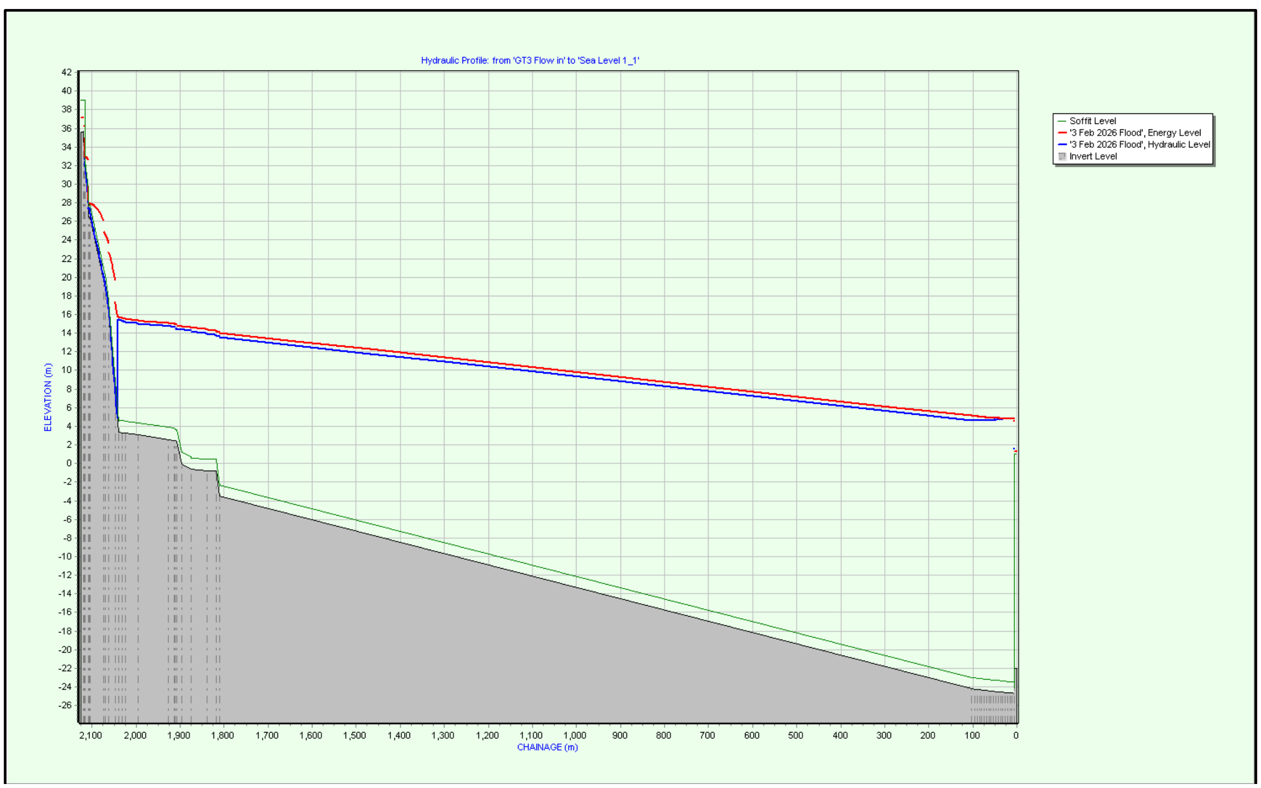
NN 31_1						
Null node		0.26582	4.841			
Diffuser Sec 18						
Circular conduit	0.000	0.26582	4.841	4.838	0.235	0.003
	5.300	0.26582	4.842	4.839	0.235	0.003
NN 12_6						
Null node		0.53141	4.842			
Diffuser Sec 17						
Circular conduit	0.000	0.53141	4.842	4.830	0.470	0.011
	5.300	0.53141	4.842	4.831	0.470	0.011
NN 11_2						
Null node		0.79648	4.842			
Diffuser Sec 16						
Circular conduit	0.000	0.79648	4.842	4.816	0.704	0.025
	5.300	0.79648	4.842	4.818	0.704	0.025
NN 10_2						
Null node		1.06074	4.842			
Diffuser Sec 15						
Circular conduit	0.000	1.06074	4.842	4.797	0.938	0.045
	5.300	1.06074	4.842	4.800	0.938	0.045
NN 9_2						
Null node		1.32411	4.842			
Diffuser Sec 14						
Circular conduit	0.000	1.32411	4.842	4.772	1.171	0.070
	5.300	1.32411	4.844	4.777	1.171	0.070
NN 8_2						
Null node		1.58642	4.844			
Diffuser Sec 13						
Circular conduit	0.000	1.58642	4.844	4.743	1.403	0.100
	5.300	1.58642	4.846	4.749	1.403	0.100
NN 7_2						
Null node		1.84729	4.846			
Diffuser Sec 12						
Circular conduit	0.000	1.84729	4.846	4.710	1.633	0.136
	5.300	1.84729	4.851	4.719	1.633	0.136
NN 6_4						
Null node		2.10671	4.851			
Diffuser Sec 11						
Circular conduit	0.000	2.10671	4.851	4.674	1.863	0.177
	5.300	2.10671	4.864	4.685	1.863	0.177
NN 5_2						
Null node		2.22796	4.864			
Diffuser Sec 10						
Circular conduit	0.000	2.22796	4.864	4.666	1.970	0.198
	5.000	2.22796	4.877	4.677	1.970	0.198
NN 4_2						
Null node		2.36622	4.877			
Diffuser Sec 9						
Circular conduit	0.000	2.36622	4.877	4.654	2.092	0.223
	5.600	2.36622	4.896	4.669	2.092	0.223

NN 3_2							
	Null node		2.48716	4.896			
Diffuser Sec 8							
	Circular conduit	0.000	2.48716	4.896	4.649	2.199	0.247
		5.600	2.48716	4.915	4.665	2.199	0.247
NN 2_2							
	Null node		2.62514	4.915			
Diffuser Sec 7							
	Circular conduit	0.000	2.62514	4.915	4.641	2.321	0.275
		5.000	2.62514	4.937	4.656	2.321	0.275
NN 1_3							
	Null node		2.74587	4.937			
Diffuser Sec 6							
	Circular conduit	0.000	2.74587	4.937	4.637	2.428	0.301
		5.300	2.74587	4.962	4.655	2.428	0.301
NN 4							
	Null node		2.88362	4.962			
Diffuser Sec 5							
	Circular conduit	0.000	2.88362	4.962	4.630	2.550	0.331
		5.300	2.88362	4.989	4.650	2.550	0.331
NN 3							
	Null node		3.00421	4.989			
Diffuser Section 4							
	Circular conduit	0.000	3.00421	4.989	4.629	2.656	0.360
		5.300	3.00421	5.019	4.651	2.656	0.360
NN 2							
	Null node		3.14185	5.019			
Diffuser Sec 3							
	Circular conduit	0.000	3.14185	5.019	4.625	2.778	0.393
		5.300	3.14185	5.051	4.649	2.778	0.393
NN 5							
	Null node		3.26238	5.051			
Diffuser Sec 2							
	Circular conduit	0.000	3.26238	5.051	4.627	2.885	0.424
		5.300	3.26238	5.086	4.652	2.885	0.424
NN 1							
	Null node		3.40000	5.086			
Diffuser Start Pipe							
	Circular conduit	0.000	3.40000	5.086	4.625	3.006	0.461
		7.950	3.40000	5.128	4.667	3.006	0.461
NN 32_1							
	Null node		3.40000	5.128			
Outfall CH66-1772_1							
	Circular conduit	0.000	3.40000	5.128	4.667	3.006	0.461
		1705.990	3.40000	14.047	13.586	3.006	0.461
19.7 Mitre_1							
	Null node		3.40000	14.047			
Outfall CH57-66_1							
	Circular conduit	0.000	3.40000	14.116	13.655	3.006	0.461
		8.050	3.40000	14.161	13.700	3.006	0.461

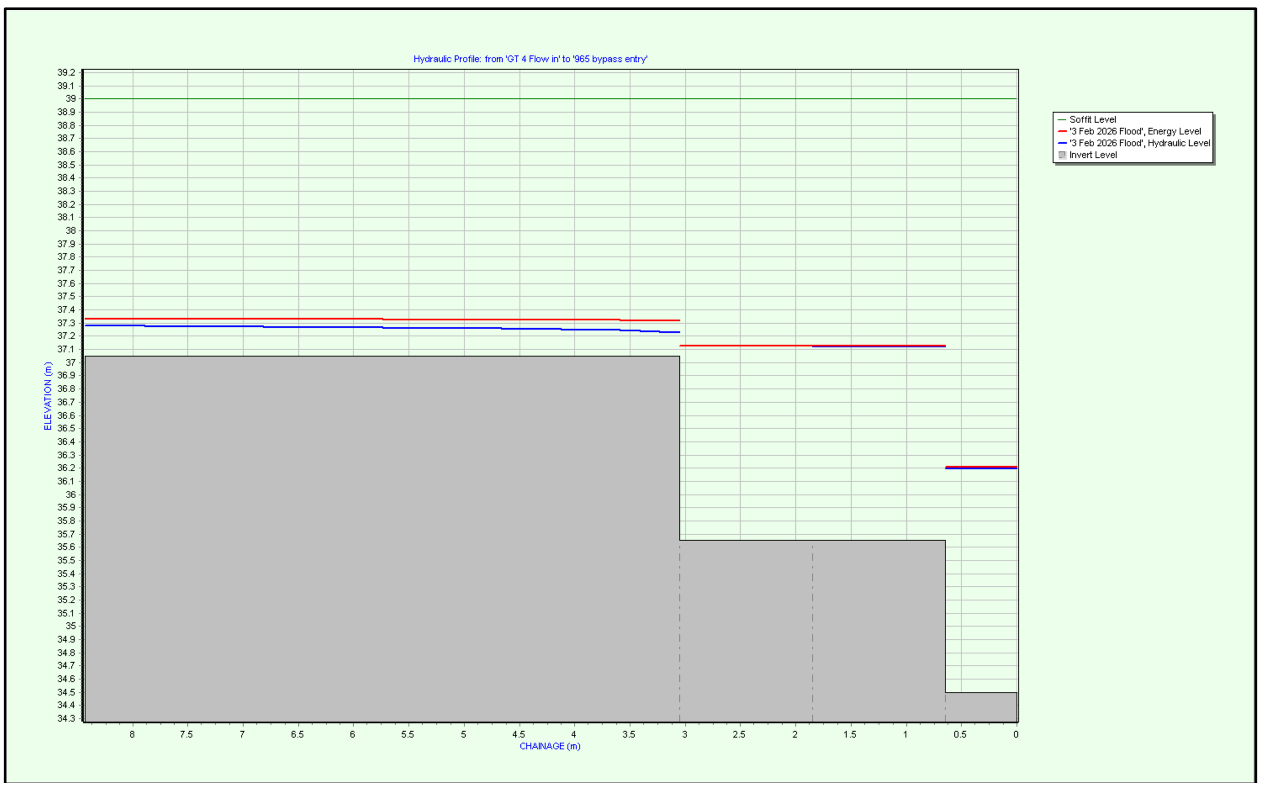
20 Mitre_1						
Null node		3.40000	14.161			
Outfall CH35-57_1						
Circular conduit	0.000	3.40000	14.230	13.769	3.006	0.461
	22.060	3.40000	14.345	13.884	3.006	0.461
22.9 Mitre_1						
Null node		3.40000	14.345			
Outfall CH0-35_1						
Circular conduit	0.000	3.40000	14.414	13.954	3.006	0.461
	35.410	3.40000	14.602	14.139	3.006	0.461
Tie In Flange						
Null node		3.40000	14.602			
Effluent Pipe 16						
Circular conduit	0.000	3.40000	14.602	14.283	2.500	0.319
	21.800	3.40000	14.673	14.354	2.500	0.319
NN 36						
Null node		3.40000	14.673			
Effluent Pipe 15						
Circular conduit	0.000	3.40000	14.697	14.374	2.515	0.322
	10.000	3.40000	14.755	14.408	2.515	0.322
NN 35						
Null node		3.40000	14.755			
Effluent Pipe 14						
Circular conduit	0.000	3.40000	14.938	14.418	3.195	0.521
	5.300	3.40000	14.971	14.450	3.195	0.521
NN 33						
Null node		3.40000	14.971			
Effluent Pipe 13						
Circular conduit	0.000	3.40000	14.971	14.652	2.500	0.319
	1.500	3.40000	14.976	14.657	2.500	0.319
NN 34						
Null node		3.40000	14.976			
Effluent Pipe 12						
Circular conduit	0.000	3.40000	14.988	14.670	2.500	0.319
	12.600	3.40000	15.029	14.711	2.500	0.319
NN 32						
Null node		3.40000	15.029			
Effluent Pipe 11						
Circular conduit	0.000	3.40000	15.061	14.743	2.500	0.319
	70.100	3.40000	15.289	14.971	2.500	0.319
NN 27_9						
Null node		3.40000	15.289			
Effluent Pipe 10						
Circular conduit	0.000	3.40000	15.369	15.050	2.500	0.319
	28.650	3.40000	15.462	15.144	2.500	0.319
NN 27_8						
Null node		3.40000	15.462			
Effluent Pipe 9						
Circular conduit	0.000	3.40000	15.542	15.223	2.500	0.319
	6.750	3.40000	15.564	15.245	2.500	0.319

NN 31						
Null node		3.40000	15.564			
Effluent Pipe 8						
Circular conduit	0.000	3.40000	15.644	15.322	2.515	0.322
	7.200	3.40000	15.668	15.346	2.515	0.322
NN 27_7						
Null node		3.40000	15.668			
Effluent Pipe 7						
Circular conduit	0.000	3.40000	15.668	15.426	2.515	0.322
	8.780	3.40000	17.331	7.903	13.598	9.428
NN 27_6						
Null node		3.40000	17.321			
Effluent Pipe 6						
Circular conduit	0.000	3.40000	17.324	7.867	15.226	11.822
	13.900	3.40000	22.641	16.614	10.873	6.028
NN 27_4						
Null node		3.40000	22.641			
Effluent Pipe 5_2						
Circular conduit	0.000	3.40000	22.641	16.633	11.774	7.068
	8.600	3.40000	24.656	19.370	10.182	5.286
NN 6						
Null node		3.40000	24.656			
Effluent Pipe 5_1						
Circular conduit	0.000	3.40000	24.656	19.377	10.175	5.279
	2.900	3.40000	24.891	20.090	9.703	4.800
NN 27_3						
Null node		3.40000	24.891			
Effluent Pipe 4						
Circular conduit	0.000	3.40000	24.891	20.061	10.881	6.037
	31.500	3.40000	27.883	27.275	3.455	0.609
NN 27_1						
Null node		3.40000	27.883			
Effluent Pipe 3_1						
Circular conduit	0.000	3.40000	27.883	27.247	3.674	0.688
	1.200	3.40000	27.943	27.333	3.459	0.610
NN 7						
Null node		3.40000	27.943			
Effluent Pipe 3						
Circular conduit	0.000	3.40000	27.943	27.276	3.615	0.667
	2.350	3.40000	27.956	27.494	3.009	0.462
NN 27						
Null node		3.40000	27.956			
1065 OD vert drop						
Circular conduit	0.000	1.90000	27.956	28.004	2.353	0.282
	0.000	1.90000	29.833	28.500	5.113	1.333
NN 26						
Null node		1.90000	29.833			
Sloping BP 965OD						
Circular conduit	0.000	1.90000	29.833	28.811	8.618	3.787
	7.500	1.90000	32.931	32.434	3.123	0.497

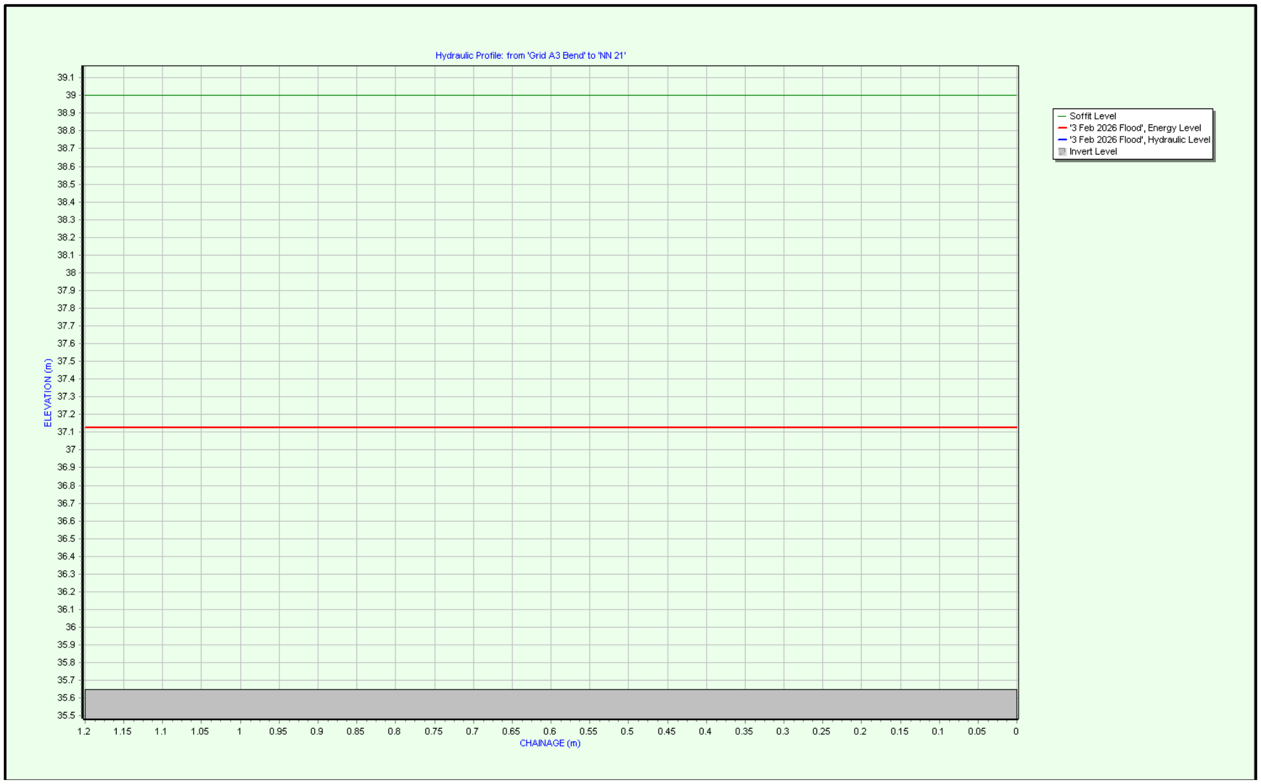
965 OD vert 67bend						
Null node		1.90000	32.931			
Vertical BP pipe						
Circular conduit	0.000	1.90000	32.931	32.633	2.889	0.426
	0.000	1.90000	34.997	34.500	3.123	0.497
965 bypass entry						
Orifice		1.90000	36.193			
Bypass Outlet Box 3						
Rect. conduit	0.000	0.95315	36.202	36.193	0.433	0.010
	2.500	0.95315	36.202	36.193	0.433	0.010
NN 20						
Null node		0.95315	36.202			
Bypass Outlet Box 1						
Rect. conduit	0.000	0.95315	36.216	36.205	0.466	0.011
	0.650	0.95315	36.216	36.205	0.466	0.011
BP Weir Penstck 1						
RSC weir		0.95315	37.126			
IW Drop Chan_3						
Rect. conduit	0.000	0.95315	37.126	37.121	0.324	0.005
	1.200	0.95315	37.126	37.121	0.324	0.005
Grid A3 Bend						
Null node		1.42500	37.126			
Asym OL Channel_1						
User-defined	0.000	1.42500	37.126	37.107	0.614	0.019
	5.300	1.42500	37.127	37.108	0.613	0.019
GT3 Flow in						
Inflow		1.42500	37.127			



ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'						
Bypass Outlet Box 2						
Rect. conduit	0.000	0.94685	36.206	36.195	0.465	0.011
	0.650	0.94685	36.206	36.195	0.465	0.011
BP Weir Penstck 2						
RSC weir		0.94685	37.123			
IW Drop Chan_4						
Rect. conduit	0.000	0.94685	37.123	37.118	0.322	0.005
	1.200	0.94685	37.123	37.118	0.322	0.005
NN 21						
Null node		0.94685	37.123			
IW Drop Chan_1						
Rect. conduit	0.000	0.47500	37.125	37.123	0.161	0.001
	1.200	0.47500	37.125	37.123	0.161	0.001
NN 28_1						
Null node		0.47500	37.125			
Grit Outlet Chan_1						
Rect. conduit	0.000	0.47500	37.319	37.229	1.325	0.090
	5.380	0.47500	37.334	37.279	1.038	0.055
GT 4 Flow in						
Inflow		0.47500	37.334			

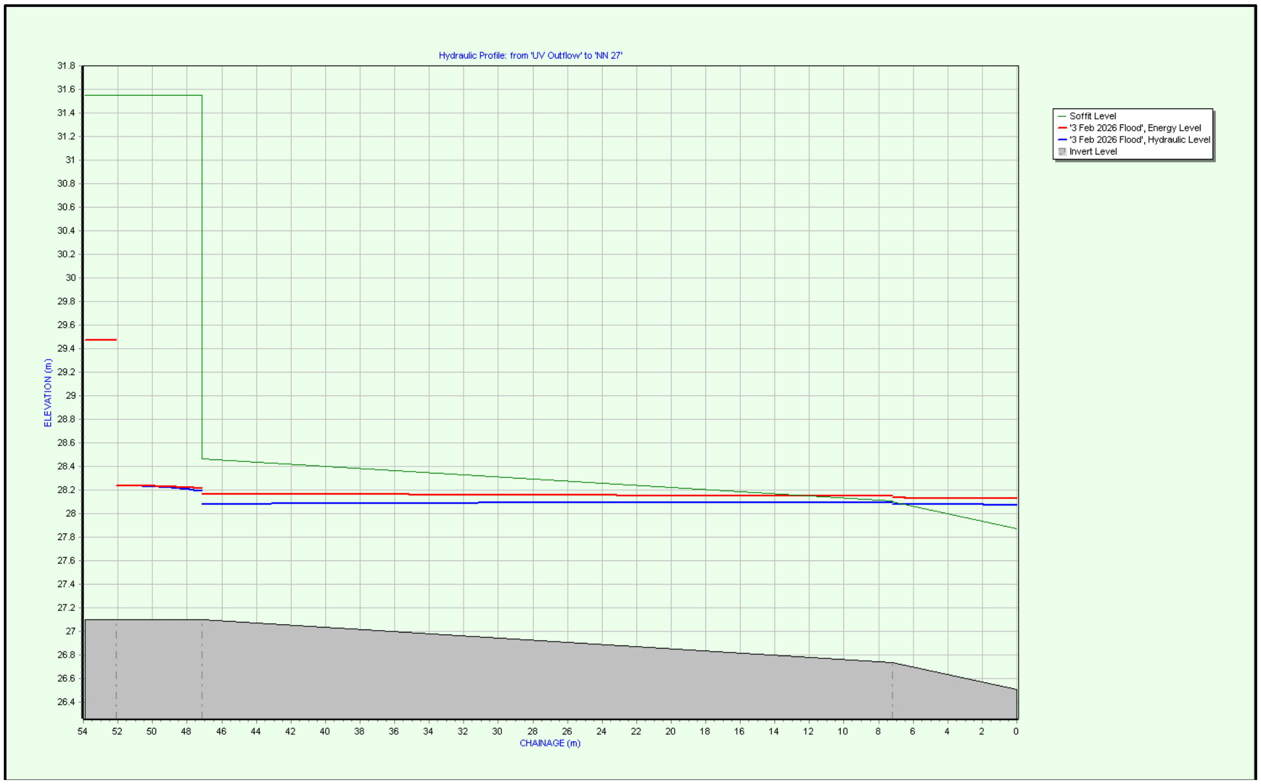


ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'							
IW Drop Chan_2							
	Rect. conduit	0.000	0.47185	37.125	37.123	0.160	0.001
		1.200	0.47185	37.126	37.123	0.160	0.001



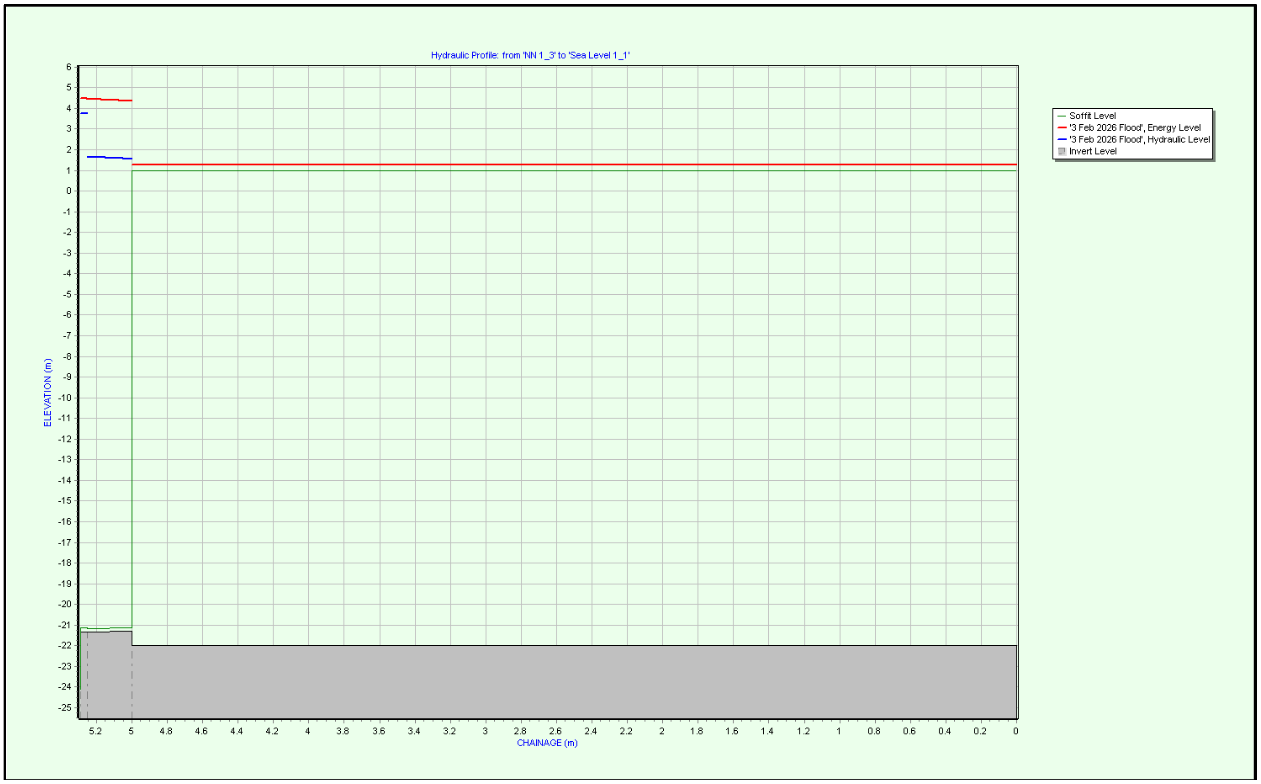
ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'							
Effluent Pipe 2							
	Circular conduit	0.000	1.50000	28.129	28.075	1.025	0.054
		7.200	1.50000	28.135	28.081	1.029	0.054
1420 pipe bend 60							
	Null node		1.50000	28.135			
Effluent Pipe 1							
	Circular conduit	0.000	1.50000	28.148	28.094	1.026	0.054
		39.950	1.50000	28.215	28.079	1.335	0.091
NN 30							
	Null node		1.50000	28.215			
UV Outlet Channel							
	Launder channel	0.000	1.50000	28.215	28.191	0.687	0.024
		4.960	0.00000	28.239	28.239	0.000	0.000
Out 1							
	Outflow		0.00000	28.239			

NL 15							
	Null link	0.000	1.50000	28.239	28.239	0.000	0.000
		0.000	1.50000	28.239	28.239	0.000	0.000
UV Out Weir							
	RSC weir		1.50000	29.473			
UV Conduit 4_1							
	Rect. conduit	0.000	1.50000	29.473	29.472	0.127	0.001
		1.800	1.50000	29.473	29.472	0.127	0.001
UV Outflow							
	Inflow		1.50000	29.473			



ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'							
Water Column 1_24							
	Rect. conduit	0.000	0.12072	1.277	1.277	0.001	0.000
		5.000	0.12072	1.277	1.277	0.001	0.000
NN 20_24							
	Null node		0.12072	1.277			
Diffuser Type_11							
	Circular conduit	0.000	0.12072	4.359	1.557	7.413	2.802
		0.250	0.12072	4.464	1.662	7.413	2.802
NN 26_24							
	Null node		0.12072	4.464			

Diffuser Type_10							
	Circular conduit	0.000	0.12072	4.464	3.768	3.694	0.696
		0.040	0.12072	4.623	3.771	3.694	0.696
NN 27_24							
	Null node		0.12072	4.623			
Riser 6							
	Circular conduit	0.000	0.12072	4.636	4.625	0.449	0.010
		0.000	0.12072	4.937	4.626	0.449	0.010

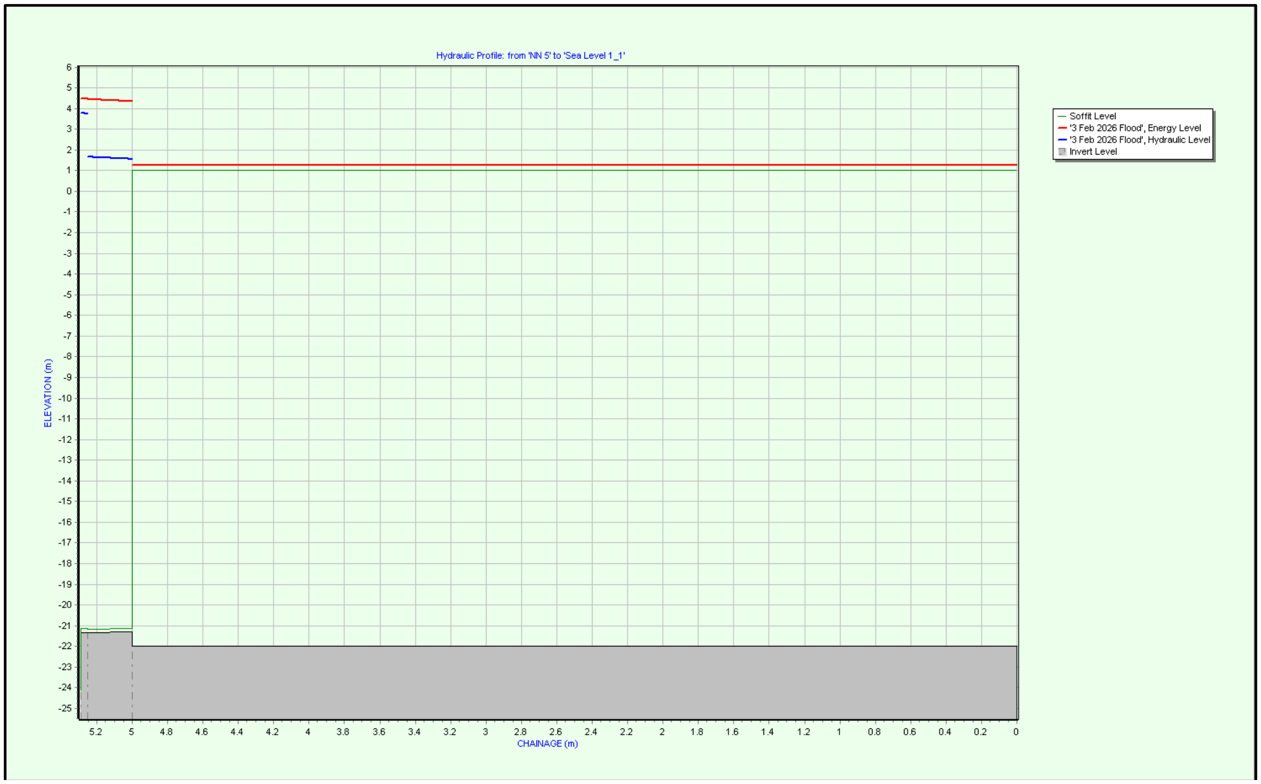


ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m

SCENARIO '3 Feb 2026 Flood'

Water Column 1_26							
	Rect. conduit	0.000	0.12053	1.277	1.277	0.001	0.000
		5.000	0.12053	1.277	1.277	0.001	0.000
NN 20_26							
	Null node		0.12053	1.277			
Diffuser Type_19							
	Circular conduit	0.000	0.12053	4.349	1.556	7.401	2.793
		0.250	0.12053	4.454	1.661	7.401	2.793
NN 26_26							
	Null node		0.12053	4.454			
Diffuser Type_18							
	Circular conduit	0.000	0.12053	4.454	3.761	3.688	0.693
		0.040	0.12053	4.613	3.763	3.688	0.693

ID / TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
NN 27_28						
Null node		0.12053	4.613			
Riser 2						
Circular conduit	0.000	0.12053	4.625	4.615	0.448	0.010
	0.000	0.12053	5.051	4.616	0.448	0.010

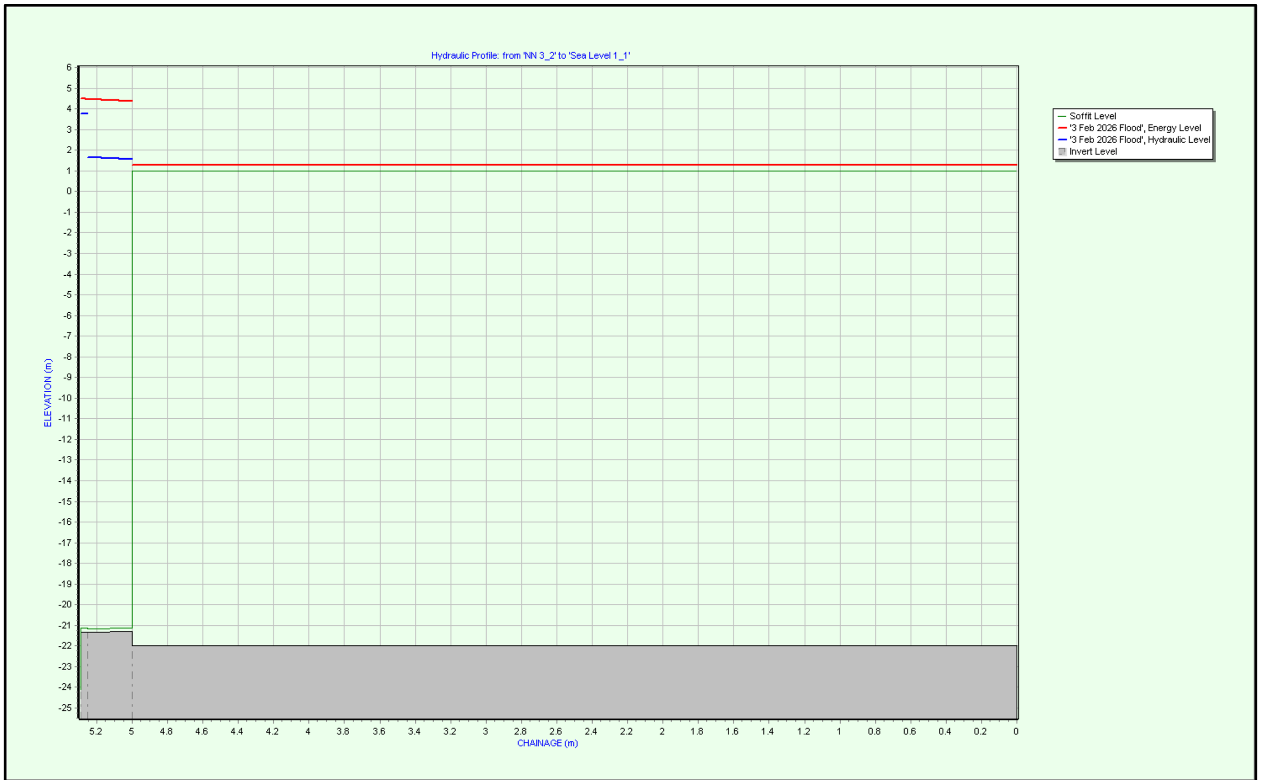


ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m

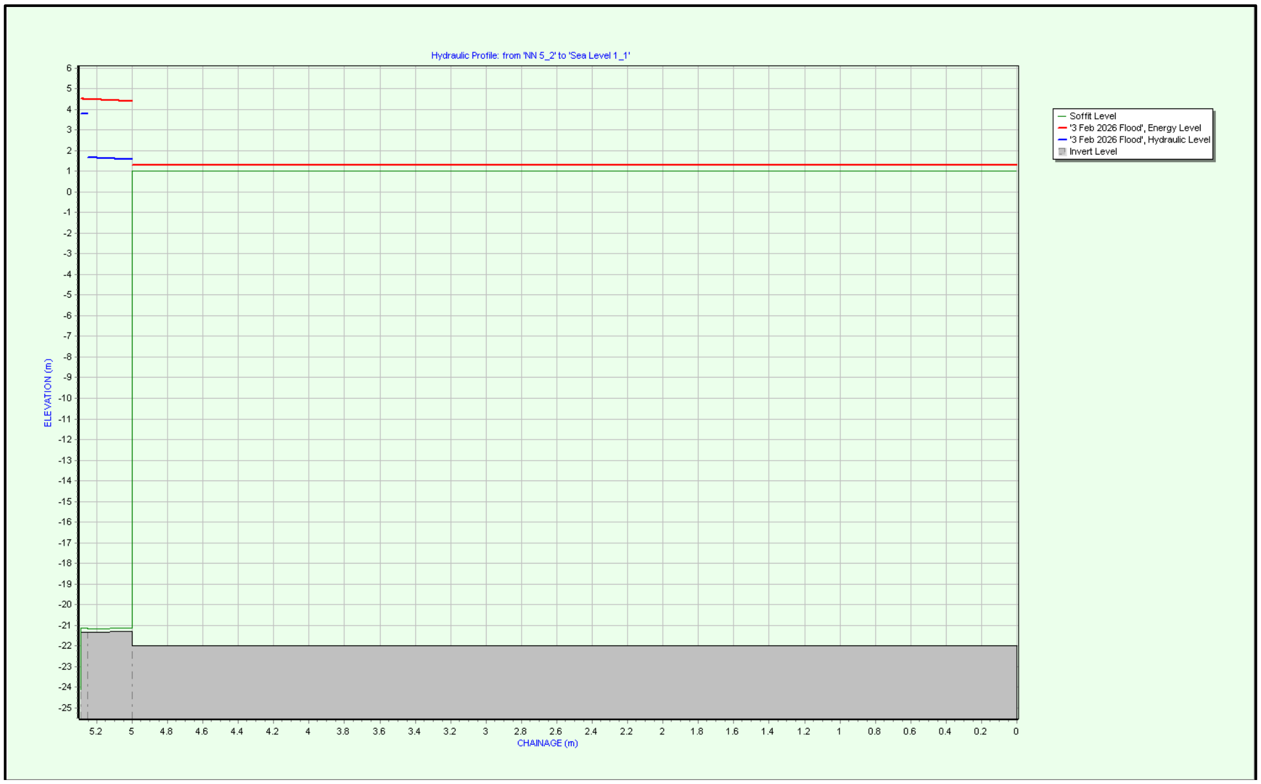
SCENARIO '3 Feb 2026 Flood'

ID / TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
Water Column 1_19						
Rect. conduit	0.000	0.12094	1.277	1.277	0.001	0.000
	5.000	0.12094	1.277	1.277	0.001	0.000
NN 20_19						
Null node		0.12094	1.277			
Diffuser Type 1a_6						
Circular conduit	0.000	0.12094	4.370	1.558	7.426	2.812
	0.250	0.12094	4.476	1.664	7.426	2.812
NN 26_19						
Null node		0.12094	4.476			
Diffuser Type 1b_6						
Circular conduit	0.000	0.12094	4.476	3.778	3.700	0.698
	0.040	0.12094	4.636	3.780	3.700	0.698
NN 27_19						
Null node		0.12094	4.636			

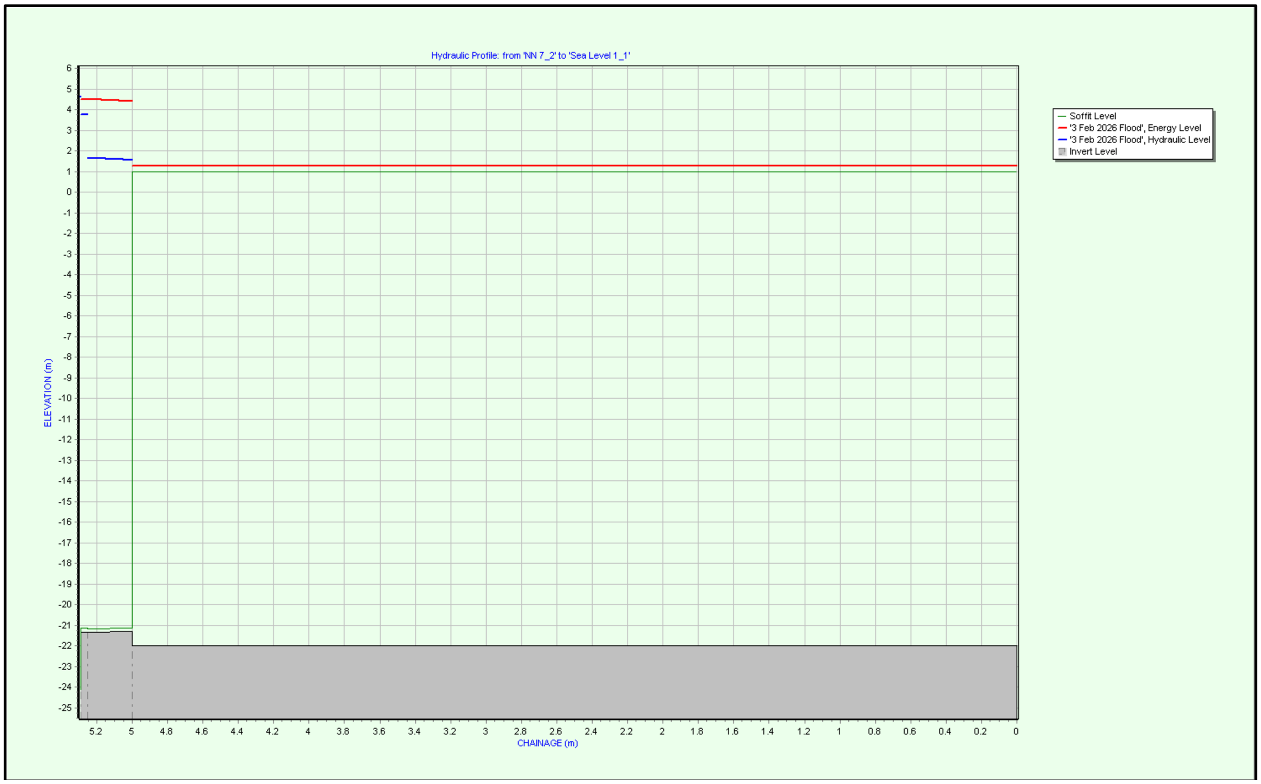
ID	TYPE	DISTANCE	FLOW	TOTAL ENERGY	HYDRAULIC GRADE	VELOCITY	VEL. HEAD
Riser 8							
	Circular conduit	0.000	0.12094	4.648	4.638	0.450	0.010
		0.000	0.12094	4.896	4.639	0.450	0.010



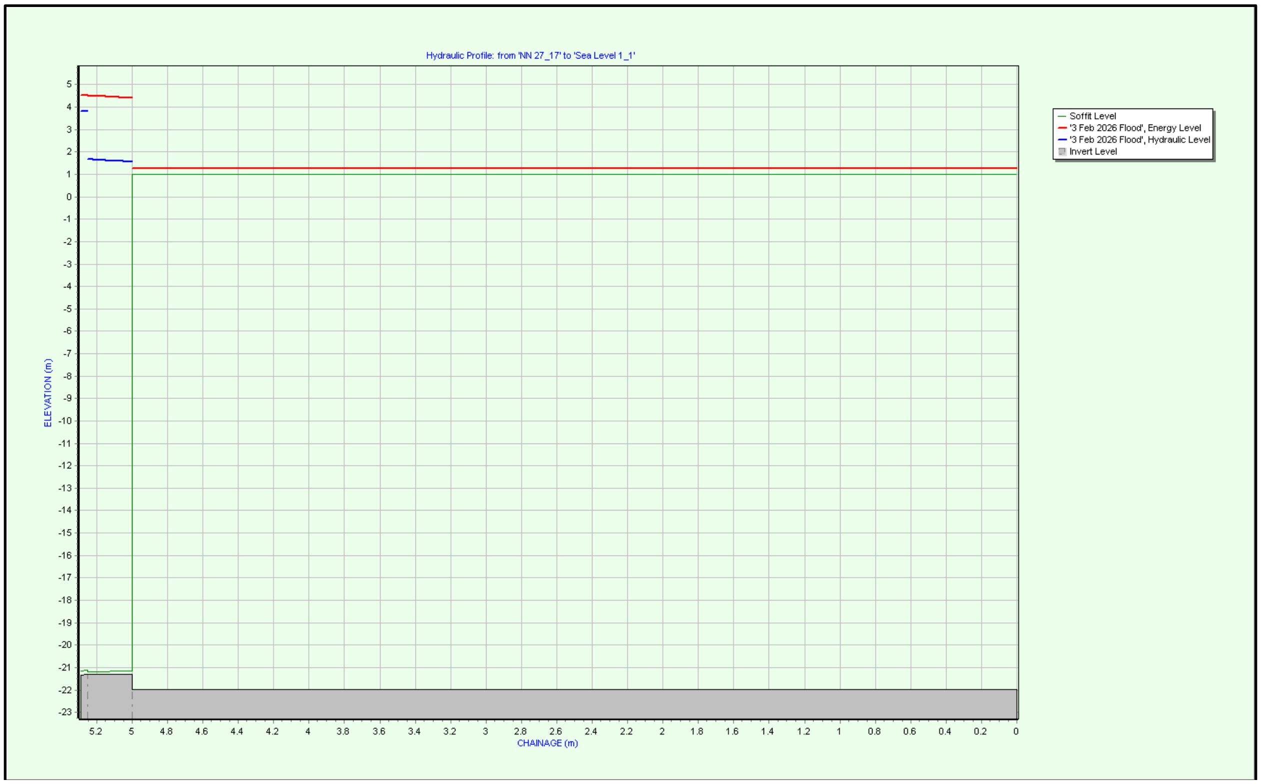
ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
<u>SCENARIO '3 Feb 2026 Flood'</u>							
Water Column 1_18							
	Rect. conduit	0.000	0.12125	1.277	1.277	0.001	0.000
		5.000	0.12125	1.277	1.277	0.001	0.000
NN 20_18							
	Null node		0.12125	1.277			
Diffuser Type 1a_5							
	Circular conduit	0.000	0.12125	4.386	1.560	7.445	2.826
		0.250	0.12125	4.492	1.666	7.445	2.826
NN 26_18							
	Null node		0.12125	4.492			
Diffuser Type 1b_5							
	Circular conduit	0.000	0.12125	4.492	3.790	3.710	0.702
		0.040	0.12125	4.653	3.793	3.710	0.702
NN 27_18							
	Null node		0.12125	4.653			
Riser 10							
	Circular conduit	0.000	0.12125	4.665	4.655	0.451	0.010
		0.000	0.12125	4.864	4.656	0.451	0.010



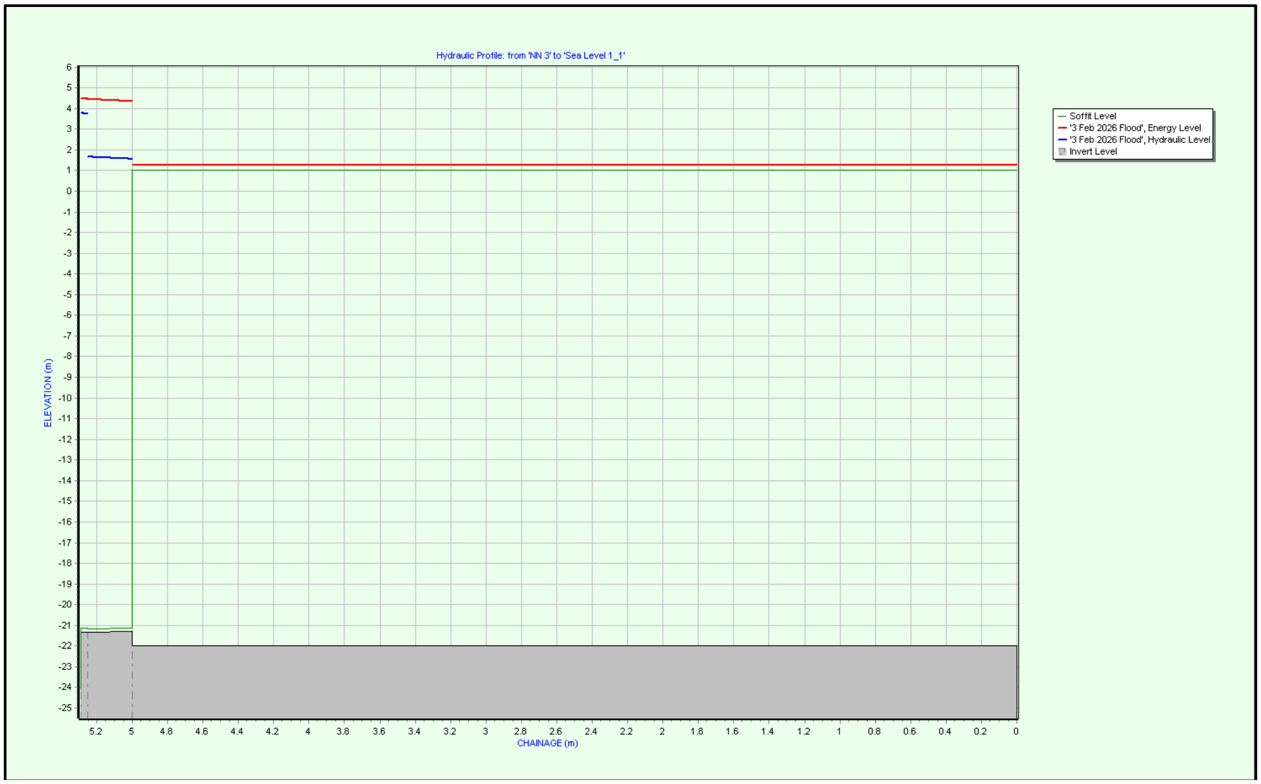
ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'						
Water Column 2_17						
Rect. conduit	0.000	0.13918	1.277	1.277	0.001	0.000
	5.000	0.13918	1.277	1.277	0.001	0.000
NN 21_17						
Null node		0.13918	1.277			
Diffuser Type 2a_4						
Circular conduit	0.000	0.13918	4.409	1.562	7.472	2.847
	0.250	0.13918	4.507	1.660	7.472	2.847
NN 30_17						
Null node		0.13918	4.507			
Diffuser Type 2b_4						
Circular conduit	0.000	0.13918	4.507	3.743	3.870	0.764
	0.040	0.13918	4.624	3.746	3.870	0.764
NN 27_17						
Null node		0.26088	4.624			
Riser 12						
Circular conduit	0.000	0.26088	4.682	4.634	0.971	0.048
	0.000	0.26088	4.846	4.638	0.971	0.048



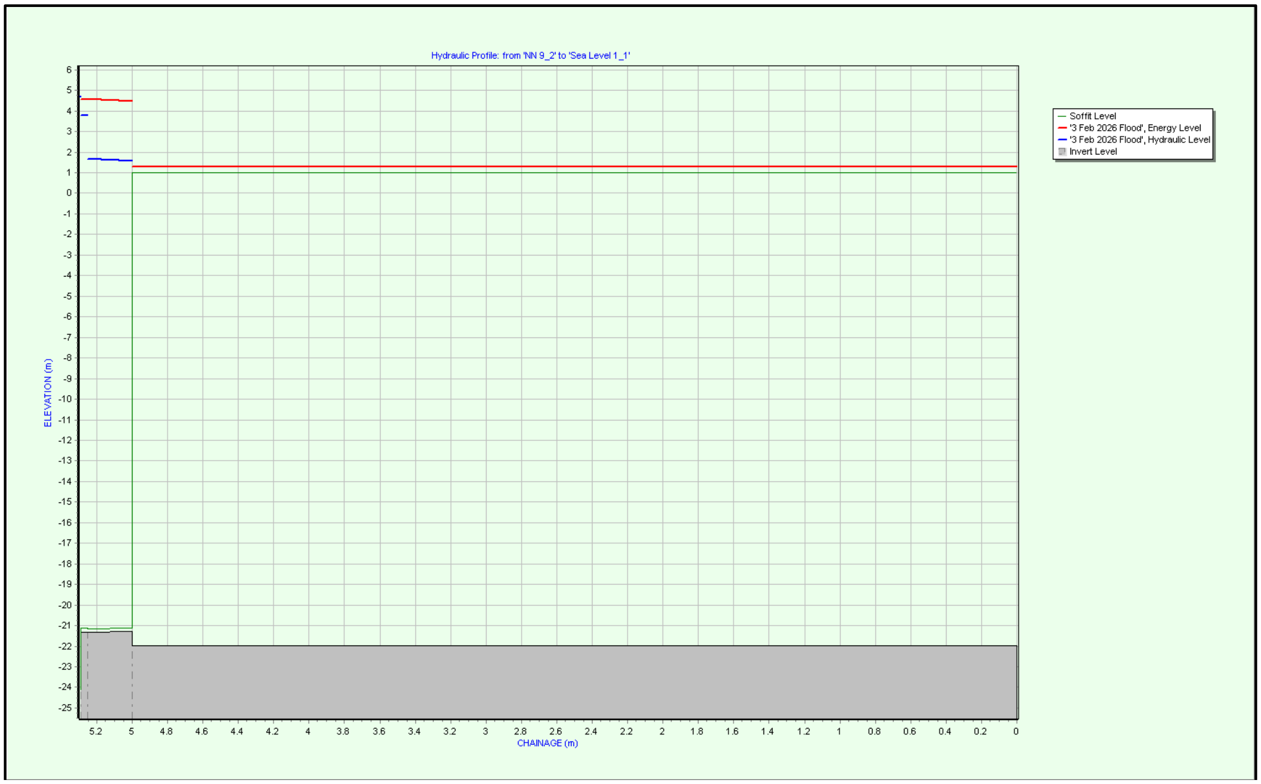
ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
<u>SCENARIO '3 Feb 2026 Flood'</u>						
Water Column 1_17						
Rect. conduit	0.000	0.12169	1.277	1.277	0.001	0.000
	5.000	0.12169	1.277	1.277	0.001	0.000
NN 20_17						
Null node		0.12169	1.277			
Diffuser Type 1a_4						
Circular conduit	0.000	0.12169	4.409	1.562	7.472	2.847
	0.250	0.12169	4.515	1.668	7.472	2.847
NN 26_17						
Null node		0.12169	4.515			
Diffuser Type 1b_4						
Circular conduit	0.000	0.12169	4.515	3.809	3.723	0.707
	0.040	0.12169	4.624	3.811	3.723	0.707



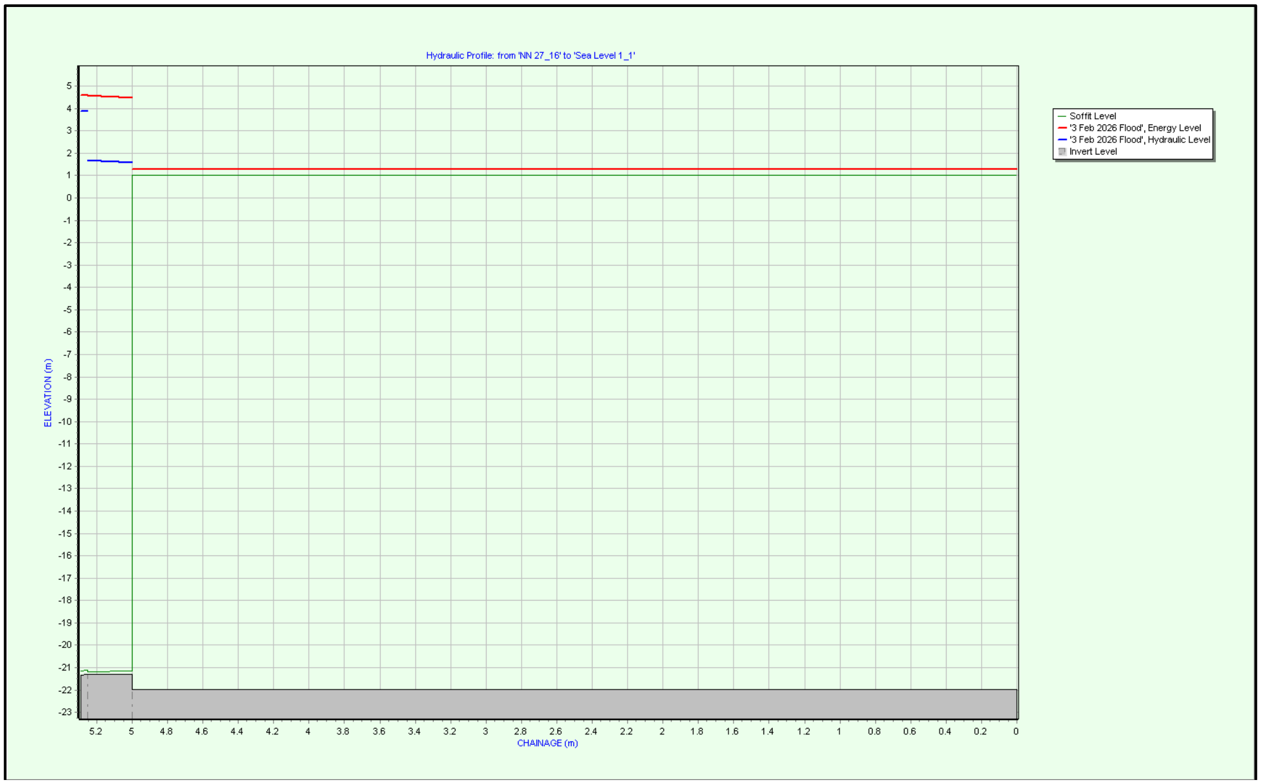
ID / TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'						
Water Column 1_25						
Rect. conduit	0.000	0.12059	1.277	1.277	0.001	0.000
	5.000	0.12059	1.277	1.277	0.001	0.000
NN 20_25						
Null node		0.12059	1.277			
Diffuser Type_15						
Circular conduit	0.000	0.12059	4.352	1.557	7.404	2.795
	0.250	0.12059	4.457	1.661	7.404	2.795
NN 26_25						
Null node		0.12059	4.457			
Diffuser Type_12						
Circular conduit	0.000	0.12059	4.457	3.763	3.689	0.694
	0.040	0.12059	4.616	3.766	3.689	0.694
NN 27_26						
Null node		0.12059	4.616			
Riser 4						
Circular conduit	0.000	0.12059	4.628	4.618	0.449	0.010
	0.000	0.12059	4.989	4.619	0.449	0.010



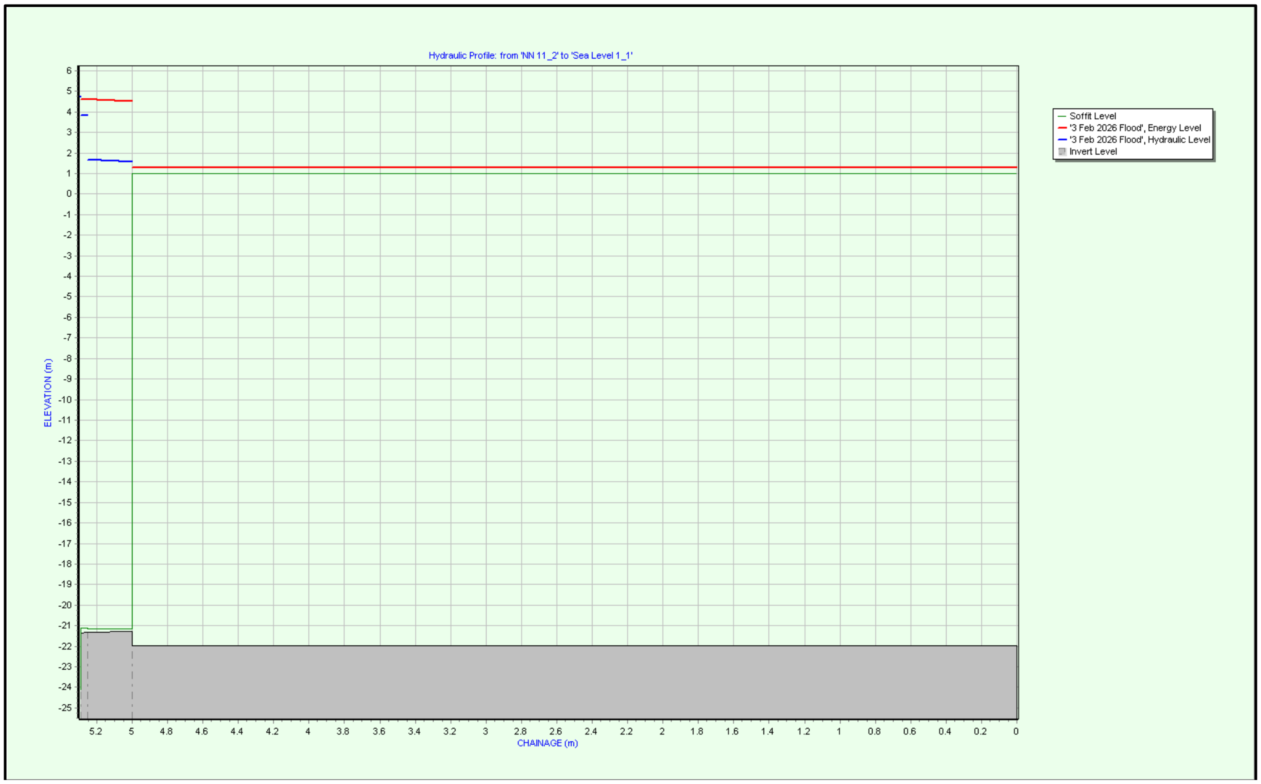
ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'							
Water Column 2_16							
	Rect. conduit	0.000	0.14052	1.277	1.277	0.001	0.000
		5.000	0.14052	1.277	1.277	0.001	0.000
NN 21_16							
	Null node		0.14052	1.277			
Diffuser Type 2a_3							
	Circular conduit	0.000	0.14052	4.469	1.567	7.544	2.902
		0.250	0.14052	4.569	1.667	7.544	2.902
NN 30_16							
	Null node		0.14052	4.569			
Diffuser Type 2b_3							
	Circular conduit	0.000	0.14052	4.569	3.791	3.907	0.778
		0.040	0.14052	4.689	3.794	3.907	0.778
NN 27_16							
	Null node		0.26337	4.689			
Riser 14							
	Circular conduit	0.000	0.26337	4.747	4.698	0.980	0.049
		0.000	0.26337	4.842	4.702	0.980	0.049



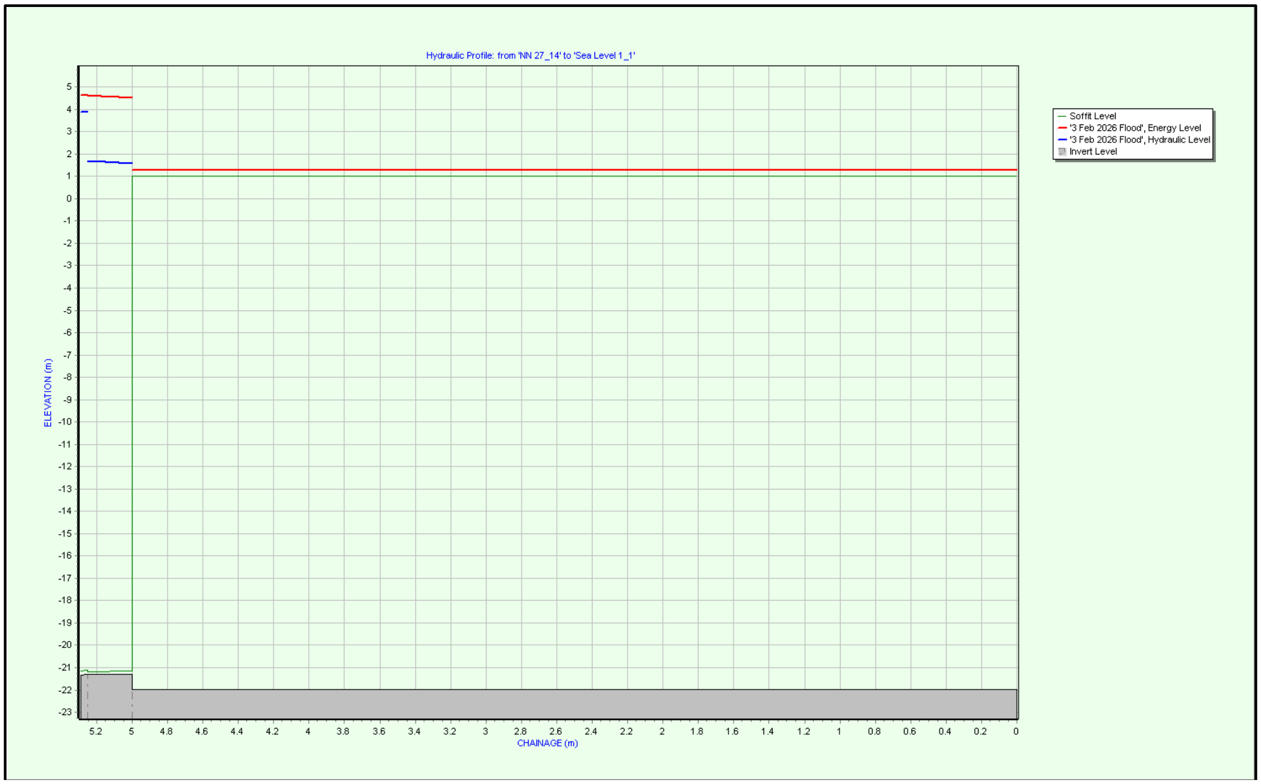
ID / TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'						
Water Column 1_16						
Rect. conduit	0.000	0.12286	1.277	1.277	0.001	0.000
	5.000	0.12286	1.277	1.277	0.001	0.000
NN 20_16						
Null node		0.12286	1.277			
Diffuser Type 1a_3						
Circular conduit	0.000	0.12286	4.469	1.567	7.544	2.902
	0.250	0.12286	4.578	1.676	7.544	2.902
NN 26_16						
Null node		0.12286	4.578			
Diffuser Type 1b_3						
Circular conduit	0.000	0.12286	4.578	3.857	3.759	0.720
	0.040	0.12286	4.689	3.860	3.759	0.720



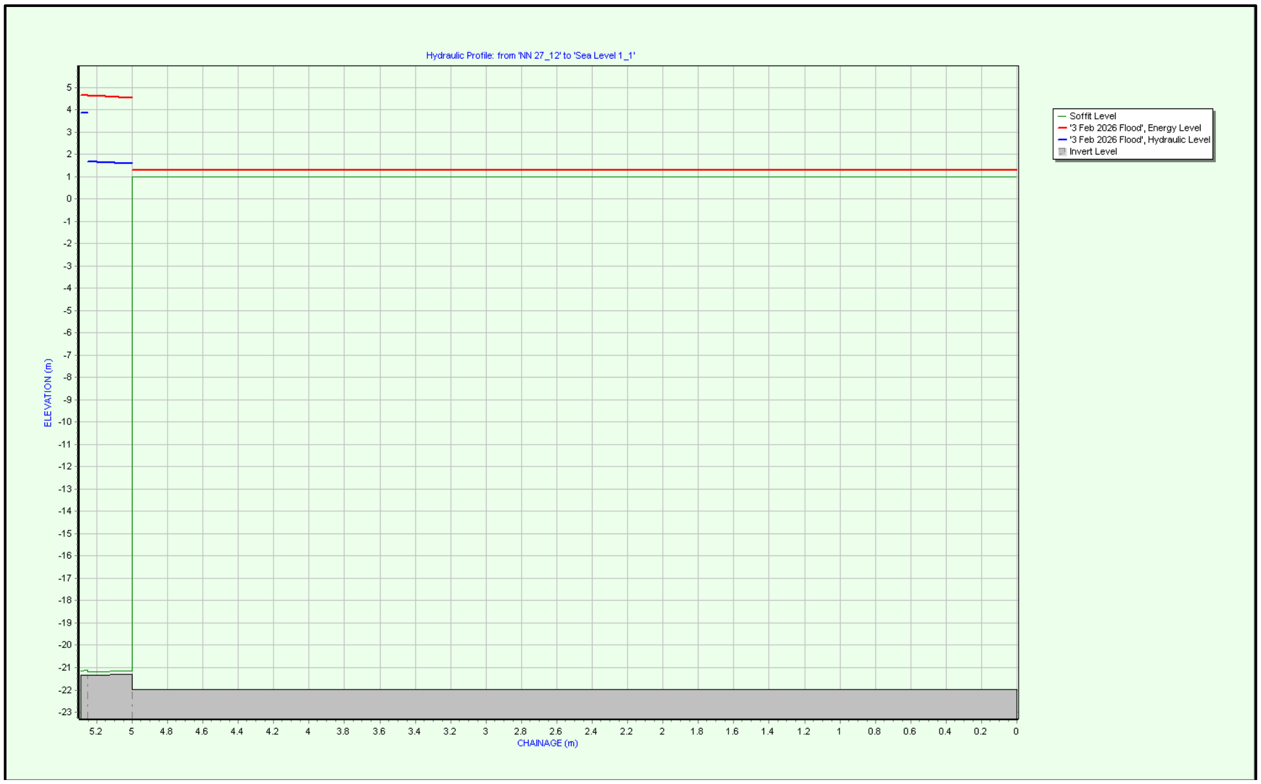
ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'						
Water Column 2_14						
Rect. conduit	0.000	0.14142	1.277	1.277	0.001	0.000
	5.000	0.14142	1.277	1.277	0.001	0.000
NN 21_14						
Null node		0.14142	1.277			
Diffuser Type 2a_2						
Circular conduit	0.000	0.14142	4.510	1.571	7.592	2.939
	0.250	0.14142	4.611	1.672	7.592	2.939
NN 30_14						
Null node		0.14142	4.611			
Diffuser Type 2b_2						
Circular conduit	0.000	0.14142	4.611	3.823	3.932	0.788
	0.040	0.14142	4.733	3.826	3.932	0.788
NN 27_14						
Null node		0.26507	4.733			
Riser 16						
Circular conduit	0.000	0.26507	4.792	4.743	0.986	0.050
	0.000	0.26507	4.842	4.747	0.986	0.050



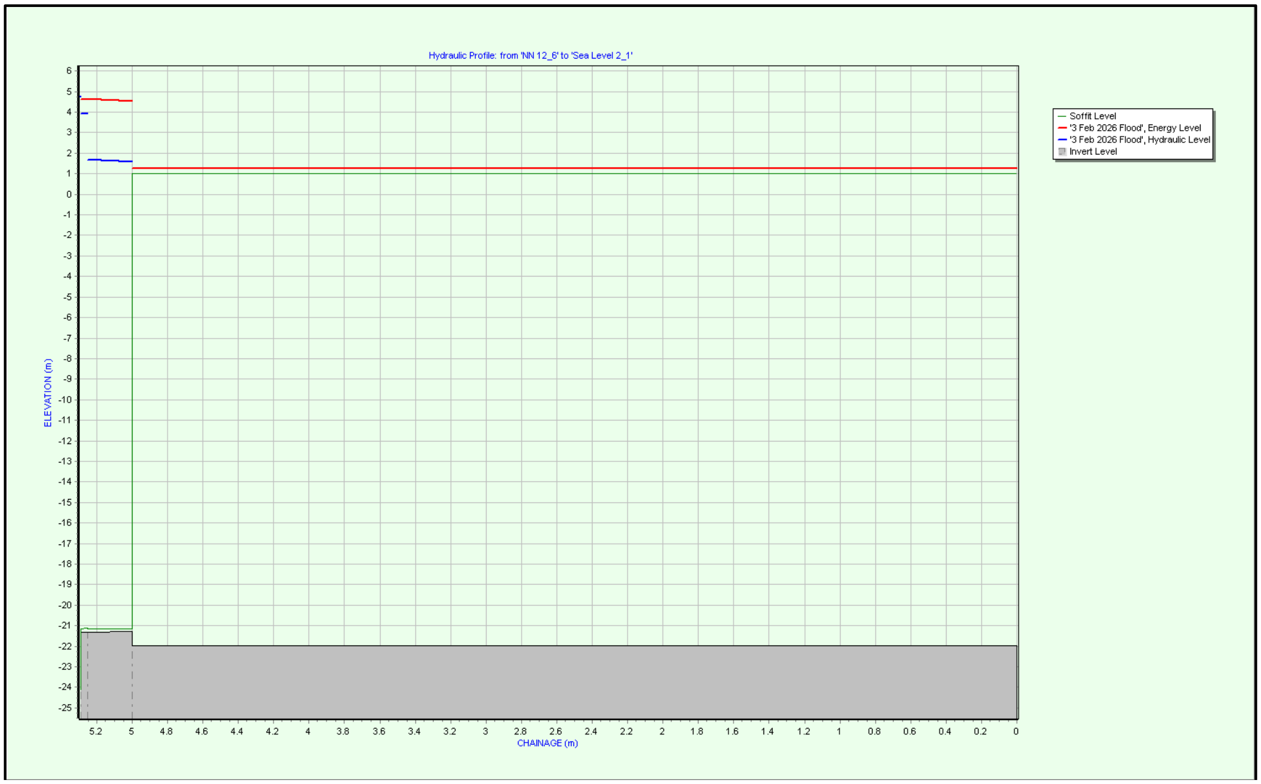
ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'							
Water Column 1_14							
	Rect. conduit	0.000	0.12365	1.277	1.277	0.001	0.000
		5.000	0.12365	1.277	1.277	0.001	0.000
NN 20_14							
	Null node		0.12365	1.277			
Diffuser Type 1a_2							
	Circular conduit	0.000	0.12365	4.510	1.571	7.592	2.939
		0.250	0.12365	4.620	1.681	7.592	2.939
NN 26_14							
	Null node		0.12365	4.620			
Diffuser Type 1b_2							
	Circular conduit	0.000	0.12365	4.620	3.891	3.783	0.730
		0.040	0.12365	4.733	3.894	3.783	0.730



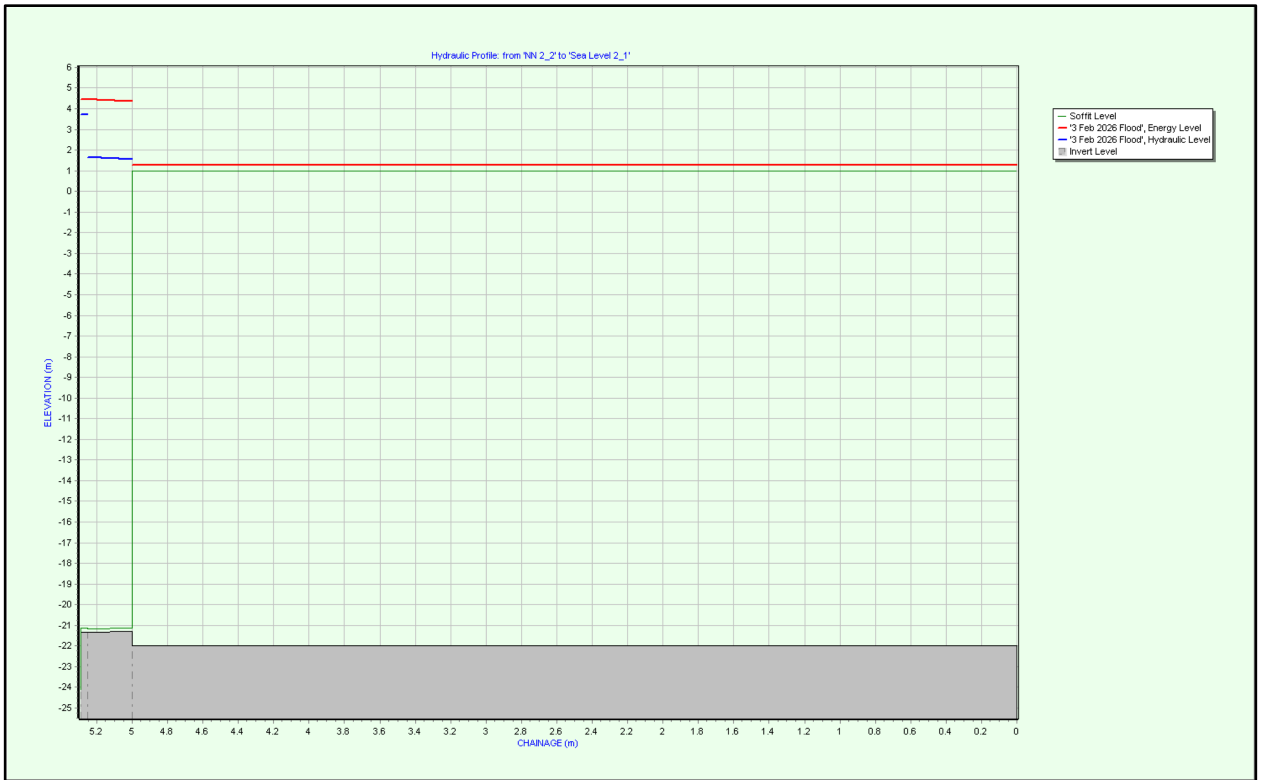
ID / TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'						
Water Column 2_12						
Rect. conduit	0.000	0.14182	1.277	1.277	0.001	0.000
	5.000	0.14182	1.277	1.277	0.001	0.000
NN 21_12						
Null node		0.14182	1.277			
Diffuser Type 2a_1						
Circular conduit	0.000	0.14182	4.529	1.573	7.614	2.956
	0.250	0.14182	4.630	1.674	7.614	2.956
NN 30_12						
Null node		0.14182	4.630			
Diffuser Type 2b_1						
Circular conduit	0.000	0.14182	4.630	3.838	3.943	0.793
	0.040	0.14182	4.752	3.841	3.943	0.793



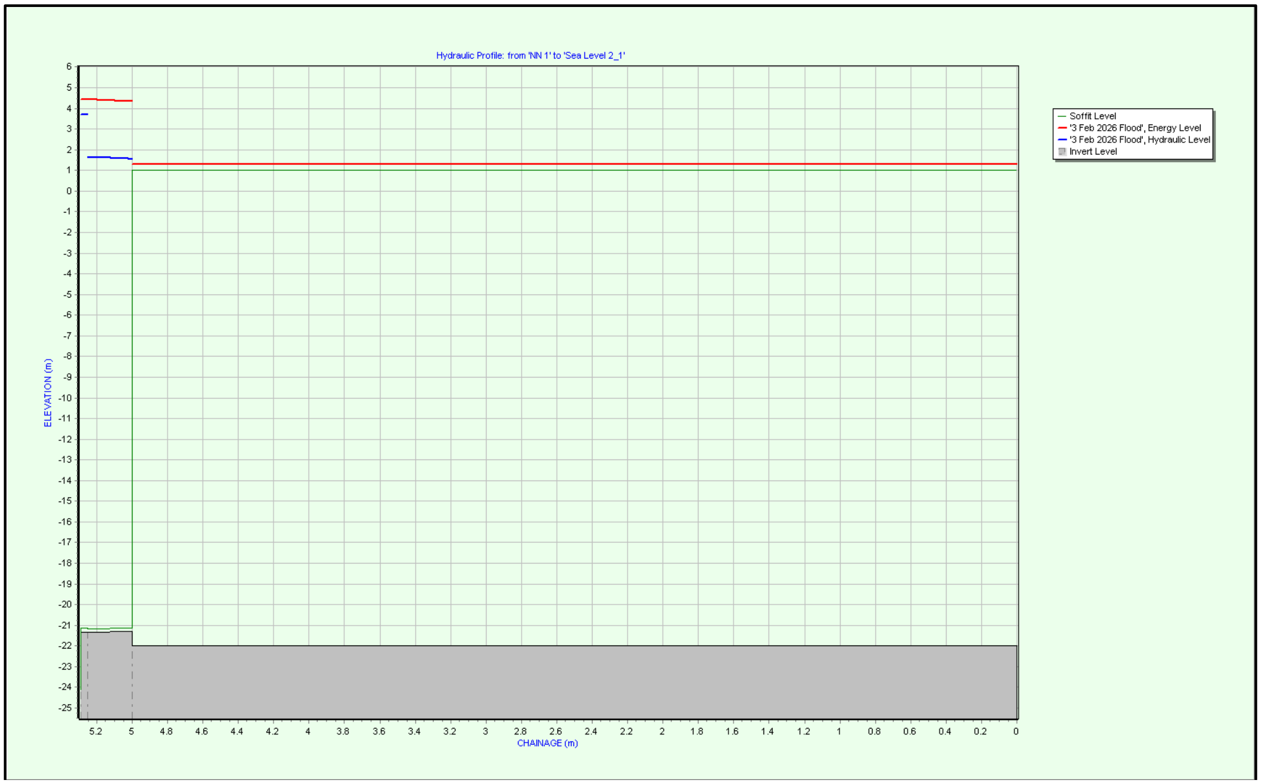
ID / TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'						
Sea Level 2_1						
Depth control		1.74082	1.277			
Water Column 1_13						
Rect. conduit	0.000	0.12389	1.277	1.277	0.001	0.000
	5.000	0.12389	1.277	1.277	0.001	0.000
NN 20_13						
Null node		0.12389	1.277			
Diffuser Type 1a_7						
Circular conduit	0.000	0.12389	4.523	1.572	7.607	2.951
	0.250	0.12389	4.634	1.683	7.607	2.951
NN 26_13						
Null node		0.12389	4.634			
Diffuser Type 1b_7						
Circular conduit	0.000	0.12389	4.634	3.901	3.791	0.733
	0.040	0.12389	4.746	3.904	3.791	0.733
NN 27_13						
Null node		0.26559	4.746			
Riser 17						
Circular conduit	0.000	0.26559	4.806	4.756	0.988	0.050
	0.000	0.26559	4.842	4.760	0.988	0.050



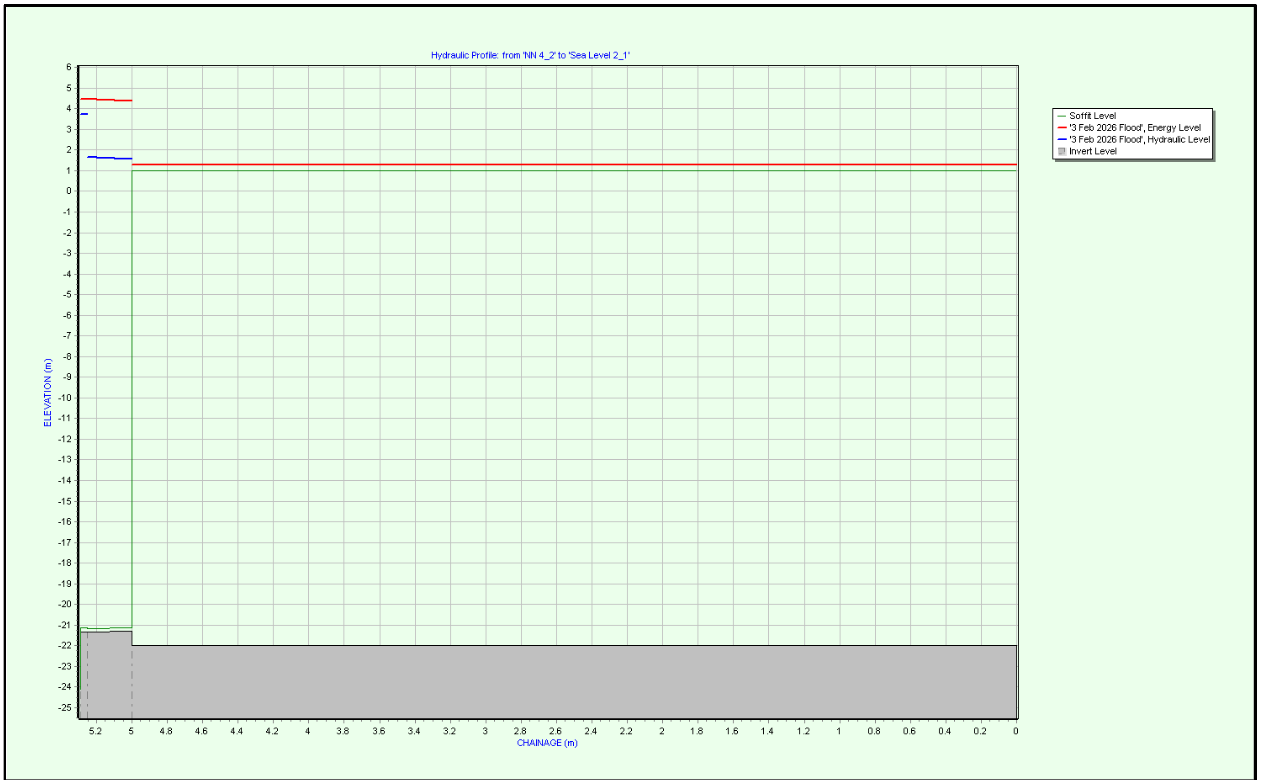
ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'						
Water Column 2_23						
Rect. conduit	0.000	0.13798	1.277	1.277	0.001	0.000
	5.000	0.13798	1.277	1.277	0.001	0.000
NN 21_23						
Null node		0.13798	1.277			
Diffuser Type 2a_12						
Circular conduit	0.000	0.13798	4.355	1.557	7.408	2.798
	0.250	0.13798	4.451	1.653	7.408	2.798
NN 30_23						
Null node		0.13798	4.451			
Diffuser Type 2b_12						
Circular conduit	0.000	0.13798	4.451	3.701	3.836	0.750
	0.040	0.13798	4.623	3.704	3.836	0.750
NN 27_23						
Null node		0.13798	4.623			
Riser 7						
Circular conduit	0.000	0.13798	4.639	4.626	0.513	0.013
	0.000	0.13798	4.916	4.627	0.513	0.013



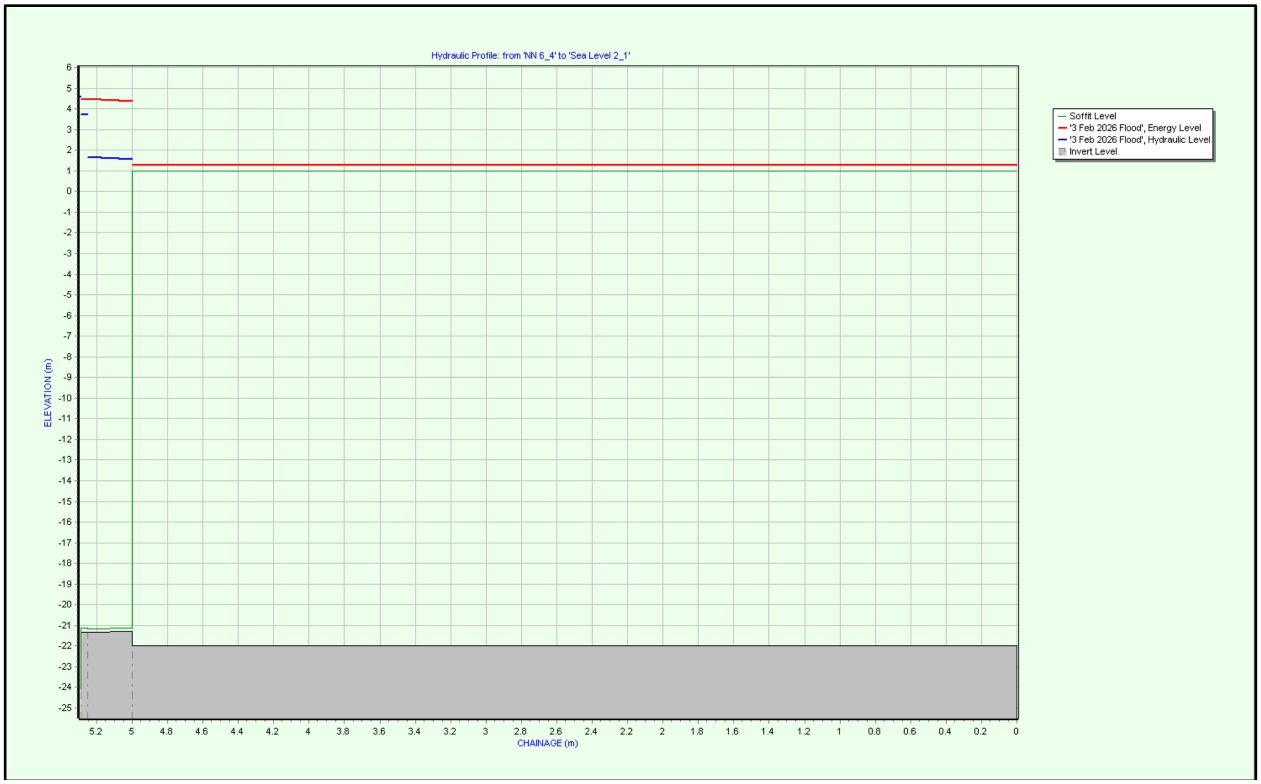
ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'							
Water Column 2_26							
	Rect. conduit	0.000	0.13762	1.277	1.277	0.001	0.000
		5.000	0.13762	1.277	1.277	0.001	0.000
NN 21_26							
	Null node		0.13762	1.277			
Diffuser Type_21							
	Circular conduit	0.000	0.13762	4.339	1.555	7.388	2.783
		0.250	0.13762	4.435	1.651	7.388	2.783
NN 30_26							
	Null node		0.13762	4.435			
Diffuser Type_20							
	Circular conduit	0.000	0.13762	4.435	3.688	3.826	0.746
		0.040	0.13762	4.605	3.691	3.826	0.746
NN 27_29							
	Null node		0.13762	4.605			
Riser 1							
	Circular conduit	0.000	0.13762	4.621	4.608	0.512	0.013
		0.000	0.13762	5.086	4.609	0.512	0.013



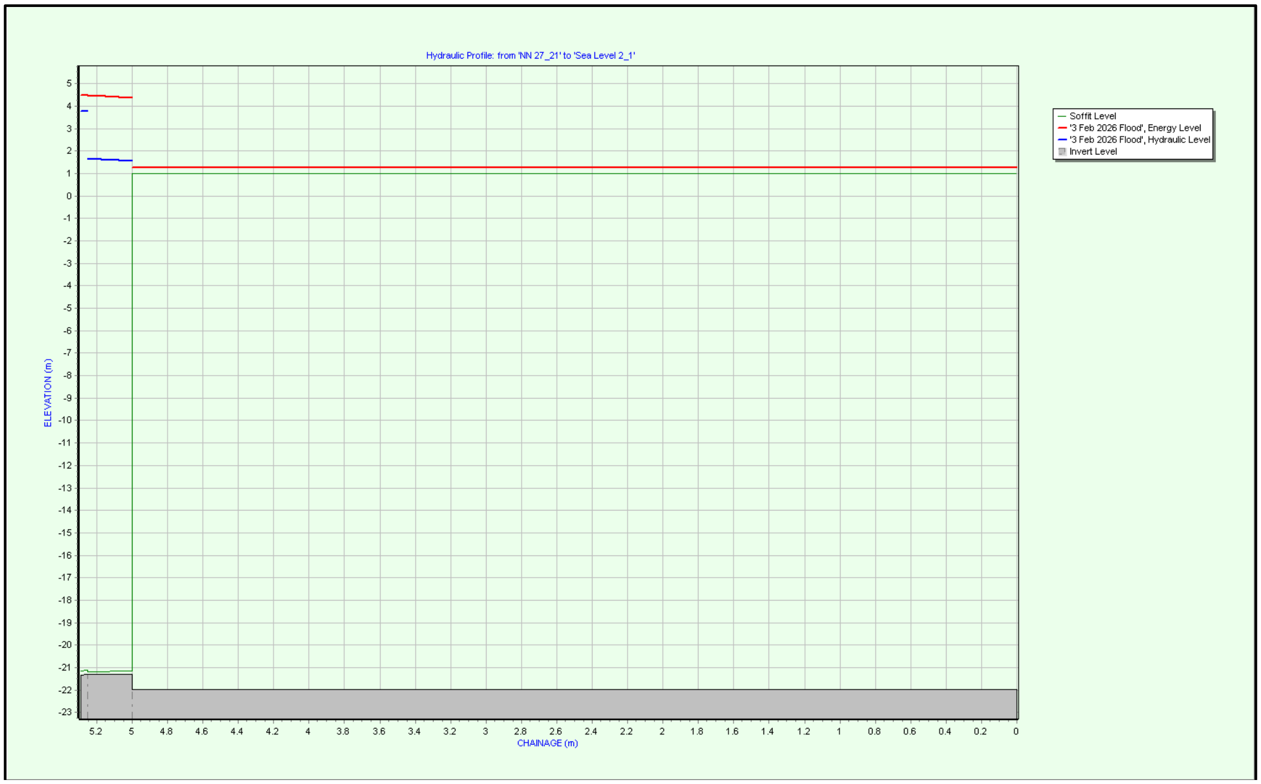
ID / TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'						
Water Column 2_22						
Rect. conduit	0.000	0.13826	1.277	1.277	0.001	0.000
	5.000	0.13826	1.277	1.277	0.001	0.000
NN 21_22						
Null node		0.13826	1.277			
Diffuser Type 2a_11						
Circular conduit	0.000	0.13826	4.367	1.558	7.423	2.809
	0.250	0.13826	4.464	1.655	7.423	2.809
NN 30_22						
Null node		0.13826	4.464			
Diffuser Type 2b_11						
Circular conduit	0.000	0.13826	4.464	3.711	3.844	0.753
	0.040	0.13826	4.637	3.714	3.844	0.753
NN 27_22						
Null node		0.13826	4.637			
Riser 9						
Circular conduit	0.000	0.13826	4.653	4.639	0.514	0.013
	0.000	0.13826	4.878	4.640	0.514	0.013



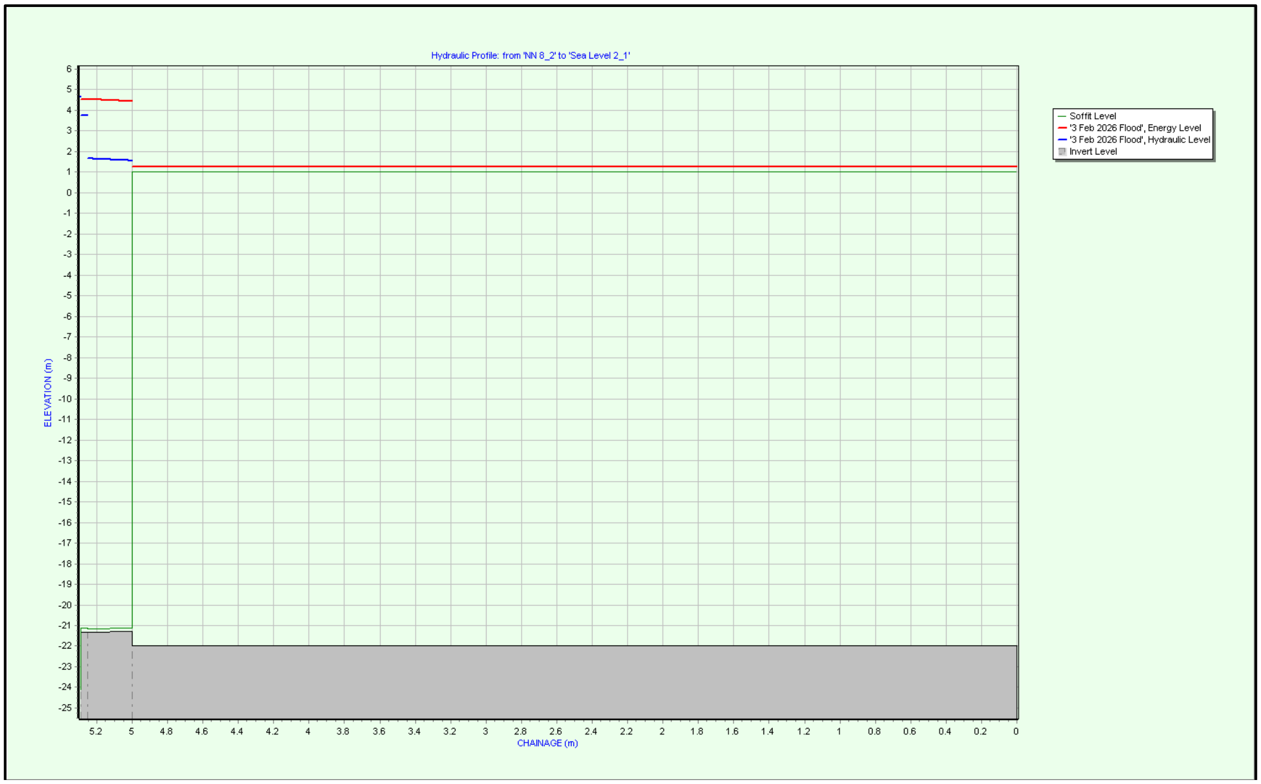
ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'						
Water Column 2_21						
Rect. conduit	0.000	0.13840	1.277	1.277	0.001	0.000
	5.000	0.13840	1.277	1.277	0.001	0.000
NN 21_21						
Null node		0.13840	1.277			
Diffuser Type 2a_10						
Circular conduit	0.000	0.13840	4.374	1.559	7.430	2.815
	0.250	0.13840	4.471	1.656	7.430	2.815
NN 30_21						
Null node		0.13840	4.471			
Diffuser Type 2b_10						
Circular conduit	0.000	0.13840	4.471	3.716	3.848	0.755
	0.040	0.13840	4.587	3.719	3.848	0.755
NN 27_21						
Null node		0.25941	4.587			
Riser 11						
Circular conduit	0.000	0.25941	4.644	4.596	0.965	0.047
	0.000	0.25941	4.851	4.600	0.965	0.047



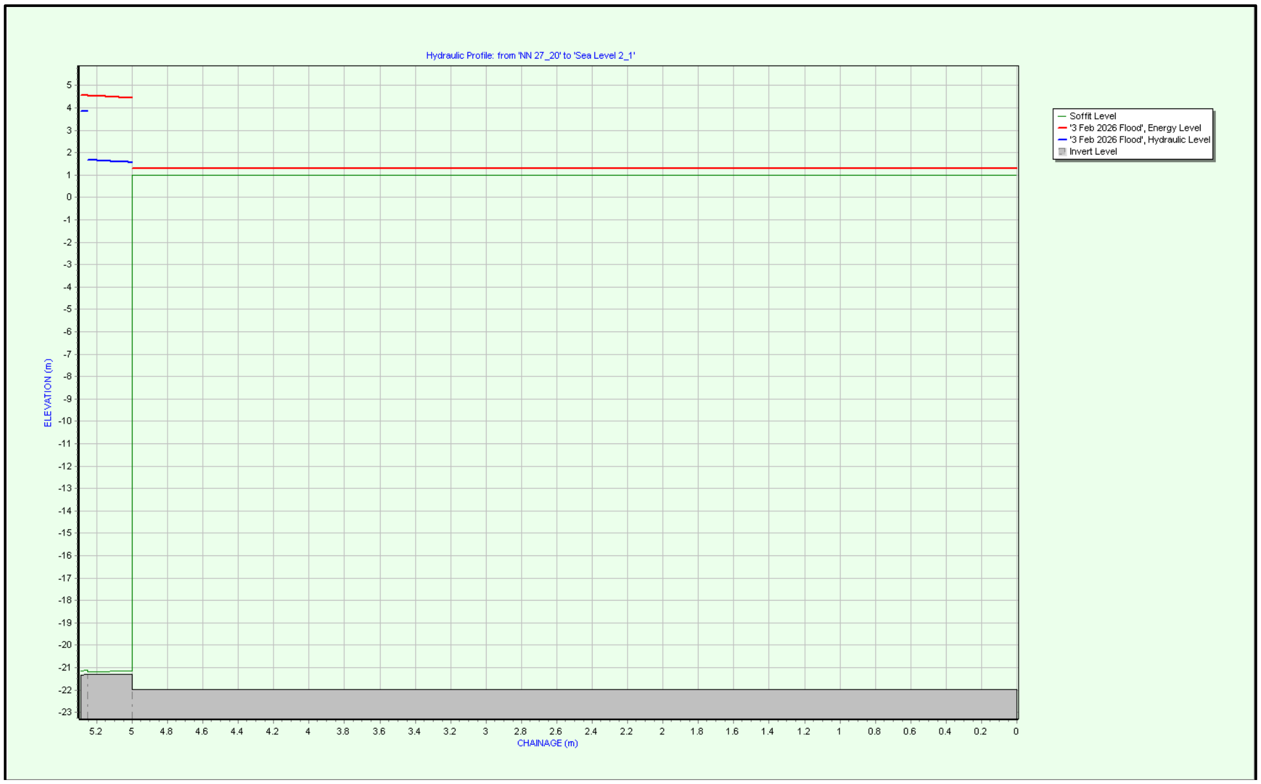
ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'						
Water Column 1_21						
Rect. conduit	0.000	0.12101	1.277	1.277	0.001	0.000
	5.000	0.12101	1.277	1.277	0.001	0.000
NN 20_21						
Null node		0.12101	1.277			
Diffuser Type 1a_10						
Circular conduit	0.000	0.12101	4.374	1.559	7.430	2.815
	0.250	0.12101	4.479	1.664	7.430	2.815
NN 26_21						
Null node		0.12101	4.479			
Diffuser Type 1b_10						
Circular conduit	0.000	0.12101	4.479	3.780	3.702	0.699
	0.040	0.12101	4.587	3.783	3.702	0.699



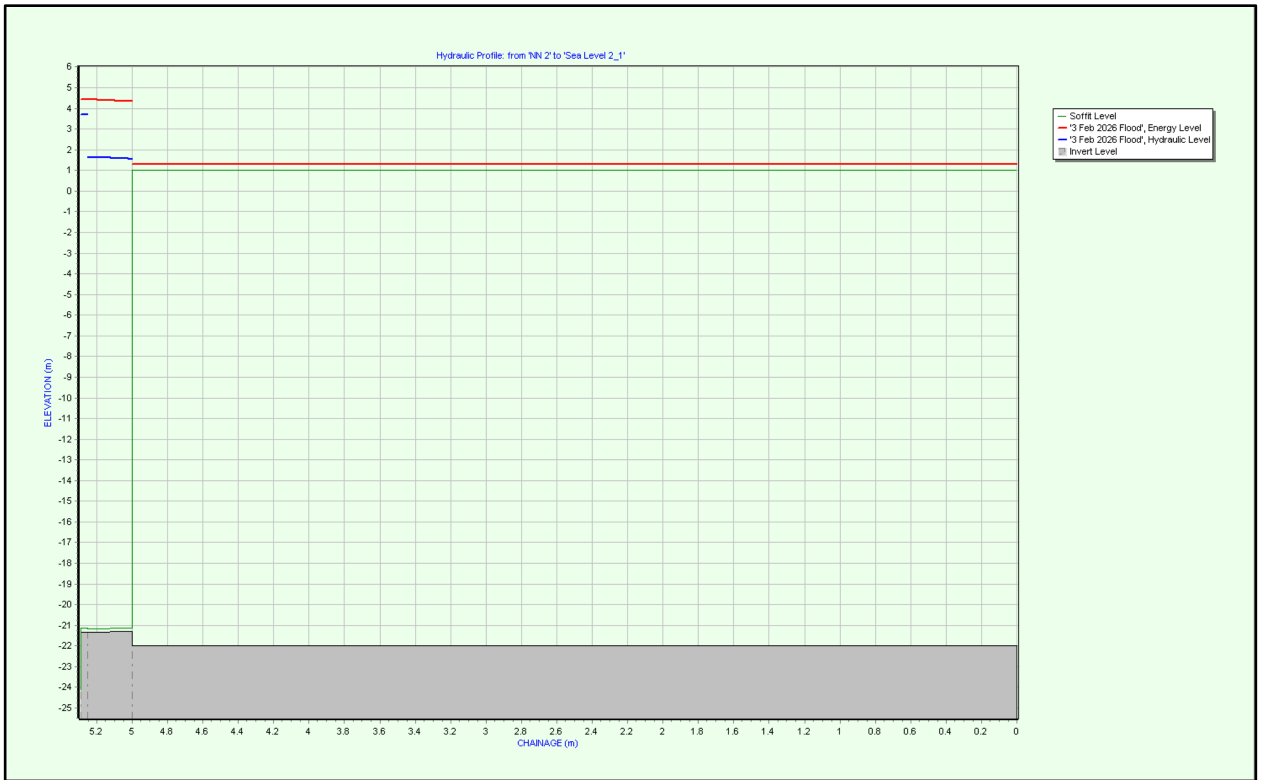
ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'							
Water Column 2_20							
	Rect. conduit	0.000	0.13995	1.277	1.277	0.001	0.000
		5.000	0.13995	1.277	1.277	0.001	0.000
NN 21_20							
	Null node		0.13995	1.277			
Diffuser Type 2a_9							
	Circular conduit	0.000	0.13995	4.443	1.565	7.513	2.878
		0.250	0.13995	4.542	1.664	7.513	2.878
NN 30_20							
	Null node		0.13995	4.542			
Diffuser Type 2b_9							
	Circular conduit	0.000	0.13995	4.542	3.770	3.891	0.772
		0.040	0.13995	4.661	3.773	3.891	0.772
NN 27_20							
	Null node		0.26231	4.661			
Riser 13							
	Circular conduit	0.000	0.26231	4.719	4.671	0.976	0.049
		0.000	0.26231	4.844	4.675	0.976	0.049



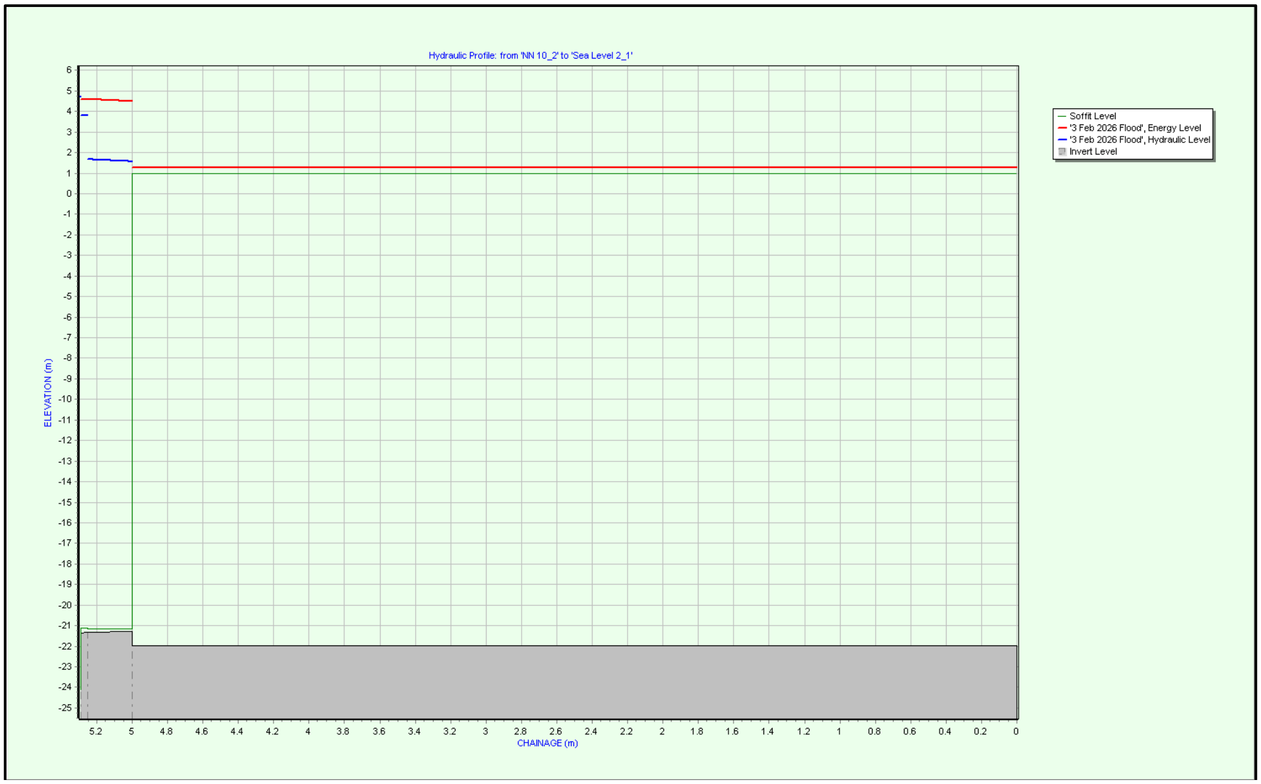
ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'						
Water Column 1_20						
Rect. conduit	0.000	0.12236	1.277	1.277	0.001	0.000
	5.000	0.12236	1.277	1.277	0.001	0.000
NN 20_20						
Null node		0.12236	1.277			
Diffuser Type 1a_9						
Circular conduit	0.000	0.12236	4.443	1.565	7.513	2.878
	0.250	0.12236	4.551	1.673	7.513	2.878
NN 26_20						
Null node		0.12236	4.551			
Diffuser Type 1b_9						
Circular conduit	0.000	0.12236	4.551	3.836	3.744	0.715
	0.040	0.12236	4.661	3.839	3.744	0.715



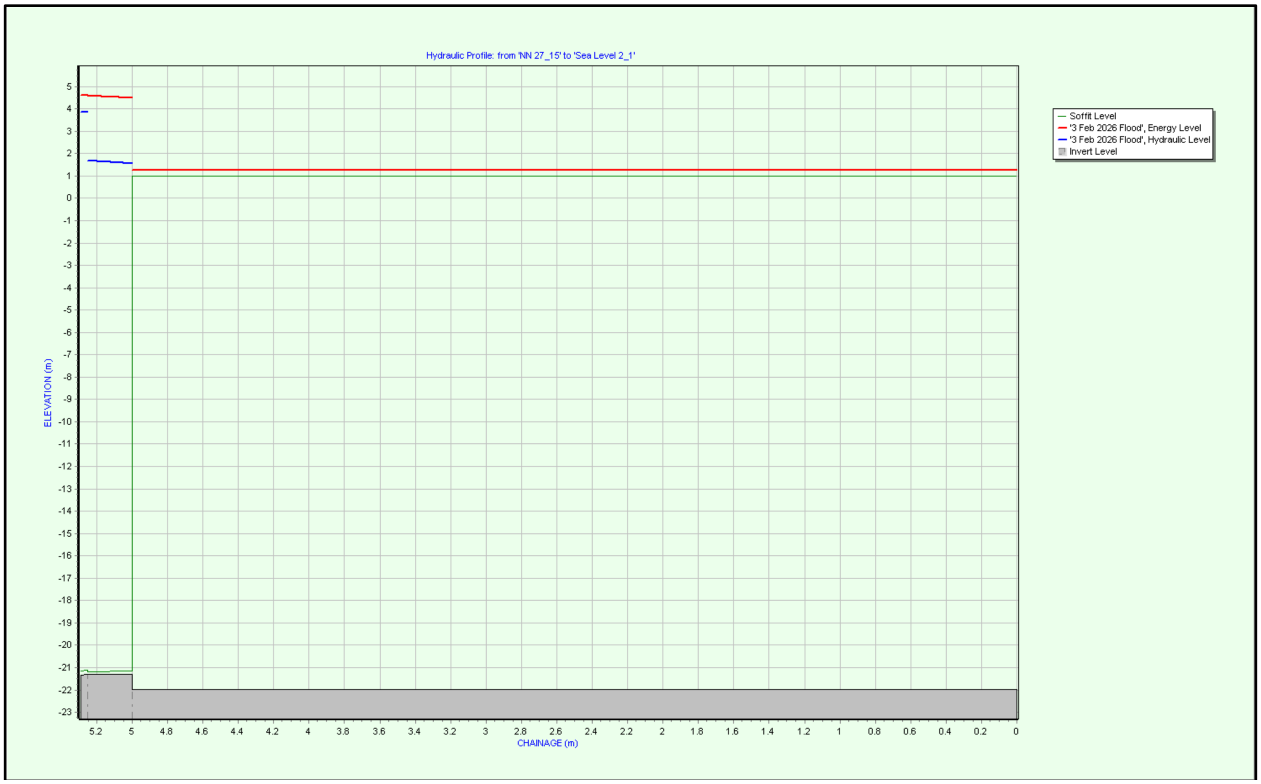
ID / TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'						
Water Column 2_25						
Rect. conduit	0.000	0.13764	1.277	1.277	0.001	0.000
	5.000	0.13764	1.277	1.277	0.001	0.000
NN 21_25						
Null node		0.13764	1.277			
Diffuser Type_17						
Circular conduit	0.000	0.13764	4.340	1.555	7.389	2.784
	0.250	0.13764	4.436	1.651	7.389	2.784
NN 30_25						
Null node		0.13764	4.436			
Diffuser Type_16						
Circular conduit	0.000	0.13764	4.436	3.689	3.827	0.747
	0.040	0.13764	4.607	3.692	3.827	0.747
NN 27_27						
Null node		0.13764	4.607			
Riser 3						
Circular conduit	0.000	0.13764	4.623	4.609	0.512	0.013
	0.000	0.13764	5.019	4.610	0.512	0.013



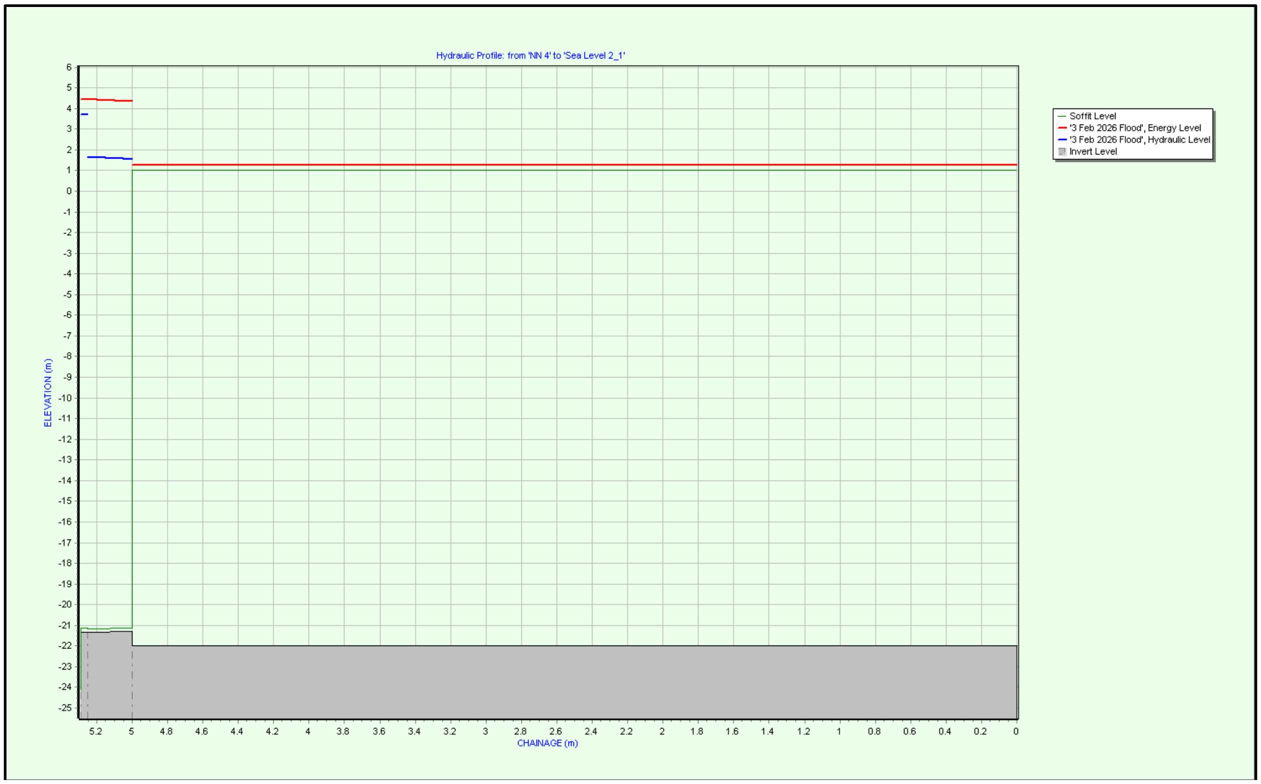
ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'							
Water Column 2_15							
	Rect. conduit	0.000	0.14098	1.277	1.277	0.001	0.000
		5.000	0.14098	1.277	1.277	0.001	0.000
NN 21_15							
	Null node		0.14098	1.277			
Diffuser Type 2a_8							
	Circular conduit	0.000	0.14098	4.490	1.569	7.569	2.921
		0.250	0.14098	4.591	1.670	7.569	2.921
NN 30_15							
	Null node		0.14098	4.591			
Diffuser Type 2b_8							
	Circular conduit	0.000	0.14098	4.591	3.808	3.920	0.783
		0.040	0.14098	4.711	3.811	3.920	0.783
NN 27_15							
	Null node		0.26425	4.711			
Riser 15							
	Circular conduit	0.000	0.26425	4.771	4.721	0.983	0.049
		0.000	0.26425	4.842	4.725	0.983	0.049



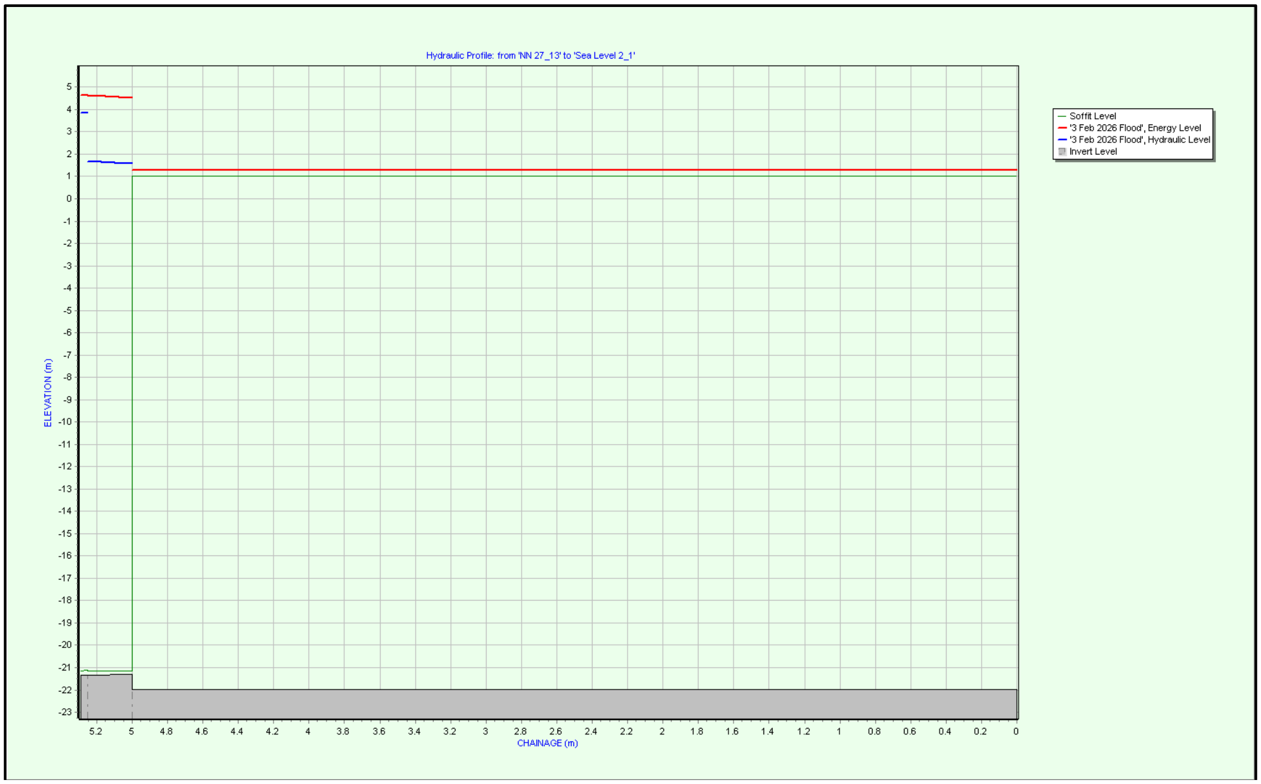
ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
<u>**SCENARIO '3 Feb 2026 Flood'**</u>						
Water Column 1_15						
Rect. conduit	0.000	0.12327	1.277	1.277	0.001	0.000
	5.000	0.12327	1.277	1.277	0.001	0.000
NN 20_15						
Null node		0.12327	1.277			
Diffuser Type 1a_8						
Circular conduit	0.000	0.12327	4.490	1.569	7.569	2.921
	0.250	0.12327	4.600	1.679	7.569	2.921
NN 26_15						
Null node		0.12327	4.600			
Diffuser Type 1b_8						
Circular conduit	0.000	0.12327	4.600	3.875	3.771	0.725
	0.040	0.12327	4.711	3.877	3.771	0.725



ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
<u>SCENARIO '3 Feb 2026 Flood'</u>						
Water Column 2_24						
Rect. conduit	0.000	0.13776	1.277	1.277	0.001	0.000
	5.000	0.13776	1.277	1.277	0.001	0.000
NN 21_24						
Null node		0.13776	1.277			
Diffuser Type_14						
Circular conduit	0.000	0.13776	4.345	1.556	7.396	2.789
	0.250	0.13776	4.441	1.652	7.396	2.789
NN 30_24						
Null node		0.13776	4.441			
Diffuser Type_13						
Circular conduit	0.000	0.13776	4.441	3.693	3.830	0.748
	0.040	0.13776	4.612	3.696	3.830	0.748
NN 27_25						
Null node		0.13776	4.612			
Riser 5						
Circular conduit	0.000	0.13776	4.628	4.615	0.513	0.013
	0.000	0.13776	4.962	4.616	0.513	0.013



ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO '3 Feb 2026 Flood'							
Water Column 2_13							
	Rect. conduit	0.000	0.14170	1.277	1.277	0.001	0.000
		5.000	0.14170	1.277	1.277	0.001	0.000
NN 21_13							
	Null node		0.14170	1.277			
Diffuser Type 2a_7							
	Circular conduit	0.000	0.14170	4.523	1.572	7.607	2.951
		0.250	0.14170	4.625	1.674	7.607	2.951
NN 30_13							
	Null node		0.14170	4.625			
Diffuser Type 2b_7							
	Circular conduit	0.000	0.14170	4.625	3.833	3.940	0.791
		0.040	0.14170	4.746	3.836	3.940	0.791


Hydraulic Profile: from 'NN 27_13' to 'Sea Level 2_1'
ELEVATION (m)
CHAINAGE (m)
Soffit Level
'3 Feb 2026 Flood', Energy Level
'3 Feb 2026 Flood', Hydraulic Level
Invert Level

Stantec

Hades
Hydraulic Analysis and Design System

Hades Version: 5.0 Release: 3 Build: 0 Database version: 155
Licensed to: Stantec only, full version with key protection

QA File Name: \\nz4113-ppfss01\shared_projects\310104737\2_Technical\calcs_design\Hades Modelling\310104197_Moa_Pt_HADES_Bypass_Scenarios_For_Review.docx
Model File Name: \\nz4113-ppfss01\shared_projects\310104737\2_Technical\calcs_design\Hades Modelling\310104737_Moa_Pt_HADES_Bypass.hmdl
Date/Time of Run: 25-Feb-2026 13:44

Originator:	Print: ..[redacted]....	Date:....27/02/2026 ......
Checked by:	Print: .[redacted]....	Date:....27/02/2026 ......
Reviewed by:	Print: ..[redacted]....	Date:....27/02/2026 ......

Project: Moa Point WWTP Hydraulic Modelling
Project No.: 310104737
Prepared by [redacted]
Date: February 2026

Purpose: Assess the performance of the Moa Pt WWTP treatment Bypass and effluent pipeline system under different flow scenarios to better understand tthe operating conditions in the pipeline during the 3 February WWTP Flooding and assess the capacity of the bypass system in wet weather for the recovery phase.

Process Description:
From the Inlet pump station (IPS), the wastewater is pumped up the hill to the inlet works via two parallel rising mains. The inlet works consists of four inlet screens and four 180 degree vortex grit traps. At the front of the inlet works flow is split into two streams and then split again into two more channels, each with a step screen. Each pair of step screen channels recombine and split into two channels again each with a grit trap (four grit traps total). Flows leaving the grit trap (GT) channels recombine into a distribution channel from which wastewater flows to three primary settlement tanks (PSTs) and/or can bypass the treatment stream via the bypass connection to the common effluent pipe. This occurs via twin 1200 wide actuated weir penstocks that connect to a common bypass outlet box before entering a 965 OD CLS bypass pipe that connects to the 1420 OD common effluent pipeline. This common 1420 OD effluent pipeline receives flow from the UV outlet channel at it's upstream end. The effluent pipeline goes through a series of diameter reductions and steep inclines and bends to get to the bottom of the Moa Pt hill before connecting to the ocean outfall pipeline in Moa Pt Road and runs approximately 1.8 km out to sea to discharge to the Cook Strait via the outfall diffuser. The Outfall diffuser consists of 26 nozzle ports which branch off 600 mm diameter vertical risers from the outfall pipe.

Under normal operation for inflows within the full treatment capacity of the WWTP: Flows from the primary settlement tanks recombine and split again into three moving bed bioreactors (MBBRs). From the MBBR flows are recombined and split again into three solids contact tanks, where return activated sludge (RAS) flows also enter from three reaeration tanks. RAS flow enter the reaeration tanks from a RAS inlet channel running parallel to the MBBR outlet channel. A portion of the flow goes straight to the solids contact tank from the PSTs' outlet channel through a parallel pipeline bypassing the MBBRs and controlled by an actuated control valve. Flows leaving the solids contact tanks (SCTs) are split between three clarifiers and then recombined at a chamber downstream before being conveyed to the UV disinfection. The flows are split into two channels for UV disinfection and then recombined before going over the UV exit weir and to the system's outfall pipe.

Wellington Water Brief for the modelling is as follows:

"1.   The initial focus should be on the bypass after the inlet screens to where it joins downstream of the UV to determine if there are any constraints on the possible flow there. We are looking to mobilise the outfall without operating the primary and secondary

treatment (which will be pumped down to avoid going septic) however there are concerns that the bypass pathway may be only able to take 1500L/s. We are looking to be able to advise on this with urgency.

2 From there another scenario is if there are any flow constrictions when flows are going down both the bypass and UV routes during the UV on-going construction works with the limited flows through UV (I believe there may be 1500L/s going to UV but the UV project team should be able to inform on that).

3 Adding the outfall pipe into the modelling to determine if that creates any further constraints. I have attached a 2012 report, I did on this using some basis hydraulics, before Cardno. I can also send through outfall drawings."

Run scenarios based on Influent flows at:

Recovery Flow scenarios:
- IPS pumps x 3 - 1,350 L/s inflow to bypass
- IPS Pumps x 4 - 1,800 L/s inflow to bypass
- IPS Pumps x 5 - 2,250 L/s inflow to bypass

Inflows assumed as multiples of 450 L/s (at higher flow rates understand the multiple reduces to approximately 430 L/s per pump). Assume this occurs once 6 or more pumps are operating reflecting feedback received from WWL.

We have only considered flows up to 2250 L/s, based on feedback received from WWL that the operators Veolia were not comfortable operating the IPS at 1800 L/s or higher considering the UV outlet channel water level observed via CCTV on Sunday 15 February 2026.

Scenarios to understand flooding event:
- Feb 3 Flooding event. Peak flows from SCADA plot (from WWL 5 February) estimated at 1,500 L/s from UV outlet and 1,900 L/s to bypassing (total of 3,400 L/s).
- Other historic flow scenarios can be considered (such as when the bypass was in use when 1 clarifier was offline during 2025)

For Information Only: Previous modelling scenarios through the WWTP considered are outlined below. Noting that the bypass systems beyond the Inlet works weirs was not part of the scope requested by Wellington Water.
% Peak Full Treatment Flow (PFTF) - 2,000 l/s Inflow, 1,200 l/s RAS flow
% Stage 1 Peak Wet Weather Flow (Stage 1 PWWF) - 3,000 l/s Inflow, 0 l/s RAS flow
% Stage 2 Peak Wet Weather Flow (Stage 2 PWWF) with inlet works overflow penstocks open - 4,000 l/s Inflow, 3,000 through treatment, 1000 L/s Bypass, 0 l/s RAS flow

The following model adjustments may be needed:

Inputs:
- All details from original WWTP As Bults (Dated 1998). The levels of the Outfall As Builts (dated June 1997) align with the levels for the effluent pipeline to within 200 mm (at the tie in flange). As such we have considered that the same datum applies to these two drawings sets.
- Flow splits for the 3 February 2026 event have been modelled based on the SCADA plots supplied by WWL which indicate flows up to 1,900 L/s entering the bypass pipe and flows up to 1,500 L/s were flowing through the single live UV channel.

Assumptions:
- We have included the details of the outfall to review the extent of the backwater effect from the outfall and identify potential location of the hydraulic hump on the downhill pipeline. The method that Hades uses to determine the location of the hydraulic jump considers balancing the momentum equation in a straight pipe run. The steep downhill pipeline includes horizontal bends which may also induce flow swirl and a wave break white water event in the pipeline which can't be analysed in hades.
- The outfall diffuser has been modelled based on the outcomes from the Diffuser diving inspection report May 2025 including correct locations of all nozzles, and nozle sizs based on As Builts.
- A series of DN1200x600 T junctions for each riser branch, the losses through which are calculated in accordance with the methodology outlined in Chapter 12 of DS Miller Internal Flow Systems (ref). This considers the relative flow splits between the branch flow and in line flow and the proportion area of the branch compared to the main line. Several manual iterations are completed between Hades model runs and looking up the loss coefficients until the errors reduce to an acceptable level. The k factors for each tee junction do not need to be changed for different total outfall flow rates as the flow to each riser as a fraction of total flow is the same.
- We have excluded hydraulic details of the rising mains (other than the flows arriving at the WWTP) considering the hydraulic separation between the rising mains and WWTP hydraulics.
- We have excluded the inlet works from this model. This is an acceptable simplification as we are primarily interested in the hydraulic conditions downstream of the Bypass weirs, in the effluent pipeline and in the UV channels. We have modelled the system in this way to reduce the model run times and considering the feedback from WWL to date which has been that the flooding that occurred on 3 and 4 February 2026 occurred from the UV channels. If WWL wish to model the inlet works and these flow spits more accurately, for the purposes of understanding maximum water levels in the inlet works more accurately, then this information can be added into the model as additional work. We note that maximum inlet works water levels are already detailed in the modelling report and hydraulic profile for the plant produced in October 2025 by Stantec (separate scope of work).
- UV outlet channel and common outlet fixed weir is included for the purposes of understanding potential operating levels in this channel and for comparison purposes with reported levels in the UV outlet channel observed during the recovery phase under

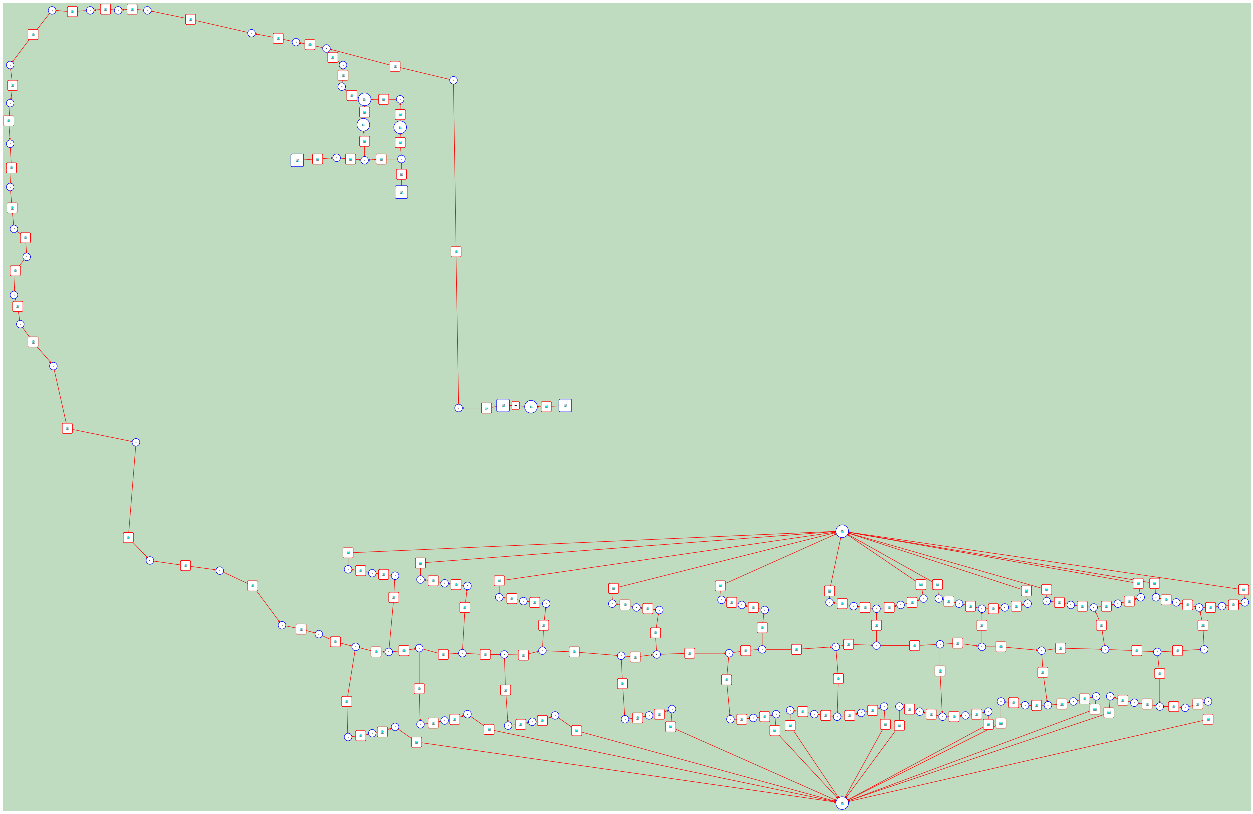
known flow conditions.

Limitations:

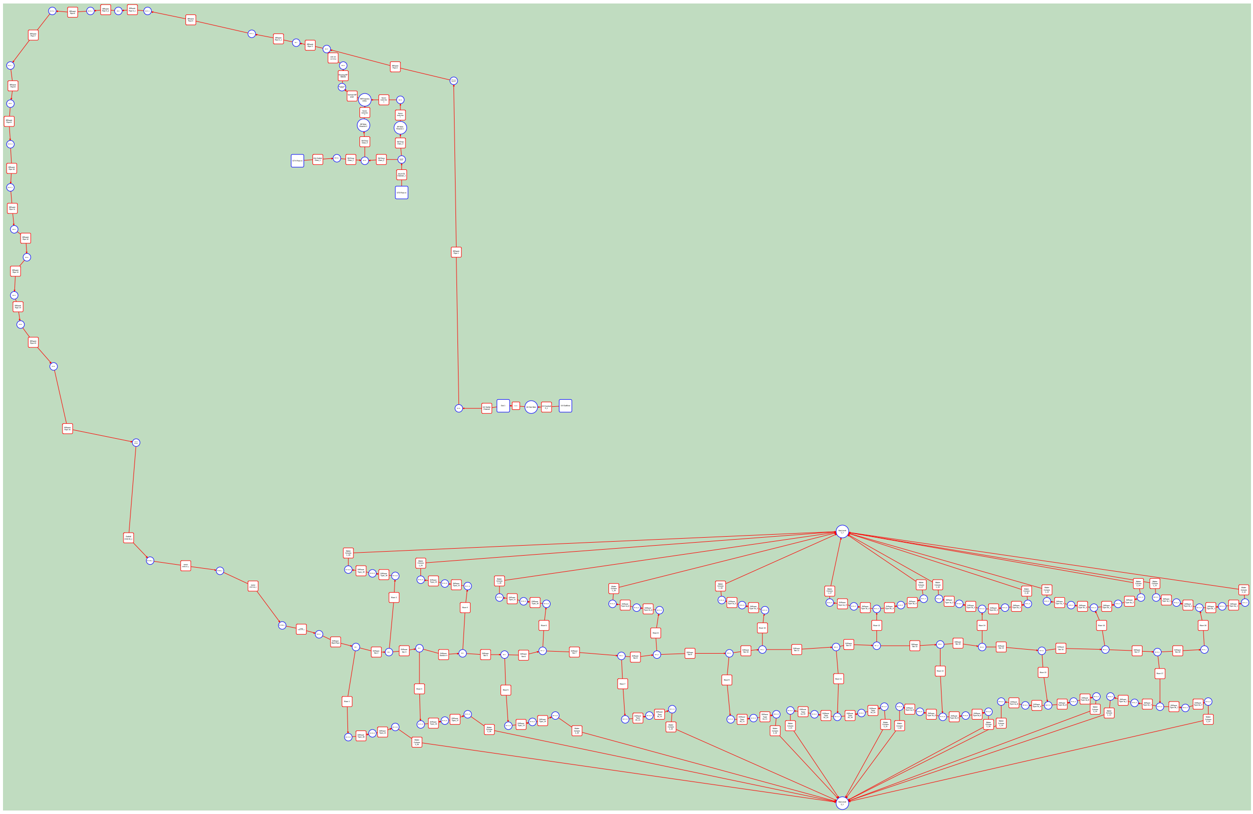
- The head losses arising from the combining 1066x1420 vertical tee where the bypass flow combines with the UV outlet flow has been modelled using the head loss graphs for sharp edge tees from DS Miller (2nd Ed) Chapter 13.2. We note these head loss coefficients consider full pipe flow in pipe junctions without significant impact from upstream discontinuities (bends immediately upstream). As a consequence, Hades is not able to accurately model the dynamics of the flow at this location.

- Hades can not model the effects of air entrained flow (two-phase flow) arising from hydraulic jumps within the pipeline.

MODEL DIAGRAM SHOWING SYMBOLS



MODEL DIAGRAM SHOWING NAMES



NETWORK DATA

SI Units
Acceleration due to gravity, g = 9.806 m/s²
Atmospheric pressure head = 100/g = 10.198 m head of water
Kinematic Viscosity = 1.14E-006 m²/s
Vapour pressure of water 0.213 m head of water
Vapour pressure of water calculated at 15.000 °C
Hardy-Cross convergence tolerance = 0.0005 m
Hardy-Cross under-relaxation factor= 1.5
Hardy-Cross maximum number of iterations = 500
Zero flow threshold = 1E-005 m³/s
Zero depth threshold = 0.0005 m
Open channel flow minimum halved step length = 0.0005 m
Open channel flow factor A, drawdown smoothing = 25%
Open channel flow factor B, transition point = 25%
Output level is summary only

NAMED FLOWS

Name	See Note
Bypass FLow	(1)
UV Out (1 chan OOS)	(2)

(1):

Total flow over the Bypass Weir Penstocks

(2):

Flow out of UV when 1 channel is out of service (ttmnt bypassing modes)

Flow Scenario: Bypass (3 pumps)

Flow to WWTP during response phase. Considers 3xIPS pumps operating and full bypass.

Name	Flow (m³/s)
Bypass FLow	1.35000
UV Out (1 chan OOS)	0.00000

Flow Scenario: Bypass (4 pumps)

Flow to WWTP during response phase. Considers 4xIPS pumps operating and full bypass.

Name	Flow (m³/s)
Bypass FLow	1.80000
UV Out (1 chan OOS)	0.00000

Flow Scenario: Bypass (5 Pumps)

Flow to WWTP during response phase. Considers 5xIPS pumps operating and full bypass.

Name	Flow (m³/s)
Bypass FLow	2.25000
UV Out (1 chan OOS)	0.00000

Flow Scenario: Feb 3 2026 Flood

Flow splits assumed based on the flows recorded in the WWTP SCADA leading up to the flood event on 3 and 4 February 2026.

Name	Flow (m³/s)
Bypass FLow	1.90000
UV Out (1 chan OOS)	1.50000

NAMED FRICTION LOSS SETTINGS

Name	See Note
Concrete channel	
Diffuser Roughness	
Effluent Outfall	(1)
Outfall Roughness	

(1):

Effluent outfall roughness to consider velocities which are expected to influence roughness substantially. Operation of significnat portion of bypass system is also expected to result in roughness performance similar to slimed pipe (velocity dependent roughness).

Roughness Scenario: 'Normal' Roughness

'Normal' roughness values per HR Wallingford

	Equation	Variable Model	Fixed k_s	Manning n
Concrete channel	C-W	Fixed	1.50000	
Diffuser Roughness	C-W	Fixed	0.06000	
Effluent Outfall	C-W	Fixed	0.06000	
Outfall Roughness	C-W	Fixed	0.06000	

Roughness Scenario: 'Poor' Roughness

Higher roughness test at 0.2mm

	Equation	Variable Model	Fixed k_s	Manning n
Concrete channel	C-W	Fixed	3.30000	
Diffuser Roughness	C-W	Fixed	0.20000	
Effluent Outfall	C-W	Fixed	0.20000	
Outfall Roughness	C-W	Fixed	0.20000	

NAMED LEVELS

Name	See Note
Sea Level in Cook St	(1)

(1):

Maximum probable tide from Moa Point WWTP Rising Main and Ocean Outfall Study, 2011, BTO Ltd.

Level Scenario: Prob max high tide

Maximum high tide level from regional monitoring over Summer 2025/2026 is 1.7 m relative to Wellington Port Chart Datum.
Conversion to Wellington 1953 datum =Wellington Port Chart Datum - 0.9025 m.

1.7-0.9025 = 0.798m in Well 1953 Datum.

Corrected to HGL at diffuser elevation based on specific gravity of sea water and depth of sea water above diffuser then gives 1.277 m RL.

Name	Level (m)
Sea Level in Cook St	1.27700

RUN SCENARIOS

Run scenario	Mode	Flow scenario	Roughness scenario	Level scenario	See note
Bypass 1350	Full	Bypass (3 pumps)	'Poor' Roughness	Prob max high tide	
Bypass 1800	Full	Bypass (4 pumps)	'Poor' Roughness	Prob max high tide	

Component reference: Sea Level 1_1

Level control node

Elevation set as 'Sea Level in Cook St' = 1.277 m for all run scenarios

Conduit reference: Water Column 1_12

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 20_12

Null node

Conduit reference: **Diffuser Type 1a_1**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100 Downstream discontinuity loss K factor
1.000 Exit
0.100 Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: **NN 26_12**

Null node

Conduit reference: **Diffuser Type 1b_1**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.150

0.150 Upstream discontinuity loss K factor
0.150 Taper (fitting), normal, 03:02. Additional loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Component reference: **NN 27_12**

Null node

Conduit reference: **Riser 18**

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		0.500

1.200 Downstream discontinuity loss K factor
1.200 Junction, Tee - flow to or from branch, sharp

0.500 Upstream discontinuity loss K factor
0.500 Entry, sharp-edged

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Component reference: **NN 31_1**

Null node

Conduit reference: **Diffuser Sec 18**

Circular conduit
Length: 5.300 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.693	1.200	-23.493	1.200		0.000
US	-24.668	1.200	-23.468	1.200		0.120

0.120 Upstream discontinuity loss K factor
0.120 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 11 to diffuser 12
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.6682 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.6933 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3 m

Component reference: **NN 12_6**

Null node

Conduit reference: **Diffuser Sec 17**

Circular conduit
Length: 5.300 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.668	1.200	-23.468	1.200		0.000
US	-24.643	1.200	-23.443	1.200		-0.067

-0.067 Upstream discontinuity loss K factor
-0.067 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 10 to diffuser 11
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.6431 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.6682 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3 m

Component reference: **NN 11_2**

Null node

Conduit reference: **Diffuser Sec 16**

Circular conduit
Length: 5.300 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.643	1.200	-23.443	1.200		0.000
US	-24.618	1.200	-23.418	1.200		-0.062

-0.062 Upstream discontinuity loss K factor
-0.062 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 9 to diffuser 10
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.618 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.6431 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3 m

Component reference: **NN 10_2**

Null node

Conduit reference: **Diffuser Sec 15**

Circular conduit
Length: 5.300 m

Friction Loss: 'Outfall Roughness'

	Invert	Height	Soffit	Width	Side Slope	Discont.
	m	m	m	m	x/y	loss K
DS	-24.618	1.200	-23.418	1.200		0.000
US	-24.593	1.200	-23.393	1.200		-0.054

-0.054 Upstream discontinuity loss K factor
-0.054 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 8 to diffuser 9
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.5929 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.618 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3 m

Component reference: **NN 9_2**

Null node

Conduit reference: **Diffuser Sec 14**

Circular conduit
Length: 5.300 m

Friction Loss: 'Outfall Roughness'

	Invert	Height	Soffit	Width	Side Slope	Discont.
	m	m	m	m	x/y	loss K
DS	-24.593	1.200	-23.393	1.200		0.000
US	-24.568	1.200	-23.368	1.200		-0.043

-0.043 Upstream discontinuity loss K factor
-0.043 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 7 to diffuser 8
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.5678 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.5929 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3 m

Component reference: **NN 8_2**

Null node

Conduit reference: **Diffuser Sec 13**

Circular conduit
Length: 5.300 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.568	1.200	-23.368	1.200		0.000
US	-24.543	1.200	-23.343	1.200		-0.034

-0.034 Upstream discontinuity loss K factor
-0.034 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 6 to diffuser 7
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.5427 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.5678 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3 m

Component reference: **NN 7_2**

Null node

Conduit reference: **Diffuser Sec 12**

Circular conduit
Length: 5.300 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.543	1.200	-23.343	1.200		0.000
US	-24.518	1.200	-23.318	1.200		-0.026

-0.026 Upstream discontinuity loss K factor
-0.026 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 5 to diffuser 6
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.5176 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.5427 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3 m

Component reference: **NN 6_4**

Null node

Conduit reference: **Diffuser Sec 11**

Circular conduit
Length: 5.300 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.518	1.200	-23.318	1.200		0.000
US	-24.492	1.200	-23.293	1.200		0.011

0.011 Upstream discontinuity loss K factor
0.011 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 4 to diffuser 5
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.4925 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.5176 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3 m

Component reference: **NN 5_2**

Null node

Conduit reference: **Diffuser Sec 10**

Circular conduit
Length: 5.000 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.492	1.200	-23.293	1.200		0.000
US	-24.469	1.200	-23.269	1.200		0.011

0.011 Upstream discontinuity loss K factor
0.011 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 3 to diffuser 4
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.4688 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.4925 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.0 m

Component reference: **NN 4_2**

Null node

Conduit reference: **Diffuser Sec 9**

Circular conduit
Length: 5.600 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.469	1.200	-23.269	1.200		0.000
US	-24.442	1.200	-23.242	1.200		0.017

0.017 Upstream discontinuity loss K factor
0.017 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 2 to diffuser 3
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.4423 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.4688 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.6 m

Component reference: **NN 3_2**

Null node

Conduit reference: **Diffuser Sec 8**

Circular conduit
Length: 5.600 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.442	1.200	-23.242	1.200		0.000
US	-24.416	1.200	-23.216	1.200		0.017

0.017 Upstream discontinuity loss K factor
0.017 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

1265 OD outfall pipe from diffuser 1 to diffuser 2
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.4158 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.4423 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.6 m

Component reference: **NN 2_2**

Null node

Conduit reference: **Diffuser Sec 7**

Circular conduit
Length: 5.000 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.416	1.200	-23.216	1.200		0.000
US	-24.392	1.200	-23.192	1.200		0.022

0.022 Upstream discontinuity loss K factor
0.022 Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

1265 OD outfall pipe from first section of diffuser with open diffuser points to diffuser 1
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.3921 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.4158 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.0 m

Component reference: **NN 1_3**

Null node

Conduit reference: **Diffuser Sec 6**

Circular conduit
Length: 5.300 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.369	1.200	-23.169	1.200		0.000
US	-24.344	1.200	-23.144	1.200		0.022

0.022 Upstream discontinuity loss K factor
0.022 Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

1265 OD outfall pipe section of diffuser
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.344 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.369 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3

Component reference: NN 4

Null node

Conduit reference: Diffuser Sec 5

Circular conduit
Length: 5.300 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.344	1.200	-23.144	1.200		0.000
US	-24.319	1.200	-23.119	1.200		0.022

0.022 Upstream discontinuity loss K factor
0.022 Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

1265 OD outfall pipe section of diffuser
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.319 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.344 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3

Component reference: NN 3

Null node

Conduit reference: Diffuser Section 4

Circular conduit
Length: 5.300 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.319	1.200	-23.119	1.200		0.000
US	-24.294	1.200	-23.094	1.200		0.022

0.022 Upstream discontinuity loss K factor
0.022 Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

1265 OD outfall pipe section of diffuser
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.294 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.319 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3

Component reference: **NN 2**

Null node

Conduit reference: **Diffuser Sec 3**

Circular conduit
Length: 5.300 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.294	1.200	-23.094	1.200		0.000
US	-24.269	1.200	-23.069	1.200		0.022

0.022 Upstream discontinuity loss K factor
0.022 Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

1265 OD outfall pipe section of diffuser
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.269 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.294 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3

Component reference: **NN 5**

Null node

Conduit reference: **Diffuser Sec 2**

Circular conduit
Length: 5.300 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.269	1.200	-23.069	1.200		0.000
US	-24.244	1.200	-23.044	1.200		0.022

0.022 Upstream discontinuity loss K factor
0.022 Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

1265 OD outfall pipe section of diffuser
Refer Drgs 18-003, 18-006, Moa Point Hades Hydraulics Calculations. xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.244 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.269 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length from dwg 5.3

Component reference: **NN 1**

Null node

Conduit reference: **Diffuser Start Pipe**

Circular conduit
Length: 7.950 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.244	1.200	-23.044	1.200		0.000
US	-24.207	1.200	-23.007	1.200		0.000

1265 OD outfall pipe from start of diffuser pipe to first section of diffuser with open diffuser points
Refer Drgs 18-003,18-006

US invert from drg = -24.207 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.244 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length was calculated from total diffuser length minus the diffuser sections 100.05-92.10 = 7.95 m

Component reference: **NN 32_1**

Null node

Conduit reference: **Outfall CH66-1772_1**

Circular conduit
Length: 1705.990 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-24.220	1.200	-23.020	1.200		0.000
US	-3.514	1.200	-2.314	1.200		0.000

1265 OD outfall pipe from 19.7 deg vertical mitre bend to start of diffuser pipe
Refer Drgs 18-001, 18-003

US invert from drg = -3.5136 (measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -24.2196 (Calculated from gradient measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length chainage 1771.51-65.52 = 1705.99 m

Component reference: **19.7 Mitre_1**

Null node

Conduit reference: **Outfall CH57-66_1**

Circular conduit
Length: 8.050 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-3.514	1.200	-2.378	1.200		0.150
US	-0.767	1.200	0.368	1.200		0.000

0.150	Downstream discontinuity loss K factor
0.150	Mitre elbow, 2-piece, 22.5°

1265 OD outfall pipe from 20 deg vertical mitre bend to 19.7 deg vertical mitre bend (assumed to be 2-piece)
Refer Drgs 18-001

US invert from drg = -0.7673 (measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -3.5136 (measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length chainage 65.52-57.47 = 8.05 m

Component reference: **20 Mitre_1**

Null node

Conduit reference: **Outfall CH35-57_1**

Circular conduit
Length: 22.060 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-0.767	1.200	0.433	1.200		0.150
US	-0.767	1.200	0.433	1.200		0.000

0.150	Downstream discontinuity loss K factor
0.150	Mitre elbow, 2-piece, 22.5°

1265 OD outfall pipe from 22.9 deg horizontal mitre bend to 20 deg vertical mitre bend (assumed to be 2-piece)
Refer Drgs 18-001

US invert from drg = -0.7673 (measured off depth scale on long section specific inverts not called out in drg)
DS invert from drg = -0.7673 (measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length chainage 57.47-35.41 = 22.06

Component reference: **22.9 Mitre_1**

Null node

Conduit reference: **Outfall CH0-35_1**

Circular conduit
Length: 35.410 m

Friction Loss: 'Outfall Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-0.767	1.200	0.433	1.200		0.150
US	-0.626	1.200	0.574	1.200		0.005

0.150	Downstream discontinuity loss K factor
0.150	Mitre elbow, 2-piece, 22.5°

0.005	Upstream discontinuity loss K factor
0.005	Small loss applied for 1371 to 1265 OD reducer (1000mm long) at upstream end.

1265 OD outfall pipe from pigging spool reducer adjacent tie-in flange to 22.9 deg horizontal mitre bend (assumed to be 2-piece)
Refer Drgs 18-001

US invert from drg = -0.626 (From On shore tie in drg 18-004)
DS invert from drg = -0.7673 (measured off depth scale on long section specific inverts not called out in drg)

Long section indicates 12.5 mm wall thickness and 20 mm cement mortar lining which gives 1.200 m ID.

Length chainage 35.41 (tie-in flange is at chainage 0)

Component reference: **Tie In Flange**

Null node

Conduit reference: **Effluent Pipe 16**

Circular conduit
Length: 21.800 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-0.600	1.316	0.716	1.316		0.000
US	-0.100	1.316	1.216	1.316		0.000

1371 OD effluent pipe from 13 deg vert bend to tie in flange
Refer Drg 02-506

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID

DS invert for tie in flange matches level information from outfall drawing set

Length from chainage 279.66-257.85=21.8

Component reference: **NN 36**

Null node

Conduit reference: **Effluent Pipe 15**

Circular conduit
Length: 10.000 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-0.100	1.312	1.174	1.312		0.075
US	2.370	1.312	3.644	1.312		0.075

0.075	Downstream discontinuity loss K factor
0.075	Bend, close radius, 11.25°. 13 deg single mitre bend approximated as 11.25 deg close radius bend

0.075	Upstream discontinuity loss K factor
0.075	Bend, close radius, 11.25°. 13 deg single mitre bend approximated as 11.25 deg close radius bend

1371 OD effluent pipe from 13 deg vertical downward bend to 13 deg vertical upward bend
Refer Drg 02-506

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID, plus 2 mm polyurethane lining gives 1312 mm

Length from chainage 257.85-247.85 = 10

Component reference: **NN 35**

Null node

Conduit reference: **Effluent Pipe 14**

Circular conduit
Length: 5.300 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	2.370	1.164	3.534	1.164		0.352
US	2.450	1.164	3.614	1.164		0.000

0.352	Downstream discontinuity loss K factor
0.300	Valve, butterfly, fully open. Fully Open butterfly valve per valve chamber plan
0.052	DS tee for air valve (100 mm branch) using DS miller Figure 13.23 k =0.04 DS tapered enlargement, 1219x1317, 800 long, using pipe flow theory calc method (spreadsheet in folder) gives = 0.012 Total k =0.052

1219 OD CLS effluent pipe from 1371x1219 reducer to 1219x1371 enlargement
Refer Drg 02-506

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.164 m ID

Length summed from valve chamber plan dims 5.3 m

Component reference: **NN 33**

Null node

Conduit reference: Effluent Pipe 13

Circular conduit
Length: 1.500 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	2.450	1.316	3.765	1.316		0.000
US	2.500	1.316	3.815	1.316		0.000

0.000 Downstream discontinuity loss K factor
0.000 Negligble headloss noted for tapered reducer from 1371 to 1219 OD pipe.

1371 OD effluent pipe from 1067 OD CLS branch to 1371x1219 reducer
Refer Drg 02-506

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID

Length approximated to 1.5m

Component reference: NN 34

Null node

Conduit reference: Effluent Pipe 12

Circular conduit
Length: 12.600 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	2.500	1.316	3.816	1.316		0.040
US	2.570	1.316	3.886	1.316		0.000

0.040 Downstream discontinuity loss K factor
0.040 Downstream inline tee with full flow straight through. DS MIller Fig 13.23, gives k=0.05

1371 OD effluent pipe from 15 deg horizontal bend to 1371/1067 OD CLS branch
Refer Drg 02-506

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID

Length from chainage 239.85-228.75 + 1.5 = 12.6

Component reference: NN 32

Null node

Conduit reference: Effluent Pipe 11

Circular conduit
Length: 70.100 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	2.570	1.316	3.886	1.316		0.100
US	3.050	1.316	4.366	1.316		0.000

0.100	Downstream discontinuity loss K factor
0.100	15 deg horizontal bend assumed approximated between head loss data for 22.5 deg close radius (0.15) and 11.25deg close radius (0.075)

1371 OD effluent pipe from 62 deg horizontal bend to 15 deg horizontal bend
Refer Drg 02-506

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID

Length chainage 228.75-158.65=70.1

Component reference: NN 27_9

Null node

Conduit reference: Effluent Pipe 10

Circular conduit
Length: 28.650 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	3.050	1.316	4.366	1.316		0.250
US	3.240	1.316	4.556	1.316		0.000

0.250	Downstream discontinuity loss K factor
0.250	Mitre elbow, 3-piece, 60°. 62 degree horizontal bend at downstream end (assumed 3 piece mitre)

1371 OD effluent pipe from PS Grid E to 62 deg horizontal bend
Refer Drg 02-506

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID

US invert interpolated

Length chainage 158.65-130.00=28.65

Component reference: NN 27_8

Null node

Conduit reference: Effluent Pipe 9

Circular conduit
Length: 6.750 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	3.240	1.316	4.556	1.316		0.250
US	3.290	1.316	4.606	1.316		0.000

0.250	Downstream discontinuity loss K factor
0.250	37 degree bend at downstream end (30 deg horizontal 25 deg vert). 30 deg is 0.2, 45 deg is 0.3. therefore use k=0.25

1371 OD effluent pipe from PS Grid C point to Grid E
Refer Drgs 02-535, 02-519, 02-529.

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID. (excludes polyurethane liner)

DS invert interpolated 3.29

Length chainage 129.98--123.23=6.75

Component reference: **NN 31**

Null node

Conduit reference: **Effluent Pipe 8**

Circular conduit
Length: 7.200 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	3.290	1.312	4.602	1.312		0.250
US	3.340	1.312	4.652	1.312		0.000

0.250 Downstream discontinuity loss K factor
0.250 37 degree bend at downstream end (30 deg horizontal 25 deg vert). 30 deg is 0.2, 45 deg is 0.3. therefore use k=0.25

1371 OD effluent pipe from 37 deg bend (horizontal and vert combined) to PS Grid C point
Refer Drgs 02-535, 02-519, 02-529.

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID. includes polyurethane lining (later drg indicates 2 mm thickness) gives 1.312 m ID.

DS invert interpolated 3.29

Length chainage 123.23-116.03=7.2

Component reference: **NN 27_7**

Null node

Conduit reference: **Effluent Pipe 7**

Circular conduit
Length: 8.780 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	3.340	1.312	4.519	1.312		0.250
US	7.620	1.312	8.799	1.312		0.000

0.250 Downstream discontinuity loss K factor
0.250 37 degree bend at downstream end (30 deg horizontal 25 deg vert). 30 deg is 0.2, 45 deg is 0.3. therefore use k=0.25

1371 OD effluent pipe from 30 deg horizontal bend to 37 deg bend (horizontal and vert combined)
Refer Drgs 02-535, 02-519, 02-529.

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID. includes polyurethane lining (later drg indicates 2 mm thickness) gives 1.312 m ID.

Length chainage 116.03-107.25=8.78

Component reference: **NN 27_6**

Null node

Conduit reference: **Effluent Pipe 6**

Circular conduit
Length: 13.900 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	7.620	1.312	8.733	1.312		0.200
US	16.300	1.312	17.413	1.312		0.000

0.200	Downstream discontinuity loss K factor
0.200	Mitre elbow, 2-piece, 30°. 35 degree horizontal bend at downstream end modeled as 30 deg bend, (As Builts also indicated 3 piece mitre therefore acceptable conservative)

1371 OD effluent pipe from 15 deg vertical bend to 30 deg horizontal bend
Refer Drgs 02-535, 02-519, 02-529.

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID. includes polyurethane lining (later drg indicates 2 mm thickness) gives 1.312 m ID.

Length chainage 107.25-93.35 = 13.9

Component reference: **NN 27_4**

Null node

Conduit reference: **Effluent Pipe 5_2**

Circular conduit
Length: 8.600 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	16.300	1.312	17.552	1.312		0.150
US	19.000	1.312	20.252	1.312		0.000

0.150	Downstream discontinuity loss K factor
0.150	Bend, close radius, 22.5°. 15 degree vert bend at downstream end considered with 4 deg vert bend just upstream)

1371 OD effluent pipe from 3.9 degree vertical bend to 15 deg vert bend
Refer Drgs 02-535, 02-519, 02-529.

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID. includes polyurethane lining (later drg indicates 2 mm thickness) gives 1.312 m ID.

Length chainage 93.35-84.75 = 8.6

Component reference: **NN 6**

Null node

Conduit reference: **Effluent Pipe 5_1**

Circular conduit
Length: 2.900 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	19.000	1.312	20.275	1.312		0.000
US	19.700	1.312	20.975	1.312		0.000

0.000	Upstream discontinuity loss K factor
0.000	negligible head loss from Taper fitting from 1420 to 1371 pipe

1371 OD effluent pipe from 36 deg horizontal bend to 3.9 deg vertical bend
Refer Drgs 02-535, 02-519, 02-529.

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID. includes polyurethane lining (later drg indicates 2 mm thickness) gives 1.312 m ID.

Length chainage 84.75-81.85 = 2.9

The 4 deg vertical bend is expected to be negligible so has been ignored.

Component reference: **NN 27_3**

Null node

Conduit reference: **Effluent Pipe 4**

Circular conduit
Length: 31.500 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	19.700	1.316	20.987	1.316		0.200
US	26.400	1.316	27.687	1.316		0.000

0.200	Downstream discontinuity loss K factor
0.200	Mitre elbow, 2-piece, 30°. 36 degree horizontal bend at downstream end

1371 OD effluent pipe from 1420/1371 reducer to 36 deg horizontal bend
Refer Drgs 02-535, 02-519, 02-529.

US invert from drg = 26.4
US invert from drg = 19.7

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID.

Length chainage 81.65-50.15

Component reference: **NN 27_1**

Null node

Conduit reference: **Effluent Pipe 3_1**

Circular conduit
Length: 1.200 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	26.400	1.316	27.715	1.316		0.075
US	26.440	1.316	27.755	1.316		0.000

0.075	Downstream discontinuity loss K factor
0.075	Bend, close radius, 11.25°. 10 vertical bend at top of slope.
0.000	Head loss from long taper reducer can be ignored as this results in negligible headloss

1371 OD effluent pipe from mid point of 1420/1371 reducer to 10 degree vert bend

Refer Drgs 02-535, 02-519, 02-529.

US invert interpolated from drg = 26.51-2.35/3.55*(26.51-26.4)=26.44.

DS invert from drg = 26.4

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.316 m ID.

Length chainage 50.7-50.15+(50.15-48.85)/2 = 1.2

Component reference: NN 7

Null node

Conduit reference: Effluent Pipe 3

Circular conduit
Length: 2.350 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	26.440	1.365	27.804	1.365		0.000
US	26.510	1.365	27.874	1.365		0.000

1420 OD effluent pipe from vert tee junction with overflow to mid point of 1420/1371 reducer

Refer Drgs 02-535, 02-519, 02-529.

US invert taken as interpolated soffit level in the 1420 OD effluent pipe. invert at junction = 26.74-7.2*(26.74-26.4)/10.75=26.51.

DS invert from drg = 26.51-2.35/3.55*(26.51-26.4)=26.44

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.365 m ID.

Length chainage (50.15-48.85)/2+48.85-47.15 = 2.35

Component reference: NN 27

Null node

Conduit reference: 1065 OD vert drop

Circular conduit
Length: 0.000 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	27.875	1.014	27.875	1.014		0.914
US	28.500	1.014	28.500	1.014		0.000

0.914	Downstream discontinuity loss K factor
0.914	Downstream Tee Junction with enlargement. Enlarges from 1065 OD (1.014 m) to 1420 OD (1.365 m). Using DS Miller Figure 13.10. For bypass only flow scenarios, flow ratio Q1/Q3=1.0, A1/A3=0.55, K13=3.0. After converting for different velocity heads as per DS Miller guidance, k=0.914 For Flood event scenario, Q1/Q3 = 1.9/3.4 = 0.56, A1/A3=0.55 -> K13=1.2. After converting for different velocity heads as per DS Miller guidance, k=1.17 applied at DS end of 1066 OD riser

Vertical 1065 OD CLS pipe that receives flow from 965 OD overflow pipe. vertical pipe sits on top of the 1420 OD effluent pipe.

Dims from As Built 02-535

US invert taken as DS invert of 965 OD sloping pipe = 28.5.
DS invert taken as interpolated soffit level in the 1420 OD effluent pipe. invert at junction = 26.74-7.2*(26.74-26.4)/10.75=26.51, plus ID of effluent pipe (1.365) = 27.875 m RL.

Component reference: NN 26

Null node

Conduit reference: Sloping BP 965OD

Circular conduit
Length: 7.500 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	28.500	0.915	29.342	0.915		0.730
US	31.700	0.915	32.542	0.915		0.000

0.730	Downstream discontinuity loss K factor
0.730	Downstream wye junction at 67 degrees to vertical 1065OD CLS pipe. 67 deg wye junction includes enlargement from 915 ID to 1014 ID. Using DS Miller Fig 13.8, consider Q1/Q3 of 1.0, Area ratio of 0.81 (0.915^2/1.014^2) gives K13=1.1, after converting for differences in velocity head per DS miller guidance, k=0.73.

Sloping portion of 965OD bypass pipe from inlet works to the dropper shaft sitting above the 1420 OD effluent pipe.

ID=965-2*9.5-2*16=915mm

All dims from As Built 02-535

US invert estimated to replicate angle of pipe based on angle of upstream bend 90 deg - 67 deg = 23 deg. RL 31.7 m which aligns with just below surface level adjacent retained surface at 32 m RL.

DS Invert level scaled from drawing as 2 m below cover level of chamber (cover at 30.5). -> 28.5 m

Length scaled from As Built

Component reference: 965 OD vert 67bend

Null node

Conduit reference: Vertical BP pipe

Circular conduit
Length: 0.000 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	31.800	0.915	31.800	0.915		0.300
US	34.500	0.915	34.500	0.915		0.000

0.300	Downstream discontinuity loss K factor
0.300	Mitre elbow, 4-piece, 90°. 67 degree 4 piece mitre elbow approximated as 4 piece 90 degree, as hades doesn't allow 4 piece 60 deg pieces. Comparatively a 3 peice 60 deg mitre would have k=0.25, so 0.3 is about right.

Levels from As Built 02-303 and 02-535.

US invert from drg 02-303 section through outlet box.
DS Invert scaled from drawing 02-535

965 outer diameter CLS pipe.

Wall thickness assumed 9.5 mm, comparable with NZS4442 Class C, and matching the wall thickness for the 1420 and 1371 OF effluent pipes.
Lining thickness assumed 16 mm per NZS4442, comparable with lining thickness of 18 mm specified for the 1371 OD effluent.

ID=965-2*9.5-2*16=915mm

No upstream entry loss applied as entrance to pipe is modelled as an orifice (allows for conservative losses).

Component reference: **965 bypass entry**

Circular orifice with diameter 0.915 m

No. of Orifices	Orientation	Entrance Type	Elevation of Top m	Orifice Coeff.
1	Horiz.	Sharp	34.500	0.595

Conduit reference: **Bypass Outlet Box 3**

Open rectangular channel
Length: 2.500 m

Friction Loss: 'Concrete channel'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	34.500	4.500	39.000	1.300		1.000
US	34.500	4.500	39.000	1.300		0.000

1.000	Downstream discontinuity loss K factor
1.000	Exit. exist loss in flow approaching the outlet (orifice)

Bypass outlet box flowing towards outlet pipe.

Details from Drg 02-303 and 02-535

Component reference: **NN 20**

Null node

Conduit reference: **Bypass Outlet Box 1**

Open rectangular channel
Length: 0.650 m

Friction Loss: 'Concrete channel'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	34.500	4.500	39.000	1.200		1.250
US	34.500	4.500	39.000	1.200		0.000

1.250	Downstream discontinuity loss K factor
1.250	Mitre elbow, 2-piece, 90°

Narrow portion of outlet box downstream of RHS penstock weir, prior to change in direction to flow towards outlet pipe.

Length based on half width of channel before change in direction

Details from Drg 02-303 and 02-535

Component reference: **BP Weir Penstck 1**

Rectangular sharp-crested weir   Solution type: Kindsvater-Carter

Weir width m	End contractions	Crest elevation m
1.200	n/a	36.540

Run Scenario	Flow m³/s	Discharge Coefficient	Head Over Weir m	Freeboard DS m
Bypass 1350	0.676	0.602	0.463	1.061
Bypass 1800	0.903	0.604	0.560	0.480

1 of 2 Bypass Weir Penstocks from common grit outlet channel.

Feedback from WWL is that penstock weirs are in fully open position 36.54 m as per As Built 05=-29.

In high bypass flows, the driving head for the flow entering bypass pipe via orifice flow can affect water levels upstream of the bypass weirs if weirs are in the lowest position.

Can use higher overflow level 37.54 "Normal Overflow Level" considering upstream HGL is still safe in this case.

Drg 05-029

Conduit reference: **IW Drop Chan_3**

Open rectangular channel
Length: 1.200 m

Friction Loss: 'Concrete channel'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	35.650	3.350	39.000	2.000		0.000
US	35.650	3.350	39.000	2.000		0.000

Object Type: Rectangular Conduit

Purpose: Represents dropped channel following the grit trap outlet conduit.

DWG References: Upper Floor Plan DWG 02-303, Inlet Works Cross Sections 1 DWG 02-305, Inlet Works Cross Sections 2 DWG 02-306

Notes / Assumptions:

Component reference: **Grid A3 Bend**

Null node

Conduit reference: **Asym OL Channel_1**

Open user-defined channel shape
Length: 5.300 m

Friction Loss: 'Concrete channel'

Shape: Inlet Works Outlet (asymmetric)
Shape Factors

--------Non-dimensional--------			------------Scaled (m)-----------					
Y	X1	X2	Y	X1	X2	Flow area (m²)	Wetted perim. (m)	Hydr. rad. (m)
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.021	0.000	1.000	0.070	0.000	1.650	0.058	1.722	0.034
0.371	0.000	1.000	1.269	0.000	1.650	2.036	4.119	0.494
0.371	0.000	0.673	1.269	0.000	1.110	2.036	4.119	0.494

1.000	0.000	0.673	3.420	0.000	1.110	4.424	8.961	0.494

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	35.580	3.420	39.000	1.650		0.000
US	35.580	3.420	39.000	1.650		0.000

Object Type: Special Shape Conduit

Purpose: Part of channel series that distributes flows from inlet works to PST inlet offices.

DWG References: Inlet Works Plan DWG 02-303 - Lengths, Inlet Works Y-sections DWG 02-306 - inverts, Inlet Works Reinforcement DWG 02-307 - Shape/dimensions

Notes / Assumptions:

Component reference: **GT3 Flow in**

Inflow node

Flow
Run scenario
Bypass 1350 Inflow set as 3/4 (75.000%) of 'Bypass FLow' (1.35000 m³/s) = 1.01250 m³/s
Bypass 1800 Inflow set as 3/4 (75.000%) of 'Bypass FLow' (1.80000 m³/s) = 1.35000 m³/s

Inflow from the inlet works upstream of the bypass weir penstocks. Considers all four grit traps in service, so 3/4 of inflow comes from the common channel.

For the purpose of the bypass and effluent model, it is not significant that in reality flow may come from 1 or 2 grit channels.

DWG References: N/A

Conduit reference: **Bypass Outlet Box 2**

Open rectangular channel
Length: 0.650 m

Friction Loss: 'Concrete channel'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	34.500	4.500	39.000	1.200		1.250
US	34.500	4.500	39.000	1.200		0.000

1.250 Downstream discontinuity loss K factor
1.250 Mitre elbow, 2-piece, 90°. vertical bend in flow approach the outlet (orifice)

Narrow portion of outlet box downstream of LHS penstock weir, prior to discharge to outlet pipe.

Length consdired half of width until entry to vertical outlet pipe.

Details from Drg 02-303 and 02-535

Component reference: **BP Weir Penstck 2**

Rectangular sharp-crested weir   Solution type: Kindsvater-Carter

Weir width m	End contractions	Crest elevation m
1.200	n/a	36.540

Run Scenario	Flow m³/s	Discharge Coefficient	Head Over Weir m	Freeboard DS m
Bypass 1350	0.674	0.602	0.462	1.077
Bypass 1800	0.897	0.604	0.558	0.490

2 of 2 Bypass Weir Penstocks from common grit outlet channel.

Feedback from WWL is that penstock weirs are in fully open position 36.54 m as per As Built 05=-29.

In high bypass flows, the driving head for the flow entering bypass pipe via orifice flow can affect water levels upstream of the bypass weirs if weirs are in the lowest position.

Can use higher overflow level 37.54 "Normal Overflow Level" considering upstream HGL is still safe in this case.

Drg 05-029

Conduit reference: **IW Drop Chan_4**

Open rectangular channel
Length: 1.200 m

Friction Loss: 'Concrete channel'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	35.650	3.350	39.000	2.000		0.000
US	35.650	3.350	39.000	2.000		0.000

Object Type: Rectangular Conduit

Purpose: Represents dropped channel following the grit trap outlet conduit.

DWG References: Upper Floor Plan DWG 02-303, Inlet Works Cross Sections 1 DWG 02-305, Inlet Works Cross Sections 2 DWG 02-306

Notes / Assumptions:

Component reference: **NN 21**

Null node

Conduit reference: **IW Drop Chan_1**

Open rectangular channel
Length: 1.200 m

Friction Loss: 'Concrete channel'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	35.650	3.350	39.000	2.000		1.000
US	35.650	3.350	39.000	2.000		0.000

1.000	Downstream discontinuity loss K factor
1.000	Bend, elbow, 90°. 90 change in direction before approach weir.

Object Type: Rectangular Conduit

Purpose: Represents dropped channel following the grit trap outlet conduit.

DWG References: Upper Floor Plan DWG 02-303, Inlet Works Cross Sections 1 DWG 02-305, Inlet Works Cross Sections 2 DWG 02-306

Notes / Assumptions:

Component reference: NN 28_1

Null node

Conduit reference: Grit Outlet Chan_1

Open rectangular channel
Length: 5.380 m

Friction Loss: 'Concrete channel'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	37.050	1.950	39.000	2.000		0.000
US	37.050	1.950	39.000	2.000		0.000

Object Type: Rectangular Conduit

Purpose: Represents grit trap outlet conduit.

DWG References: Upper Floor Plan DWG 02-303, Inlet Works Cross Sections 1 DWG 02-305, Inlet Works Cross Sections 2 DWG 02-306

Notes / Assumptions:

Length from GT to RL drop: 10250 - (2*2435) = 5380mm (5.38m) from DWG 02-303

Component reference: GT 4 Flow in

Inflow node

Flow
Run scenario
Bypass 1350 Inflow set as 1/4 (25.000%) of 'Bypass FLow' (1.35000 m³/s) = 0.33750 m³/s
Bypass 1800 Inflow set as 1/4 (25.000%) of 'Bypass FLow' (1.80000 m³/s) = 0.45000 m³/s

Inflow from the inlet works upstream of the bypass weir penstocks. Considers all four grit traps in service, so 1/4 of inflow comes from the one grit channel that is in line with the weir penstocks.

For the purpose of the bypass and effluent model, it is not significant that in reality flow may come from 1 or 2 grit channels.

Conduit reference: IW Drop Chan_2

Open rectangular channel
Length: 1.200 m

Friction Loss: 'Concrete channel'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	35.650	3.350	39.000	2.000		1.000
US	35.650	3.350	39.000	2.000		1.000

1.000	Downstream discontinuity loss K factor
1.000	Bend, elbow, 90°. 90 degree change in flow direction before approaching bypass weir

1.000	Upstream discontinuity loss K factor
1.000	Bend, elbow, 90°. 90 deg bend at Grid A3

Object Type: Rectangular Conduit

Purpose: Represents dropped channel following the grit trap outlet conduit.

DWG References: Upper Floor Plan DWG 02-303, Inlet Works Cross Sections 1 DWG 02-305, Inlet Works Cross Sections 2 DWG 02-306

Notes / Assumptions:

Conduit reference: Effluent Pipe 2

Circular conduit
Length: 7.200 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	26.510	1.365	27.874	1.365		0.000
US	26.740	1.365	28.104	1.365		0.000

0.000	Downstream discontinuity loss K factor
0.000	K23 to be determined, depending on flow condition being considered For Feb 3 flooding scenario: Bypass flow = 1.9 m3/s, UV flow = 1.5 m3/s, total flow = 3.4 m3/s Use the following K23, Using DS Miller Figure 13.11, flow ratio Q1/Q3=0.56, A1/A3=0.55, K23=0.65. After converting for different velocity heads as per DS Miller guidance, k=3.237

1420 OD effluent pipe from 60 degree bend to vertical tee junction with bypass riser.

Refer Drgs 02-535, 02-519, 02-529.

DS invert taken as interpolated from long section:. invert at junction = 26.74-7.2*(26.74-26.4)/10.75=26.51,

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.365 m ID.

Length chainage 47.15-39.95 = 7.2

Component reference: 1420 pipe bend 60

Null node

Conduit reference: Effluent Pipe 1

Circular conduit
Length: 39.950 m

Friction Loss: 'Effluent Outfall'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	26.740	1.365	28.105	1.365		0.250
US	27.100	1.365	28.465	1.365		0.500

0.250	Downstream discontinuity loss K factor
0.250	Mitre elbow, 3-piece, 60°

0.500	Upstream discontinuity loss K factor
0.500	Entry, sharp-edged. As Built 02-405 indicates chamfered entry however this is only slightly rounded so ignored for conservatism.

1420 OD effluent pipe from UV outlet box to 60 degree bend.

Refer Drgs 02-535, 02-519, 02-529, 02-405

Long section indicates 9.5 mm wall thickness and 18 mm cement mortar lining which gives 1.365 m ID

Component reference: **NN 30**

Null node

Conduit reference: **UV Outlet Channel**

Launder channel
Length: 4.960 m

Friction Loss: 'Concrete channel'

Weir Crest elevation: 29.170 m

Inflow set as 'UV Out (1 chan OOS)' = 0.00000 m³/s for all run scenarios

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	27.100	4.450	31.550	2.000	0.000	0.000
US	27.100	4.450	31.550	2.000	0.000	0.000

UV OuItlet Channel as reflected in As Builts 02-401 and 02-402.

Modelled as Launder reflecting flow which progressively joins from the side weir (common UV channel exit weir).

As Builts 02-402 section 300 and 02-403 section 311 indicate two different levels for this weir, the higher level 29.17 has been adopted which aligns with level also indicated on 02-405. This is considered acceptably conservative given it will raise upstream water levels more in peak flows.

Component reference: **Out 1**

Outflow node

Outflow set as upstream flow for all run scenarios

Outflow component required upstream of launder channel (in order for launder channel to be modelled correctly).

Conduit reference: **NL 15**

Null link

Component reference: **UV Out Weir**

Rectangular sharp-crested weir Solution type: Kindsvater-Carter

Weir width m	End contractions	Crest elevation m
4.960	n/a	29.170

Run Scenario	Flow m³/s	Discharge Coefficient	Head Over Weir m	Freeboard DS m
Bypass 1350	0.000	0.623	0.000	1.818
Bypass 1800	0.000	0.623	0.000	1.671

Common UV channels outlet exit weir.

As Builts 02-402 section 300 and 02-403 section 311 indicate two different levels for this weir, the higher level 29.17 has been adopted which aligns with level also indicated on 02-405. This is considered acceptably conservative given it will raise upstream water levels more in peak flows.

Conduit reference: UV Conduit 4_1

Closed rectangular culvert
Length: 1.800 m

Friction Loss: 'Concrete channel'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	27.100	4.450	31.550	4.960		0.000
US	27.100	4.450	31.550	4.960		0.000

Object Type: Rectangular Conduit

Purpose: Represents combined flow in exit chamber before going over UV Outlet Weir.

DWG References: UV Disinfection Room Plan DWG 02-401 - all dimensions

Notes / Assumptions:
Channels not modelled upstream of this section. This considers that Hades Model does not currently predict the flooding that occurred; so the previously predicted headlosses through the UV channels will not likley be a cause of the flooding experienced. Refer previous Hydraulic report "*Moa Point Wastewater Treatment Plant Hydraulic Modelling,* Stantec, October 2025) and Hydraulic Grade line drawing 310104197-STN-00-410-DR-HY-000001 Rev B

Component reference: UV Outflow

Inflow node

Inflow set as 'UV Out (1 chan OOS)' = 0.00000 m³/s for all run scenarios

Placeholder in model to be able to simlulate draining of UV works in future, can be checked against UV outflowweir level 29.17

Conduit reference: Water Column 1_24

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 20_24

Null node

Conduit reference: Diffuser Type_11

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: NN 26_24

Null node

Conduit reference: Diffuser Type_10

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Component reference: NN 27_24

Null node

Conduit reference: Riser 6

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		29.250

1.200 Downstream discontinuity loss K factor
1.200 Junction, Tee - flow to or from branch, sharp

29.250 Upstream discontinuity loss K factor
29.250 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 6 in Hades corresponds to Riser 13 in the inspection report, which has east nozzle (OD150) open, west nozzle (OD160) closed.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers.

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: Water Column 1_26

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 20_26

Null node

Conduit reference: Diffuser Type_19

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: NN 26_26

Null node

Conduit reference: Diffuser Type_18

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Component reference: NN 27_28

Null node

Conduit reference: Riser 2

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		41.466

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

41.466	Upstream discontinuity loss K factor
41.466	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 2 in Hades corresponds to Riser 17 in the inspection report, which has east nozzle (OD150) open, west nozzle (OD160) closed.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: Water Column 1_19

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 20_19

Null node

Conduit reference: Diffuser Type 1a_6

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: NN 26_19

Null node

Conduit reference: Diffuser Type 1b_6

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Component reference: NN 27_19

Null node

Conduit reference: Riser 8

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		23.900

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

23.900	Upstream discontinuity loss K factor
23.900	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 8 in Hades corresponds to Riser 11 in the inspection report, which has east nozzle (OD150) open, west nozzle (OD160) closed.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: Water Column 1_18

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 20_18

Null node

Conduit reference: Diffuser Type 1a_5

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: NN 26_18

Null node

Conduit reference: Diffuser Type 1b_5

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Component reference: NN 27_18

Null node

Conduit reference: **Riser 10**

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		19.075

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

19.075	Upstream discontinuity loss K factor
19.075	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 10 in Hades corresponds to Riser 9 in the inspection report, which has east nozzle (OD150) open, west nozzle (OD160) closed.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: **Water Column 2_17**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_17**

Null node

Conduit reference: **Diffuser Type 2a_4**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 154 mm dia, US 214 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 154 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 72% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: NN 30_17

Null node

Conduit reference: Diffuser Type 2b_4

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert	Height	Soffit	Width	Side Slope	Discont.
	m	m	m	m	x/y	loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: NN 27_17

Null node

Conduit reference: Riser 12

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		3.343

1.200 Downstream discontinuity loss K factor
1.200 Junction, Tee - flow to or from branch, sharp

3.343 Upstream discontinuity loss K factor
3.343 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: Water Column 1_17

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 20_17

Null node

Conduit reference: Diffuser Type 1a_4

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: NN 26_17

Null node

Conduit reference: Diffuser Type 1b_4

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Conduit reference: Water Column 1_25

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 20_25**

Null node

Conduit reference: **Diffuser Type_15**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100 Downstream discontinuity loss K factor
1.000 Exit
0.100 Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: **NN 26_25**

Null node

Conduit reference: **Diffuser Type_12**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.225

0.225 Upstream discontinuity loss K factor
0.225 Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Component reference: **NN 27_26**

Null node

Conduit reference: **Riser 4**

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		35.110

1.200 Downstream discontinuity loss K factor
1.200 Junction, Tee - flow to or from branch, sharp

35.110 Upstream discontinuity loss K factor
35.110 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 4 in Hades corresponds to Riser 15 in the inspection report, which has east nozzle (OD150) open, west nozzle (OD160) closed.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: **Water Column 2_16**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_16**

Null node

Conduit reference: **Diffuser Type 2a_3**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 154 mm dia, US 214 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 154 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 72% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: **NN 30_16**

Null node

Conduit reference: **Diffuser Type 2b_3**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: **NN 27_16**

Null node

Conduit reference: **Riser 14**

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		1.856

1.200 Downstream discontinuity loss K factor
1.200 Junction, Tee - flow to or from branch, sharp

1.856 Upstream discontinuity loss K factor
1.856 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: **Water Column 1_16**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 20_16**

Null node

Conduit reference: **Diffuser Type 1a_3**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: NN 26_16

Null node

Conduit reference: Diffuser Type 1b_3

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Conduit reference: Water Column 2_14

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_14**

Null node

Conduit reference: **Diffuser Type 2a_2**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: **NN 30_14**

Null node

Conduit reference: **Diffuser Type 2b_2**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Additional loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: **NN 27_14**

Null node

Conduit reference: **Riser 16**

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		0.918

1.200 Downstream discontinuity loss K factor
1.200 Junction, Tee - flow to or from branch, sharp

0.918 Upstream discontinuity loss K factor
0.918 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx
DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: **Water Column 1_14**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 20_14**

Null node

Conduit reference: Diffuser Type 1a_2

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: NN 26_14

Null node

Conduit reference: Diffuser Type 1b_2

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Additional loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Conduit reference: **Water Column 2_12**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_12**

Null node

Conduit reference: **Diffuser Type 2a_1**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: **NN 30_12**

Null node

Conduit reference: **Diffuser Type 2b_1**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Additional loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: Sea Level 2_1

Level control node

Elevation set as 'Sea Level in Cook St' = 1.277 m for all run scenarios

Conduit reference: Water Column 1_13

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 20_13

Null node

Conduit reference: Diffuser Type 1a_7

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: NN 26_13

Null node

Conduit reference: Diffuser Type 1b_7

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Component reference: NN 27_13

Null node

Conduit reference: Riser 17

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		0.633

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

0.633	Upstream discontinuity loss K factor
0.633	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: Water Column 2_23

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 21_23

Null node

Conduit reference: Diffuser Type 2a_12

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: NN 30_23

Null node

Conduit reference: Diffuser Type 2b_12

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Lloss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: NN 27_23

Null node

Conduit reference: Riser 7

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		20.500

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

20.500	Upstream discontinuity loss K factor
20.500	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 7 in Hades corresponds to Riser 12 in the inspection report, which has east nozzle (OD150) closed, west nozzle (OD160) open.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: **Water Column 2_26**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_26**

Null node

Conduit reference: **Diffuser Type_21**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: **NN 30_26**

Null node

Conduit reference: **Diffuser Type_20**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: NN 27_29

Null node

Conduit reference: Riser 1

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		34.683

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

34.683	Upstream discontinuity loss K factor
34.683	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 1 in Hades corresponds to Riser 18 in the inspection report, which has east nozzle (OD150) closed, west nozzle (OD160) open.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: **Water Column 2_22**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_22**

Null node

Conduit reference: **Diffuser Type 2a_11**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: **NN 30_22**

Null node

Conduit reference: **Diffuser Type 2b_11**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: NN 27_22

Null node

Conduit reference: Riser 9

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		16.570

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

16.570	Upstream discontinuity loss K factor
16.570	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 9 in Hades corresponds to Riser 10 in the inspection report, which has east nozzle (OD150) closed, west nozzle (OD160) open.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: **Water Column 2_21**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_21**

Null node

Conduit reference: **Diffuser Type 2a_10**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: **NN 30_21**

Null node

Conduit reference: **Diffuser Type 2b_10**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 72% so 4:3 taper used (k=0.1)

Component reference: NN 27_21

Null node

Conduit reference: Riser 11

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		4.285

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

4.285	Upstream discontinuity loss K factor
4.285	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: Water Column 1_21

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 20_21

Null node

Conduit reference: Diffuser Type 1a_10

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: NN 26_21

Null node

Conduit reference: Diffuser Type 1b_10

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Conduit reference: **Water Column 2_20**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_20**

Null node

Conduit reference: **Diffuser Type 2a_9**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: **NN 30_20**

Null node

Conduit reference: **Diffuser Type 2b_9**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.150

0.150 Upstream discontinuity loss K factor
0.150 Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: **NN 27_20**

Null node

Conduit reference: **Riser 13**

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		2.479

1.200 Downstream discontinuity loss K factor
1.200 Junction, Tee - flow to or from branch, sharp

2.479 Upstream discontinuity loss K factor
2.479 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: **Water Column 1_20**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 20_20**

Null node

Conduit reference: **Diffuser Type 1a_9**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: **NN 26_20**

Null node

Conduit reference: **Diffuser Type 1b_9**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Conduit reference: **Water Column 2_25**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_25**

Null node

Conduit reference: **Diffuser Type_17**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics

Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: NN 30_25

Null node

Conduit reference: Diffuser Type_16

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: NN 27_27

Null node

Conduit reference: Riser 3

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		29.568

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

29.568	Upstream discontinuity loss K factor
29.568	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx Proportion flow splits are the same at lower total flow rates.

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor

conversion_3500ls.xlsx

Riser 3 in Hades corresponds to Riser 16 in the inspection report, which has east nozzle (OD150) closed, west nozzle (OD160) open.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: Water Column 2_15

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 21_15

Null node

Conduit reference: Diffuser Type 2a_8

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: NN 30_15

Null node

Conduit reference: Diffuser Type 2b_8

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.150

0.150 Upstream discontinuity loss K factor
0.150 Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: NN 27_15

Null node

Conduit reference: Riser 15

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		1.365

1.200 Downstream discontinuity loss K factor
1.200 Junction, Tee - flow to or from branch, sharp

1.365 Upstream discontinuity loss K factor
1.365 Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: **Water Column 1_15**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 20_15**

Null node

Conduit reference: **Diffuser Type 1a_8**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.288	0.144	-21.145	0.144		1.100
US	-21.318	0.144	-21.175	0.144		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 1a Diffuser Taper DS 144 mm dia, US 204 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3183 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2883 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 144 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 71% so 4:3 taper used (k=0.1)

Exist loss applied DS (k=1)

Component reference: **NN 26_15**

Null node

Conduit reference: **Diffuser Type 1b_8**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.318	0.204	-21.120	0.204		0.000
US	-21.338	0.204	-21.140	0.204		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 1b Diffuser Taper DS 204 mm dia, US 244 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3383 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3183 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 204 mm dia to be conservative

Conduit reference: **Water Column 2_24**

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: **NN 21_24**

Null node

Conduit reference: **Diffuser Type_14**

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics

Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: **NN 30_24**

Null node

Conduit reference: **Diffuser Type_13**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.225

0.225	Upstream discontinuity loss K factor
0.225	Taper (fitting), normal, 03:01. Loss applied for taper from 0.585 diameter to 0.2 diameter (3:1 normal taper) for riser with just one nozzle open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

Component reference: **NN 27_25**

Null node

Conduit reference: **Riser 5**

Circular conduit
Length: 0.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.213	0.585	-21.213	0.585		1.200
US	-24.093	0.585	-24.093	0.585		24.837

1.200	Downstream discontinuity loss K factor
1.200	Junction, Tee - flow to or from branch, sharp

24.837	Upstream discontinuity loss K factor
24.837	Based on results from: Sea outfall with 18 risers - Miller loss factor conversion.xlsx

610 OD Vertical Diffuser Riser
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx, Sea outfall with 18 risers - Miller loss factor conversion_3500ls.xlsx

Riser 5 in Hades corresponds to Riser 14 in the inspection report, which has east nozzle (OD150) closed, west nozzle (OD160) open.

US invert from drg = -24.0933 (Approximate centerline of outfall pipe, end of diffuser invert + half the outfall ID, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2133 (+2.88 m from centreline of outfall pipe to centreline of diffuser opening, see dwg 18-006)

Length from dwg 2.88 m, applied as height for vertical riser

Tee Junction loss (k=1.2) applied downstream where flow is split between two open diffusers

US loss based on results from Sea outfall with 18 risers - Miller loss factor conversion.xlsx

DWG 18-007 indicates 9.5 mm wall thickness and 3 mm internal epoxy lining which gives 0.585 m ID.

Conduit reference: Water Column 2_13

Closed rectangular culvert
Length: 5.000 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.970	22.970	1.000	5.000		0.000
US	-21.970	22.970	1.000	5.000		0.000

Dummy conduit with no losses to connect to set sea level

Component reference: NN 21_13

Null node

Conduit reference: Diffuser Type 2a_7

Circular conduit
Length: 0.250 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.293	0.154	-21.140	0.154		1.100
US	-21.323	0.154	-21.170	0.154		0.000

1.100	Downstream discontinuity loss K factor
1.000	Exit
0.100	Tapered conduit, normal, 04:03

Type 2a Diffuser Taper DS 160 mm dia, US 220 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3233 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.2933 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.25 m

Width used DS 160 mm dia to be conservative

Taper conduit loss applied DS, DS/US cross sectional area difference is approx 51% so 2:1 taper used (k=0.175)

Exist loss applied DS (k=1)

Component reference: **NN 30_13**

Null node

Conduit reference: **Diffuser Type 2b_7**

Circular conduit
Length: 0.040 m

Friction Loss: 'Diffuser Roughness'

	Invert m	Height m	Soffit m	Width m	Side Slope x/y	Discont. loss K
DS	-21.323	0.214	-21.115	0.214		0.000
US	-21.343	0.214	-21.135	0.214		0.150

0.150	Upstream discontinuity loss K factor
0.150	Taper (fitting), normal, 03:02. Loss applied for taper from 0.585 diameter to 0.2 diameter but half of the flow (3:2 normal taper) for riser with two nozzles open. Sudden taper not considered suitable.

Type 2b Diffuser Taper DS 214 mm dia, US 254 mm dia,
Refer Drgs 18-003, 18-006, 18-007, Moa Point Hades Hydraulics Calculations.xlsx,

US invert from drg = -21.3433 (Approximate centerline of diffuser minus half US dia, see Moa Point Hades Hydraulics Calculations.xlsx)
DS invert from drg = -21.3233 (Approximate centerline of diffuser minus half DS dia, see Moa Point Hades Hydraulics Calculations.xlsx)

Length from dwg 18-007, 0.04 m

Width used DS 214 mm dia to be conservative

RESULTS SECTION

SCENARIO 'Bypass 1350'

INFORMATION MESSAGES, WARNINGS AND ERRORS

Topology is Complex

WARNING: DS K factor in conduit 'Bypass Outlet Box 2' should be equal to 1 US of horizontal orifice '965 bypass entry'

Hardy-Cross iteration required

Effluent Pipe 15
Free-surface flow commences at 10.134m

Effluent Pipe 14
Free-surface flow commences at 5.091m

Effluent Pipe 11
Subcritical flow at 7.010 m

Effluent Pipe 3
WARNING: Open channel hydraulic profile solution did not converge at chainage 0.432m. Try reducing minimum halved step length

Sloping BP 965OD
Free discharge at DS end
WARNING: Open channel hydraulic profile solution did not converge at chainage 0.001m, failing criterion on change in successive values of depth over critical. Calculation at this point was omitted. For increased resolution try reducing minimum halved step length or increasing profile transition point 'Factor B' to at least 468%

Vertical BP pipe
Free-surface flow commences at 0.713m
WARNING: Open channel hydraulic profile solution did not converge at chainage 0.000m, failing criterion on change in successive values of depth over critical. Calculation at this point was omitted. For increased resolution try reducing minimum halved step length or increasing profile transition point 'Factor B' to at least 378%
Free discharge at DS end

Grit Outlet Chan_1
Free discharge at DS end

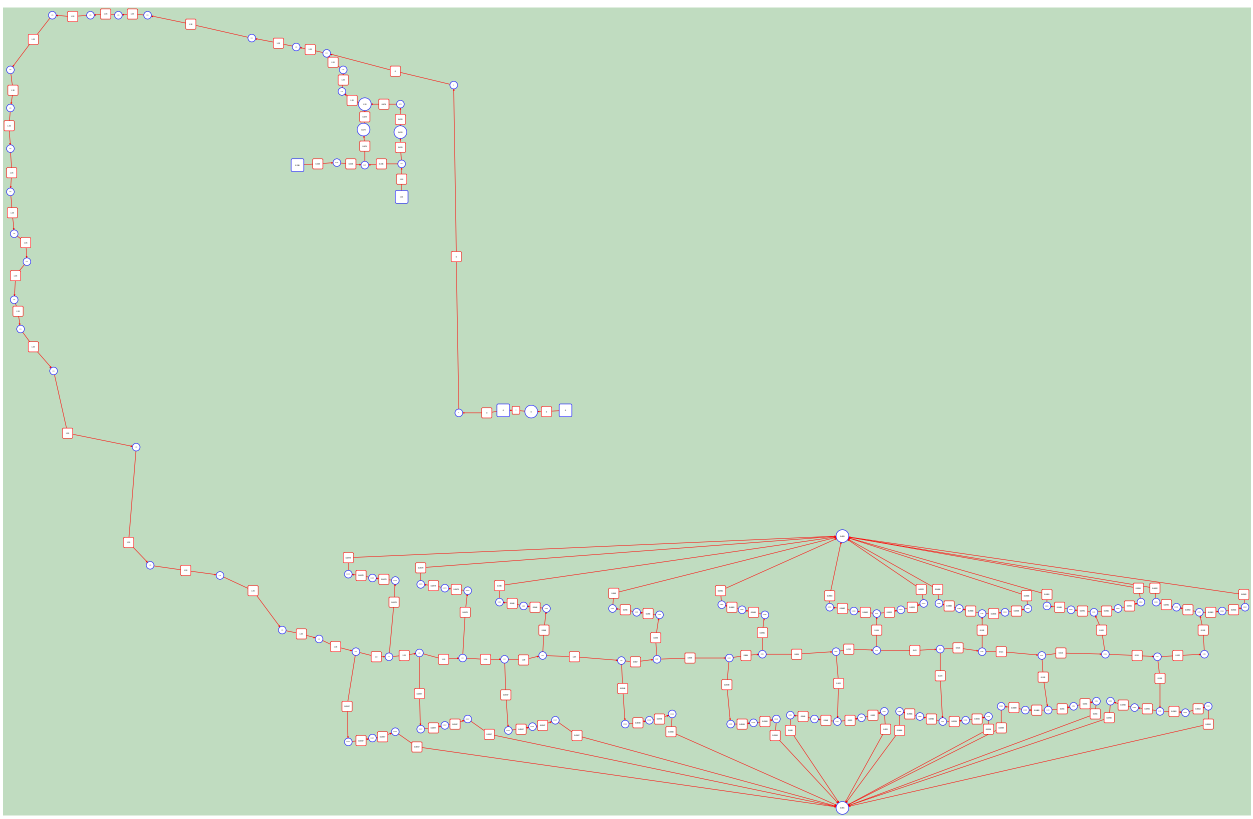
Effluent Pipe 2
WARNING: No flow in 'Effluent Pipe 2'

Effluent Pipe 1
WARNING: No flow in 'Effluent Pipe 1'

UV Outlet Channel
WARNING: No flow in 'UV Outlet Channel'

UV Conduit 4_1
WARNING: No flow in 'UV Conduit 4_1'

MODEL DIAGRAM SHOWING FLOWS



SCENARIO 'Bypass 1800'

INFORMATION MESSAGES, WARNINGS AND ERRORS

Topology is Complex

WARNING: DS K factor in conduit 'Bypass Outlet Box 2' should be equal to 1 US of horizontal orifice '965 bypass entry'

Hardy-Cross iteration required

Effluent Pipe 10
Subcritical flow at 2.865 m

Effluent Pipe 3
WARNING: Open channel hydraulic profile solution did not converge at chainage 0.565m. Calculation at this point was omitted. For increased resolution try reducing minimum halved step length

Sloping BP 965OD
Free discharge at DS end
WARNING: Open channel hydraulic profile solution did not converge at chainage 0.001m, failing criterion on change in successive values of depth over critical. Calculation at this point was omitted. For increased resolution try reducing minimum halved step length or increasing profile transition point 'Factor B' to at least 3874%

Vertical BP pipe
Free-surface flow commences at 0.813m
WARNING: Open channel hydraulic profile solution did not converge at chainage 0.000m, failing criterion on change in successive values of depth over critical. Calculation at this point was omitted. For increased resolution try reducing minimum halved step length or increasing profile transition point 'Factor B' to at least 2987%
Free discharge at DS end

Grit Outlet Chan_1
Free discharge at DS end

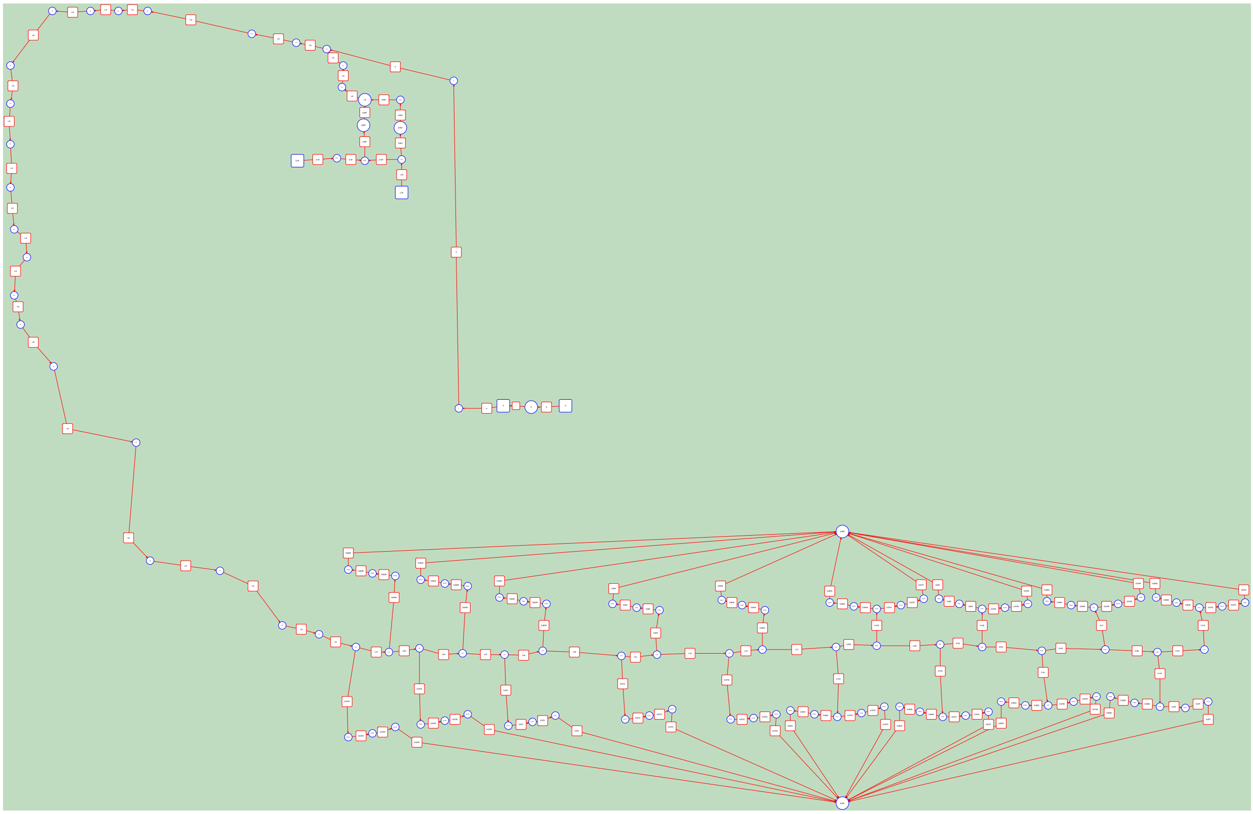
Effluent Pipe 2
WARNING: No flow in 'Effluent Pipe 2'

Effluent Pipe 1
WARNING: No flow in 'Effluent Pipe 1'

UV Outlet Channel
WARNING: No flow in 'UV Outlet Channel'

UV Conduit 4_1
WARNING: No flow in 'UV Conduit 4_1'

MODEL DIAGRAM SHOWING FLOWS



ID / TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO 'Bypass 1350'						
Sea Level 1_1						
Depth control		0.65876	1.277			
Water Column 1_12						
Rect. conduit	0.000	0.04921	1.277	1.277	0.000	0.000
	5.000	0.04921	1.277	1.277	0.000	0.000
NN 20_12						
Null node		0.04921	1.277			
Diffuser Type 1a_1						
Circular conduit	0.000	0.04921	1.789	1.324	3.022	0.466
	0.250	0.04921	1.807	1.341	3.022	0.466
NN 26_12						
Null node		0.04921	1.807			
Diffuser Type 1b_1						
Circular conduit	0.000	0.04921	1.807	1.691	1.506	0.116
	0.040	0.04921	1.825	1.692	1.506	0.116
NN 27_12						
Null node		0.10550	1.825			
Riser 18						
Circular conduit	0.000	0.10550	1.834	1.826	0.393	0.008
	0.000	0.10550	1.839	1.827	0.393	0.008

NN 31_1						
Null node		0.10550	1.839			
Diffuser Sec 18						
Circular conduit	0.000	0.10550	1.839	1.838	0.093	0.000
	5.300	0.10550	1.839	1.838	0.093	0.000
NN 12_6						
Null node		0.21091	1.839			
Diffuser Sec 17						
Circular conduit	0.000	0.21091	1.839	1.837	0.186	0.002
	5.300	0.21091	1.839	1.837	0.186	0.002
NN 11_2						
Null node		0.31612	1.839			
Diffuser Sec 16						
Circular conduit	0.000	0.31612	1.839	1.835	0.280	0.004
	5.300	0.31612	1.839	1.835	0.280	0.004
NN 10_2						
Null node		0.42101	1.839			
Diffuser Sec 15						
Circular conduit	0.000	0.42101	1.839	1.832	0.372	0.007
	5.300	0.42101	1.839	1.832	0.372	0.007
NN 9_2						
Null node		0.52555	1.839			
Diffuser Sec 14						
Circular conduit	0.000	0.52555	1.839	1.828	0.465	0.011
	5.300	0.52555	1.839	1.829	0.465	0.011
NN 8_2						
Null node		0.62968	1.839			
Diffuser Sec 13						
Circular conduit	0.000	0.62968	1.839	1.823	0.557	0.016
	5.300	0.62968	1.840	1.825	0.557	0.016
NN 7_2						
Null node		0.73325	1.840			
Diffuser Sec 12						
Circular conduit	0.000	0.73325	1.840	1.818	0.648	0.021
	5.300	0.73325	1.841	1.820	0.648	0.021
NN 6_4						
Null node		0.83624	1.841			
Diffuser Sec 11						
Circular conduit	0.000	0.83624	1.841	1.813	0.739	0.028
	5.300	0.83624	1.843	1.815	0.739	0.028
NN 5_2						
Null node		0.88439	1.843			
Diffuser Sec 10						
Circular conduit	0.000	0.88439	1.843	1.812	0.782	0.031
	5.000	0.88439	1.845	1.813	0.782	0.031
NN 4_2						
Null node		0.93929	1.845			
Diffuser Sec 9						
Circular conduit	0.000	0.93929	1.845	1.810	0.831	0.035
	5.600	0.93929	1.848	1.812	0.831	0.035

NN 3_2						
Null node		0.98732	1.848			
Diffuser Sec 8						
Circular conduit	0.000	0.98732	1.848	1.809	0.873	0.039
	5.600	0.98732	1.851	1.812	0.873	0.039
NN 2_2						
Null node		1.04212	1.851			
Diffuser Sec 7						
Circular conduit	0.000	1.04212	1.851	1.808	0.921	0.043
	5.000	1.04212	1.855	1.810	0.921	0.043
NN 1_3						
Null node		1.09008	1.855			
Diffuser Sec 6						
Circular conduit	0.000	1.09008	1.855	1.807	0.964	0.047
	5.300	1.09008	1.859	1.810	0.964	0.047
NN 4						
Null node		1.14481	1.859			
Diffuser Sec 5						
Circular conduit	0.000	1.14481	1.859	1.806	1.012	0.052
	5.300	1.14481	1.863	1.810	1.012	0.052
NN 3						
Null node		1.19272	1.863			
Diffuser Section 4						
Circular conduit	0.000	1.19272	1.863	1.806	1.055	0.057
	5.300	1.19272	1.868	1.810	1.055	0.057
NN 2						
Null node		1.24741	1.868			
Diffuser Sec 3						
Circular conduit	0.000	1.24741	1.868	1.806	1.103	0.062
	5.300	1.24741	1.873	1.810	1.103	0.062
NN 5						
Null node		1.29531	1.873			
Diffuser Sec 2						
Circular conduit	0.000	1.29531	1.873	1.806	1.145	0.067
	5.300	1.29531	1.879	1.810	1.145	0.067
NN 1						
Null node		1.35000	1.879			
Diffuser Start Pipe						
Circular conduit	0.000	1.35000	1.879	1.806	1.194	0.073
	7.950	1.35000	1.886	1.813	1.194	0.073
NN 32_1						
Null node		1.35000	1.886			
Outfall CH66-1772_1						
Circular conduit	0.000	1.35000	1.886	1.813	1.194	0.073
	1705.990	1.35000	3.344	3.271	1.194	0.073
19.7 Mitre_1						
Null node		1.35000	3.344			
Outfall CH57-66_1						
Circular conduit	0.000	1.35000	3.355	3.282	1.194	0.073
	8.050	1.35000	3.362	3.289	1.194	0.073

20 Mitre_1						
Null node		1.35000	3.362			
Outfall CH35-57_1						
Circular conduit	0.000	1.35000	3.373	3.300	1.194	0.073
	22.060	1.35000	3.392	3.319	1.194	0.073
22.9 Mitre_1						
Null node		1.35000	3.392			
Outfall CH0-35_1						
Circular conduit	0.000	1.35000	3.402	3.330	1.194	0.073
	35.410	1.35000	3.433	3.360	1.194	0.073
Tie In Flange						
Null node		1.35000	3.433			
Effluent Pipe 16						
Circular conduit	0.000	1.35000	3.433	3.383	0.993	0.050
	21.800	1.35000	3.445	3.394	0.993	0.050
NN 36						
Null node		1.35000	3.445			
Effluent Pipe 15						
Circular conduit	0.000	1.35000	3.449	3.398	0.999	0.051
	10.000	1.35000	3.659	3.603	1.008	0.052
NN 35						
Null node		1.35000	3.659			
Effluent Pipe 14						
Circular conduit	0.000	1.35000	3.687	3.605	1.269	0.082
	5.300	1.35000	3.693	3.611	1.269	0.082
NN 33						
Null node		1.35000	3.693			
Effluent Pipe 13						
Circular conduit	0.000	1.35000	3.693	3.637	1.045	0.056
	1.500	1.35000	3.694	3.634	1.083	0.060
NN 34						
Null node		1.35000	3.694			
Effluent Pipe 12						
Circular conduit	0.000	1.35000	3.696	3.637	1.081	0.060
	12.600	1.35000	3.703	3.636	1.144	0.067
NN 32						
Null node		1.35000	3.703			
Effluent Pipe 11						
Circular conduit	0.000	1.35000	3.703	3.644	1.136	0.066
	70.100	1.35000	4.411	3.413	4.425	0.998
NN 27_9						
Null node		1.35000	4.411			
Effluent Pipe 10						
Circular conduit	0.000	1.35000	4.411	3.373	5.210	1.384
	28.650	1.35000	5.876	3.507	6.815	2.368
NN 27_8						
Null node		1.35000	5.875			
Effluent Pipe 9						
Circular conduit	0.000	1.35000	5.875	3.481	7.913	3.192
	6.750	1.35000	7.320	3.517	8.637	3.803

NN 31						
Null node		1.35000	7.320			
Effluent Pipe 8						
Circular conduit	0.000	1.35000	7.320	3.495	10.001	5.100
	7.200	1.35000	9.960	3.529	11.230	6.431
NN 27_7						
Null node		1.35000	9.960			
Effluent Pipe 7						
Circular conduit	0.000	1.35000	9.960	3.494	13.003	8.621
	8.780	1.35000	15.049	7.783	11.938	7.266
NN 27_6						
Null node		1.35000	15.049			
Effluent Pipe 6						
Circular conduit	0.000	1.35000	15.049	7.762	13.366	9.109
	13.900	1.35000	21.164	16.479	9.585	4.685
NN 27_4						
Null node		1.35000	21.164			
Effluent Pipe 5_2						
Circular conduit	0.000	1.35000	21.164	16.491	10.384	5.498
	8.600	1.35000	23.351	19.210	9.012	4.141
NN 6						
Null node		1.35000	23.351			
Effluent Pipe 5_1						
Circular conduit	0.000	1.35000	23.351	19.214	9.007	4.137
	2.900	1.35000	23.690	19.921	8.597	3.768
NN 27_3						
Null node		1.35000	23.690			
Effluent Pipe 4						
Circular conduit	0.000	1.35000	23.690	19.906	9.632	4.730
	31.500	1.35000	27.302	26.890	2.843	0.412
NN 27_1						
Null node		1.35000	27.302			
Effluent Pipe 3_1						
Circular conduit	0.000	1.35000	27.302	26.883	2.978	0.452
	1.200	1.35000	27.341	26.950	2.771	0.392
NN 7						
Null node		1.35000	27.341			
Effluent Pipe 3						
Circular conduit	0.000	1.35000	27.341	26.933	2.829	0.408
	2.350	1.35000	27.352	27.119	2.137	0.233
NN 27						
Null node		1.35000	27.352			
1065 OD vert drop						
Circular conduit	0.000	1.35000	27.900	27.875	2.396	0.293
	0.000	1.35000	29.704	28.500	4.860	1.204
NN 26						
Null node		1.35000	29.704			
Sloping BP 965OD						
Circular conduit	0.000	1.35000	29.704	28.748	8.334	3.542
	7.500	1.35000	32.663	32.330	2.556	0.333

965 OD vert 67bend						
Null node		1.35000	32.663			
Vertical BP pipe						
Circular conduit	0.000	1.35000	32.663	32.513	2.053	0.215
	0.000	1.35000	34.833	34.500	2.555	0.333
965 bypass entry						
Orifice		1.35000	35.441			
Bypass Outlet Box 3						
Rect. conduit	0.000	0.67647	35.456	35.441	0.553	0.016
	2.500	0.67647	35.457	35.441	0.553	0.016
NN 20						
Null node		0.67647	35.457			
Bypass Outlet Box 1						
Rect. conduit	0.000	0.67647	35.479	35.461	0.586	0.018
	0.650	0.67647	35.479	35.462	0.586	0.018
BP Weir Penstck 1						
RSC weir		0.67647	37.006			
IW Drop Chan_3						
Rect. conduit	0.000	0.67647	37.006	37.003	0.250	0.003
	1.200	0.67647	37.006	37.003	0.250	0.003
Grid A3 Bend						
Null node		1.01250	37.006			
Asym OL Channel_1						
User-defined	0.000	1.01250	37.006	36.995	0.461	0.011
	5.300	1.01250	37.007	36.996	0.460	0.011
GT3 Flow in						
Inflow		1.01250	37.007			

<u>SCENARIO 'Bypass 1800'</u>

Sea Level 1_1						
Depth control		0.87836	1.277			
Water Column 1_12						
Rect. conduit	0.000	0.06563	1.277	1.277	0.001	0.000
	5.000	0.06563	1.277	1.277	0.001	0.000
NN 20_12						
Null node		0.06563	1.277			
Diffuser Type 1a_1						
Circular conduit	0.000	0.06563	2.188	1.360	4.030	0.828
	0.250	0.06563	2.219	1.391	4.030	0.828
NN 26_12						
Null node		0.06563	2.219			
Diffuser Type 1b_1						
Circular conduit	0.000	0.06563	2.219	2.014	2.008	0.206
	0.040	0.06563	2.251	2.014	2.008	0.206
NN 27_12						
Null node		0.14069	2.251			
Riser 18						
Circular conduit	0.000	0.14069	2.268	2.254	0.523	0.014
	0.000	0.14069	2.276	2.255	0.523	0.014

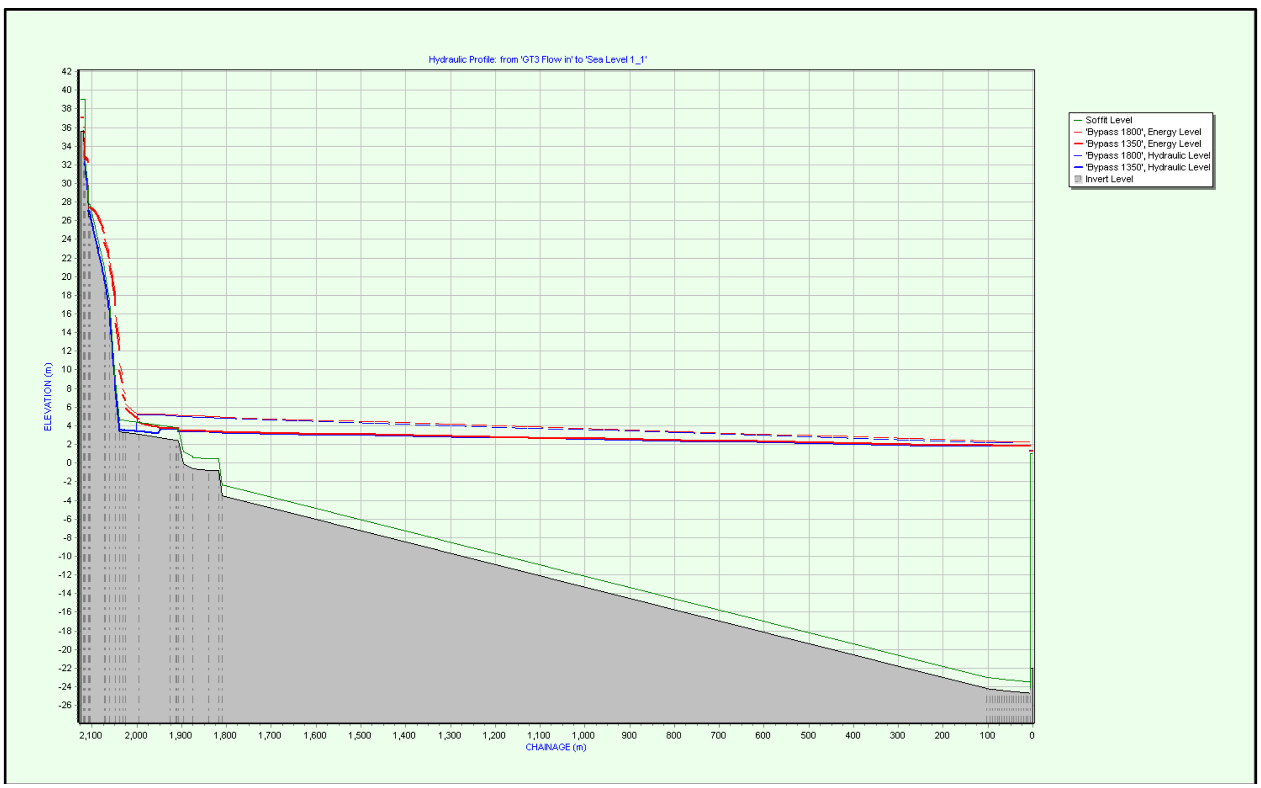
NN 31_1						
Null node		0.14069	2.276			
Diffuser Sec 18						
Circular conduit	0.000	0.14069	2.276	2.275	0.124	0.001
	5.300	0.14069	2.276	2.275	0.124	0.001
NN 12_6						
Null node		0.28127	2.276			
Diffuser Sec 17						
Circular conduit	0.000	0.28127	2.276	2.273	0.249	0.003
	5.300	0.28127	2.276	2.273	0.249	0.003
NN 11_2						
Null node		0.42156	2.276			
Diffuser Sec 16						
Circular conduit	0.000	0.42156	2.276	2.269	0.373	0.007
	5.300	0.42156	2.276	2.269	0.373	0.007
NN 10_2						
Null node		0.56144	2.276			
Diffuser Sec 15						
Circular conduit	0.000	0.56144	2.276	2.263	0.496	0.013
	5.300	0.56144	2.276	2.264	0.496	0.013
NN 9_2						
Null node		0.70085	2.276			
Diffuser Sec 14						
Circular conduit	0.000	0.70085	2.276	2.257	0.620	0.020
	5.300	0.70085	2.277	2.258	0.620	0.020
NN 8_2						
Null node		0.83970	2.277			
Diffuser Sec 13						
Circular conduit	0.000	0.83970	2.277	2.249	0.742	0.028
	5.300	0.83970	2.277	2.250	0.742	0.028
NN 7_2						
Null node		0.97779	2.277			
Diffuser Sec 12						
Circular conduit	0.000	0.97779	2.277	2.239	0.865	0.038
	5.300	0.97779	2.279	2.242	0.865	0.038
NN 6_4						
Null node		1.11513	2.279			
Diffuser Sec 11						
Circular conduit	0.000	1.11513	2.279	2.229	0.986	0.050
	5.300	1.11513	2.283	2.232	0.986	0.050
NN 5_2						
Null node		1.17932	2.283			
Diffuser Sec 10						
Circular conduit	0.000	1.17932	2.283	2.227	1.043	0.055
	5.000	1.17932	2.286	2.230	1.043	0.055
NN 4_2						
Null node		1.25252	2.286			
Diffuser Sec 9						
Circular conduit	0.000	1.25252	2.286	2.224	1.107	0.063
	5.600	1.25252	2.292	2.228	1.107	0.063

NN 3_2							
	Null node		1.31655	2.292			
Diffuser Sec 8							
	Circular conduit	0.000	1.31655	2.292	2.223	1.164	0.069
		5.600	1.31655	2.297	2.227	1.164	0.069
NN 2_2							
	Null node		1.38961	2.297			
Diffuser Sec 7							
	Circular conduit	0.000	1.38961	2.297	2.220	1.229	0.077
		5.000	1.38961	2.304	2.225	1.229	0.077
NN 1_3							
	Null node		1.45354	2.304			
Diffuser Sec 6							
	Circular conduit	0.000	1.45354	2.304	2.219	1.285	0.084
		5.300	1.45354	2.311	2.225	1.285	0.084
NN 4							
	Null node		1.52649	2.311			
Diffuser Sec 5							
	Circular conduit	0.000	1.52649	2.311	2.218	1.350	0.093
		5.300	1.52649	2.318	2.223	1.350	0.093
NN 3							
	Null node		1.59036	2.318			
Diffuser Section 4							
	Circular conduit	0.000	1.59036	2.318	2.218	1.406	0.101
		5.300	1.59036	2.327	2.224	1.406	0.101
NN 2							
	Null node		1.66326	2.327			
Diffuser Sec 3							
	Circular conduit	0.000	1.66326	2.327	2.217	1.471	0.110
		5.300	1.66326	2.336	2.223	1.471	0.110
NN 5							
	Null node		1.72710	2.336			
Diffuser Sec 2							
	Circular conduit	0.000	1.72710	2.336	2.217	1.527	0.119
		5.300	1.72710	2.346	2.225	1.527	0.119
NN 1							
	Null node		1.80000	2.346			
Diffuser Start Pipe							
	Circular conduit	0.000	1.80000	2.346	2.217	1.592	0.129
		7.950	1.80000	2.358	2.229	1.592	0.129
NN 32_1							
	Null node		1.80000	2.358			
Outfall CH66-1772_1							
	Circular conduit	0.000	1.80000	2.358	2.229	1.592	0.129
		1705.990	1.80000	4.913	4.784	1.592	0.129
19.7 Mitre_1							
	Null node		1.80000	4.913			
Outfall CH57-66_1							
	Circular conduit	0.000	1.80000	4.933	4.804	1.592	0.129
		8.050	1.80000	4.946	4.816	1.592	0.129

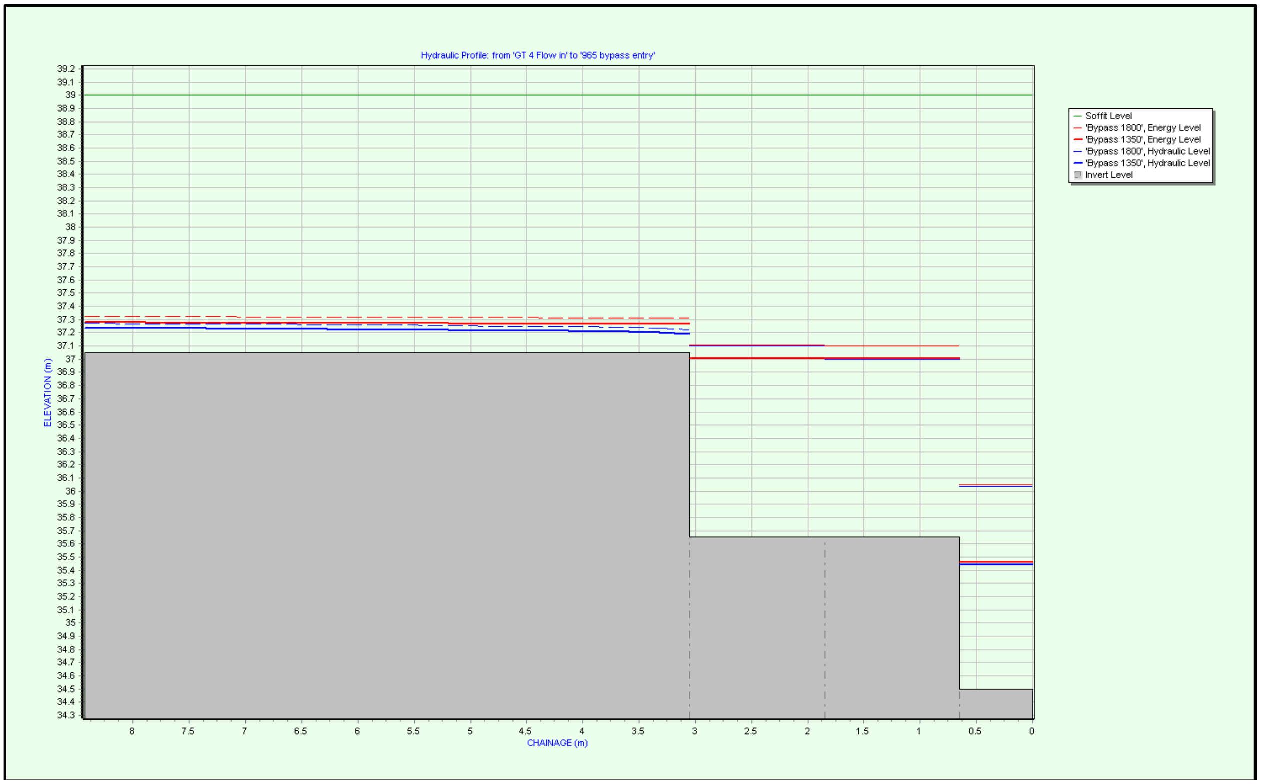
20 Mitre_1						
Null node		1.80000	4.946			
Outfall CH35-57_1						
Circular conduit	0.000	1.80000	4.965	4.836	1.592	0.129
	22.060	1.80000	4.998	4.869	1.592	0.129
22.9 Mitre_1						
Null node		1.80000	4.998			
Outfall CH0-35_1						
Circular conduit	0.000	1.80000	5.017	4.888	1.592	0.129
	35.410	1.80000	5.071	4.941	1.592	0.129
Tie In Flange						
Null node		1.80000	5.071			
Effluent Pipe 16						
Circular conduit	0.000	1.80000	5.071	4.982	1.323	0.089
	21.800	1.80000	5.091	5.002	1.323	0.089
NN 36						
Null node		1.80000	5.091			
Effluent Pipe 15						
Circular conduit	0.000	1.80000	5.098	5.008	1.331	0.090
	10.000	1.80000	5.115	5.018	1.331	0.090
NN 35						
Null node		1.80000	5.115			
Effluent Pipe 14						
Circular conduit	0.000	1.80000	5.166	5.020	1.692	0.146
	5.300	1.80000	5.175	5.030	1.692	0.146
NN 33						
Null node		1.80000	5.175			
Effluent Pipe 13						
Circular conduit	0.000	1.80000	5.175	5.086	1.323	0.089
	1.500	1.80000	5.177	5.088	1.323	0.089
NN 34						
Null node		1.80000	5.177			
Effluent Pipe 12						
Circular conduit	0.000	1.80000	5.180	5.091	1.323	0.089
	12.600	1.80000	5.192	5.103	1.323	0.089
NN 32						
Null node		1.80000	5.192			
Effluent Pipe 11						
Circular conduit	0.000	1.80000	5.201	5.112	1.323	0.089
	70.100	1.80000	5.267	5.177	1.323	0.089
NN 27_9						
Null node		1.80000	5.267			
Effluent Pipe 10						
Circular conduit	0.000	1.80000	5.267	5.200	1.323	0.089
	28.650	1.80000	6.349	3.549	7.411	2.800
NN 27_8						
Null node		1.80000	6.349			
Effluent Pipe 9						
Circular conduit	0.000	1.80000	6.349	3.518	8.604	3.775
	6.750	1.80000	7.936	3.554	9.270	4.382

NN 31						
Null node		1.80000	7.936			
Effluent Pipe 8						
Circular conduit	0.000	1.80000	7.936	3.528	10.735	5.876
	7.200	1.80000	10.695	3.563	11.827	7.133
NN 27_7						
Null node		1.80000	10.695			
Effluent Pipe 7						
Circular conduit	0.000	1.80000	10.695	3.521	13.697	9.566
	8.780	1.80000	15.777	7.813	12.498	7.965
NN 27_6						
Null node		1.80000	15.777			
Effluent Pipe 6						
Circular conduit	0.000	1.80000	15.777	7.788	13.995	9.986
	13.900	1.80000	21.626	16.512	10.015	5.114
NN 27_4						
Null node		1.80000	21.626			
Effluent Pipe 5_2						
Circular conduit	0.000	1.80000	21.626	16.526	10.848	6.001
	8.600	1.80000	23.753	19.249	9.399	4.504
NN 6						
Null node		1.80000	23.754			
Effluent Pipe 5_1						
Circular conduit	0.000	1.80000	23.754	19.254	9.394	4.499
	2.900	1.80000	24.062	19.963	8.966	4.099
NN 27_3						
Null node		1.80000	24.062			
Effluent Pipe 4						
Circular conduit	0.000	1.80000	24.062	19.944	10.048	5.148
	31.500	1.80000	27.444	26.983	3.009	0.462
NN 27_1						
Null node		1.80000	27.444			
Effluent Pipe 3_1						
Circular conduit	0.000	1.80000	27.444	26.974	3.159	0.509
	1.200	1.80000	27.488	27.044	2.951	0.444
NN 7						
Null node		1.80000	27.488			
Effluent Pipe 3						
Circular conduit	0.000	1.80000	27.488	27.022	3.025	0.467
	2.350	1.80000	27.499	27.218	2.348	0.281
NN 27						
Null node		1.80000	27.499			
1065 OD vert drop						
Circular conduit	0.000	1.80000	27.908	27.875	2.732	0.381
	0.000	1.80000	29.810	28.500	5.069	1.310
NN 26						
Null node		1.80000	29.810			
Sloping BP 965OD						
Circular conduit	0.000	1.80000	29.810	28.800	8.567	3.742
	7.500	1.80000	32.881	32.418	3.011	0.462

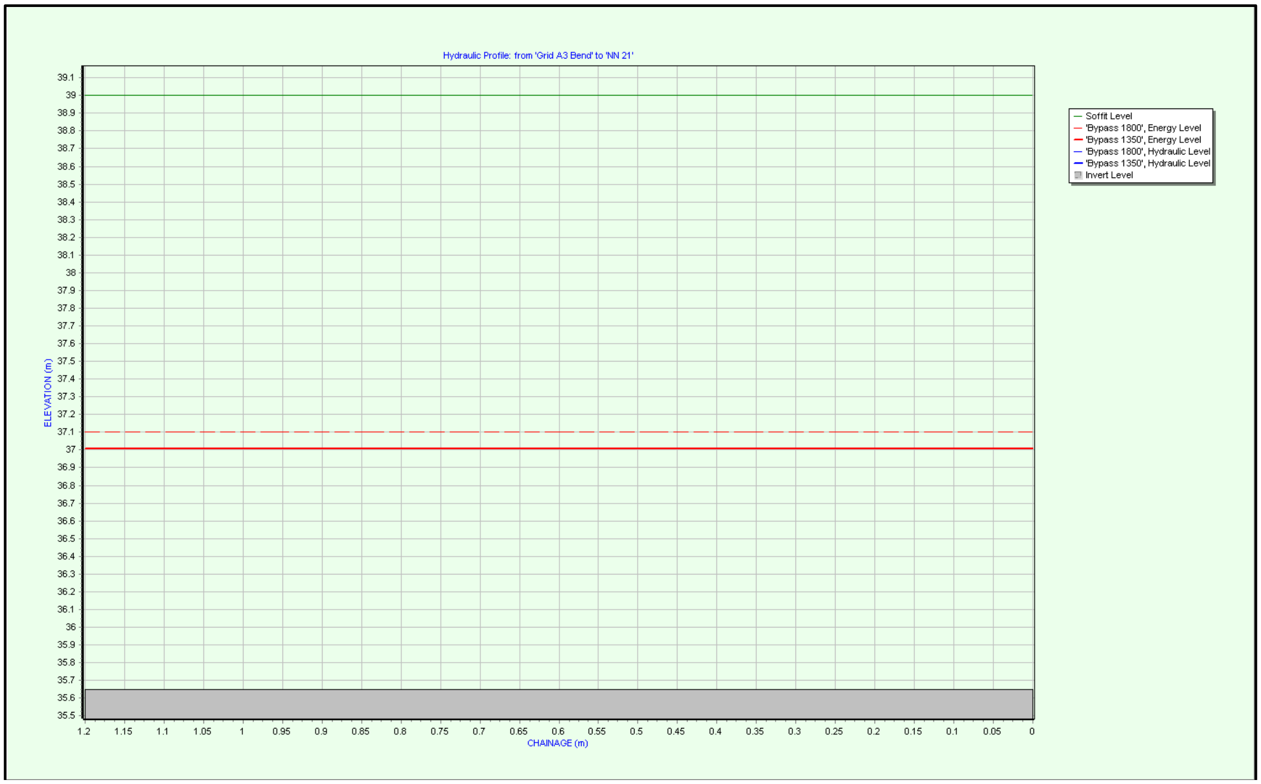
965 OD vert 67bend							
	Null node		1.80000	32.881			
Vertical BP pipe							
	Circular conduit	0.000	1.80000	32.881	32.613	2.737	0.382
		0.000	1.80000	34.962	34.500	3.011	0.462
965 bypass entry							
	Orifice		1.80000	36.034			
Bypass Outlet Box 3							
	Rect. conduit	0.000	0.90279	36.045	36.034	0.453	0.010
		2.500	0.90279	36.045	36.035	0.452	0.010
NN 20							
	Null node		0.90279	36.045			
Bypass Outlet Box 1							
	Rect. conduit	0.000	0.90279	36.060	36.048	0.486	0.012
		0.650	0.90279	36.060	36.048	0.486	0.012
BP Weir Penstck 1							
	RSC weir		0.90279	37.105			
IW Drop Chan_3							
	Rect. conduit	0.000	0.90279	37.105	37.100	0.311	0.005
		1.200	0.90279	37.105	37.100	0.311	0.005
Grid A3 Bend							
	Null node		1.35000	37.105			
Asym OL Channel_1							
	User-defined	0.000	1.35000	37.105	37.088	0.587	0.018
		5.300	1.35000	37.106	37.089	0.586	0.018
GT3 Flow in							
	Inflow		1.35000	37.106			



ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO 'Bypass 1350'						
Bypass Outlet Box 2						
Rect. conduit	0.000	0.67353	35.463	35.445	0.594	0.018
	0.650	0.67353	35.463	35.445	0.594	0.018
BP Weir Penstck 2						
RSC weir		0.67353	37.005			
IW Drop Chan_4						
Rect. conduit	0.000	0.67353	37.005	37.002	0.249	0.003
	1.200	0.67353	37.005	37.002	0.249	0.003
NN 21						
Null node		0.67353	37.005			
IW Drop Chan_1						
Rect. conduit	0.000	0.33750	37.006	37.005	0.125	0.001
	1.200	0.33750	37.006	37.005	0.125	0.001
NN 28_1						
Null node		0.33750	37.006			
Grit Outlet Chan_1						
Rect. conduit	0.000	0.33750	37.264	37.193	1.183	0.071
	5.380	0.33750	37.278	37.237	0.903	0.042
GT 4 Flow in						
Inflow		0.33750	37.278			
SCENARIO 'Bypass 1800'						
Bypass Outlet Box 2						
Rect. conduit	0.000	0.89721	36.050	36.037	0.486	0.012
	0.650	0.89721	36.050	36.038	0.486	0.012
BP Weir Penstck 2						
RSC weir		0.89721	37.103			
IW Drop Chan_4						
Rect. conduit	0.000	0.89721	37.103	37.098	0.310	0.005
	1.200	0.89721	37.103	37.098	0.310	0.005
NN 21						
Null node		0.89721	37.103			
IW Drop Chan_1						
Rect. conduit	0.000	0.45000	37.104	37.103	0.155	0.001
	1.200	0.45000	37.104	37.103	0.155	0.001
NN 28_1						
Null node		0.45000	37.104			
Grit Outlet Chan_1						
Rect. conduit	0.000	0.45000	37.309	37.223	1.302	0.086
	5.380	0.45000	37.324	37.271	1.016	0.053
GT 4 Flow in						
Inflow		0.45000	37.324			



ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO 'Bypass 1350'						
IW Drop Chan_2						
Rect. conduit	0.000	0.33603	37.006	37.005	0.124	0.001
	1.200	0.33603	37.006	37.005	0.124	0.001
SCENARIO 'Bypass 1800'						
IW Drop Chan_2						
Rect. conduit	0.000	0.44721	37.104	37.103	0.154	0.001
	1.200	0.44721	37.105	37.103	0.154	0.001

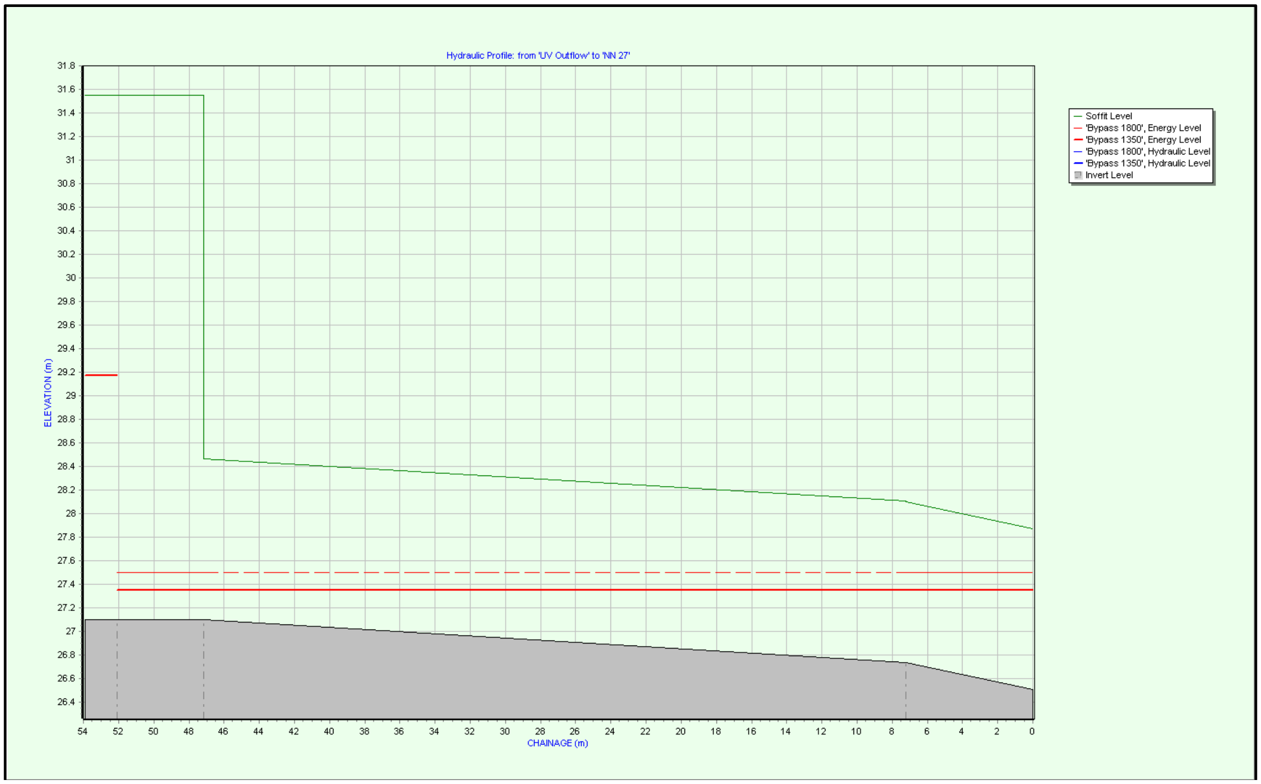


ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO 'Bypass 1350'						
Effluent Pipe 2						
Circular conduit	0.000	0.00000	27.352	27.352	0.000	0.000
	7.200	0.00000	27.352	27.352	0.000	0.000
1420 pipe bend 60						
Null node		0.00000	27.352			
Effluent Pipe 1						
Circular conduit	0.000	0.00000	27.352	27.352	0.000	0.000
	39.950	0.00000	27.352	27.352	0.000	0.000
NN 30						
Null node		0.00000	27.352			
UV Outlet Channel						
Launder channel	0.000	0.00000	27.352	27.352	0.000	0.000
	4.960	0.00000	27.352	27.352	0.000	0.000
Out 1						
Outflow		0.00000	27.352			
NL 15						
Null link	0.000	0.00000	27.352	27.352	0.000	0.000
	0.000	0.00000	27.352	27.352	0.000	0.000
UV Out Weir						
RSC weir		0.00000	29.170			

UV Conduit 4_1						
Rect. conduit	0.000	0.00000	29.170	29.170	0.000	0.000
	1.800	0.00000	29.170	29.170	0.000	0.000
UV Outflow						
Inflow		0.00000	29.170			

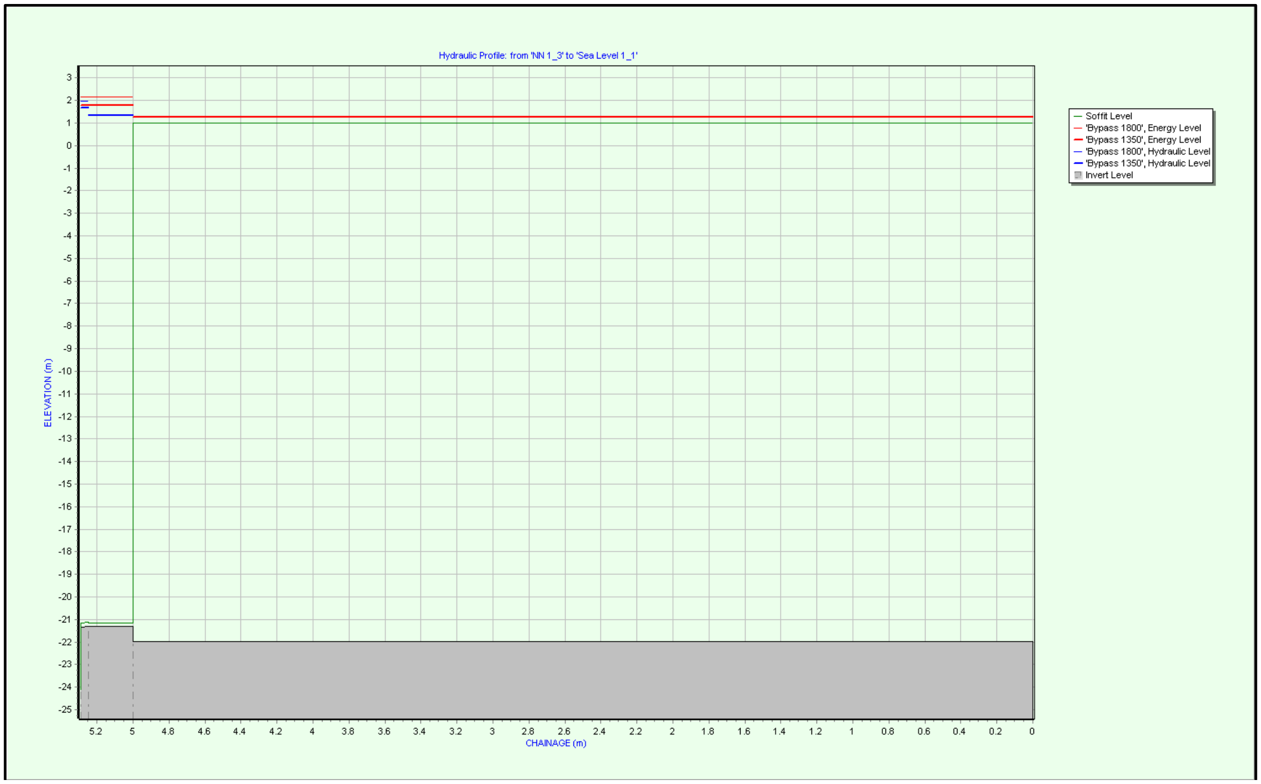
SCENARIO 'Bypass 1800'

Effluent Pipe 2						
Circular conduit	0.000	0.00000	27.499	27.499	0.000	0.000
	7.200	0.00000	27.499	27.499	0.000	0.000
1420 pipe bend 60						
Null node		0.00000	27.499			
Effluent Pipe 1						
Circular conduit	0.000	0.00000	27.499	27.499	0.000	0.000
	39.950	0.00000	27.499	27.499	0.000	0.000
NN 30						
Null node		0.00000	27.499			
UV Outlet Channel						
Launder channel	0.000	0.00000	27.499	27.499	0.000	0.000
	4.960	0.00000	27.499	27.499	0.000	0.000
Out 1						
Outflow		0.00000	27.499			
NL 15						
Null link	0.000	0.00000	27.499	27.499	0.000	0.000
	0.000	0.00000	27.499	27.499	0.000	0.000
UV Out Weir						
RSC weir		0.00000	29.170			
UV Conduit 4_1						
Rect. conduit	0.000	0.00000	29.170	29.170	0.000	0.000
	1.800	0.00000	29.170	29.170	0.000	0.000
UV Outflow						
Inflow		0.00000	29.170			



ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO 'Bypass 1350'						
Water Column 1_24						
Rect. conduit	0.000	0.04796	1.277	1.277	0.000	0.000
	5.000	0.04796	1.277	1.277	0.000	0.000
NN 20_24						
Null node		0.04796	1.277			
Diffuser Type_11						
Circular conduit	0.000	0.04796	1.763	1.321	2.945	0.442
	0.250	0.04796	1.780	1.338	2.945	0.442
NN 26_24						
Null node		0.04796	1.780			
Diffuser Type_10						
Circular conduit	0.000	0.04796	1.780	1.671	1.467	0.110
	0.040	0.04796	1.805	1.671	1.467	0.110
NN 27_24						
Null node		0.04796	1.805			
Riser 6						
Circular conduit	0.000	0.04796	1.807	1.806	0.178	0.002
	0.000	0.04796	1.855	1.806	0.178	0.002
SCENARIO 'Bypass 1800'						
Water Column 1_24						
Rect. conduit	0.000	0.06393	1.277	1.277	0.001	0.000
	5.000	0.06393	1.277	1.277	0.001	0.000

NN 20_24							
	Null node		0.06393	1.277			
Diffuser Type_11							
	Circular conduit	0.000	0.06393	2.141	1.356	3.926	0.786
		0.250	0.06393	2.171	1.385	3.926	0.786
NN 26_24							
	Null node		0.06393	2.171			
Diffuser Type_10							
	Circular conduit	0.000	0.06393	2.171	1.976	1.956	0.195
		0.040	0.06393	2.216	1.977	1.956	0.195
NN 27_24							
	Null node		0.06393	2.216			
Riser 6							
	Circular conduit	0.000	0.06393	2.219	2.216	0.238	0.003
		0.000	0.06393	2.304	2.217	0.238	0.003

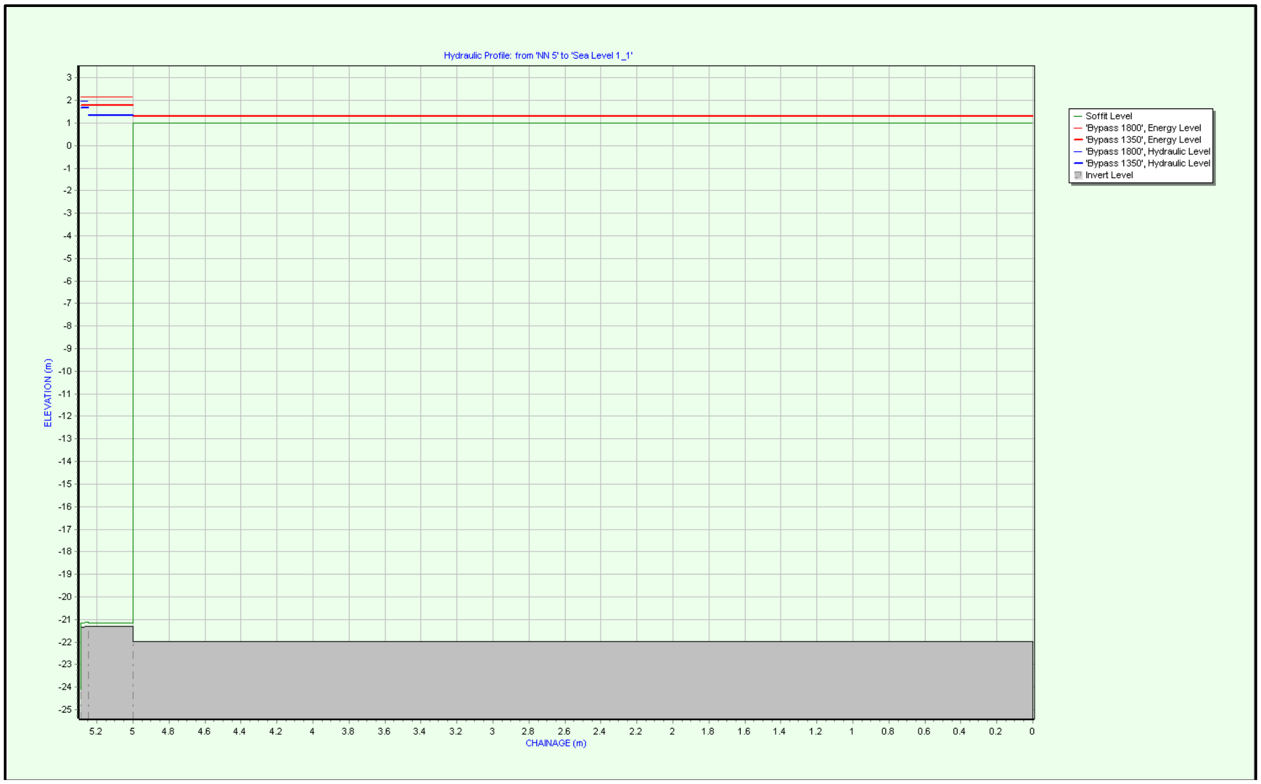


ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
<u>SCENARIO 'Bypass 1350'</u>							
Water Column 1_26							
	Rect. conduit	0.000	0.04790	1.277	1.277	0.000	0.000
		5.000	0.04790	1.277	1.277	0.000	0.000
NN 20_26							
	Null node		0.04790	1.277			

Diffuser Type_19						
Circular conduit	0.000	0.04790	1.762	1.321	2.941	0.441
	0.250	0.04790	1.779	1.338	2.941	0.441
NN 26_26						
Null node		0.04790	1.779			
Diffuser Type_18						
Circular conduit	0.000	0.04790	1.779	1.669	1.465	0.109
	0.040	0.04790	1.804	1.670	1.465	0.109
NN 27_28						
Null node		0.04790	1.804			
Riser 2						
Circular conduit	0.000	0.04790	1.806	1.804	0.178	0.002
	0.000	0.04790	1.873	1.805	0.178	0.002

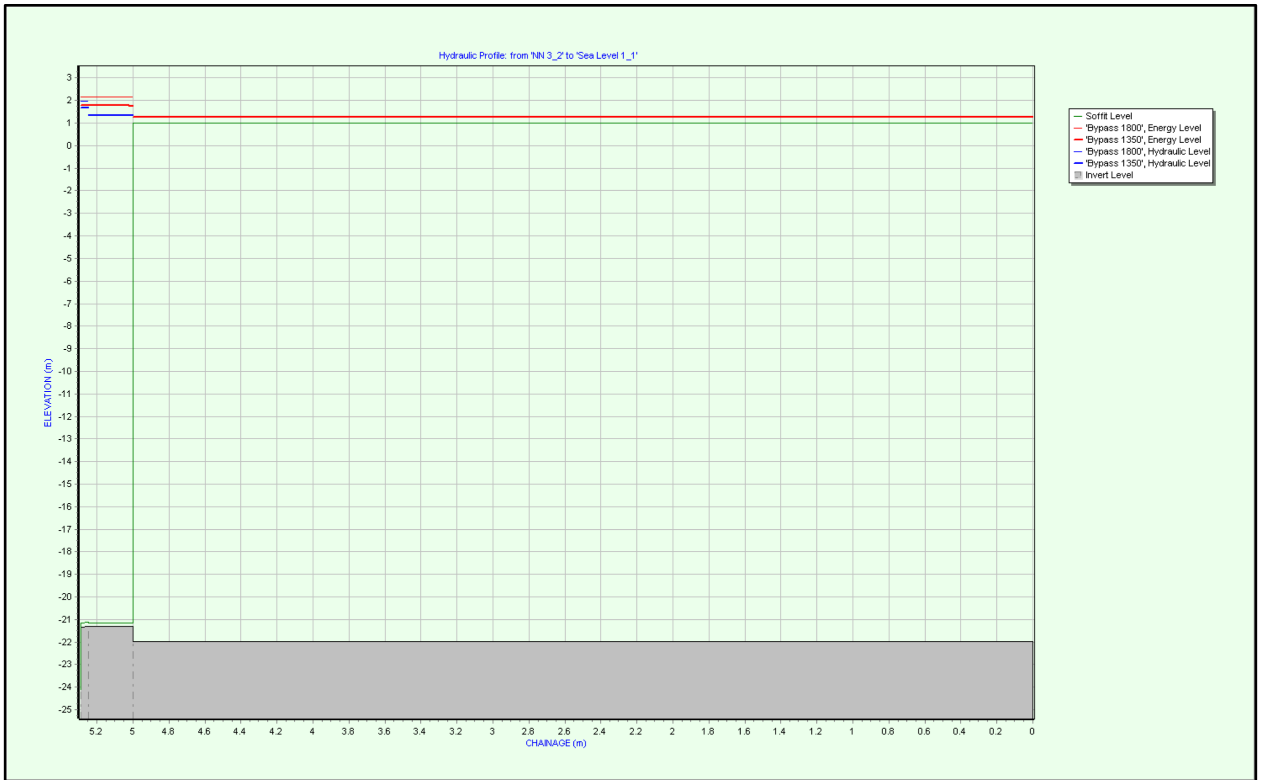
SCENARIO 'Bypass 1800'

Water Column 1_26						
Rect. conduit	0.000	0.06384	1.277	1.277	0.001	0.000
	5.000	0.06384	1.277	1.277	0.001	0.000
NN 20_26						
Null node		0.06384	1.277			
Diffuser Type_19						
Circular conduit	0.000	0.06384	2.139	1.355	3.920	0.784
	0.250	0.06384	2.169	1.385	3.920	0.784
NN 26_26						
Null node		0.06384	2.169			
Diffuser Type_18						
Circular conduit	0.000	0.06384	2.169	1.974	1.953	0.195
	0.040	0.06384	2.213	1.975	1.953	0.195
NN 27_28						
Null node		0.06384	2.213			
Riser 2						
Circular conduit	0.000	0.06384	2.217	2.214	0.238	0.003
	0.000	0.06384	2.336	2.214	0.238	0.003



ID / TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
<u>SCENARIO 'Bypass 1350'</u>						
Water Column 1_19						
Rect. conduit	0.000	0.04803	1.277	1.277	0.000	0.000
	5.000	0.04803	1.277	1.277	0.000	0.000
NN 20_19						
Null node		0.04803	1.277			
Diffuser Type 1a_6						
Circular conduit	0.000	0.04803	1.765	1.321	2.949	0.443
	0.250	0.04803	1.782	1.338	2.949	0.443
NN 26_19						
Null node		0.04803	1.782			
Diffuser Type 1b_6						
Circular conduit	0.000	0.04803	1.782	1.672	1.469	0.110
	0.040	0.04803	1.807	1.672	1.469	0.110
NN 27_19						
Null node		0.04803	1.807			
Riser 8						
Circular conduit	0.000	0.04803	1.809	1.807	0.179	0.002
	0.000	0.04803	1.848	1.807	0.179	0.002
<u>SCENARIO 'Bypass 1800'</u>						
Water Column 1_19						
Rect. conduit	0.000	0.06404	1.277	1.277	0.001	0.000
	5.000	0.06404	1.277	1.277	0.001	0.000

NN 20_19							
	Null node		0.06404	1.277			
Diffuser Type 1a_6							
	Circular conduit	0.000	0.06404	2.144	1.356	3.932	0.788
		0.250	0.06404	2.174	1.386	3.932	0.788
NN 26_19							
	Null node		0.06404	2.174			
Diffuser Type 1b_6							
	Circular conduit	0.000	0.06404	2.174	1.978	1.959	0.196
		0.040	0.06404	2.219	1.979	1.959	0.196
NN 27_19							
	Null node		0.06404	2.219			
Riser 8							
	Circular conduit	0.000	0.06404	2.222	2.219	0.238	0.003
		0.000	0.06404	2.292	2.220	0.238	0.003

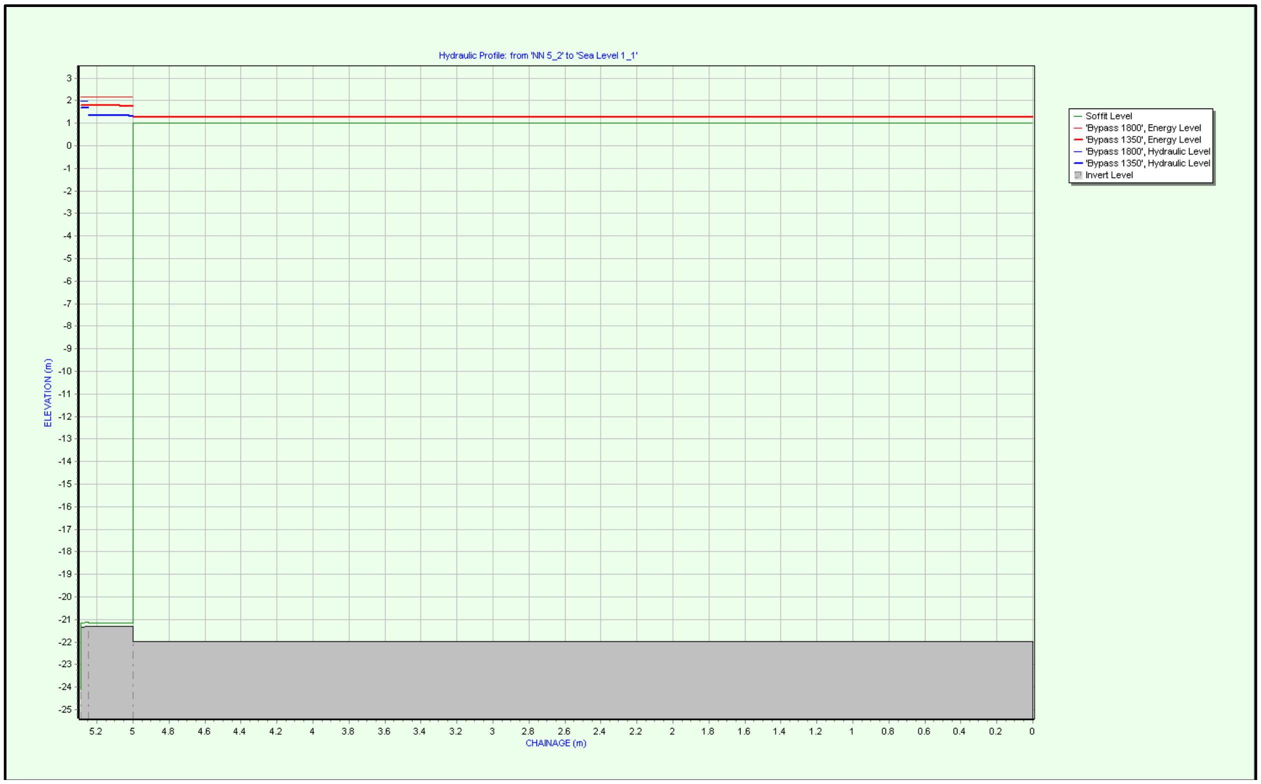


ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
<u>SCENARIO 'Bypass 1350'</u>							
Water Column 1_18							
	Rect. conduit	0.000	0.04814	1.277	1.277	0.000	0.000
		5.000	0.04814	1.277	1.277	0.000	0.000
NN 20_18							
	Null node		0.04814	1.277			

Diffuser Type 1a_5						
Circular conduit	0.000	0.04814	1.767	1.322	2.956	0.446
	0.250	0.04814	1.784	1.339	2.956	0.446
NN 26_18						
Null node		0.04814	1.784			
Diffuser Type 1b_5						
Circular conduit	0.000	0.04814	1.784	1.673	1.473	0.111
	0.040	0.04814	1.809	1.674	1.473	0.111
NN 27_18						
Null node		0.04814	1.809			
Riser 10						
Circular conduit	0.000	0.04814	1.811	1.810	0.179	0.002
	0.000	0.04814	1.843	1.810	0.179	0.002

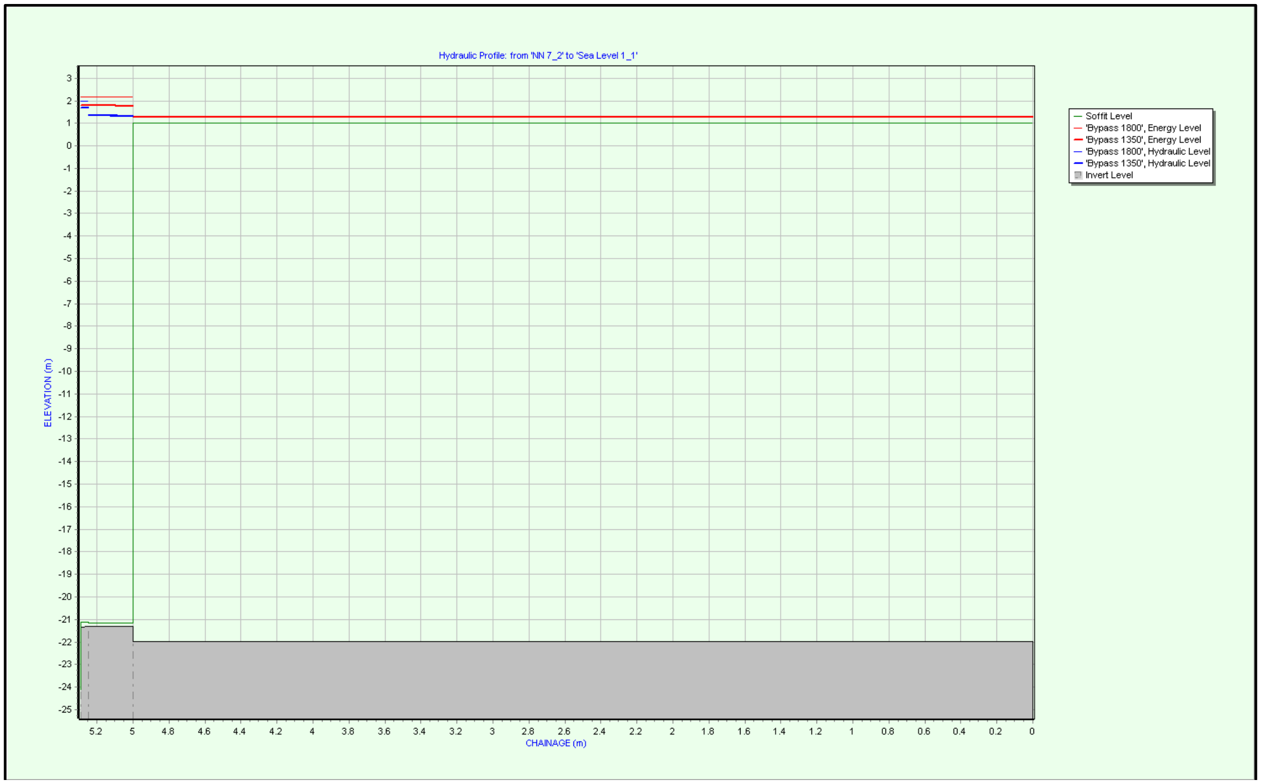
SCENARIO 'Bypass 1800'

Water Column 1_18						
Rect. conduit	0.000	0.06419	1.277	1.277	0.001	0.000
	5.000	0.06419	1.277	1.277	0.001	0.000
NN 20_18						
Null node		0.06419	1.277			
Diffuser Type 1a_5						
Circular conduit	0.000	0.06419	2.148	1.356	3.941	0.792
	0.250	0.06419	2.178	1.386	3.941	0.792
NN 26_18						
Null node		0.06419	2.178			
Diffuser Type 1b_5						
Circular conduit	0.000	0.06419	2.178	1.982	1.964	0.197
	0.040	0.06419	2.223	1.982	1.964	0.197
NN 27_18						
Null node		0.06419	2.223			
Riser 10						
Circular conduit	0.000	0.06419	2.227	2.224	0.239	0.003
	0.000	0.06419	2.283	2.224	0.239	0.003



ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
<u>SCENARIO 'Bypass 1350'</u>						
Water Column 2_17						
Rect. conduit	0.000	0.05526	1.277	1.277	0.000	0.000
	5.000	0.05526	1.277	1.277	0.000	0.000
NN 21_17						
Null node		0.05526	1.277			
Diffuser Type 2a_4						
Circular conduit	0.000	0.05526	1.771	1.322	2.967	0.449
	0.250	0.05526	1.786	1.338	2.967	0.449
NN 30_17						
Null node		0.05526	1.786			
Diffuser Type 2b_4						
Circular conduit	0.000	0.05526	1.786	1.666	1.536	0.120
	0.040	0.05526	1.805	1.666	1.536	0.120
NN 27_17						
Null node		0.10357	1.805			
Riser 12						
Circular conduit	0.000	0.10357	1.814	1.806	0.385	0.008
	0.000	0.10357	1.840	1.807	0.385	0.008
<u>SCENARIO 'Bypass 1800'</u>						
Water Column 2_17						
Rect. conduit	0.000	0.07368	1.277	1.277	0.001	0.000
	5.000	0.07368	1.277	1.277	0.001	0.000

NN 21_17							
	Null node		0.07368	1.277			
Diffuser Type 2a_4							
	Circular conduit	0.000	0.07368	2.155	1.357	3.956	0.798
		0.250	0.07368	2.182	1.385	3.956	0.798
NN 30_17							
	Null node		0.07368	2.182			
Diffuser Type 2b_4							
	Circular conduit	0.000	0.07368	2.182	1.968	2.048	0.214
		0.040	0.07368	2.215	1.969	2.048	0.214
NN 27_17							
	Null node		0.13810	2.215			
Riser 12							
	Circular conduit	0.000	0.13810	2.231	2.218	0.514	0.013
		0.000	0.13810	2.278	2.219	0.514	0.013

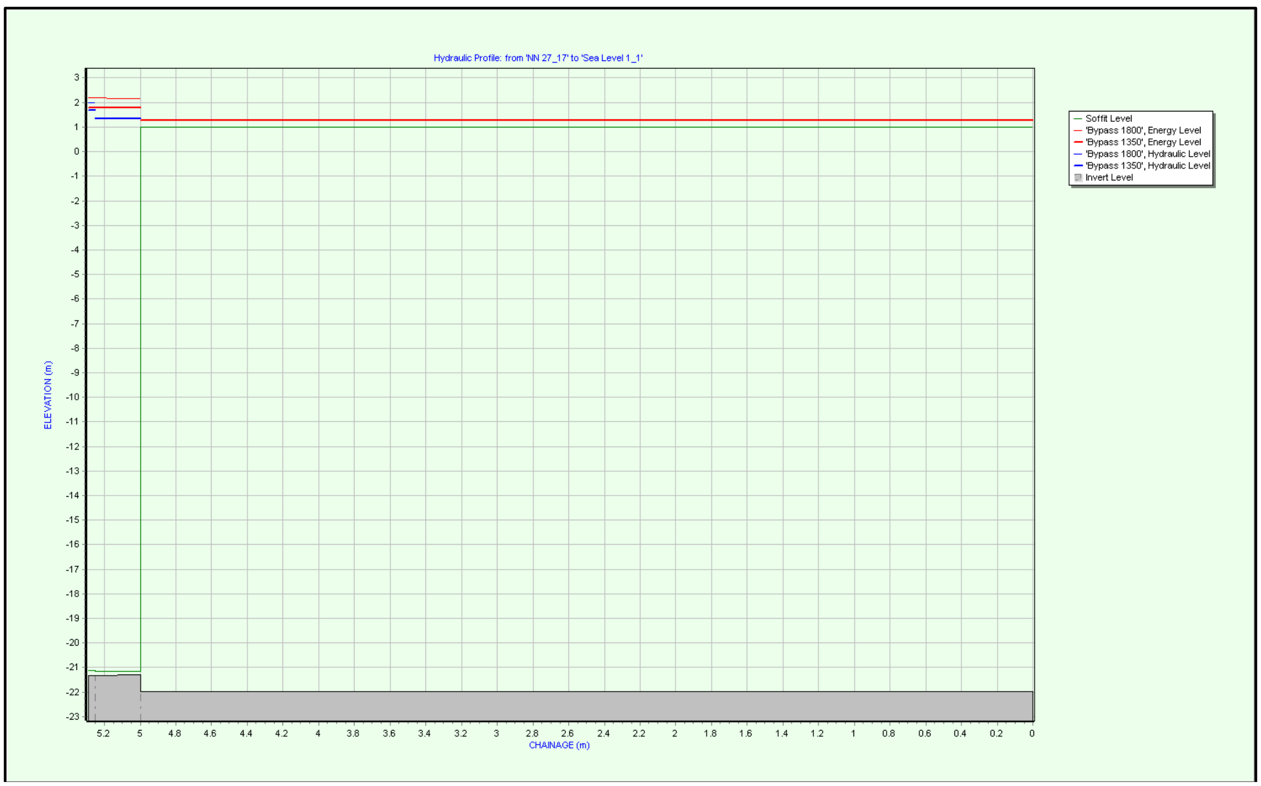


ID				TOTAL	HYDRAULIC		VEL.
	TYPE	DISTANCE	FLOW	ENERGY	GRADE	VELOCITY	HEAD
		m	m³/s	m	m	m/s	m
<u>SCENARIO 'Bypass 1350'</u>							
Water Column 1_17							
	Rect. conduit	0.000	0.04831	1.277	1.277	0.000	0.000
		5.000	0.04831	1.277	1.277	0.000	0.000
NN 20_17							
	Null node		0.04831	1.277			

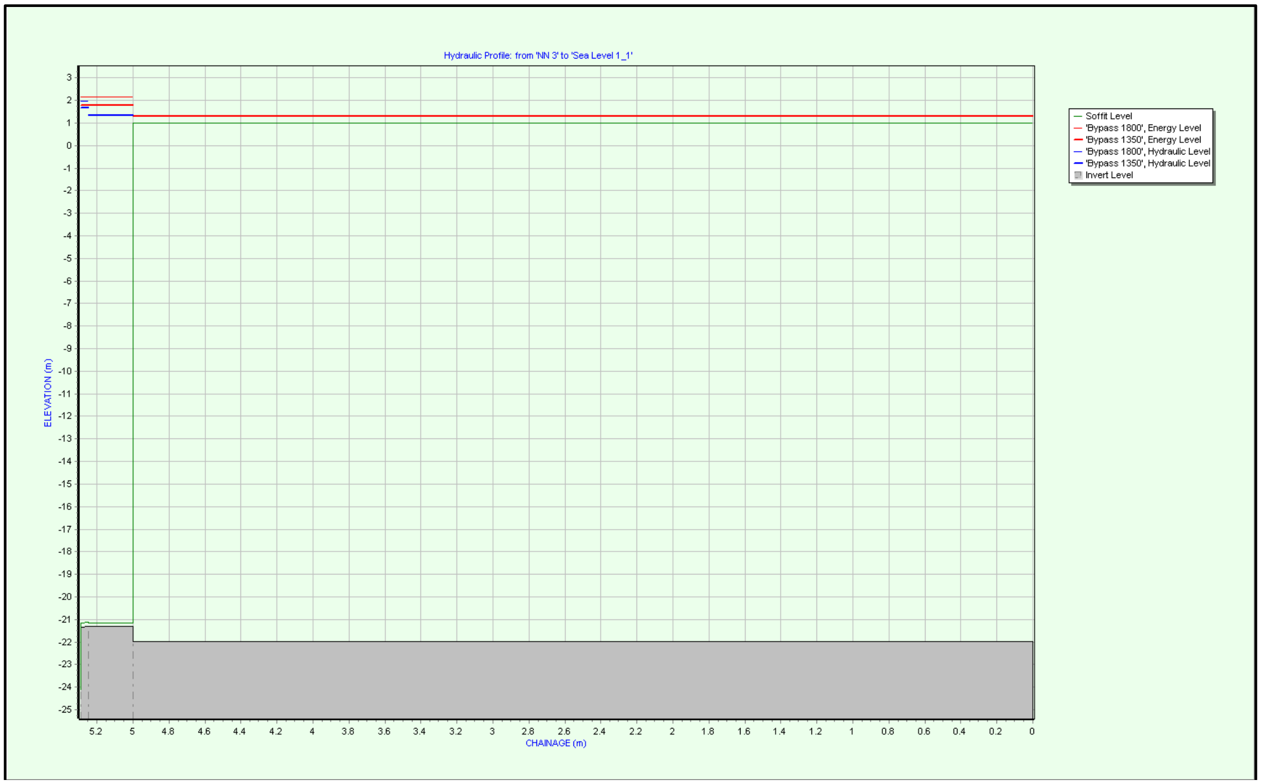
Diffuser Type 1a_4							
	Circular conduit	0.000	0.04831	1.771	1.322	2.966	0.449
		0.250	0.04831	1.788	1.339	2.966	0.449
NN 26_17							
	Null node		0.04831	1.788			
Diffuser Type 1b_4							
	Circular conduit	0.000	0.04831	1.788	1.676	1.478	0.111
		0.040	0.04831	1.805	1.677	1.478	0.111

SCENARIO 'Bypass 1800'

Water Column 1_17							
	Rect. conduit	0.000	0.06442	1.277	1.277	0.001	0.000
		5.000	0.06442	1.277	1.277	0.001	0.000
NN 20_17							
	Null node		0.06442	1.277			
Diffuser Type 1a_4							
	Circular conduit	0.000	0.06442	2.155	1.357	3.956	0.798
		0.250	0.06442	2.185	1.387	3.956	0.798
NN 26_17							
	Null node		0.06442	2.185			
Diffuser Type 1b_4							
	Circular conduit	0.000	0.06442	2.185	1.987	1.971	0.198
		0.040	0.06442	2.215	1.988	1.971	0.198

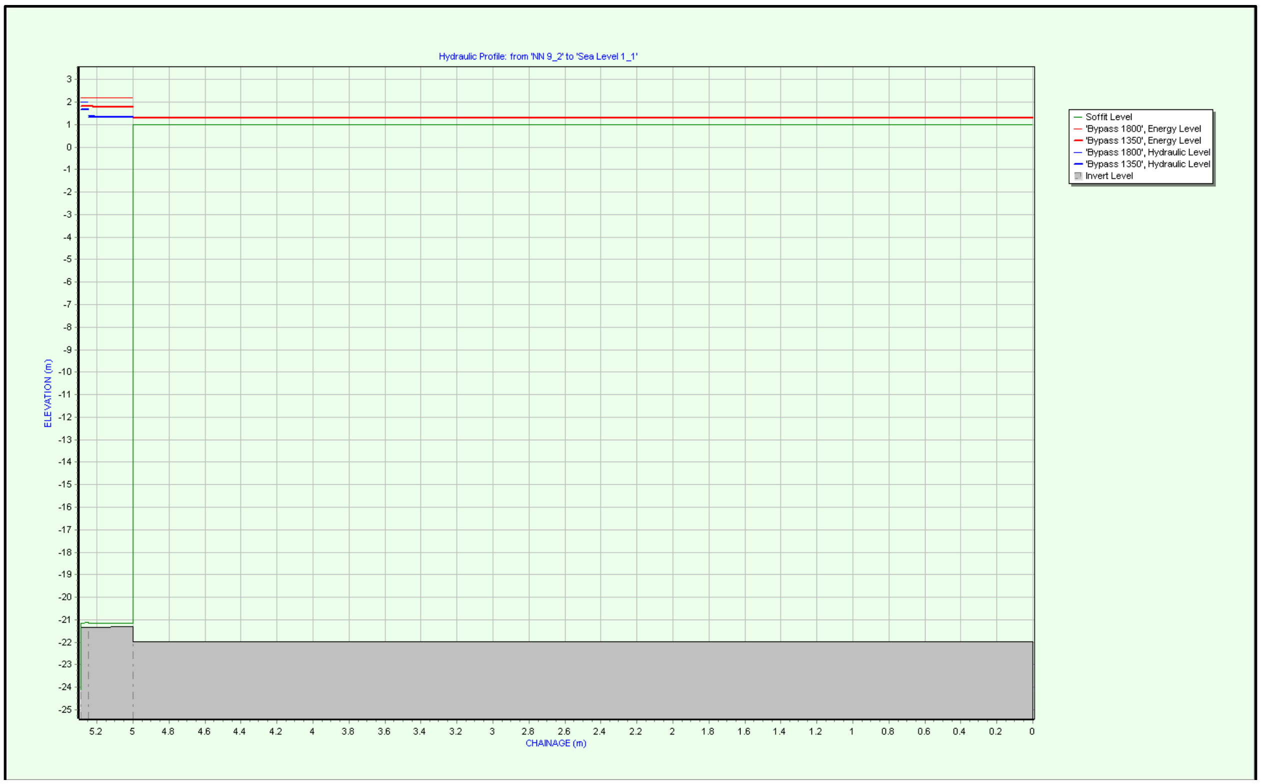


ID			TOTAL	HYDRAULIC		VEL.
TYPE	DISTANCE	FLOW	ENERGY	GRADE	VELOCITY	HEAD
	m	m³/s	m	m	m/s	m
SCENARIO 'Bypass 1350'						
Water Column 1_25						
Rect. conduit	0.000	0.04791	1.277	1.277	0.000	0.000
	5.000	0.04791	1.277	1.277	0.000	0.000
NN 20_25						
Null node		0.04791	1.277			
Diffuser Type_15						
Circular conduit	0.000	0.04791	1.762	1.321	2.942	0.441
	0.250	0.04791	1.779	1.338	2.942	0.441
NN 26_25						
Null node		0.04791	1.779			
Diffuser Type_12						
Circular conduit	0.000	0.04791	1.779	1.670	1.466	0.110
	0.040	0.04791	1.804	1.670	1.466	0.110
NN 27_26						
Null node		0.04791	1.804			
Riser 4						
Circular conduit	0.000	0.04791	1.806	1.805	0.178	0.002
	0.000	0.04791	1.863	1.805	0.178	0.002
SCENARIO 'Bypass 1800'						
Water Column 1_25						
Rect. conduit	0.000	0.06386	1.277	1.277	0.001	0.000
	5.000	0.06386	1.277	1.277	0.001	0.000
NN 20_25						
Null node		0.06386	1.277			
Diffuser Type_15						
Circular conduit	0.000	0.06386	2.139	1.355	3.921	0.784
	0.250	0.06386	2.169	1.385	3.921	0.784
NN 26_25						
Null node		0.06386	2.169			
Diffuser Type_12						
Circular conduit	0.000	0.06386	2.169	1.975	1.954	0.195
	0.040	0.06386	2.214	1.975	1.954	0.195
NN 27_26						
Null node		0.06386	2.214			
Riser 4						
Circular conduit	0.000	0.06386	2.217	2.214	0.238	0.003
	0.000	0.06386	2.319	2.215	0.238	0.003



ID	TYPE	DISTANCE m	FLOW m^3/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO 'Bypass 1350'							
Water Column 2_16	Rect. conduit	0.000	0.05578	1.277	1.277	0.000	0.000
		5.000	0.05578	1.277	1.277	0.000	0.000
NN 21_16	Null node		0.05578	1.277			
Diffuser Type 2a_3	Circular conduit	0.000	0.05578	1.780	1.323	2.995	0.457
		0.250	0.05578	1.796	1.339	2.995	0.457
NN 30_16	Null node		0.05578	1.796			
Diffuser Type 2b_3	Circular conduit	0.000	0.05578	1.796	1.673	1.551	0.123
		0.040	0.05578	1.815	1.674	1.551	0.123
NN 27_16	Null node		0.10454	1.815			
Riser 14	Circular conduit	0.000	0.10454	1.824	1.816	0.389	0.008
		0.000	0.10454	1.839	1.817	0.389	0.008
SCENARIO 'Bypass 1800'							
Water Column 2_16	Rect. conduit	0.000	0.07438	1.277	1.277	0.001	0.000
		5.000	0.07438	1.277	1.277	0.001	0.000

NN 21_16							
	Null node		0.07438	1.277			
Diffuser Type 2a_3							
	Circular conduit	0.000	0.07438	2.171	1.358	3.993	0.813
		0.250	0.07438	2.200	1.387	3.993	0.813
NN 30_16							
	Null node		0.07438	2.200			
Diffuser Type 2b_3							
	Circular conduit	0.000	0.07438	2.200	1.982	2.068	0.218
		0.040	0.07438	2.233	1.982	2.068	0.218
NN 27_16							
	Null node		0.13941	2.233			
Riser 14							
	Circular conduit	0.000	0.13941	2.250	2.236	0.519	0.014
		0.000	0.13941	2.276	2.237	0.519	0.014

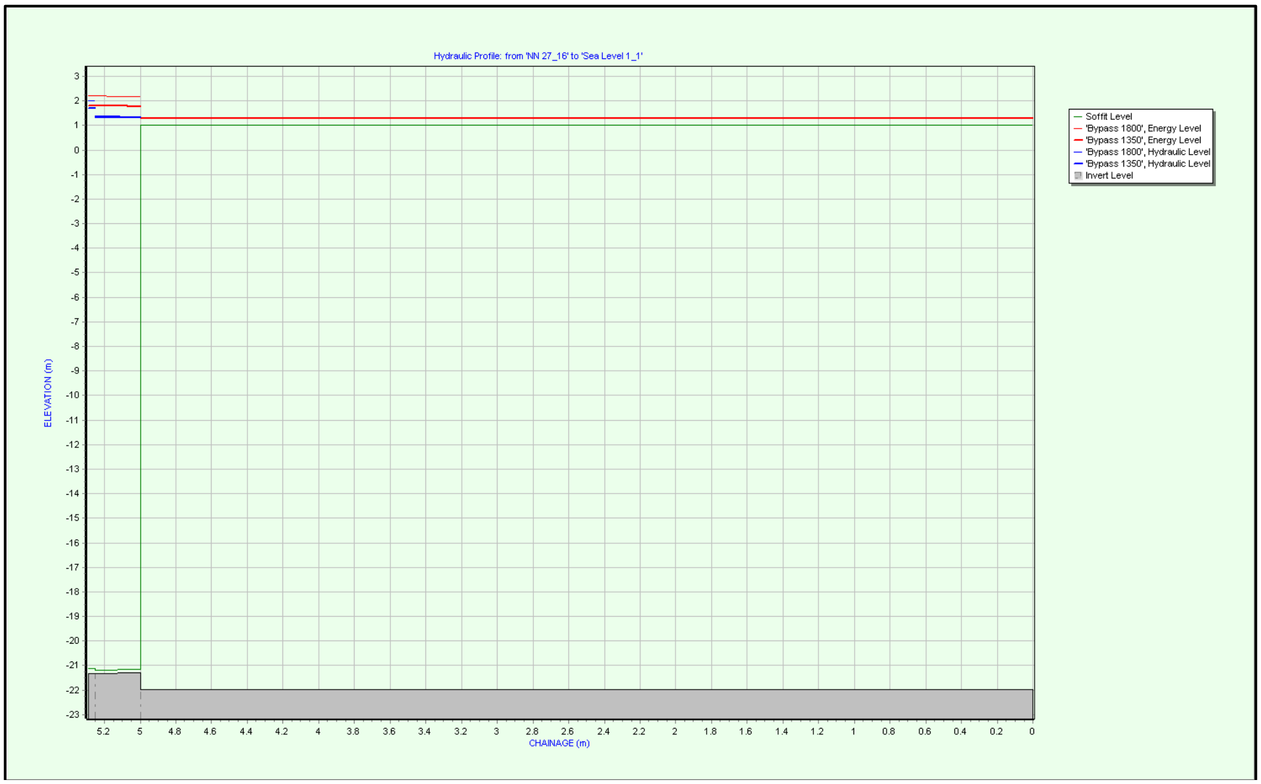


ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
<u>SCENARIO 'Bypass 1350'</u>							
Water Column 1_16							
	Rect. conduit	0.000	0.04877	1.277	1.277	0.000	0.000
		5.000	0.04877	1.277	1.277	0.000	0.000
NN 20_16							
	Null node		0.04877	1.277			

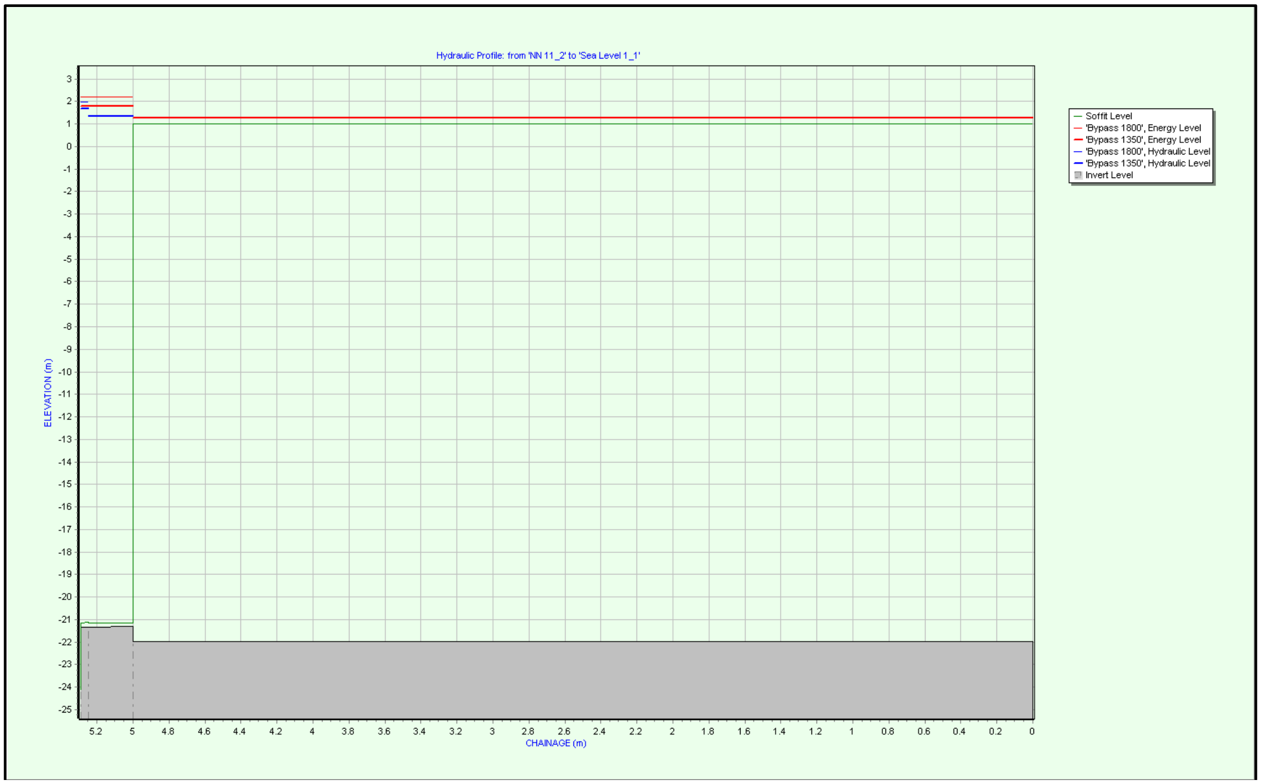
Diffuser Type 1a_3							
	Circular conduit	0.000	0.04877	1.780	1.323	2.994	0.457
		0.250	0.04877	1.797	1.340	2.994	0.457
NN 26_16							
	Null node		0.04877	1.797			
Diffuser Type 1b_3							
	Circular conduit	0.000	0.04877	1.797	1.684	1.492	0.114
		0.040	0.04877	1.815	1.684	1.492	0.114

SCENARIO 'Bypass 1800'

Water Column 1_16							
	Rect. conduit	0.000	0.06503	1.277	1.277	0.001	0.000
		5.000	0.06503	1.277	1.277	0.001	0.000
NN 20_16							
	Null node		0.06503	1.277			
Diffuser Type 1a_3							
	Circular conduit	0.000	0.06503	2.171	1.358	3.993	0.813
		0.250	0.06503	2.202	1.389	3.993	0.813
NN 26_16							
	Null node		0.06503	2.202			
Diffuser Type 1b_3							
	Circular conduit	0.000	0.06503	2.202	2.000	1.990	0.202
		0.040	0.06503	2.233	2.001	1.990	0.202

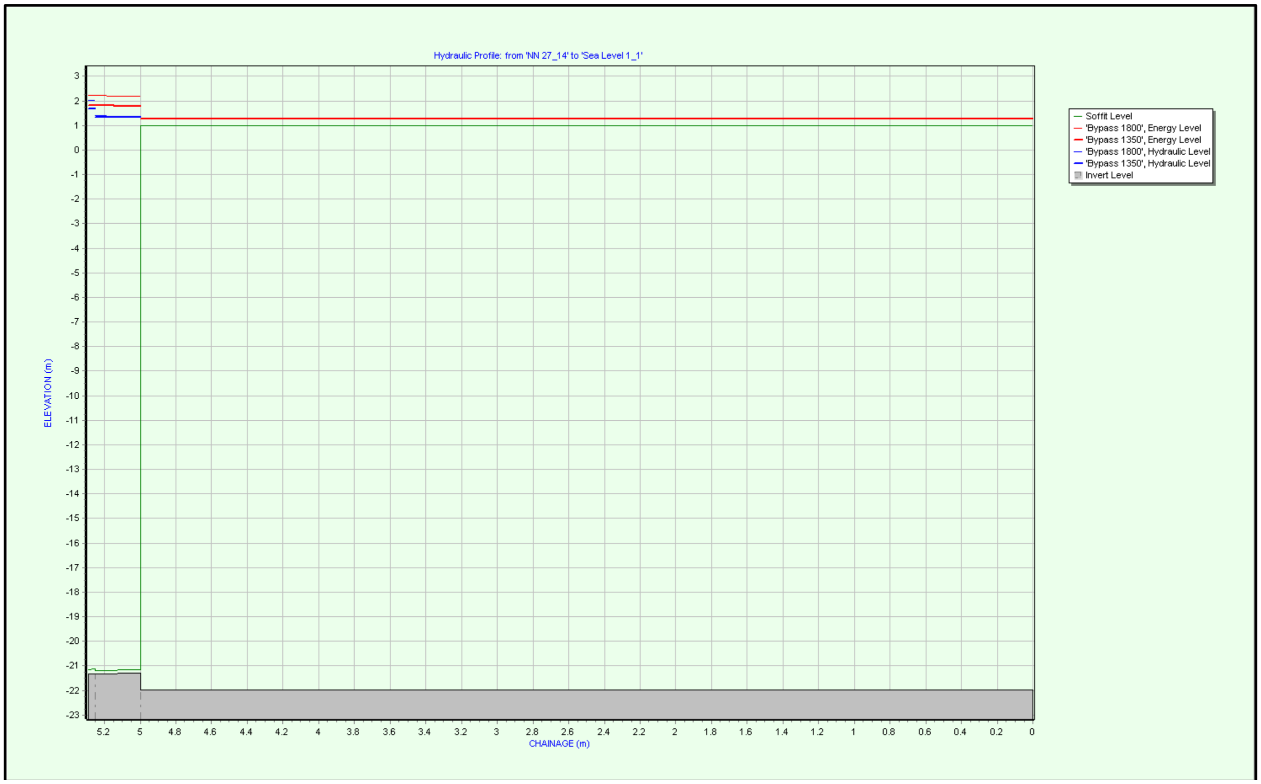


ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
<u>SCENARIO 'Bypass 1350'</u>						
Water Column 2_14						
Rect. conduit	0.000	0.05613	1.277	1.277	0.000	0.000
	5.000	0.05613	1.277	1.277	0.000	0.000
NN 21_14						
Null node		0.05613	1.277			
Diffuser Type 2a_2						
Circular conduit	0.000	0.05613	1.786	1.323	3.013	0.463
	0.250	0.05613	1.803	1.340	3.013	0.463
NN 30_14						
Null node		0.05613	1.803			
Diffuser Type 2b_2						
Circular conduit	0.000	0.05613	1.803	1.678	1.561	0.124
	0.040	0.05613	1.822	1.679	1.561	0.124
NN 27_14						
Null node		0.10521	1.822			
Riser 16						
Circular conduit	0.000	0.10521	1.831	1.823	0.391	0.008
	0.000	0.10521	1.839	1.824	0.391	0.008
<u>SCENARIO 'Bypass 1800'</u>						
Water Column 2_14						
Rect. conduit	0.000	0.07485	1.277	1.277	0.001	0.000
	5.000	0.07485	1.277	1.277	0.001	0.000
NN 21_14						
Null node		0.07485	1.277			
Diffuser Type 2a_2						
Circular conduit	0.000	0.07485	2.183	1.359	4.019	0.823
	0.250	0.07485	2.211	1.388	4.019	0.823
NN 30_14						
Null node		0.07485	2.211			
Diffuser Type 2b_2						
Circular conduit	0.000	0.07485	2.211	1.991	2.081	0.221
	0.040	0.07485	2.245	1.991	2.081	0.221
NN 27_14						
Null node		0.14030	2.245			
Riser 16						
Circular conduit	0.000	0.14030	2.262	2.248	0.522	0.014
	0.000	0.14030	2.276	2.249	0.522	0.014



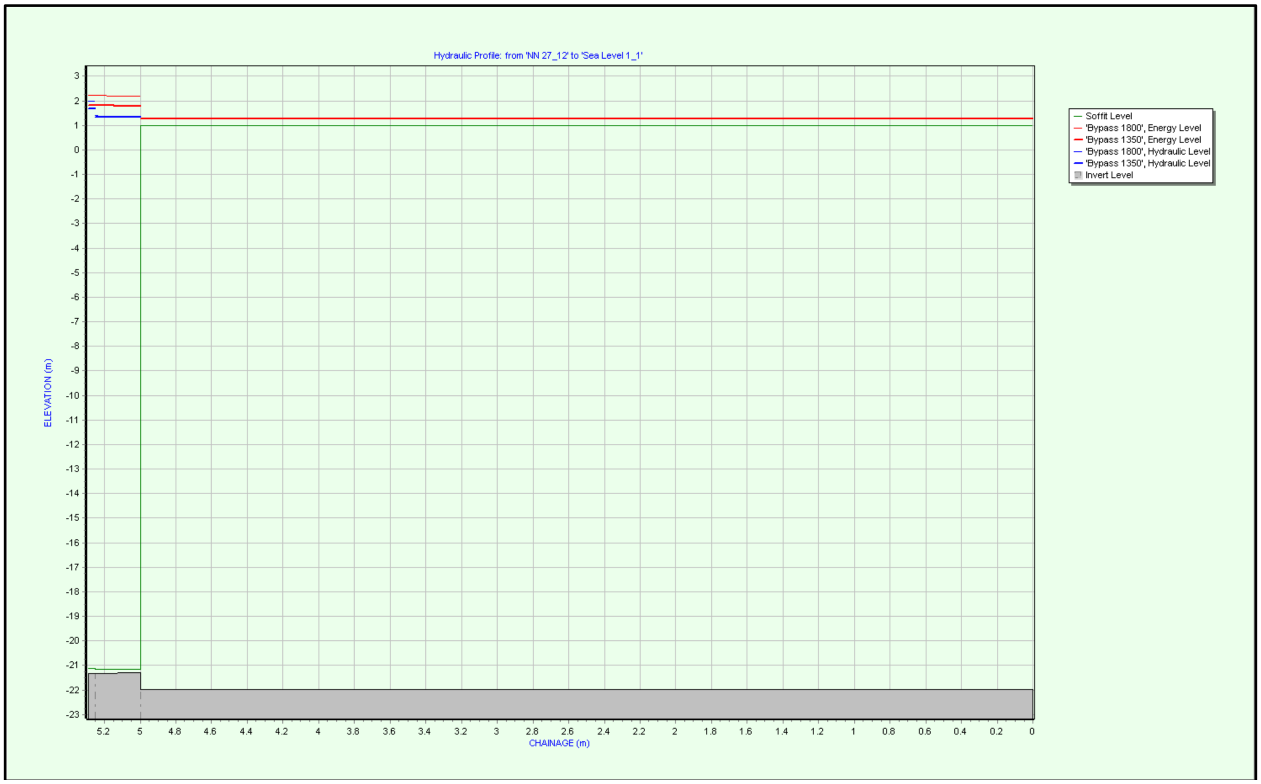
ID / TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO 'Bypass 1350'						
Water Column 1_14						
Rect. conduit	0.000	0.04908	1.277	1.277	0.000	0.000
	5.000	0.04908	1.277	1.277	0.000	0.000
NN 20_14						
Null node		0.04908	1.277			
Diffuser Type 1a_2						
Circular conduit	0.000	0.04908	1.786	1.323	3.013	0.463
	0.250	0.04908	1.804	1.341	3.013	0.463
NN 26_14						
Null node		0.04908	1.804			
Diffuser Type 1b_2						
Circular conduit	0.000	0.04908	1.804	1.689	1.501	0.115
	0.040	0.04908	1.822	1.689	1.501	0.115
SCENARIO 'Bypass 1800'						
Water Column 1_14						
Rect. conduit	0.000	0.06545	1.277	1.277	0.001	0.000
	5.000	0.06545	1.277	1.277	0.001	0.000
NN 20_14						
Null node		0.06545	1.277			
Diffuser Type 1a_2						
Circular conduit	0.000	0.06545	2.183	1.359	4.019	0.823
	0.250	0.06545	2.214	1.391	4.019	0.823

NN 26_14							
	Null node		0.06545	2.214			
Diffuser Type 1b_2							
	Circular conduit	0.000	0.06545	2.214	2.010	2.002	0.204
		0.040	0.06545	2.245	2.010	2.002	0.204



ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO 'Bypass 1350'							
Water Column 2_12							
	Rect. conduit	0.000	0.05629	1.277	1.277	0.000	0.000
		5.000	0.05629	1.277	1.277	0.000	0.000
NN 21_12							
	Null node		0.05629	1.277			
Diffuser Type 2a_1							
	Circular conduit	0.000	0.05629	1.789	1.324	3.022	0.466
		0.250	0.05629	1.806	1.340	3.022	0.466
NN 30_12							
	Null node		0.05629	1.806			
Diffuser Type 2b_1							
	Circular conduit	0.000	0.05629	1.806	1.681	1.565	0.125
		0.040	0.05629	1.825	1.681	1.565	0.125
SCENARIO 'Bypass 1800'							
Water Column 2_12							
	Rect. conduit	0.000	0.07506	1.277	1.277	0.001	0.000
		5.000	0.07506	1.277	1.277	0.001	0.000

NN 21_12							
	Null node		0.07506	1.277			
Diffuser Type 2a_1							
	Circular conduit	0.000	0.07506	2.188	1.360	4.030	0.828
		0.250	0.07506	2.217	1.389	4.030	0.828
NN 30_12							
	Null node		0.07506	2.217			
Diffuser Type 2b_1							
	Circular conduit	0.000	0.07506	2.217	1.995	2.087	0.222
		0.040	0.07506	2.251	1.995	2.087	0.222

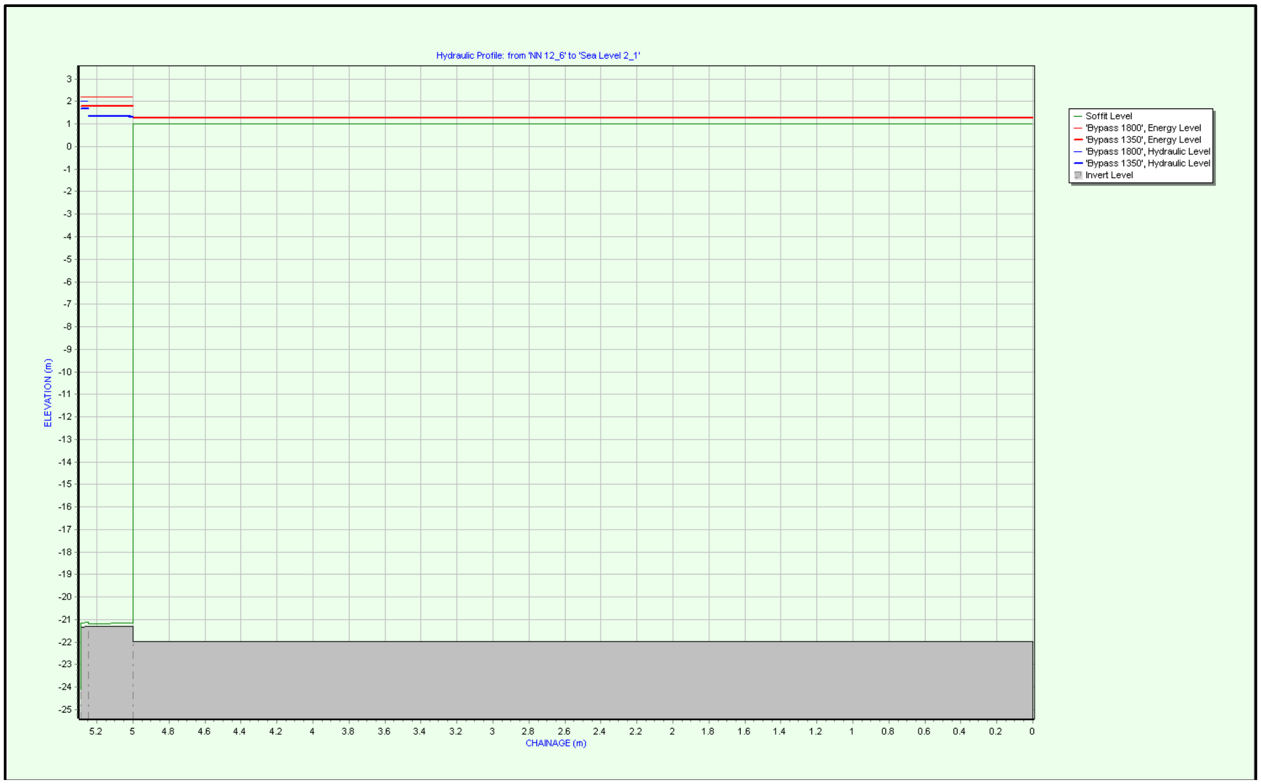


ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
<u>SCENARIO 'Bypass 1350'</u>							
Sea Level 2_1							
	Depth control		0.69124	1.277			
Water Column 1_13							
	Rect. conduit	0.000	0.04917	1.277	1.277	0.000	0.000
		5.000	0.04917	1.277	1.277	0.000	0.000
NN 20_13							
	Null node		0.04917	1.277			
Diffuser Type 1a_7							
	Circular conduit	0.000	0.04917	1.788	1.323	3.019	0.465
		0.250	0.04917	1.806	1.341	3.019	0.465
NN 26_13							
	Null node		0.04917	1.806			

Diffuser Type 1b_7						
Circular conduit	0.000	0.04917	1.806	1.691	1.504	0.115
	0.040	0.04917	1.824	1.691	1.504	0.115
NN 27_13						
Null node		0.10541	1.824			
Riser 17						
Circular conduit	0.000	0.10541	1.833	1.825	0.392	0.008
	0.000	0.10541	1.839	1.826	0.392	0.008

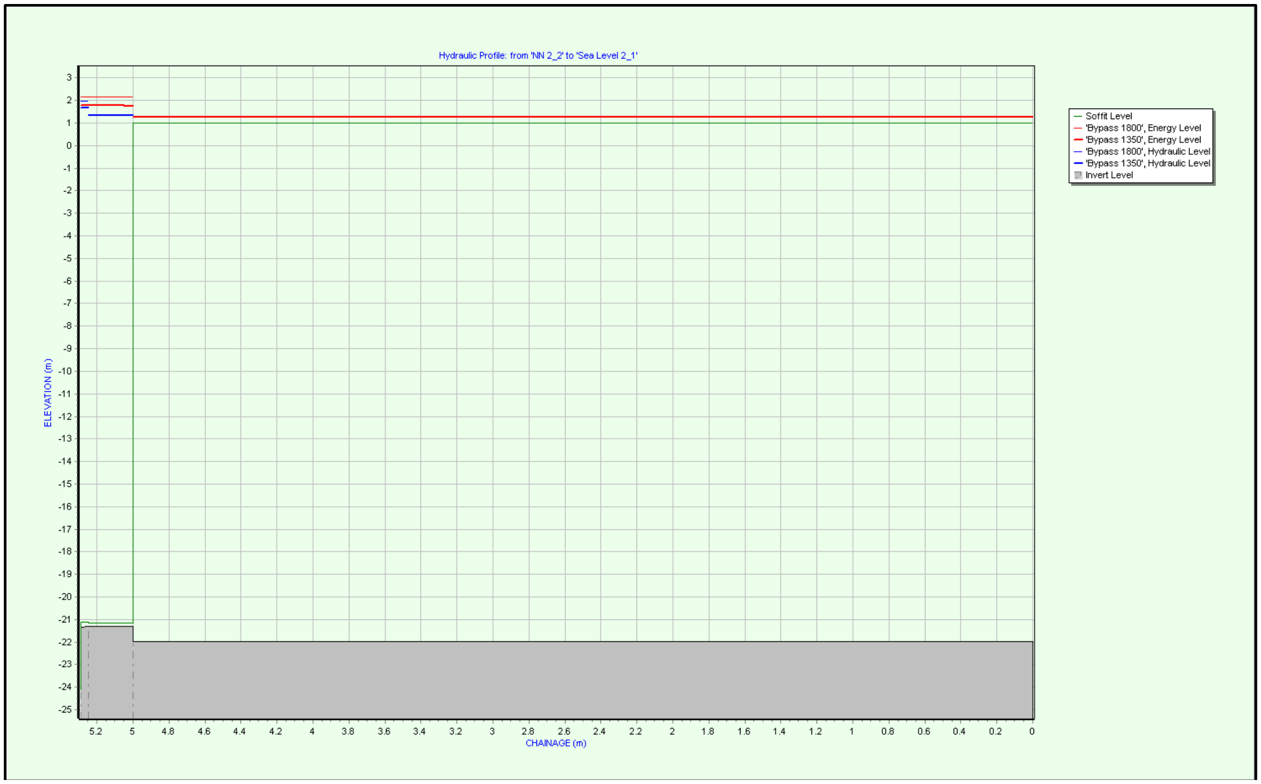
SCENARIO 'Bypass 1800'

Sea Level 2_1						
Depth control		0.92164	1.277			
Water Column 1_13						
Rect. conduit	0.000	0.06557	1.277	1.277	0.001	0.000
	5.000	0.06557	1.277	1.277	0.001	0.000
NN 20_13						
Null node		0.06557	1.277			
Diffuser Type 1a_7						
Circular conduit	0.000	0.06557	2.186	1.360	4.026	0.827
	0.250	0.06557	2.218	1.391	4.026	0.827
NN 26_13						
Null node		0.06557	2.218			
Diffuser Type 1b_7						
Circular conduit	0.000	0.06557	2.218	2.012	2.006	0.205
	0.040	0.06557	2.249	2.013	2.006	0.205
NN 27_13						
Null node		0.14057	2.249			
Riser 17						
Circular conduit	0.000	0.14057	2.266	2.252	0.523	0.014
	0.000	0.14057	2.276	2.253	0.523	0.014



ID / TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO 'Bypass 1350'						
Water Column 2_23						
Rect. conduit	0.000	0.05481	1.277	1.277	0.000	0.000
	5.000	0.05481	1.277	1.277	0.000	0.000
NN 21_23						
Null node		0.05481	1.277			
Diffuser Type 2a_12						
Circular conduit	0.000	0.05481	1.763	1.321	2.942	0.441
	0.250	0.05481	1.778	1.337	2.942	0.441
NN 30_23						
Null node		0.05481	1.778			
Diffuser Type 2b_12						
Circular conduit	0.000	0.05481	1.778	1.660	1.524	0.118
	0.040	0.05481	1.805	1.660	1.524	0.118
NN 27_23						
Null node		0.05481	1.805			
Riser 7						
Circular conduit	0.000	0.05481	1.808	1.806	0.204	0.002
	0.000	0.05481	1.851	1.806	0.204	0.002
SCENARIO 'Bypass 1800'						
Water Column 2_23						
Rect. conduit	0.000	0.07306	1.277	1.277	0.001	0.000
	5.000	0.07306	1.277	1.277	0.001	0.000

NN 21_23							
	Null node		0.07306	1.277			
Diffuser Type 2a_12							
	Circular conduit	0.000	0.07306	2.140	1.355	3.922	0.785
		0.250	0.07306	2.167	1.383	3.922	0.785
NN 30_23							
	Null node		0.07306	2.167			
Diffuser Type 2b_12							
	Circular conduit	0.000	0.07306	2.167	1.957	2.031	0.210
		0.040	0.07306	2.215	1.958	2.031	0.210
NN 27_23							
	Null node		0.07306	2.215			
Riser 7							
	Circular conduit	0.000	0.07306	2.220	2.216	0.272	0.004
		0.000	0.07306	2.298	2.217	0.272	0.004



ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
<u>SCENARIO 'Bypass 1350'</u>							
Water Column 2_26							
	Rect. conduit	0.000	0.05469	1.277	1.277	0.000	0.000
		5.000	0.05469	1.277	1.277	0.000	0.000
NN 21_26							
	Null node		0.05469	1.277			

Diffuser Type_21

Circular conduit	0.000	0.05469	1.761	1.321	2.936	0.440
	0.250	0.05469	1.776	1.336	2.936	0.440

NN 30_26

Null node		0.05469	1.776

Diffuser Type_20

Circular conduit	0.000	0.05469	1.776	1.658	1.521	0.118
	0.040	0.05469	1.803	1.659	1.521	0.118

NN 27_29

Null node		0.05469	1.803

Riser 1

Circular conduit	0.000	0.05469	1.805	1.803	0.203	0.002
	0.000	0.05469	1.879	1.804	0.203	0.002

<u>SCENARIO 'Bypass 1800'</u>

Water Column 2_26

Rect. conduit	0.000	0.07290	1.277	1.277	0.001	0.000
	5.000	0.07290	1.277	1.277	0.001	0.000

NN 21_26

Null node		0.07290	1.277

Diffuser Type_21

Circular conduit	0.000	0.07290	2.136	1.355	3.914	0.781
	0.250	0.07290	2.163	1.382	3.914	0.781

NN 30_26

Null node		0.07290	2.163

Diffuser Type_20

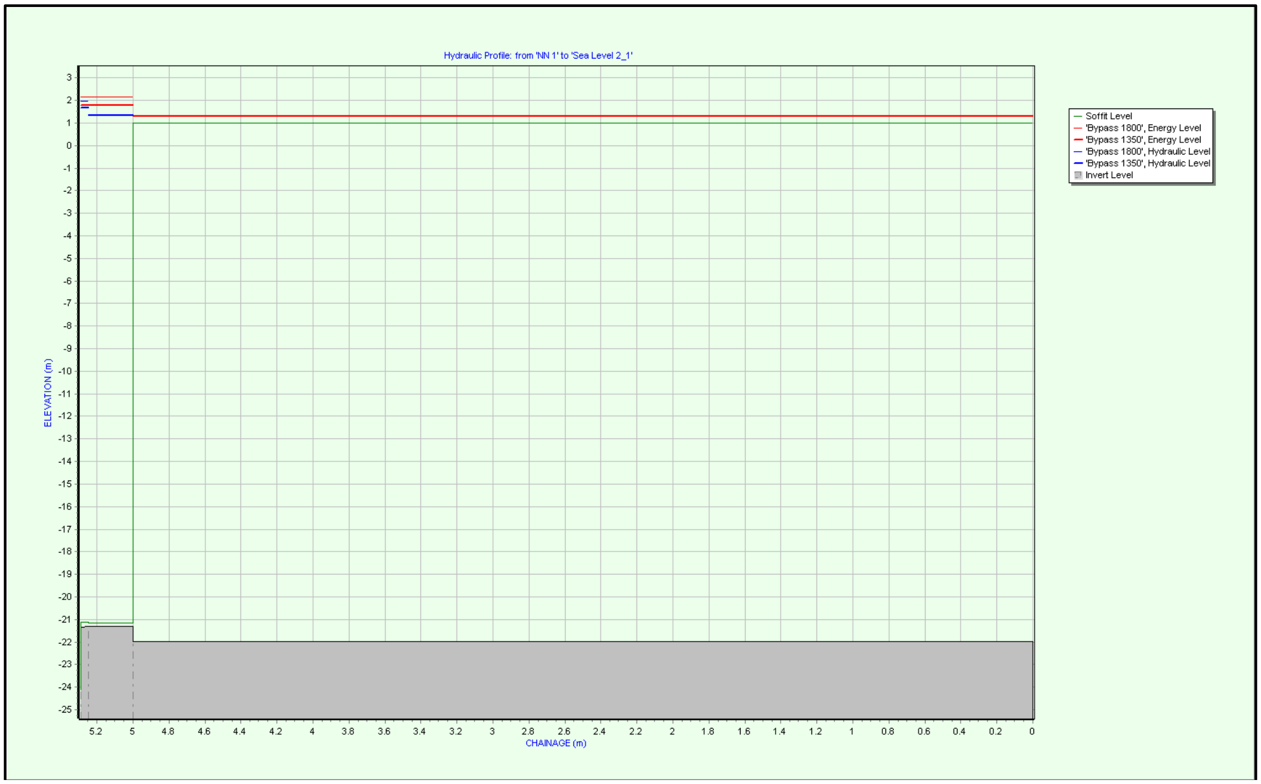
Circular conduit	0.000	0.07290	2.163	1.954	2.027	0.209
	0.040	0.07290	2.211	1.955	2.027	0.209

NN 27_29

Null node		0.07290	2.211

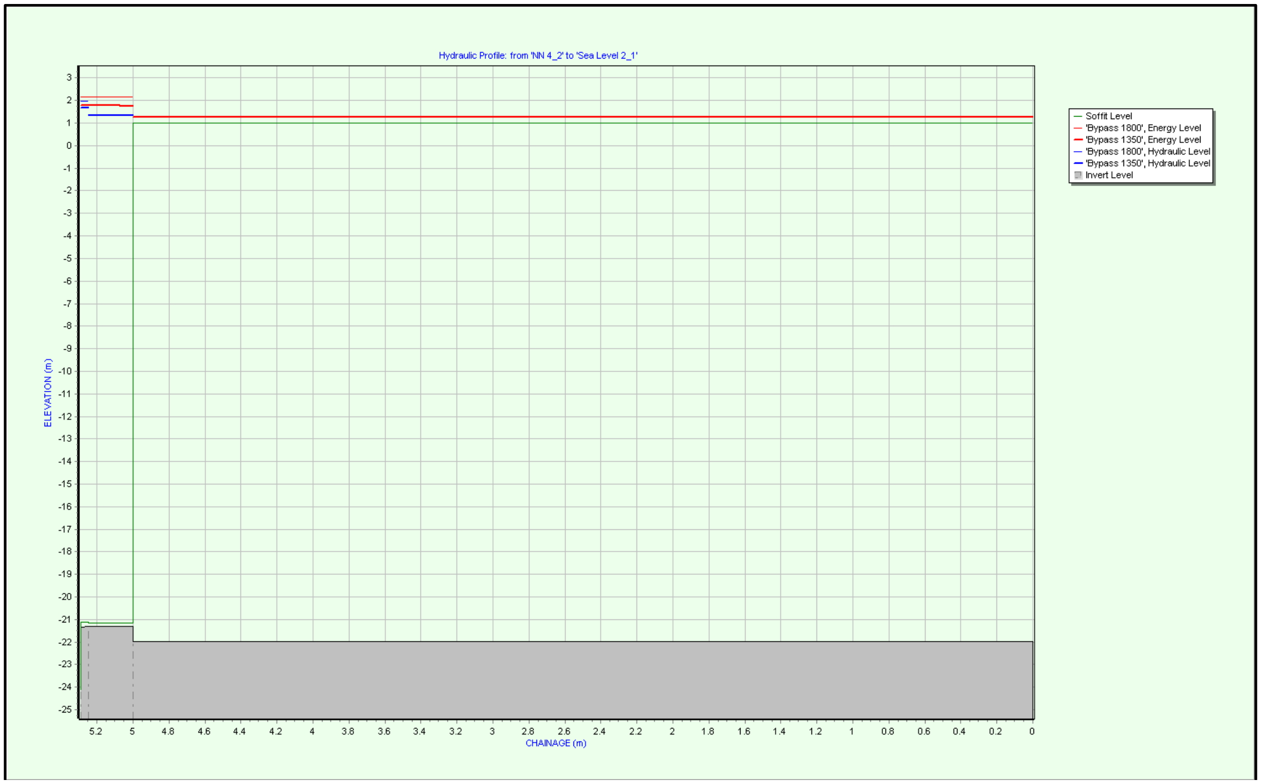
Riser 1

Circular conduit	0.000	0.07290	2.216	2.212	0.271	0.004
	0.000	0.07290	2.346	2.212	0.271	0.004



ID / TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO 'Bypass 1350'						
Water Column 2_22						
Rect. conduit	0.000	0.05490	1.277	1.277	0.000	0.000
	5.000	0.05490	1.277	1.277	0.000	0.000
NN 21_22						
Null node		0.05490	1.277			
Diffuser Type 2a_11						
Circular conduit	0.000	0.05490	1.764	1.321	2.947	0.443
	0.250	0.05490	1.780	1.337	2.947	0.443
NN 30_22						
Null node		0.05490	1.780			
Diffuser Type 2b_11						
Circular conduit	0.000	0.05490	1.780	1.661	1.526	0.119
	0.040	0.05490	1.807	1.661	1.526	0.119
NN 27_22						
Null node		0.05490	1.807			
Riser 9						
Circular conduit	0.000	0.05490	1.810	1.807	0.204	0.002
	0.000	0.05490	1.845	1.808	0.204	0.002
SCENARIO 'Bypass 1800'						
Water Column 2_22						
Rect. conduit	0.000	0.07320	1.277	1.277	0.001	0.000
	5.000	0.07320	1.277	1.277	0.001	0.000

ID / TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
NN 21_22						
Null node		0.07320	1.277			
Diffuser Type 2a_11						
Circular conduit	0.000	0.07320	2.143	1.356	3.930	0.787
	0.250	0.07320	2.171	1.383	3.930	0.787
NN 30_22						
Null node		0.07320	2.171			
Diffuser Type 2b_11						
Circular conduit	0.000	0.07320	2.171	1.959	2.035	0.211
	0.040	0.07320	2.219	1.960	2.035	0.211
NN 27_22						
Null node		0.07320	2.219			
Riser 9						
Circular conduit	0.000	0.07320	2.224	2.220	0.272	0.004
	0.000	0.07320	2.287	2.220	0.272	0.004



ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m

SCENARIO 'Bypass 1350'

ID / TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
Water Column 2_21						
Rect. conduit	0.000	0.05495	1.277	1.277	0.000	0.000
	5.000	0.05495	1.277	1.277	0.000	0.000
NN 21_21						
Null node		0.05495	1.277			

Diffuser Type 2a_10

Circular conduit	0.000	0.05495	1.765	1.321	2.950	0.444
	0.250	0.05495	1.781	1.337	2.950	0.444

NN 30_21

Null node		0.05495	1.781			

Diffuser Type 2b_10

Circular conduit	0.000	0.05495	1.781	1.662	1.528	0.119
	0.040	0.05495	1.799	1.662	1.528	0.119

NN 27_21

Null node		0.10300	1.799			

Riser 11

Circular conduit	0.000	0.10300	1.808	1.801	0.383	0.007
	0.000	0.10300	1.841	1.801	0.383	0.007

SCENARIO 'Bypass 1800'

Water Column 2_21

Rect. conduit	0.000	0.07327	1.277	1.277	0.001	0.000
	5.000	0.07327	1.277	1.277	0.001	0.000

NN 21_21

Null node		0.07327	1.277			

Diffuser Type 2a_10

Circular conduit	0.000	0.07327	2.145	1.356	3.934	0.789
	0.250	0.07327	2.172	1.383	3.934	0.789

NN 30_21

Null node		0.07327	2.172			

Diffuser Type 2b_10

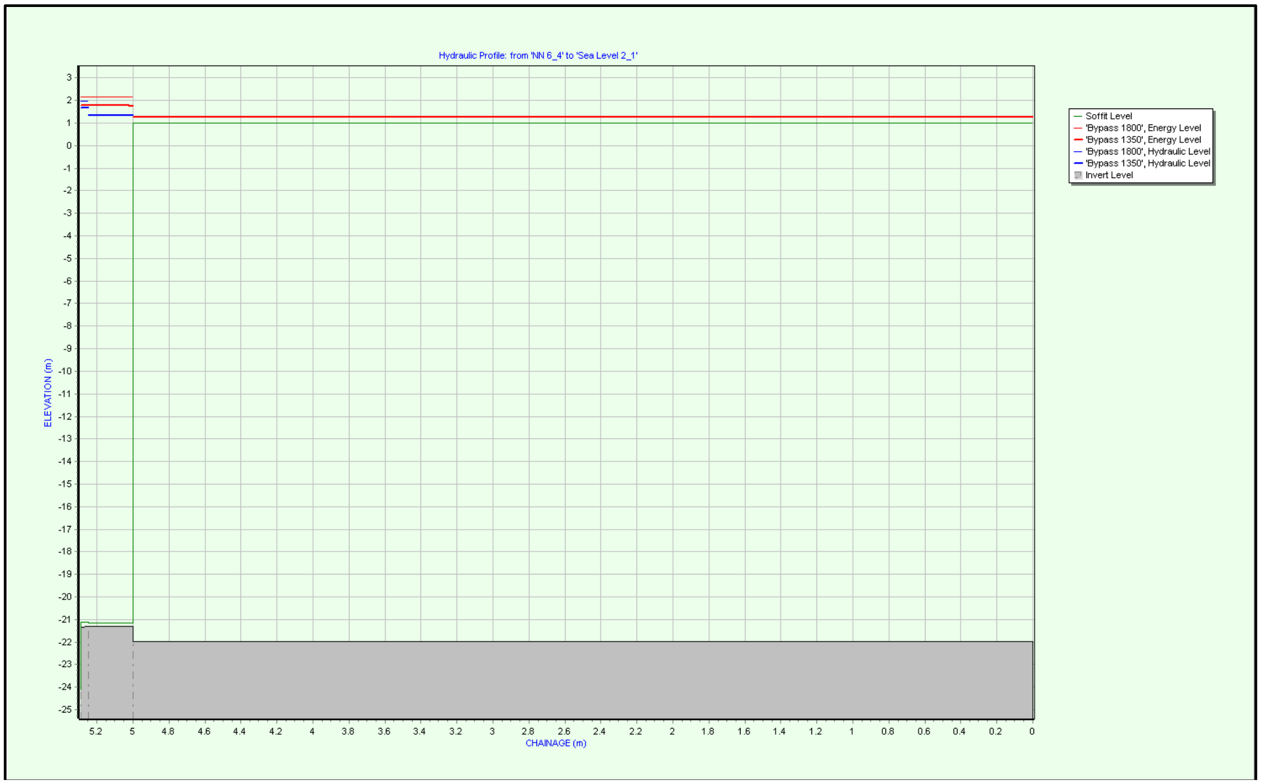
Circular conduit	0.000	0.07327	2.172	1.961	2.037	0.212
	0.040	0.07327	2.205	1.962	2.037	0.212

NN 27_21

Null node		0.13733	2.205			

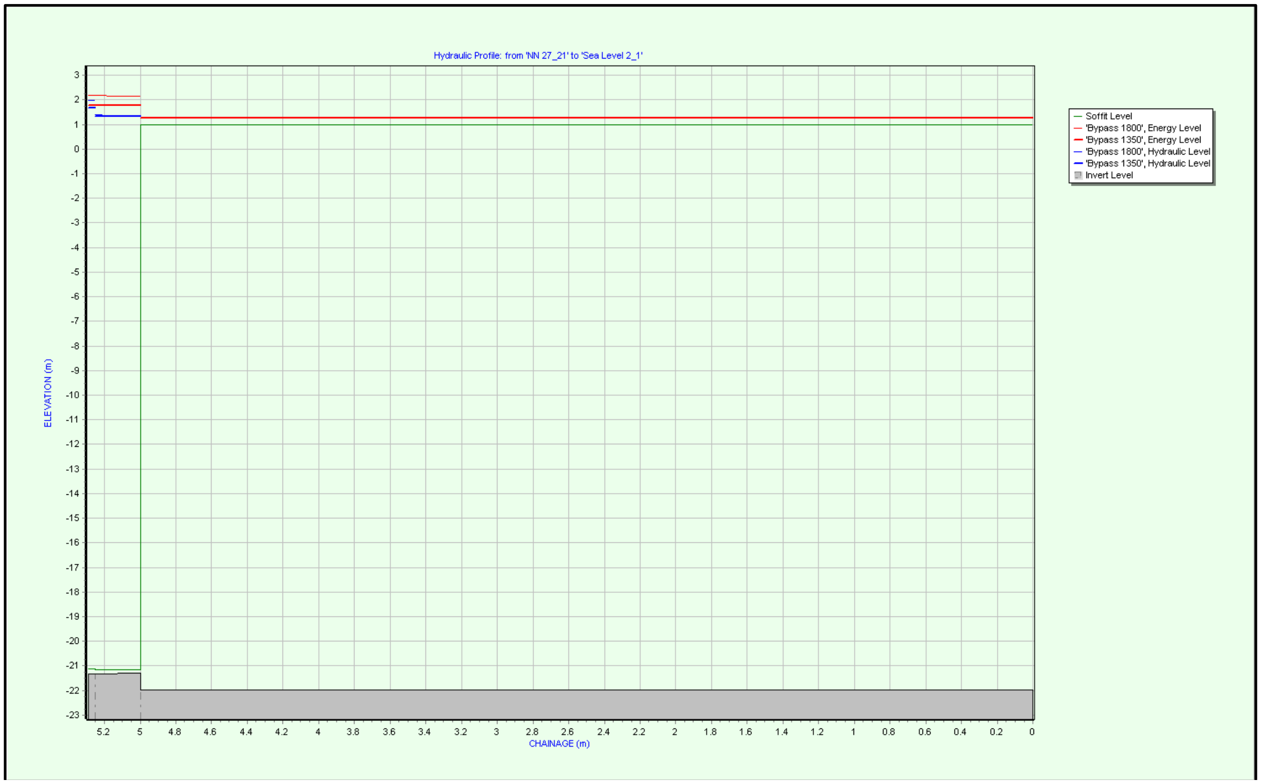
Riser 11

Circular conduit	0.000	0.13733	2.221	2.208	0.511	0.013
	0.000	0.13733	2.279	2.209	0.511	0.013



ID / TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO 'Bypass 1350'						
Water Column 1_21						
Rect. conduit	0.000	0.04805	1.277	1.277	0.000	0.000
	5.000	0.04805	1.277	1.277	0.000	0.000
NN 20_21						
Null node		0.04805	1.277			
Diffuser Type 1a_10						
Circular conduit	0.000	0.04805	1.765	1.321	2.950	0.444
	0.250	0.04805	1.782	1.338	2.950	0.444
NN 26_21						
Null node		0.04805	1.782			
Diffuser Type 1b_10						
Circular conduit	0.000	0.04805	1.782	1.672	1.470	0.110
	0.040	0.04805	1.799	1.672	1.470	0.110
SCENARIO 'Bypass 1800'						
Water Column 1_21						
Rect. conduit	0.000	0.06406	1.277	1.277	0.001	0.000
	5.000	0.06406	1.277	1.277	0.001	0.000
NN 20_21						
Null node		0.06406	1.277			
Diffuser Type 1a_10						
Circular conduit	0.000	0.06406	2.145	1.356	3.934	0.789
	0.250	0.06406	2.175	1.386	3.934	0.789

NN 26_21							
	Null node		0.06406	2.175			
Diffuser Type 1b_10							
	Circular conduit	0.000	0.06406	2.175	1.979	1.960	0.196
		0.040	0.06406	2.205	1.980	1.960	0.196

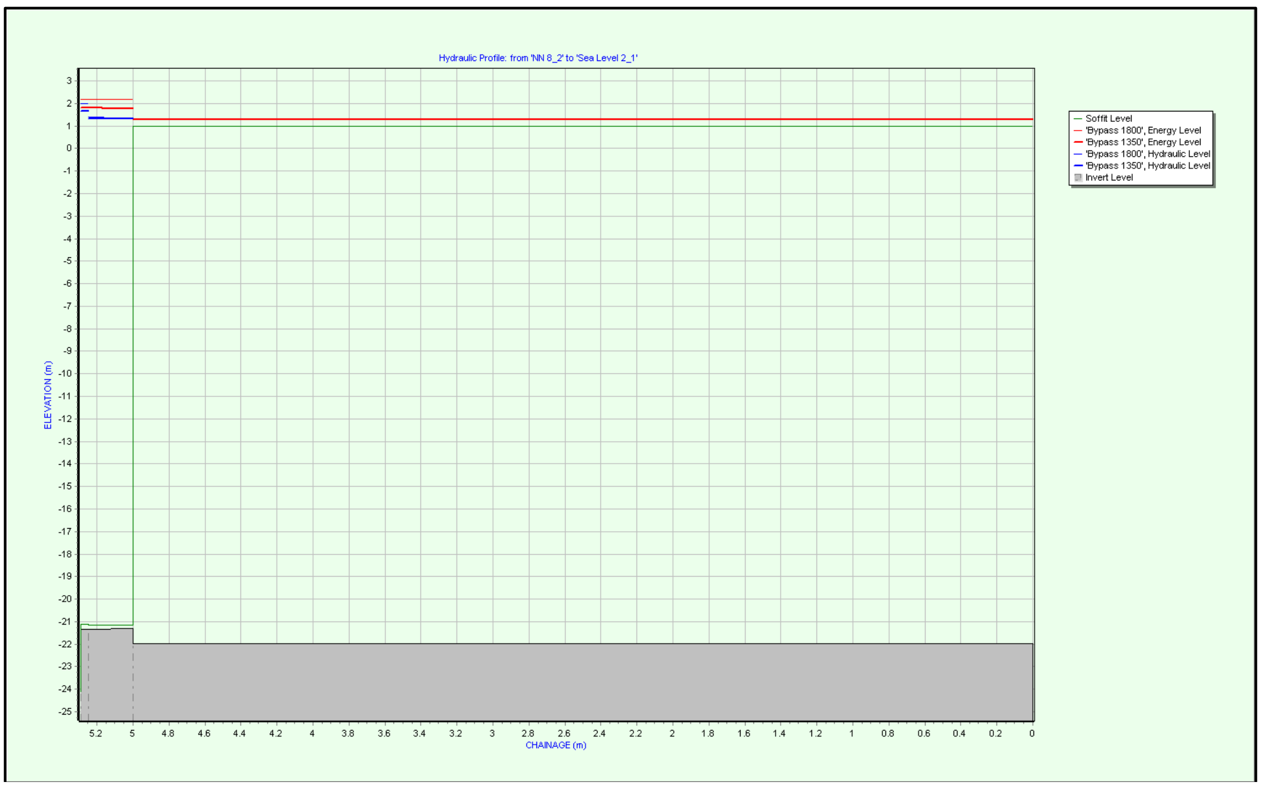


ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
<u>SCENARIO 'Bypass 1350'</u>							
Water Column 2_20							
	Rect. conduit	0.000	0.05555	1.277	1.277	0.000	0.000
		5.000	0.05555	1.277	1.277	0.000	0.000
NN 21_20							
	Null node		0.05555	1.277			
Diffuser Type 2a_9							
	Circular conduit	0.000	0.05555	1.776	1.322	2.983	0.454
		0.250	0.05555	1.792	1.338	2.983	0.454
NN 30_20							
	Null node		0.05555	1.792			
Diffuser Type 2b_9							
	Circular conduit	0.000	0.05555	1.792	1.670	1.545	0.122
		0.040	0.05555	1.811	1.671	1.545	0.122
NN 27_20							
	Null node		0.10413	1.811			

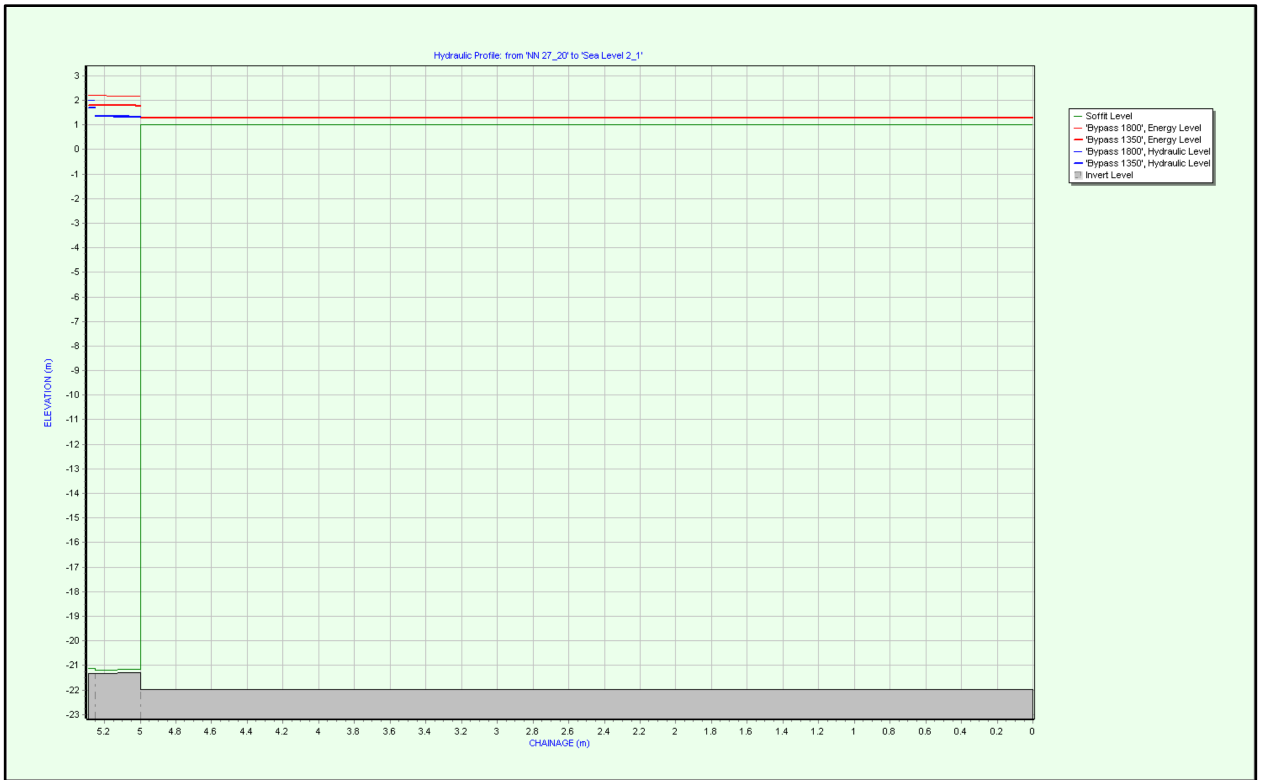
Riser 13							
	Circular conduit	0.000	0.10413	1.820	1.812	0.387	0.008
		0.000	0.10413	1.839	1.813	0.387	0.008

SCENARIO 'Bypass 1800'

Water Column 2_20							
	Rect. conduit	0.000	0.07408	1.277	1.277	0.001	0.000
		5.000	0.07408	1.277	1.277	0.001	0.000
NN 21_20							
	Null node		0.07408	1.277			
Diffuser Type 2a_9							
	Circular conduit	0.000	0.07408	2.164	1.358	3.977	0.807
		0.250	0.07408	2.192	1.386	3.977	0.807
NN 30_20							
	Null node		0.07408	2.192			
Diffuser Type 2b_9							
	Circular conduit	0.000	0.07408	2.192	1.976	2.060	0.216
		0.040	0.07408	2.226	1.977	2.060	0.216
NN 27_20							
	Null node		0.13885	2.226			
Riser 13							
	Circular conduit	0.000	0.13885	2.242	2.228	0.517	0.014
		0.000	0.13885	2.277	2.229	0.517	0.014

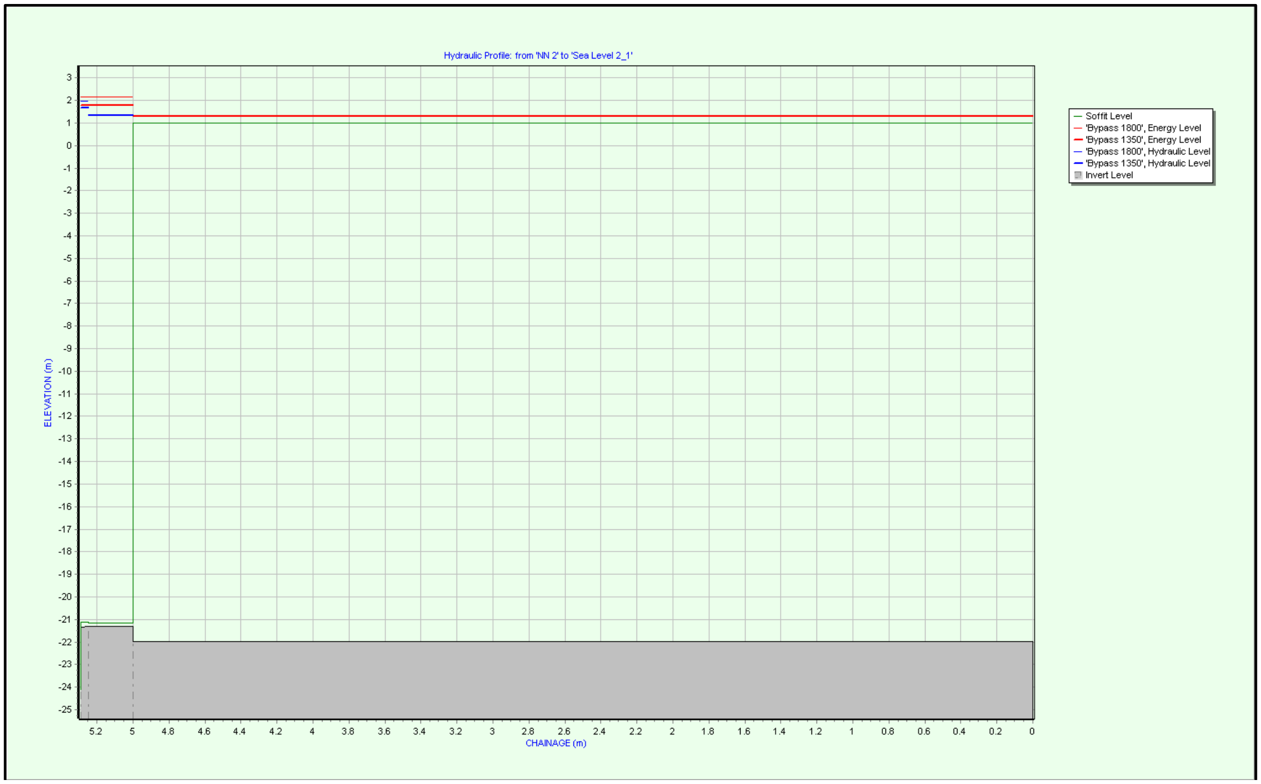


ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO 'Bypass 1350'						
Water Column 1_20						
Rect. conduit	0.000	0.04857	1.277	1.277	0.000	0.000
	5.000	0.04857	1.277	1.277	0.000	0.000
NN 20_20						
Null node		0.04857	1.277			
Diffuser Type 1a_9						
Circular conduit	0.000	0.04857	1.776	1.322	2.982	0.454
	0.250	0.04857	1.793	1.340	2.982	0.454
NN 26_20						
Null node		0.04857	1.793			
Diffuser Type 1b_9						
Circular conduit	0.000	0.04857	1.793	1.681	1.486	0.113
	0.040	0.04857	1.811	1.681	1.486	0.113
SCENARIO 'Bypass 1800'						
Water Column 1_20						
Rect. conduit	0.000	0.06477	1.277	1.277	0.001	0.000
	5.000	0.06477	1.277	1.277	0.001	0.000
NN 20_20						
Null node		0.06477	1.277			
Diffuser Type 1a_9						
Circular conduit	0.000	0.06477	2.164	1.358	3.977	0.806
	0.250	0.06477	2.195	1.388	3.977	0.806
NN 26_20						
Null node		0.06477	2.195			
Diffuser Type 1b_9						
Circular conduit	0.000	0.06477	2.195	1.994	1.982	0.200
	0.040	0.06477	2.226	1.995	1.982	0.200



ID / TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO 'Bypass 1350'						
Water Column 2_25						
Rect. conduit	0.000	0.05470	1.277	1.277	0.000	0.000
	5.000	0.05470	1.277	1.277	0.000	0.000
NN 21_25						
Null node		0.05470	1.277			
Diffuser Type_17						
Circular conduit	0.000	0.05470	1.761	1.321	2.936	0.440
	0.250	0.05470	1.776	1.336	2.936	0.440
NN 30_25						
Null node		0.05470	1.776			
Diffuser Type_16						
Circular conduit	0.000	0.05470	1.776	1.658	1.521	0.118
	0.040	0.05470	1.803	1.659	1.521	0.118
NN 27_27						
Null node		0.05470	1.803			
Riser 3						
Circular conduit	0.000	0.05470	1.806	1.803	0.203	0.002
	0.000	0.05470	1.868	1.804	0.203	0.002
SCENARIO 'Bypass 1800'						
Water Column 2_25						
Rect. conduit	0.000	0.07290	1.277	1.277	0.001	0.000
	5.000	0.07290	1.277	1.277	0.001	0.000

ID	TYPE	DISTANCE	FLOW	TOTAL ENERGY	HYDRAULIC GRADE	VELOCITY	VEL. HEAD
NN 21_25							
	Null node		0.07290	1.277			
Diffuser Type_17							
	Circular conduit	0.000	0.07290	2.136	1.355	3.914	0.781
		0.250	0.07290	2.163	1.382	3.914	0.781
NN 30_25							
	Null node		0.07290	2.163			
Diffuser Type_16							
	Circular conduit	0.000	0.07290	2.163	1.954	2.027	0.209
		0.040	0.07290	2.211	1.955	2.027	0.209
NN 27_27							
	Null node		0.07290	2.211			
Riser 3							
	Circular conduit	0.000	0.07290	2.216	2.212	0.271	0.004
		0.000	0.07290	2.327	2.212	0.271	0.004



ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m

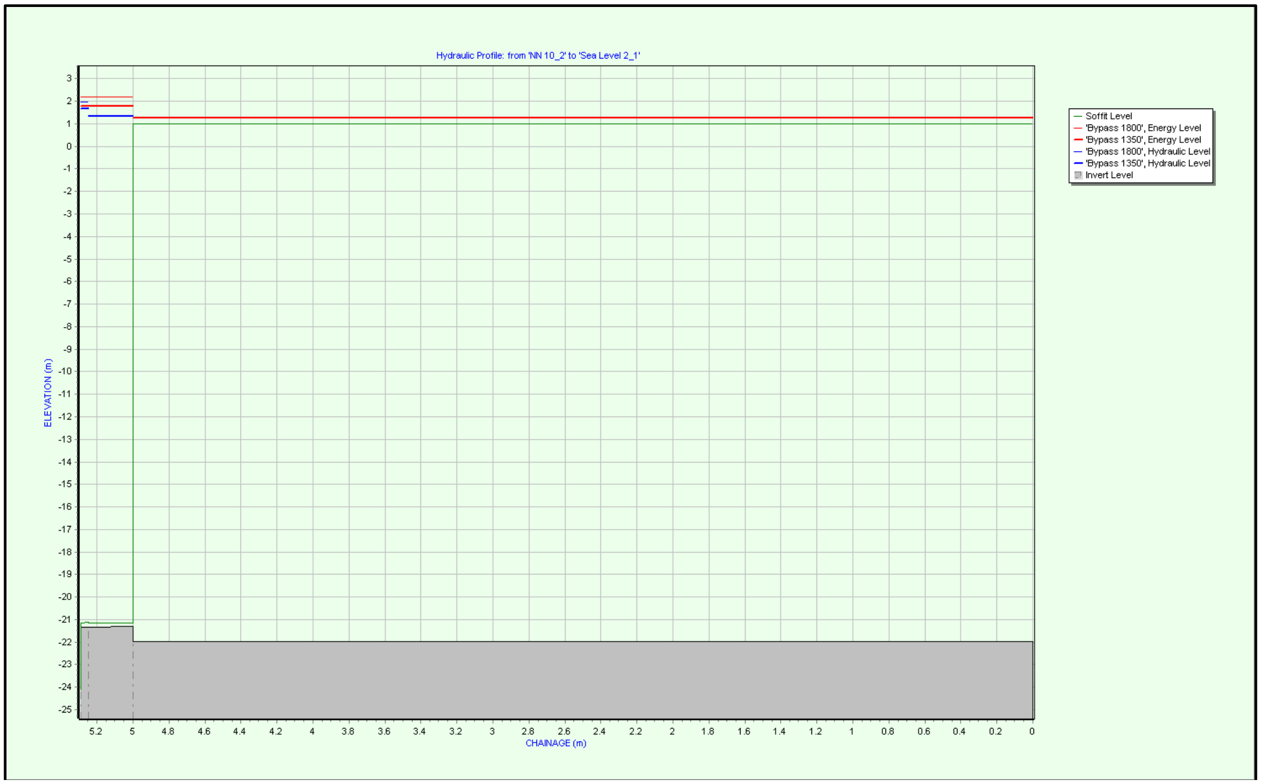
<u>SCENARIO 'Bypass 1350'</u>

ID	TYPE	DISTANCE	FLOW	TOTAL ENERGY	HYDRAULIC GRADE	VELOCITY	VEL. HEAD
Water Column 2_15							
	Rect. conduit	0.000	0.05596	1.277	1.277	0.000	0.000
		5.000	0.05596	1.277	1.277	0.000	0.000
NN 21_15							
	Null node		0.05596	1.277			

Diffuser Type 2a_8						
Circular conduit	0.000	0.05596	1.783	1.323	3.004	0.460
	0.250	0.05596	1.799	1.339	3.004	0.460
NN 30_15						
Null node		0.05596	1.799			
Diffuser Type 2b_8						
Circular conduit	0.000	0.05596	1.799	1.676	1.556	0.123
	0.040	0.05596	1.818	1.676	1.556	0.123
NN 27_15						
Null node		0.10489	1.818			
Riser 15						
Circular conduit	0.000	0.10489	1.828	1.820	0.390	0.008
	0.000	0.10489	1.839	1.821	0.390	0.008

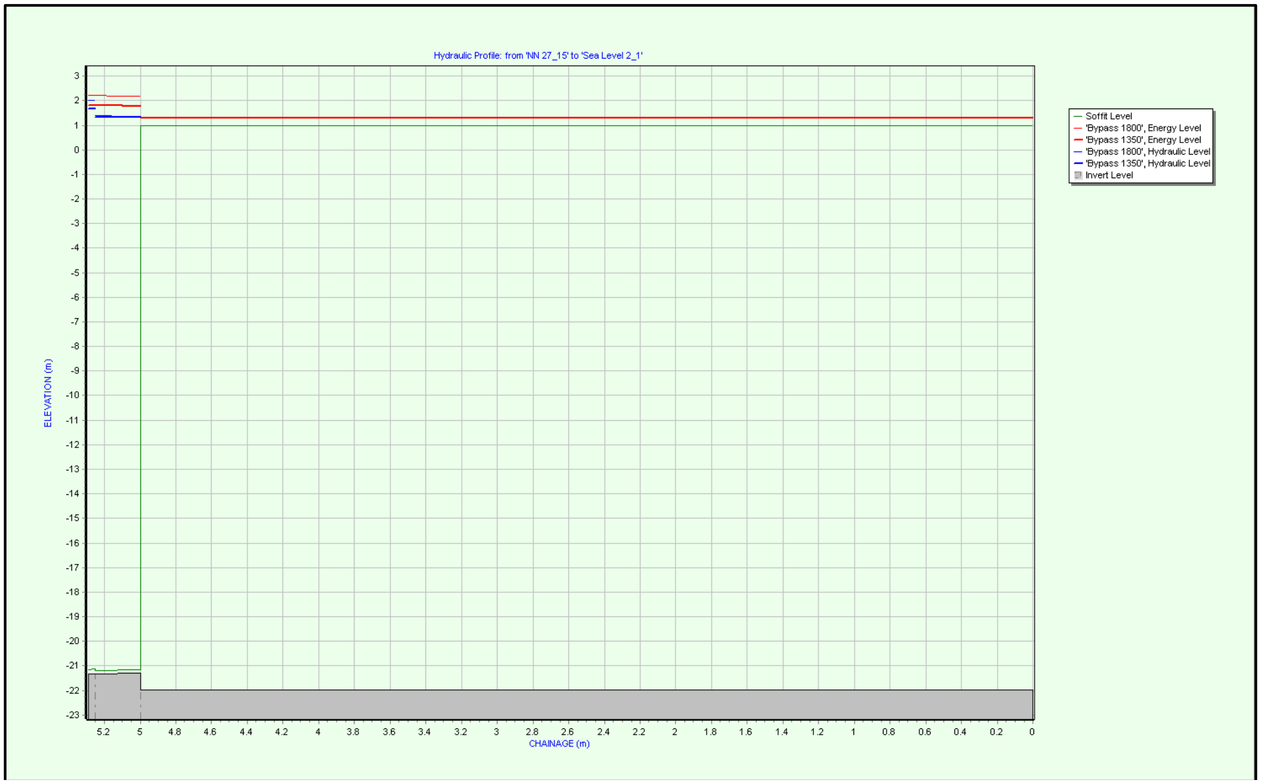
SCENARIO 'Bypass 1800'

Water Column 2_15						
Rect. conduit	0.000	0.07463	1.277	1.277	0.001	0.000
	5.000	0.07463	1.277	1.277	0.001	0.000
NN 21_15						
Null node		0.07463	1.277			
Diffuser Type 2a_8						
Circular conduit	0.000	0.07463	2.177	1.359	4.006	0.818
	0.250	0.07463	2.206	1.387	4.006	0.818
NN 30_15						
Null node		0.07463	2.206			
Diffuser Type 2b_8						
Circular conduit	0.000	0.07463	2.206	1.986	2.075	0.219
	0.040	0.07463	2.240	1.987	2.075	0.219
NN 27_15						
Null node		0.13987	2.240			
Riser 15						
Circular conduit	0.000	0.13987	2.256	2.242	0.520	0.014
	0.000	0.13987	2.276	2.244	0.520	0.014



ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
SCENARIO 'Bypass 1350'						
Water Column 1_15						
Rect. conduit	0.000	0.04893	1.277	1.277	0.000	0.000
	5.000	0.04893	1.277	1.277	0.000	0.000
NN 20_15						
Null node		0.04893	1.277			
Diffuser Type 1a_8						
Circular conduit	0.000	0.04893	1.783	1.323	3.004	0.460
	0.250	0.04893	1.801	1.341	3.004	0.460
NN 26_15						
Null node		0.04893	1.801			
Diffuser Type 1b_8						
Circular conduit	0.000	0.04893	1.801	1.687	1.497	0.114
	0.040	0.04893	1.818	1.687	1.497	0.114
SCENARIO 'Bypass 1800'						
Water Column 1_15						
Rect. conduit	0.000	0.06525	1.277	1.277	0.001	0.000
	5.000	0.06525	1.277	1.277	0.001	0.000
NN 20_15						
Null node		0.06525	1.277			
Diffuser Type 1a_8						
Circular conduit	0.000	0.06525	2.177	1.359	4.006	0.818
	0.250	0.06525	2.208	1.390	4.006	0.818

ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
NN 26_15							
	Null node		0.06525	2.208			
Diffuser Type 1b_8							
	Circular conduit	0.000	0.06525	2.208	2.005	1.996	0.203
		0.040	0.06525	2.240	2.006	1.996	0.203

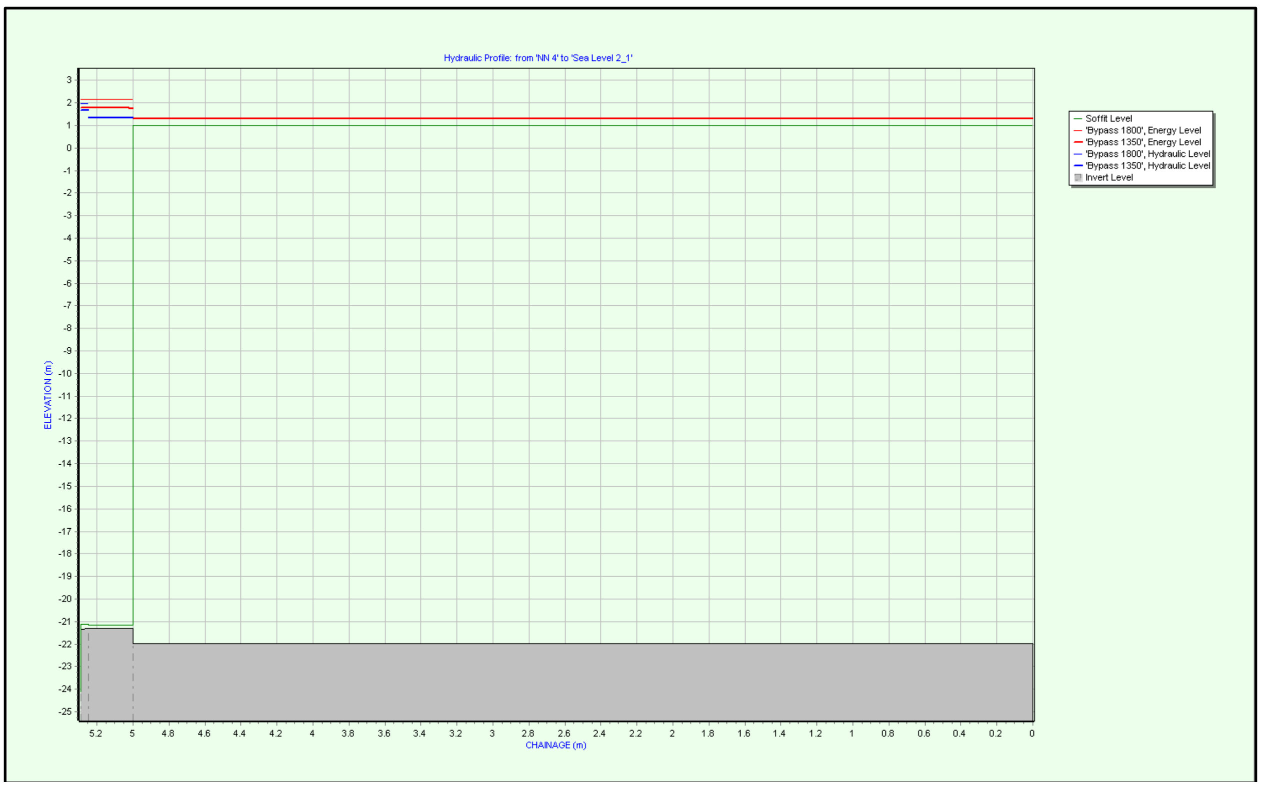


ID	TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
<u>SCENARIO 'Bypass 1350'</u>							
Water Column 2_24							
	Rect. conduit	0.000	0.05472	1.277	1.277	0.000	0.000
		5.000	0.05472	1.277	1.277	0.000	0.000
NN 21_24							
	Null node		0.05472	1.277			
Diffuser Type_14							
	Circular conduit	0.000	0.05472	1.761	1.321	2.938	0.440
		0.250	0.05472	1.777	1.336	2.938	0.440
NN 30_24							
	Null node		0.05472	1.777			
Diffuser Type_13							
	Circular conduit	0.000	0.05472	1.777	1.659	1.521	0.118
		0.040	0.05472	1.804	1.659	1.521	0.118
NN 27_25							
	Null node		0.05472	1.804			

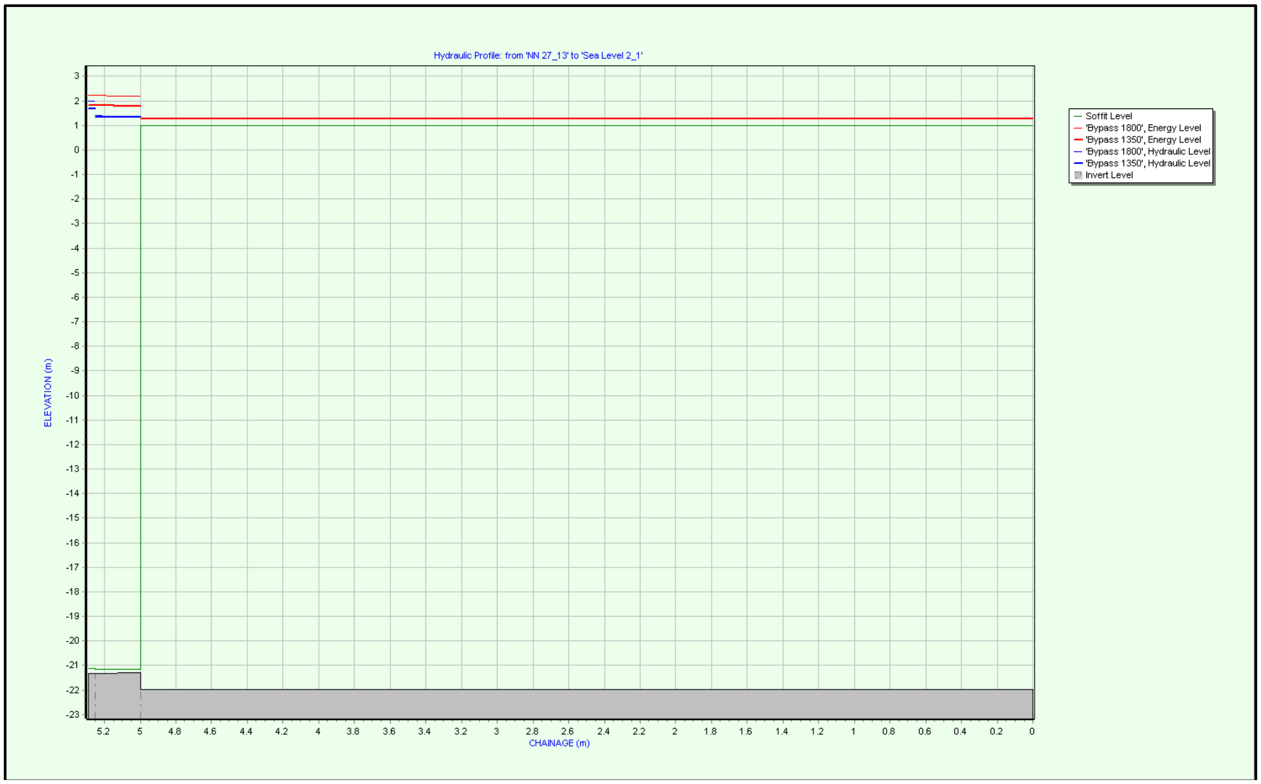
Riser 5							
	Circular conduit	0.000	0.05472	1.806	1.804	0.204	0.002
		0.000	0.05472	1.859	1.804	0.204	0.002

<u>SCENARIO 'Bypass 1800'</u>

Water Column 2_24							
	Rect. conduit	0.000	0.07295	1.277	1.277	0.001	0.000
		5.000	0.07295	1.277	1.277	0.001	0.000
NN 21_24							
	Null node		0.07295	1.277			
Diffuser Type_14							
	Circular conduit	0.000	0.07295	2.137	1.355	3.917	0.782
		0.250	0.07295	2.165	1.382	3.917	0.782
NN 30_24							
	Null node		0.07295	2.165			
Diffuser Type_13							
	Circular conduit	0.000	0.07295	2.165	1.955	2.028	0.210
		0.040	0.07295	2.213	1.956	2.028	0.210
NN 27_25							
	Null node		0.07295	2.213			
Riser 5							
	Circular conduit	0.000	0.07295	2.217	2.213	0.271	0.004
		0.000	0.07295	2.311	2.214	0.271	0.004



ID TYPE	DISTANCE m	FLOW m³/s	TOTAL ENERGY m	HYDRAULIC GRADE m	VELOCITY m/s	VEL. HEAD m
<u>SCENARIO 'Bypass 1350'</u>						
Water Column 2_13						
Rect. conduit	0.000	0.05624	1.277	1.277	0.000	0.000
	5.000	0.05624	1.277	1.277	0.000	0.000
NN 21_13						
Null node		0.05624	1.277			
Diffuser Type 2a_7						
Circular conduit	0.000	0.05624	1.788	1.323	3.019	0.465
	0.250	0.05624	1.805	1.340	3.019	0.465
NN 30_13						
Null node		0.05624	1.805			
Diffuser Type 2b_7						
Circular conduit	0.000	0.05624	1.805	1.680	1.564	0.125
	0.040	0.05624	1.824	1.680	1.564	0.125
<u>SCENARIO 'Bypass 1800'</u>						
Water Column 2_13						
Rect. conduit	0.000	0.07500	1.277	1.277	0.001	0.000
	5.000	0.07500	1.277	1.277	0.001	0.000
NN 21_13						
Null node		0.07500	1.277			
Diffuser Type 2a_7						
Circular conduit	0.000	0.07500	2.186	1.360	4.026	0.827
	0.250	0.07500	2.215	1.388	4.026	0.827
NN 30_13						
Null node		0.07500	2.215			
Diffuser Type 2b_7						
Circular conduit	0.000	0.07500	2.215	1.993	2.085	0.222
	0.040	0.07500	2.249	1.994	2.085	0.222



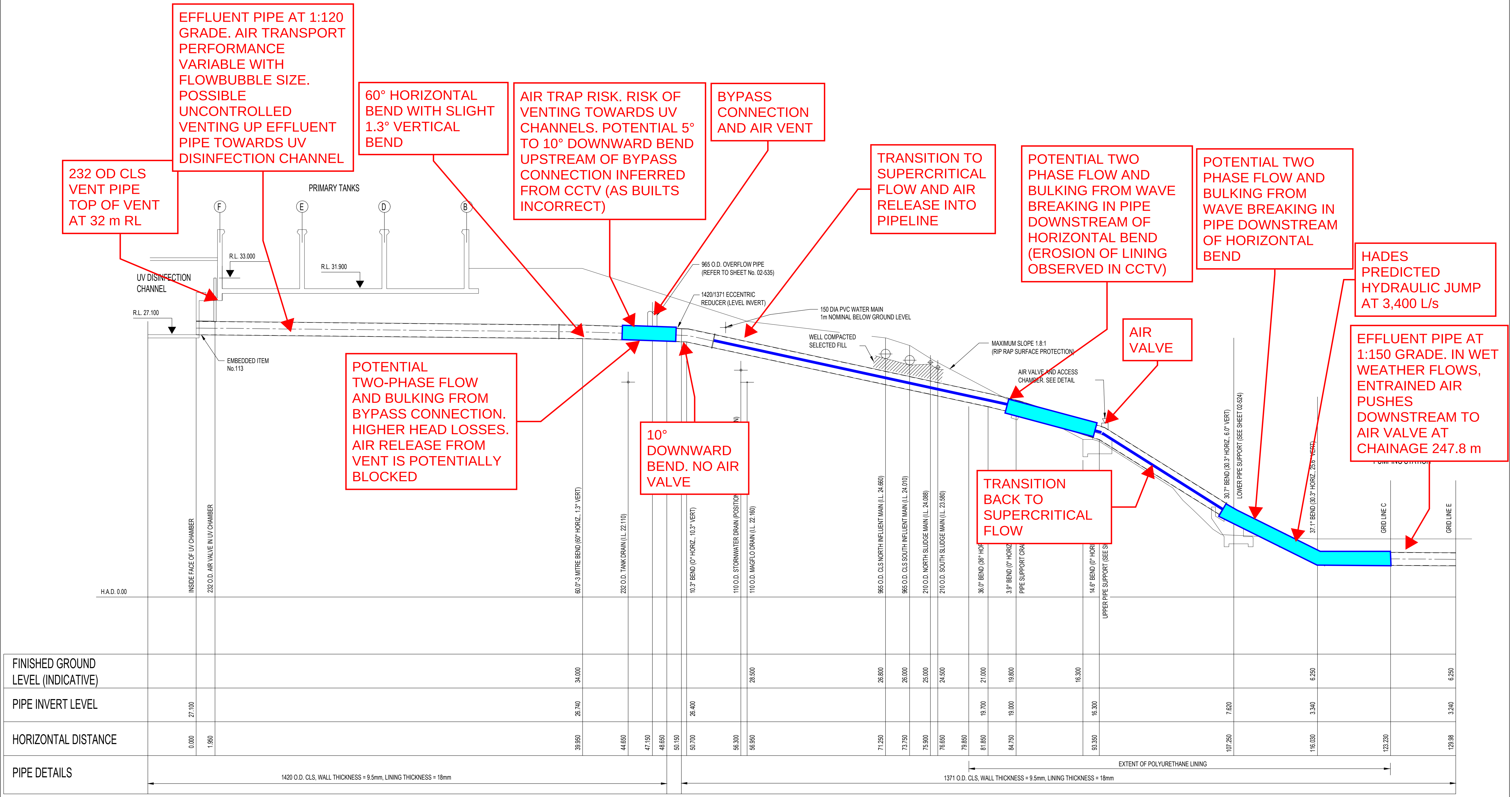
Hydraulic Profile: from 'NN 27_13' to 'Sea Level 2_1'
ELEVATION (m)
CHAINAGE (m)
Soffit Level
'Bypass 1800', Energy Level
'Bypass 1350', Energy Level
'Bypass 1800', Hydraulic Level
'Bypass 1350', Hydraulic Level
Invert Level

Appendix B Hades QA Files

Appendix C

Moa Point WWTP Effluent Pipe Long Section Markup

Source As Built Drg 951092_02-519)



EFFLUENT MAIN

CONCRETE LINED STEEL PIPE

CAD FILE No.: MOA-R20

WORKS Consultancy Services Wellington

5/1420/15/7504/20

REV	DATE	DESCRIPTION	DRN	CHK	APP
Z	7/98	AS BUILT	K.J.A.		D.O'D.
D	14/6/96	ALIGNMENT OF EFFLUENT PIPE ADJACENT TO PUMP STATION	K.R.B.	V.T.	G.M.
C	27/5/96	POLYURETHANE LINING ADDED	GMO		G.B.M.
B	29/4/96	GROUND LEVEL AMEMDED AND LEVELS ADDED	WHE		G.M.
A	15/3/96	FOR CONSTRUCTION	K.J.A.		G.M.

	BY	CHECKED	DATE
Survey			
Design	M. PATERSON	V. TAM	3/96
Drawn	K.J. ALEKNA	R. CLARK	3/96
Recom'd	V. TAM	R.L. BISHOP	3/96
Approval	G.B. McFETRIDGE		15/3/96
Status:	AS BUILT		A1

MAINZEAL DESIGN & BUILD
PO Box 6441 Wellington
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Fax 385 4079

WELLINGTON CITY COUNCIL
TUMEKE PŌNEKE
Absolutely Positively Wellington
101 Wakefield Street Wellington New Zealand
P.O. Box 2199 Telephone (04) 499-4444

Anglian Water INTERNATIONAL (NZ) Ltd
296 Lambton Quay
James Cook Arcade
Wellington
New Zealand
Ph: (04) 499-9182

WELLINGTON WASTE WATER PROJECT

MOA POINT TREATMENT OLANT

Title: ENVIRONMENTAL EFFLUENT MAIN LONGITUDINAL SECTION

Drawing No. 951092

02- 519

Scale 1:200 | Sheet 02-519 | REV Z

Appendix C Moa Point WWTP Effluent Long Section Markup

With every community, we redefine what's possible.

Stantec is a global leader in sustainable engineering, architecture, and environmental consulting. The diverse perspectives of our partners and interested parties drive us to think beyond what's previously been done on critical issues like climate change, digital transformation, and future-proofing our cities and infrastructure. We innovate at the intersection of community, creativity, and client relationships to advance communities everywhere, so that together we can redefine what's possible.

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