Sirius Minerals

# Phase 3 Works

NYMNPA 60 and 79 Surface Water Drainage Scheme

40-ARI-WS-71-PA-RP-1050

Rev 0 | 3 April 2017



Job number 234376-00

**Ove Arup & Partners Ltd**
Admiral House Rose Wharf
78 East Street
Leeds LS9 8EE
United Kingdom
www.arup.com

ARUP

# Document Verification

ARUP

| | | | | | |
|---|---|---|---|---|---|
| **Job title** | | Phase 3 Works | | | **Job number**<br>234376-00 |
| **Document title** | | NYMNPA 60 and 79 Surface Water Drainage Scheme | | | **File reference**<br>0-12-08 |
| **Document ref** | | 40-ARI-WS-71-PA-RP-1050 | | | |
| **Revision** | **Date** | **Filename** | REP-P10-WS-CD-004 SWD DoC 60 and 79 14-03-2017 Rev A.docx | | |
| Draft A | 14 March 2017 | **Description** | First draft | | |
| | | | Prepared by | Checked by | Approved by |
| | | Name | N. Ferro | D. Ainger | A. Hornung |
| | | Signature | | | |
| Rev 0 | 03 Apr 2017 | **Filename** | 40-ARI-WS-71-PA-RP-1050_0_IFU_20170331 SWD DoC 60_79.docx | | |
| | | **Description** | Incorporate comments and Issue | | |
| | | | Prepared by | Checked by | Approved by |
| | | Name | N. Ferro | D. Ainger | A. Hornung |
| | | Signature | [signature] | [signature] | [signature] |
| | | **Filename** | | | |
| | | **Description** | | | |
| | | | Prepared by | Checked by | Approved by |
| | | Name | | | |
| | | Signature | | | |
| | | **Filename** | | | |
| | | **Description** | | | |
| | | | Prepared by | Checked by | Approved by |
| | | Name | | | |
| | | Signature | | | |

**Issue Document Verification with Document** ✓

# Contents

# Appendix F

Typical Drainage Details

# 1 Introduction

## 1.1 Overview

This document has been prepared on behalf of Sirius Minerals PLC and details the surface water drainage design for the Phase 3 Site Establishment at Woodsmith Mine (Phase 3 Works). This is required to discharge conditions 60 and 79 of the North York Moors National Park Authority (NYMNPA) planning permission NYM/2014/0676/MEIA [1].

This report only details the works required at the Woodsmith Mine site.

The Phase 3 Works comprise:

- General site clearance including demolition of all farm buildings and sheds, and localised tree and scrub clearance, as shown on Drawing 40-ARI-WS-71-CI-DR-1051;
- Excavation and construction of the south western extension of the upper tiered working platform at around 203m AOD, as shown on Drawing 40-ARI-WS-71-CI-DR-1053;
- Excavation and construction of the Platform for the Construction Welfare Facility, Parking Area and Concrete Batching Plant, as shown on Drawing 40-ARI-WS-71-CI-DR-1053;
- Construction of temporary and permanent soil mounds, including the basal liner for a future storage facility in the northeast corner of the site for non-hazardous non-inert spoil and three topsoil, subsoil and inert material storage bunds in the south western area of the site, as shown on drawings 40-ARI-WS-71-CI-DR-1053 and 40-ARI-WS-71-CI-DR-1055, with earthworks volumes presented in 40-ARI-WS-71-CI-DR-1054;
- Construction of surface water drainage, a temporary surface water attenuation pond and temporary wetland in the southern area and two permanent attenuation ponds and two wetland areas in the north eastern area, as shown on Drawing 40-ARI-WS-71-CI-DR-1050;
- Construction of a spring and groundwater drainage layer in the north eastern area, discharging into a wetland area, as shown on Drawing 40-ARI-WS-71-CI-DR-1080;
- Installation and commissioning of temporary dewatering as shown on Drawing 40-ARI-WS-71-CI-DR-1050;
- Erection on site of the Concrete Batching Plant as shown on Drawing 40-AMC-WS-72-SW-RA-0001, complete with reticulated water supplies and tanks;
- Construction of the drilling platform and temporary saline lagoon area for the groundwater reinjection well as shown on Drawing 40-ARI-WS-71-CI-DR-1057; and
- Provision of Construction Welfare and Security Facilities - complete with hook-up of power, communications & water supplies and new waste water collection facilities.

## 1.2 Compliance with Conditions

The wording of planning condition 60, and where the necessary material has been provided within the report, is set out in the table below:

| **NYMNPA 60** | **Compliance with Condition 60** |
|---|---|
| *Surface water management at the Doves Nest Farm site during construction shall incorporate measures to slow water flow such that sediment settles out prior to surface water draining from the site into the Sneaton Thorpe Beck. Prior to the commencement of preparatory works the design of the surface water management system at Doves Nest Farm shall be submitted to and agreed in writing by the MPA to ensure it incorporates measures that may be required to prevent sediment entering the Sneaton Thorpe Beck causing harm to the brown trout population present there.* | Refer to the Surface Water Management Plan and Construction Sequencing in Appendix C. |

The wording of planning condition 79, and where the necessary material has been provided within the report, is set out in the table below:

| **NYMNPA 79** | **Compliance with Condition 79** |
|---|---|
| *No development shall take place at Doves Nest Farm until a Surface Water Drainage Scheme for the site, based on sustainable drainage principles and an assessment of the hydrological and hydro-geological context of the development, has been submitted to and approved in writing by the MPA.* | Refer to this report and appendices for the surface water drainage scheme.<br><br>Refer to Sections 2.2, 2.3, 2.4, 2.5 and 2.6. |
| *The drainage strategy must demonstrate that surface water run-off generated up to and including the 1 in 100 critical storm will not exceed the run-off from the undeveloped site following the corresponding rainfall event.* | This element of condition 79 does not need to be discharged for the Phase 3 Works because the 1 in 100 critical storm is applicable only to the operational phase. Refer to section 2.2. |
| *The scheme shall include:*<br>*Confirmation that the surface water drainage system is to be built first so that it is available to provide the drainage for the construction phase as well as the completed mine head, and is to be in accordance with information provided in the Supplementary Environmental Information report (specifically Section 15 and Appendix C). Details of the surface water drainage system will include a plan for silt management and reduction during the construction phase;* | Refer to the Surface Water Management Plan and Construction Sequencing in Appendix C.<br><br>Refer to sections 1.4, 2.2, 2.3 and 2.6. |
| *The scheme shall include:*<br>*In order to construct the settlement facility/facilities some site preparation works have to be undertaken before the settlement facility/facilities are operational - details of temporary silt reduction and management measures shall be included;* | Refer to the Surface Water Management Plan and Construction Sequencing in Appendix C.<br><br>Refer to the Typical Drainage Details in Appendix F |
| *The scheme shall include:* | Refer to section 2.6 and Appendix D. |

| | |
|---|---|
| *Surface water discharge rates from the impermeable areas of the site are to be limited to greenfield Qbar flows as calculated in Appendix C of the Supplementary Environmental Information report (an overall maximum surface water discharge of 6.5 litres per second per hectare);* | |
| *The scheme shall include:*<br>*Sufficient attenuation storage for up to and including the 1 in 100 year storm event plus a 30% allowance for climate change, and surcharging the drainage system can be stored on the site without risk to people or property and without overflowing into a watercourse;* | This element of condition 79 does not need to be discharged for the Phase 3 Works because the 1 in 100 critical storm is applicable only to the operational phase. Refer to section 2.2. |
| *The scheme shall include:*<br>*Details of the design of the attenuation storage basins;* | Refer to section 2.6 and Appendix F |
| *The scheme shall include:*<br>*Details of the outfalls to watercourse(s), including the provision of a penstock, erosion protection measures and measures to ensure velocities are limited to no more than 0.3m per second unless otherwise agreed by the MPA in consultation with the Environment Agency;* | Refer to section 2.6 and Appendix E and F. |
| *The scheme shall include:*<br>*Details of how the whole surface water drainage system will be designed so as to maximise its biodiversity benefits;* | This element of condition 79 does not need to be discharged for the Phase 3 Works because the final restoration of the site will occur during later phases of the project. |
| *The scheme shall include:*<br>*Drainage from the landscaped areas is to drain into the proposed swales, upstream of a check dam where required to reduce velocities;* | Refer to section 2.3.1 and Appendix B, D and F. |
| *The scheme shall include:*<br>*Details of the proposed rainwater harvesting system;* | This element of condition 79 does not need to be discharged for the Phase 3 Works because no permanent buildings are to be constructed in this phase. |
| *The scheme shall include:*<br>*The provision of permeable surfacing on areas where it can be demonstrated that the risk of pollution is low;* | This element of condition 79 does not need to be discharged for the Phase 3 Works because no permanent permeable surfacing is proposed during this phase. |
| *The scheme shall include:*<br>*Details of how clean roof water shall be discharged to ground;* | This element of condition 79 does not need to be discharged for the Phase 3 Works because no permanent buildings are to be constructed in this phase. |
| *The scheme shall include:*<br>*Details of how the entire surface water drainage system will be maintained and managed throughout the lifetime of the development, including the construction phase. This must include details of maintenance to deal with any siltation of the attenuation storage basins and any resultant loss of capacity; and* | Refer to the Surface Water Management Plan in Appendix C. |
| *The scheme shall include:*<br>*A timetable for the implementation of the Surface Water Drainage Scheme, including during the construction phase. This is to include details regarding* | Refer to the Surface Water Management Plan and Construction Sequencing in Appendix C. |

| | |
|---|---|
| *the phasing of the construction works demonstrating that the storage available during construction is maximised (i.e. that the period of time that only the minimum 1 in 20 standard of protection is kept to the shortest possible).* | Refer to section 2.6. |
| *Development shall thereafter proceed only in strict accordance with the approved Surface Water Drainage Scheme and the timetable included within it. Once implemented, the Surface Water Drainage Scheme shall be retained and maintained throughout the lifetime of the development such that it continues to function in the manner intended and so as to ensure identified limits are not breached.* | Refer to the Surface Water Management Plan and Construction Sequencing in Appendix C. |

## 1.3 Site and Location

The Woodsmith Mine site is located approximately 5 km south of Whitby bounded by the B1416 to the West/South. The site is located in the River Esk catchment and at the very upper reaches of the Sneaton Thorpe Beck.

## 1.4 Other Documents Key to this Report

BWB undertook the Baseline Surface Hydrology report, Ref: LDT/2021/BSH [2]. This has been used to inform the surface water drainage (SWD) design. The SWD design follows the principles set out in the Surface Water Drainage Design Parameters report, Ref: LDT/2021/SWDS [3] and the Surface Water Drainage - Design Basis Report for Dove's Nest Site, Ref: REP-P2-CD-001 [4]. The design has been developed in parallel with the masterplan for the site which is shown in Appendix A, *"Woodsmith Mine Construction Phase 3 Masterplan 40-ARI-WS-71-CI-DR-1050"*.

## 1.5 Design Guidance

The design standards and guidance used in the SWD design for the site include:

- Sewers for Adoption (7$^{th}$ Edition, 2012).
- BS EN 752 Drains and sewer systems outside buildings.
- DEFRA, Rainfall runoff management for developments – Report SC030219.
- Technical Guidance to National Planning Policy Framework (NPPF).
- Design Analysis of urban storm drainage – The Wallingford Procedure.
- CIRIA Report C697, The SuDS Manual, 2007.
- CIRIA Report C753, The SuDS Manual, 2015.
- CIRIA Report C609, Sustainable Drainage Systems – Hydraulic, Structural and water quality advice, 2004.
- CIRIA Book 14, The Design of Flood Storage Reservoirs, 1993.
- CIRIA Report 156, Infiltration Drainage – Manual of Good practice, 1996.

- Environment Agency and Department for Environment, Food & Rural Affairs, Pollution prevention for businesses, 12 July 2016.
- BRE Digest 365, Soakaway Design 2012.
- Environment Agency Guidance on Outfalls: Flood Defence Information Sheet No. 3.
- Fluvial Forms and Processes, A New Perspective, David Knighton, 1998.
- Open-channel hydraulics: New York, McGraw-Hill, Chow, V.T., 1959.

# 2 Phase 3 Works Surface Water Drainage Design

## 2.1 General Arrangement

The masterplan for the Phase 3 Works (40-ARI-WS-71-CI-DR-1050) is included in Appendix A.

## 2.2 Design Principles

The SWD has been designed to drain the hard standing areas, the landscaped areas and the access road, so that the development does not increase flood risk to the surrounding area and manages flood risk at the site. To help minimise runoff from bare ground and to reduce any possible siltation of watercourses, the SWD will be one of the first construction activities. Refer to the Surface Water Management Plan in Appendix C for more details of the construction programme.

Where the potential for contamination of surface water runoff by hydrocarbons has been assessed to be sufficiently high, the surface water runoff from these areas will pass through an oil separator before being passed first to a silt removal facility then to a series of attenuation ponds, then through a series of wetlands before discharging into the local watercourse.

The runoff from developed and disturbed areas will be directed to the attenuation ponds. These include hard standing areas; disturbed soils; granular access road and, due to the natural slope of the ground, some of the undisturbed vegetated permeable areas. One small section of the access road near the welfare entrance cannot gravitate to the attenuation ponds, and as such will be treated locally before discharging to the tributaries of Sneaton Thorpe Beck. This is described further in the Surface Water Management Plan in Appendix C and the technical note for the highways work at the welfare entrance (reference TN-P10-DNF-CH-001) [5].

The surface water runoff from temporary spoil bunds to the North and East of the platform were discussed in the Phase 2 Surface Water Drainage Scheme report (reference REP-P10-DNF-CD-001) [6]. In Phase 3 a perimeter swale and a wetland will be constructed to the East (downhill) of these temporary spoil bunds. This swale and wetland will collect and treat runoff from the construction of the permanent landscaped bund that will start to form in the North East corner of the site. The discharge from this wetland will discharge into the attenuation ponds until the permanent landscaped bund is complete and the risk of sediment entering the watercourse is minimal. The connection to the attenuation pond will be maintained throughout Phase 3. The locations of these drainage features are shown on the Surface Water Drainage General Arrangement drawing 40-ARI-WS-71-CI-DR-1070 in Appendix B.

In Phase 3 a second catchment is required to drain runoff from an area of temporary spoil and landscaped bunds to the south of the platform and laydown areas. This catchment does not drain any hard standing areas and so should not pass through the oil separators. The runoff from the spoil bunds will discharge into an attenuation pond via swales with check dams and then through a wetland to control the flow and remove sediment from the runoff. This catchment is temporary prior to construction within Haxby plantation. Silt fences will be constructed at the base of all bunds to reduce sediment getting into the runoff.

For the impermeability values used in the design for the different area types, refer to table 2.0. These values are conservative and have been derived using the surface water drainage design basis report, (reference REP-P2-CD-001) [4], which is in accordance with BS EN 752.

Table 2.0: Specific Impermeability for area types

| Area | Percentage Impermeable |
|---|---|
| Hard standing | 100% |
| Disturbed bare soils | 80% |
| Granular Access Road | 80% |
| Landscaped Bunds | 30% |
| Undisturbed Fields/grass | 30% |

Only surface water runoff is to be directed to the attenuation ponds, other sources of water, such as ground water and waste water, will not discharge to the attenuation ponds.

During the Phase 3 Works, the discharge rate from all the drained areas on site will be limited to the theoretical $Q_{Bar}$ greenfield runoff rate for return periods up to the 1 in 20 year event for the critical duration. This is in accordance with the sustainable drainage principles outlined in the Surface Water Drainage Design Parameters report, (reference: LDT/2021/SWDS) [3] and has been agreed by the Environment Agency in a letter dated 13th March 2014 (reference: RA/2014/127863/01-L01). During the operational phase, the discharge rate will be limited to the theoretical $Q_{Bar}$ greenfield runoff rate for return periods up to the 1 in 100 year event for the critical duration.

The sequencing and timescales of constructing the drainage during the Phase 3 Works is summarised in the Surface Water Management Plan in Appendix C.

## 2.3 Drainage Features

A drainage plan for the Woodsmith Mine site has been developed. The drainage plan shows principal drainage infrastructure for the drained areas during Phase 3, including silt fences, swales, ditches, carrier pipes, oil separators, a silt removal facility, attenuation ponds, wetlands and outfalls.

Refer to the general arrangement drawing, *"40-ARI-WS-71-CI-DR-1070 Woodsmith Mine Surface Water Drainage General Arrangement"* in Appendix B for the location of the principal proposed SWD features.

Appendix F contains typical details of drainage features such as swales, ditches, check dams and attenuation pond details.

### 2.3.1 Swales/Ditches

Additional swales and ditches, to those constructed in Phase 2, will be used to collect surface water runoff at the toe of the landscaping bunds and around the perimeter of the hard standing platform.

They will incorporate check dams to create a terraced ponding effect, thus helping to attenuate the flow. Energy dissipation / erosion protection will be provided where required, downstream of the check dams across both the base and sides of the swale/ditch. Where possible, swales/ditches that are not located next to hard standing will incorporate a 3.5m wide access route to allow maintenance vehicles to access these assets.

Swales/ditches will also be used to intercept any runoff from undisturbed areas so that this water does not flow onto disturbed areas of the construction. Where possible, these swales/ditches will direct the runoff to local ditches/streams without going through attenuation ponds in order to mimic the natural and existing hydraulic characteristics of the site. Refer to the general arrangement drawing in Appendix B.

### 2.3.2 Silt Removal Facility

The silt removal facility, constructed during Phase 2, will incorporate a long flat treatment ditch designed to settle out fine sediments that get past the silt fences and check dams. The ditch will be lined with concrete canvas or similar to enable easier dredging operations and will have a control valve on the outlet, so that dredging can be undertaken without sediment laden water escaping downstream to the attenuation pond.

### 2.3.3 Attenuation Ponds

In the Phase 2 report [6], the revised location for the surface water attenuation ponds is explained.

During Phase 3, the attenuation ponds and wetland receiving runoff from the hard standing platform and laydown areas in the north of the site, as described in section 2.2, will be constructed.

A temporary attenuation pond to attenuate runoff from the bunds will be constructed in Phase 3. The location of the ponds are shown on the general arrangement drawing in Appendix B.

The ponds have capacity to store rainfall runoff such that no surface flooding occurs on the site during the 1 in 20 year design critical rainfall event. If a rainfall event exceeds the design capacity, an emergency overflow will be incorporated to allow water to discharge from the ponds without compromising their integrity. This is achieved by the width and gradient of the overflows and the erosion protection on the overflows.

As stated in the planning conditions and as agreed with the Environment Agency in a letter dated 13th March 2014 (reference: RA/2014/127863/01-L01), during construction, the discharge rate from the attenuation pond will be limited to the $Q_{Bar}$ greenfield runoff rate for return periods up to the 1 in 20 year event for the critical duration. The method of calculating $Q_{Bar}$ is detailed in the BWB Baseline Surface Hydrology report, Ref LDT/2021/BSH. [2].

### 2.3.4 Wetlands

During Phase 3, the three wetlands will be constructed forming the final stage of SuDS treatment before discharge to the tributaries of Sneaton Thorpe Beck.

The northernmost permeable catchment drains to an existing low point on the north eastern boundary of the site. Although a wetland is not strictly needed for permeable catchments, the existing land is already marshy and therefore conducive to the incorporation of a wetland / ecological enhancement area. Therefore, this wetland will be constructed but the outfall will be temporarily directed into the attenuation ponds as silty runoff is expected during Phase 3. During later phases the wetland will be landscaped and planted appropriately once the bunds upstream have vegetation established. At this stage the wetland outfall will be amended to discharge into the existing tributary of Sneaton Thorpe Beck.

The catchment to the south of the platform draining the landscaped bunds will pass through a temporary wetland, to provide the final stages of treatment prior to discharge to an existing ditch.

A permanent wetland will be constructed to provide the final stage of treatment for the runoff from the hard standing platform and laydown areas in the north of the site after passing through the attenuation ponds.

### 2.3.5 Additional Sediment Control

In addition to the silt removal facility, attenuation pond, swales / ditches and check dams, there will be further sediment control techniques and features such as silt fences at the toe of the bare landscaped bunds. These features will be maintained throughout the Phase 3 Works to ensure the silt runoff is managed appropriately. Further details can be found in the Surface Water Management Plan in Appendix C.

### 2.3.6 Oil Separators

Oil separators will be provided on all SWD systems installed to collect and convey runoff from hard standing areas. The separators will be designed in accordance with the Environment Agency's "Pollution Prevention for Businesses" guidance. The locations of the separators are shown on the general arrangement drawing in Appendix B.

### 2.3.7 Flow controls

The discharge from the attenuation ponds will be controlled by flow control devices such as an orifice plates or vortex flow control devices (e.g. Hydrobrakes), which will be installed as soon as the ponds are constructed. These can be easily modified or replaced as and when required throughout subsequent phases of construction to maintain the required design standard, i.e. a maximum allowable rate of discharge equating to 6.5 litres per second per hectare.

### 2.3.8 Outfalls

One permanent and two temporary outfalls will be constructed during the Phase 3 works, as shown on the general arrangement drawing in Appendix B. The temporary outfall from the Phase 2 attenuation pond will be removed and a permanent outfall downstream of the permanent wetland taking runoff from the hard standing catchment will be constructed. To ensure velocities are kept to a minimum, this outfall will comprise a wide weir with a gentle gradient slope to the watercourse. Water from the wetland will trickle over this weir and onto the slope, which will have erosion protection to assist vegetation to establish.

A temporary outfall from the wetland on the Southern catchment will be constructed. It will also be formed with a weir and gentle slope directing water to the existing field ditch.

A second temporary outfall will be constructed downstream of the granular reinjection borehole pad. This outfall is located downstream of an oil separator, and as such will be via a pipe and concrete headwall. A typical outfall detail is shown in Appendix F.

During later phases, these temporary outfalls will be removed and additional permanent outfall arrangements will be constructed.

Land Drainage Consent will be obtained for any temporary or permanent structures in or adjacent to the watercourses.

## 2.4 Groundwater

There will be no permanent ground water discharges to the proposed SWD attenuation features. On impermeable networks, where some drainage features are required below normal ground water level, liners will be used to exclude ground water from the SWD system.

In Phase 3, for stability purposes, the proposed landscaped bund at the north eastern corner of the site may require a drainage blanket to be installed at formation level to drain existing high ground water levels. This would be delivered using a series of granular trenches discharging to the nearest surface water drainage feature. The extent of these granular drainage blankets will be determined when the top soil and subsoil is removed.

All the landscaping and temporary spoil bunds will be surrounded by swales. The swales will have check dams to attenuate the runoff during rainfall events and help to settle out sediments. Although no positive infiltration will be provided, over time some of this water will infiltrate into the superficial deposits.

## 2.5 Calculation Methodology

The Phase 3 Works layout for the Woodsmith Mine has been assessed and the required attenuation volumes calculated. The results are shown in section 2.6.

The allowable rates of discharge from the ponds have been calculated for the Phase 3 Works based on the $Q_{Bar}$ greenfield runoff rate for the total contributing area.

For the Phase 3 Works, a 1 in 20 year return period design storm with no climate change allowance has been applied to a MicroDrainage model of the proposed network. Simulations have been undertaken using a range of durations from 15 minutes to seven days to determine the critical duration for each part of the network to ensure no flooding occurs and the attenuation is sufficient.

## 2.6 Calculation Results

The MicroDrainage model outputs in Appendix D demonstrate that the design described in this report meets the requirements set out in the planning conditions [1]. In particular, the discharge rate from the developed areas has been limited to the $Q_{Bar}$ greenfield runoff rate and the volume of attenuation provided is sufficient to attenuate flows up to the 1 in 20 year return period event.

### Runoff Rates

The allowable $Q_{Bar}$ greenfield runoff rate is 6.5 l/s/ha, based on the Baseline Surface Hydrology report [2].

The flow rate is controlled by flow control devices at the outlets of the attenuation ponds. Table 2.1 summarises the modelling outputs in Appendix D.

| | Northern Catchment | Southern Catchment | Refer to: |
|---|---|---|---|
| Gross Area drained | 25.38 hectares | 2.58 hectares | Appendix D, Area Summary table |
| Greenfield Runoff Rate (Allowable Rate of Discharge) | 6.5 x 25.38 = 165 l/s | 6.5 x 2.58 = 16.8 l/s | |
| Maximum modelled rate of discharge | 77.7 l/s | 12.0 l/s | Appendix D, critical results by maximum level for Pipes PH3-N-1.037 and PH3-S-1.020 |

**Table 2.1 Summary of modelled Runoff Rates**

### Volume of Attenuation

A summary of the MicroDrainage modelling results are shown in Table 2.2 and the modelling outputs are shown in Appendix D.

| | Northern Catchment | Southern Catchment | Refer to: |
|---|---|---|---|
| Volume used in MicroDrainage model | 8838 $m^3$ | 471 $m^3$ | Appendix D, Graphs for Pipes PH3-N-1.034 to 1.036 and Pipe PH3-S-1.009 |
| Volume provided by proposed Phase 3 Earthworks Design | 9900 $m^3$ | 1100 $m^3$ | Appendix B, Volumes provided on General Arrangement Drawing. |

**Table 2.2 Summary of modelled attenuation volume requirements**

In both catchments the attenuation ponds provided in the earthworks design have sufficient storage volumes to attenuate surface water runoff to the allowable rate of discharge.

In the Northern catchment, the storage provided has been maximised to minimise the risk of sediment discharging into the watercourse. Providing additional storage means that the rate of discharge can be significantly reduced to approximately half of the allowable greenfield runoff rate.

The Southern catchment is temporary and, during Phase 3, the volume stored is less than half the total storage provided and hence the rate of discharge is also lower than the allowable greenfield runoff rate.

### Silt Removal

As stated in the Surface Water Drainage Design Parameters report, Ref: LDT/2021/SWDS [3], a minimum of three stages of treatment have been provided to minimise the risk of sediments entering the tributaries of Sneaton Thorpe Beck. The design in Phase 3 incorporates; swales and ditches with check dams, infiltration to ground, oil separators with silt traps, a silt removal facility a series of attenuation ponds and wetlands.

Calculations have been carried out to estimate the percentage removal of sediments in the silt removal facility, attenuation ponds and wetlands using the 1 in 20 year critical duration storm event. CIRIA Book 14, Chapter 6.5, "Estimating Pollutant Removal Efficiency" was used for this calculation. A summary of the results are shown in the table below. The calculations are provided in Appendix E.

| **Particle** | **Settling velocities (mm/s)** | **% Removal in Silt Removal Facility** | **% Removal in Attenuation Ponds** | **% Removal in Wetland** | **Total % Removed** |
|---|---|---|---|---|---|
| Coarse Sand | 200 | 100% | | | 100% |
| Fine Sand | 22 | 100% | | | 100% |
| Coarse Silt | 6.7 | 100% | | | 100% |
| Fine Silt | 0.18 | 68% | 100% | | 100% |
| Coarse Clay | 0.016 | 10% | 76% | 33% | 85% |
| Fine Clay | 0.011 | 7% | 59% | 23% | 70% |

**Table 2.3 Summary of Silt Removal Calculations for Northern Catchment**

In the Northern catchment, for the critical duration 1 in 20 year storm event, all the sands and most of the silts are shown to drop out before reaching the attenuation pond. In the series of ponds, the remaining silts and approximately 68% of all clays would drop out. In the wetland, a further 28% would drop out giving a total of about 78% clay removal for the whole system, before discharging to the watercourse. These calculations are conservative, as they do not take into account the additional settlement that would occur in the swales, the oil separator, behind the silt fences and in the check dams. The calculations are also conservative because they use the maximum flow rates generated during the critical duration storm.

In large events, such as the 1 in 20 year critical duration storm, sediment erosion and transportation would be expected in the existing tributaries. Therefore, removal of 78% clays and 100% of larger particles in the 1 in 20 year storm is considered acceptable.

| Particle | Settling velocities (mm/s) | % Removal in Attenuation pond | % Removal in Wetland | Total % Removed |
|---|---|---|---|---|
| Coarse Sand | 200 | 100% | | 100% |
| Fine Sand | 22 | 100% | | 100% |
| Coarse Silt | 6.7 | 100% | | 100% |
| Fine Silt | 0.18 | 100% | | 100% |
| Coarse Clay | 0.016 | 100% | | 100% |
| Fine Clay | 0.011 | 84% | 76% | 96% |

**Table 2.4 Summary of Silt Removal Calculations for Southern Catchment**

In the Southern catchment, for the critical duration 1 in 20 year storm event, all the sands and silts are shown to drop out in the attenuation pond. 98% of clays are shown to drop out in the pond and wetland before discharging to the watercourse. These calculations are conservative as they do not take into account the additional settlement that would occur in the swales, behind the silt fences and in the check dams. The calculations are also conservative because they use the maximum flow rates generated during the critical duration storm.

In large events such as the 1 in 20 year critical duration storm sediment erosion and transportation would be expected in the existing tributaries. Therefore, removal of 98% clays and 100% of larger particles in the 1 in 20 year storm is considered acceptable.

## Outfall Velocities

Appendix E contains an assessment of the existing tributaries of Sneaton Thorpe Beck downstream of the site. The assessment demonstrates that a maximum allowable velocity of 1.2m/s would be appropriate for these tributaries.

As described in section 2.3.8, there are two temporary outfalls to be constructed during the Phase 3 Works, as shown in the general arrangement drawing in Appendix B.

The first temporary outfall drains the granular reinjection borehole pad, which will be drained via filter drains and a catchpit, through an oil separator and into the ditch via an outfall headwall. Appendix E contains calculations specific to this temporary outfall. The calculations show that using an outfall with an up-stand or “stilling basin” the maximum velocity discharging in the critical storm event is 0.6 m/s. This is less than the allowable discharge rate of 1.2m/s and therefore can be considered acceptable. A typical outfall headwall detail is shown in Appendix F.

The second temporary outfall is downstream of the temporary wetland draining the landscaped bunds to the south of the platform. Appendix D contains model outputs for the outfall velocity. The graph show that the maximum velocity discharging in the critical storm event is approximately 0.1 m/s and is therefore considered acceptable (it is less than 1.2m/s).

There is one permanent outfall to be constructed during the Phase 3 Works. This outfall discharge flows from the Northern catchment after passing through the attenuation ponds and wetland. Appendix D contains model outputs for the outfall velocity. The graph show that the maximum velocity discharging in the critical storm event is approximately 0.2 m/s and is therefore considered acceptable (it is less than 1.2m/s).

# 3 Conclusions

The design demonstrates how the surface water will be managed on site during the Phase 3 Works. The proposed arrangements will ensure that the site is not at risk of flooding and does not impact on flood risk elsewhere.

The MicroDrainage model outputs demonstrate that the design described in this report meets the requirements set out in the planning conditions. In particular the discharge rates from the developed areas have been limited to the $Q_{Bar}$ greenfield runoff rates and the volume of attenuation provided is sufficient to attenuate flows up to the 1 in 20 year return period event.

The design complies with the sustainable drainage strategy. In particular an appropriate treatment train is proposed and the calculations demonstrate that the provision for sediment removal is sufficient prior to discharging to the watercourse and that the outfall velocity is appropriate to minimise the impact on the receiving water body.

This report demonstrates that the SWD design and management during the Phase 3 Works meets the requirements of conditions 60 and 79 of the North York Moors National Park Authority (NYMNPA) planning permission NYM/2014/0676/MEIA.

The necessary land drainage consents will be applied for from North Yorkshire County Council ahead of the works.

# References

[1] North York Moors National Park Authority planning permission NYM/2014/0676/MEIA.

[2] Baseline Surface Hydrology, Ref LDT/2021/BSH, Revision F, BWB, 11/09/2014.

[3] Surface Water Drainage Design Parameters, Ref LDT/2021/SWDS, Revision D, BWB, 12/09/2014.

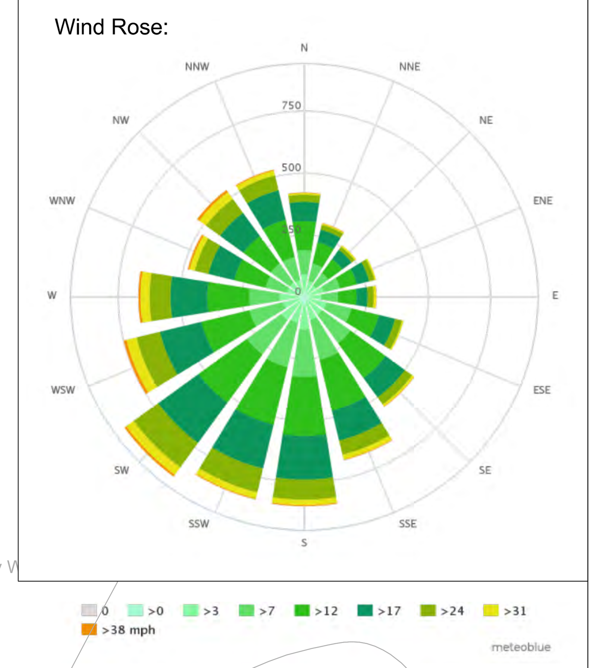
[4] Surface Water Drainage - Design Basis Report for Dove's Nest Site, REP-P2-CD-001, Rev 3, Arup, July 2014.

[5] Highway Improvement 2: Dove's Nest Farm Welfare Access B1416. Technical Note, TN-P10-DNF-CH-001, Rev A, Arup, November 2016.

[6] NYMNPA 60 and 79 Surface Water Drainage Scheme, REP-P10-DNF-CD-001, Rev 1, Arup, December 2016.

# Appendix A

Phase 3 Masterplan


Notes:

1. Dewatering during phase 3 to a maximum of 3m below platform level.

Key:

- Land ownership boundary
- Construction Phase Security Fence
- Temporary Heras Fence
- Topographical survey
- Proposed layout
- 3m high Environmental / acoustic barrier
- Safety Bund
- Proposed drainage ditch
- Surface water drainage attenuation pond
- Surface water drainage wetland
- Telecommunication mast

Key to utilities:

- Existing Northern Powergrid electrical apparatus

| Issue | Date | By | Chkd | Appd |
|---|---|---|---|---|
| 0 | 31/03/17 | JB | CW | AH |
| | Issued for Planning | | | |
| D | 30/03/17 | JB | CW | AH |
| | Draft for comment | | | |
| C | 14/03/17 | JB | CW | AH |
| | Draft | | | |
| B | 22/02/17 | JB | CW | AH |
| | Draft | | | |
| A | 13/02/17 | JB | CW | AH |
| | Draft | | | |

ARUP

Admiral House, Rose Wharf,
78 East Street, Leeds, LS9 8EE
Tel +44(0)113 242 8498 Fax +44(0)113 242 8573
www.arup.com

Client
Sirius Minerals Plc

Job Title
Woodsmith Mine
Proposed Minehead

Woodsmith Mine
Construction Phase 3
Masterplan

Scale at A1: 1:2000

Discipline: Highways

Job No: 253285

Drawing Status: Planning

Drawing No: 40-ARI-WS-71-CI-DR-1050

Issue: 0

Do not scale

# Appendix B

Phase 3 Drainage Layout


Notes:

1. The surface water drainage has been coordinated with Earthworks contours dated March 2017.
2. This drawing shows the proposed surface water drainage network for Site Preparation Phase 3.
3. For surface water drainage features refer to drawings 40-ARI-WS-71-CI-DR-1071 to 74.
4. The perimeter ditches around the platforms are to be lined with an impermeable liner.

Key:

- Land Ownership Boundary
- Proposed General Arrangement layout
- Surface water drainage attenuation pond
- Existing watercourses / ditch
- Manhole and carrier pipe
- Swale
- Check dam
- Silt fence
- Ditch
- Ditch with impermeable liner
- Inlet/ outlet headwall
- Filter drain

| Issue | Date | By | Chkd | Appd |
|---|---|---|---|---|
| 0 | 31/03/17 | JB | CW | AH |
| | Issued for Planning | | | |
| B | 30/03/17 | JB | CW | AH |
| | Draft | | | |
| A | 07/03/17 | JB | NF | AH |
| | Draft issue | | | |

ARUP

Admiral House, Rose Wharf,
78 East Street, Leeds, LS9 8EE
Tel +44(0)113 242 8498 Fax +44(0)113 242 8573
www.arup.com

Client
Sirius Minerals Plc

Job Title
Woodsmith Mine
Proposed Minehead

Woodsmith Mine Site
Construction Phase 3
Drainage General Arrangement

Scale at A1: 1:2000

Discipline: Drainage

Job No: 253285

Drawing Status: Planning

Drawing No: 40-ARI-WS-71-CI-DR-1070

Issue: 0

Do not scale

# Appendix C

Surface Water Management Plan

Sirius Minerals

**Phase 3 Works**

# NYMNPA 60 and 79: Surface Water Management Plan

40-ARI-WS-71-PA-RP-1051

Rev 0 | 31 March 2017



Job number 234376-00

**Ove Arup & Partners Ltd**
Admiral House Rose Wharf
78 East Street
Leeds LS9 8EE
United Kingdom
www.arup.com

ARUP

# Document Verification

ARUP

| Job title | | Phase 3 Works | | Job number<br>234376-00 | |
|---|---|---|---|---|---|
| **Document title** | | NYMNPA 60 and 79: Surface Water Management Plan | | **File reference**<br>0-12-8 | |
| **Document ref** | | 40-ARI-WS-71-PA-RP-1051 | | | |
| **Revision** | **Date** | **Filename** | REP-P10-WS-CD-003 Phase 3 SW Management Plan 20170313 Rev A.docx | | |
| Draft A | 13 Mar 2017 | **Description** | First draft | | |
| | | | Prepared by | Checked by | Approved by |
| | | Name | N. Ferro | D. Ainger | A.Hornung |
| | | Signature | | | |
| Rev 0 | 31 Mar 2017 | **Filename** | 40-ARI-WS-71-PA-RP-1051_0_IFU_20170313 SWMP.docx | | |
| | | **Description** | Incorporated comments and Issue | | |
| | | | Prepared by | Checked by | Approved by |
| | | Name | N. Ferro | D. Ainger | A. Hornung |
| | | Signature | | | |
| | | **Filename** | | | |
| | | **Description** | | | |
| | | | Prepared by | Checked by | Approved by |
| | | Name | | | |
| | | Signature | | | |
| | | **Filename** | | | |
| | | **Description** | | | |
| | | | Prepared by | Checked by | Approved by |
| | | Name | | | |
| | | Signature | | | |

**Issue Document Verification with Document** ✓

# Contents

# 1 Surface Water Management Plan (Phase 3)

For the Surface Water Management Plan for the previous phase of construction (Phase 2) refer to document REP-P10-DNF-CD-002, Rev 1. This Plan for Phase 3 is very similar to the Phase 2 Plan but it has been amended to suit the new drainage configuration and features that are constructed in Phase 3.

There are a range of methodologies for managing sediment contaminated surface water runoff from construction sites, with the method used being dependent on the volumes of surface water runoff and the levels of sedimentation. The surface water drainage masterplan for the Phase 3 Works is shown on drawing 40-ARI-WS-71-CI-DR-1070. This drawing shows the location of the main drainage network and the features to manage sediment. Typical details of the drainage features are shown on drawings 40-ARI-WS-71-CI-DR-1071 to 1074.

As far as practicable, surface water runoff from areas of hard standing will be kept separate from those areas where sediment contaminated surface water runoff is anticipated. While runoff from areas of hard standing is not anticipated to generate large quantities of sediment, this surface water will be collected in hard standing perimeter ditches with check dams and passed through oil separators, a silt removal facility, attenuation storage ponds and a wetland before being discharged to the tributaries of Sneaton Thorpe Beck.

Surface water runoff from temporary spoil bunds and permanent landscaped bunds will be controlled by the aid of swales with check dams and cleansed with hay/heather bales and silt fencing before being passed through the treatment train of attenuation ponds and wetlands. There will be multiple secondary silt fences positioned in fields downstream of some swales to intercept, slow and treat any water that seeps over the edge of the swales to mimic a more ‘natural’ response and avoid surface water ‘sheeting’ off the slopes.

The drainage of the main access road connecting the Welfare entrance and the platform will combine with the drainage from the platform and drain through the treatment train. There is a short section of the access road near the welfare entrance that cannot gravitate to the main attenuation pond. For this section of the access road, local measures will be applied similar to the treatment methodology described in the Technical Note TN-P10-DNF-CH-001 Rev B for the highways work at the welfare entrance.

The discharge from the wetlands will be monitored for suspended solids, using a combination of visual monitoring and turbidity meter monitoring in accordance with the Groundwater and Surface Water Monitoring Scheme, condition NYMNPA 46. If the trigger levels are exceeded the appropriate plan of action will be implemented in accordance with the remedial action plan condition NYMNPA 46. Depending on the results a number of options are available:

The penstock on the attenuation pond can be temporarily closed or partially closed to temporarily reduce the flow to the watercourse and increase the retention time to allow the sediments to settle out. This will be particularly effective for short intense storms. These temporary measures can be put in place without compromising the overall drainage strategy for Phase 3. This would be actively managed so that the pond is empty before the next storm event occurs.

Additional treatment such as hay/heather bales and silt fences could be put in place in the tributaries of Sneaton Thorpe Beck downstream of the outfall locations but still within the site boundary. An experienced drainage engineer or geomorphologist will supervise the placement of these features to maximise sediment removal. These additional treatments will be readily available and stored local to the beck, should the need arise.

An environmentally friendly coagulant can be used in specific check dams upstream of the silt removal facility to promote flocculation of the finer particles within the storage areas and speed up the settling rate.

In addition to inspections of the discharges, regular monitoring of the tributaries of Sneaton Thorpe Beck will be undertaken, as detailed in the Groundwater and Surface Water Monitoring Scheme, to ensure that the discharge is not causing discoloration, erosion of the bank or disturbance of the bed of the watercourse. Records of all monitoring will be kept along with actions that were taken in the event of issues arising.

During Phase 3 all permanent landscaped bunds and temporary spoil bunds will be grass seeded as soon as practicable to ensure that sediment laden surface water runoff is minimised. Erecting silt fences at source around these spoil bunds, in combination with swales and check dams is the main method to prevent siltation getting into the drainage system. Silt fences will be installed to manufacturer's recommendations (such as http://www.geofabrics.co.nz/media/2910/silt-fence-installation.pdf).

The silt fences and check dams will be monitored through regular surveys. If silt builds up and 30% of the available storage is used up, then scraping, dredging or emptying and re-profiling will be undertaken to ensure the full storage volume is maintained.

The silt removal facility and attenuation storage will be monitored through regular surveys. If silt builds up to a depth of 200mm then scraping, dredging or emptying and re-profiling will be undertaken to ensure the full storage volume is maintained.

Throughout the Phase 3 Works, the surface water drainage system will be inspected on a daily basis to ensure that it is in good working order and when necessary all pipework, swales and other drainage elements, such as the oil separators and flow control devices, shall be cleaned out to guarantee unobstructed flow and prevent build-up of sediment. Any extracted sediment will be redistributed thinly over the works area to dry out and become integrated into the landscaping.

Due to the nature of the works, and their phasing, the drainage arrangements will alter during construction and as a result, the Surface Water Management Plan will be a live and flexible document. While the attenuation pond will be sized to take account of storm events, the flexibility of the Plan will also allow rapid response to weather conditions and unexpected events.

The timescales and construction methods for this work are summarised below.

# 2 Surface Water Drainage – Sequence of Works and Construction Methods

The order in which the proposed surface water drainage measures are implemented will have a bearing on the protection of Seaton Thorpe Beck; the proposed surface water drainage design will be constructed, in general, working from the downstream end towards the upstream end. The following sequencing will be undertaken (start date on site of 05/06/17 is assumed).

- (05/06) All existing surface water drainage measures implemented during Phase 3 will be inspected to ensure they are in good order. Any necessary remedials will be undertaken immediately.
- (05/06 to 16/06) The proposed wetland and attenuation pond will be excavated and formed; the slipway into the Seaton Thorpe Beck tributary will not be constructed until all other aspects of the wetland and pond are complete.
- (05/06 to 09/06) Before starting works to the platforms, the existing perimeter ditches will be extended to suit the extended platform profiles; check dams will be installed for de-silting purposes.
- (12/06 to 13/06) Once the platform ditches have been extended, the redundant section of the existing Phase 2 ditch will be abandoned.
- (12/06 to 16/06) The existing attenuation pond will be enlarged to suit the new design profile.
- (19/06 to 23/06) Modifications to utilise the existing carrier drainage system will be made such that the new surface water measures work with infrastructure constructed during Phase 2.
- (19/06 to 23/06) The drainage ditch and temporary attenuation pond located south of the concrete batching plant location will be constructed.
- De-watering of excavations and working areas will be undertaken using submersible pumps with discharge directed into the silt removal facility or a suitable area within the site upstream of this.

The following construction methods will be implemented:

- Excavation of drainage trenches, ponds and swales will be undertaken using an excavator or dozer in accordance with the earthworks method statements.
- Spoil will be transported by dumper and incorporated into the earthworks cut & fill operations.
- Geotextile and geogrid membranes will be rolled out and overlapped / welded in accordance with the manufacturer's instructions.
- Concrete canvas will be placed within drainage ditches, with the canvas being lifted into position by an excavator and laid out by hand.

# Appendix D

Micro Drainage Model Outputs

## STORM SEWER DESIGN by the Modified Rational Method

## Design Criteria for Phase 3 Northern

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

| | | | | | |
|---|---|---|---|---|---|
| Return Period (years) | 20 | F (1km) | 2.381 | Maximum Backdrop Height (m) | 1.500 |
| Site Location | | Maximum Rainfall (mm/hr) | 100 | Min Design Depth for Optimisation (m) | 0.500 |
| C (1km) | -0.022 | Maximum Time of Concentration (mins) | 30 | Min Vel for Auto Design only (m/s) | 1.00 |
| D1 (1km) | 0.374 | Foul Sewage (l/s/ha) | 0.000 | Min Slope for Optimisation (1:X) | 500 |
| D2 (1km) | 0.409 | Volumetric Runoff Coeff. | 0.750 | | |
| D3 (1km) | 0.270 | Add Flow / Climate Change (%) | 0 | | |
| E (1km) | 0.288 | Minimum Backdrop Height (m) | 0.200 | | |

Designed with Level Inverts

## Network Design Table for Phase 3 Northern

« - Indicates pipe capacity < flow

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-1.000 | 29.672 | 0.050 | 593.4 | 0.155 | 10.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-1.001 | 29.672 | 0.050 | 593.4 | 0.000 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-1.002 | 30.700 | 0.050 | 614.0 | 0.114 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-1.003 | 10.836 | 0.020 | 541.8 | 0.000 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-2.000 | 39.366 | 0.500 | 78.7 | 0.025 | 15.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-2.001 | 38.563 | 0.500 | 77.1 | 0.049 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-2.002 | 38.563 | 0.500 | 77.1 | 0.000 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-2.003 | 42.943 | 0.700 | 61.3 | 0.031 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-3.000 | 70.000 | 1.000 | 70.0 | 0.041 | 15.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-1.000 | 83.88 | 10.68 | 203.500 | 0.155 | 0.0 | 0.0 | 0.0 | 0.72 | 314.4 | 35.1 |
| PH3-N-1.001 | 80.36 | 11.37 | 203.450 | 0.155 | 0.0 | 0.0 | 0.0 | 0.72 | 314.4 | 35.1 |
| PH3-N-1.002 | 77.02 | 12.09 | 203.400 | 0.268 | 0.0 | 0.0 | 0.0 | 0.71 | 309.1 | 55.9 |
| PH3-N-1.003 | 75.98 | 12.33 | 203.350 | 0.268 | 0.0 | 0.0 | 0.0 | 0.76 | 329.0 | 55.9 |
| PH3-N-2.000 | 58.62 | 17.94 | 208.500 | 0.025 | 0.0 | 0.0 | 0.0 | 0.22 | 48.6 | 4.0 |
| PH3-N-2.001 | 52.94 | 20.79 | 208.000 | 0.074 | 0.0 | 0.0 | 0.0 | 0.23 | 49.1 | 10.6 |
| PH3-N-2.002 | 48.45 | 23.64 | 207.500 | 0.074 | 0.0 | 0.0 | 0.0 | 0.23 | 49.1 | 10.6 |
| PH3-N-2.003 | 44.80 | 26.47 | 207.000 | 0.105 | 0.0 | 0.0 | 0.0 | 0.25 | 55.0 | 12.8 |
| PH3-N-3.000 | 54.52 | 19.93 | 208.500 | 0.041 | 0.0 | 0.0 | 0.0 | 0.24 | 51.5 | 6.1 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-3.001 | 53.700 | 0.409 | 131.3 | 0.032 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-3.002 | 20.500 | 0.156 | 131.4 | 0.015 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-3.003 | 20.200 | 0.154 | 131.2 | 0.013 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-3.004 | 10.700 | 0.081 | 132.1 | 0.000 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-3.005 | 21.800 | 0.390 | 55.9 | 0.000 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-3.006 | 31.600 | 0.010 | 3160.0 | 0.026 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-2.004 | 38.400 | 3.270 | 11.7 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 300 | |
| PH3-N-1.004 | 28.500 | 0.360 | 79.2 | 0.085 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-1.005 | 31.400 | 0.470 | 66.8 | 0.046 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-3.001 | 46.47 | 25.10 | 207.500 | 0.073 | 0.0 | 0.0 | 0.0 | 0.17 | 37.6 | 9.2 |
| PH3-N-3.002 | 44.10 | 27.08 | 207.091 | 0.088 | 0.0 | 0.0 | 0.0 | 0.17 | 37.6 | 10.5 |
| PH3-N-3.003 | 42.03 | 29.03 | 206.935 | 0.101 | 0.0 | 0.0 | 0.0 | 0.17 | 37.6 | 11.5 |
| PH3-N-3.004 | 41.08 | 30.00 | 206.781 | 0.101 | 0.0 | 0.0 | 0.0 | 0.17 | 37.5 | 11.5 |
| PH3-N-3.005 | 41.08 | 30.00 | 206.700 | 0.101 | 0.0 | 0.0 | 0.0 | 0.27 | 57.6 | 11.5 |
| PH3-N-3.006 | 41.08 | 30.00 | 206.310 | 0.127 | 0.0 | 0.0 | 0.0 | 0.04 | 7.7« | 14.1 |
| PH3-N-2.004 | 41.08 | 30.00 | 206.600 | 0.232 | 0.0 | 0.0 | 0.0 | 4.61 | 326.1 | 25.8 |
| PH3-N-1.004 | 41.08 | 30.00 | 203.330 | 0.585 | 0.0 | 0.0 | 0.0 | 1.98 | 860.8 | 65.1 |
| PH3-N-1.005 | 41.08 | 30.00 | 202.970 | 0.631 | 0.0 | 0.0 | 0.0 | 2.15 | 937.0 | 70.2 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-1.006 | 23.261 | 2.000 | 11.6 | 0.047 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-1.007 | 23.000 | 0.020 | 1150.0 | 0.036 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-1.008 | 14.735 | 0.080 | 184.2 | 0.174 | 0.00 | 0.0 | 0.600 | | o | 300 | |
| PH3-N-1.009 | 14.735 | 0.015 | 1000.0 | 0.000 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-1.010 | 15.880 | 0.016 | 1000.0 | 0.224 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-1.011 | 15.603 | 0.016 | 1000.0 | 0.136 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-1.012 | 30.421 | 0.030 | 1000.0 | 0.174 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-1.013 | 24.500 | 0.025 | 1000.0 | 0.181 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-1.014 | 18.824 | 0.090 | 209.2 | 0.199 | 0.00 | 0.0 | 0.600 | | o | 300 | |
| PH3-N-1.015 | 18.824 | 0.019 | 1000.0 | 0.000 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-1.016 | 35.017 | 0.035 | 1000.0 | 0.274 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-1.006 | 41.08 | 30.00 | 202.500 | 0.678 | 0.0 | 0.0 | 0.0 | 5.16 | 2245.8 | 75.4 |
| PH3-N-1.007 | 41.08 | 30.00 | 200.500 | 0.714 | 0.0 | 0.0 | 0.0 | 0.52 | 225.9 | 79.4 |
| PH3-N-1.008 | 41.08 | 30.00 | 200.480 | 0.887 | 0.0 | 0.0 | 0.0 | 1.16 | 163.3 | 98.7 |
| PH3-N-1.009 | 41.08 | 30.00 | 200.400 | 0.887 | 0.0 | 0.0 | 0.0 | 0.56 | 242.2 | 98.7 |
| PH3-N-1.010 | 41.08 | 30.00 | 200.385 | 1.111 | 0.0 | 0.0 | 0.0 | 0.56 | 242.2 | 123.6 |
| PH3-N-1.011 | 41.08 | 30.00 | 200.369 | 1.247 | 0.0 | 0.0 | 0.0 | 0.56 | 242.2 | 138.8 |
| PH3-N-1.012 | 41.08 | 30.00 | 200.353 | 1.421 | 0.0 | 0.0 | 0.0 | 0.56 | 242.2 | 158.2 |
| PH3-N-1.013 | 41.08 | 30.00 | 200.323 | 1.602 | 0.0 | 0.0 | 0.0 | 0.56 | 242.2 | 178.3 |
| PH3-N-1.014 | 41.08 | 30.00 | 200.299 | 1.801 | 0.0 | 0.0 | 0.0 | 1.08 | 153.1« | 200.4 |
| PH3-N-1.015 | 41.08 | 30.00 | 200.209 | 1.801 | 0.0 | 0.0 | 0.0 | 0.56 | 242.2 | 200.4 |
| PH3-N-1.016 | 41.08 | 30.00 | 200.190 | 2.075 | 0.0 | 0.0 | 0.0 | 0.56 | 242.2 | 230.9 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-1.017 | 42.873 | 0.055 | 779.5 | 0.288 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-4.000 | 15.700 | 0.040 | 392.5 | 0.025 | 10.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-4.001 | 37.300 | 0.150 | 248.7 | 0.018 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-4.002 | 20.000 | 0.150 | 133.3 | 0.036 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-4.003 | 5.500 | 0.025 | 220.0 | 0.027 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-4.004 | 30.000 | 0.100 | 300.0 | 0.046 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-4.005 | 30.667 | 0.100 | 306.7 | 0.139 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-4.006 | 29.363 | 0.075 | 391.5 | 0.127 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-4.007 | 7.000 | 0.020 | 350.0 | 0.111 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-4.008 | 33.500 | 0.150 | 223.3 | 0.020 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-1.017 | 41.08 | 30.00 | 200.155 | 2.363 | 0.0 | 0.0 | 0.0 | 0.63 | 274.3 | 263.0 |
| PH3-N-4.000 | 86.06 | 10.29 | 202.840 | 0.025 | 0.0 | 0.0 | 0.0 | 0.89 | 386.6 | 5.7 |
| PH3-N-4.001 | 82.99 | 10.85 | 202.800 | 0.042 | 0.0 | 0.0 | 0.0 | 1.12 | 485.7 | 9.5 |
| PH3-N-4.002 | 81.85 | 11.07 | 202.650 | 0.078 | 0.0 | 0.0 | 0.0 | 1.52 | 663.3 | 17.3 |
| PH3-N-4.003 | 81.46 | 11.15 | 202.500 | 0.105 | 0.0 | 0.0 | 0.0 | 1.19 | 516.4 | 23.1 |
| PH3-N-4.004 | 79.06 | 11.64 | 202.475 | 0.150 | 0.0 | 0.0 | 0.0 | 1.02 | 442.2 | 32.2 |
| PH3-N-4.005 | 76.76 | 12.15 | 202.375 | 0.289 | 0.0 | 0.0 | 0.0 | 1.01 | 437.4 | 60.1 |
| PH3-N-4.006 | 74.44 | 12.70 | 202.275 | 0.416 | 0.0 | 0.0 | 0.0 | 0.89 | 387.1 | 84.0 |
| PH3-N-4.007 | 73.95 | 12.82 | 202.200 | 0.527 | 0.0 | 0.0 | 0.0 | 0.94 | 409.4 | 105.6 |
| PH3-N-4.008 | 72.11 | 13.30 | 202.180 | 0.547 | 0.0 | 0.0 | 0.0 | 1.18 | 512.5 | 106.9 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-4.009 | 34.471 | 0.180 | 191.5 | 0.134 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-4.010 | 28.566 | 0.150 | 190.4 | 0.123 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-4.011 | 24.472 | 0.050 | 489.4 | 0.104 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-5.000 | 64.000 | 1.100 | 58.2 | 0.199 | 10.00 | 0.0 | 0.600 | | o | 225 | |
| PH3-N-5.001 | 63.500 | 1.100 | 57.7 | 0.228 | 0.00 | 0.0 | 0.600 | | o | 225 | |
| PH3-N-5.002 | 32.500 | 0.700 | 46.4 | 0.240 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 500 | |
| PH3-N-6.000 | 64.000 | 1.000 | 64.0 | 0.148 | 10.00 | 0.0 | 0.600 | | o | 225 | |
| PH3-N-6.001 | 63.500 | 1.100 | 57.7 | 0.152 | 0.00 | 0.0 | 0.600 | | o | 225 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-4.009 | 70.47 | 13.75 | 202.030 | 0.681 | 0.0 | 0.0 | 0.0 | 1.27 | 553.5 | 130.0 |
| PH3-N-4.010 | 69.17 | 14.12 | 201.850 | 0.804 | 0.0 | 0.0 | 0.0 | 1.28 | 555.0 | 150.7 |
| PH3-N-4.011 | 67.49 | 14.63 | 201.700 | 0.908 | 0.0 | 0.0 | 0.0 | 0.80 | 346.2 | 166.0 |
| PH3-N-5.000 | 84.23 | 10.62 | 208.300 | 0.199 | 0.0 | 0.0 | 0.0 | 1.72 | 68.3 | 45.3 |
| PH3-N-5.001 | 81.02 | 11.23 | 207.200 | 0.427 | 0.0 | 0.0 | 0.0 | 1.72 | 68.6« | 93.7 |
| PH3-N-5.002 | 79.88 | 11.47 | 206.100 | 0.667 | 0.0 | 0.0 | 0.0 | 2.34 | 667.2 | 144.2 |
| PH3-N-6.000 | 84.06 | 10.65 | 207.500 | 0.148 | 0.0 | 0.0 | 0.0 | 1.64 | 65.1 | 33.6 |
| PH3-N-6.001 | 80.87 | 11.27 | 206.500 | 0.300 | 0.0 | 0.0 | 0.0 | 1.72 | 68.6 | 65.6 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-5.003 | 32.600 | 1.200 | 27.2 | 0.164 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 500 | |
| PH3-N-7.000 | 64.000 | 1.000 | 64.0 | 0.148 | 10.00 | 0.0 | 0.600 | | o | 225 | |
| PH3-N-7.001 | 63.300 | 1.200 | 52.8 | 0.148 | 0.00 | 0.0 | 0.600 | | o | 225 | |
| PH3-N-5.004 | 32.582 | 1.450 | 22.5 | 0.168 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 500 | |
| PH3-N-8.000 | 64.500 | 1.000 | 64.5 | 0.153 | 10.00 | 0.0 | 0.600 | | o | 225 | |
| PH3-N-8.001 | 62.000 | 1.250 | 49.6 | 0.140 | 0.00 | 0.0 | 0.600 | | o | 225 | |
| PH3-N-5.005 | 3.746 | 0.050 | 74.9 | 0.165 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 500 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-5.003 | 79.04 | 11.64 | 205.400 | 1.130 | 0.0 | 0.0 | 0.0 | 3.06 | 872.2 | 241.9 |
| PH3-N-7.000 | 84.06 | 10.65 | 206.400 | 0.148 | 0.0 | 0.0 | 0.0 | 1.64 | 65.1 | 33.6 |
| PH3-N-7.001 | 81.01 | 11.24 | 205.400 | 0.295 | 0.0 | 0.0 | 0.0 | 1.80 | 71.8 | 64.8 |
| PH3-N-5.004 | 78.29 | 11.80 | 204.200 | 1.593 | 0.0 | 0.0 | 0.0 | 3.36 | 959.0 | 337.7 |
| PH3-N-8.000 | 84.02 | 10.66 | 205.000 | 0.153 | 0.0 | 0.0 | 0.0 | 1.63 | 64.9 | 34.7 |
| PH3-N-8.001 | 81.12 | 11.21 | 204.000 | 0.292 | 0.0 | 0.0 | 0.0 | 1.86 | 74.0 | 64.2 |
| PH3-N-5.005 | 78.14 | 11.84 | 202.750 | 2.050 | 0.0 | 0.0 | 0.0 | 1.84 | 525.2 | 433.8 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-9.000 | 40.323 | 0.200 | 201.6 | 0.149 | 10.00 | 0.0 | 0.600 | | o | 225 | 🔒 |
| PH3-N-9.001 | 35.442 | 0.175 | 202.5 | 0.129 | 0.00 | 0.0 | 0.600 | | o | 225 | 🔒 |
| PH3-N-9.002 | 22.885 | 0.100 | 228.9 | 0.080 | 0.00 | 0.0 | 0.600 | | o | 225 | 🔒 |
| PH3-N-9.003 | 32.208 | 0.125 | 257.7 | 0.039 | 0.00 | 0.0 | 0.600 | | o | 225 | 🔒 |
| PH3-N-10.000 | 32.000 | 0.900 | 35.6 | 0.034 | 5.00 | 0.0 | 0.600 | | o | 225 | 🔒 |
| PH3-N-10.001 | 31.000 | 1.000 | 31.0 | 0.032 | 0.00 | 0.0 | 0.600 | | o | 225 | 🔒 |
| PH3-N-10.002 | 29.000 | 1.350 | 21.5 | 0.089 | 0.00 | 0.0 | 0.600 | | o | 225 | 🔒 |
| PH3-N-10.003 | 30.000 | 0.100 | 300.0 | 0.000 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 1000 | 🔒 |
| PH3-N-10.004 | 30.000 | 0.100 | 300.0 | 0.000 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 1000 | 🔒 |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-9.000 | 83.62 | 10.73 | 203.300 | 0.149 | 0.0 | 0.0 | 0.0 | 0.92 | 36.5 | 33.6 |
| PH3-N-9.001 | 80.31 | 11.38 | 203.100 | 0.278 | 0.0 | 0.0 | 0.0 | 0.92 | 36.4« | 60.4 |
| PH3-N-9.002 | 78.21 | 11.82 | 202.925 | 0.358 | 0.0 | 0.0 | 0.0 | 0.86 | 34.2« | 75.8 |
| PH3-N-9.003 | 75.32 | 12.48 | 202.825 | 0.397 | 0.0 | 0.0 | 0.0 | 0.81 | 32.2« | 81.0 |
| PH3-N-10.000 | 100.00 | 5.24 | 207.250 | 0.034 | 0.0 | 0.0 | 0.0 | 2.20 | 87.5 | 9.2 |
| PH3-N-10.001 | 100.00 | 5.46 | 206.350 | 0.065 | 0.0 | 0.0 | 0.0 | 2.36 | 93.8 | 17.7 |
| PH3-N-10.002 | 100.00 | 5.63 | 205.350 | 0.154 | 0.0 | 0.0 | 0.0 | 2.84 | 112.7 | 41.7 |
| PH3-N-10.003 | 98.17 | 8.51 | 204.000 | 0.154 | 0.0 | 0.0 | 0.0 | 0.17 | 75.6 | 41.7 |
| PH3-N-10.004 | 80.27 | 11.39 | 203.900 | 0.154 | 0.0 | 0.0 | 0.0 | 0.17 | 75.6 | 41.7 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-11.000 | 22.836 | 0.640 | 35.7 | 0.003 | 15.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-11.001 | 23.250 | 0.760 | 30.6 | 0.008 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-11.002 | 24.359 | 0.400 | 60.9 | 0.010 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-11.003 | 16.357 | 0.100 | 163.6 | 0.005 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-11.004 | 20.000 | 0.100 | 200.0 | 0.011 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-11.005 | 23.000 | 0.300 | 76.7 | 0.014 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-11.006 | 14.800 | 0.362 | 40.9 | 0.009 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-11.007 | 4.200 | 0.138 | 30.4 | 0.003 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-12.000 | 41.200 | 0.200 | 206.0 | 0.013 | 15.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-11.000 | 63.05 | 16.15 | 208.300 | 0.003 | 0.0 | 0.0 | 0.0 | 0.33 | 72.1 | 0.6 |
| PH3-N-11.001 | 60.28 | 17.23 | 207.660 | 0.012 | 0.0 | 0.0 | 0.0 | 0.36 | 77.9 | 1.9 |
| PH3-N-11.002 | 56.69 | 18.83 | 206.900 | 0.022 | 0.0 | 0.0 | 0.0 | 0.25 | 55.2 | 3.3 |
| PH3-N-11.003 | 53.30 | 20.59 | 206.500 | 0.027 | 0.0 | 0.0 | 0.0 | 0.15 | 33.7 | 3.9 |
| PH3-N-11.004 | 49.42 | 22.97 | 206.400 | 0.038 | 0.0 | 0.0 | 0.0 | 0.14 | 30.5 | 5.0 |
| PH3-N-11.005 | 47.04 | 24.66 | 206.300 | 0.052 | 0.0 | 0.0 | 0.0 | 0.23 | 49.2 | 6.6 |
| PH3-N-11.006 | 46.02 | 25.46 | 206.000 | 0.061 | 0.0 | 0.0 | 0.0 | 0.31 | 67.4 | 7.6 |
| PH3-N-11.007 | 45.78 | 25.65 | 205.638 | 0.064 | 0.0 | 0.0 | 0.0 | 0.36 | 78.1 | 7.9 |
| PH3-N-12.000 | 54.43 | 19.97 | 208.300 | 0.013 | 0.0 | 0.0 | 0.0 | 0.14 | 30.0 | 1.9 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-12.001 | 30.400 | 0.800 | 38.0 | 0.016 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-12.002 | 19.700 | 0.853 | 23.1 | 0.011 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-12.003 | 11.000 | 0.900 | 12.2 | 0.008 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-11.008 | 21.500 | 0.200 | 107.5 | 0.005 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-11.009 | 30.500 | 0.800 | 38.1 | 0.008 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-11.010 | 30.000 | 0.200 | 150.0 | 0.026 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-11.011 | 13.300 | 0.100 | 133.0 | 0.015 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-13.000 | 17.700 | 0.050 | 354.0 | 0.006 | 15.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-13.001 | 30.600 | 0.450 | 68.0 | 0.005 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-12.001 | 51.64 | 21.55 | 208.100 | 0.029 | 0.0 | 0.0 | 0.0 | 0.32 | 69.9 | 4.0 |
| PH3-N-12.002 | 50.36 | 22.35 | 207.300 | 0.040 | 0.0 | 0.0 | 0.0 | 0.41 | 89.7 | 5.4 |
| PH3-N-12.003 | 49.86 | 22.67 | 206.400 | 0.048 | 0.0 | 0.0 | 0.0 | 0.57 | 123.3 | 6.5 |
| PH3-N-11.008 | 43.60 | 27.53 | 205.500 | 0.117 | 0.0 | 0.0 | 0.0 | 0.19 | 41.6 | 13.8 |
| PH3-N-11.009 | 41.95 | 29.11 | 205.300 | 0.125 | 0.0 | 0.0 | 0.0 | 0.32 | 69.8 | 14.1 |
| PH3-N-11.010 | 41.08 | 30.00 | 204.500 | 0.150 | 0.0 | 0.0 | 0.0 | 0.16 | 35.2 | 16.7 |
| PH3-N-11.011 | 41.08 | 30.00 | 204.300 | 0.165 | 0.0 | 0.0 | 0.0 | 0.17 | 37.4 | 18.4 |
| PH3-N-13.000 | 58.94 | 17.80 | 206.500 | 0.006 | 0.0 | 0.0 | 0.0 | 0.11 | 22.9 | 0.9 |
| PH3-N-13.001 | 54.52 | 19.92 | 206.450 | 0.011 | 0.0 | 0.0 | 0.0 | 0.24 | 52.3 | 1.6 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-13.002 | 29.700 | 0.200 | 148.5 | 0.024 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | 🔒 |
| PH3-N-13.003 | 30.800 | 0.900 | 34.2 | 0.013 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | 🔒 |
| PH3-N-13.004 | 17.700 | 0.800 | 22.1 | 0.012 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | 🔒 |
| PH3-N-11.012 | 20.300 | 0.400 | 50.8 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 150 | 🔒 |
| PH3-N-10.005 | 31.000 | 0.150 | 206.7 | 0.127 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 1000 | 🔒 |
| PH3-N-10.006 | 30.500 | 0.150 | 203.3 | 0.052 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 1000 | 🔒 |
| PH3-N-10.007 | 29.500 | 0.150 | 196.7 | 0.048 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 1000 | 🔒 |
| PH3-N-10.008 | 24.500 | 0.100 | 245.0 | 0.049 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 1000 | 🔒 |
| PH3-N-10.009 | 30.000 | 0.100 | 300.0 | 0.045 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 1000 | 🔒 |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-13.002 | 49.42 | 22.97 | 206.000 | 0.034 | 0.0 | 0.0 | 0.0 | 0.16 | 35.4 | 4.6 |
| PH3-N-13.003 | 47.28 | 24.48 | 205.800 | 0.047 | 0.0 | 0.0 | 0.0 | 0.34 | 73.7 | 6.0 |
| PH3-N-13.004 | 46.37 | 25.18 | 204.900 | 0.059 | 0.0 | 0.0 | 0.0 | 0.42 | 91.6 | 7.4 |
| PH3-N-11.012 | 41.08 | 30.00 | 204.400 | 0.224 | 0.0 | 0.0 | 0.0 | 1.42 | 25.0 | 25.0 |
| PH3-N-10.005 | 41.08 | 30.00 | 203.800 | 0.505 | 0.0 | 0.0 | 0.0 | 0.21 | 91.1 | 56.2 |
| PH3-N-10.006 | 41.08 | 30.00 | 203.650 | 0.557 | 0.0 | 0.0 | 0.0 | 0.21 | 91.8 | 62.0 |
| PH3-N-10.007 | 41.08 | 30.00 | 203.500 | 0.605 | 0.0 | 0.0 | 0.0 | 0.21 | 93.4 | 67.3 |
| PH3-N-10.008 | 41.08 | 30.00 | 203.350 | 0.654 | 0.0 | 0.0 | 0.0 | 0.19 | 83.6 | 72.7 |
| PH3-N-10.009 | 41.08 | 30.00 | 203.250 | 0.698 | 0.0 | 0.0 | 0.0 | 0.17 | 75.6« | 77.7 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-10.010 | 27.000 | 0.100 | 270.0 | 0.050 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 1000 | |
| PH3-N-10.011 | 31.116 | 0.150 | 207.4 | 0.042 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 1000 | |
| PH3-N-10.012 | 42.297 | 0.150 | 282.0 | 0.052 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 1000 | |
| PH3-N-10.013 | 17.594 | 0.050 | 351.9 | 0.093 | 0.00 | 0.0 | 0.600 | | oo | 300 | |
| PH3-N-5.006 | 25.545 | 0.400 | 63.9 | 0.016 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-5.007 | 31.641 | 0.300 | 105.5 | 0.116 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-5.008 | 16.827 | 0.200 | 84.1 | 0.094 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-14.000 | 47.859 | 1.100 | 43.5 | 0.042 | 10.00 | 0.0 | 0.600 | | o | 225 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-10.010 | 41.08 | 30.00 | 203.150 | 0.748 | 0.0 | 0.0 | 0.0 | 0.18 | 79.7« | 83.3 |
| PH3-N-10.011 | 41.08 | 30.00 | 203.050 | 0.790 | 0.0 | 0.0 | 0.0 | 0.21 | 90.9 | 87.9 |
| PH3-N-10.012 | 41.08 | 30.00 | 202.900 | 0.842 | 0.0 | 0.0 | 0.0 | 0.18 | 78.0« | 93.7 |
| PH3-N-10.013 | 41.08 | 30.00 | 202.750 | 0.935 | 0.0 | 0.0 | 0.0 | 0.83 | 117.7 | 104.1 |
| PH3-N-5.006 | 41.08 | 30.00 | 202.700 | 3.399 | 0.0 | 0.0 | 0.0 | 2.20 | 958.4 | 433.8 |
| PH3-N-5.007 | 41.08 | 30.00 | 202.300 | 3.514 | 0.0 | 0.0 | 0.0 | 1.71 | 745.8 | 433.8 |
| PH3-N-5.008 | 41.08 | 30.00 | 202.000 | 3.608 | 0.0 | 0.0 | 0.0 | 1.92 | 835.0 | 433.8 |
| PH3-N-14.000 | 85.45 | 10.40 | 206.100 | 0.042 | 0.0 | 0.0 | 0.0 | 1.99 | 79.1 | 9.7 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-15.000 | 70.113 | 1.100 | 63.7 | 0.146 | 10.00 | 0.0 | 0.600 | | o | 225 | |
| PH3-N-14.001 | 32.050 | 0.800 | 40.1 | 0.182 | 0.00 | 0.0 | 0.600 | | o | 225 | |
| PH3-N-16.000 | 69.985 | 1.200 | 58.3 | 0.098 | 10.00 | 0.0 | 0.600 | | o | 225 | |
| PH3-N-14.002 | 31.777 | 1.000 | 31.8 | 0.149 | 0.00 | 0.0 | 0.600 | | o | 225 | |
| PH3-N-17.000 | 69.985 | 1.000 | 70.0 | 0.096 | 10.00 | 0.0 | 0.600 | | o | 225 | |
| PH3-N-14.003 | 24.781 | 1.400 | 17.7 | 0.152 | 0.00 | 0.0 | 0.600 | | o | 225 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-15.000 | 83.73 | 10.71 | 206.100 | 0.146 | 0.0 | 0.0 | 0.0 | 1.64 | 65.2 | 33.0 |
| PH3-N-14.001 | 82.36 | 10.97 | 205.000 | 0.370 | 0.0 | 0.0 | 0.0 | 2.07 | 82.4« | 82.5 |
| PH3-N-16.000 | 83.90 | 10.68 | 205.400 | 0.098 | 0.0 | 0.0 | 0.0 | 1.72 | 68.2 | 22.3 |
| PH3-N-14.002 | 81.20 | 11.20 | 204.200 | 0.617 | 0.0 | 0.0 | 0.0 | 2.33 | 92.6« | 135.6 |
| PH3-N-17.000 | 83.55 | 10.75 | 204.200 | 0.096 | 0.0 | 0.0 | 0.0 | 1.57 | 62.2 | 21.8 |
| PH3-N-14.003 | 80.55 | 11.33 | 203.200 | 0.865 | 0.0 | 0.0 | 0.0 | 3.13 | 124.3« | 188.7 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-5.009 | 7.136 | 0.200 | 35.7 | 0.055 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-4.012 | 14.238 | 0.140 | 101.7 | 0.106 | 0.00 | 0.0 | 0.600 | | oo | 300 | |
| PH3-N-4.013 | 19.623 | 0.260 | 75.5 | 0.000 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-4.014 | 12.709 | 0.400 | 31.8 | 0.060 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-4.015 | 18.357 | 0.400 | 45.9 | 0.040 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-4.016 | 21.794 | 0.300 | 72.6 | 0.061 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-1.018 | 15.431 | 0.150 | 102.9 | 0.551 | 0.00 | 0.0 | 0.600 | | o | 375 | |
| PH3-N-1.019 | 24.112 | 0.250 | 96.4 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 375 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-5.009 | 41.08 | 30.00 | 201.800 | 4.528 | 0.0 | 0.0 | 0.0 | 2.95 | 1282.2 | 503.9 |
| PH3-N-4.012 | 41.08 | 30.00 | 201.600 | 5.542 | 0.0 | 0.0 | 0.0 | 1.56 | 220.4« | 616.7 |
| PH3-N-4.013 | 41.08 | 30.00 | 201.460 | 5.542 | 0.0 | 0.0 | 0.0 | 2.03 | 881.6 | 616.7 |
| PH3-N-4.014 | 41.08 | 30.00 | 201.200 | 5.602 | 0.0 | 0.0 | 0.0 | 3.12 | 1358.8 | 623.3 |
| PH3-N-4.015 | 41.08 | 30.00 | 200.800 | 5.642 | 0.0 | 0.0 | 0.0 | 2.60 | 1130.6 | 627.7 |
| PH3-N-4.016 | 41.08 | 30.00 | 200.400 | 5.703 | 0.0 | 0.0 | 0.0 | 2.07 | 898.6 | 634.5 |
| PH3-N-1.018 | 41.08 | 30.00 | 200.100 | 8.617 | 0.0 | 0.0 | 0.0 | 1.79 | 197.3« | 958.8 |
| PH3-N-1.019 | 41.08 | 30.00 | 199.850 | 8.617 | 0.0 | 0.0 | 0.0 | 1.85 | 203.8« | 958.8 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-1.020 | 29.107 | 0.029 | 1000.0 | 0.000 | 0.00 | 0.0 | 0.600 | | oo | 600 | 🔒 |
| PH3-N-1.021 | 50.872 | 1.272 | 40.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 525 | 🔒 |
| PH3-N-1.022 | 11.472 | 0.299 | 38.4 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 525 | 🔒 |
| PH3-N-18.000 | 29.027 | 0.500 | 58.1 | 0.024 | 5.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | 🔒 |
| PH3-N-18.001 | 27.000 | 0.600 | 45.0 | 0.036 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | 🔒 |
| PH3-N-18.002 | 21.509 | 0.300 | 71.7 | 0.100 | 0.00 | 0.0 | 0.600 | | oo | 300 | 🔒 |
| PH3-N-18.003 | 19.462 | 0.150 | 129.7 | 0.089 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | 🔒 |
| PH3-N-18.004 | 18.069 | 0.036 | 500.0 | 0.120 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | 🔒 |
| PH3-N-18.005 | 20.791 | 0.042 | 500.0 | 0.120 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | 🔒 |
| PH3-N-18.006 | 30.425 | 0.061 | 500.0 | 0.143 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | 🔒 |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-1.020 | 41.08 | 30.00 | 199.375 | 8.617 | 0.0 | 0.0 | 0.0 | 0.76 | 430.7« | 958.8 |
| PH3-N-1.021 | 41.08 | 30.00 | 199.571 | 8.617 | 0.0 | 0.0 | 0.0 | 3.55 | 768.3« | 958.8 |
| PH3-N-1.022 | 41.08 | 30.00 | 198.299 | 8.617 | 0.0 | 0.0 | 0.0 | 3.62 | 784.6« | 958.8 |
| PH3-N-18.000 | 100.00 | 5.21 | 200.900 | 0.024 | 0.0 | 0.0 | 0.0 | 2.31 | 1005.2 | 6.6 |
| PH3-N-18.001 | 100.00 | 5.38 | 200.400 | 0.061 | 0.0 | 0.0 | 0.0 | 2.62 | 1141.7 | 16.4 |
| PH3-N-18.002 | 100.00 | 5.57 | 199.800 | 0.161 | 0.0 | 0.0 | 0.0 | 1.86 | 262.8 | 43.6 |
| PH3-N-18.003 | 100.00 | 5.78 | 199.500 | 0.250 | 0.0 | 0.0 | 0.0 | 1.55 | 672.4 | 67.6 |
| PH3-N-18.004 | 100.00 | 6.17 | 199.350 | 0.370 | 0.0 | 0.0 | 0.0 | 0.79 | 342.5 | 100.2 |
| PH3-N-18.005 | 100.00 | 6.61 | 199.314 | 0.490 | 0.0 | 0.0 | 0.0 | 0.79 | 342.5 | 132.6 |
| PH3-N-18.006 | 100.00 | 7.25 | 199.272 | 0.633 | 0.0 | 0.0 | 0.0 | 0.79 | 342.5 | 171.3 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-18.007 | 39.704 | 0.099 | 401.1 | 0.288 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-18.008 | 17.212 | 0.043 | 400.3 | 0.397 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-19.000 | 43.148 | 0.400 | 107.9 | 0.034 | 5.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-19.001 | 30.872 | 0.400 | 77.2 | 0.096 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-19.002 | 15.921 | 0.200 | 79.6 | 0.124 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-19.003 | 21.935 | 0.500 | 43.9 | 0.070 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-19.004 | 30.913 | 0.600 | 51.5 | 0.116 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-19.005 | 35.026 | 0.800 | 43.8 | 0.163 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-19.006 | 30.755 | 0.300 | 102.5 | 0.189 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-19.007 | 33.746 | 0.300 | 112.5 | 0.227 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-18.007 | 100.00 | 8.00 | 199.212 | 0.921 | 0.0 | 0.0 | 0.0 | 0.88 | 382.5 | 249.3 |
| PH3-N-18.008 | 99.64 | 8.33 | 199.113 | 1.317 | 0.0 | 0.0 | 0.0 | 0.88 | 382.8 | 355.5 |
| PH3-N-19.000 | 100.00 | 5.42 | 203.000 | 0.034 | 0.0 | 0.0 | 0.0 | 1.70 | 737.4 | 9.1 |
| PH3-N-19.001 | 100.00 | 5.68 | 202.600 | 0.130 | 0.0 | 0.0 | 0.0 | 2.00 | 871.8 | 35.1 |
| PH3-N-19.002 | 100.00 | 5.82 | 202.200 | 0.253 | 0.0 | 0.0 | 0.0 | 1.97 | 858.4 | 68.6 |
| PH3-N-19.003 | 100.00 | 5.95 | 202.000 | 0.324 | 0.0 | 0.0 | 0.0 | 2.66 | 1156.4 | 87.7 |
| PH3-N-19.004 | 100.00 | 6.16 | 201.500 | 0.440 | 0.0 | 0.0 | 0.0 | 2.45 | 1067.0 | 119.1 |
| PH3-N-19.005 | 100.00 | 6.38 | 200.900 | 0.603 | 0.0 | 0.0 | 0.0 | 2.66 | 1157.5 | 163.4 |
| PH3-N-19.006 | 100.00 | 6.68 | 200.100 | 0.792 | 0.0 | 0.0 | 0.0 | 1.74 | 756.4 | 214.4 |
| PH3-N-19.007 | 100.00 | 7.02 | 199.800 | 1.019 | 0.0 | 0.0 | 0.0 | 1.66 | 722.1 | 276.0 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-19.008 | 29.880 | 0.200 | 149.4 | 0.251 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-19.009 | 35.695 | 0.050 | 713.9 | 0.321 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-19.010 | 17.152 | 0.180 | 95.3 | 0.394 | 0.00 | 0.0 | | 0.020 | 1.5 _/ | 1000 | |
| PH3-N-18.009 | 8.010 | 0.075 | 106.8 | 0.385 | 0.00 | 0.0 | 0.600 | | o | 375 | |
| PH3-N-18.010 | 17.891 | 0.018 | 993.9 | 0.000 | 0.00 | 0.0 | 0.600 | | oo | 700 | |
| PH3-N-18.011 | 40.602 | 0.203 | 200.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 375 | |
| PH3-N-18.012 | 40.602 | 0.203 | 200.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 375 | |
| PH3-N-18.013 | 35.305 | 0.177 | 199.5 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 375 | |
| PH3-N-18.014 | 42.000 | 0.210 | 200.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 375 | |
| PH3-N-18.015 | 36.000 | 0.184 | 195.7 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 375 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-19.008 | 100.00 | 7.36 | 199.500 | 1.270 | 0.0 | 0.0 | 0.0 | 1.44 | 626.6 | 344.0 |
| PH3-N-19.009 | 100.00 | 8.26 | 199.300 | 1.591 | 0.0 | 0.0 | 0.0 | 0.66 | 286.7« | 430.9 |
| PH3-N-19.010 | 98.87 | 8.42 | 199.250 | 1.985 | 0.0 | 0.0 | 0.0 | 1.80 | 784.6 | 531.5 |
| PH3-N-18.009 | 98.26 | 8.50 | 199.070 | 3.687 | 0.0 | 0.0 | 0.0 | 1.75 | 193.6« | 981.2 |
| PH3-N-18.010 | 95.52 | 8.85 | 198.670 | 3.687 | 0.0 | 0.0 | 0.0 | 0.84 | 648.1« | 981.2 |
| PH3-N-18.011 | 91.76 | 9.38 | 198.977 | 3.687 | 0.0 | 0.0 | 0.0 | 1.28 | 141.1« | 981.2 |
| PH3-N-18.012 | 88.34 | 9.91 | 198.774 | 3.687 | 0.0 | 0.0 | 0.0 | 1.28 | 141.1« | 981.2 |
| PH3-N-18.013 | 85.61 | 10.37 | 198.571 | 3.687 | 0.0 | 0.0 | 0.0 | 1.28 | 141.3« | 981.2 |
| PH3-N-18.014 | 82.62 | 10.92 | 198.394 | 3.687 | 0.0 | 0.0 | 0.0 | 1.28 | 141.1« | 981.2 |
| PH3-N-18.015 | 80.28 | 11.38 | 198.184 | 3.687 | 0.0 | 0.0 | 0.0 | 1.29 | 142.7« | 981.2 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-1.023 | 53.675 | 0.537 | 100.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 525 | |
| PH3-N-1.024 | 22.340 | 0.223 | 100.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 525 | |
| PH3-N-1.025 | 60.800 | 0.900 | 67.6 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 525 | |
| PH3-N-1.026 | 29.954 | 3.297 | 9.1 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 525 | |
| PH3-N-1.027 | 51.495 | 1.400 | 36.8 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 525 | |
| PH3-N-1.028 | 55.879 | 0.970 | 57.6 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 525 | |
| PH3-N-1.029 | 43.893 | 0.147 | 298.0 | 0.000 | 0.00 | 0.0 | | 0.020 | \w/ | -11 | |
| PH3-N-1.030 | 31.175 | 0.071 | 439.1 | 0.000 | 0.00 | 0.0 | | 0.020 | \w/ | -11 | |
| PH3-N-1.031 | 30.539 | 0.049 | 623.2 | 0.000 | 0.00 | 0.0 | | 0.020 | \w/ | -11 | |
| PH3-N-1.032 | 22.562 | 2.835 | 8.0 | 0.093 | 0.00 | 0.0 | 0.600 | | o | 450 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-1.023 | 41.08 | 30.00 | 197.850 | 12.304 | 0.0 | 0.0 | 0.0 | 2.24 | 485.0« | 1369.0 |
| PH3-N-1.024 | 41.08 | 30.00 | 197.256 | 12.304 | 0.0 | 0.0 | 0.0 | 2.24 | 484.9« | 1369.0 |
| PH3-N-1.025 | 41.08 | 30.00 | 197.033 | 12.304 | 0.0 | 0.0 | 0.0 | 2.73 | 590.6« | 1369.0 |
| PH3-N-1.026 | 41.08 | 30.00 | 196.097 | 12.304 | 0.0 | 0.0 | 0.0 | 7.46 | 1615.3 | 1369.0 |
| PH3-N-1.027 | 41.08 | 30.00 | 192.800 | 12.304 | 0.0 | 0.0 | 0.0 | 3.70 | 801.4« | 1369.0 |
| PH3-N-1.028 | 41.08 | 30.00 | 191.400 | 12.304 | 0.0 | 0.0 | 0.0 | 2.96 | 639.8« | 1369.0 |
| PH3-N-1.029 | 41.08 | 30.00 | 190.430 | 12.304 | 0.0 | 0.0 | 0.0 | 1.66 | 6632.0 | 1369.0 |
| PH3-N-1.030 | 41.08 | 30.00 | 190.283 | 12.304 | 0.0 | 0.0 | 0.0 | 1.37 | 5463.4 | 1369.0 |
| PH3-N-1.031 | 41.08 | 30.00 | 190.212 | 12.304 | 0.0 | 0.0 | 0.0 | 1.15 | 4585.8 | 1369.0 |
| PH3-N-1.032 | 41.08 | 30.00 | 190.163 | 12.397 | 0.0 | 0.0 | 0.0 | 7.24 | 1151.5« | 1379.4 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-1.033 | 65.295 | 3.328 | 19.6 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 450 | |
| PH3-N-20.000 | 35.517 | 2.000 | 17.8 | 0.231 | 15.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-20.001 | 39.664 | 2.700 | 14.7 | 0.056 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-20.002 | 40.852 | 1.800 | 22.7 | 0.174 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-21.000 | 28.000 | 0.280 | 100.0 | 0.073 | 15.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-21.001 | 39.000 | 0.390 | 100.0 | 0.112 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-21.002 | 23.500 | 0.235 | 100.0 | 0.159 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | |
| PH3-N-21.003 | 51.424 | 0.398 | 129.4 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 300 | |
| PH3-N-21.004 | 51.424 | 0.398 | 129.2 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 300 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-1.033 | 41.08 | 30.00 | 187.328 | 12.397 | 0.0 | 0.0 | 0.0 | 4.61 | 732.6« | 1379.4 |
| PH3-N-20.000 | 62.75 | 16.26 | 192.500 | 0.231 | 0.0 | 0.0 | 0.0 | 0.47 | 102.3 | 39.3 |
| PH3-N-20.001 | 59.55 | 17.54 | 190.500 | 0.287 | 0.0 | 0.0 | 0.0 | 0.52 | 112.4 | 46.3 |
| PH3-N-20.002 | 55.98 | 19.17 | 187.800 | 0.461 | 0.0 | 0.0 | 0.0 | 0.42 | 90.5 | 69.9 |
| PH3-N-21.000 | 59.98 | 17.36 | 188.500 | 0.073 | 0.0 | 0.0 | 0.0 | 0.20 | 43.1 | 11.9 |
| PH3-N-21.001 | 53.21 | 20.64 | 188.220 | 0.185 | 0.0 | 0.0 | 0.0 | 0.20 | 43.1 | 26.7 |
| PH3-N-21.002 | 49.95 | 22.61 | 187.830 | 0.344 | 0.0 | 0.0 | 0.0 | 0.20 | 43.1« | 46.5 |
| PH3-N-21.003 | 49.03 | 23.23 | 187.595 | 0.344 | 0.0 | 0.0 | 0.0 | 1.38 | 97.6 | 46.5 |
| PH3-N-21.004 | 48.14 | 23.85 | 187.198 | 0.344 | 0.0 | 0.0 | 0.0 | 1.38 | 97.7 | 46.5 |

## Network Design Table for Phase 3 Northern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-21.005 | 29.973 | 0.800 | 37.5 | 0.404 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 1000 | 🔒 |
| PH3-N-20.003 | 36.783 | 1.800 | 20.4 | 1.272 | 0.00 | 0.0 | 0.600 | | o | 375 | 🔒 |
| PH3-N-20.004 | 35.000 | 0.300 | 116.7 | 0.171 | 0.00 | 0.0 | 0.600 | | o | 375 | 🔒 |
| PH3-N-20.005 | 131.800 | 1.100 | 119.8 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 300 | 🔒 |
| PH3-N-1.034 | 60.624 | 2.700 | 22.5 | 1.411 | 0.00 | 0.0 | 0.600 | | o | 450 | 🔒 |
| PH3-N-1.035 | 63.784 | 2.450 | 26.0 | 0.397 | 0.00 | 0.0 | 0.600 | | o | 450 | 🔒 |
| PH3-N-1.036 | 45.998 | 4.850 | 9.5 | 0.273 | 0.00 | 0.0 | 0.600 | | o | 450 | 🔒 |
| PH3-N-1.037 | 33.612 | 3.500 | 9.6 | 0.260 | 0.00 | 0.0 | | 0.250 | \~/ | -13 | 🔒 |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-N-21.005 | 46.10 | 25.40 | 186.800 | 0.748 | 0.0 | 0.0 | 0.0 | 0.32 | 70.4« | 93.4 |
| PH3-N-20.003 | 45.91 | 25.55 | 186.300 | 2.481 | 0.0 | 0.0 | 0.0 | 4.02 | 444.4 | 308.5 |
| PH3-N-20.004 | 45.48 | 25.90 | 185.400 | 2.652 | 0.0 | 0.0 | 0.0 | 1.68 | 185.2« | 326.6 |
| PH3-N-20.005 | 43.71 | 27.43 | 185.108 | 2.652 | 0.0 | 0.0 | 0.0 | 1.44 | 101.5« | 326.6 |
| PH3-N-1.034 | 41.08 | 30.00 | 184.000 | 16.461 | 0.0 | 0.0 | 0.0 | 4.31 | 684.7« | 1831.5 |
| PH3-N-1.035 | 41.08 | 30.00 | 181.300 | 16.858 | 0.0 | 0.0 | 0.0 | 4.00 | 635.7« | 1875.7 |
| PH3-N-1.036 | 41.08 | 30.00 | 178.850 | 17.130 | 0.0 | 0.0 | 0.0 | 6.63 | 1054.6« | 1906.0 |
| PH3-N-1.037 | 41.08 | 30.00 | 174.500 | 17.390 | 0.0 | 0.0 | 0.0 | 0.42 | 792.9« | 1934.9 |

## Conduit Sections for Phase 3 Northern

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

| Section Number | Conduit Type | Major Dimn. (mm) | Minor Dimn. (mm) | Side Slope (Deg) | Corner Splay (mm) | 4*Hyd Radius (m) | XSect Area (m²) |
|---|---|---|---|---|---|---|---|
| -11 | \w/ | 9000 | 500 | | | 1.732 | 4.000 |
| -13 | \~/ | 10000 | 300 | | | 0.747 | 1.880 |

## Summary of Critical Results by Maximum Level (Rank 1) for Phase 3 Northern

### Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 50 Number of Storage Structures 54 Number of Real Time Controls 0

### Synthetic Rainfall Details

Rainfall Model FEH C (1km) -0.022 D2 (1km) 0.409 E (1km) 0.288 Cv (Summer) 0.750
Site Location D1 (1km) 0.374 D3 (1km) 0.270 F (1km) 2.381 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 100.0 DTS Status ON Inertia Status ON
Analysis Timestep Fine DVD Status ON

| | |
|---|---|
| Profile(s) | Summer and Winter |
| Duration(s) (mins) | 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080 |
| Return Period(s) (years) | 20 |
| Climate Change (%) | 0 |

| PN | Event | Water Level (m) | Flooded Volume (m³) | Maximum Velocity (m/s) | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|
| PH3-N-1.000 | 30 minute 20 year Winter I+0% | 203.812 | 0.000 | 0.1 | 25.1 | FLOOD RISK* |
| PH3-N-1.001 | 30 minute 20 year Winter I+0% | 203.774 | 0.000 | 0.1 | 19.6 | OK |
| PH3-N-1.002 | 60 minute 20 year Winter I+0% | 203.749 | 0.000 | 0.1 | 25.7 | OK |

## Summary of Critical Results by Maximum Level (Rank 1) for Phase 3 Northern

| PN | Event | Water Level (m) | Flooded Volume (m³) | Maximum Velocity (m/s) | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|
| PH3-N-1.003 | 60 minute 20 year Winter I+0% | 203.420 | 0.000 | 0.3 | 25.8 | OK |
| PH3-N-2.000 | 15 minute 20 year Winter I+0% | 208.555 | 0.000 | 0.1 | 3.8 | OK |
| PH3-N-2.001 | 30 minute 20 year Winter I+0% | 208.307 | 0.000 | 0.2 | 9.3 | OK |
| PH3-N-2.002 | 30 minute 20 year Winter I+0% | 207.589 | 0.000 | 0.1 | 8.5 | OK |
| PH3-N-2.003 | 60 minute 20 year Winter I+0% | 207.307 | 0.000 | 0.2 | 9.5 | OK |
| PH3-N-3.000 | 15 minute 20 year Winter I+0% | 208.571 | 0.000 | 0.1 | 6.3 | OK |
| PH3-N-3.001 | 30 minute 20 year Winter I+0% | 207.806 | 0.000 | 0.2 | 8.4 | OK |
| PH3-N-3.002 | 120 minute 20 year Winter I+0% | 207.393 | 0.000 | 0.2 | 3.1 | OK |
| PH3-N-3.003 | 1440 minute 20 year Winter I+0% | 207.064 | 0.000 | 0.0 | 1.2 | OK |
| PH3-N-3.004 | 1440 minute 20 year Winter I+0% | 207.064 | 0.000 | 0.2 | 1.0 | OK |
| PH3-N-3.005 | 1440 minute 20 year Winter I+0% | 206.872 | 0.000 | 0.0 | 0.9 | OK |
| PH3-N-3.006 | 1440 minute 20 year Winter I+0% | 206.871 | 0.000 | 0.0 | 1.0 | OK |
| PH3-N-2.004 | 480 minute 20 year Winter I+0% | 206.616 | 0.000 | 2.0 | 3.7 | OK* |
| PH3-N-1.004 | 60 minute 20 year Winter I+0% | 203.381 | 0.000 | 0.6 | 33.2 | OK |
| PH3-N-1.005 | 15 minute 20 year Winter I+0% | 203.314 | 0.000 | 1.2 | 39.1 | OK |
| PH3-N-1.006 | 15 minute 20 year Winter I+0% | 202.856 | 0.000 | 2.4 | 48.7 | OK |
| PH3-N-1.007 | 120 minute 20 year Winter I+0% | 200.926 | 0.000 | 0.1 | 36.8 | OK |
| PH3-N-1.008 | 120 minute 20 year Winter I+0% | 200.924 | 0.000 | 0.6 | 33.4 | SURCHARGED* |
| PH3-N-1.009 | 120 minute 20 year Winter I+0% | 200.921 | 0.000 | 0.1 | 32.9 | OK |
| PH3-N-1.010 | 120 minute 20 year Winter I+0% | 200.920 | 0.000 | 0.1 | 61.9 | OK |
| PH3-N-1.011 | 120 minute 20 year Winter I+0% | 200.919 | 0.000 | 0.2 | 92.1 | OK |
| PH3-N-1.012 | 120 minute 20 year Winter I+0% | 200.918 | 0.000 | 0.2 | 121.9 | OK |
| PH3-N-1.013 | 120 minute 20 year Winter I+0% | 200.912 | 0.000 | 0.2 | 153.4 | OK |
| PH3-N-1.014 | 120 minute 20 year Winter I+0% | 200.908 | 0.000 | 1.3 | 178.7 | SURCHARGED* |
| PH3-N-1.015 | 120 minute 20 year Winter I+0% | 200.900 | 0.000 | 0.3 | 180.2 | OK |
| PH3-N-1.016 | 120 minute 20 year Winter I+0% | 200.899 | 0.000 | 0.3 | 181.0 | OK |

## Summary of Critical Results by Maximum Level (Rank 1) for Phase 3 Northern

| PN | Event | Water Level (m) | Flooded Volume (m³) | Maximum Velocity (m/s) | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|
| PH3-N-1.017 | 60 minute 20 year Winter I+0% | 200.909 | 0.000 | 0.3 | 158.4 | OK |
| PH3-N-4.000 | 120 minute 20 year Winter I+0% | 202.955 | 0.000 | 0.1 | 2.0 | OK |
| PH3-N-4.001 | 120 minute 20 year Winter I+0% | 202.955 | 0.000 | 0.1 | 2.9 | OK |
| PH3-N-4.002 | 120 minute 20 year Winter I+0% | 202.955 | 0.000 | 0.4 | 2.2 | OK |
| PH3-N-4.003 | 120 minute 20 year Winter I+0% | 202.680 | 0.000 | 0.2 | 4.2 | OK |
| PH3-N-4.004 | 120 minute 20 year Winter I+0% | 202.680 | 0.000 | 0.2 | 6.7 | OK |
| PH3-N-4.005 | 120 minute 20 year Winter I+0% | 202.680 | 0.000 | 0.2 | 17.6 | OK |
| PH3-N-4.006 | 120 minute 20 year Winter I+0% | 202.678 | 0.000 | 0.6 | 27.9 | OK |
| PH3-N-4.007 | 120 minute 20 year Winter I+0% | 202.376 | 0.000 | 0.3 | 36.7 | OK |
| PH3-N-4.008 | 120 minute 20 year Winter I+0% | 202.376 | 0.000 | 0.3 | 38.0 | OK |
| PH3-N-4.009 | 60 minute 20 year Winter I+0% | 202.375 | 0.000 | 0.3 | 49.4 | OK |
| PH3-N-4.010 | 60 minute 20 year Winter I+0% | 202.373 | 0.000 | 0.9 | 69.6 | OK |
| PH3-N-4.011 | 30 minute 20 year Winter I+0% | 202.270 | 0.000 | 0.4 | 86.7 | OK |
| PH3-N-5.000 | 15 minute 20 year Winter I+0% | 208.428 | 0.000 | 1.7 | 40.5 | OK |
| PH3-N-5.001 | 15 minute 20 year Winter I+0% | 207.833 | 0.000 | 2.0 | 77.5 | SURCHARGED |
| PH3-N-5.002 | 15 minute 20 year Winter I+0% | 206.232 | 0.000 | 1.6 | 145.9 | OK |
| PH3-N-6.000 | 15 minute 20 year Winter I+0% | 207.610 | 0.000 | 1.6 | 30.1 | OK |
| PH3-N-6.001 | 15 minute 20 year Winter I+0% | 206.867 | 0.000 | 1.8 | 62.0 | SURCHARGED |
| PH3-N-5.003 | 15 minute 20 year Winter I+0% | 205.906 | 0.000 | 4.5 | 251.7 | OK |
| PH3-N-7.000 | 15 minute 20 year Winter I+0% | 206.510 | 0.000 | 1.6 | 30.0 | OK |
| PH3-N-7.001 | 15 minute 20 year Winter I+0% | 205.729 | 0.000 | 1.9 | 62.1 | SURCHARGED |
| PH3-N-5.004 | 15 minute 20 year Winter I+0% | 204.762 | 0.000 | 5.9 | 362.8 | OK |
| PH3-N-8.000 | 15 minute 20 year Winter I+0% | 205.112 | 0.000 | 1.6 | 31.1 | OK |
| PH3-N-8.001 | 15 minute 20 year Winter I+0% | 204.217 | 0.000 | 2.0 | 65.2 | OK |
| PH3-N-5.005 | 30 minute 20 year Winter I+0% | 203.327 | 0.000 | 1.4 | 375.0 | OK |
| PH3-N-9.000 | 15 minute 20 year Winter I+0% | 203.943 | 0.000 | 0.9 | 27.1 | SURCHARGED |

## Summary of Critical Results by Maximum Level (Rank 1) for Phase 3 Northern

| PN | Event | Water Level (m) | Flooded Volume (m³) | Maximum Velocity (m/s) | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|
| PH3-N-9.001 | 15 minute 20 year Winter I+0% | 203.817 | 0.000 | 0.9 | 33.3 | SURCHARGED |
| PH3-N-9.002 | 30 minute 20 year Winter I+0% | 203.661 | 0.000 | 0.9 | 36.3 | SURCHARGED |
| PH3-N-9.003 | 30 minute 20 year Winter I+0% | 203.526 | 0.000 | 1.0 | 38.6 | SURCHARGED |
| PH3-N-10.000 | 15 minute 20 year Winter I+0% | 207.302 | 0.000 | 1.4 | 10.0 | OK |
| PH3-N-10.001 | 15 minute 20 year Winter I+0% | 206.423 | 0.000 | 1.8 | 20.0 | OK |
| PH3-N-10.002 | 15 minute 20 year Winter I+0% | 205.457 | 0.000 | 2.6 | 48.1 | OK |
| PH3-N-10.003 | 15 minute 20 year Winter I+0% | 204.284 | 0.000 | 0.1 | 46.8 | OK |
| PH3-N-10.004 | 15 minute 20 year Winter I+0% | 204.154 | 0.000 | 0.1 | 33.2 | OK |
| PH3-N-11.000 | 15 minute 20 year Winter I+0% | 208.314 | 0.000 | 0.0 | 0.5 | OK |
| PH3-N-11.001 | 15 minute 20 year Winter I+0% | 207.813 | 0.000 | 0.2 | 1.0 | OK |
| PH3-N-11.002 | 60 minute 20 year Winter I+0% | 207.145 | 0.000 | 0.2 | 1.0 | OK |
| PH3-N-11.003 | 180 minute 20 year Winter I+0% | 206.742 | 0.000 | 0.1 | 0.7 | OK |
| PH3-N-11.004 | 180 minute 20 year Winter I+0% | 206.587 | 0.000 | 0.1 | 0.8 | OK |
| PH3-N-11.005 | 120 minute 20 year Winter I+0% | 206.428 | 0.000 | 0.2 | 1.0 | OK |
| PH3-N-11.006 | 360 minute 20 year Winter I+0% | 206.209 | 0.000 | 0.2 | 1.0 | OK |
| PH3-N-11.007 | 15 minute 20 year Winter I+0% | 205.665 | 0.000 | 0.1 | 1.8 | OK |
| PH3-N-12.000 | 15 minute 20 year Winter I+0% | 208.350 | 0.000 | 0.0 | 2.0 | OK |
| PH3-N-12.001 | 60 minute 20 year Winter I+0% | 208.252 | 0.000 | 0.2 | 1.0 | OK |
| PH3-N-12.002 | 180 minute 20 year Winter I+0% | 207.578 | 0.000 | 0.2 | 1.0 | OK |
| PH3-N-12.003 | 120 minute 20 year Winter I+0% | 206.700 | 0.000 | 0.2 | 1.3 | OK |
| PH3-N-11.008 | 240 minute 20 year Winter I+0% | 205.606 | 0.000 | 0.0 | 2.6 | OK |
| PH3-N-11.009 | 240 minute 20 year Winter I+0% | 205.601 | 0.000 | 0.3 | 2.9 | OK |
| PH3-N-11.010 | 720 minute 20 year Winter I+0% | 205.037 | 0.000 | 0.1 | 2.2 | OK |
| PH3-N-11.011 | 720 minute 20 year Winter I+0% | 204.737 | 0.000 | 0.2 | 2.3 | OK |
| PH3-N-13.000 | 30 minute 20 year Winter I+0% | 206.550 | 0.000 | 0.0 | 0.8 | OK |
| PH3-N-13.001 | 30 minute 20 year Winter I+0% | 206.536 | 0.000 | 0.1 | 0.9 | OK |

## Summary of Critical Results by Maximum Level (Rank 1) for Phase 3 Northern

| PN | Event | Water Level (m) | Flooded Volume (m³) | Maximum Velocity (m/s) | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|
| PH3-N-13.002 | 60 minute 20 year Winter I+0% | 206.252 | 0.000 | 0.2 | 1.0 | OK |
| PH3-N-13.003 | 240 minute 20 year Winter I+0% | 205.986 | 0.000 | 0.2 | 1.0 | OK |
| PH3-N-13.004 | 360 minute 20 year Winter I+0% | 205.200 | 0.000 | 0.2 | 1.2 | OK |
| PH3-N-11.012 | 720 minute 20 year Winter I+0% | 204.436 | 0.000 | 1.0 | 3.2 | OK* |
| PH3-N-10.005 | 120 minute 20 year Winter I+0% | 204.143 | 0.000 | 0.0 | 16.6 | OK |
| PH3-N-10.006 | 120 minute 20 year Winter I+0% | 204.138 | 0.000 | 0.2 | 13.6 | OK |
| PH3-N-10.007 | 60 minute 20 year Winter I+0% | 203.827 | 0.000 | 0.1 | 16.0 | OK |
| PH3-N-10.008 | 60 minute 20 year Winter I+0% | 203.825 | 0.000 | 0.0 | 11.8 | OK |
| PH3-N-10.009 | 60 minute 20 year Winter I+0% | 203.516 | 0.000 | 0.0 | 13.3 | OK |
| PH3-N-10.010 | 60 minute 20 year Winter I+0% | 203.508 | 0.000 | 0.0 | 16.5 | OK |
| PH3-N-10.011 | 60 minute 20 year Winter I+0% | 203.506 | 0.000 | 0.2 | 21.0 | OK |
| PH3-N-10.012 | 30 minute 20 year Winter I+0% | 203.305 | 0.000 | 0.1 | 22.7 | OK |
| PH3-N-10.013 | 30 minute 20 year Winter I+0% | 203.310 | 0.000 | 0.8 | 85.0 | SURCHARGED* |
| PH3-N-5.006 | 30 minute 20 year Winter I+0% | 203.322 | 0.000 | 1.1 | 358.3 | OK |
| PH3-N-5.007 | 30 minute 20 year Winter I+0% | 203.279 | 0.000 | 1.2 | 324.1 | FLOOD RISK* |
| PH3-N-5.008 | 30 minute 20 year Winter I+0% | 202.774 | 0.000 | 2.7 | 290.4 | OK |
| PH3-N-14.000 | 15 minute 20 year Winter I+0% | 206.150 | 0.000 | 1.3 | 8.6 | OK |
| PH3-N-15.000 | 15 minute 20 year Winter I+0% | 206.208 | 0.000 | 1.6 | 29.6 | OK |
| PH3-N-14.001 | 15 minute 20 year Winter I+0% | 205.457 | 0.000 | 2.2 | 68.6 | SURCHARGED |
| PH3-N-16.000 | 15 minute 20 year Winter I+0% | 205.484 | 0.000 | 1.5 | 20.0 | OK |
| PH3-N-14.002 | 15 minute 20 year Winter I+0% | 204.973 | 0.000 | 2.4 | 92.2 | SURCHARGED |
| PH3-N-17.000 | 15 minute 20 year Winter I+0% | 204.288 | 0.000 | 1.4 | 19.6 | OK |
| PH3-N-14.003 | 15 minute 20 year Winter I+0% | 203.844 | 0.000 | 3.2 | 126.4 | SURCHARGED |
| PH3-N-5.009 | 30 minute 20 year Winter I+0% | 202.276 | 0.000 | 2.0 | 401.7 | OK |
| PH3-N-4.012 | 30 minute 20 year Winter I+0% | 202.269 | 0.000 | 2.6 | 362.7 | SURCHARGED* |
| PH3-N-4.013 | 30 minute 20 year Winter I+0% | 201.639 | 0.000 | 1.6 | 362.7 | OK |

## Summary of Critical Results by Maximum Level (Rank 1) for Phase 3 Northern

| PN | Event | Water Level (m) | Flooded Volume (m³) | Maximum Velocity (m/s) | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|
| PH3-N-4.014 | 30 minute 20 year Winter I+0% | 201.341 | 0.000 | 2.1 | 365.1 | OK |
| PH3-N-4.015 | 60 minute 20 year Winter I+0% | 200.975 | 0.000 | 1.9 | 349.2 | OK |
| PH3-N-4.016 | 60 minute 20 year Winter I+0% | 200.953 | 0.000 | 1.3 | 337.4 | OK |
| PH3-N-1.018 | 60 minute 20 year Winter I+0% | 200.925 | 0.000 | 2.3 | 257.1 | SURCHARGED* |
| PH3-N-1.019 | 60 minute 20 year Winter I+0% | 200.493 | 0.000 | 2.3 | 257.1 | SURCHARGED |
| PH3-N-1.020 | 60 minute 20 year Winter I+0% | 199.854 | 0.000 | 0.5 | 257.1 | OK |
| PH3-N-1.021 | 60 minute 20 year Winter I+0% | 199.793 | 0.000 | 3.0 | 257.1 | OK |
| PH3-N-1.022 | 60 minute 20 year Winter I+0% | 198.596 | 0.000 | 2.0 | 257.1 | OK |
| PH3-N-18.000 | 15 minute 20 year Winter I+0% | 200.917 | 0.000 | 0.4 | 7.3 | OK |
| PH3-N-18.001 | 15 minute 20 year Winter I+0% | 200.428 | 0.000 | 0.7 | 18.8 | OK |
| PH3-N-18.002 | 60 minute 20 year Winter I+0% | 200.052 | 0.000 | 0.9 | 20.6 | OK* |
| PH3-N-18.003 | 60 minute 20 year Winter I+0% | 200.050 | 0.000 | 1.0 | 28.7 | OK |
| PH3-N-18.004 | 60 minute 20 year Winter I+0% | 199.744 | 0.000 | 0.2 | 29.9 | OK |
| PH3-N-18.005 | 60 minute 20 year Winter I+0% | 199.743 | 0.000 | 0.2 | 29.9 | OK |
| PH3-N-18.006 | 60 minute 20 year Winter I+0% | 199.740 | 0.000 | 0.2 | 35.4 | OK |
| PH3-N-18.007 | 60 minute 20 year Winter I+0% | 199.735 | 0.000 | 0.2 | 50.8 | OK |
| PH3-N-18.008 | 60 minute 20 year Winter I+0% | 199.725 | 0.000 | 0.2 | 73.8 | OK |
| PH3-N-19.000 | 15 minute 20 year Winter I+0% | 203.027 | 0.000 | 0.4 | 9.9 | OK |
| PH3-N-19.001 | 30 minute 20 year Winter I+0% | 202.996 | 0.000 | 0.9 | 13.8 | OK |
| PH3-N-19.002 | 30 minute 20 year Winter I+0% | 202.681 | 0.000 | 0.2 | 26.4 | FLOOD RISK* |
| PH3-N-19.003 | 30 minute 20 year Winter I+0% | 202.352 | 0.000 | 1.7 | 33.5 | OK |
| PH3-N-19.004 | 30 minute 20 year Winter I+0% | 201.867 | 0.000 | 1.6 | 48.8 | OK |
| PH3-N-19.005 | 15 minute 20 year Winter I+0% | 201.296 | 0.000 | 1.8 | 80.5 | OK |
| PH3-N-19.006 | 15 minute 20 year Winter I+0% | 200.210 | 0.000 | 1.0 | 122.8 | OK |
| PH3-N-19.007 | 15 minute 20 year Winter I+0% | 199.940 | 0.000 | 1.1 | 178.6 | OK |
| PH3-N-19.008 | 30 minute 20 year Winter I+0% | 199.775 | 0.000 | 0.8 | 187.8 | OK |

## Summary of Critical Results by Maximum Level (Rank 1) for Phase 3 Northern

| PN | Event | Water Level (m) | Flooded Volume (m³) | Maximum Velocity (m/s) | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|
| PH3-N-19.009 | 60 minute 20 year Winter I+0% | 199.757 | 0.000 | 0.4 | 149.6 | OK |
| PH3-N-19.010 | 60 minute 20 year Winter I+0% | 199.733 | 0.000 | 0.6 | 156.3 | OK |
| PH3-N-18.009 | 60 minute 20 year Winter I+0% | 199.717 | 0.000 | 1.4 | 151.5 | SURCHARGED* |
| PH3-N-18.010 | 60 minute 20 year Winter I+0% | 199.583 | 0.000 | 0.2 | 149.8 | SURCHARGED |
| PH3-N-18.011 | 60 minute 20 year Winter I+0% | 199.573 | 0.000 | 1.3 | 145.5 | SURCHARGED |
| PH3-N-18.012 | 60 minute 20 year Winter I+0% | 199.321 | 0.000 | 1.3 | 143.6 | SURCHARGED |
| PH3-N-18.013 | 30 minute 20 year Winter I+0% | 199.069 | 0.000 | 1.3 | 144.4 | SURCHARGED |
| PH3-N-18.014 | 30 minute 20 year Winter I+0% | 198.844 | 0.000 | 1.4 | 143.2 | SURCHARGED |
| PH3-N-18.015 | 30 minute 20 year Winter I+0% | 198.585 | 0.000 | 1.4 | 143.2 | SURCHARGED |
| PH3-N-1.023 | 60 minute 20 year Winter I+0% | 198.251 | 0.000 | 2.3 | 398.6 | OK |
| PH3-N-1.024 | 60 minute 20 year Winter I+0% | 197.801 | 0.000 | 1.9 | 398.6 | SURCHARGED |
| PH3-N-1.025 | 60 minute 20 year Winter I+0% | 197.371 | 0.000 | 2.7 | 398.6 | OK |
| PH3-N-1.026 | 60 minute 20 year Winter I+0% | 196.291 | 0.000 | 5.5 | 398.6 | OK |
| PH3-N-1.027 | 60 minute 20 year Winter I+0% | 193.080 | 0.000 | 3.4 | 398.6 | OK |
| PH3-N-1.028 | 60 minute 20 year Winter I+0% | 191.722 | 0.000 | 2.9 | 398.6 | OK |
| PH3-N-1.029 | 60 minute 20 year Winter I+0% | 191.105 | 0.000 | 0.4 | 398.6 | SURCHARGED* |
| PH3-N-1.030 | 60 minute 20 year Winter I+0% | 190.974 | 0.000 | 0.3 | 398.6 | FLOOD RISK* |
| PH3-N-1.031 | 120 minute 20 year Summer I+0% | 190.910 | 0.000 | 0.2 | 385.6 | FLOOD RISK* |
| PH3-N-1.032 | 60 minute 20 year Winter I+0% | 190.758 | 0.000 | 6.6 | 398.6 | SURCHARGED |
| PH3-N-1.033 | 60 minute 20 year Winter I+0% | 187.576 | 0.000 | 4.4 | 398.6 | OK |
| PH3-N-20.000 | 15 minute 20 year Winter I+0% | 192.627 | 0.000 | 0.2 | 35.5 | OK |
| PH3-N-20.001 | 15 minute 20 year Winter I+0% | 190.849 | 0.000 | 0.8 | 43.1 | OK |
| PH3-N-20.002 | 15 minute 20 year Winter I+0% | 188.182 | 0.000 | 0.7 | 87.6 | OK |
| PH3-N-21.000 | 30 minute 20 year Winter I+0% | 188.619 | 0.000 | 0.1 | 11.2 | OK |
| PH3-N-21.001 | 15 minute 20 year Winter I+0% | 188.559 | 0.000 | 0.2 | 28.6 | OK |
| PH3-N-21.002 | 30 minute 20 year Winter I+0% | 188.187 | 0.000 | 0.4 | 55.1 | OK |

## Summary of Critical Results by Maximum Level (Rank 1) for Phase 3 Northern

| PN | Event | Water Level (m) | Flooded Volume (m³) | Maximum Velocity (m/s) | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|
| PH3-N-21.003 | 30 minute 20 year Winter I+0% | 187.755 | 0.000 | 1.4 | 53.3 | OK* |
| PH3-N-21.004 | 30 minute 20 year Winter I+0% | 187.362 | 0.000 | 1.3 | 52.7 | OK |
| PH3-N-21.005 | 15 minute 20 year Winter I+0% | 187.082 | 0.000 | 0.2 | 124.3 | OK |
| PH3-N-20.003 | 15 minute 20 year Winter I+0% | 186.815 | 0.000 | 4.2 | 380.2 | SURCHARGED* |
| PH3-N-20.004 | 120 minute 20 year Winter I+0% | 185.615 | 0.000 | 1.6 | 99.4 | OK |
| PH3-N-20.005 | 720 minute 20 year Winter I+0% | 185.517 | 0.000 | 1.5 | 64.9 | SURCHARGED |
| PH3-N-1.034 | 720 minute 20 year Winter I+0% | 185.485 | 0.000 | 3.4 | 138.1 | FLOOD RISK |
| PH3-N-1.035 | 2160 minute 20 year Winter I+0% | 182.598 | 0.000 | 2.9 | 91.4 | SURCHARGED |
| PH3-N-1.036 | 2880 minute 20 year Winter I+0% | 180.290 | 0.000 | 4.0 | 77.7 | FLOOD RISK |
| PH3-N-1.037 | 2880 minute 20 year Winter I+0% | 174.575 | 0.000 | 0.2 | 77.7 | OK |

## Area Summary for Phase 3 Northern

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 1.000 | User | - | 30 | 0.043 | 0.013 | 0.013 |
| | User | - | 100 | 0.142 | 0.142 | 0.155 |
| 1.001 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.002 | User | - | 100 | 0.090 | 0.090 | 0.090 |
| | User | - | 30 | 0.079 | 0.024 | 0.114 |
| 1.003 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 2.000 | User | - | 30 | 0.083 | 0.025 | 0.025 |
| 2.001 | User | - | 30 | 0.163 | 0.049 | 0.049 |
| 2.002 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 2.003 | User | - | 30 | 0.104 | 0.031 | 0.031 |
| 3.000 | User | - | 30 | 0.138 | 0.041 | 0.041 |
| 3.001 | User | - | 30 | 0.106 | 0.032 | 0.032 |
| 3.002 | User | - | 30 | 0.049 | 0.015 | 0.015 |
| 3.003 | User | - | 30 | 0.042 | 0.013 | 0.013 |
| 3.004 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 3.005 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 3.006 | User | - | 30 | 0.087 | 0.026 | 0.026 |
| 2.004 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.004 | User | - | 100 | 0.061 | 0.061 | 0.061 |
| | User | - | 30 | 0.079 | 0.024 | 0.085 |
| 1.005 | User | - | 100 | 0.046 | 0.046 | 0.046 |
| 1.006 | User | - | 100 | 0.047 | 0.047 | 0.047 |
| 1.007 | User | - | 100 | 0.036 | 0.036 | 0.036 |
| 1.008 | User | - | 100 | 0.174 | 0.174 | 0.174 |
| 1.009 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.010 | User | - | 100 | 0.224 | 0.224 | 0.224 |
| 1.011 | User | - | 100 | 0.136 | 0.136 | 0.136 |
| 1.012 | User | - | 100 | 0.174 | 0.174 | 0.174 |

## Area Summary for Phase 3 Northern

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 1.013 | User | - | 100 | 0.181 | 0.181 | 0.181 |
| 1.014 | User | - | 100 | 0.199 | 0.199 | 0.199 |
| 1.015 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.016 | User | - | 100 | 0.274 | 0.274 | 0.274 |
| 1.017 | User | - | 100 | 0.288 | 0.288 | 0.288 |
| 4.000 | User | - | 100 | 0.025 | 0.025 | 0.025 |
| 4.001 | User | - | 100 | 0.018 | 0.018 | 0.018 |
| 4.002 | User | - | 100 | 0.036 | 0.036 | 0.036 |
| 4.003 | User | - | 100 | 0.027 | 0.027 | 0.027 |
| 4.004 | User | - | 100 | 0.009 | 0.009 | 0.009 |
| | User | - | 100 | 0.037 | 0.037 | 0.046 |
| 4.005 | User | - | 100 | 0.046 | 0.046 | 0.046 |
| | User | - | 100 | 0.092 | 0.092 | 0.139 |
| 4.006 | User | - | 100 | 0.051 | 0.051 | 0.051 |
| | User | - | 100 | 0.076 | 0.076 | 0.127 |
| 4.007 | User | - | 100 | 0.049 | 0.049 | 0.049 |
| | User | - | 100 | 0.062 | 0.062 | 0.111 |
| 4.008 | User | - | 100 | 0.020 | 0.020 | 0.020 |
| 4.009 | User | - | 100 | 0.040 | 0.040 | 0.040 |
| | User | - | 100 | 0.094 | 0.094 | 0.134 |
| 4.010 | User | - | 100 | 0.039 | 0.039 | 0.039 |
| | User | - | 100 | 0.085 | 0.085 | 0.123 |
| 4.011 | User | - | 100 | 0.031 | 0.031 | 0.031 |
| | User | - | 100 | 0.073 | 0.073 | 0.104 |
| 5.000 | User | - | 100 | 0.199 | 0.199 | 0.199 |
| 5.001 | User | - | 100 | 0.228 | 0.228 | 0.228 |
| 5.002 | User | - | 100 | 0.240 | 0.240 | 0.240 |
| 6.000 | User | - | 100 | 0.148 | 0.148 | 0.148 |

## Area Summary for Phase 3 Northern

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 6.001 | User | - | 100 | 0.152 | 0.152 | 0.152 |
| 5.003 | User | - | 100 | 0.164 | 0.164 | 0.164 |
| 7.000 | User | - | 100 | 0.148 | 0.148 | 0.148 |
| 7.001 | User | - | 100 | 0.148 | 0.148 | 0.148 |
| 5.004 | User | - | 100 | 0.168 | 0.168 | 0.168 |
| 8.000 | User | - | 100 | 0.153 | 0.153 | 0.153 |
| 8.001 | User | - | 100 | 0.140 | 0.140 | 0.140 |
| 5.005 | User | - | 100 | 0.165 | 0.165 | 0.165 |
| 9.000 | User | - | 100 | 0.149 | 0.149 | 0.149 |
| 9.001 | User | - | 100 | 0.129 | 0.129 | 0.129 |
| 9.002 | User | - | 100 | 0.080 | 0.080 | 0.080 |
| 9.003 | User | - | 100 | 0.039 | 0.039 | 0.039 |
| 10.000 | User | - | 100 | 0.034 | 0.034 | 0.034 |
| 10.001 | User | - | 100 | 0.032 | 0.032 | 0.032 |
| 10.002 | User | - | 100 | 0.089 | 0.089 | 0.089 |
| 10.003 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 10.004 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 11.000 | User | - | 30 | 0.011 | 0.003 | 0.003 |
| 11.001 | User | - | 30 | 0.028 | 0.008 | 0.008 |
| 11.002 | User | - | 30 | 0.033 | 0.010 | 0.010 |
| 11.003 | User | - | 30 | 0.017 | 0.005 | 0.005 |
| 11.004 | User | - | 30 | 0.036 | 0.011 | 0.011 |
| 11.005 | User | - | 30 | 0.047 | 0.014 | 0.014 |
| 11.006 | User | - | 30 | 0.030 | 0.009 | 0.009 |
| 11.007 | User | - | 30 | 0.009 | 0.003 | 0.003 |
| 12.000 | User | - | 30 | 0.043 | 0.013 | 0.013 |
| 12.001 | User | - | 30 | 0.052 | 0.016 | 0.016 |
| 12.002 | User | - | 30 | 0.038 | 0.011 | 0.011 |

## Area Summary for Phase 3 Northern

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 12.003 | User | - | 30 | 0.018 | 0.005 | 0.005 |
| | User | - | 30 | 0.010 | 0.003 | 0.008 |
| 11.008 | User | - | 30 | 0.016 | 0.005 | 0.005 |
| 11.009 | User | - | 30 | 0.026 | 0.008 | 0.008 |
| 11.010 | User | - | 30 | 0.085 | 0.026 | 0.026 |
| 11.011 | User | - | 30 | 0.050 | 0.015 | 0.015 |
| 13.000 | User | - | 30 | 0.019 | 0.006 | 0.006 |
| 13.001 | User | - | 30 | 0.017 | 0.005 | 0.005 |
| 13.002 | User | - | 30 | 0.079 | 0.024 | 0.024 |
| 13.003 | User | - | 30 | 0.042 | 0.013 | 0.013 |
| 13.004 | User | - | 30 | 0.041 | 0.012 | 0.012 |
| 11.012 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 10.005 | User | - | 100 | 0.127 | 0.127 | 0.127 |
| 10.006 | User | - | 100 | 0.052 | 0.052 | 0.052 |
| 10.007 | User | - | 100 | 0.048 | 0.048 | 0.048 |
| 10.008 | User | - | 100 | 0.049 | 0.049 | 0.049 |
| 10.009 | User | - | 100 | 0.045 | 0.045 | 0.045 |
| 10.010 | User | - | 100 | 0.050 | 0.050 | 0.050 |
| 10.011 | User | - | 100 | 0.042 | 0.042 | 0.042 |
| 10.012 | User | - | 100 | 0.052 | 0.052 | 0.052 |
| 10.013 | User | - | 100 | 0.093 | 0.093 | 0.093 |
| 5.006 | User | - | 100 | 0.016 | 0.016 | 0.016 |
| 5.007 | User | - | 100 | 0.116 | 0.116 | 0.116 |
| 5.008 | User | - | 100 | 0.094 | 0.094 | 0.094 |
| 14.000 | User | - | 100 | 0.042 | 0.042 | 0.042 |
| 15.000 | User | - | 100 | 0.146 | 0.146 | 0.146 |
| 14.001 | User | - | 100 | 0.182 | 0.182 | 0.182 |
| 16.000 | User | - | 100 | 0.098 | 0.098 | 0.098 |

## Area Summary for Phase 3 Northern

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 14.002 | User | - | 100 | 0.149 | 0.149 | 0.149 |
| 17.000 | User | - | 100 | 0.096 | 0.096 | 0.096 |
| 14.003 | User | - | 100 | 0.152 | 0.152 | 0.152 |
| 5.009 | User | - | 100 | 0.055 | 0.055 | 0.055 |
| 4.012 | User | - | 100 | 0.025 | 0.025 | 0.025 |
| | User | - | 100 | 0.080 | 0.080 | 0.106 |
| 4.013 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 4.014 | User | - | 100 | 0.060 | 0.060 | 0.060 |
| 4.015 | User | - | 100 | 0.040 | 0.040 | 0.040 |
| 4.016 | User | - | 100 | 0.061 | 0.061 | 0.061 |
| 1.018 | User | - | 100 | 0.279 | 0.279 | 0.279 |
| | User | - | 100 | 0.272 | 0.272 | 0.551 |
| 1.019 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.020 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.021 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.022 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 18.000 | User | - | 100 | 0.024 | 0.024 | 0.024 |
| 18.001 | User | - | 100 | 0.036 | 0.036 | 0.036 |
| 18.002 | User | - | 100 | 0.100 | 0.100 | 0.100 |
| 18.003 | User | - | 100 | 0.089 | 0.089 | 0.089 |
| 18.004 | User | - | 100 | 0.120 | 0.120 | 0.120 |
| 18.005 | User | - | 100 | 0.120 | 0.120 | 0.120 |
| 18.006 | User | - | 100 | 0.143 | 0.143 | 0.143 |
| 18.007 | User | - | 100 | 0.288 | 0.288 | 0.288 |
| 18.008 | User | - | 100 | 0.397 | 0.397 | 0.397 |
| 19.000 | User | - | 100 | 0.034 | 0.034 | 0.034 |
| 19.001 | User | - | 100 | 0.096 | 0.096 | 0.096 |
| 19.002 | User | - | 100 | 0.124 | 0.124 | 0.124 |

## Area Summary for Phase 3 Northern

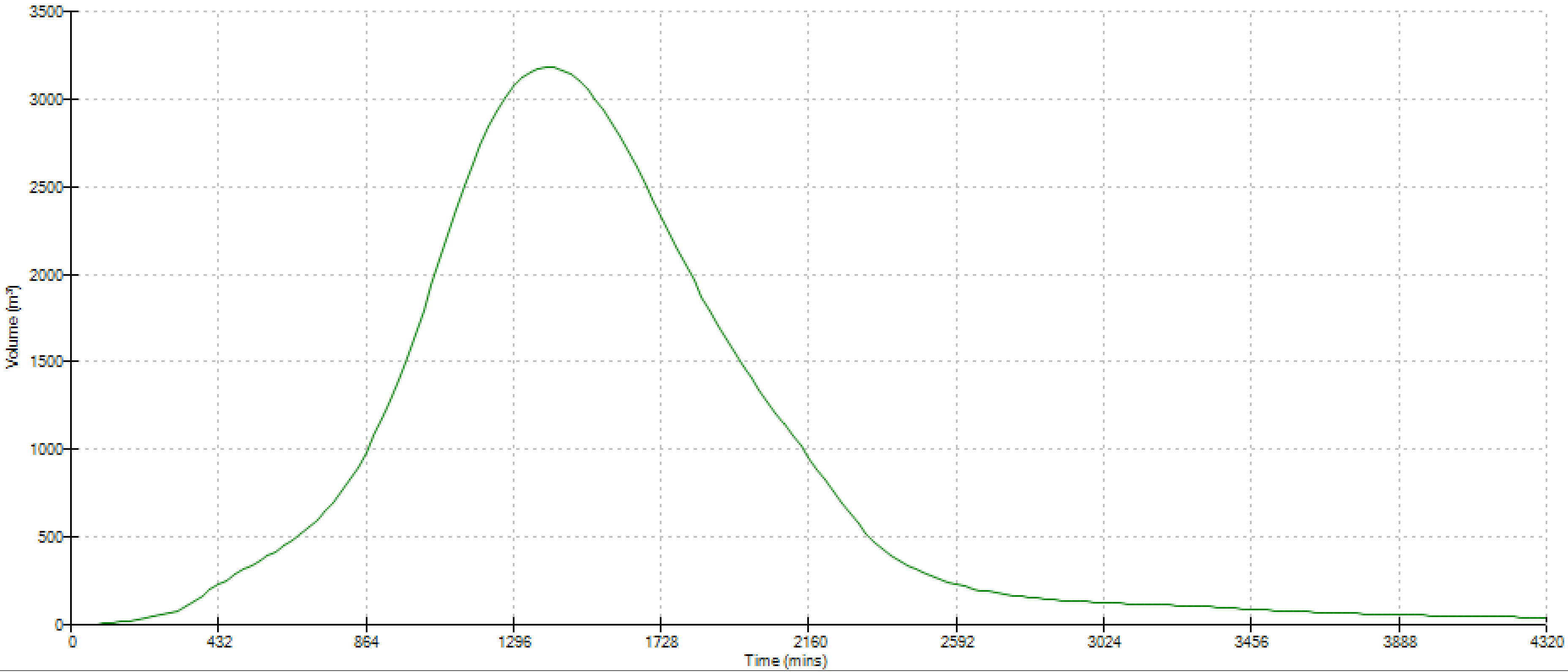
| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 19.003 | User | - | 100 | 0.070 | 0.070 | 0.070 |
| 19.004 | User | - | 100 | 0.116 | 0.116 | 0.116 |
| 19.005 | User | - | 100 | 0.163 | 0.163 | 0.163 |
| 19.006 | User | - | 100 | 0.189 | 0.189 | 0.189 |
| 19.007 | User | - | 100 | 0.227 | 0.227 | 0.227 |
| 19.008 | User | - | 100 | 0.251 | 0.251 | 0.251 |
| 19.009 | User | - | 100 | 0.321 | 0.321 | 0.321 |
| 19.010 | User | - | 100 | 0.394 | 0.394 | 0.394 |
| 18.009 | User | - | 100 | 0.385 | 0.385 | 0.385 |
| 18.010 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 18.011 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 18.012 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 18.013 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 18.014 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 18.015 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.023 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.024 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.025 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.026 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.027 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.028 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.029 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.030 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.031 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.032 | User | - | 100 | 0.093 | 0.093 | 0.093 |
| 1.033 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 20.000 | User | - | 30 | 0.771 | 0.231 | 0.231 |
| 20.001 | User | - | 80 | 0.070 | 0.056 | 0.056 |

## Area Summary for Phase 3 Northern

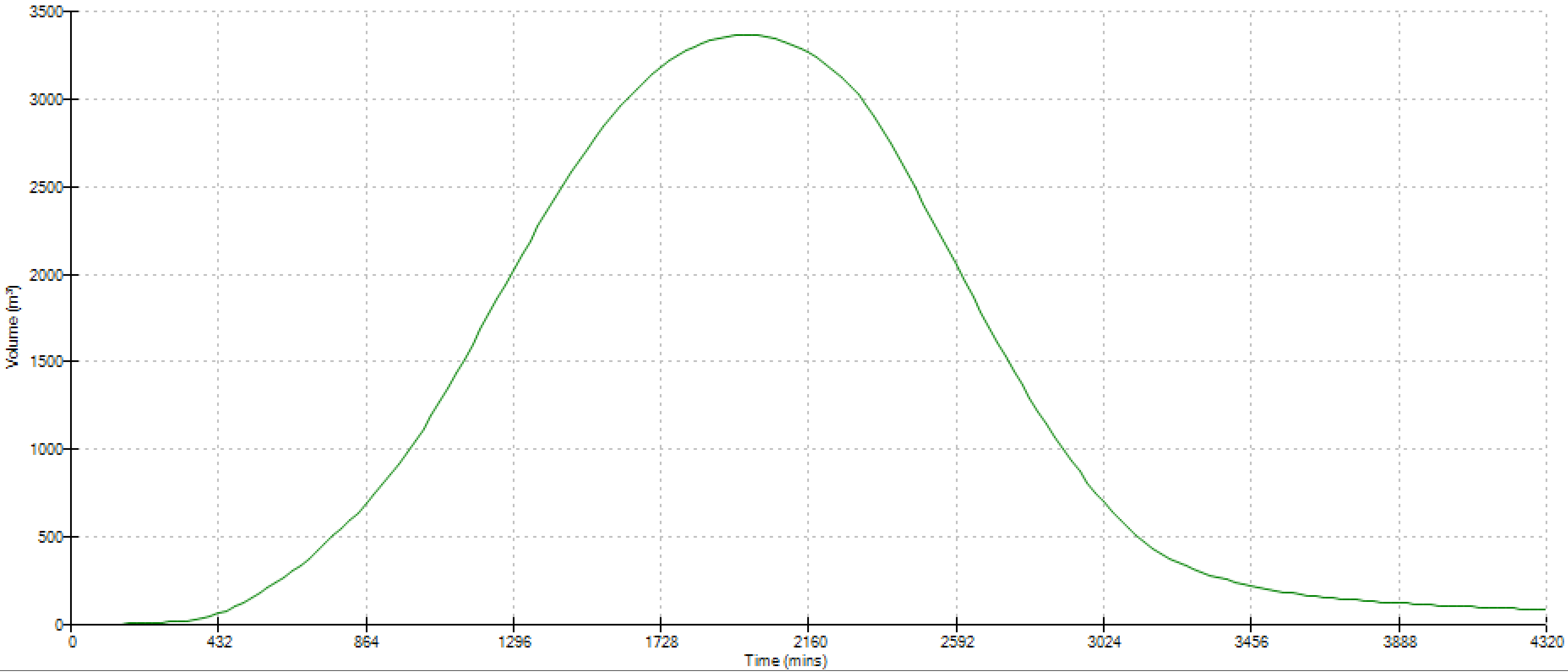
| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 20.002 | User | - | 80 | 0.072 | 0.058 | 0.058 |
| | User | - | 30 | 0.389 | 0.117 | 0.174 |
| 21.000 | User | - | 30 | 0.244 | 0.073 | 0.073 |
| 21.001 | User | - | 30 | 0.374 | 0.112 | 0.112 |
| 21.002 | User | - | 30 | 0.530 | 0.159 | 0.159 |
| 21.003 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 21.004 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 21.005 | User | - | 80 | 0.309 | 0.247 | 0.247 |
| | User | - | 30 | 0.525 | 0.157 | 0.404 |
| 20.003 | User | - | 80 | 0.241 | 0.193 | 0.193 |
| | User | - | 80 | 0.179 | 0.144 | 0.336 |
| | User | - | 80 | 0.178 | 0.143 | 0.479 |
| | User | - | 30 | 1.866 | 0.560 | 1.039 |
| | User | - | 30 | 0.776 | 0.233 | 1.272 |
| 20.004 | User | - | 100 | 0.171 | 0.171 | 0.171 |
| 20.005 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.034 | User | - | 100 | 0.458 | 0.458 | 0.458 |
| | User | - | 30 | 3.178 | 0.953 | 1.411 |
| 1.035 | User | - | 100 | 0.320 | 0.320 | 0.320 |
| | User | - | 30 | 0.256 | 0.077 | 0.397 |
| 1.036 | User | - | 30 | 0.183 | 0.055 | 0.055 |
| | User | - | 100 | 0.218 | 0.218 | 0.273 |
| 1.037 | User | - | 100 | 0.170 | 0.170 | 0.170 |
| | User | - | 30 | 0.300 | 0.090 | 0.260 |
| | | | | Total | Total | Total |
| | | | | 25.380 | 17.390 | 17.390 |

| Ove Arup & Partners International Ltd | | Page 1 |
|---|---|---|
| The Arup Campus<br>Blyth Gate<br>Solihull  B90 8AE | | |
| Date 13/03/2017 11:45<br>File Woodsmith Mine Phase 3 Rev A for Planning.mdx | Designed by veronika.stoyanova<br>Checked by | |
| XP Solutions | Network 2015.1 | |

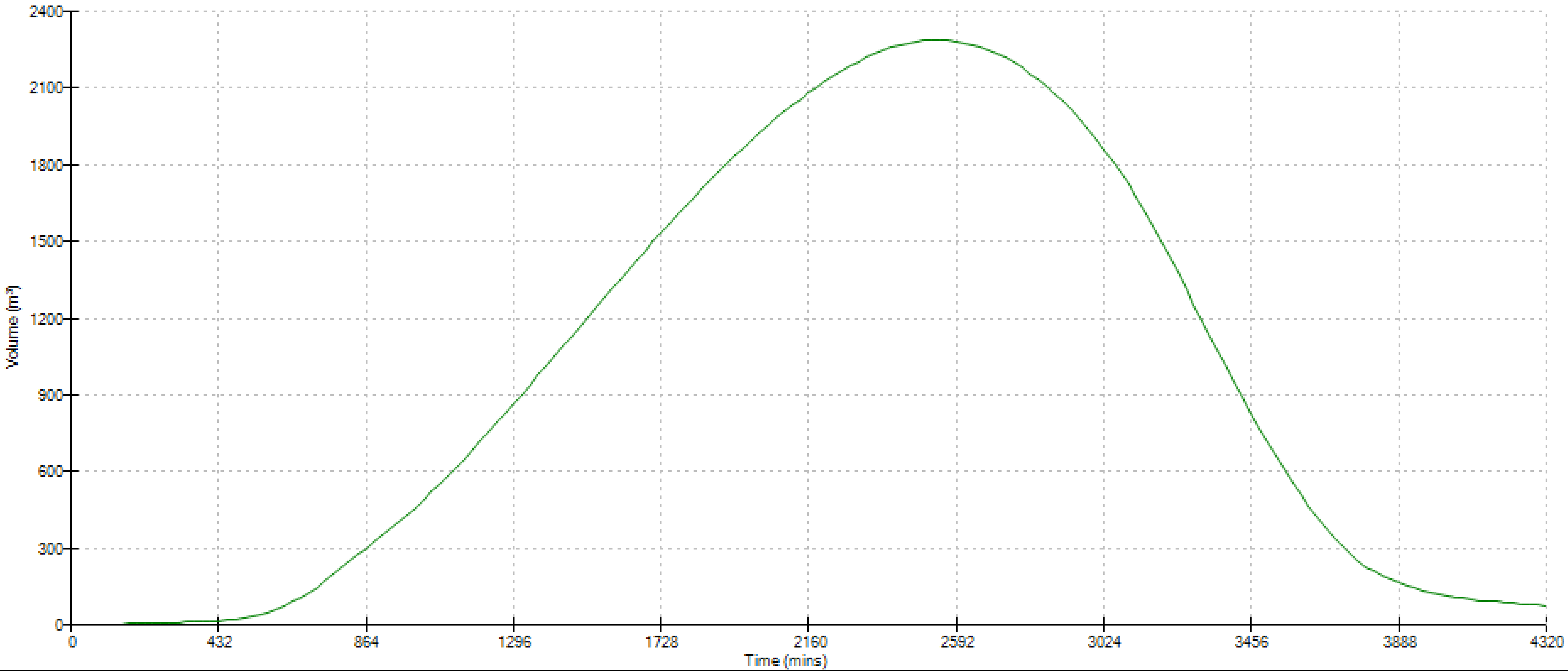
Graphs for Pipe PH3-N-1.034 US/MH PH3-N-102  (Phase 3 Northern)
2160 minute 20 year Winter I+0%
Status:  SURCHARGED



Graphs for Pipe PH3-N-1.035 US/MH PH3-N-103  (Phase 3 Northern)
2160 minute 20 year Winter I+0%
Status:  SURCHARGED

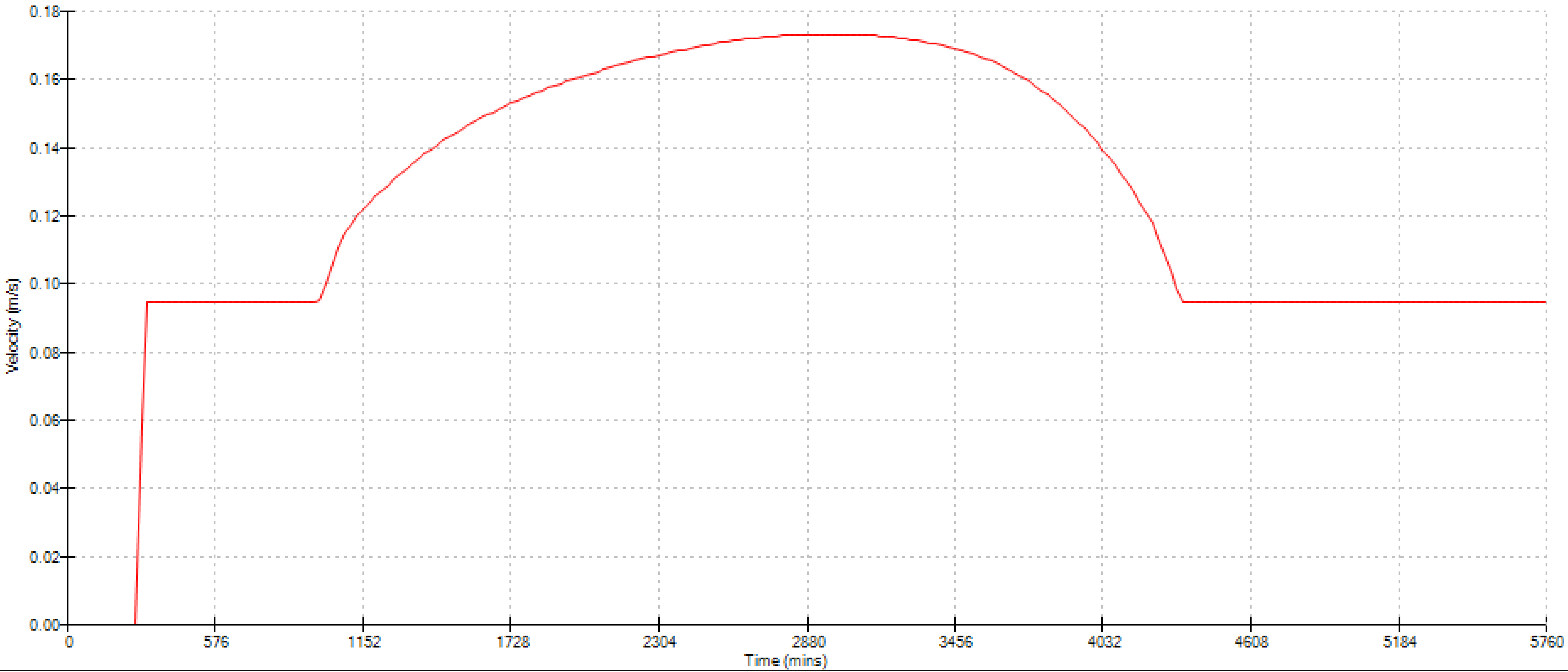


Graphs for Pipe PH3-N-1.036 US/MH PH3-N-128  (Phase 3 Northern)
2160 minute 20 year Winter I+0%
Status:  FLOOD RISK



| Ove Arup & Partners International Ltd | | Page 1 |
|---|---|---|
| The Arup Campus<br>Blyth Gate<br>Solihull  B90 8AE | | |
| Date 10/03/2017 17:19<br>File Woodsmith Mine Phase 3 Rev A for Planning.mdx | Designed by veronika.stoyanova<br>Checked by | |
| XP Solutions | Network 2015.1 | |

Graphs for Pipe PH3-N-1.037 US/MH PH3-N-129  (Phase 3 Northern)
2880 minute 20 year Winter I+0%
Status:  OK



## STORM SEWER DESIGN by the Modified Rational Method

## Design Criteria for Phase 3 Southern

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

| | | | | | |
|---|---|---|---|---|---|
| Return Period (years) | 20 | F (1km) | 2.381 | Maximum Backdrop Height (m) | 1.500 |
| Site Location | | Maximum Rainfall (mm/hr) | 100 | Min Design Depth for Optimisation (m) | 0.500 |
| C (1km) | -0.022 | Maximum Time of Concentration (mins) | 30 | Min Vel for Auto Design only (m/s) | 0.10 |
| D1 (1km) | 0.374 | Foul Sewage (l/s/ha) | 0.000 | Min Slope for Optimisation (1:X) | 500 |
| D2 (1km) | 0.409 | Volumetric Runoff Coeff. | 0.750 | | |
| D3 (1km) | 0.270 | Add Flow / Climate Change (%) | 0 | | |
| E (1km) | 0.288 | Minimum Backdrop Height (m) | 0.200 | | |

Designed with Level Inverts

## Network Design Table for Phase 3 Southern

« - Indicates pipe capacity < flow

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|

## Network Design Table for Phase 3 Southern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-S-1.000 | 44.121 | 0.400 | 110.3 | 0.018 | 5.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-2.000 | 21.904 | 0.400 | 54.8 | 0.024 | 5.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-1.001 | 32.461 | 0.300 | 108.2 | 0.069 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-1.002 | 30.397 | 0.500 | 60.8 | 0.119 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-1.003 | 46.470 | 0.500 | 92.9 | 0.102 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-1.004 | 42.710 | 0.900 | 47.5 | 0.082 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-3.000 | 30.000 | 0.200 | 150.0 | 0.022 | 5.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-3.001 | 30.000 | 0.300 | 100.0 | 0.046 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-S-1.000 | 92.74 | 9.24 | 210.700 | 0.018 | 0.0 | 0.0 | 0.0 | 0.17 | 24.7 | 4.5 |
| PH3-S-2.000 | 100.00 | 6.48 | 210.700 | 0.024 | 0.0 | 0.0 | 0.0 | 0.25 | 35.1 | 6.4 |
| PH3-S-1.001 | 75.97 | 12.33 | 210.300 | 0.111 | 0.0 | 0.0 | 0.0 | 0.18 | 24.9 | 22.8 |
| PH3-S-1.002 | 67.92 | 14.50 | 210.000 | 0.230 | 0.0 | 0.0 | 0.0 | 0.23 | 33.3« | 42.3 |
| PH3-S-1.003 | 57.18 | 18.60 | 209.500 | 0.332 | 0.0 | 0.0 | 0.0 | 0.19 | 26.9« | 51.4 |
| PH3-S-1.004 | 52.07 | 21.29 | 209.000 | 0.414 | 0.0 | 0.0 | 0.0 | 0.26 | 37.7« | 58.4 |
| PH3-S-3.000 | 99.36 | 8.36 | 209.500 | 0.022 | 0.0 | 0.0 | 0.0 | 0.15 | 21.2 | 6.0 |
| PH3-S-3.001 | 81.66 | 11.11 | 209.300 | 0.068 | 0.0 | 0.0 | 0.0 | 0.18 | 26.0 | 15.1 |

## Network Design Table for Phase 3 Southern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-S-3.002 | 30.000 | 0.200 | 150.0 | 0.055 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-3.003 | 20.000 | 0.100 | 200.0 | 0.063 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-3.004 | 15.000 | 0.100 | 150.0 | 0.020 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-3.005 | 20.000 | 0.100 | 200.0 | 0.014 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-3.006 | 30.000 | 0.080 | 375.0 | 0.014 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-3.007 | 32.000 | 0.100 | 320.0 | 0.058 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-3.008 | 40.000 | 0.120 | 333.3 | 0.056 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-4.000 | 22.839 | 0.300 | 76.1 | 0.015 | 5.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-4.001 | 19.851 | 0.600 | 33.1 | 0.016 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-4.002 | 30.527 | 0.700 | 43.6 | 0.019 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-S-3.002 | 68.01 | 14.47 | 209.000 | 0.123 | 0.0 | 0.0 | 0.0 | 0.15 | 21.2« | 22.7 |
| PH3-S-3.003 | 60.70 | 17.06 | 208.800 | 0.186 | 0.0 | 0.0 | 0.0 | 0.13 | 18.4« | 30.6 |
| PH3-S-3.004 | 56.88 | 18.74 | 208.700 | 0.206 | 0.0 | 0.0 | 0.0 | 0.15 | 21.2« | 31.8 |
| PH3-S-3.005 | 52.01 | 21.33 | 208.600 | 0.220 | 0.0 | 0.0 | 0.0 | 0.13 | 18.4« | 31.8 |
| PH3-S-3.006 | 44.60 | 26.64 | 208.500 | 0.234 | 0.0 | 0.0 | 0.0 | 0.09 | 13.4« | 31.8 |
| PH3-S-3.007 | 41.08 | 30.00 | 208.420 | 0.293 | 0.0 | 0.0 | 0.0 | 0.10 | 14.5« | 32.6 |
| PH3-S-3.008 | 41.08 | 30.00 | 208.320 | 0.348 | 0.0 | 0.0 | 0.0 | 0.10 | 14.2« | 38.8 |
| PH3-S-4.000 | 100.00 | 6.82 | 210.600 | 0.015 | 0.0 | 0.0 | 0.0 | 0.21 | 29.7 | 4.0 |
| PH3-S-4.001 | 100.00 | 7.87 | 210.300 | 0.031 | 0.0 | 0.0 | 0.0 | 0.32 | 45.1 | 8.3 |
| PH3-S-4.002 | 89.59 | 9.71 | 209.700 | 0.050 | 0.0 | 0.0 | 0.0 | 0.28 | 39.3 | 12.0 |

## Network Design Table for Phase 3 Southern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-S-4.003 | 31.868 | 0.300 | 106.2 | 0.054 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-4.004 | 35.497 | 0.500 | 71.0 | 0.080 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-3.009 | 17.332 | 0.050 | 346.6 | 0.107 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-3.010 | 30.228 | 0.080 | 377.9 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 220 | |
| PH3-S-3.011 | 40.650 | 0.120 | 338.8 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | |
| PH3-S-3.012 | 42.343 | 0.140 | 302.5 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | |
| PH3-S-3.013 | 3.809 | 0.010 | 380.9 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | |
| PH3-S-1.005 | 46.003 | 2.000 | 23.0 | 0.122 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-S-4.003 | 74.36 | 12.72 | 209.000 | 0.104 | 0.0 | 0.0 | 0.0 | 0.18 | 25.2 | 20.9 |
| PH3-S-4.004 | 64.98 | 15.46 | 208.700 | 0.183 | 0.0 | 0.0 | 0.0 | 0.22 | 30.8« | 32.3 |
| PH3-S-3.009 | 41.08 | 30.00 | 208.200 | 0.638 | 0.0 | 0.0 | 0.0 | 0.10 | 13.9« | 71.0 |
| PH3-S-3.010 | 41.08 | 30.00 | 208.450 | 0.638 | 0.0 | 0.0 | 0.0 | 0.66 | 25.0« | 71.0 |
| PH3-S-3.011 | 41.08 | 30.00 | 208.350 | 0.638 | 0.0 | 0.0 | 0.0 | 0.70 | 28.0« | 71.0 |
| PH3-S-3.012 | 41.08 | 30.00 | 208.250 | 0.638 | 0.0 | 0.0 | 0.0 | 0.75 | 29.7« | 71.0 |
| PH3-S-3.013 | 41.08 | 30.00 | 208.110 | 0.638 | 0.0 | 0.0 | 0.0 | 0.66 | 26.4« | 71.0 |
| PH3-S-1.005 | 41.08 | 30.00 | 208.100 | 1.175 | 0.0 | 0.0 | 0.0 | 0.38 | 54.1« | 130.7 |

## Network Design Table for Phase 3 Southern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-S-5.000 | 27.262 | 0.100 | 272.6 | 0.023 | 5.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-5.001 | 29.769 | 1.200 | 24.8 | 0.078 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-5.002 | 32.845 | 1.800 | 18.2 | 0.089 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-5.003 | 23.665 | 0.600 | 39.4 | 0.075 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-5.004 | 22.165 | 0.300 | 73.9 | 0.044 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-5.005 | 33.305 | 0.500 | 66.6 | 0.047 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-1.006 | 22.824 | 1.300 | 17.6 | 0.119 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-1.007 | 23.359 | 0.800 | 29.2 | 0.000 | 0.00 | 0.0 | | 0.117 | 3 \=/ | 500 | |
| PH3-S-1.008 | 41.122 | 0.200 | 205.6 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 375 | |
| PH3-S-1.009 | 48.182 | 0.600 | 80.3 | 0.293 | 0.00 | 0.0 | 0.600 | | o | 375 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-S-5.000 | 93.59 | 9.12 | 210.600 | 0.023 | 0.0 | 0.0 | 0.0 | 0.11 | 15.7 | 5.7 |
| PH3-S-5.001 | 85.03 | 10.48 | 210.500 | 0.100 | 0.0 | 0.0 | 0.0 | 0.37 | 52.1 | 23.0 |
| PH3-S-5.002 | 78.50 | 11.76 | 209.300 | 0.189 | 0.0 | 0.0 | 0.0 | 0.43 | 60.8 | 40.2 |
| PH3-S-5.003 | 72.78 | 13.12 | 207.500 | 0.264 | 0.0 | 0.0 | 0.0 | 0.29 | 41.3« | 51.9 |
| PH3-S-5.004 | 66.76 | 14.86 | 206.900 | 0.307 | 0.0 | 0.0 | 0.0 | 0.21 | 30.2« | 55.5 |
| PH3-S-5.005 | 59.99 | 17.35 | 206.600 | 0.354 | 0.0 | 0.0 | 0.0 | 0.22 | 31.8« | 57.6 |
| PH3-S-1.006 | 41.08 | 30.00 | 206.100 | 1.648 | 0.0 | 0.0 | 0.0 | 0.43 | 61.9« | 183.4 |
| PH3-S-1.007 | 41.08 | 30.00 | 204.800 | 1.648 | 0.0 | 0.0 | 0.0 | 0.34 | 48.0« | 183.4 |
| PH3-S-1.008 | 41.08 | 30.00 | 204.000 | 1.648 | 0.0 | 0.0 | 0.0 | 1.26 | 139.1« | 183.4 |
| PH3-S-1.009 | 41.08 | 30.00 | 203.800 | 1.941 | 0.0 | 0.0 | 0.0 | 2.02 | 223.5 | 216.0 |

## Network Design Table for Phase 3 Southern

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | n | HYD SECT | DIA (mm) | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PH3-S-1.010 | 29.247 | 0.250 | 117.0 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | |
| PH3-S-1.011 | 7.734 | 0.050 | 154.7 | 0.000 | 0.00 | 0.0 | 0.600 | | o | 225 | |
| PH3-S-1.012 | 15.445 | 1.000 | 15.4 | 0.000 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 500 | |
| PH3-S-1.013 | 16.959 | 0.500 | 33.9 | 0.000 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 500 | |
| PH3-S-1.014 | 19.325 | 0.100 | 193.3 | 0.000 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 500 | |
| PH3-S-1.015 | 17.689 | 0.400 | 44.2 | 0.000 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 500 | |
| PH3-S-1.016 | 17.534 | 1.500 | 11.7 | 0.000 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 500 | |
| PH3-S-1.017 | 14.246 | 1.500 | 9.5 | 0.000 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 500 | |
| PH3-S-1.018 | 17.787 | 1.500 | 11.9 | 0.000 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 500 | |
| PH3-S-1.019 | 15.277 | 0.300 | 50.9 | 0.000 | 0.00 | 0.0 | | 0.117 | 1.5 _/ | 500 | |
| PH3-S-1.020 | 7.000 | 0.700 | 10.0 | 0.080 | 0.00 | 0.0 | | 0.117 | \|_\| | 5000 | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| PH3-S-1.010 | 41.08 | 30.00 | 202.300 | 1.941 | 0.0 | 0.0 | 0.0 | 1.21 | 48.0« | 216.0 |
| PH3-S-1.011 | 41.08 | 30.00 | 202.050 | 1.941 | 0.0 | 0.0 | 0.0 | 1.05 | 41.7« | 216.0 |
| PH3-S-1.012 | 41.08 | 30.00 | 202.000 | 1.941 | 0.0 | 0.0 | 0.0 | 0.69 | 197.7« | 216.0 |
| PH3-S-1.013 | 41.08 | 30.00 | 201.000 | 1.941 | 0.0 | 0.0 | 0.0 | 0.47 | 133.5« | 216.0 |
| PH3-S-1.014 | 41.08 | 30.00 | 200.500 | 1.941 | 0.0 | 0.0 | 0.0 | 0.20 | 55.9« | 216.0 |
| PH3-S-1.015 | 41.08 | 30.00 | 200.400 | 1.941 | 0.0 | 0.0 | 0.0 | 0.41 | 116.9« | 216.0 |
| PH3-S-1.016 | 41.08 | 30.00 | 200.000 | 1.941 | 0.0 | 0.0 | 0.0 | 0.80 | 227.3 | 216.0 |
| PH3-S-1.017 | 41.08 | 30.00 | 198.500 | 1.941 | 0.0 | 0.0 | 0.0 | 0.88 | 252.2 | 216.0 |
| PH3-S-1.018 | 41.08 | 30.00 | 197.000 | 1.941 | 0.0 | 0.0 | 0.0 | 0.79 | 225.7 | 216.0 |
| PH3-S-1.019 | 41.08 | 30.00 | 195.500 | 1.941 | 0.0 | 0.0 | 0.0 | 0.38 | 108.9« | 216.0 |
| PH3-S-1.020 | 41.08 | 30.00 | 195.700 | 2.021 | 0.0 | 0.0 | 0.0 | 1.12 | 1684.6 | 224.9 |

## Summary of Critical Results by Maximum Level (Rank 1) for Phase 3 Southern

### Simulation Criteria

| | | | | | |
|---|---|---|---|---|---|
| Areal Reduction Factor | 1.000 | Manhole Headloss Coeff (Global) | 0.500 | MADD Factor * 10m³/ha Storage | 2.000 |
| Hot Start (mins) | 0 | Foul Sewage per hectare (l/s) | 0.000 | Inlet Coeffiecient | 0.800 |
| Hot Start Level (mm) | 0 | Additional Flow - % of Total Flow | 0.000 | Flow per Person per Day (l/per/day) | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| Number of Input Hydrographs | 0 | Number of Offline Controls | 0 | Number of Time/Area Diagrams | 0 |
| Number of Online Controls | 22 | Number of Storage Structures | 2 | Number of Real Time Controls | 0 |

### Synthetic Rainfall Details

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rainfall Model | FEH | C (1km) | -0.022 | D2 (1km) | 0.409 | E (1km) | 0.288 | Cv (Summer) | 0.750 |
| Site Location | | D1 (1km) | 0.374 | D3 (1km) | 0.270 | F (1km) | 2.381 | Cv (Winter) | 0.840 |

Margin for Flood Risk Warning (mm) 100.0 DTS Status ON Inertia Status ON
Analysis Timestep Fine DVD Status ON

| | |
|---|---|
| Profile(s) | Summer and Winter |
| Duration(s) (mins) | 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080 |
| Return Period(s) (years) | 20 |
| Climate Change (%) | 0 |

| PN | Event | Water Level (m) | Flooded Volume (m³) | Maximum Velocity (m/s) | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|
| PH3-S-1.000 | 15 minute 20 year Winter I+0% | 210.801 | 0.000 | 0.1 | 5.0 | OK |
| PH3-S-2.000 | 15 minute 20 year Winter I+0% | 210.798 | 0.000 | 0.1 | 6.9 | OK |
| PH3-S-1.001 | 30 minute 20 year Winter I+0% | 210.645 | 0.000 | 0.3 | 11.9 | OK |

## Summary of Critical Results by Maximum Level (Rank 1) for Phase 3 Southern

| PN | Event | Water Level (m) | Flooded Volume (m³) | Maximum Velocity (m/s) | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|
| PH3-S-1.002 | 15 minute 20 year Winter I+0% | 210.343 | 0.000 | 0.5 | 27.8 | OK |
| PH3-S-1.003 | 15 minute 20 year Winter I+0% | 209.859 | 0.000 | 0.4 | 44.9 | OK |
| PH3-S-1.004 | 15 minute 20 year Winter I+0% | 209.365 | 0.000 | 0.5 | 52.6 | OK |
| PH3-S-3.000 | 15 minute 20 year Winter I+0% | 209.621 | 0.000 | 0.1 | 6.5 | OK |
| PH3-S-3.001 | 15 minute 20 year Winter I+0% | 209.474 | 0.000 | 0.1 | 16.8 | OK |
| PH3-S-3.002 | 600 minute 20 year Winter I+0% | 209.455 | 0.000 | 0.1 | 2.3 | FLOOD RISK* |
| PH3-S-3.003 | 600 minute 20 year Winter I+0% | 209.154 | 0.000 | 0.0 | 3.1 | OK |
| PH3-S-3.004 | 600 minute 20 year Winter I+0% | 209.153 | 0.000 | 0.1 | 2.8 | FLOOD RISK* |
| PH3-S-3.005 | 600 minute 20 year Winter I+0% | 208.852 | 0.000 | 0.0 | 3.0 | OK |
| PH3-S-3.006 | 600 minute 20 year Winter I+0% | 208.850 | 0.000 | 0.0 | 3.2 | OK |
| PH3-S-3.007 | 600 minute 20 year Winter I+0% | 208.849 | 0.000 | 0.0 | 4.0 | OK |
| PH3-S-3.008 | 600 minute 20 year Winter I+0% | 208.848 | 0.000 | 0.0 | 4.9 | OK |
| PH3-S-4.000 | 15 minute 20 year Winter I+0% | 210.681 | 0.000 | 0.1 | 4.3 | OK |
| PH3-S-4.001 | 30 minute 20 year Winter I+0% | 210.584 | 0.000 | 0.1 | 1.0 | OK |
| PH3-S-4.002 | 30 minute 20 year Winter I+0% | 210.009 | 0.000 | 0.3 | 3.5 | OK |
| PH3-S-4.003 | 15 minute 20 year Winter I+0% | 209.329 | 0.000 | 0.3 | 15.5 | OK |
| PH3-S-4.004 | 15 minute 20 year Winter I+0% | 208.920 | 0.000 | 0.1 | 31.0 | OK |
| PH3-S-3.009 | 120 minute 20 year Winter I+0% | 208.601 | 0.000 | 0.0 | 16.2 | OK |
| PH3-S-3.010 | 120 minute 20 year Winter I+0% | 208.597 | 0.000 | 0.6 | 15.6 | OK* |
| PH3-S-3.011 | 120 minute 20 year Winter I+0% | 208.558 | 0.000 | 0.4 | 15.7 | OK |
| PH3-S-3.012 | 60 minute 20 year Winter I+0% | 208.516 | 0.000 | 0.4 | 15.6 | SURCHARGED |
| PH3-S-3.013 | 60 minute 20 year Winter I+0% | 208.476 | 0.000 | 0.4 | 15.6 | SURCHARGED |
| PH3-S-1.005 | 30 minute 20 year Winter I+0% | 208.475 | 0.000 | 0.7 | 66.7 | OK |
| PH3-S-5.000 | 15 minute 20 year Winter I+0% | 210.743 | 0.000 | 0.1 | 6.5 | OK |
| PH3-S-5.001 | 15 minute 20 year Winter I+0% | 210.656 | 0.000 | 0.2 | 25.9 | OK |
| PH3-S-5.002 | 15 minute 20 year Winter I+0% | 209.661 | 0.000 | 0.8 | 48.6 | OK |

## Summary of Critical Results by Maximum Level (Rank 1) for Phase 3 Southern

| PN | Event | Water Level (m) | Flooded Volume (m³) | Maximum Velocity (m/s) | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|
| PH3-S-5.003 | 15 minute 20 year Winter I+0% | 207.876 | 0.000 | 0.6 | 67.9 | OK |
| PH3-S-5.004 | 15 minute 20 year Winter I+0% | 207.347 | 0.000 | 0.4 | 69.8 | FLOOD RISK* |
| PH3-S-5.005 | 15 minute 20 year Winter I+0% | 206.981 | 0.000 | 0.4 | 74.2 | OK |
| PH3-S-1.006 | 30 minute 20 year Winter I+0% | 206.394 | 0.000 | 0.4 | 145.6 | OK |
| PH3-S-1.007 | 30 minute 20 year Winter I+0% | 205.224 | 0.000 | 0.8 | 145.0 | OK |
| PH3-S-1.008 | 30 minute 20 year Winter I+0% | 204.342 | 0.000 | 1.4 | 139.1 | OK* |
| PH3-S-1.009 | 1440 minute 20 year Winter I+0% | 204.305 | 0.000 | 1.1 | 12.2 | SURCHARGED |
| PH3-S-1.010 | 1440 minute 20 year Winter I+0% | 202.380 | 0.000 | 1.0 | 12.2 | OK |
| PH3-S-1.011 | 1440 minute 20 year Winter I+0% | 202.147 | 0.000 | 0.7 | 12.2 | OK |
| PH3-S-1.012 | 1440 minute 20 year Winter I+0% | 202.102 | 0.000 | 0.2 | 12.2 | OK |
| PH3-S-1.013 | 1440 minute 20 year Winter I+0% | 201.332 | 0.000 | 0.5 | 12.2 | OK |
| PH3-S-1.014 | 1440 minute 20 year Winter I+0% | 200.853 | 0.000 | 0.1 | 12.2 | OK |
| PH3-S-1.015 | 1440 minute 20 year Winter I+0% | 200.535 | 0.000 | 0.1 | 12.2 | OK |
| PH3-S-1.016 | 1440 minute 20 year Winter I+0% | 200.332 | 0.000 | 0.5 | 12.2 | OK |
| PH3-S-1.017 | 1440 minute 20 year Winter I+0% | 198.832 | 0.000 | 0.6 | 12.2 | OK |
| PH3-S-1.018 | 1440 minute 20 year Winter I+0% | 197.332 | 0.000 | 0.5 | 12.2 | OK |
| PH3-S-1.019 | 960 minute 20 year Winter I+0% | 195.732 | 0.000 | 0.1 | 12.2 | OK |
| PH3-S-1.020 | 1440 minute 20 year Winter I+0% | 195.724 | 0.000 | 0.1 | 12.6 | OK |

## STORM SEWER DESIGN by the Modified Rational Method

## Design Criteria for Phase 3 Southern

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

| | | | | | |
|---|---|---|---|---|---|
| Return Period (years) | 20 | F (1km) | 2.381 | Maximum Backdrop Height (m) | 1.500 |
| Site Location | | Maximum Rainfall (mm/hr) | 100 | Min Design Depth for Optimisation (m) | 0.500 |
| C (1km) | -0.022 | Maximum Time of Concentration (mins) | 30 | Min Vel for Auto Design only (m/s) | 0.10 |
| D1 (1km) | 0.374 | Foul Sewage (l/s/ha) | 0.000 | Min Slope for Optimisation (1:X) | 500 |
| D2 (1km) | 0.409 | Volumetric Runoff Coeff. | 0.750 | | |
| D3 (1km) | 0.270 | Add Flow / Climate Change (%) | 0 | | |
| E (1km) | 0.288 | Minimum Backdrop Height (m) | 0.200 | | |

Designed with Level Inverts

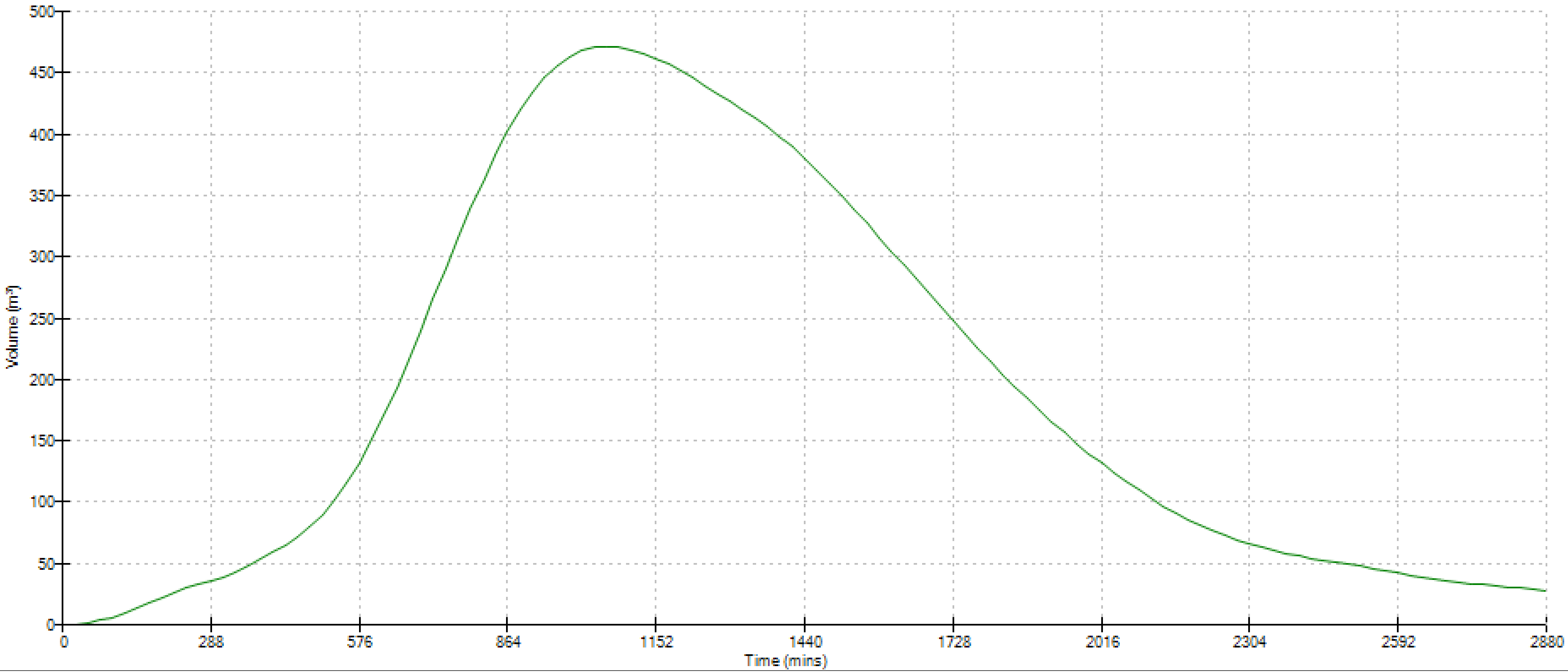
## Area Summary for Phase 3 Southern

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 1.000 | User | - | 80 | 0.022 | 0.018 | 0.018 |
| 2.000 | User | - | 80 | 0.029 | 0.024 | 0.024 |
| 1.001 | User | - | 80 | 0.087 | 0.069 | 0.069 |
| 1.002 | User | - | 80 | 0.149 | 0.119 | 0.119 |
| 1.003 | User | - | 80 | 0.127 | 0.102 | 0.102 |
| 1.004 | User | - | 80 | 0.103 | 0.082 | 0.082 |
| 3.000 | User | - | 80 | 0.028 | 0.022 | 0.022 |
| 3.001 | User | - | 80 | 0.058 | 0.046 | 0.046 |
| 3.002 | User | - | 80 | 0.069 | 0.055 | 0.055 |
| 3.003 | User | - | 80 | 0.078 | 0.063 | 0.063 |
| 3.004 | User | - | 80 | 0.025 | 0.020 | 0.020 |
| 3.005 | User | - | 80 | 0.018 | 0.014 | 0.014 |
| 3.006 | User | - | 80 | 0.017 | 0.014 | 0.014 |
| 3.007 | User | - | 80 | 0.073 | 0.058 | 0.058 |
| 3.008 | User | - | 80 | 0.070 | 0.056 | 0.056 |
| 4.000 | User | - | 80 | 0.018 | 0.015 | 0.015 |
| 4.001 | User | - | 80 | 0.020 | 0.016 | 0.016 |
| 4.002 | User | - | 80 | 0.024 | 0.019 | 0.019 |
| 4.003 | User | - | 80 | 0.068 | 0.054 | 0.054 |
| 4.004 | User | - | 80 | 0.099 | 0.080 | 0.080 |
| 3.009 | User | - | 80 | 0.133 | 0.107 | 0.107 |
| 3.010 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 3.011 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 3.012 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 3.013 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.005 | User | - | 80 | 0.153 | 0.122 | 0.122 |
| 5.000 | User | - | 80 | 0.028 | 0.023 | 0.023 |
| 5.001 | User | - | 80 | 0.097 | 0.078 | 0.078 |

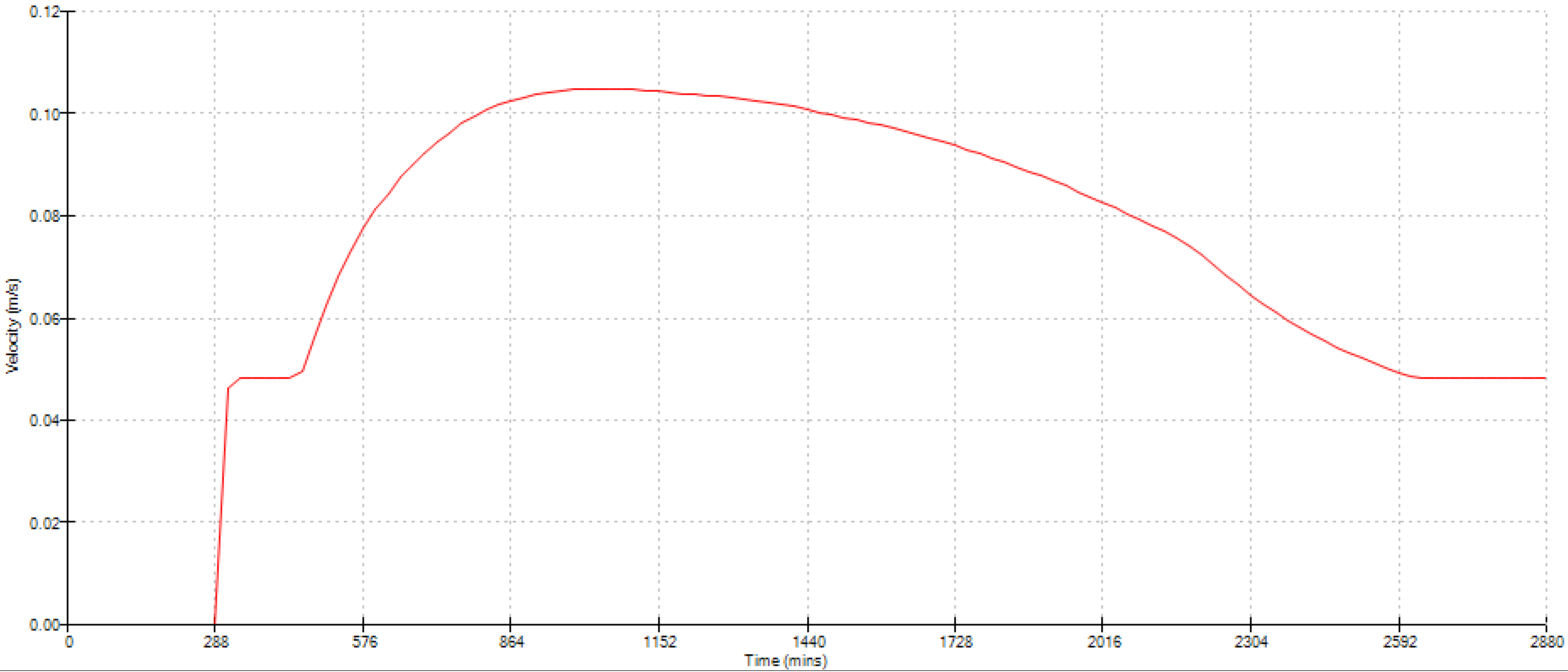
## Area Summary for Phase 3 Southern

| Pipe Number | PIMP Type | PIMP Name | PIMP (%) | Gross Area (ha) | Imp. Area (ha) | Pipe Total (ha) |
|---|---|---|---|---|---|---|
| 5.002 | User | - | 80 | 0.111 | 0.089 | 0.089 |
| 5.003 | User | - | 80 | 0.093 | 0.075 | 0.075 |
| 5.004 | User | - | 80 | 0.055 | 0.044 | 0.044 |
| 5.005 | User | - | 80 | 0.059 | 0.047 | 0.047 |
| 1.006 | User | - | 80 | 0.149 | 0.119 | 0.119 |
| 1.007 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.008 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.009 | User | - | 100 | 0.232 | 0.232 | 0.232 |
| | User | - | 30 | 0.204 | 0.061 | 0.293 |
| 1.010 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.011 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.012 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.013 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.014 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.015 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.016 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.017 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.018 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.019 | - | - | 100 | 0.000 | 0.000 | 0.000 |
| 1.020 | User | - | 100 | 0.080 | 0.080 | 0.080 |
| | | | | Total | Total | Total |
| | | | | 2.576 | 2.021 | 2.021 |

Graphs for Pipe PH3-S-1.009 US/MH PH3-S-37 (Phase 3 Southern)
1440 minute 20 year Winter I+0%
Status: SURCHARGED



Graphs for Pipe PH3-S-1.020 US/MH PH3-S-48 (Phase 3 Southern)
1440 minute 20 year Winter I+0%
Status: OK

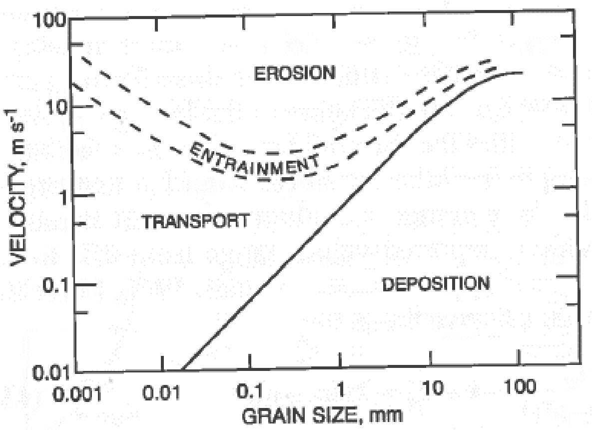


# Appendix E

## Outfall Velocity and Silt Removal Calculations

**Determination of a maximum velocity to discharge surface water into Sneaton Thorpe Beck tributaries.**

The textbook “Fluvial Forms and Processes, A New Perspective” contains a graph that gives some basic limiting velocities for sediment erosion and entrainment based on various grain sizes.




The graph shows that no grain sizes are entrained into the flow until velocities are greater than 1m/s.

Using Ordnance Survey maps, topographic surveys and contours produced from lidar, Sneaton Thorpe Beck tributaries have an average gradient of approximately 1 in 20.

The tributaries of Sneaton Thorpe Beck are small. The photograph below shows the typical size of the tributaries downstream from the site. The width of the tributaries have been estimated at approximately 1m wide.

Flow monitoring has been undertaken at a number of locations on Sneaton Thorpe Beck. The monitoring data gives typical depths of flow at three monitoring points on the beck over a 4 month period. During rainfall events the depths at these monitoring points increases to about 200mm. The depths of the water in the beck will be dependent on the geometry at any specific location, but the data offers a guide to allow us to undertake some calculations. If we consider that the depth data only covers a 4 month period, we would expect increased depths during higher return period rainfall events.

Using the above information a manning's calculation was undertaken to give an indication of typical velocities in the existing beck during rainfall events:

Manning's "n" has been estimated using (Chow, 1959):
3a. Mountain Streams, no vegetation in channel, banks usually steep, with trees and brush on banks submerged. Bottom: gravels cobbles and few boulders: normal n = 0.040

Slope: 1 in 20
Width of base = 1m
Depth of flow = varies

**Manning's Equation**

$$V = \frac{R^{2/3} S^{1/2}}{n}$$

V is average velocity (m/s)
R = hydraulic radius (m)
S = energy slope (m/m)
n = Manning's roughness coefficient

| Depth of flow (mm) | Velocity (m/s) |
|---|---|
| 100 | 1.07 |
| 200 | 1.53 |
| 300 | 1.83 |
| 400 | 2.05 |

This table gives indicative average velocities in the tributary of Sneaton Thorpe Beck downstream of the outfall during rainfall events.

The results suggest velocities ranging from about 1 m/s to 2m/s would be expected during rainfall events. Velocities nearer the upper end of this range would be expected for large storm events such as a 1 in 20year return period event.

In an email from the Environment Agency on the 18th February 2016 contained guidance notes with typical outfall structures that contained limits to the exit velocities. These were 1.2m/s for a typical outfall without a stilling basin and 1.8m/s for outfalls with a stilling basin.

Using the information above, a conservative maximum discharge velocity to set for the outfalls from the site is 1.2m/s for return periods up to the 1 in 20 year return period event.

ARUP

| Job No. | Sheet No. | Rev. |
|---|---|---|
| 243369-00 | | |

| | |
|---|---|
| Job Title | Woodsmith Mine Phase 3 Planning |
| Calculation | Velocity at outfall from reinjection borehole pad drainage to existing watercourse |
| Member/Location | Leeds |
| Drg. Ref. | |
| Made by | VS |
| Date | 14/03/2017 |
| Chd. | NF |

| Description | Value | Unit | Notes |
|---|---|---|---|
| **1. Calculation of Outfall Pipe Velocity** | | | |
| Upstream cover level = | 207.4 | mAOD | *Specified oil separator outlet pipe* |
| Upstream invert level = | 207.0 | mAOD | |
| Downstream Cover Level = | 207.4 | mAOD | |
| Downstream Invert Depth = | 206.85 | mAOD | *Cover Level of 0.55m to enable outfall to ditch.* |
| Fall= | 0.2 | m | |
| Length= | 5 | m | |
| Gradient = 1 in | 33.3 | | |
| Maximum Flow Rate | 80 | l/s | *Windes Model using 1 in 20 year return period storm with critical duration of 15 minutes.* |
| Pipe Size= | 225 | mm | |
| **Pipe Velocity =** | **2.22** | **m/s** | *Colebrook White Equation* |

Pipe velocity is too high, therefore stilling basin is required for the outfall.

## 2. Calculation of Outfall Velocity after Stilling Basin

Using upstand design as shown on drawing YP-P10-WS-CD-024. Calculated as flow over weir.

| | | | |
| --- | --- | --- | --- |
| Weir Width = | 1.3 | m | H3C Althon Headwall Assumed |
| Total Flow= | 0.08 | m3/s | |
| **Height of water over weir =** | **0.105** | **m** | $Q = 0.59b\sqrt{g}h^{3/2}$ |
| Gravity, g= | 9.81 | m/s2 | |
| *Flow Calculated=* | *0.08* | | |
| *Proportion =* | *1.00* | | |
| Cross sectional area, A = | 0.1366 | m2 | |
| **Velocity=** | **0.59** | **m/s** | V=Q/A |

The utilised volume of the pond and the wetland, as well as the discharge flow rates are based on the results from the WinDES Model: **Woodsmith_Mine_Phase_3 _revA_For_Planning.**
Maximum utilised flow depth and volume during the critical storm for the Pond - **1 in 20 year Winter 1440 minute storm**- are used as most conservative estimate.

***"Design of flood storage reservoirs" (CIRIA B14, 1993),***
**Chapter 6.5, "estimating Pollutant Removal Efficiency "**

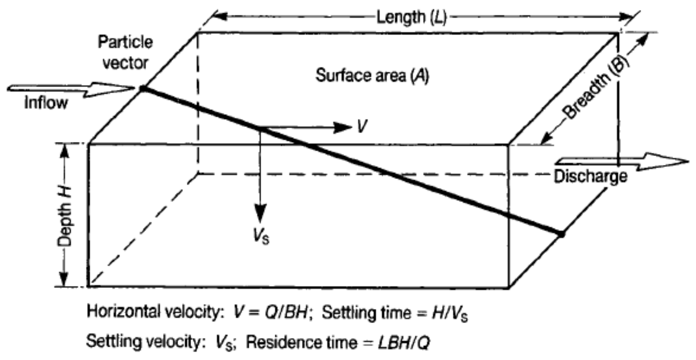



**Figure 6.8** *Idealised settlement of discrete particles*

**Table 6.6** Settling velocities and particle size

| *Sediment grade* | *Particle diameter d (mm)* | *Settling velocity* $V_s$ *(mm/s) at 10°C* — *Sand, density 2650 kg/m³* | *Sewage solids, density 1200 kg/m³* |
|---|---|---|---|
| Gravel | 10.0 | 800.0 | — |
| Coarse sand | 1.0 | 200.0 | 30.0 |
| Medium sand | 0.5 | 70.0 | 17.0 |
| Fine sand | 0.2 | 22.0 | 5.0 |
| Very fine sand | 0.1 | 10.0 | 1.3 |
| Coarse silt | 0.06 | 6.7 | 0.3 |
| Fine silt | 0.01 | 0.18 | 0.08 |
| Coarse clay | 0.004 | 0.016 | 0.002 |
| Fine clay | 0.001 | 0.011 | 0.001 |

For soil particles: $V_s = 1/10\,[d/0.0314]^{½}$

$$\eta = V_s t_R / d_1$$

## Pond

Volume of Pond 1050 m3 *Based on Geometry of the Pond*

Total Treatment Volume = 471 m3 *Based on 20min Winter 1440min design storm.*

Discharge Rate = 12.2 l/s

Average Retention Time = 38607 s 10.7 h

*Depth Varies, max:* 0.505 m

**Treatment Efficiency Rates**

Fine Silt Particles
Settling Velocity Vs= 0.18 mm/s *From Table 6.6*
Removal efficiency is 1376%
*Therefore it is assumed that all silt and coarser particles will settle out.*

Coarse Clay
Settling Velocity Vs= 0.016 mm/s
Removal efficiency is 122.3%
*Therefore it is assumed that all coarse clay particles will settle out.*

Fine Clay
Settling Velocity Vs= 0.011 mm/s
Removal efficiency is 84.1%
*Therefore it is assumed that 84% of the fine clay particles will settle out.*

## Wetland

Static Volume of Wetland 400 m3 *Based on Geometry of the Wetland*
Storm Stored Volume= 35 m3 *Based on critical design storm*
Total Treatment Volume = 435 m3

Discharge Rate = 12.6 l/s *Based on critical design storm*

Average Retention Time = 34524 s 9.6 h

*Depth Varies, approx:* 0.5 m *From the WinDes Model*

**Treatment Efficiency Rates**

Fine Silt Particles
Settling Velocity Vs= 0.18 mm/s *From Table 6.6*
Removal efficiency is 1243%
*Therefore it is assumed that all silt and coarser particles will settle out.*

Coarse Clay
Settling Velocity Vs= 0.016 mm/s
Removal efficiency is 110.5%
*Therefore it is assumed that all the coarse clay particles will settle out.*

Fine Clay
Settling Velocity Vs= 0.011 mm/s
Removal efficiency is 76.0%
*Therefore it is assumed that 76% of the remaining suspended fine clay particles will settle ou*

| Particle Size | Typical Settling velocities (mm/s) | % Removal in Pond | % Removal in Wetland | Total % Efficiency |
|---|---|---|---|---|
| Course Sand | 200 | 100% | | 100% |
| Fine Sand | 22 | 100% | | 100% |
| Coarse Silt | 6.7 | 100% | | 100% |
| Fine Silt | 0.18 | 100% | 100% | 100% |
| Coarse Clay | 0.016 | 100% | 100% | 100% |
| Fine Clay | 0.011 | 84% | 76% | 96% |

| Particle Size | Overall Removal |
|---|---|
| Sand | 100% |
| Silt | 100% |
| Clay | 98% |

Excluding any removal benefits from Silt Fences and Check Dams

ıt

The volume and the discharge rates of the silt removal facility, the ponds and the wetlands are based on the results from the WinDES Model:
**Woodsmith_Mine_Phase_3 _revA_For_Planning.**
Maximum utilised flow depth and volume during the critical storm for Pond A -
**1 in 20 year Winter 720 minute storm** - are used as the most conservative estimate.

***"Design of flood storage reservoirs" (CIRIA B14, 1993),***
**Chapter 6.5, "estimating Pollutant Removal Efficiency "**

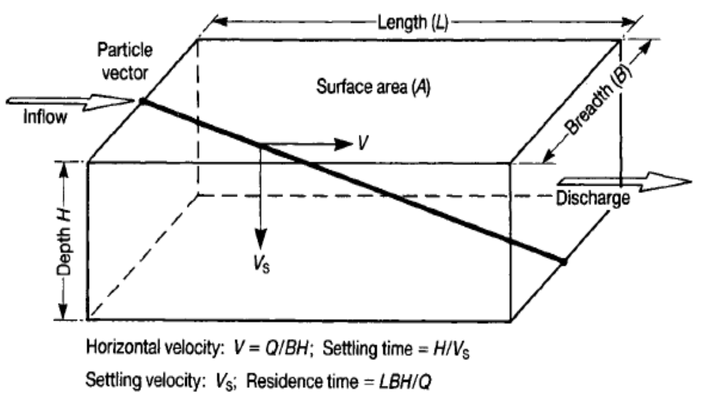



**Figure 6.8** *Idealised settlement of discrete particles*

$$\eta = V_s t_R / d_l$$

**Table 6.6** Settling velocities and particle size

| *Sediment grade* | *Particle diameter d (mm)* | *Settling velocity $V_s$ (mm/s) at 10°C* — *Sand, density 2650 kg/m³* | *Sewage solids, density 1200 kg/m³* |
|---|---|---|---|
| Gravel | 10.0 | 800.0 | — |
| Coarse sand | 1.0 | 200.0 | 30.0 |
| Medium sand | 0.5 | 70.0 | 17.0 |
| Fine sand | 0.2 | 22.0 | 5.0 |
| Very fine sand | 0.1 | 10.0 | 1.3 |
| Coarse silt | 0.06 | 6.7 | 0.3 |
| Fine silt | 0.01 | 0.18 | 0.08 |
| Coarse clay | 0.004 | 0.016 | 0.002 |
| Fine clay | 0.001 | 0.011 | 0.001 |

For soil particles: $V_s = 1/10\,[d/0.0314]^{½}$

## Silt removal facility

| | | |
|---|---|---|
| Volume of Silt removal facility= | 350 m3 | *Based on Geometry* |
| Total Treatment Volume = | 350 m3 | *Based on design storm* |
| Discharge Rate = | 283.5 l/s | *Based on design storm* |
| Average Retention Time = | 1235 s | 0.3 h |
| *Depth Varies, approx:* | 0.625 m | *From the WinDes Model* |

<u>**Treatment Efficiency Rates**</u>

<u>Fine Silt Particles</u>
Settling Velocity Vs= 0.18 mm/s *From Table 6.6*
Removal efficiency is 36%
Therefore it is assumed that 36% of fine silt particles and all coarser particles will settle out.

<u>Coarse Clay</u>
Settling Velocity Vs= 0.016 mm/s
Removal efficiency is 3.2%
Therefore it is assumed that 3.2% of the coarse clay particles will settle out.

<u>Fine Clay</u>
Settling Velocity Vs= 0.011 mm/s
Removal efficiency is 2.2%
Therefore it is assumed that 2.2% of the fine clay particles will settle out.

## Wetland A

| | | |
|---|---|---|
| Static Volume of Wetland A= | 687 m3 | *Based on Wetland Geometry* |
| Storm Stored Volume= | 214 m3 | *Based on design storm* |
| Total Treatment Volume = | 901 m3 | |
| Discharge Rate = | 66.1 l/s | *Based on design storm* |
| Average Retention Time = | 13631 s | 3.8 h |
| *Depth Varies, approx:* | 1.25 m | *From the WinDes Model* |

<u>**Treatment Efficiency Rates**</u>

<u>Fine Silt Particles</u>
Settling Velocity Vs= 0.18 mm/s *From Table 6.6*
Removal efficiency is 196%
Therefore it is assumed that all silt and coarser particles will settle out.

<u>Coarse Clay</u>
Settling Velocity Vs= 0.016 mm/s
Removal efficiency is 17.4%
Therefore it is assumed that 17.4% of the coarse clay particles will settle out.

<u>Fine Clay</u>
Settling Velocity Vs= 0.011 mm/s
Removal efficiency is 12.0%
Therefore it is assumed that 12% of the fine clay particles will settle out.

## Pond A

| | | | |
|---|---|---|---|
| Volume of Pond A | 3717 m3 | *Based on Pond Geometry* | |
| Total Treatment Volume = | 3672 m3 | *Based on design storm* | |
| Discharge Rate = | 138 l/s | *Q From WinDes Model* | |
| Average Retention Time = | 26609 s | 7.4 h | |
| *Depth Varies, approx:* | 1.5 m | | |

**Treatment Efficiency Rates**

Fine Silt Particles
Settling Velocity Vs= 0.18 mm/s *From Table 6.6*
Removal efficiency is 319%
Therefore it is assumed that all silt and coarser particles will settle out.

Coarse Clay
Settling Velocity Vs= 0.016 mm/s
Removal efficiency is 28.4%
Therefore it is assumed that 28.4% of the ramaining suspended coarse clay particles will settle out.

Fine Clay
Settling Velocity Vs= 0.011 mm/s
Removal efficiency is 19.5%
Therefore it is assumed that 19.5% of the ramaining suspended fine clay particles will settle out.

## Pond B

| | | | |
|---|---|---|---|
| Volume of pond | 3694 m3 | *Based on Pond Geometry* | |
| Total Treatment Volume = | 2796 m3 | *Based on design storm* | |
| Discharge Rate = | 84.5 l/s | *Q From WinDes Model* | |
| Average Retention Time = | 33089 s | 9.2 h | 551.48 |
| *Depth Varies, approx:* | 1.125 m | *Maximum from the WinDes Model* | |

**Treatment Efficiency Rates**

Fine Silt Particles
Settling Velocity Vs= 0.18 mm/s *From Table 6.6*
Removal efficiency is 529%
Therefore it is assumed that all silt and coarser particles will settle out.

Coarse Clay
Settling Velocity Vs= 0.016 mm/s
Removal efficiency is 47.1%
Therefore it is assumed that 47.1% of the ramaining suspended coarse clay particles will settle out.

Fine Clay
Settling Velocity Vs= 0.011 mm/s
Removal efficiency is 32.4%
Therefore it is assumed that 32.4% of the ramaining suspended fine clay particles will settle out.

## Pond C

| | | |
|---|---|---|
| Volume of Pond C = | 2474 m3 | *Based on Pond Geometry* |
| Total Treatment Volume = | 1672 m3 | *Based on design storm* |
| Discharge Rate = | 67.7 l/s | *Q From WinDes Model* |
| Average Retention Time = | 24697 s | 6.9 h |
| *Depth Varies, approx:* | 1.114 m | *From the WinDes Model* |

**Treatment Efficiency Rates**

Fine Silt Particles
Settling Velocity Vs= 0.18 mm/s *From Table 6.6*
Removal efficiency is 399%
Therefore it is assumed that all silt and coarser particles will settle out.

Coarse Clay
Settling Velocity Vs= 0.016 mm/s
Removal efficiency is 35.5%
Therefore it is assumed that 35.5% of the ramaining suspended coarse clay particles will settle out.

Fine Clay
Settling Velocity Vs= 0.011 mm/s
Removal efficiency is 24.4%
Therefore it is assumed that 24.4% of the ramaining suspended fine clay particles will settle out.

## Wetland B

| | | |
|---|---|---|
| Static Volume of Wetland | 676 m3 | *Based on Wetland Geometry* |
| Storm Stored Volume= | 119 m3 | *Based on design storm* |
| Total Treatment Volume = | 795 m3 | |
| Discharge Rate = | 67.5 l/s | *Q From WinDes Model* |
| Average Retention Time = | 11778 s | 3.3 h |
| *Depth Varies, approx:* | 0.57 m | *From the WinDes Model* |

**Treatment Efficiency Rates**

Fine Silt Particles
Settling Velocity Vs= 0.18 mm/s *From Table 6.6*
Removal efficiency is 372%
Therefore it is assumed that all silt and coarser particles will settle out.

Coarse Clay
Settling Velocity Vs= 0.016 mm/s
Removal efficiency is 33.1% 188 mm
Therefore it is assumed that 33.1% of the ramaining suspended coarse clay particles will settle out.

Fine Clay
Settling Velocity Vs= 0.011 mm/s
Removal efficiency is 22.7% 130 mm
Therefore it is assumed that 22.7% of the ramaining suspended fine clay particles will settle out.

| Particle Size | Typical Settling velocities (mm/s) | % Removal in Silt removal facility | % Removal in Wetland A | % Removal in Pond A | % Removal in Pond B | % Removal in Pond C | % Removal in Wetland B | Total % Efficiency |
|---|---|---|---|---|---|---|---|---|
| Course Sand | 200 | 100% | | | | | | 100% |
| Fine Sand | 22 | 100% | | | | | | 100% |
| Coarse Silt | 6.7 | 100% | | | | | | 100% |
| Fine Silt | 0.18 | 36% | 100% | 100% | | | | 100% |
| Coarse Clay | 0.016 | 3% | 17% | 28% | 47% | 35.5% | 33.1% | 85.3% |
| Fine Clay | 0.011 | 2% | 12% | 20% | 32% | 24.4% | 22.7% | 70.4% |

| Particle Size | Overall Removal |
|---|---|
| Sand | 100% |
| Silt | 100% |
| Clay | 78% |

Excluding any removal benefits from Silt Fences and Check Dams

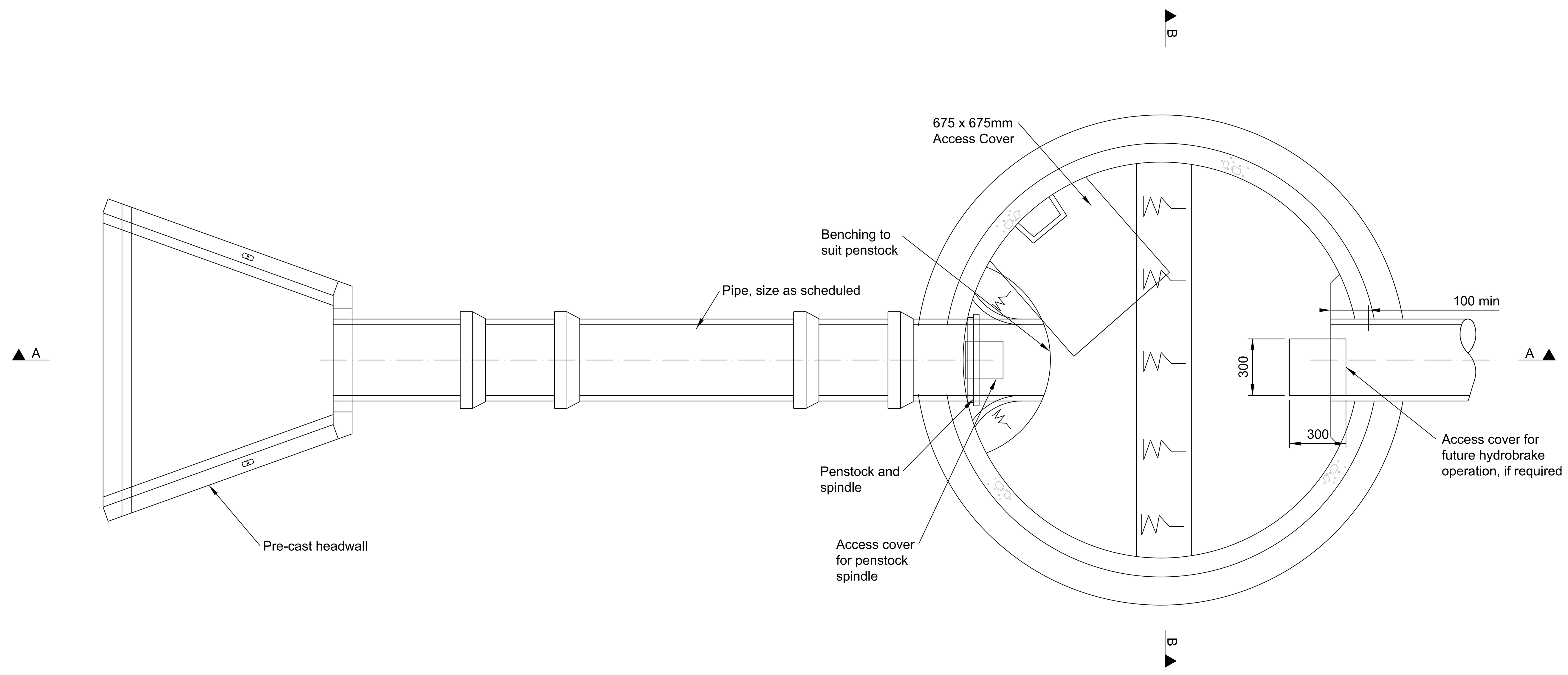
# Appendix F

Typical Drainage Details

Notes:

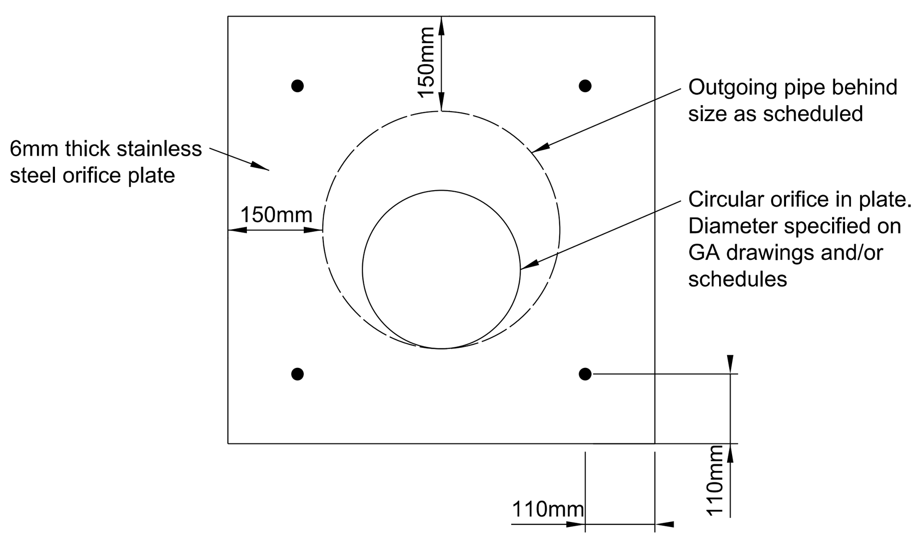
1. All levels in metres above Ordnance Datum.

2. All dimensions in mm unless otherwise stated.



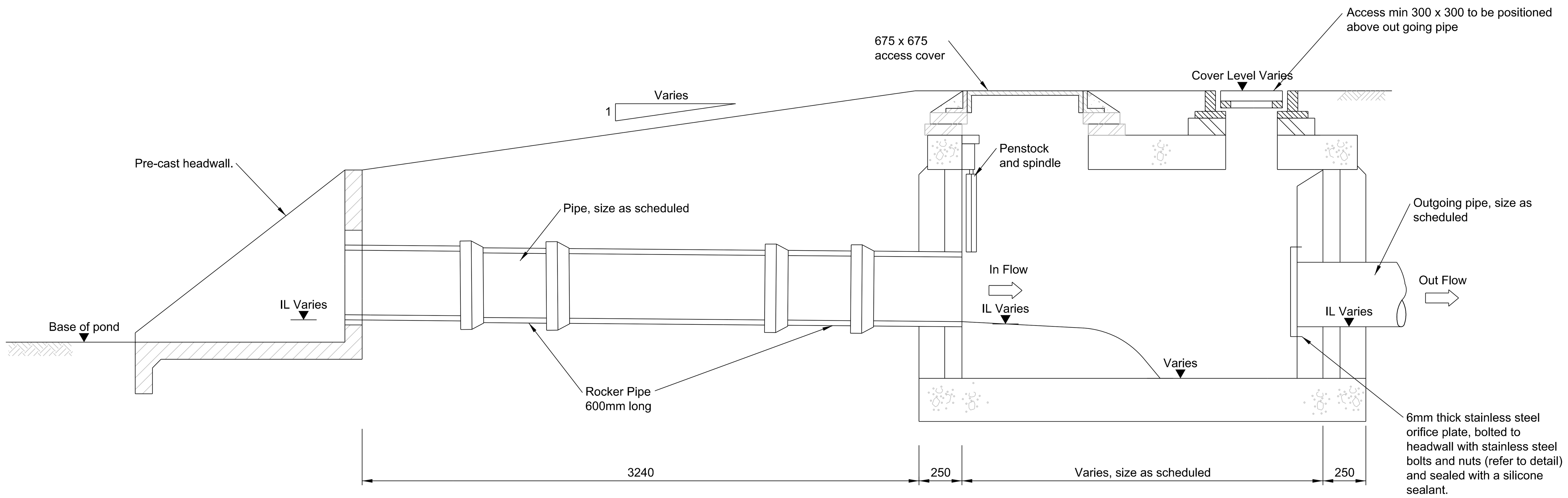

## Plan

Scale 1:20




## Orifice Plate Detail

Scale 1:10




## Cross Section A - A

Scale 1:20

# Typical Attenuation Pond Outlet Details with Typical Orifice Flow Control Chamber

| Issue | Date | By | Chkd | Appd |
|---|---|---|---|---|
| 0 | 31/03/17 | JB | NF | DA |
| | Issued for Planning | | | |

ARUP

Admiral House, Rose Wharf,
78 East Street, Leeds, LS9 8EE
Tel +44(0)113 242 8498 Fax +44(0)113 242 8573
www.arup.com

Client
Sirius Minerals Plc

Job Title
Woodsmith Mine
Proposed Minehead

Surface Water Drainage
Attenuation Pond Details
Sheet 1

Scale at A1: As shown

Discipline: Drainage

Job No: 253285

Drawing Status: Planning

Drawing No: 40-ARI-WS-71-CI-DR-1071

Issue: 0

Do not scale

A1

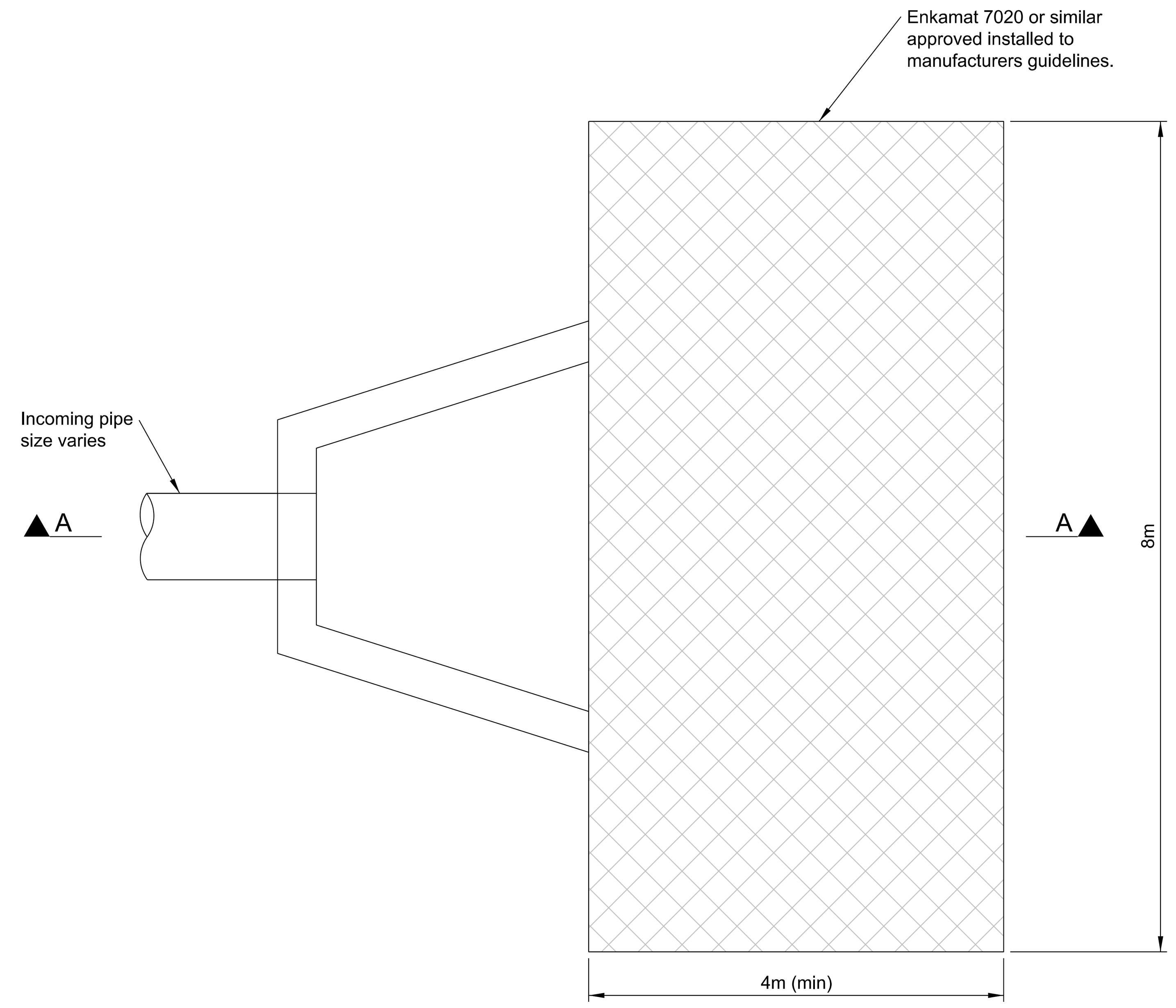
Notes:

1. All levels in metres above Ordnance Datum.

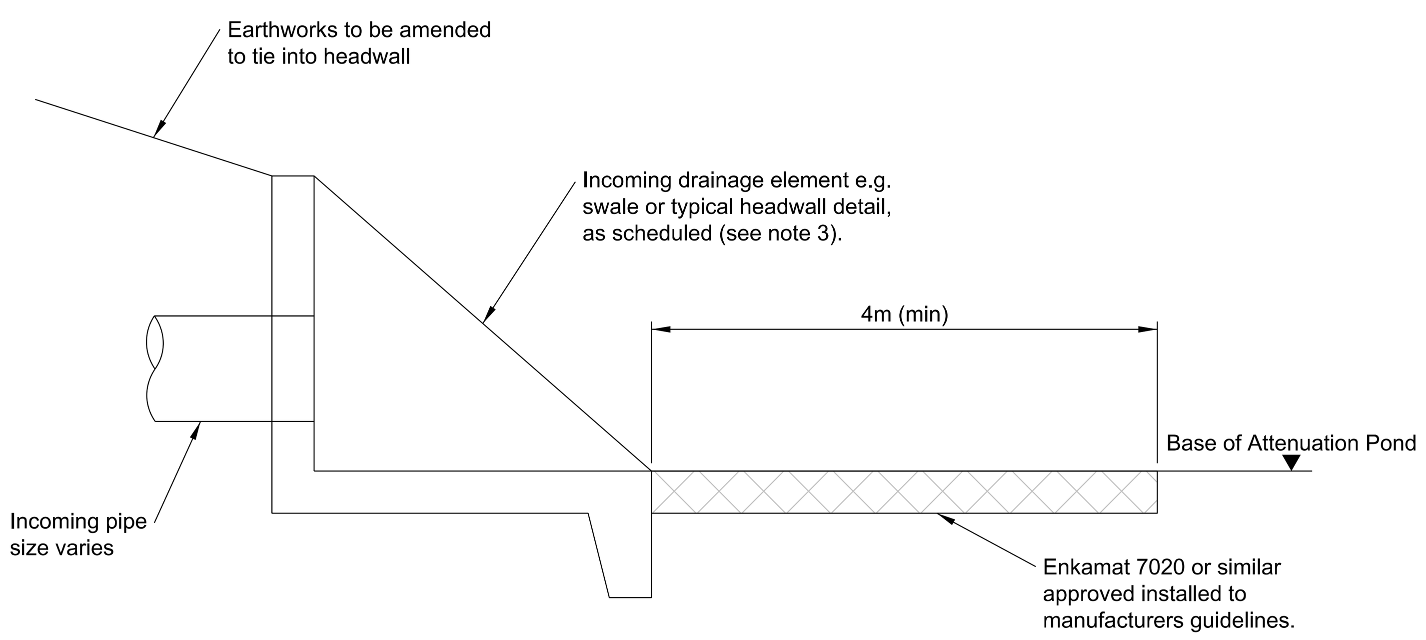
2. All dimensions in mm unless otherwise stated.

3. Typical headwall detail Althon or similar approved

| Maximum Pipe Size (mm) | | Althon Headwall reference |
|---|---|---|
| Clay or Plastic | PCC | |
| 300 | 225 | H3C |
| 500 | 450 | H6C |
| 900 | 900 | H10C |
| 1050 | 1050 | H20C |




Plan




Section A-A

## Typical Inlet to Attenuation Ponds

Scale 1:50

| Issue | Date | By | Chkd | Appd |
|---|---|---|---|---|
| 0 | 31/03/17 | JB | NF | DA |
| | Issue for Planning | | | |

ARUP


Admiral House, Rose Wharf,
78 East Street, Leeds, LS9 8EE
Tel +44(0)113 242 8498 Fax +44(0)113 242 8573
www.arup.com


Client
Sirius Minerals Plc

Job Title
Woodsmith Mine
Proposed Minehead

Surface Water Drainage
Attenuation Pond Details
Sheet 2

Scale at A1: As shown

Discipline: Drainage

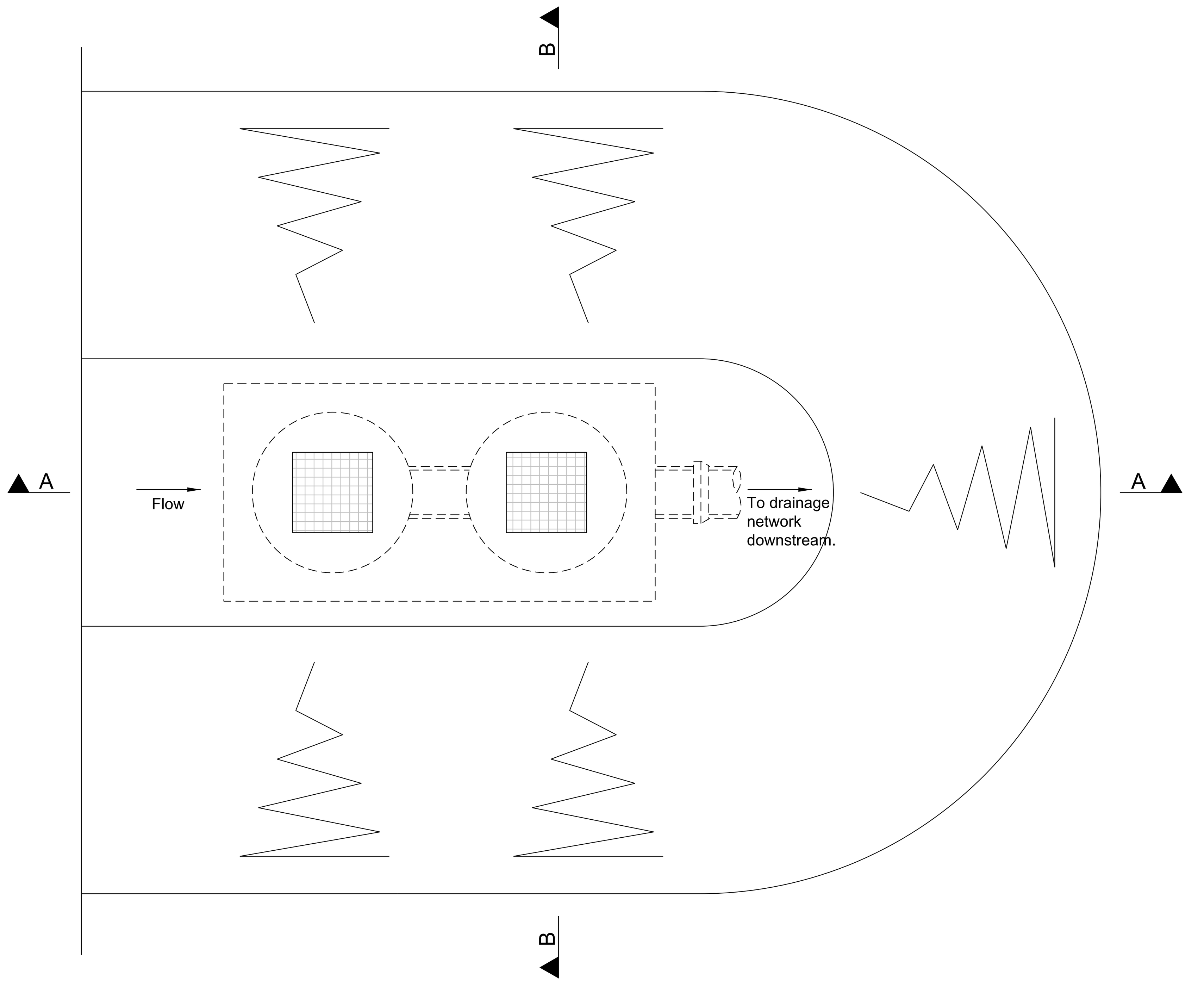
Job No: 253285

Drawing Status: Planning

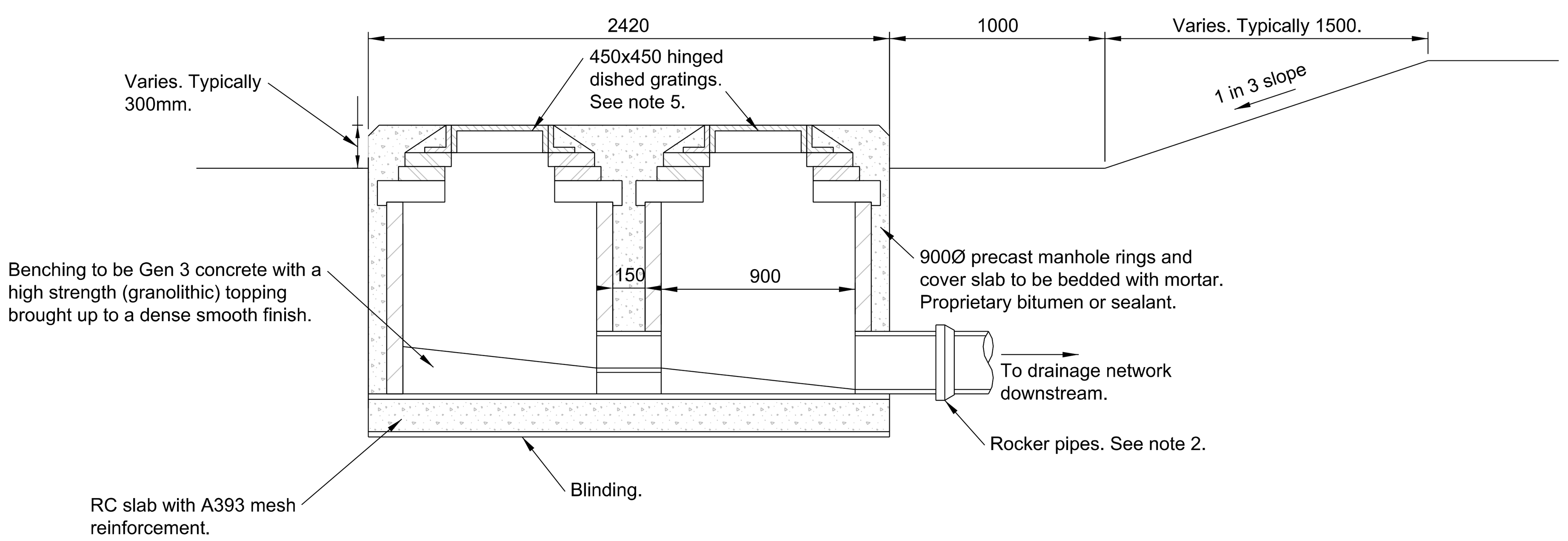
Drawing No: 40-ARI-WS-71-CI-DR-1072

Issue: 0

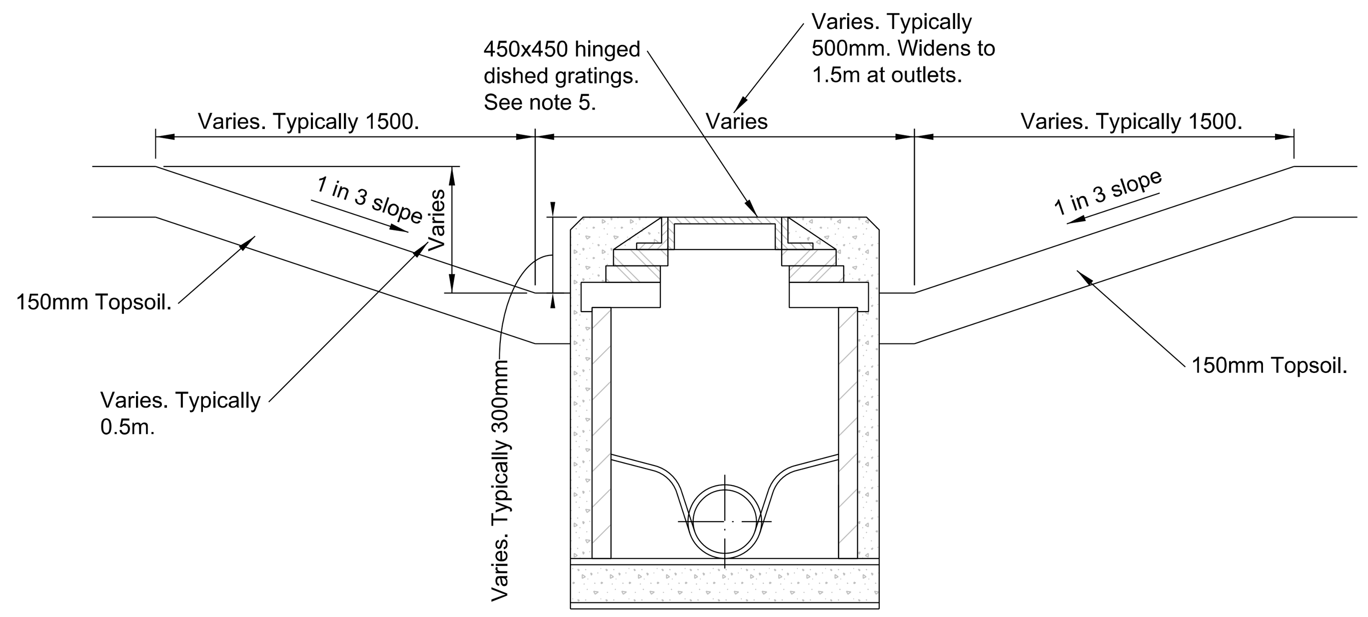
Do not scale




## Plan
Scale 1:25

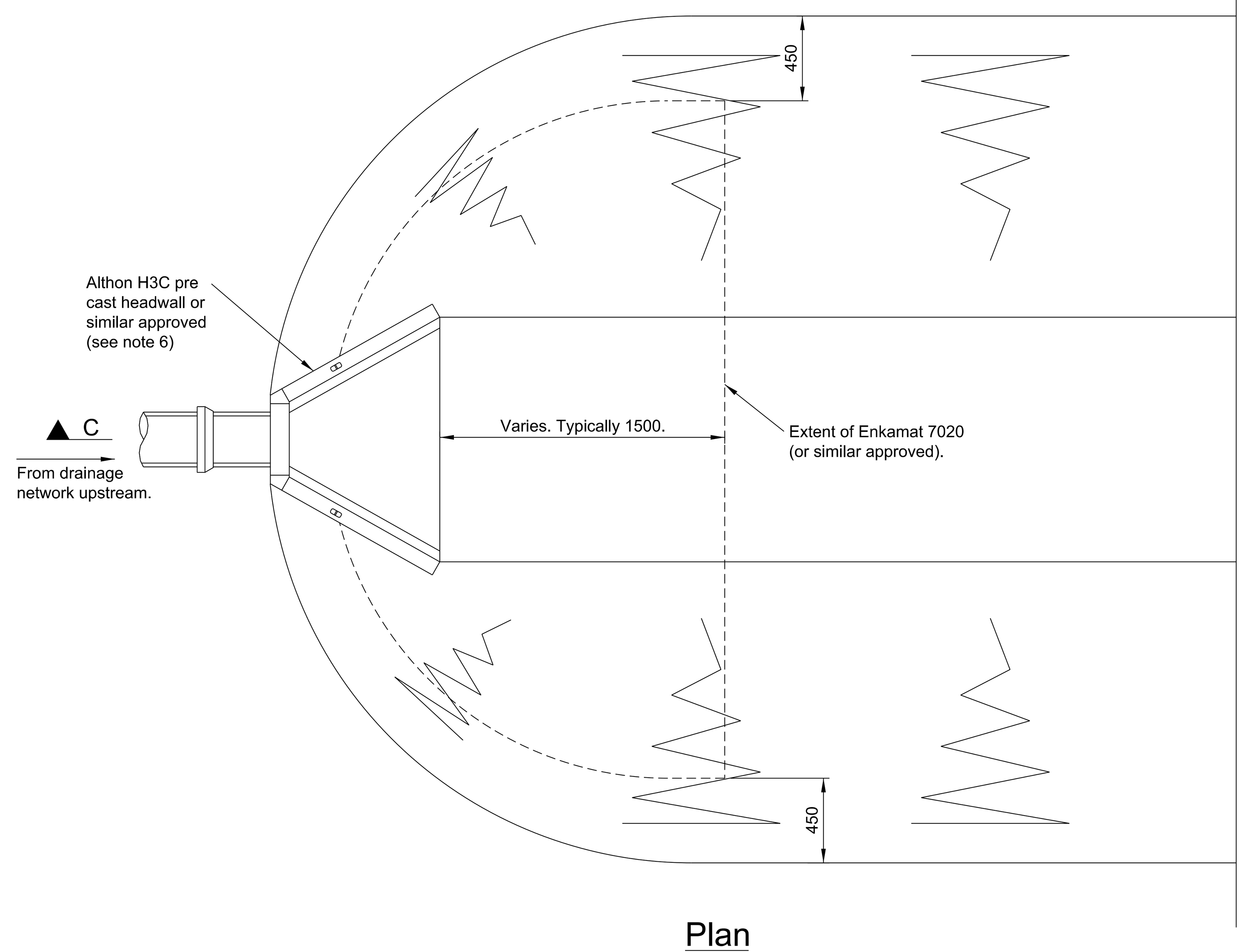



## Section A-A
Scale 1:25

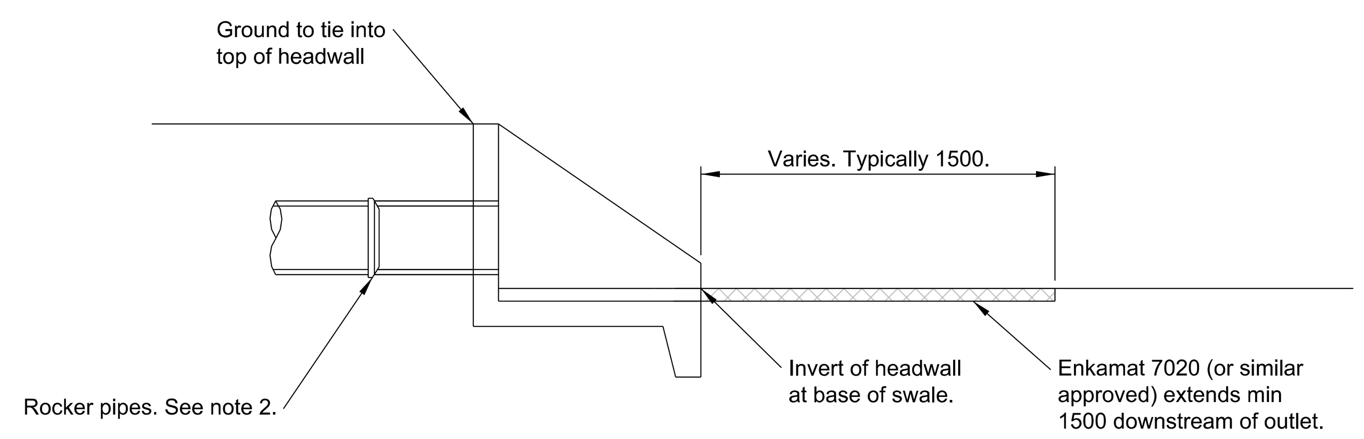



## Section B-B
Scale 1:25

## Typical Swale Outlet Detail (Chamber)

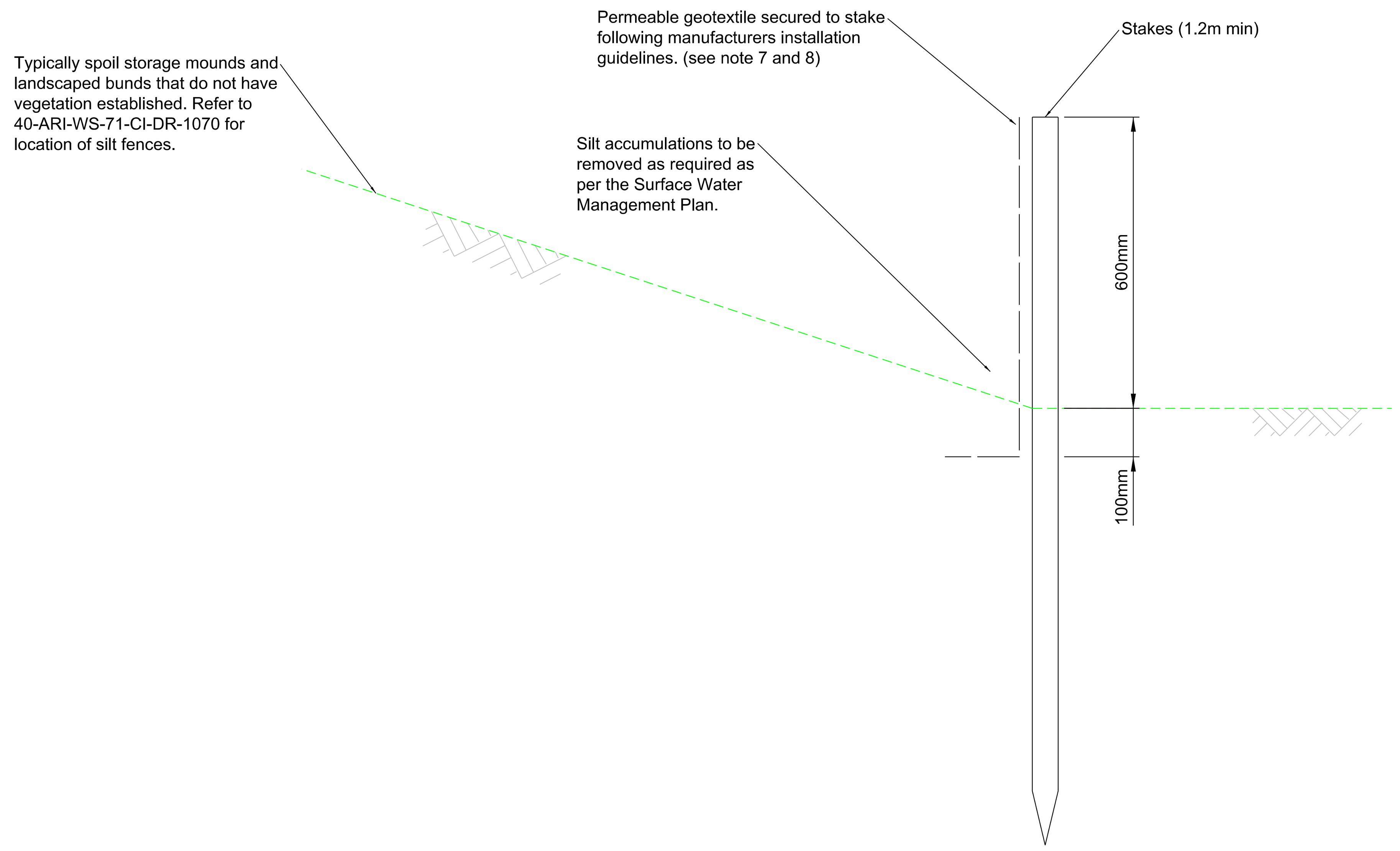



## Plan
Scale 1:25




## Section C-C
Scale 1:25

## Typical Swale Inlet and Outlet Detail (Headwall)




## Silt Fence Typical Detail
Scale 1:10

Notes:

1. All works to be in accordance with Sewers for Adoption 7th Edition.
2. Rocker pipe lengths as follows:

| Schedule of rocker pipe lengths | |
|---|---|
| Rocker pipe lenght (mm) | Nominal diameter of pipe (mm) |
| 600 | 150 to 600 |
| 1000 | 675 to 750 |
| 1250 | over 750 |

3. For locations of swales refer to drawing 40-ARI-WS-71-CI-DR-1070.
4. Outlet chambers shall be 900mm Ø precast concrete rings with 150 thick concrete surround.
5. Gratings shall be hinged dishes. Gratings to load class B125 minimum with 450x450 clear opening.
6. Headwall to be installed to manufacturers installation details. For pipe sizes greater than 300mm Ø use Headwall H6CA or similar approved.
7. A proprietary silt fence product should be used and installed to the manufacturers guidelines.
8. Silt fences to be installed to intercept all runoff from all unvegetated slopes. When vegetation has been established and risk silt run off is minimal the silt fence can be removed.

| Issue | Date | By | Chkd | Appd |
|---|---|---|---|---|
| 0 | 31/03/17 | JB | NF | DA |
| | Issue for Planning | | | |

ARUP


Admiral House, Rose Wharf,
78 East Street, Leeds, LS9 8EE
Tel +44(0)113 242 8498 Fax +44(0)113 242 8573
www.arup.com


Client
Sirius Minerals Plc

Job Title
Woodsmith Mine
Proposed Minehead

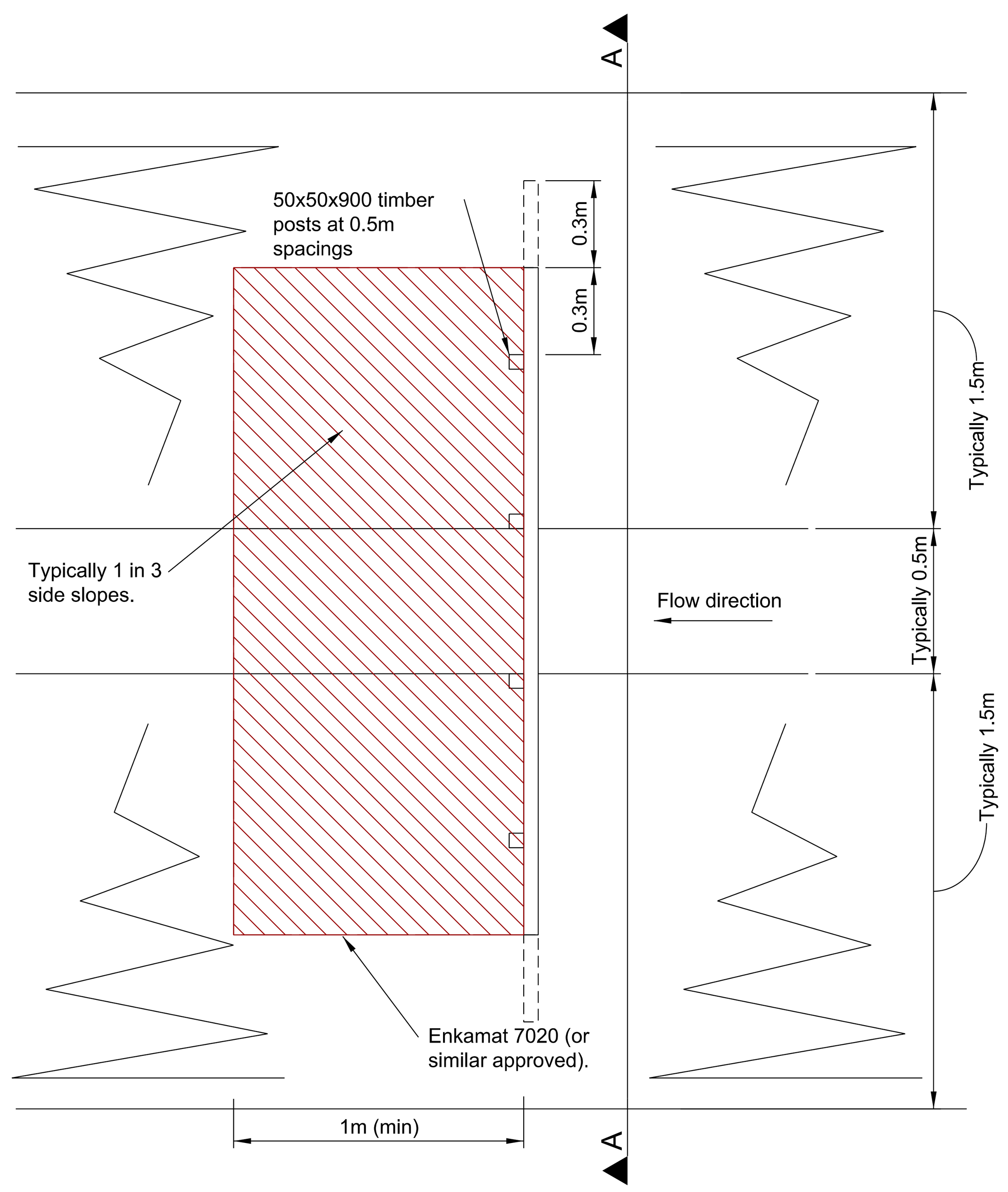
Surface Water Drainage
Typical Swale and Silt Fence
Details

Scale at A1: As shown
Discipline: Drainage
Job No: 253285
Drawing Status: Planning
Drawing No: 40-ARI-WS-71-CI-DR-1073
Issue: 0

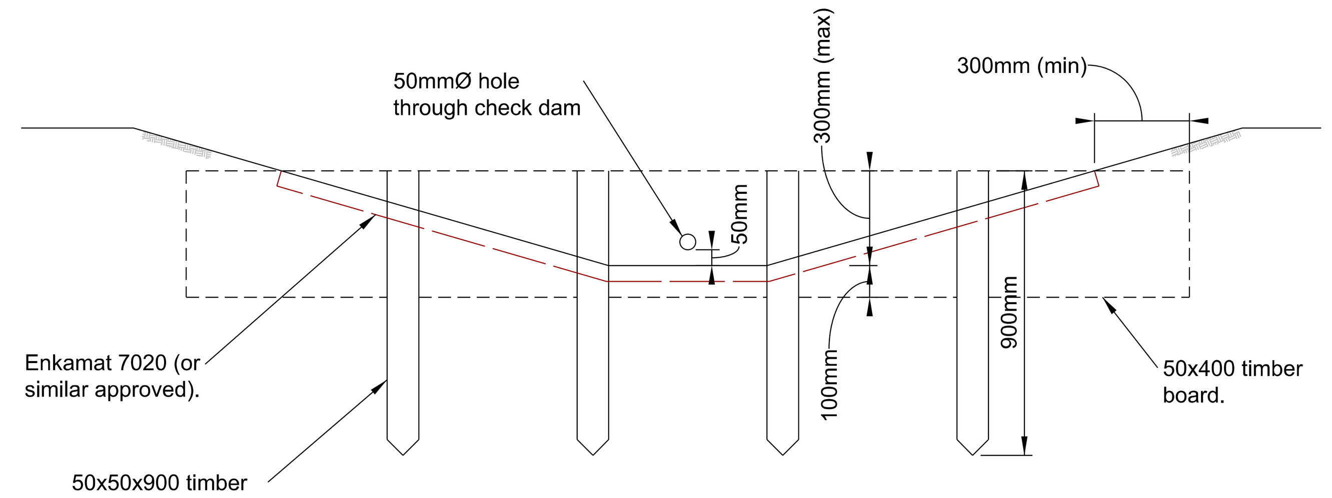
Do not scale



\\Global\europe\Leeds\Jobs\250000\253285-00\1-2 Arup - P10 Platform Redesign\0-20 CAD P10 - Platform Redesign\0_Drawings\40-ARI-WS-71-CI-DR-1073.dgn

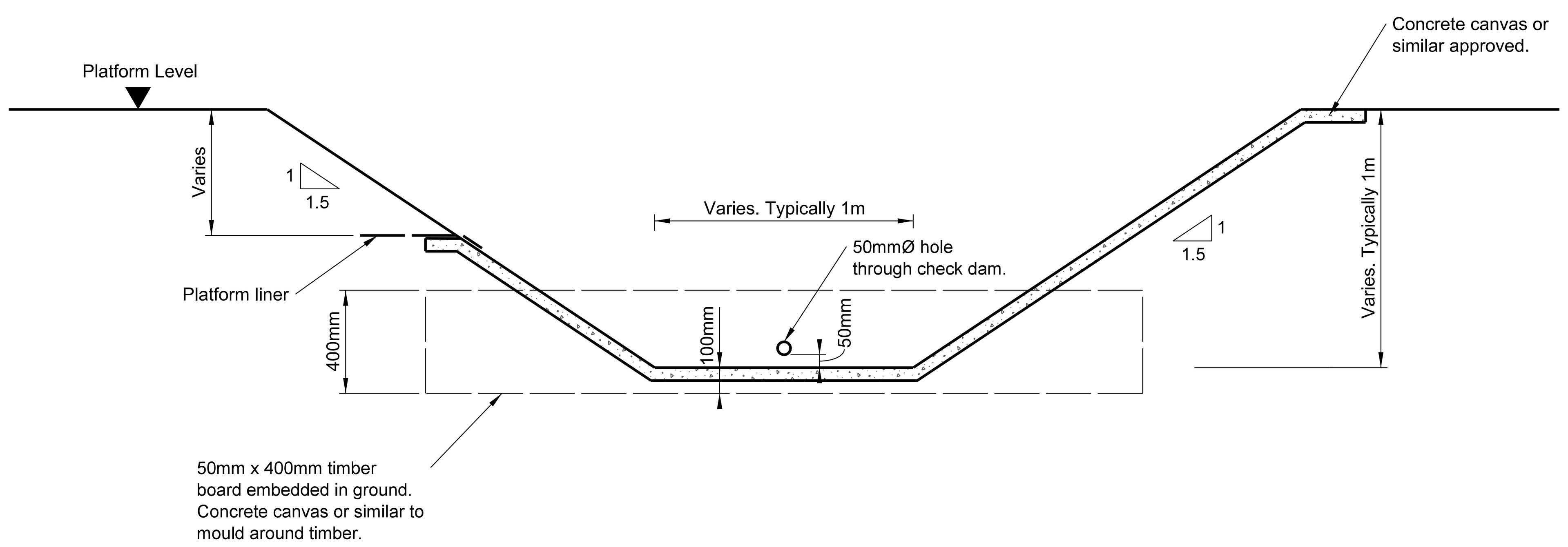



Plan
Scale 1:20



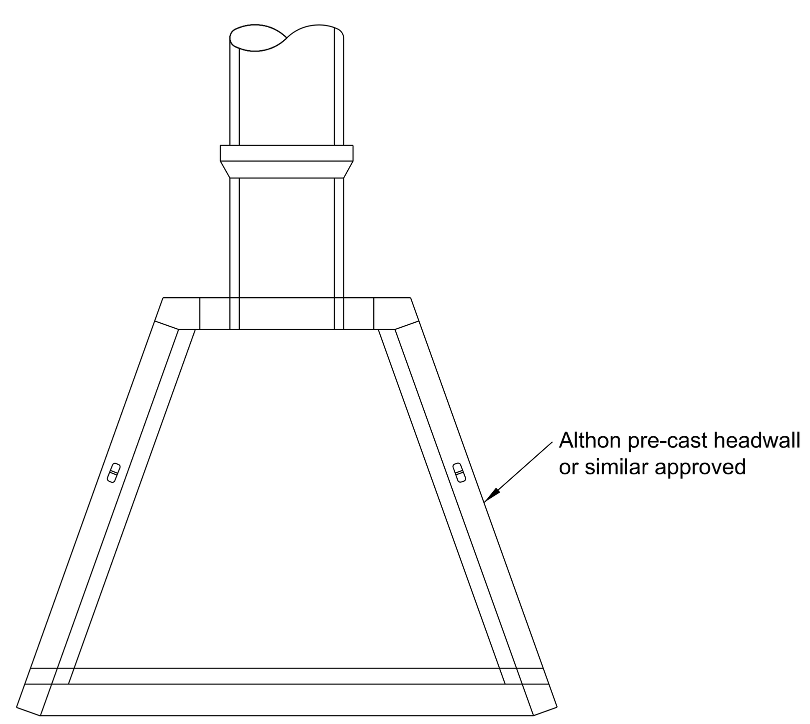

Cross Section A-A
Scale 1:20

## Typical Check Dam in Swale

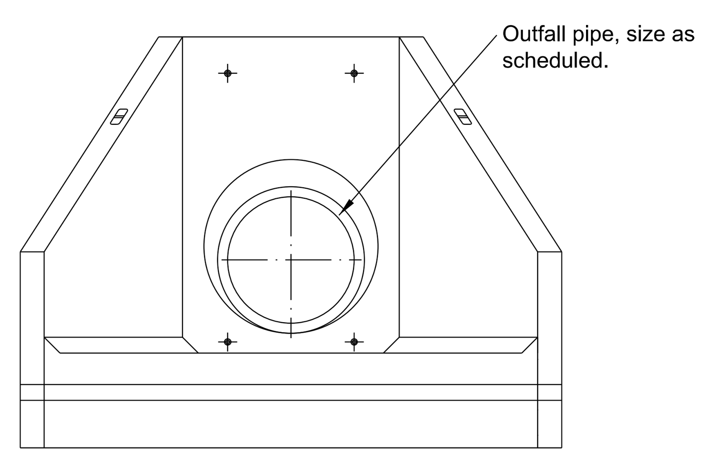



## Typical Ditch with Check Dam

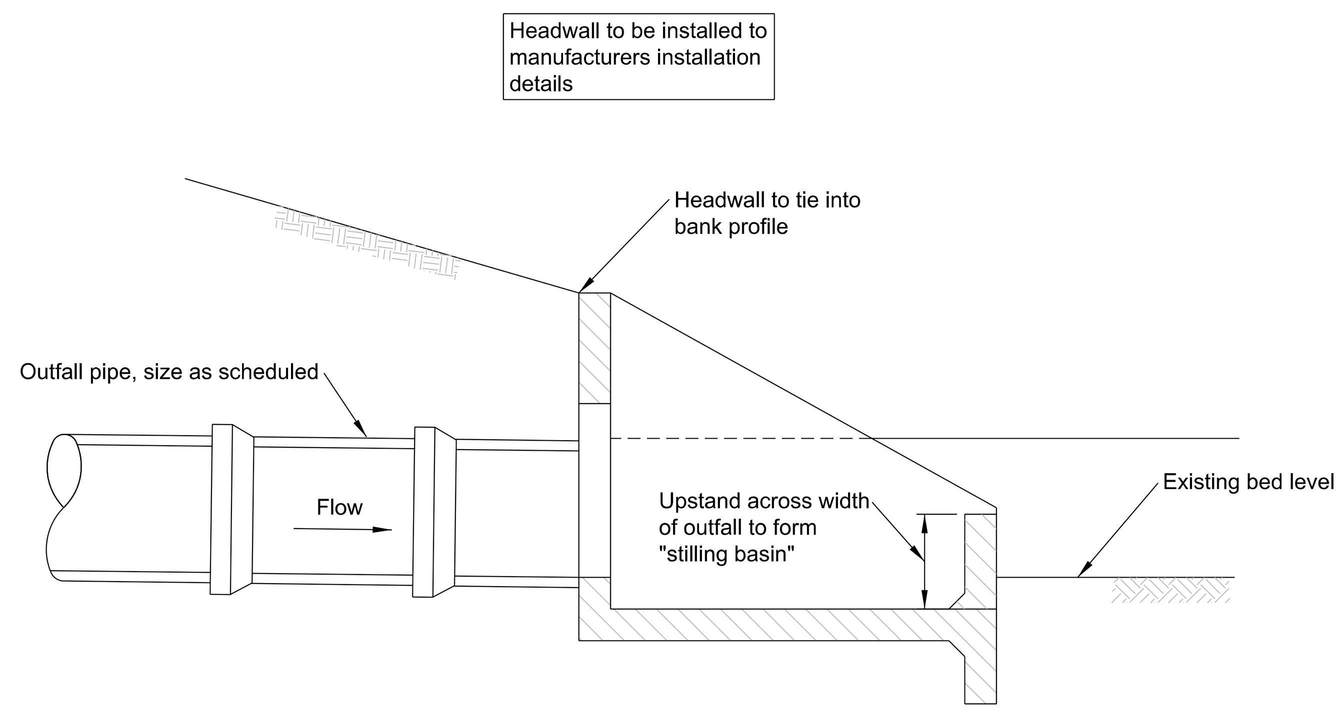
Scale 1:20




Plan
Scale 1:20




Elevation
Scale 1:20




Section
Scale 1:20

## Outfall to Existing Watercourse Typical Detail

Notes:

1. To be read in conjunction with all relevant project drawings and specifications.
2. All levels in metres above Ordnance Datum.
3. All dimensions in mm unless otherwise stated.
4. For outfall locations, refer to the surface water drainage general arrangement plan, 40-ARI-WS-71-CI-DR-1070. Exact position to be confirmed on-site by a qualified engineer.

| Issue | Date | By | Chkd | Appd |
|---|---|---|---|---|
| 0 | 31/03/17 | JB | NF | DA |
| | Issue for Planning | | | |

ARUP

Admiral House, Rose Wharf,
78 East Street, Leeds, LS9 8EE
Tel +44(0)113 242 8498 Fax +44(0)113 242 8573
www.arup.com

Client
Sirius Minerals Plc

Job Title
Woodsmith Mine
Proposed Minehead

Surface Water Drainage
Typical Ditch Check
Dam and Outfall Details

Scale at A1: As shown

Discipline: Drainage

Job No: 253285

Drawing Status: Planning

Drawing No: 40-ARI-WS-71-CI-DR-1074

Issue: 0

\\Global\europe\Leeds\Jobs\250000\253285-00\1-2 Arup - P10 Platform Redesign\0-20 CAD P10 - Platform Redesign\0_Drawings\ 40-ARI-WS-71-CI-DR-1074.dgn

Do not scale