Sandown Quarry Landfill Restoration

Stubbers Green Road, Aldridge, Walsall

Surface Water Management Plan

Date: July 2022

Revision: 02 – October 2022

Status: Permitting

Project No. 07200

Report Ref. 07200/SWMP/R02

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Revision	Description	Issued by	Issue Date
00	DRAFT issue	TJG	26.07.2022
01	Updated with comments	TJG	08.08.2022
02	Updated with further comments	TJG	21.10.2022

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1. Introduction

Byrne Looby Partners (UK) Ltd have been commissioned for the restoration design, and have commissioned 7 Engineering Consultancy Ltd as sub-consultant, to produce a surface water design and surface water management plan for runoff from the restored surface to support an environmental permit application for the restoration of the Sandown Quarry Landfill.

This report, including the surface water design details in the appendices, sets out how surface water runoff from the restored surface is to be collected, managed, and discharged in an appropriate manner without increasing flood risk on or off the site.

The surface water design and surface water management plan will follow the guidance in relevant legislation and technical guidance documents including the DEFRA/EA Non-statutory technical SUDS standards, CIRIA C753 The Suds Manual and the National Planning Policy Framework (NPPF)

2. Site location, ground conditions and restoration proposals

2.1. Site location and setting

The site is the Sandown Quarry landfill site off Stubbers Green Road, Aldridge, Walsall. The Ordnance Survey National Grid Reference for the approximate centre of the site is E 404336, N 301989.

The former quarry is to the north of the Wienerberger Ltd Sandown Works and used to supply material for brick production.

2.2. Existing site description

The site is a quarry void formed by opencast working for clay for brick making.

The quarry void has a base level of 93m AOD with the top edge of the void at circa 141m along the north-east side and 130m on the south-west side. The north-west and south-east sides of the void fall from the higher level to the lower level. The area in the western corner of the site near the Swan Pool lies at around 131m level and includes a series of existing settlement ponds and the outfall from the site to the Vigo Brook at the far western corner of the site.

The site is bounded by the Wienerberger brickworks site to the south-east side, by Daw End Branch canal to the north-east, by the site access to the Veolia Environmental facility on the north-western boundary and by Stubbers Green Road and Swan Pool to the south-west.

Swan pool is a waterbody to the north side of Stubbers Green Road and is not part of the site. A further waterbody known as The Swag lies to the south of Stubbers Green Road and is also outside the site.

The Vigo Brook watercourse passes the far western corner of the site at the junction between the Veolia access and Stubbers Green Road. The brook flows from north to south, into The Swag waterbody and continues to the south-west.

The Wienerberger brickworks lies to the south-east of the quarry and its levels are generally higher than the top edge of the quarry void.

The existing quarry void has pumped drainage with a discharge to the Vigo Brook.

There is a Site of Special Scientific Interest (SSSI) close to the restoration site. The SSSI covers the Swan Pool and part of The Swag. The citation for the SSSI notes that it is for the protection of reed bed areas that provide an important roost for migratory birds (Swallows and Sand Martins). The SSSI designation extends into the restoration site boundary in the area of the existing pond, but it understood that the reuse of this pond and the creation of new pond areas is not in conflict with the aims of the SSSI.

2.3. Geology and ground conditions

The site lies on the Glacial Diamicton Till superficial deposits with the area of the void shows as worked with no superficial deposits shown. The bedrock is shown as Etruria formation mudstone, sandstone and conglomerate. The BGS records show areas of made ground to the south-east of the void and also in the western corner of the site.

2.4. Existing site drainage

The existing site drains to the Vigo Brook in the western corner of the site. The site drainage passes through a series of settlement ponds before the outfall point. There appears to be no further formal surface water drainage on the site. The majority of the site would drain into the quarry void in the current situation.

The existing quarry void has a pumped drainage system and a final discharge to the Vigo Brook.

2.5. Restoration proposals

The quarry void is to be infilled with suitable soil, excavation, and demolition type wastes in a series of phases before capping and surface restoration with topsoil and seeded to form a grassed surface.

The proposed restoration surface levels tie into the existing levels inside the north-east boundary at approximately 139m and fall to the south-west to tie into the lower edge of the site. The restoration proposals include the provision of drainage ditches or swales to collect surface runoff. The drainage runs toward the south-west of the site, discharging via the first existing sediment pond and into a further enlarged pond area to provide attenuation before discharge.

3. Proposed surface water management plan

3.1. Suds hierarchy

The SUDS hierarchy included in the DEFRA non-statutory technical standards and the CIRIA SUDS Manual sets out an order of priority for discharge of surface water with infiltration being the most favoured option and discharge to a combined sewer being least favourable. The options for discharge are ranked;

i) Discharge by infiltration
ii) Discharge to a watercourse at a restricted rate, as close to greenfield rates as possible
iii) Discharge to a surface water sewer at a restricted rate
iv) Discharge to a combined sewer at a restricted rate

We have reviewed the site options in relation to this hierarchy. The quarry void will have been filled and some adjacent areas are noted as existing made ground. Infiltration from soakaways or basins is not normally permitted in made ground due the risks of mobilising contaminants. This option has been discounted.

The existing site discharges to the Vigo Brook, a watercourse passing close to the western corner of the site. This watercourse appears a suitable destination for attenuated flows form the site.

Discharge to a watercourse is the most favoured feasible option in the SUDS hierarchy for all areas of the restoration where flows can reach the watercourse by gravity.

Climate change has been included in the peak rainfall intensities based on the National Planning Policy Framework (NPPF) recommendations for the period through to 2115. A 40% upper end allowance has been included in line with the recommendations for small catchments.

3.2. Proposed surface water management scheme

The proposed surface water scheme will pick up surface runoff from the newly restored surface. Natural surface flow will follow the gradients of the restored surface to the drainage channels.

Interception storage is provided by absorption into the clean restoration topsoil and by evapotranspiration in the vegetation on the surfaces.

The maximum discharge for the site has been set at a rate equivalent to the 1:1 year greenfield rate calculated for the soils that existed at the site before its working for minerals.

Drainage channels are to be constructed around the south-east, south-west and north-west sides of the restoration surface to collect surface flows and convey the runoff. No channel is provided to the north-east side where the restoration surface falls away from the boundary. The site is split into two catchments to suit the site levels and these combined to a single discharge point through the attenuation ponds.

The channels on the south-east and south-west sides of the site run to the pond in the south-west of the site. The channel runs near the boundary on the south-east side and are set in from the boundary on the south-west where the boundary levels are higher than the drainage channels. The north-west channel runs near the site boundary to the pond in the south-west. There is an existing area outside the proposed channel that is lower than the drainage channel and lower than the site boundary. Informal overland flow in this lower area will make its way south and enter the existing pond. It will not escape off site.

There are 2 attenuation ponds proposed. The first pond is an existing pond that will be used for both sediment control and attenuation volume. A second pond is to be constructed to the south-west of the existing pond to provide further attenuation volume. This in place of a second small sediment pond. The ponds are intended to have shallow standing water to provide habitat with a gravity vortex flow control (Hydrobrake) on the outlet. The water level will rise above the standing water level to provide attenuation volume in times of rainfall. The ponds are not intended to have any infiltration due to the made ground below and may need to be lined to hold water.

The channels are shallow grassed ditches with 1:1.5 or flatter side slopes for the majority of the site.

The channels are to be constructed with erosion control matting in the bed and sides to resist erosion, particularly while the grass establishes. The use of grassed swales or ditches will assist in removal of sediment from the flow by trapping of sediments in the vegetation.

The vegetated swales and ditches are not designed as infiltration features but an element of the water entering the channels will be retained by the topsoil and lost by evapotranspiration from the vegetation.

The surface water runoff is initially from clean vegetated restoration soils and follows the gradients of the restored landform. The passage of the water over a vegetated surface tends to remove sediments and any other contaminants. The water then passes into vegetated swales and ditches which will further aid removal of suspended material before discharge to the attenuation ponds.

The ponds will include sediment forebays at each of the inlet points formed from a permeable berm form of gabions across the pond. The berm will slow the flow of water in the sediment forebay encouraging any remaining sediment to settle out of the flow. The sediment can be removed as necessary from the forebay areas using a long reach excavator without disturbing the remainder of the pond.

3.3. Hydraulic Modelling

The proposed scheme has been modelled in Microdrainage hydraulic modelling software for storms up to the 1:100 year return period plus 40% climate change with durations from 15 minutes to 10080 minutes (7 days).

The site has been modelled as a single network with two branches representing the two catchment areas draining to the attenuation ponds and then out falling to the Vigo Brook. The channels have been modelled as ditches generally following the prevailing topography to avoid the ditches becoming excessively deep. Each network is broken up into ‘pipe runs’ with junctions at the nodes and catchment areas attached to each ‘pipe’. A Manning’s N value of 0.045 was used to represent submerged grass in the channels in higher flow conditions.

The run-off rate from the restored surfaces has been calculated using the Nomogram for determining runoff coefficients (Technical management of water in the coal mining industry, National Coal Board 1982). This gives winter runoff coefficients based on differing slopes and soil materials. Runoff coefficients were calculated based on restoration with a clayey soil to be conservative. The runoff coefficient calculation is included in the appendices.

The winter runoff coefficients used in the catchment modelling were 0.68 for the clay soil at average grade of 1:25 or flatter, covering the majority of the area and 0.72 for a smaller area of clay soil at an average grade of 1:12. These were combined to give an overall rate of 0.69 for the whole area (Microdrainage does not permit the application of different rates of runoff for different areas in a single simulation). There are very small areas graded at 1:5 but the flow from these areas will pass over shallower graded areas before entry into the drainage system. The combined figure of 0.69 is considered conservative for the site as a whole. The same coefficients were used for winter and summer conditions. The summer condition will be conservative due to increased ability of the dryer soils to retain part of the rainfall.

The maximum discharge for the north and south catchments has been set at a rate equivalent to the 1:1 year greenfield rate for the soils that were presumed to have existed at the site before its working for minerals.

The models were run and adjusted to give a network of ditches and attenuation basins that does not flood in any event up to the 1:100 year return period + 40% climate change allowance.

The models were run in the Microdrainage Network module with the following base inputs

Return period – up to 1:100 year

Climate change allowance 40% for 1;100 year event, 35% for 1:30 year event (as current Defra guidance for the Tame Anker and Mease Management Catchment)

M5-60 rainfall = 19.0mm

Ratio r = 0.4

Final discharge 74.8l/s (equivalent to the 1:1 year greenfield predevelopment flow)

The model input and output for the site is included in the appendices. A sketch is included showing the catchment areas used.

The final restoration surface will need minor adjustment in a few locations to provide the bank levels required by the hydraulic modelling. These minor updates to the restoration surface will be carried out before restoration commences.

3.4. Maintenance

The drainage will be owned and maintained by the site owner. Adoption of the site drainage by a third party is not proposed.

The main suds drainage elements on the site will require periodic maintenance to maintain their effectiveness.

The ditches will require periodic inspection to identify erosion or sedimentation issues in the channels. Removal of significant sediment build up should be undertaken as necessary and any erosion damage repaired. Any trees, bushes or large vegetation establishing in the channels should be removed.

The attenuation ponds should be inspected for sediment build up every few months and after significant rainfall during the restoration period when sediment loads would be expected to be at their highest. Once the restoration is established and vegetated, sediment loads would be expected to decrease, and the frequency of inspections reduced to annually or bi-annually depending on the rate of sedimentation. The ponds include a sediment forebay at the entry points separated from the main pond by a permeable berm. The forebay encourages sediments to drop out of the inflow and be retained within the forebay area. If sediment is observed to be accumulating to a depth of 25mm or more, the sediment should be removed and safely disposed of.

The ponds will require occasional clearance of vegetation to maintain the available attenuation volumes. The clearance of vegetation will need to be managed with the area of Special Scientific Interest (SSSI) in mind and specialist advice on the type and timing of vegetation clearance will be needed. The SSSI is in place to protect reedbeds that provide roosting sites for migratory birds as described in section 2.

The flow control on the outlet from the pond is a vortex flow controls in chambers with inlet pipe from the basin protected by a trash screen. The trash screen should be inspected on a 6 monthly basis or as required after rainfall events or if there is any evidence of blockage, and any build-up of debris removed. The flow control chamber should be inspected at least annually and checked as required if there is any evidence of blockage. The chamber should be opened, inspected and any sediment or debris removed. The operation of the bypass door on the flow control should be checked. If the bypass door has become jammed or stiff, it should be freed off and lubricated.

4. Summary and conclusions

The site is to be restored with a grass vegetated surface over the entire area with the surface shaped to provide natural drainage to the proposed drainage ditches.

A new drainage system is to be provided for the restoration surface with swales or ditches around the north-west, south-east and south-west sides of the site leading to attenuation ponds toward the south-western corner of the site discharging Vigo Brook which passes the western corner of the site. The flow to the brook is to be limited with the use of gravity vortex flow controls to the greenfield 1:1 year rate estimated for the predevelopment site (4.01 litres per second per hectare).

The south-east and south-west catchment system drains 15.88ha to the attenuation ponds. The north-west drainage system drains 0.95ha to the ponds via the drainage ditch and a further 1.04ha that drains directly by overland flow into the first pond. The overall drained area discharging to the outfall including the pond areas is 18.64ha.

The two attenuation ponds providing a total available attenuation storage volume of 5,900m3. The maximum final discharge to the brook is limited to 4.01l/s/ha (74.75l/s total) in all storms up to the 1:100 year plus 40% climate change event with no surface flooding.

The surface water management proposals follow the SUDS hierarchy and use controlled discharge to a watercourse for discharge of the surface water from the restored site.

5. Closure

The conclusions and recommendations made in this report are limited to those that can be made on the basis of the research carried out. The results of the research should be viewed in the context of the work that has been carried out and no liability can be accepted for matters outside the stated scope of the research. Any comments made on the basis of the information obtained from third parties are given in good faith on the assumption that the information is accurate. No independent validation of third party information has been made by 7 Engineering Consultancy Ltd.

This report is written in the context of an agreed scope of work provided by 7 Engineering Consultancy Ltd and should only be used in this specific context. Re-interpretation of this report in whole or in part may become necessary if additional information becomes available or legislation or guidance changes.

7 Engineering Consultancy does not provide legal or other advice; the advice of the Client's legal and other advisors may also be required.

Appendices

The following appendices are included

Appendix A: Existing topographical survey

Appendix B: Existing SSSI location

Appendix C: Proposed restoration plan

Appendix D: Proposed drainage layout, sections and details

Appendix E: Greenfield runoff rate calculations

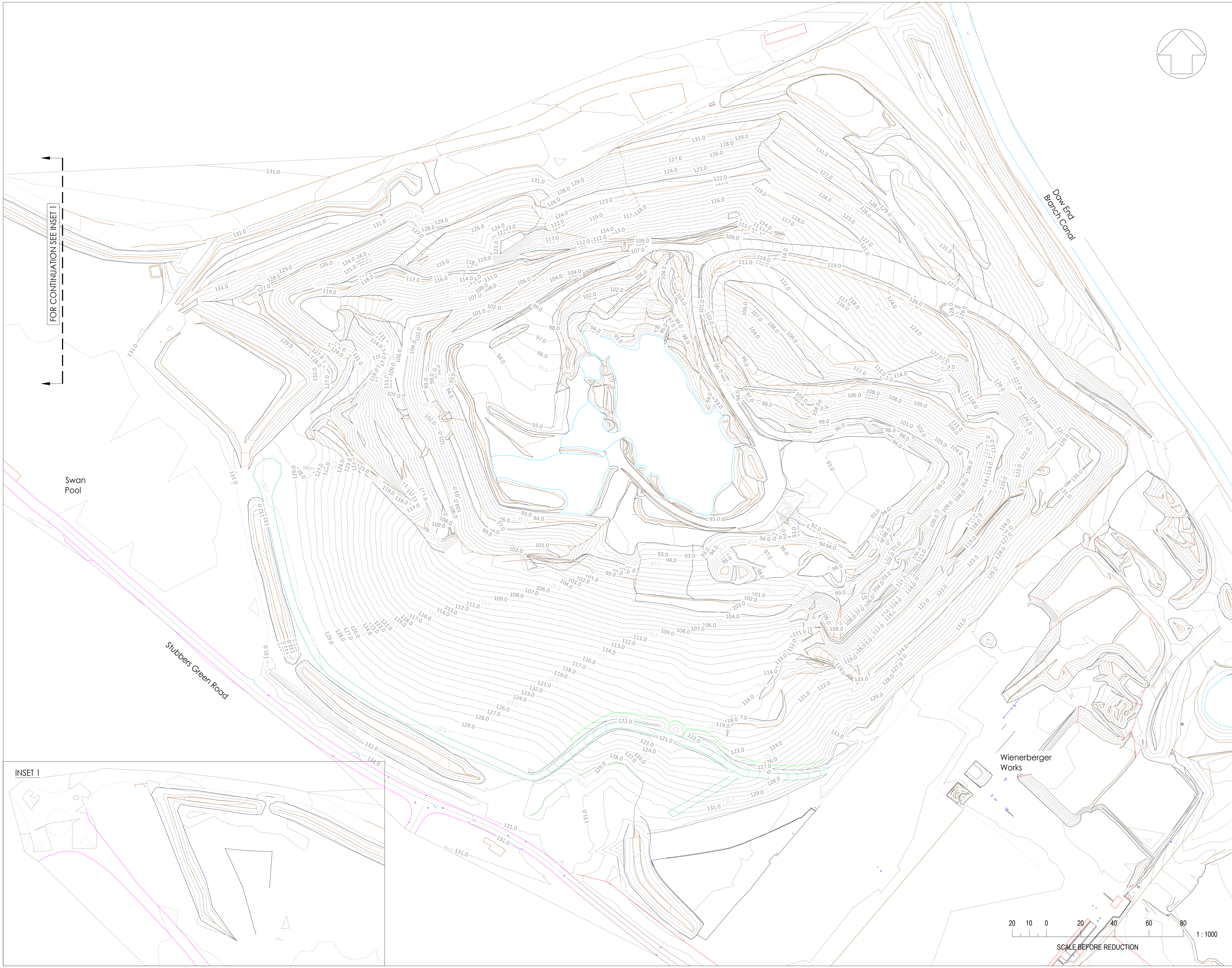
Appendix F: Runoff coefficient calculations

Appendix G: Climate change allowances

Appendix H: Hydraulic modelling calculations key plans

Appendix J: Microdrainage hydraulic modelling calculations

Appendix A: Existing topographical survey



DO NOT SCALE THIS DRAWING.

All dimensions and levels to be checked on site and any discrepancies reported to the Engineers.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

MAINTENANCE/CLEANING/OPERATION.

DECOMMISSIONING/DEMOLITION.

NOTES.

Rev	Description	Date	Drn	Ch'd
00	FIRST ISSUE	08.08.22	JC	TG

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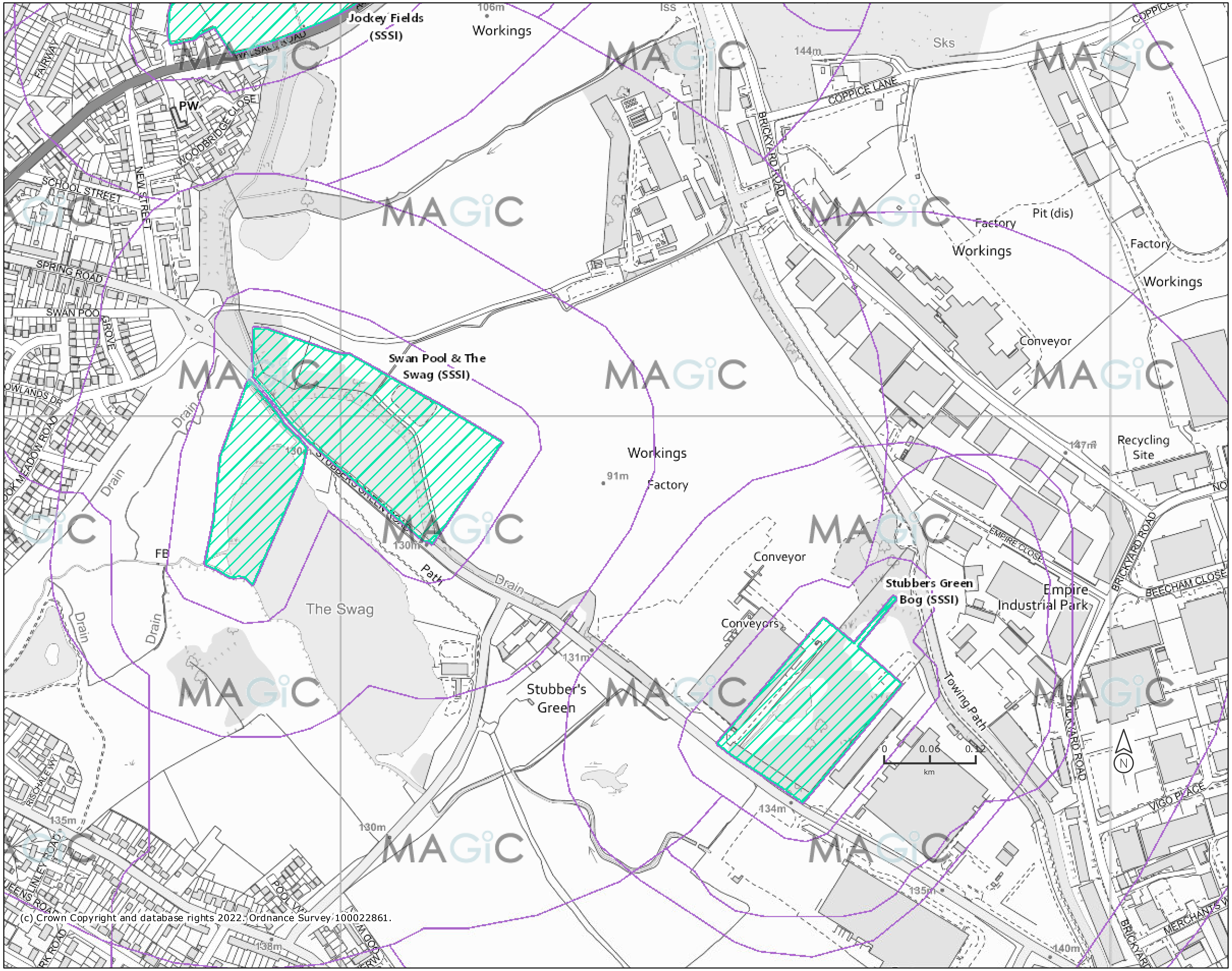
Client	Byrne Looby
Project	Sandown Quarry Restoration WS9 8BL
Drawing title	Existing Topographical Survey
Scales @A1	1:1000
Date	August 2022

Status: Information

Drg No.: 07200 - 010 | Rev.: 00

Appendix B: Existing SSSI location

Sandown Quarry - SSSI



Legend

- Ramsar Sites (England)
- Proposed Ramsar Sites (England)
- Sites of Special Scientific Interest (England)
- SSSI Impact Risk Zones - to assess planning applications for likely impacts on SSSIs/SACs/SPAs & Ramsar sites (England)
- Special Areas of Conservation (England)
- Special Protection Areas (England)
- Potential Special Protection Areas (England)
- Biosphere Reserves (England)

Less Favoured Areas (England)

- Disadvantaged
- Severely Disadvantaged
- Wild Bird General Licence Protected Sites Condition Zone (England)

Projection = OSGB36
xmin = 403100
ymin = 301300
xmax = 405600
ymax = 302500

0 0.095 0.19
km

Map produced by MAGIC on 14 January, 2022.

COUNTY: WEST MIDLANDS SITE NAME: SWAN POOL & THE SWAG

DISTRICT: WALSALL SITE REF: 15WN5

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981 as amended

Local Planning Authority: WALSALL METROPOLITAN BOROUGH COUNCIL

National Grid Reference: SK 040019 Area: 5.7 (ha.) 14.0 (ac.)

Ordnance Survey Sheet 1:50,000: 139 1:10,000: SK 00 SW

Date Notified (Under 1949 Act): – Date of Last Revision: –

Date Notified (Under 1981 Act): 1986 Date of Last Revision: –

Other Information:
A new site.

Description and Reasons for Notification:
Swan Pool and The Swag are two pools, linked by a culvert under Stubbers Green Road, Walsall. They lie on an impermeable layer of the Etruria Marl (Upper Carboniferous Coal Measures). They are important as their associated reedbeds hold the largest roost for swallows and other hirundines in the West Midlands County.

Swan Pool is surrounded on three sides by swamp and tall fen vegetation dominated by greater reedmace *Typha latifolia* and reed sweet-grass *Glyceria maxima* with scattered clumps of goat willow *Salix caprea*, grey willow *Salix cinerea*, and hawthorn *Crataegus monogyna*. The north western end of The Swag has similar emergent vegetation. This grades into areas of wet neutral grassland with tufted hair-grass *Deschampsia cespitosa* and creeping bent *Agrostis stolonifera*.

The reedbeds around the pools hold a peak population of around 10,000 hirundines during their autumn migration. The roost is composed mainly of swallows *Hirundo rustica* with up to one-third being sand martins *Riparia riparia*. The two sites provide a roost for a significant proportion (at least 1%) of the total British swallow population.

Common snipe *Gallinago gallinago* and jack snipe *Lymnocryptes minimus* overwinter on areas adjacent to the site and use the shelter of the reedbeds. The reedbed on The Swag is an autumn roost for up to 100 yellow wagtails *Motacilla flava*.

Appendix C: Proposed restoration plan

GENERAL NOTES

1. SURVEY INFORMATION SUPPLIED BY CLIENT
2. DO NOT SCALE
3. ALL DIMENSIONS ARE IN MILLIMETRES AND ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM
4. ANY ANOMALIES ON THIS DRAWING ARE TO BE BROUGHT TO THE ATTENTION OF BYRNE LOOBY LTD

LEGEND

OWNERSHIP BOUNDARY

130.0 / 129.0 — EXISTING GROUND CONTOURS

150.0 / 149.0 — PROPOSED RESTORATION CONTOURS

Rev	Date	Description	By	Chk	App
A	11/05	CLIENT ISSUE	GH	PS	JB
00	11/05	FOR REVIEW	GH	PS	JB

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CLIENT

BOOTH VENTURES

PROJECT

SANDOWN QUARRY LANDFILL

DRAWING TITLE

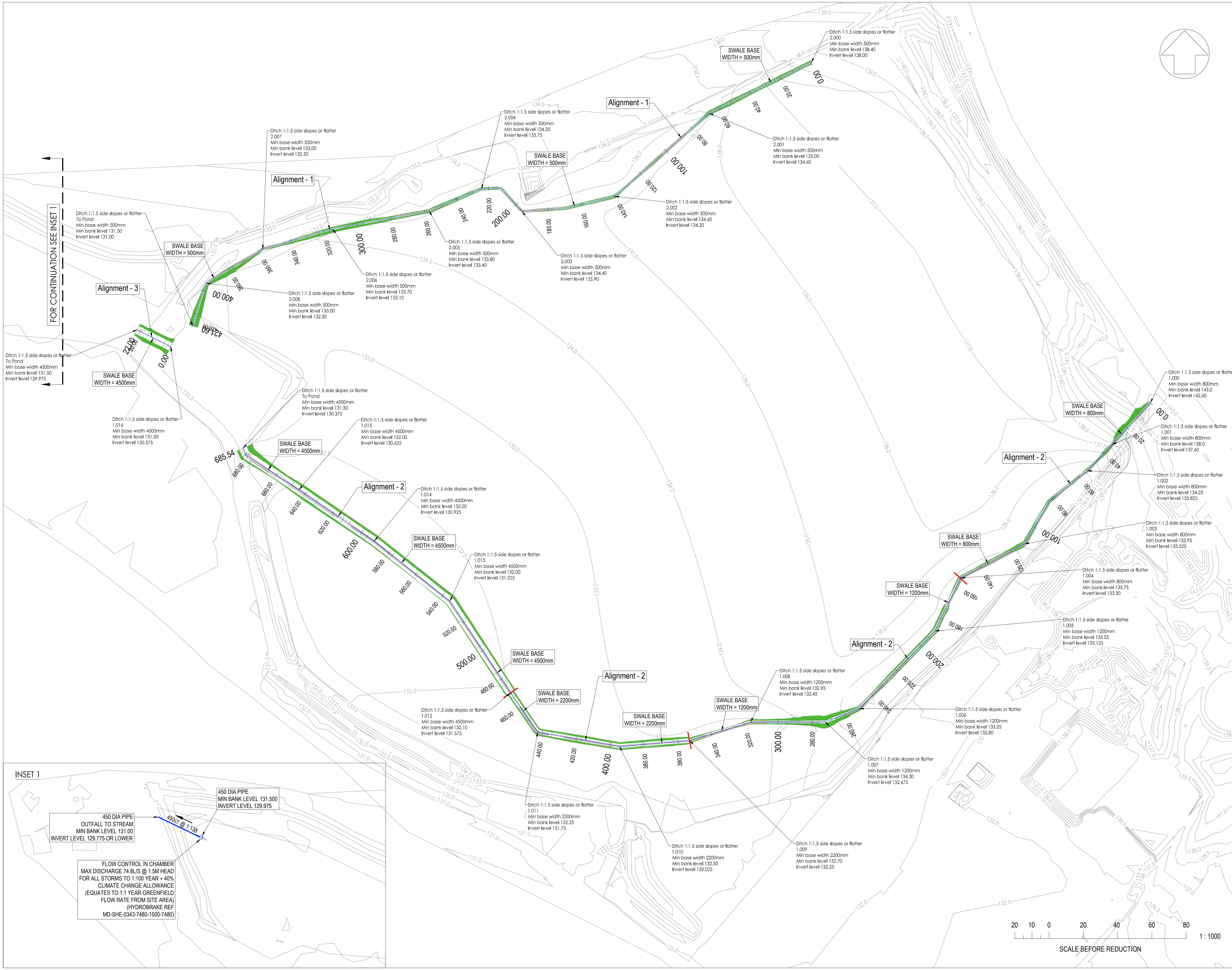
FINAL RESTORATION

STATUS

CLIENT ISSUE

Date: 09.05.22	Scale: 1:1250	Drawn: GH	Chk: PR	App: JB
Project No: 5430	Drg. No: 5430/1/007			Rev: A

Appendix D: Proposed drainage layout, sections and details



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HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

- Site for drainage works will be a capped landfill site. Potential for contamination exists
- Existing unknown services may exist
- Works to pond and outfall in proximity to open water
- Part of site is within and abuts SSSI. Particular care required for any works that may affect SSSI

MAINTENANCE/CLEANING/OPERATION.

- Part of site is within and abuts SSSI. Particular care required for any maintenance works including vegetation clearance that may affect SSSI. Specialist advice may be required
- Works to pond and outfall in proximity to open water

DECOMMISSIONING/DEMOLITION.

NOTES.

PROPOSED MAJOR CONTOUR SET @ 1m

PROPOSED MINOR CONTOUR SET @ 0.2m

1. FOR SWALE CROSS SECTIONS REFER TO DRAWINGS:
   - 07200-121 CROSS SECTIONS SH.1
   - 07200-122 CROSS SECTIONS SH.2
   - 07200-123 CROSS SECTIONS SH.3

Rev	Description	Date	Drn	Ch'd
03	INFORMATION ISSUE	05.08.22	JC	TG
02	MINOR UPDATES TO TEXT	04.08.22	JC	TG
01	MD REFERENCES ADDED	01.08.22	JC	TG
00	DRAFT ISSUE	26.07.22	JC	TG

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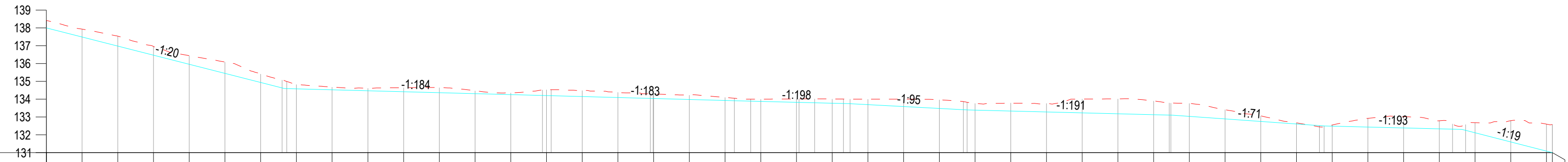
Client	Byrne Looby
Project	Sandown Quarry Restoration WS9 8BL
Drawing title	General Arrangement
Scales @A1	1:1000
Date	July 2022
Status:	Information
Drg No.:	07200 - 100
Rev.:	03



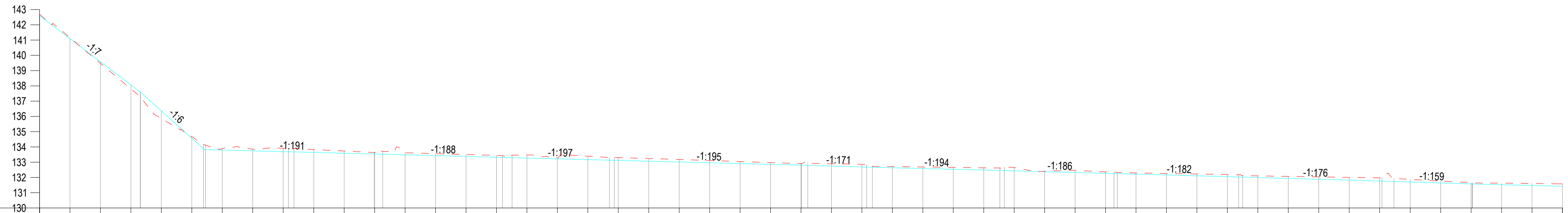
DATUM 131.00

EXISTING SURFACE LEVEL	138.42	137.93	137.53	136.96	136.44	136.09	135.42	134.83	134.68	134.62	134.65	134.65	134.48	134.35	134.53	134.49	134.39	134.30	134.23	134.10	134.00	134.01
PROPOSED SURFACE LEVEL	138.00	137.49	136.98	136.47	135.96	135.45	134.94	134.58	134.53	134.47	134.42	134.36	134.31	134.26	134.20	134.15	134.09	134.04	133.98	133.93	133.88	133.82
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00	170.00	180.00	190.00	200.00	210.00

EXISTING SURFACE LEVEL	134.01	134.00	134.00	133.97	133.77	133.79	133.76	134.01	134.02	133.90	133.76	133.41	133.07	132.67	132.55	132.92	133.02	132.79	132.68	132.79	132.60	132.58
PROPOSED SURFACE LEVEL	133.77	133.70	133.59	133.48	133.39	133.34	133.28	133.23	133.18	133.13	133.03	132.89	132.75	132.61	132.49	132.44	132.38	132.33	132.11	131.60	131.08	131.00
CHAINAGE	220.00	230.00	240.00	250.00	260.00	270.00	280.00	290.00	300.00	310.00	320.00	330.00	340.00	350.00	360.00	370.00	380.00	390.00	400.00	410.00	420.00	421.60

LONGITUDINAL SECTION - Alignment - 1

HORZ SCALE 1: 1000
VERT SCALE 1: 200



DATUM 130.00

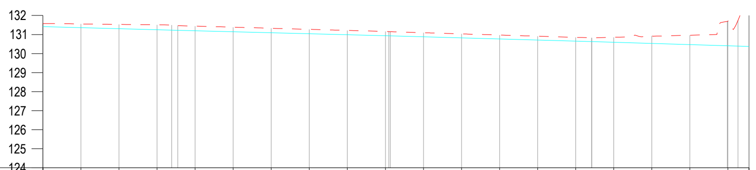
EXISTING SURFACE LEVEL	142.66	141.15	139.47	137.80	135.86	134.67	133.89	133.85	133.91	133.83	133.73	133.64	133.66	133.56	133.50	133.44	133.47
PROPOSED SURFACE LEVEL	142.60	141.09	139.58	138.07	136.36	134.57	133.79	133.74	133.69	133.64	133.58	133.53	133.48	133.43	133.37	133.32	133.27
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00	160.00

EXISTING SURFACE LEVEL	133.29	133.39	133.31	133.24	133.17	133.11	133.04	132.97	132.91	132.90	132.86	132.71	132.69	132.66	132.63	132.65	132.40
PROPOSED SURFACE LEVEL	133.22	133.17	133.12	133.06	133.01	132.96	132.91	132.86	132.81	132.75	132.69	132.64	132.59	132.53	132.48	132.43	132.38
CHAINAGE	170.00	180.00	190.00	200.00	210.00	220.00	230.00	240.00	250.00	260.00	270.00	280.00	290.00	300.00	310.00	320.00	330.00

EXISTING SURFACE LEVEL	132.46	132.36	132.30	132.26	132.23	132.19	132.10	132.07	132.04	132.00	131.97	131.87	131.76	131.66	131.63	131.60	131.58
PROPOSED SURFACE LEVEL	132.32	132.27	132.21	132.16	132.11	132.05	131.99	131.94	131.88	131.82	131.77	131.71	131.64	131.58	131.53	131.47	131.42
CHAINAGE	340.00	350.00	360.00	370.00	380.00	390.00	400.00	410.00	420.00	430.00	440.00	450.00	460.00	470.00	480.00	490.00	500.00

LONGITUDINAL SECTION - Alignment - 2

HORZ SCALE 1: 1000
VERT SCALE 1: 200

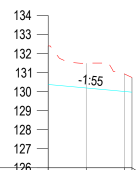


DATUM 124.00

EXISTING SURFACE LEVEL	131.58	131.56	131.53	131.51	131.44	131.39	131.33	131.27	131.22	131.16	131.10	131.03	130.97	130.91	130.85	130.86	130.93	130.96	131.71	132.43
PROPOSED SURFACE LEVEL	131.42	131.36	131.31	131.25	131.20	131.15	131.09	131.04	130.99	130.93	130.88	130.82	130.76	130.71	130.65	130.59	130.53	130.47	130.41	130.38
CHAINAGE	500.00	510.00	520.00	530.00	540.00	550.00	560.00	570.00	580.00	590.00	600.00	610.00	620.00	630.00	640.00	650.00	660.00	670.00	680.00	685.54

LONGITUDINAL SECTION - Alignment - 2

HORZ SCALE 1: 1000
VERT SCALE 1: 200



DATUM 126.00

EXISTING SURFACE LEVEL	132.40	131.49	130.93	130.75
PROPOSED SURFACE LEVEL	130.38	130.19	130.01	129.98
CHAINAGE	0.00	10.00	20.00	22.00

LONGITUDINAL SECTION - Alignment - 3

HORZ SCALE 1: 1000
VERT SCALE 1: 200

DO NOT SCALE THIS DRAWING.

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HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

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MAINTENANCE/CLEANING/OPERATION.

DECOMMISSIONING/DEMOLITION.

NOTES.

1. FOR SWALE LAYOUT & SECTION LOCATIONS REFER TO DRAWING:
   - 07200-100 GENERAL ARRANGEMENT

Rev	Description	Date	Drn	Ch'd
01	INFORMATION ISSUE	05.08.22	JC	TG
00	DRAFT ISSUE	26.07.22	JC	TG

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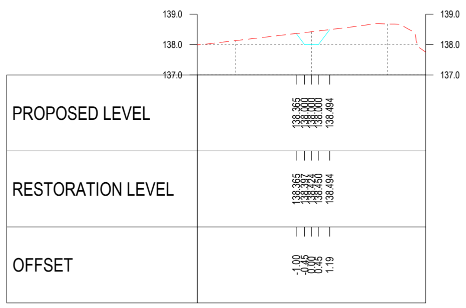
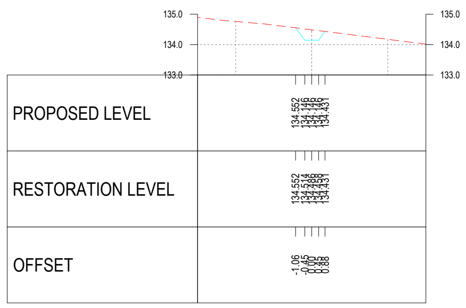
Client	Byrne Looby
Project	Sandown Quarry Restoration WS9 8BL
Drawing title	Long Sections Sheet 1
Scales @A1	As Shown
Date	July 2022

Status: Information

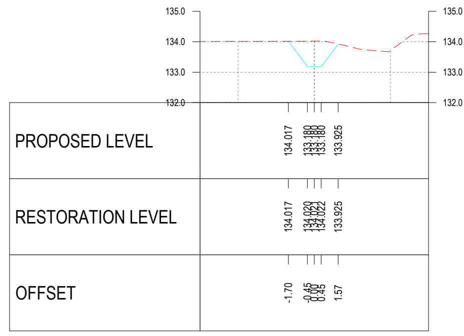
Drg No.: 07200 - 111 | Rev.: 01



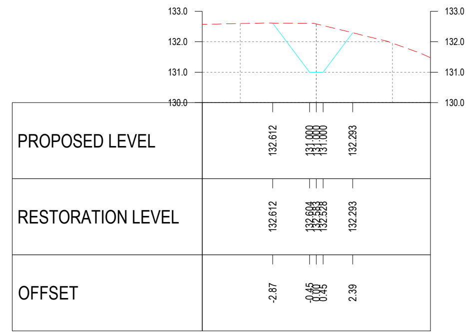
Alignment - 1 CH 0+000.00
SCALES: H 1:250, V 1:125



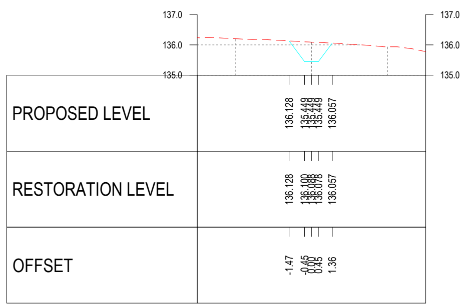
Alignment - 1 CH 0+150.00
SCALES: H 1:250, V 1:125



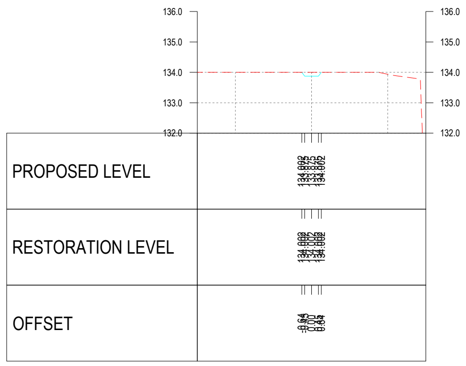
Alignment - 1 CH 0+300.00
SCALES: H 1:250, V 1:125



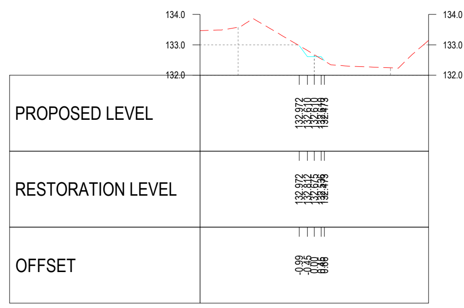
Alignment - 1 CH 0+421.60
SCALES: H 1:250, V 1:125



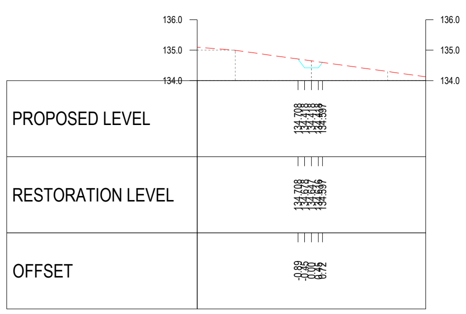
Alignment - 1 CH 0+050.00
SCALES: H 1:250, V 1:125



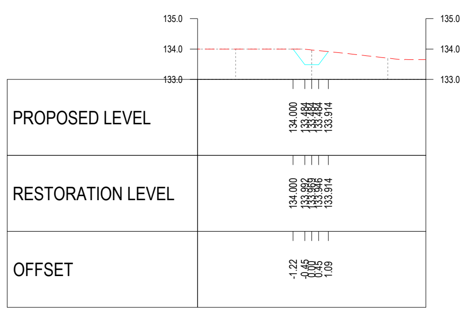
Alignment - 1 CH 0+200.00
SCALES: H 1:250, V 1:125



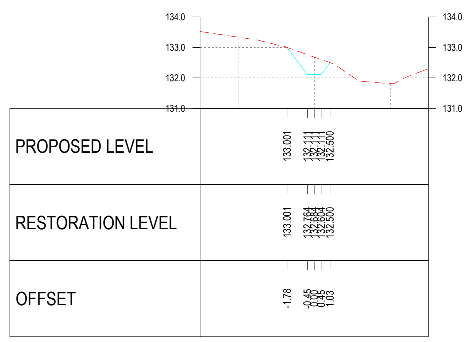
Alignment - 1 CH 0+350.00
SCALES: H 1:250, V 1:125



Alignment - 1 CH 0+100.00
SCALES: H 1:250, V 1:125



Alignment - 1 CH 0+250.00
SCALES: H 1:250, V 1:125



Alignment - 1 CH 0+400.00
SCALES: H 1:250, V 1:125

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HEALTH AND SAFETY INFORMATION

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NOTES.

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Rev	Description	Date	Drn	Ch'd
01	INFORMATION ISSUE	05.08.22	JC	TG
00	DRAFT ISSUE	26.07.22	JC	TG

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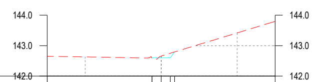
Client	Byrne Looby
Project	Sandown Quarry Restoration WS9 8BL
Drawing title	Cross Sections Sheet 1
Scales @A1	As Shown
Date	July 2022

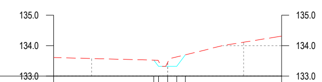
Status: Information

Drg No.: 07200 - 121 | Rev.:01



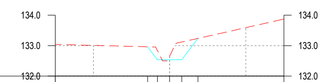
PROPOSED LEVEL	[illegible]	142.600	[illegible]	142.793	
RESTORATION LEVEL	142.594	142.656	142.749	142.793	
OFFSET	-0.60	0.00	0.60	0.89	

Alignment - 2 CH 0+000.00
SCALES: H 1:250, V 1:125



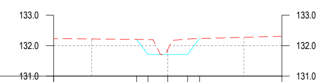
PROPOSED LEVEL	133.524	133.320	133.320	133.320	133.697
RESTORATION LEVEL	133.524	133.492	133.445	133.631	133.697
OFFSET	-0.81	-0.80	0.00	0.60	1.17

Alignment - 2 CH 0+150.00
SCALES: H 1:250, V 1:125



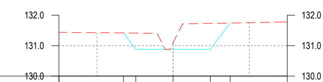
PROPOSED LEVEL	132.962	132.534	132.534	132.534	133.237
RESTORATION LEVEL	132.962	132.839	132.609	133.118	133.237
OFFSET	-1.44	-0.80	0.00	0.80	1.85

Alignment - 2 CH 0+300.00
SCALES: H 1:250, V 1:125



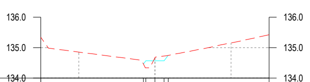
PROPOSED LEVEL	132.203	131.707	131.707	131.707	132.233
RESTORATION LEVEL	132.203	132.200	131.875	132.213	132.233
OFFSET	-2.05	-1.30	0.00	1.30	2.09

Alignment - 2 CH 0+450.00
SCALES: H 1:250, V 1:125



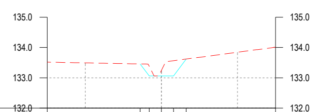
PROPOSED LEVEL	131.416	130.878	130.878	130.878	131.742
RESTORATION LEVEL	131.416	131.412	131.095	131.720	131.742
OFFSET	-3.26	-2.45	0.00	2.45	3.75

Alignment - 2 CH 0+600.00
SCALES: H 1:250, V 1:125



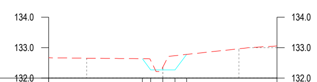
PROPOSED LEVEL	134.463	134.566	134.566	134.746	
RESTORATION LEVEL	134.463	134.599	134.667	134.724	134.746
OFFSET	-0.75	0.00	0.60	0.87	

Alignment - 2 CH 0+050.00
SCALES: H 1:250, V 1:125



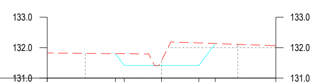
PROPOSED LEVEL	133.458	133.064	133.064	133.064	133.619
RESTORATION LEVEL	133.458	133.386	133.240	133.564	133.619
OFFSET	-1.39	-0.80	0.00	0.80	1.63

Alignment - 2 CH 0+200.00
SCALES: H 1:250, V 1:125



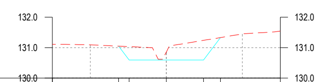
PROPOSED LEVEL	132.636	132.269	132.269	132.269	132.779
RESTORATION LEVEL	132.636	132.575	132.364	132.738	132.779
OFFSET	-1.35	-0.80	0.00	0.80	1.56

Alignment - 2 CH 0+350.00
SCALES: H 1:250, V 1:125



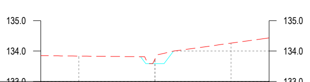
PROPOSED LEVEL	131.804	131.417	131.417	131.417	132.136
RESTORATION LEVEL	131.804	131.801	131.579	132.155	132.136
OFFSET	-3.03	-2.45	0.00	2.45	3.53

Alignment - 2 CH 0+500.00
SCALES: H 1:250, V 1:125



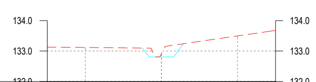
PROPOSED LEVEL	131.050	130.593	130.593	130.593	131.331
RESTORATION LEVEL	131.050	131.034	130.866	131.240	131.331
OFFSET	-3.14	-2.45	0.00	2.45	3.56

Alignment - 2 CH 0+650.00
SCALES: H 1:250, V 1:125



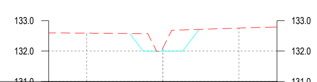
PROPOSED LEVEL	133.813	[illegible]	[illegible]	[illegible]	133.967
RESTORATION LEVEL	133.813	[illegible]	[illegible]	[illegible]	133.967
OFFSET	-0.94	[illegible]	0.00	0.60	1.22

Alignment - 2 CH 0+100.00
SCALES: H 1:250, V 1:125



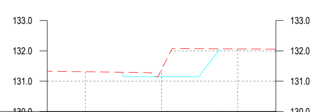
PROPOSED LEVEL	133.086	[illegible]	132.807	132.807	133.229
RESTORATION LEVEL	133.086	[illegible]	133.193	132.807	133.229
OFFSET	-1.23	-0.80	0.00	0.80	1.45

Alignment - 2 CH 0+250.00
SCALES: H 1:250, V 1:125



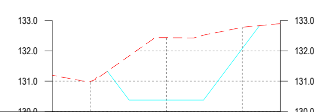
PROPOSED LEVEL	132.576	131.995	131.995	131.995	132.712
RESTORATION LEVEL	132.576	132.573	132.103	132.684	132.712
OFFSET	-2.17	-1.30	0.00	1.30	2.38

Alignment - 2 CH 0+400.00
SCALES: H 1:250, V 1:125



PROPOSED LEVEL	[illegible]	[illegible]	131.146	131.146	132.068
RESTORATION LEVEL	[illegible]	[illegible]	131.385	132.072	132.068
OFFSET	[illegible]	[illegible]	0.00	2.45	3.83

Alignment - 2 CH 0+550.00
SCALES: H 1:250, V 1:125



PROPOSED LEVEL	131.327	130.375	130.375	130.375	132.833
RESTORATION LEVEL	131.327	131.832	132.433	132.518	132.833
OFFSET	-3.88	-2.45	0.00	2.45	6.14

Alignment - 2 CH 0+685.54
SCALES: H 1:250, V 1:125

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Rev	Description	Date	Drn	Ch'd
01	INFORMATION ISSUE	05.08.22	JC	TG
00	DRAFT ISSUE	26.07.22	JC	TG

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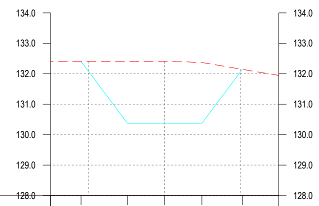
w. www.7-engineering.co.uk

Client	Byrne Looby
Project	Sandown Quarry Restoration WS9 8BL
Drawing title	Cross Sections Sheet 2
Scales @A1	As Shown
Date	July 2022

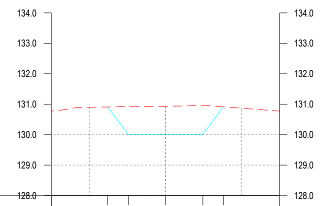
Status: Information

Drg No.: 07200 - 122 Rev.: 01



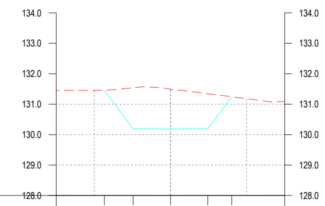
PROPOSED LEVEL	132.403	130.375	130.375	130.375	132.146
RESTORATION LEVEL	132.403	132.403	132.401	132.362	132.146
OFFSET	-5.49	-2.45	0.00	2.45	5.11

Alignment - 3 CH 0+000.00
SCALES: H 1:250, V 1:125



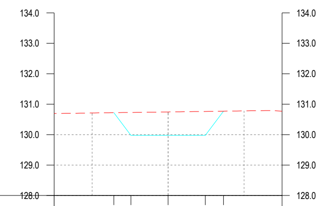
PROPOSED LEVEL	130.909	130.011	130.011	130.011	130.912
RESTORATION LEVEL	130.909	130.918	130.935	130.952	130.912
OFFSET	-3.80	-2.45	0.00	2.45	3.80

Alignment - 3 CH 0+020.00
SCALES: H 1:250, V 1:125



PROPOSED LEVEL	131.457	130.193	130.193	130.193	131.244
RESTORATION LEVEL	131.457	131.540	131.494	131.344	131.244
OFFSET	-4.35	-2.45	0.00	2.45	4.03

Alignment - 3 CH 0+010.00
SCALES: H 1:250, V 1:125



PROPOSED LEVEL	130.721	129.975	129.975	129.975	130.771
RESTORATION LEVEL	130.721	130.729	130.746	130.762	130.771
OFFSET	-3.57	-2.45	0.00	2.45	3.64

Alignment - 3 CH 0+022.00
SCALES: H 1:250, V 1:125

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00	DRAFT ISSUE	26.07.22	JC	TG

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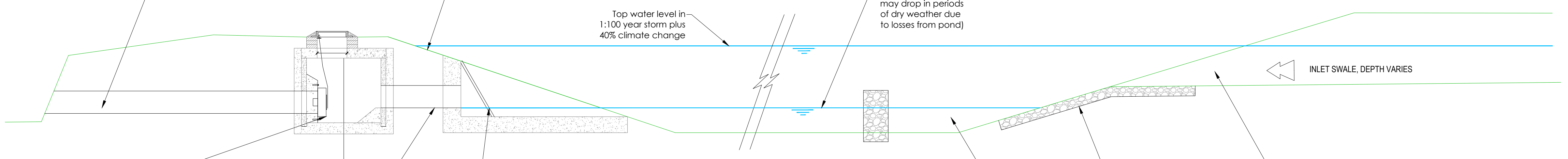
w. www.7-engineering.co.uk

Client	Byrne Looby		
Project	Sandown Quarry Restoration WS9 8BL		
Drawing title	Cross Sections Sheet 3		
Scales @A1	As Shown	Date	July 2022

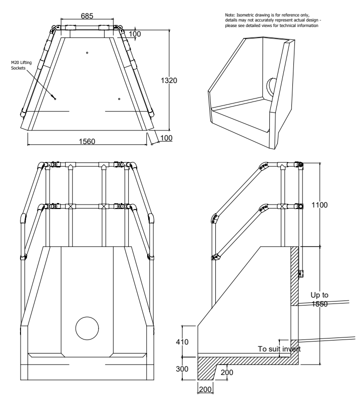
Status: Information

Drg No.: 07200 - 123 Rev.: 01



Typical Attenuation Pond with Sediment forebay and Vortex Flow Control outlet

Scale NTS



OUTFALL
TYPICALPRECAST HEADWALL DETAIL
JOINING SQUARE TO WATERCOURSE

Based on H6CB Precast Headwall with 3 Sided Kee Klamp by Althon Limited

Headwall bedded on min 150mm semi dry concrete and set level ot falling toward the watercourse at 1:50.
Provide insitu or precast toe at river edge to prevent undermining of the headwall.
Provide gabion basket and mattress reinforcement to bank either side and to bed of river in from of headwall as required to limit erosion risks
Provide erosion protection to disturbed parts of bank around headwall to ensourage re-establishment of vegetation

DO NOT SCALE THIS DRAWING.

All dimensions and levels to be checked on site and any discrepancies reported to the Engineers.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

MAINTENANCE/CLEANING/OPERATION.

DECOMMISSIONING/DEMOLITION.

NOTES.

- FOR DETAILS OF THE PROPOSED RESTORATION SURFACE, REFER TO BYRNE LOOBY DRAWINGS
- FOR PROPOSED SURFACE WATER DRAINAGE PLAN AND SECTIONS, REFER TO DRAWINGS 07200/100 TO 123

Rev	Description	Date	Dm	Ch'd
00	ISSUED FOR INFORMATION	04.08.22	JC	TG

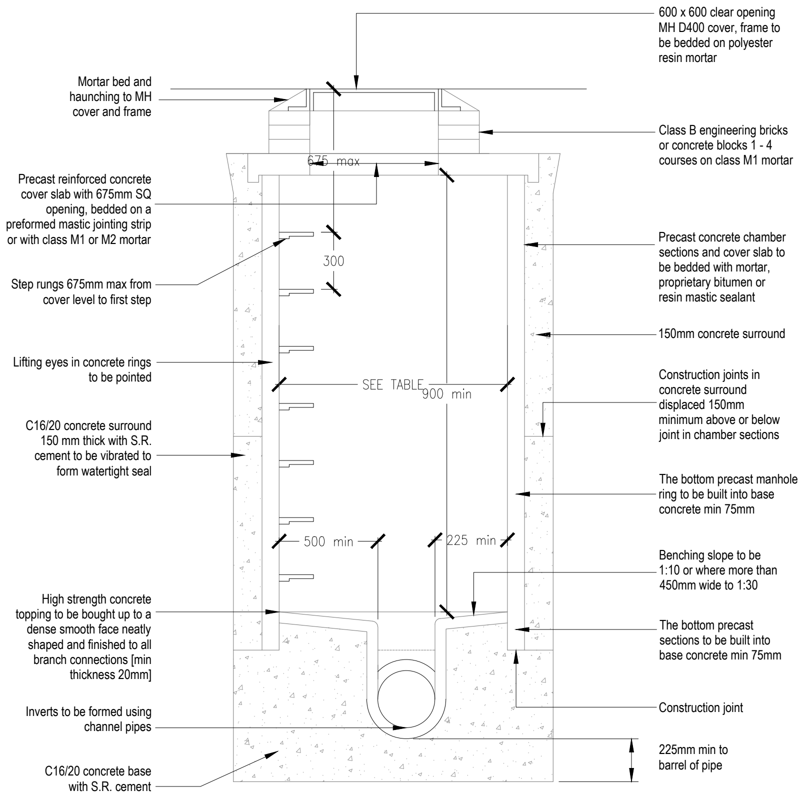
7 ENGINEERING CONSULTANCY
19 Kennedy Crescent
Alverstoke
PO12 2NL

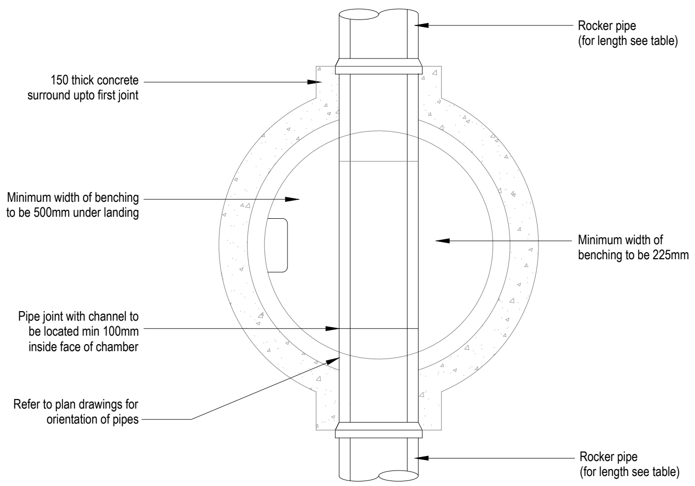
e.tony.goff@7-engineering.co.uk
m. 07803 120963
w. www.7-engineering.co.uk

Client	Byrne Looby
Project	Sandown Quarry Restoration WS9 8BL
Drawing title	Surface Water Drainage Typical Details Sheet 1
Scales @A1	1:1000
Date	Aug 2022

Status: Information

Drg No.: 07200 - 301 Rev.: 00





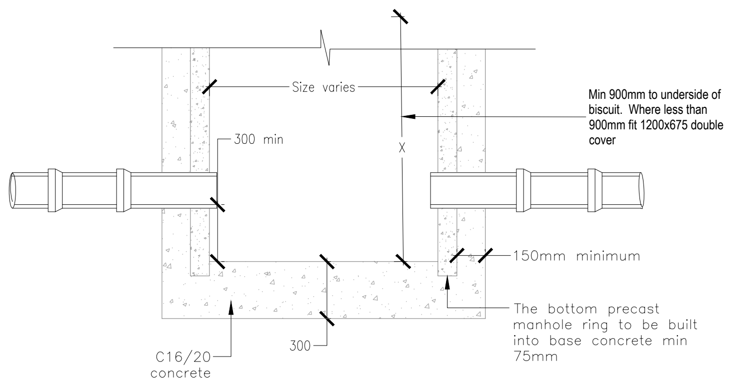
Typical Manhole Type 2

Max depth from cover level to soffit of pipe up to 3m

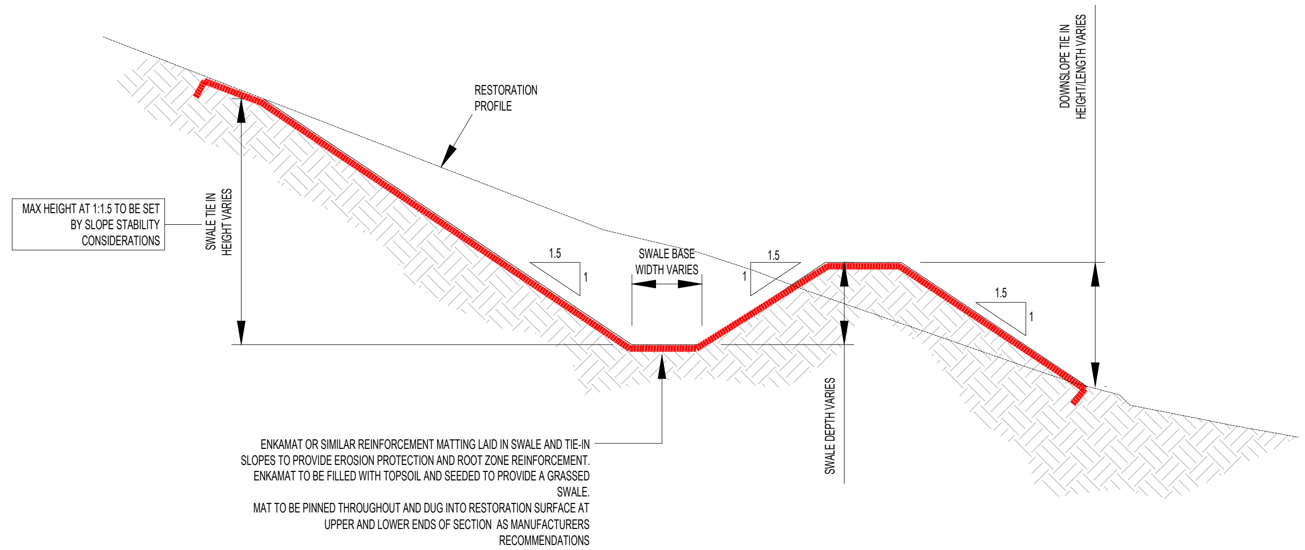
Manhole cover off centred from centre of chamber, contractor to position chamber accordingly.

Diameter of largest pipe in manhole (mm)	Chamber section diameter (mm)
Less than 375	1200 (reducing to 1050 where the depth to the soffit is between 1.35m and 1.5m)
375 – 450	1350
500 – 700	1500
750 – 900	1800
Greater than 900	Pipe diameter + 900

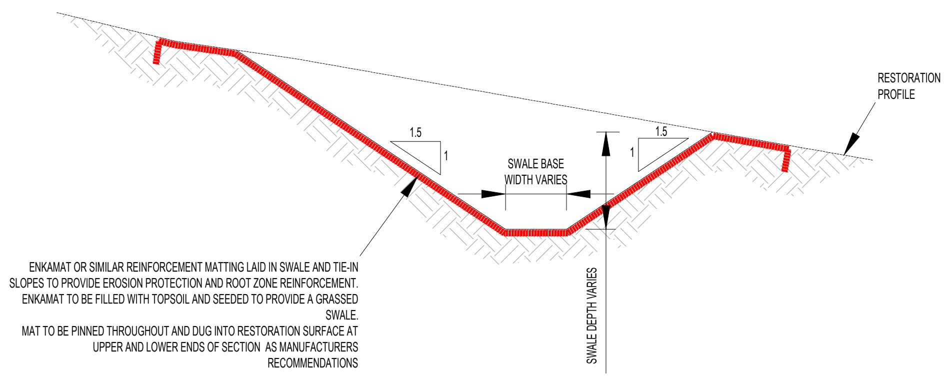
Unless noted otherwise on drawings



Typical catchpit manhole detail



TYPICAL 1:1.5 SWALE DETAILS



TYPICAL 1:1.5 SWALE DETAILS

DO NOT SCALE THIS DRAWING.

All dimensions and levels to be checked on site and any discrepancies reported to the Engineers.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

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Rev	Description	Date	Drn	Ch'd
00	ISSUED FOR INFORMATION	04.08.22	JC	TG

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Client	Byrne Looby
Project	Sandown Quarry Restoration WS9 8BL
Drawing title	Surface Water Drainage Typical Details Sheet 2
Scales @A1	1:1000
Date	Aug 2022

Status: Information

Drg No.: 07200 - 302 Rev.: 00

Appendix E: Greenfield runoff rate calculations

Print | Close Report

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Tony Goff
Site name:	Sandown Quarry
Site location:	Walsall

Site Details

Latitude:	52.61864° N
Longitude:	1.9399° W
Reference:	2423733987
Date:	Jun 27 2022 20:59

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	701	701
Hydrological region:	4	4
Growth curve factor 1 year:	0.83	0.83
Growth curve factor 30 years:	2	2
Growth curve factor 100 years:	2.57	2.57
Growth curve factor 200 years:	3.04	3.04

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

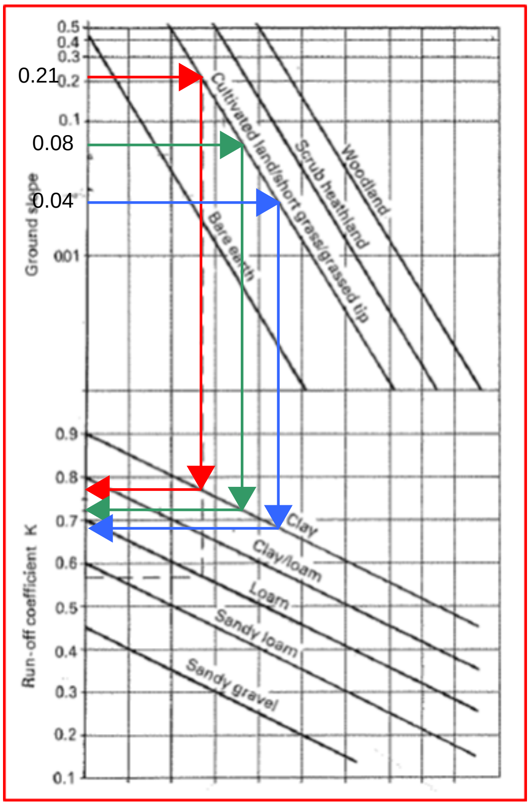
(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	4.84	4.84
1 in 1 year (l/s):	4.01	4.01
1 in 30 years (l/s):	9.67	9.67
1 in 100 year (l/s):	12.43	12.43
1 in 200 years (l/s):	14.7	14.7

Litres per second per hectare of site
(Site 18.64ha, total 1:1 yr flow = 74.75l/s)

Appendix F: Runoff coefficient calculations



Nomogram for determining Runoff Coefficents (Source: Technical Management of Water in the Coal Mining Industry (1982)).

Shallow graded section on top of restored area (majority of site area)

Average Slope (or 1:x) - 0.04 (1:25)
Cover type - Cultivated land/ short grass/ grassed tip
Soil Type for restoration - Clay soils
Season - Winter
Run off Coefficient from nomogram - 0.68

Side slope restoration areas

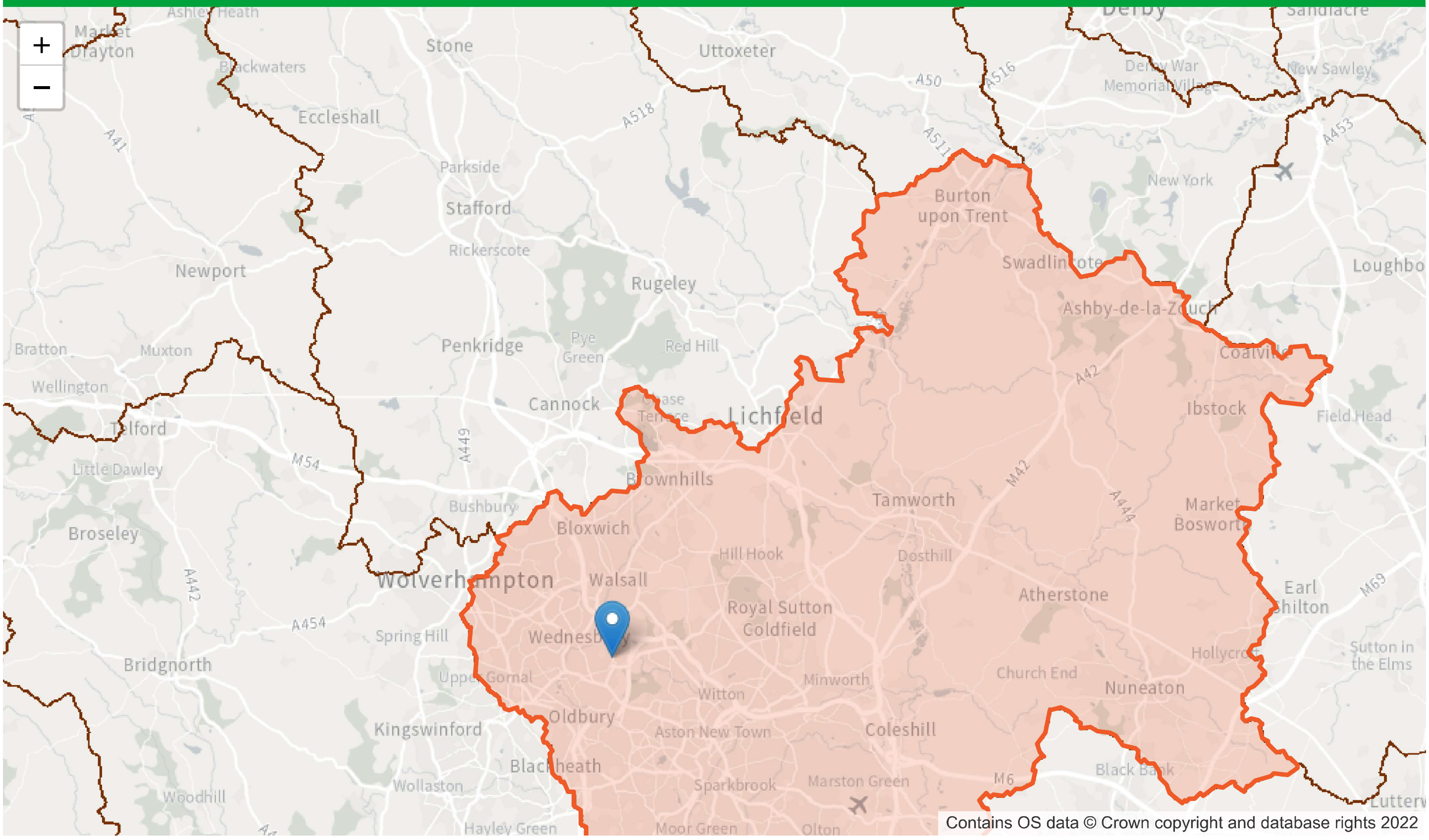
Average Slope (or 1:x) - 0.08 (1:12)
Cover type - Cultivated land/ short grass/ grassed tip
Soil Type for restoration - Clay soils
Season - Winter
Run off Coefficient from nomogram - 0.72

Steepest areas of restoration slope (small area and drains over shallower areas before discharge)

Average Slope (or 1:x) - 0.21 (1:4.8)
Cover type - Cultivated land/ short grass/ grassed tip
Soil Type for restoration - Clay soils
Season - Winter
Run off Coefficient from nomogram - 0.77

Average runoff coefficient approximately prorata by areas = 0.69 for use in Microdrainage model

Appendix G: Climate change allowances



Tame Anker and Mease Management Catchment peak rainfall allowances

3.3% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	35%
2070s	25%	35%

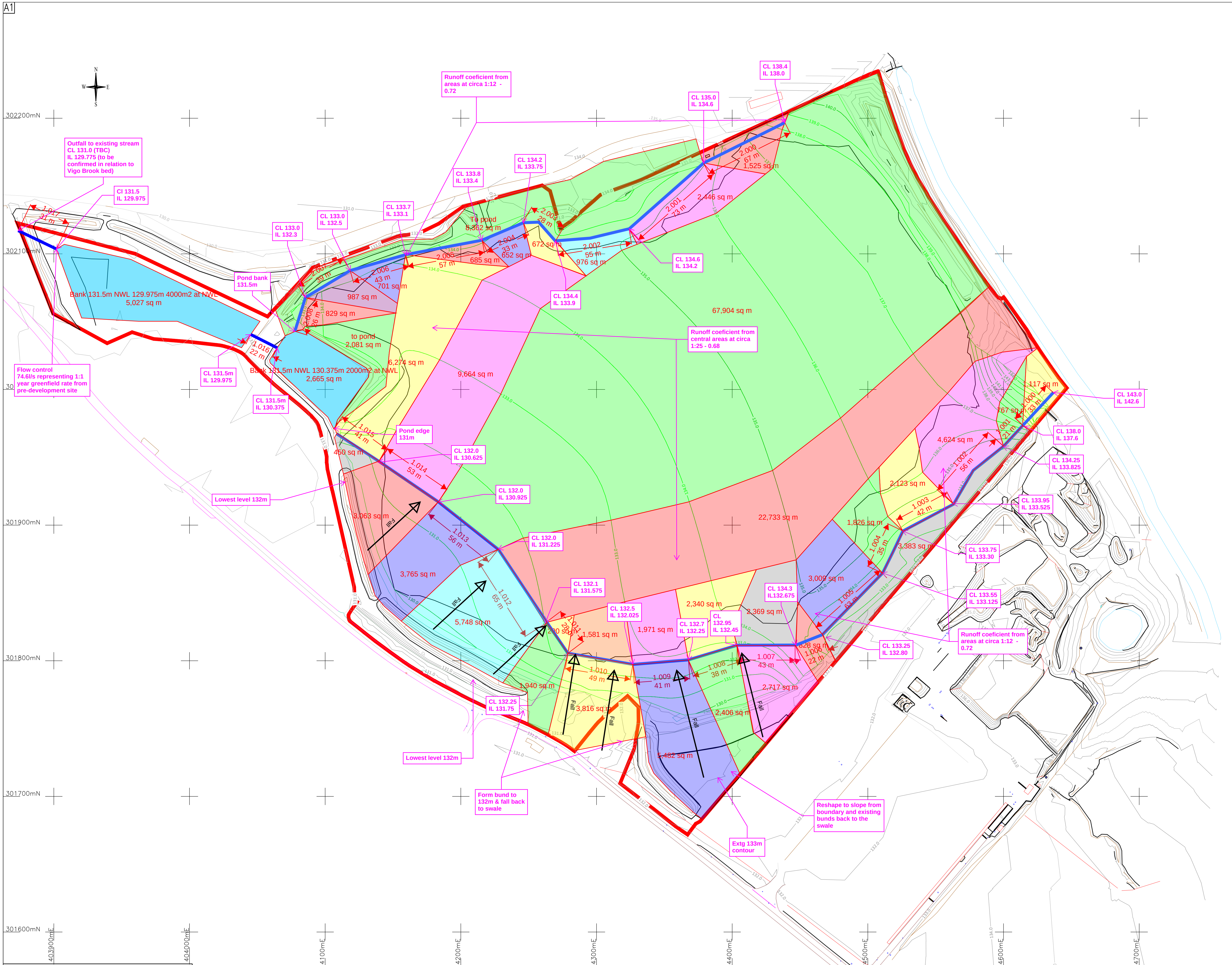
1% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	40%
2070s	25%	40%

*Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125.

Appendix H: Hydraulic modelling calculations key plans

A1



GENERAL NOTES

1. SURVEY INFORMATION SUPPLIED BY CLIENT
2. DO NOT SCALE
3. ALL DIMENSIONS ARE IN MILLIMETRES AND ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM
4. ANY ANOMALIES ON THIS DRAWING ARE TO BE BROUGHT TO THE ATTENTION OF BYRNE LOOBY LTD

LEGEND

OWNERSHIP BOUNDARY

EXISTING GROUND CONTOURS

PROPOSED RESTORATION CONTOURS

Rev	Date	Description	By	Chk	App
A	11/05	CLIENT ISSUE	GH	PS	JB
00	11/05	FOR REVIEW	GH	PS	JB

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IRELAND | UK | UAE | BAHRAIN | KSA

CLIENT
BOOTH VENTURES

PROJECT
SANDOWN QUARRY LANDFILL

DRAWING TITLE
FINAL RESTORATION

STATUS
CLIENT ISSUE

Date: 09.05.22 | Scale: 1:1250 | Drawn: GH | Chk: PR | App: JB

Project No: 5430 | Drg. No: 5430/1/007 | Rev: A

Appendix J: Microdrainage hydraulic modelling calculations

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	33.000	5.000	6.6	0.112	10.00	0.0	0.045	1.5 _/	800	1:1.5 Ditch	
1.001	21.000	3.775	5.6	0.077	0.00	0.0	0.045	1.5 _/	800	1:1.5 Ditch	
1.002	56.000	0.300	186.7	0.462	0.00	0.0	0.045	1.5 _/	800	1:1.5 Ditch	
1.003	42.000	0.225	186.7	0.212	0.00	0.0	0.045	1.5 _/	800	1:1.5 Ditch	
1.004	35.000	0.175	200.0	0.183	0.00	0.0	0.045	1.5 _/	800	1:1.5 Ditch	
1.005	63.000	0.325	193.8	0.301	0.00	0.0	0.045	1.5 _/	1200	1:1.5 Ditch	
1.006	22.000	0.125	176.0	0.083	0.00	0.0	0.045	1.5 _/	1200	1:1.5 Ditch	
1.007	43.000	0.225	191.1	0.509	0.00	0.0	0.045	1.5 _/	1200	1:1.5 Ditch	
1.008	38.000	0.200	190.0	0.475	0.00	0.0	0.045	1.5 _/	1200	1:1.5 Ditch	
1.009	41.000	0.225	182.2	0.745	0.00	0.0	0.045	1.5 _/	2200	1:1.5 Ditch	
1.010	49.000	0.275	178.2	0.540	0.00	0.0	0.045	1.5 _/	2200	1:1.5 Ditch	
1.011	28.000	0.175	160.0	0.223	0.00	0.0	0.045	1.5 _/	2200	1:1.5 Ditch	
1.012	65.000	0.350	185.7	2.848	0.00	0.0	0.045	1.5 _/	4500	1:1.5 Ditch	
1.013	56.000	0.300	186.7	7.167	0.00	0.0	0.045	1.5 _/	4500	1:1.5 Ditch	
1.014	53.000	0.300	176.7	1.273	0.00	0.0	0.045	1.5 _/	4500	1:1.5 Ditch	
1.015	41.000	0.250	164.0	0.672	0.00	0.0	0.045	1.5 _/	4500	1:1.5 Ditch	
2.000	67.000	3.400	19.7	0.153	10.00	0.0	0.045	1.5 _/	500	1:1.5 Ditch	
2.001	73.000	0.400	182.5	0.245	0.00	0.0	0.045	1.5 _/	500	1:1.5 Ditch	

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)
1.000	50.00	10.19	142.600	0.112	0.0	0.0	0.0	2.95	1106.7	14.6
1.001	50.00	10.30	137.600	0.189	0.0	0.0	0.0	3.21	1205.5	24.6
1.002	50.00	11.98	133.825	0.651	0.0	0.0	0.0	0.55	208.1	84.6
1.003	50.00	13.24	133.525	0.863	0.0	0.0	0.0	0.55	208.1	112.2
1.004	50.00	14.33	133.300	1.046	0.0	0.0	0.0	0.54	201.0	136.0
1.005	50.00	16.15	133.125	1.347	0.0	0.0	0.0	0.58	285.3	175.1
1.006	50.00	16.75	132.800	1.430	0.0	0.0	0.0	0.60	299.4	185.9
1.007	50.00	17.99	132.675	1.939	0.0	0.0	0.0	0.58	287.3	252.1
1.008	49.16	19.08	132.450	2.414	0.0	0.0	0.0	0.58	288.1«	308.6
1.009	47.52	20.15	132.250	3.159	0.0	0.0	0.0	0.64	508.6	390.3
1.010	45.74	21.41	132.025	3.699	0.0	0.0	0.0	0.65	514.3	439.9
1.011	44.84	22.09	131.750	3.922	0.0	0.0	0.0	0.68	542.8	457.2
1.012	42.87	23.70	131.575	6.770	0.0	0.0	0.0	0.67	1001.7	754.6
1.013	41.32	25.09	131.225	13.937	0.0	0.0	0.0	0.67	999.1«	1497.4
1.014	40.01	26.36	130.925	15.210	0.0	0.0	0.0	0.69	1027.0«	1582.2
1.015	39.09	27.31	130.625	15.882	0.0	0.0	0.0	0.72	1065.9«	1614.2
2.000	50.00	10.70	138.000	0.153	0.0	0.0	0.0	1.60	455.1	19.9
2.001	50.00	13.02	134.600	0.398	0.0	0.0	0.0	0.52	149.6	51.7

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
2.002	55.000	0.300	183.3	0.098	0.00	0.0	0.045	1.5 _/	500	1:1.5 Ditch	
2.003	28.000	0.150	186.7	0.067	0.00	0.0	0.045	1.5 _/	500	1:1.5 Ditch	
2.004	33.000	0.350	94.3	0.065	0.00	0.0	0.045	1.5 _/	500	1:1.5 Ditch	
2.005	57.000	0.300	190.0	0.069	0.00	0.0	0.045	1.5 _/	500	1:1.5 Ditch	
2.006	43.000	0.600	71.7	0.070	0.00	0.0	0.045	1.5 _/	500	1:1.5 Ditch	
2.007	39.000	0.200	195.0	0.099	0.00	0.0	0.045	1.5 _/	500	1:1.5 Ditch	
2.008	26.000	1.300	20.0	0.083	0.00	0.0	0.045	1.5 _/	500	1:1.5 Ditch	
1.016	22.000	0.400	55.0	1.311	0.00	0.0	0.045	1.5 _/	4500	1:1.5 Ditch	
1.017	31.000	0.200	155.0	0.050	0.00	0.0	0.045	o	450	Pipe/Conduit	

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)
2.002	50.00	14.77	134.200	0.496	0.0	0.0	0.0	0.52	149.2	64.5
2.003	50.00	15.67	133.900	0.563	0.0	0.0	0.0	0.52	147.9	73.2
2.004	50.00	16.42	133.750	0.628	0.0	0.0	0.0	0.73	208.1	81.6
2.005	50.00	18.27	133.400	0.697	0.0	0.0	0.0	0.51	146.6	90.6
2.006	49.09	19.12	133.100	0.767	0.0	0.0	0.0	0.84	238.7	97.9
2.007	47.14	20.40	132.500	0.866	0.0	0.0	0.0	0.51	144.7	106.1
2.008	46.75	20.68	132.300	0.949	0.0	0.0	0.0	1.59	451.8	115.4
1.016	38.82	27.61	130.375	18.142	0.0	0.0	0.0	1.24	1840.7	1830.9
1.017	37.71	28.85	129.975	18.192	0.0	0.0	0.0	0.42	66.2«	1830.9

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	143.000	0.400	Junction		1.000	142.600	800				
2	138.000	0.400	Junction		1.001	137.600	800	1.000	137.600	800	
3	134.250	0.425	Junction		1.002	133.825	800	1.001	133.825	800	
4	133.950	0.425	Junction		1.003	133.525	800	1.002	133.525	800	
5	133.750	0.450	Junction		1.004	133.300	800	1.003	133.300	800	
6	133.550	0.425	Junction		1.005	133.125	1200	1.004	133.125	800	
7	133.250	0.450	Junction		1.006	132.800	1200	1.005	132.800	1200	
8	134.300	1.625	Junction		1.007	132.675	1200	1.006	132.675	1200	
9	132.950	0.500	Junction		1.008	132.450	1200	1.007	132.450	1200	
10	132.700	0.450	Junction		1.009	132.250	2200	1.008	132.250	1200	
11	132.500	0.475	Junction		1.010	132.025	2200	1.009	132.025	2200	
12	132.250	0.500	Junction		1.011	131.750	2200	1.010	131.750	2200	
13	132.100	0.525	Junction		1.012	131.575	4500	1.011	131.575	2200	
14	132.000	0.775	Junction		1.013	131.225	4500	1.012	131.225	4500	
15	132.000	1.075	Junction		1.014	130.925	4500	1.013	130.925	4500	
16	132.000	1.375	Junction		1.015	130.625	4500	1.014	130.625	4500	
17	138.400	0.400	Junction		2.000	138.000	500				
18	135.000	0.400	Junction		2.001	134.600	500	2.000	134.600	500	
19	134.600	0.400	Junction		2.002	134.200	500	2.001	134.200	500	
20	134.400	0.500	Junction		2.003	133.900	500	2.002	133.900	500	
21	134.200	0.450	Junction		2.004	133.750	500	2.003	133.750	500	
22	133.800	0.400	Junction		2.005	133.400	500	2.004	133.400	500	
23	133.700	0.600	Junction		2.006	133.100	500	2.005	133.100	500	
24	133.000	0.500	Junction		2.007	132.500	500	2.006	132.500	500	
25	133.000	0.700	Junction		2.008	132.300	500	2.007	132.300	500	
26	131.500	1.125	Junction		1.016	130.375	4500	1.015	130.375	4500	
								2.008	131.000	500	625
27	131.500	1.525	Junction		1.017	129.975	450	1.016	129.975	4500	
	131.000	1.225	Open Manhole	0		OUTFALL		1.017	129.775	450	

No coordinates have been specified, layout information cannot be produced.

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	1.5 _/	800	1	143.000	142.600	0.100	Junction	
1.001	1.5 _/	800	2	138.000	137.600	0.100	Junction	
1.002	1.5 _/	800	3	134.250	133.825	0.125	Junction	
1.003	1.5 _/	800	4	133.950	133.525	0.125	Junction	
1.004	1.5 _/	800	5	133.750	133.300	0.150	Junction	
1.005	1.5 _/	1200	6	133.550	133.125	0.125	Junction	
1.006	1.5 _/	1200	7	133.250	132.800	0.150	Junction	
1.007	1.5 _/	1200	8	134.300	132.675	1.325	Junction	
1.008	1.5 _/	1200	9	132.950	132.450	0.200	Junction	
1.009	1.5 _/	2200	10	132.700	132.250	0.150	Junction	
1.010	1.5 _/	2200	11	132.500	132.025	0.175	Junction	
1.011	1.5 _/	2200	12	132.250	131.750	0.200	Junction	
1.012	1.5 _/	4500	13	132.100	131.575	0.225	Junction	
1.013	1.5 _/	4500	14	132.000	131.225	0.475	Junction	
1.014	1.5 _/	4500	15	132.000	130.925	0.775	Junction	
1.015	1.5 _/	4500	16	132.000	130.625	1.075	Junction	
2.000	1.5 _/	500	17	138.400	138.000	0.100	Junction	
2.001	1.5 _/	500	18	135.000	134.600	0.100	Junction	
2.002	1.5 _/	500	19	134.600	134.200	0.100	Junction	
2.003	1.5 _/	500	20	134.400	133.900	0.200	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	33.000	6.6	2	138.000	137.600	0.100	Junction	
1.001	21.000	5.6	3	134.250	133.825	0.125	Junction	
1.002	56.000	186.7	4	133.950	133.525	0.125	Junction	
1.003	42.000	186.7	5	133.750	133.300	0.150	Junction	
1.004	35.000	200.0	6	133.550	133.125	0.125	Junction	
1.005	63.000	193.8	7	133.250	132.800	0.150	Junction	
1.006	22.000	176.0	8	134.300	132.675	1.325	Junction	
1.007	43.000	191.1	9	132.950	132.450	0.200	Junction	
1.008	38.000	190.0	10	132.700	132.250	0.150	Junction	
1.009	41.000	182.2	11	132.500	132.025	0.175	Junction	
1.010	49.000	178.2	12	132.250	131.750	0.200	Junction	
1.011	28.000	160.0	13	132.100	131.575	0.225	Junction	
1.012	65.000	185.7	14	132.000	131.225	0.475	Junction	
1.013	56.000	186.7	15	132.000	130.925	0.775	Junction	
1.014	53.000	176.7	16	132.000	130.625	1.075	Junction	
1.015	41.000	164.0	26	131.500	130.375	0.825	Junction	
2.000	67.000	19.7	18	135.000	134.600	0.100	Junction	
2.001	73.000	182.5	19	134.600	134.200	0.100	Junction	
2.002	55.000	183.3	20	134.400	133.900	0.200	Junction	
2.003	28.000	186.7	21	134.200	133.750	0.150	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
2.004	1.5 _/	500	21	134.200	133.750	0.150	Junction	
2.005	1.5 _/	500	22	133.800	133.400	0.100	Junction	
2.006	1.5 _/	500	23	133.700	133.100	0.300	Junction	
2.007	1.5 _/	500	24	133.000	132.500	0.200	Junction	
2.008	1.5 _/	500	25	133.000	132.300	0.400	Junction	
1.016	1.5 _/	4500	26	131.500	130.375	0.825	Junction	
1.017	o	450	27	131.500	129.975	1.075	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
2.004	33.000	94.3	22	133.800	133.400	0.100	Junction	
2.005	57.000	190.0	23	133.700	133.100	0.300	Junction	
2.006	43.000	71.7	24	133.000	132.500	0.200	Junction	
2.007	39.000	195.0	25	133.000	132.300	0.400	Junction	
2.008	26.000	20.0	26	131.500	131.000	0.200	Junction	
1.016	22.000	55.0	27	131.500	129.975	1.225	Junction	
1.017	31.000	155.0		131.000	129.775	0.775	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.017		131.000	129.775	0.000	0	0

Online Controls for Storm

Hydro-Brake® Optimum Manhole: 27, DS/PN: 1.017, Volume (m³): 153.1

Unit Reference	MD-SHE-0343-7480-1500-7480
Design Head (m)	1.500
Design Flow (l/s)	74.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	343
Invert Level (m)	129.975
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.500	74.8
Flush-Flo™	0.560	74.8
Kick-Flo®	1.109	64.6
Mean Flow over Head Range	-	62.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	10.0	1.200	67.1	3.000	104.7	7.000	158.3
0.200	34.8	1.400	72.3	3.500	112.8	7.500	163.7
0.300	63.4	1.600	77.2	4.000	120.4	8.000	169.0
0.400	73.3	1.800	81.7	4.500	127.6	8.500	174.1
0.500	74.6	2.000	86.0	5.000	134.3	9.000	179.0
0.600	74.7	2.200	90.0	5.500	140.7	9.500	183.8
0.800	73.1	2.400	93.9	6.000	146.8		
1.000	69.3	2.600	97.7	6.500	152.7		

Storage Structures for Storm

Tank or Pond Manhole: 26, DS/PN: 1.016

Invert Level (m) 130.375

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	2000.0	0.600	2665.0

Tank or Pond Manhole: 27, DS/PN: 1.017

Invert Level (m) 129.975

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	4000.0	1.000	5027.0

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.400
Region England and Wales Cv (Summer) 0.690
M5-60 (mm) 19.000 Cv (Winter) 0.690

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS 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) 1, 30, 100
Climate Change (%) 35, 35, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	30 Summer	1	+35%					142.621
1.001	2	15 Summer	1	+35%					137.629
1.002	3	15 Summer	1	+35%					134.004
1.003	4	15 Summer	1	+35%					133.722
1.004	5	15 Summer	1	+35%					133.513
1.005	6	30 Summer	1	+35%					133.316
1.006	7	30 Summer	1	+35%					132.986
1.007	8	30 Summer	1	+35%					132.889
1.008	9	30 Summer	1	+35%					132.690
1.009	10	30 Summer	1	+35%					132.451
1.010	11	30 Summer	1	+35%					132.244
1.011	12	30 Summer	1	+35%					131.964
1.012	13	30 Summer	1	+35%					131.786
1.013	14	30 Summer	1	+35%					131.566
1.014	15	30 Summer	1	+35%					131.274
1.015	16	30 Summer	1	+35%					130.970
2.000	17	30 Summer	1	+35%					138.046
2.001	18	15 Summer	1	+35%					134.761
2.002	19	30 Summer	1	+35%					134.370

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.379	0.000	0.01		11.5	OK	
1.001	2	-0.371	0.000	0.01		20.8	OK	
1.002	3	-0.246	0.000	0.18		74.8	FLOOD RISK*	
1.003	4	-0.228	0.000	0.23		92.3	FLOOD RISK*	
1.004	5	-0.237	0.000	0.24		105.5	FLOOD RISK*	
1.005	6	-0.234	0.000	0.23		123.8	FLOOD RISK*	
1.006	7	-0.264	0.000	0.20		127.4	FLOOD RISK*	
1.007	8	-1.411	0.000	0.02		162.3	OK	
1.008	9	-0.260	0.000	0.26		191.7	FLOOD RISK*	
1.009	10	-0.249	0.000	0.25		254.2	FLOOD RISK*	
1.010	11	-0.256	0.000	0.26		294.1	FLOOD RISK*	
1.011	12	-0.286	0.000	0.23		302.9	FLOOD RISK*	
1.012	13	-0.314	0.000	0.21		537.7	OK	
1.013	14	-0.434	0.000	0.24		1223.2	OK	
1.014	15	-0.726	0.000	0.14		1316.6	OK	
1.015	16	-1.030	0.000	0.09		1352.0	OK	
2.000	17	-0.354	0.000	0.02		15.6	OK	
2.001	18	-0.239	0.000	0.15		40.9	FLOOD RISK*	
2.002	19	-0.230	0.000	0.18		48.5	FLOOD RISK*	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
2.003	20	30 Summer	1	+35%					134.076
2.004	21	30 Summer	1	+35%					133.902
2.005	22	30 Summer	1	+35%					133.589
2.006	23	30 Summer	1	+35%					133.246
2.007	24	30 Summer	1	+35%					132.698
2.008	25	30 Summer	1	+35%					132.406
1.016	26	30 Summer	1	+35%					130.604
1.017	27	720 Summer	1	+35%	1/120 Summer				130.520

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
2.003	20	-0.324	0.000	0.12		52.9	OK	
2.004	21	-0.298	0.000	0.12		56.5	FLOOD RISK*	
2.005	22	-0.211	0.000	0.22		58.7	FLOOD RISK*	
2.006	23	-0.454	0.000	0.06		61.0	OK	
2.007	24	-0.302	0.000	0.15		63.9	OK	
2.008	25	-0.594	0.000	0.02		66.4	OK	
1.016	26	-0.896	0.000	0.06		1173.0	OK	
1.017	27	0.095	0.000	1.13		74.6	SURCHARGED*	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.400
Region England and Wales Cv (Summer) 0.690
M5-60 (mm) 19.000 Cv (Winter) 0.690

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS 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) 1, 30, 100
Climate Change (%) 35, 35, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	30 Summer	30	+35%					142.637
1.001	2	15 Summer	30	+35%					137.654
1.002	3	15 Summer	30	+35%					134.161
1.003	4	15 Summer	30	+35%					133.885
1.004	5	15 Summer	30	+35%					133.675
1.005	6	30 Summer	30	+35%					133.457
1.006	7	30 Summer	30	+35%					133.120
1.007	8	30 Summer	30	+35%					133.046
1.008	9	30 Summer	30	+35%					132.854
1.009	10	30 Summer	30	+35%					132.601
1.010	11	30 Summer	30	+35%					132.404
1.011	12	30 Summer	30	+35%					132.118
1.012	13	30 Summer	30	+35%					131.939
1.013	14	30 Summer	30	+35%					131.817
1.014	15	30 Summer	30	+35%					131.530
1.015	16	30 Summer	30	+35%					131.226
2.000	17	30 Summer	30	+35%					138.079
2.001	18	15 Summer	30	+35%					134.889
2.002	19	15 Summer	30	+35%					134.496

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.363	0.000	0.01		28.2	OK	
1.001	2	-0.346	0.000	0.03		58.6	OK	
1.002	3	-0.089	0.000	0.57		232.6	FLOOD RISK*	
1.003	4	-0.065	0.000	0.68		274.7	FLOOD RISK*	
1.004	5	-0.075	0.000	0.68		298.5	FLOOD RISK*	
1.005	6	-0.093	0.000	0.61		328.6	FLOOD RISK*	
1.006	7	-0.130	0.000	0.53		334.7	FLOOD RISK*	
1.007	8	-1.254	0.000	0.05		427.9	OK	
1.008	9	-0.096	0.000	0.66		490.1	FLOOD RISK*	
1.009	10	-0.099	0.000	0.63		655.0	FLOOD RISK*	
1.010	11	-0.096	0.000	0.66		757.0	FLOOD RISK*	
1.011	12	-0.132	0.000	0.58		772.3	FLOOD RISK*	
1.012	13	-0.161	0.000	0.52		1342.6	FLOOD RISK*	
1.013	14	-0.183	0.000	0.61		3120.6	FLOOD RISK*	
1.014	15	-0.470	0.000	0.36		3377.0	OK	
1.015	16	-0.774	0.000	0.23		3474.8	OK	
2.000	17	-0.321	0.000	0.05		38.4	OK	
2.001	18	-0.111	0.000	0.43		116.4	FLOOD RISK*	
2.002	19	-0.104	0.000	0.50		133.1	FLOOD RISK*	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
2.003	20	15 Summer	30	+35%					134.192
2.004	21	30 Summer	30	+35%					134.001
2.005	22	30 Summer	30	+35%					133.706
2.006	23	30 Summer	30	+35%					133.340
2.007	24	30 Summer	30	+35%					132.815
2.008	25	30 Summer	30	+35%					132.476
1.016	26	600 Winter	30	+35%					131.064
1.017	27	600 Winter	30	+35%	1/120 Summer				131.062

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
2.003	20	-0.208	0.000	0.32		138.4	FLOOD RISK*	
2.004	21	-0.199	0.000	0.30		145.0	FLOOD RISK*	
2.005	22	-0.094	0.000	0.56		148.6	FLOOD RISK*	
2.006	23	-0.360	0.000	0.15		153.1	OK	
2.007	24	-0.185	0.000	0.38		159.1	FLOOD RISK*	
2.008	25	-0.524	0.000	0.06		164.0	OK	
1.016	26	-0.436	0.000	0.02		439.3	OK	
1.017	27	0.637	0.000	1.13		74.6	SURCHARGED*	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.400
Region England and Wales Cv (Summer) 0.690
M5-60 (mm) 19.000 Cv (Winter) 0.690

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS 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) 1, 30, 100
Climate Change (%) 35, 35, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	30 Summer	100	+40%					142.644
1.001	2	15 Summer	100	+40%					137.664
1.002	3	15 Summer	100	+40%					134.216
1.003	4	15 Summer	100	+40%					133.946
1.004	5	15 Summer	100	+40%					133.741
1.005	6	30 Summer	100	+40%					133.521
1.006	7	30 Summer	100	+40%					133.185
1.007	8	30 Summer	100	+40%					133.116
1.008	9	30 Summer	100	+40%					132.925
1.009	10	30 Summer	100	+40%					132.669
1.010	11	30 Summer	100	+40%					132.478
1.011	12	30 Summer	100	+40%					132.205
1.012	13	30 Summer	100	+40%					132.099
1.013	14	30 Summer	100	+40%					131.929
1.014	15	30 Summer	100	+40%					131.647
1.015	16	720 Winter	100	+40%					131.394
2.000	17	30 Summer	100	+40%					138.093
2.001	18	15 Summer	100	+40%					134.935
2.002	19	15 Summer	100	+40%					134.540

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.356	0.000	0.02		38.2	OK	
1.001	2	-0.336	0.000	0.04		78.7	OK	
1.002	3	-0.034	0.000	0.77		313.6	FLOOD RISK*	
1.003	4	-0.004	0.000	0.92		373.6	FLOOD RISK*	
1.004	5	-0.009	0.000	0.93		409.7	FLOOD RISK*	
1.005	6	-0.029	0.000	0.84		451.7	FLOOD RISK*	
1.006	7	-0.065	0.000	0.73		462.9	FLOOD RISK*	
1.007	8	-1.184	0.000	0.07		587.5	OK	
1.008	9	-0.025	0.000	0.90		668.1	FLOOD RISK*	
1.009	10	-0.031	0.000	0.87		895.5	FLOOD RISK*	
1.010	11	-0.022	0.000	0.90		1037.6	FLOOD RISK*	
1.011	12	-0.045	0.000	0.81		1084.0	FLOOD RISK*	
1.012	13	-0.001	0.000	0.72		1876.7	FLOOD RISK*	
1.013	14	-0.071	0.000	0.83		4201.0	FLOOD RISK*	
1.014	15	-0.353	0.000	0.49		4569.9	OK	
1.015	16	-0.606	0.000	0.04		605.5	OK	
2.000	17	-0.307	0.000	0.06		52.0	OK	
2.001	18	-0.065	0.000	0.58		157.3	FLOOD RISK*	
2.002	19	-0.060	0.000	0.67		179.3	FLOOD RISK*	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
2.003	20	15 Summer	100	+40%					134.237
2.004	21	30 Summer	100	+40%					134.042
2.005	22	30 Summer	100	+40%					133.755
2.006	23	30 Summer	100	+40%					133.380
2.007	24	30 Summer	100	+40%					132.867
2.008	25	30 Summer	100	+40%					132.509
1.016	26	720 Winter	100	+40%					131.392
1.017	27	720 Winter	100	+40%	1/120 Summer				131.384

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
2.003	20	-0.163	0.000	0.44		185.6	FLOOD RISK*	
2.004	21	-0.158	0.000	0.41		196.5	FLOOD RISK*	
2.005	22	-0.045	0.000	0.77		201.8	FLOOD RISK*	
2.006	23	-0.320	0.000	0.20		208.6	OK	
2.007	24	-0.133	0.000	0.52		217.0	FLOOD RISK*	
2.008	25	-0.491	0.000	0.08		224.0	OK	
1.016	26	-0.108	0.000	0.03		471.7	FLOOD RISK*	
1.017	27	0.959	0.000	1.13		74.6	FLOOD RISK*	

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