MARSHALLS MONO LTD

PASTURE HOUSE QUARRY, SOUTHOWRAM

BESPOKE RECOVERY PERMIT APPLICATION

ENVIRONMENTAL MONITORING PLAN

SEPTEMBER 2021

Silkstone
Environmental Ltd
www.silkstoneenvironmental.co.uk

1.0 Introduction

1.1 Silkstone Environmental Ltd. (SEL) on behalf of Marshalls Mono Ltd (Marshalls) has produced this Environmental Monitoring Plan as part of a bespoke recovery permit application at Pasture House Quarry, Southowram.

1.2 The waste recovery facility is to enable the site to be restored back to original ground levels since the completion of mineral extraction. The waste to be used consists of inert quarry shale overburden mixed with fines in the form of inert concrete sludge from the block manufacturing plant at the adjacent Brookfoot Works factory.

1.3 In preparation of their application for a waste recovery permit, Marshalls commissioned the installation of a number of groundwater and gas monitoring wells to establish initial baseline data prior to a permit being issued and the commencement of waste importation.

1.4 Baseline environmental monitoring for groundwater and landfill gas has been carried out by SEL since June 2021 where initially three monthly visits were carried out prior to submission of the permit application and will be ongoing on a monthly basis until a full 6 months data has been collected and will then revert to a quarterly basis going forward.

1.5 This document therefore describes how the groundwater monitoring boreholes have been constructed in accordance with the approved CQA plan.

2.0 Methodology

2.1 The area of quarry proposed for waste recovery activity is shown on drawing 20293/100 in Appendix A.

2.2 New borehole installations were agreed with the Environment Agency for the purposes of background gas and groundwater and these are detailed in this section and include:

- 6 new perimeter groundwater monitoring boreholes (2 neighboring boreholes to monitor differing groundwater horizons at 3 positions across the site).
- The drilling depths of the new boreholes ranged from 38.5m below existing ground level (begl) to 68.9m begl and are detailed in Table 1 below.

2.3 The layout was based on the requirement for a minimum of one up-gradient and two down gradient groundwater monitoring boreholes as per EA guidance.

2.4 Each borehole was drilled using open-hole drilling techniques by ACE Drilling Services. Actual drilling depths were dependent on site specific conditions as experienced at each drilling location and interpreted by the supervising engineer, however initial estimates gave an indication of the depths required to intercept the groundwater horizons as seen in Table 1 below. The depths to which the boreholes were installed is also presented in the table below.

Table 1. In-waste water/gas monitoring boreholes installation depths

Borehole No.	Position	Top of Scheme (mAOD)	Base of Scheme (mAOD)	Proposed Drilling Depth (m)	Depth of Installation (m)
1A	Up gradient	197.5	150.2	47.3	44.0
1B	Up gradient		130.2	67.3	68.9
2A	Down gradient	183.5	141.2	42.3	42.0
2B	Down gradient		121.2	62.3	63.0
3A	Down gradient	180.5	142.2	38.3	38.5
3B	Down gradient		122.2	58.3	63.5

3. Groundwater Monitoring Procedure

3.1 Groundwater monitoring is carried out at the boreholes BH1A to 3B in accordance with Table 1, above. The chemical components that are tested for in the groundwater samples are given in Table 2. In the event of any trigger level exceedance, Table 3 details the appropriate actions to be carried out.

3.2 All monitoring boreholes will be inspected during the monitoring visits. Any damaged or non-functioning monitoring boreholes will be recorded on the monitoring record sheets and reported to the Site Management. Arrangements will then be made for the repairs or re-instatement of the installation with a month of the date of the incident being recorded. Damage to monitoring infrastructure will be avoided through clear marking out of monitoring locations (to avoid collision etc.) and a briefing given to all operations staff at the site as to the location of the monitoring infrastructure and the importance of preventing damage to the installations.

3.3 Monitoring currently takes places monthly initially for 6 months from June to November 2021 and will then revert to quarterly until the site is closed and the permit is surrendered.

Table 1- Groundwater Monitoring Schedule

Type of Investigation	Sampling For:	Frequency, Location and Methodology	Guidance Followed
Groundwater Level Monitoring	Groundwater Level	Groundwater levels will be monitored MONTHLY for an initial period of 6 months and all subsequent years monitoring will take place at SIX monthly intervals until the licence is surrendered. Monitoring will take place at all operational groundwater monitoring boreholes (Refer to BH Plan 20293/700)	LFTGN 02 - Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water
Groundwater Quality Sampling	The substances that will be sampled for are those given in Table 2	Groundwater levels will be monitored MONTHLY for an initial period of 6 months and all subsequent years monitoring will take place at SIX monthly intervals until the licence is surrendered. Monitoring will take place at all operational groundwater monitoring boreholes (Refer to BH Plan 20293/700). All laboratory testing will be carried out to the appropriate detection limits and compared to the site specific Control and Trigger Levels, as detailed in Table 3.	LFTGN 02 - Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water

Table 2- Groundwater Testing Contamination Suite

Mercury, Total as Hg	0.0001	mg/l
Chloride as Cl	3.0	mg/l
Nitrate as N	0.42	mg/l
Nitrite as N	0.025	mg/l
Nitrogen, Total Oxidised as N	0.42	mg/l
Conductivity- Electrical 20C	30	uS/cm
pH	1	pH units
COD (Total)	11	mg/l
Antimony, Total as Sb	0.0016	mg/l
Arsenic, Total as As	0.0014	mg/l
Selenium, Total as Se	0.0016	mg/l
Tellurium, Total as Te	0.11	ug/l
Uranium, Total as U	0.11	ug/l
Fluoride as F	0.2	mg/l
Barium, Total as Ba	0.007	mg/l
Beryllium, Total as Be	0.0021	mg/l
Boron, Total as B	0.23	mg/l
Cadmium , Total as Cd	0.0006	mg/l
Chromium , Total as Cr	0.002	mg/l
Cobalt , Total as Co	0.002	mg/l
Copper, Total as Cu	0.009	mg/l
Iron , Total as Fe	0.23	mg/l
Lead , Total as Pb	0.006	mg/l
Molybdenum , Total as Mo	0.003	mg/l
Nickel, Total as Ni	0.003	mg/l

Silver , Total as Ag	0.0007	mg/l
Thallium , Total as Tl	0.012	mg/l
Tin , Total as Sn	0.007	mg/l
Titanium , Total as Ti	0.002	mg/l
Vanadium , Total as V	0.004	mg/l
Zinc, Total as Zn	0.018	mg/l
BOD + ATU (5 day)	1	mg/l
Inorganic Phosphorus, Tot as P	0.08	mg/l
Ammoniacal Nitrogen as N	0.27	mg/l

Table 3. Groundwater & Gas Monitoring Action Plan

Breach of Control Level	Breach of Trigger Level	Contingency Action to be Taken
✓	✓	Advise site management
✓	✓	Confirm reading by repeat monitoring
✓	✓	Review existing monitoring information
✓	✓	Increase monitoring frequency to establish magnitude of problem
	✓	Advise Environment Agency and agree on corrective action based on the level of trigger level exceedance

4. Groundwater Sampling Procedure

4.1 Prior to groundwater monitoring commencing at the site, HDPE tubing and foot valves were installed at each groundwater monitoring point to enable groundwater to be pumped to surface. The length of HDPE tubing used was equivalent to the distance from borehole base to just below the gas bung seated on top of the borehole.

4.2 For each monitoring visit, a dip meter is used to determine the depth of groundwater inside each borehole. A record is made of groundwater depth and depth to borehole base. Based on the dip measurements, the volume of groundwater to be purged is calculated, based on a requirement to purge three times the well volume.

4.3 Groundwater is pumped from within the borehole to ground surface were it is collected and the volume measured in a suitable receptacle (usually a bucket). Groundwater is pumped from the borehole until sufficient purging has been achieved.

4.4 Plastic sample bottles which do not contain preserving agents/chemicals are rinsed a minimum of three times prior to collection of groundwater samples.

4.5 If groundwater recharge is very slow (and the borehole is dry) sometimes the borehole is revisited to collect a groundwater sample later in the day, or the next day.

4.6 In cases where groundwater recharge is insufficient to provide groundwater samples in a reasonable timeframe, we sometimes collect a grab sample (i.e. sample without purging).

4.7 Once groundwater purging is completed and the relevant sample bottles are rinsed, groundwater is pumped directly from the HDPE tubing into the sample bottles until there is no air left in the bottle. The bottle is then be sealed with a cap/lid.

4.8 Groundwater samples are not be collected from receptacles used for measuring purge volume to prevent cross contamination.

4.9 Each groundwater sample bottle is appropriately labelled with the following details (generally a pre-labelled sample bottle system is used);

- Date, Time of sampling, and Site Name.
- Borehole identification.
- Initials of person sampling.
- Sample Number (If more than one sample is collected from same borehole).
- Grid reference number (if appropriate)
- Any additional site specific info that may be of relevance to a borehole (if appropriate)

4.10 The monitoring technician checks that the details of the sample bottles are accurate and correct, for each sample collected. Sample bottles should be in good condition, and free from contamination.

4.11 Should contaminated purge water be extracted from a borehole during sample collection, then the monitoring technician ensures it is collected stored in a suitable container (such as a five gallon drum) and handed over to site management who will arrange for its safe disposal/treatment. The site operator is responsible for ensuring any recovered contaminated purge water is disposed of or treated by suitably licensed means.

4.12 All collected groundwater samples are stored in suitable conditions prior to collection for laboratory analysis, i.e. samples are kept out of direct sunlight and stored in a cool dark place.

4.13 Groundwater samples are stored in a refrigerated system while collection and analysis by the laboratory is arranged. Groundwater samples are collected for analysis by the laboratory the following day. This is to ensure that preserving agents and samples do not expire accredited shelf life periods.

4.14 Groundwater analysis is carried out by a UKAS accredited laboratory facility.

5. Landfill Gas Monitoring

5.1 Background landfill gas monitoring is currently carried out at the installation in accordance with Table 5, below. The results of all landfill gas monitoring will be compared with the control and trigger levels for parameters given in table 6, which are as yet to be set. Table 4 gives details of the actions that will be carried out following any breach of a control and trigger level.

5.2 All monitoring boreholes are inspected during the monitoring visits as per Para 3.2.

5.3 The table below shows the full suite of landfill gas monitoring analysis carried out on all six monitoring boreholes every six months.

5.4 Background monitoring currently takes place monthly for the first 6 months, then reverts to quarterly and will continue at this frequency when waste deposition commences.

Table 5 - Gas Monitoring Schedule

Type of Investigation	Sampling For:	Frequency, Location and Methodology	Guidance Followed
1) Routine Perimeter Boreholes	CH_4, CO_2, O_2, CO & H_2S	Landfill Gas will be monitored MONTHLY for an initial period of 6 months. QUARTERLY monitoring will then be carried out for all subsequent years monitoring until the licence is surrendered. Monitoring will take place at all operational groundwater monitoring boreholes (Refer to BH Plan 20293/700).	Environment Agency Guidance LFTGN 03 – Management of Landfill Gas
	Also Recording:		
	Atmospheric Pressure Differential Pressure Meteorological Data		

Table 6. Gas Monitoring Analysis

Parameter	Unit
Methane (CH_4)	%
Carbon Dioxide (CO_2)	%
Oxygen (0_2)	%
Balance (Bal)	%
Hydrogen Sulphide (H_2S)	%
Carbon Monoxide (CO_2)	%
Relative Pressure	mbar
Atmospheric Pressure	mbar
Flow	l/h

6. Landfill Gas Monitoring Procedure

6.1 Landfill gas monitoring is undertaken using a handheld GA2000 infra-red gas analyser. Gas readings are taken first prior to water monitoring of the same borehole.

6.2 To ensure a correct and valid reading, it is ensured that every gas bung and valve has been maintained in airtight and good condition at each borehole location. If any valves are damaged, not airtight, or missing, then details are recorded on the appropriate data sheet and arrangements made for replacement or repairs as soon as is practical.

6.3 The borehole cover is opened first. A transparent pipe is attached to the gas bung valve and the other end to the “sample in” socket on the gas meter. Gas is then pumped from the borehole by the gas meter for two minutes. All gas concentrations listed in the landfill gas table above in Table 6 are then saved and noted once readings stabilise.

6.4 The gas valve is then closed and the transparent pipe is switched from the “sample in” socket to the “flow in” socket. The valve on the gas bung is then re-opened. The valve on the gas bung is then opened and the gas flow measured until readings become stable.

6.5 Once all readings are noted, the gas tap is closed and the transparent pipe is disconnected at both ends.

APPENDIX A - PLANS

Waste Recovery Area

Monitoring Well Location Plan

LEGEND

Proposed Waste Recovery Area

Rev	Description	Date	Drawn	Chkd

Client:

Marshalls

Project:

PASTURE HOUSE QUARRY

Plan Title:

WASTE RECOVERY PLAN

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Project No. 20293	Dwg No. 20293/100	Rev
Date: Jan 20	Scale: 1:1250 @ A2	

424000N

423800N

PASTURE HOUSE QUARRY

PASTURE HOUSE FARM

PASTURE HOUSE

SOUTH FACE

Holly Royd

Holly Royd

Barker Royd

Reservoir

FP37

Path

Path (um)

Cattle Grid

FP29

Greenfield

Stonecroft

St Anne in the Grove

Kirk Lea

LB

Sunday School

Beech Cottage

189.6m

184.1m

184.4m

182.9m

180.7m

173.7

Gas Governor

The Stables

Hollins House

Amberstones

Posts

Beaumont

Meadowcroft

2 to 10

Stonelea

Slead Cott

The Woodlands

CHAPEL LANE

The Chapel

CROMWELL VIEW

CHURCH LANE

Allotment Gardens

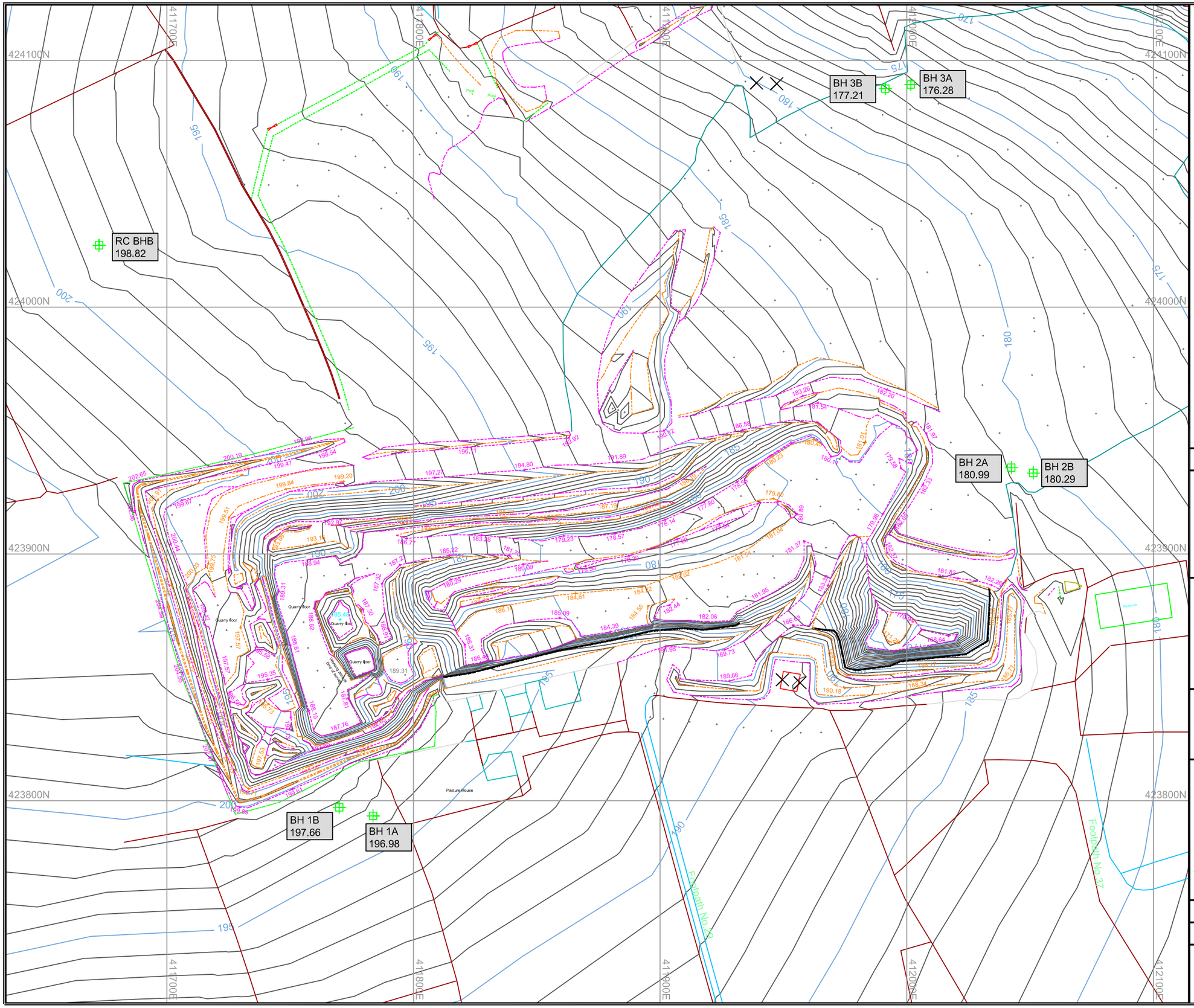
411700E

411800E

411900E

412000E

412100E



LEGEND

- Bottom of Bank
- Top of Bank
- Fence
- Building
- Wall
- Quarry Face
- 1m Contours
- 5m Contours (195)
- Levels (+ 114.06)
- Borehole ID & ground level (BH 2A 180.99)

Rev	Description	Date	Drawn	Chkd

Client:

Marshalls

Project:

PASTURE HOUSE QUARRY
WASTE RECOVERY PERMIT

Plan Title:

BOREHOLE LOCATIONS

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Project No. 20293	Dwg No. ESSD 6	Rev
Date: Sept 21	Drawn: MS	Chkd: RD	Scale: 1:1500 @ A3