Hydrock Consultants Ltd
Over Court Barns
Over Lane
Almondsbury
Bristol BS32 4DF
United Kingdom

T +44 (0)1454 619533
F +44 (0)1454 614125
E bristol@hydrock.com

Hydrock
www.hydrock.com

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18th January 2013

Bovis Homes Limited

Cleeve Hall

Cheltenham Road

Bishops Cleeve

Cheltenham

Gloucestershire

GL52 8GD

For the attention of Mr Arron Joyner

Dear Arron

Re: Land at Bankside, Banbury - Remediation Strategy

Hydrock has been appointed by Bovis Homes, Barratt Homes and Taylor Wimpey Homes to prepare a remediation strategy for the above site. This strategy is based on a number of sources of information as discussed in the following sections.

The Site

The site is located on land north east of Oxford Road, west of the Oxford Canal and east of Bankside in Banbury (nearest postcode: OX15 4AD, National Grid Reference of centroid 446470E 238326N) and is shown on the site location plan (Drawing C12702-G001).

The site covers approximately 75 ha and is currently predominantly agricultural land with a fenced off area of overgrown open ground predominantly used by dog walkers at the northern end of the site. This is an area on un-licensed tipping and the available information indicates that tipped materials included brick, concrete, timber, ironstone, tarmac, tile, asbestos, flint, ash, coal, slate and metal in a gravelly, sandy, clayey soil matrix. It is thought that the materials were tipped on to the natural surface and may be up to 4 m thick in places.

The proposed development is to comprise combined residential and commercial development with public open space. An indicative masterplan is shown on Paul Drew Design Drawing GE.B.005 (dated 29/06/10). There is a requirement to raise the existing ground levels for flood protection.

Ground Investigation

A number of ground investigations have been carried out in recent years. These are summarised in Hydrock Report R/12702/001 (January 2013). Drawing C12702-G003 gives the locations of all the exploratory holes, together with outcrops of the underlying solid geology and the outline of the tip area in the northern corner.

In the latest round of investigation, Hydrock dug 35 additional trial pits to obtain a better spread of geo-environmental data points and the following analyses were performed:

- 20 Hydrock default suite of determinants for solids comprising: As, B (water soluble), Be, Cd, Cr (III), Cr(VI), Cu, Hg (inorganic), Ni, Pb, Se, V, Zn, cyanide (free), pH, asbestos screen, speciated polycyclic aromatic hydrocarbons (PAH, by GC-MS), total phenols and fraction of organic carbon; and
- 4 Hydrock default waters suite of determinants, following leaching to BS12457-2, comprising: Ag, Al, As, B, Ba, Cd, Co, Cr (III), Cr(VI), Cu, Fe, Hg, Mn, Mo, Na, Ni, Pb, Sb, Se, Sn, Zn, V, cyanide (total), phenols (total), ammonium, bromate, chloride, fluoride, nitrate, nitrite, sulfate, PAH (speciated), pH, EC and hardness.

In conjunction with data obtained previously by others, and assessed as suitable for purpose by Hydrock, this has produced two data sets:

- a total of 28 samples in the tip area (there being between 19 and 28 results for most determinands and 7 for others); and
- a total of 41 samples in the wider site area (there being between 17 and 24 results for most determinands and 41 for arsenic and nickel as a result of bioaccessibility testing).

Generic Quantitative Risk Assessment

The findings of the Generic Quantitative Risk Assessment are as follows:

Human Health

Arsenic and vanadium are present in the natural strata at US_{95} in excess of their generic assessment criteria (GAC). There is no evidence of a man-made source of these metals on the site. The local geology has naturally high levels of arsenic and vanadium and the concentrations at this site are similar to the normal background levels given in *The Advanced Geochemical Atlas of England and Wales* (Rowlins *et al* 2012)[1]. In addition, the arsenic US_{95} is below the site specific assessment criterion (SSAC) when bioaccessibility is taken into account.

Consequently, these metals are not considered a significant risk to human health and in line with the current Contaminated Land Statutory Guidance, which accepts that there may be natural background levels of substances as a result of the geology, no further consideration is considered necessary. However, it is recommended that the opinion of the regulatory authorities be sought in this regard.

The Made Ground also contains arsenic and vanadium and it is most likely that this is also in natural soils that were tipped with the other builders; waste. Consequently, they are not a cause for concern. However, the Made Ground also contains a number of PAH species and is considered unsuitable for use as shallow soil in the proposed garden and soft landscaped areas.

Controlled Waters

No issues have been identified with the soils at the site with regard to the pollution of Controlled Waters.

Plant Life

No issues have been identified with the soils at the site with regard to plant life.

Construction Materials (Water Pipelines)

[1] RAWLINS, B. G., McGRATH, S. P., SCHEIB, A. J., CAVE, N., LISTER, T. R., INGHAM, M., GOWING, C. and CARTER, S. 2012 .*The advanced geochemical atlas of England and Wales.* British Geological Survey, Keyworth.

It is envisaged that standard pipework will be suitable for the majority of the site. However, the investigations were not designed specifically for water pipe runs and because of conflicting and ambiguous guidance contained in UKWIR Report 10/WM/03/02[2] (re-issued 2010), confirmation should be sought from the water supply company at the earliest opportunity.

The organic contamination (including benzo(a)pyrene) in the tip area is in excess of the threshold values barrier pipe is recommended where water supply pipes are to be place within the Made Ground.

Precautions Against Ground Gases

The ground gas risk assessment of the tip area in accordance with CIRIA Report C665, for Situation B, classifies the area as "green" and no protection are be required in respect of methane or carbon dioxide.

Reference to the Annex A maps in BR 211[3] (Scivyer 2007), based on the *Indicative Atlas of Radon in England and Wales*[4] (Miles *et a*l 2007) indicates that Full radon protection is required for new dwellings at this location in line with current guidance.

Remediation Strategy

The proposed remediation strategy for the site is the placement of a simple cover a minimum of 600 mm thick over the Made Ground in the tip area in garden and soft landscaped public open space. The thickness is based on BRE guidance[5] (Hollingsworth 2004) taking into account the PAH concentrations and assuming that the cover material has PAH concentrations less than the respective GACs.

Site-won natural soils from the wider site area can be used. Alternatively, imported clean material can be used. The definition of 'clean' will have to be agreed with the Contaminated Land Officer, but in the first instance can be assumed not to have concentrations of any potential contaminating substance in excess of the GAC.

A geotextile marker layer shall be placed at the base of the cover to alert any person digging that they have reached the base of clean material.

It is understood that site levels are required to be raised in order to provide suitable finished ground levels for the development. The clean cover must be incorporated into this land raising and so must have suitable geotechnical properties. In places where the land raise is less than 600 mm, removal of some Made Ground will be required to ensure a minimum cover thickness of 600 mm.

Made Ground once removed can be re-located elsewhere within the tip area and beneath the cover, roads or hardstanding (so as to sever the contaminant linkages with site end users) in accordance with a Material Management Plan for the site and provided it is geotechnically suitable.

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[2] UK WATER INDUSTRY RESEARCH (UKWIR). 2010 re-issued. Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites. *Report 10/WM/03/21*.

[3] SCIVYER, C. 2007. Radon: Guidance on protective measures for new buildings, extensions, conversions and refurbishment (2007 edition). Building Research Establishment Report BR 211. BRE, Garston.

[4] MILES, J. C. H., APPLETON, J. D., REES, D. M., GREEN, B. M. R., ADLAM. K. A. M. and MYRES. A. H. 2007. Indicative Atlas of Radon in England and Wales. Health Protection Agency and British Geological Survey. Report HPA-RPD-033.

[5] HOLLINGSWORTH, S. C.. 2004. *Cover systems for land regeneration.* BRE, Garston. 88pp + CD-ROM.

The methodology for the remediation should be submitted to the regulators and their approval sought prior to any works taking place.

Following completion of the above works verification reports, undertaken by a suitably qualified independent engineer will be required for approval by the NHBC and the regulatory authorities.

Foundations will have to be taken down to natural ground and consideration given to protection of water supply pipes and other utilities.

Additionally, the ground workers should be advised that there may be contamination present that has not been recorded in the site investigation works. Should any visible gross or olfactory evidence of contamination be noted Hydrock should be contacted to inspect and or sample the material and recommend a suitable remedial approach.

Waste Management

Any material excavated on site may be classified as waste and it is the responsibility of the holder of a material to form their own view on whether or not it is waste. This includes determining when waste that has been treated in some way can cease to be classed as waste for a particular purpose.

One of the ways this can be achieved is set out in the Development Industry Code of Practice[6] (CoP) (CL:AIRE, September 2008).

The handling, re-use or disposal of waste is regulated by the Environment Agency. The Agency will take into account the use of the CoP in deciding whether to regulate materials as waste. If materials are dealt with in accordance with the CoP, the Agency considers that those materials are unlikely to be waste at the point when they are to be used for the purpose of land development. This may be because the materials were never discarded in the first place, or because they have been submitted to a recovery operation and have been completely recovered so that they have ceased to be waste.

A Materials Management Plan (MMP) should be used to allow the re-use of soils at the site. The MMP must be signed off by a Qualified Person as defined in the CoP.

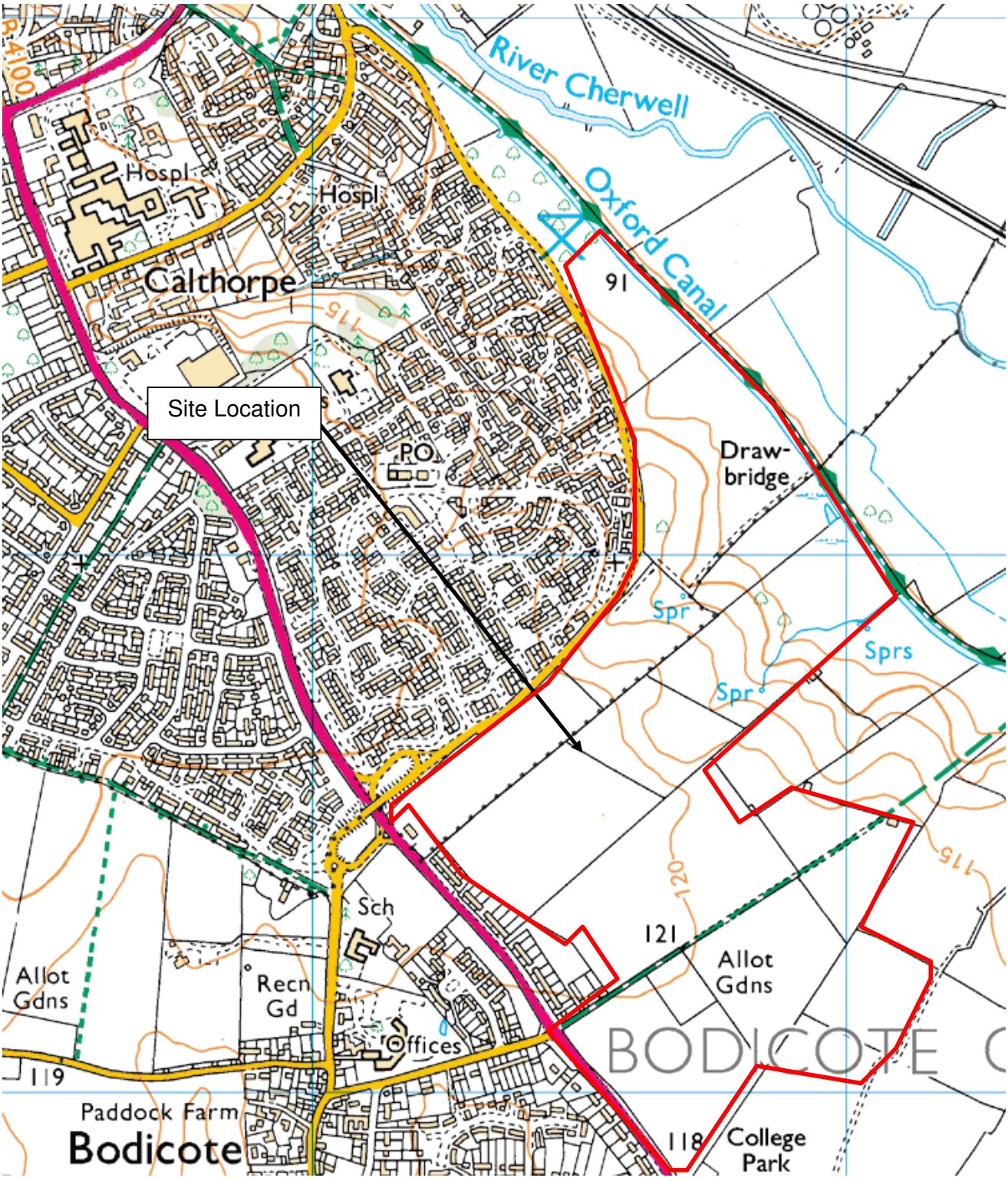
If you need any further information or wish to discuss our recommendations further please do not hesitate to contact the undersigned.

Yours sincerely
for **Hydrock Consultants Ltd**

Robert Hooker
Principal Engineer
roberthooker@hydrock.com

Enc: Site Location Plan (Drawing Number C12702-G001).
Geo-environmental Zonation Plan (Drawing Number C12702-G003).

[6] CL:AIRE. March 2011. T*he Definition of Waste: Development Industry Code of Practice, Version 2.* Contaminated Land: Applications in the Real Environment (CL:AIRE), London.



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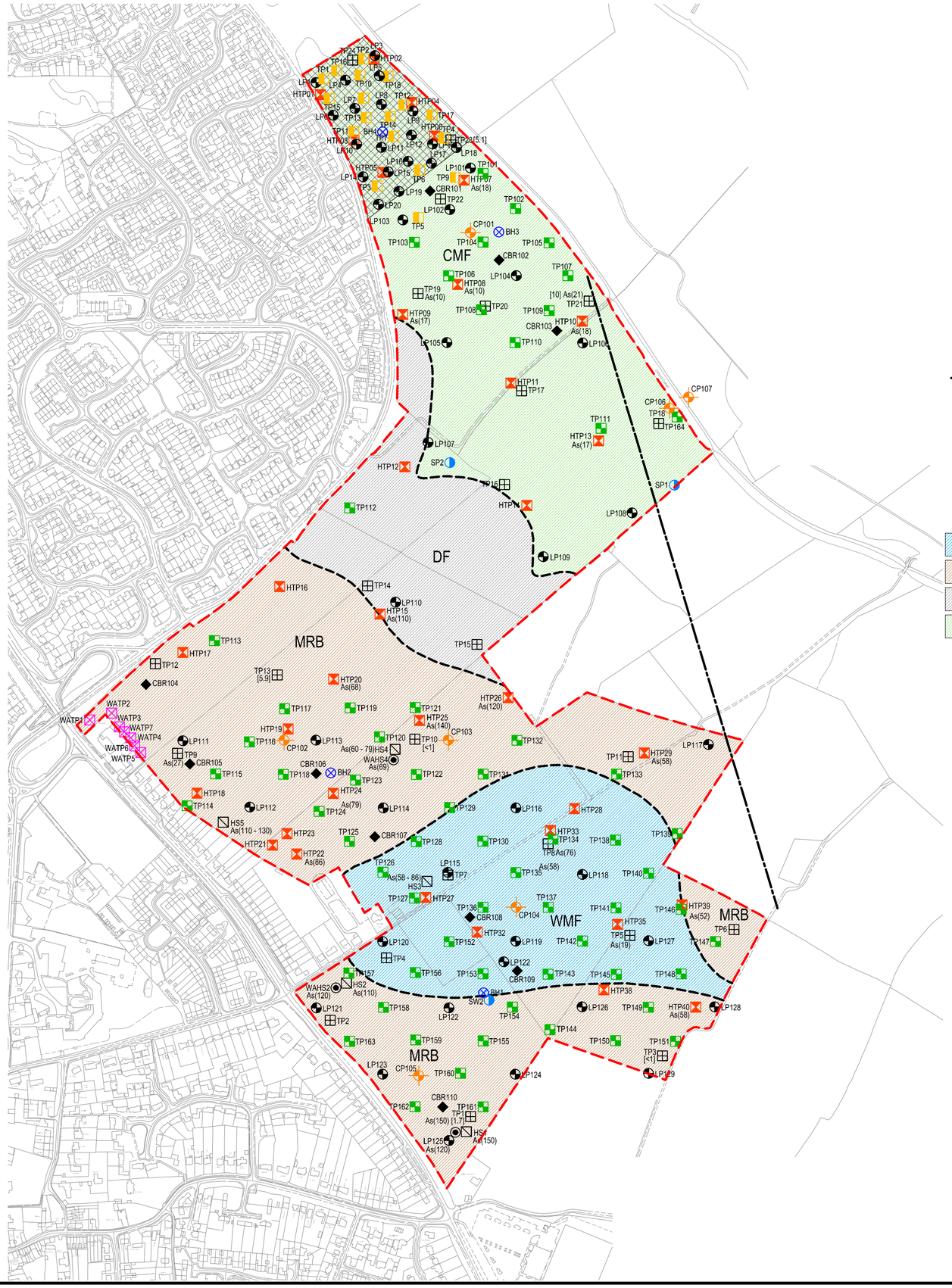
Client: Bovis Homes	
Site: Land at Bankside Banbury	
Drawing No: C12702/G001	
Title: Site Location Plan	
Scale: NTS	

Hydrock Consultants

Over Court Barns
Over Lane
Almondsbury
Bristol BS32 4DF

Tel: +44 (0)1454 619 533
Fax: +44 (0)1454 614 125



SITE BOUNDARY
TRIAL PIT - HYDROCK 2012
HISTORICAL WELL
HISTORICAL TRIAL PIT - 2012
HISTORICAL TRIAL PIT - APRIL 2006
HISTORICAL TRIAL PIT - 2005
HISTORICAL TRIAL PIT - MAY 2007
HISTORICAL HAND SAMPLE - JUNE 2007
HISTORICAL TRIAL PIT - DEC 2011
HISTORICAL BOREHOLE - APRIL 2006
CABLE PERCUSSION BOREHOLE
CBR TEST
WATER SAMPLE
RISING MAIN (ASSUMED ROUTE)
As(21) ARSENIC (mg/kg)
[5.1] PBET (%)
TIP AREA

GEOLOGY

GEOLOGICAL BOUNDARY
WMF WHITBY MUDSTONE FORMATION (MAINLY CLAY)
MRB MARLSTONE ROCK BED
DF DYRHAM FORMATION (CLAYS & SILTS)
CMF CHARMOUTH MUDSTONE FORMATION (MAINLY CLAY)

NOTE - GEOLOGY BASED ON WARDELL ARMSTRONG 2012 REMEDIATION GROUND INVESTIGATION REPORT.

Notes:

Rev	Date	Description	By	Ckd
A	18/01/13	Issued for Information	NG	RS

Hydrock
Over Court Barns
Over Lane
Almondsbury
Bristol BS32 4DF
TEL: 01454 619 533
FAX: 01454 614 125
E-Mail: bristol@hydrock.com
or visit www.hydrock.com

Client
BOVIS HOMES

Project
LAND AT BANKSIDE, BANBURY

Title
Geo-environmental Zonation Plan

Drawing Status
INFORMATION

Job No.
C12702

Drawn	Checked	Scale at A2	Date	Issue Date
NG	RS	1:5000	18/01/13	18/03/13

Drawing No.
C12702 - G003

Revision
A

Notes:
All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.
This drawing is to be read in conjunction with all relevant Engineers' and Service Engineers' drawings and specifications. This drawing is copyright.