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Barratt Homes (Eastern Counties)

Remediation Strategy & Verification Plan

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Project Revision Sheet

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1 Introduction

1.1 General

This report is a Remediation Strategy & Verification Plan and has been prepared by MLM Consulting Ltd (MLMCL) for Barratt Homes (Eastern Counties), which is proposing the development of the site off Rectory Road, Hawkwell for new housing estate.

1.2 Development Proposals

It is understood that the proposed development includes the construction of 175 private and affordable residential units with associated infrastructure, parking, garden area, open space and maintained woodland. The proposed layout is shown on Woods Hardwick site layout drawing ref. H4606/200B rev. B, dated October 2012.

1.3 Current Planning Status

A planning application for the development has been submitted to Rochford District Council.

1.4 Context and Objectives

The site is brownfield land previously developed as a horticultural nursery.

Previous investigations and assessments by MLMCL have identified remediation requirements for the redevelopment.

This report presents a Remediation Strategy and Verification Plan for the site based on these investigations and assessments.

This document will be submitted pursuant to anticipated contaminated land planning conditions.

1.5 Remediation Strategy Overview

This report presents a Remediation Strategy and Verification Plan, which when implemented, will ensure that the site is suitable for future use when developed.

The document sets out the principles to be applied in remediation in terms of the methods to be employed and general requirements for mitigation of human health and environmental receptors on and off the site.

In summary, the following remediation requirements have been identified and are covered in this document:

- Capping in selected garden and landscape areas
- Installation of upgraded water supply pipes

Details of planned remediation activities are set out in section 7.

Although not part of remediation, a redundant water well is in the southeast of the site and is to be decommissioned in accordance with the MLM specification contained within Appendix A.

1.6 Remediation Basis

Remediation of land affected by contamination includes putting into effect measures that prevent or mitigate the effects of contamination and as a result would reduce risks to an acceptable level.

The Remediation Strategy is based on the findings of previous investigations and assessments. This report should therefore be read in conjunction with the following documents:

- MLMCL (June 2013) Phase II geoenvironmental assessment report. Ref. DMB/724005/R1
- MLMCL (December 2011) Phase II geoenvironmental assessment report. Ref. DMB/723382/R2
- MLMCL (January 2008) Preliminary geoenvironmental site assessment. Ref. DMB/731044/R1 revision 1

The Remediation Strategy and Verification Plan has been developed for the site incorporating, where appropriate, the guiding principles of the following documents:

General

- Defra & Environment Agency (2004) Model Procedures for the Management of Land Contamination. CLR11
- Environment Agency (2010) Guiding Principles for Land Contamination. GPLC1-3
- Environment Agency (2010) Verification of Remediation of Land Contamination. Science report SC030114/R1
- Environment Agency (2001) General guide to the prevention of pollution: PPG1

Cover Systems and Landscaping

- British Standards Institute (2007) Specification for topsoil and requirements for use. BS 3882:2007
- BRE (2004) Cover systems for land regeneration. BRE 465
- NHBC (2012) Technical extra: Verification of cover systems – testing criteria for subsoil and topsoil. Issue 08

1.7 Legislative Framework

The following legislation is relevant to the preparation of this Remediation Strategy and Verification Plan and to the implementation of remediation including measures for the control and prevention of pollution during works involving remediation.

Key Legislation

Environment Act 1995 – sets out a system to identify and repair contaminated land.

Environmental Protection Act 1990 - defines the legal framework for duty of care for waste, contaminated land and statutory nuisance.

Contaminated Land (England) (Amendment) Regulations 2012 - sets out provisions relating to the identification and remediation of contaminated land.

Water Resources Act 1991 (as amended 2009) - sets up the regime to conserve, manage and control pollution of water resources.

Relevant Legislation

Environmental Damage (Prevention and Remediation) Regulations 2009 - brings into force rules to force polluters to prevent and repair damage to water systems, land quality, species and their habitats and protected sites.

Pollution Prevention and Control Act 1999 – sets out provisions for regulating activities which are capable of causing pollution and measures for preventing or controlling emissions capable of pollution.

Control of Pollution (Oil Storage) (England) Regulations 2001 - imposes general requirements for preventing pollution of controlled waters from oil storage, particularly fixed tanks or mobile bowsers.

The Controlled Waste Regulations 1992 (as amended 1993) - defines waste types for waste management licensing purposes.

The Controlled Waste (Registration of Carriers and Seizure of Vehicles) Regulations 1991 (as amended 1998) - introduces a registration system for carriers of controlled waste.

The Environmental Protection (Duty of Care) Regulations 1991 (as amended 2003) - imposes a duty of care on any person who imports, produces, carries, keeps, treats or disposes of controlled waste to ensure there is no unauthorized or harmful depositing, treatment or disposal of the waste.

The Hazardous Waste (England and Wales) Regulations 2005 (as amended 2009) - details requirements for controlling and tracking the movement of hazardous waste and bans mixing different types of hazardous waste

Water Supply (Water Fittings) Regulations 1999 – sets out the requirements for the design and installation of service pipes and water mains underground to protect water consumers when laying unprotected water supply pipes in contaminated ground.

1.8 Sustainable Remediation

In line with best practice, it is proposed to adopt where possible remediation that is compatible with sustainable development principles.

The key principles that are associated with sustainable remediation and which should be considered in the design, implementation and reporting of sustainable remediation schemes are as follows:

Principle 1 - Protection of human health and the wider environment. Remediation should remove unacceptable risks to human health and protect the wider environment now and in the future for the agreed land use and give due consideration to the costs, benefits, effectiveness, durability and technical feasibility of available options.

Principle 2 - Safe working practices. Remediation works should be safe for all workers and for local communities and should minimise impacts on the environment.

Principle 3 - Consistent, clear and reproducible, evidence-based decision-making. Sustainable risk-based remediation decisions are made having regard to environmental, social and economic factors, and consider both current and likely future implications.

Principle 4 - Record keeping and transparent reporting. Remediation decisions, including the assumptions and supporting data used to reach them, should be documented in a clear and easily understood format in order to demonstrate to interested parties that a sustainable solution has been adopted.

Principle 5 - Good governance and stakeholder involvement. Remediation decisions should be made having regard to the views of stakeholders and following a clear process within which they can participate.

Principle 6 - Sound science. Decisions should be made on the basis of sound science, relevant and accurate data and clearly explained assumptions, uncertainties and professional judgement. This will ensure that decisions are based upon the best available information and are justifiable and reproducible.

2 Site Background and Environmental Setting

2.1 Site Location

The site is located to the north of Rectory Road, southwest of Hawkwell village centre, Essex. The National Grid Reference for the site is 585000, 191500.

The site location is presented as Figure 1.

2.2 Site Description

The site is irregular in shape, and covers an area of approximately 14 hectares.

The site is largely undeveloped, with the exception of buildings associated with a Christmas tree farm in the southeast; barns in the centre of the site; nursery buildings and greenhouses in the southwest, and farm buildings in the west. In the north of the site are open paddocks and woodland. A redundant water well, contained within a small wooden structure, is in the southeast.

The site is being prepared for the start of building works, and large areas of the site are being cleared, with on-site buildings being demolished.

2.3 Site History

The site was undeveloped up until between 1923 and 1938 after which a nursery with associated buildings was on site. The buildings included workshops (some used for light engineering and car repair work), two boiler houses each with aboveground storage tank (AST), glasshouses and coal store.

Across some external areas was evidence of potential contamination in the form of automotive parts, scrap metals, fuel/oil containers, general waste and burnt remains.

2.4 Ground Conditions

The ground conditions encountered in the previous investigation by MLMCL encountered the following general strata sequence:

Stratum	Top range (m bgl)	Thickness range (m)	Soil description
Topsoil	GL	0.1 – 0.5	Sandy gravelly clay
Made ground	GL	0.2 – 1.2	Encountered in approximately 50% of the exploratory holes. Generally less than 0.5m thick though locally deeper. There are two types of made ground; a reworked brown sandy gravelly clay or soils comprising gravelly clay with concrete, brick, ash and occasionally plastic, metal and rarely cement sheet.
Head deposit	GL – 0.6	0.2 – 1.7	Brown and orange brown gravelly and occasionally silty and sandy clay is present locally from the ground surface or below made ground.
London Clay	GL – 2.0	19.8 – 20.0+	Encountered in all exploratory holes, the upper 2-3m comprised soft to stiff and where significantly desiccated very stiff brown occasionally sandy clay becoming grey mottled brown with depth. At approximately 7m bgl the London Clay becomes stiff or very stiff dark grey fissured clay with selenite crystals.

+ Base of stratum not proven

2.5 Groundwater

Groundwater seepages were not encountered during the initial phase of investigation in 2011, however during the February 2013 investigation groundwater was encountered in 4.57 – 4.80m bgl.

During post-fieldwork monitoring in 2011 and 2013, water levels were between 0.26m and 1.75m bgl. These levels were considered to possibly be representative of surface water entering wells via shallow made ground.

2.6 Ground Gas Conditions

Stratum	Description
Number of visits	6
Date range(s)	7 Oct 2011 to 24 Mar 2013
Methane concentration (% max.)	<0.1
Carbon dioxide concentration (% max.)	4.7
Gas flow rate (l hr^{-1} max.)	0.7

2.7 Hydrogeology

The Environment Agency website provides the following hydrogeological information:

Aspect	Designation	Description
Groundwater Source Protection Zone	No SPZ	The site is not within a catchment area where groundwater is discharged to a source.
Aquifer designation – superficial deposit (Head)	Secondary Aquifer (undifferentiated)	Assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
Aquifer designation – bedrock deposit (London Clay)	Unproductive Strata	These are deposits with low permeability that have negligible significance for water supply or river base flow.

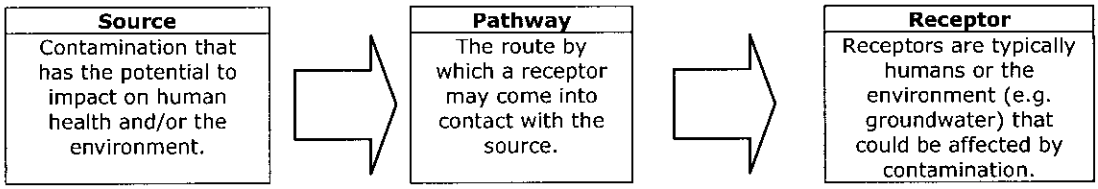
2.8 Hydrology

The Hawkwell Brook runs west to east along the northern boundary of the site and flows into the River Roach, located approximately 1.5km south of the site.

3 Contamination Risk Assessment

3.1 General

The assessment of risk from contamination follows the source-pathway-receptor approach. Each of these elements is described as follows.



Without a source-pathway-receptor linkage in place, it is considered that there is no risk of harm and remediation is unlikely to be required.

If, however, there is a linkage between source and receptor then a risk-based approach is used to assess the significance or potential impact of the SPR-linkage to determine if remediation is required.

Such an assessment involves Quantitative Risk Assessment (QRA). The QRA process involves the identification of sources based on site investigation findings (e.g. compound concentration exceeding Generic Assessment Criteria) together with identification of the exposure pathway and sensitive receptor. A Conceptual Site Model (CSM) is then developed and presented that shows the possible pollution linkages.

In terms of identifying *significant* pollution linkages (i.e. those that require remediation), MLM assigns a level of risk (ranging from Very High to Very Low) to each. Where the level of risk is Moderate or greater, then the pollution linkage is considered to be 'significant' and remediation is required.

3.2 Data Used in QRA

Intrusive investigation of the site has previously been undertaken as follows:

Organisation	Purpose	Fieldwork	Testing
MLMCL (2008)	Preliminary geoenvironmental assessment	7 trial pits (1.0-2.2m)	Soil samples for metals, TPH, PAH, BTEX, total cyanide, total sulphate, pH
MLMCL (2011)	Phase II geoenvironmental assessment	3 cable tool boreholes (20m) 24 windowless sampler boreholes (3.0-5.45m) 6 hand-held windowless sampler boreholes (1.9-3.0m) 20 trial pits (0.35-4.3m) 3 gas monitoring visits	Soil samples for metals (30), TPHCWG (2), speciated PAH (24), asbestos (7), pH (1), sulphate (8) and organic matter (4) Groundwater sample (1) for metals, speciated PAH and hardness
MLMCL (2013)	Updated phase II geoenvironmental assessment	3 gas monitoring visits	-

3.3 Identified Significant Pollutant Linkages

The CSM presented below is based on the above contamination assessment reports which identified significant pollution linkages requiring remediation or mitigation.

Source/Contaminants	Pathway	Receptor
Metals and PAH compounds in made ground	Ingestion, dermal contact and inhalation	Site end users
Asbestos in made ground	Inhalation	Site end users
Zinc in made ground	Plant uptake	Plant life
PAH compounds in Made Ground	Contact and potable water consumption	Water supply pipes and water consumers
Contamination in Made Ground generally	Direct contact	Construction and services maintenance staff
Metals and PAH compounds in made ground	Surface runoff	Hawkwell Brook

4 Land Remediation Options Appraisal

4.1 Pollutant Linkages

There are three main ways to reduce or control unacceptable risks from land contamination. These are as follows.

- Remove or treat the contamination source
- Remove or modify the pathway
- Remove or modify the behaviour of receptors

For the purpose of this Remediation Strategy and Verification Plan the identified receptors cannot be removed or their behaviour modified. The focus of the Remediation Strategy and Verification Plan is therefore to set out processes for dealing with contamination sources and/or breaking significant pollutant pathways.

4.2 Remediation Objectives

In consideration of the proposed development, the nature, location and level of the contaminants present together with the potential liability associated with contaminated land, a number of key objectives have been identified for site remediation.

Key Objectives

- Reduce to an acceptable level the risk to human health and environmental receptors both on and off the site
- To meet with the requirements of an anticipated contaminated land planning condition
- Provide sufficient information to allow discharge of NHBC land quality conditions

Management Objectives

- Produce a plan that can be agreed with the client and regulators
- Minimise environmental impacts from contamination and remediation activities
- Adopt sustainable practices
- Use commercially available techniques that have a proven track record
- Use techniques that are durable and have few or no long term maintenance requirements
- Use techniques that are financially viable

Technical Objectives

- Remediation is implemented and verified

4.3 Remediation Options

In this section a range of feasible remediation options have been identified and discussed for dealing with the significant pollutant linkages. Where further information is required before the feasible options can be narrowed down to one method this is indicated below:

Source to be Remediated	Receptor to be Protected	Remediation Options	Quantum Estimates
Metals in soil hotspots: Area 1 – TP109 (0.35m) Area 2 – WS26 (0.50m) Area 3 – TP6 (0.40m) Area 4 – TP17 (0.45m) Area 7 – WS6 (0.40m)	Site end users	Capping in selected garden and landscape areas. Some contaminated soils may be removed by virtue of site strip/remodelling Complete removal of contaminated soil may be feasible in some locations where the thickness of contaminated made ground is shallow.	Area 1 (plots 6 to 8) Area 2 (plots 78, 79, 95 & 96) Area 3 (plots 31 to 36) Area 4 (plots 60 to 63) Area 5 (plots 71, 72 & 76) Area 6 (plots 106, 122, 123 front, 151, 152) Area 7 (plots 116 to 118)
Metals and PAH in soil hotspots: Area 5 – WS24 (0.40m) Area 6 – TP13 (0.35m)			
Asbestos Area 3 – TP8 Area 8 – WS105 Area 9 – WS108	Site end users	As above	Area 3 (plots 31 to 36) Area 8 (plots 65 to 70) Area 9 (open space)
Nickel in soil hotspot Area 6 – TP13 (0.35m)	Plant life	As above	Area 6 (plots 106, 122, 123 front, 151, 152)
TPH and PAH in made ground	Water supply pipework and water consumers	Upgrade of water supply pipes for resistance to organic compounds	Whole site where made ground is present
Contamination in made ground generally	Construction workers	Adopt appropriate working practices and PPE	Whole site where made ground is present
	Services maintenance staff	Adopt appropriate working practices and PPE; and Construct services in clean corridors	Whole site where made ground is present

5 Remediation Sequence

5.1 Project Phasing and Timescales

Development is anticipated to proceed in phases as follows:

- Demolition
- Site strip
- Decommission redundant water well
- Infrastructure
- Foundation construction
- Above-ground construction
- Landscaping

5.2 Remediation Sequence

There is anticipated to be the following arrangement of activities:

- Installation of upgraded water supply pipes and clean corridors
- Capping in garden/landscape areas
- Verification

6 Implementation Plan

6.1 Roles and Responsibilities

The table below sets out who will be involved with the various stages and aspects of the remediation.

Organisation	Name
Client	Barratt Homes (Eastern Counties)
Planning Supervisor	TBC
Project Manager	TBC
Principal Contractor	TBC
Regulators	Environment Agency (Hatfield) Rochford District Council
Environmental Consultant	MLM

6.2 Quality Assurance

Quality assurance is an important thread throughout the implementation of the remediation strategy. There are two key features:

i) The need to provide an accurate and permanent record of remediation and the standard it has achieved (the Verification Report)
ii) Remediation may need maintenance and/or monitoring to achieve or demonstrate on-going effectiveness

The Verification Plan details what is to be measured on site during remediation and how records will be kept and maintained throughout the project for use in the verification report on completion of the remediation.

6.3 Permits and Approvals

Some aspects of the remediation could require permits and approvals as follows:

- The site has planning permission from Rochford District Council for the development (ref. 13/00035/NMA)
- Agreement is required from Rochford District Council (planning and environmental health departments) and the Environment Agency of this Remediation Strategy and Verification Plan
- If groundwater is to be discharged to a watercourse a discharge consent will be required from the Environment Agency
- If groundwater is to be discharged to a foul sewer a trade effluent discharge consent will be required from the local sewerage undertaker

6.4 Changes to Design

This Remediation Strategy and Verification Plan should be considered a 'living document' and will require reviews and updates if plans change for works, layout, use etc on site.

6.5 Variation and Contingency Plan (Unforeseen Contamination)

No amount of previous investigation can completely identify all possible soil and contamination conditions across the site and there is the potential for unforeseen circumstances and contamination to be encountered during construction that are not covered by this Remediation Strategy and Verification Plan and will need to be dealt with during the site works.

The procedure below will be followed in the event that unforeseen contamination is encountered during remediation works:

- Take whatever action is required to prevent immediate harm to health and safety or site workers and the general public or environmental receptors in the interim
- Inform environmental consultant
- Identify source of contamination and its extent
- Determine if there are impacts which require additional remediation or whether it can be included in a variation to the existing works
- Agree variation in course of action with regulators and undertake verification and reporting

6.6 Verification

Demonstrating the remediation objectives and criteria have been met will be achieved through the verification process. The Verification Plan sets out the detailed data requirements, including compliance criteria, sampling frequencies and analytical suites necessary to demonstrate that remediation objectives have been met.

The Verification Report is prepared at the end of the remediation and incorporates all site test data and measurements of quality-critical parameters, as well as records of the management of recovery or disposal of materials at the site. This includes materials that have been re-deposited on site, recovered for re-use, taken off site for treatment or imported as backfill.

The Verification Report will demonstrate that remediation has complied with relevant legislation, the planning conditions for the site and that the outcome of the project has met its remediation objectives and criteria.

6.7 Maintenance

Protected services can require maintenance (e.g. like for like repair of water supply barrier pipe) and following their installation it will be necessary for a copy of this strategy document to be kept of the CDM file for the site.

No other permanent structures requiring maintenance will be constructed as part of remediation.

6.8 Monitoring

Long term monitoring of remediation or contamination is not required.

7 Remediation Activities

The remediation activities are described in this section.

7.1 Remediation Overview

In summary, remediation is to comprise the following:

- Capping in selected garden and landscape areas
- Installation of upgraded water supply

During construction there are also requirements for the following:

- Protection of site workers and the general public
- Decommissioning of redundant water well

A preliminary illustrated site remediation plan is presented in Figure 2.

7.2 Enabling Works

Certain works can be carried out on site prior to decommissioning, remediation or demolition/construction to facilitate an early start on site. Subject to planning restrictions, enabling works could include:

- Demolition
- Site strip
- Preparation of contractors site compound etc
- Decommissioning of redundant water well

7.3 Capping in Garden and Landscape Areas

To protect site occupants and users from exposure to soil contamination, capping soils will be installed on site as follows:

Area	Requirement
Gardens	Clean soil min. 600mm thick Area 1 (plots 6 to 8) Area 2 (plots 78, 79, 95 & 96) Area 3 (plots 31 to 36) Area 4 (plots 60 to 63) Area 5 (plots 71, 72 & 76) Area 6 (plots 106, 122, 123 front, 151, 152) Area 7 (plots 116 to 118)
Landscape	Include landscape verges adjacent plots listed above.
Open space	Not required
Soil characteristics	Capping soils may be either imported or re-used from site. Capping soils will be compatible with landscape and planting requirements and free from contamination (eg. contaminant concentrations below GAC, SGV or EQS). Capping will be in addition to topsoil and the minimum thickness should be achieved after compaction and settlement. Soils failing the verification criteria will not be used in the development and will require removal off site or re-used on site beneath clean capping, buildings or hard paving.

Notes	Verification of capping soil quality is required. Capping is not required beneath buildings or permanent hard paving such as site roads, parking and footpaths. Where existing trees are to be retained or are subject to TPO, capping thickness may be reduced or eliminated. Where made ground is absent after site strip then requirements for capping should be reviewed as contaminated soils could have been removed.

7.4 Removing Aboveground Storage Tanks (ASTs)

An AST have been identified on site. The following description of AST removal is provided as guidance only.

ASTs and pipework will be fully drained before they are taken out of use and removed. Containment bunds surrounding tanks will remain in place until ASTs and pipework are drained. Prior to removing containment walls, bunds shall be inspected and any contamination or liquids (including rainwater) removed.

Additional detailed guidance can be found in the Environment Agency Pollution Prevention Guideline, *Above ground oil storage tanks: PPG2* (2006).

Verification of AST removal is required.

7.5 Removing Underground Storage Tanks (USTs)

USTs have not been identified at the site.

7.6 Protected Water Supply Pipes

Requirements for protected water supply pipes are set out in guidance published by UKWIR (UK Water Industry Research) entitled *Guidance for the selection of water supply pipes to be used in brownfield sites (2010)* and if implemented, will comply with the Water Supply (Water Fittings) Regulations 1999.

As a guide, protected water supply pipes are most commonly installed using compound pipes incorporating an aluminium barrier between layers of polyethylene (so-called barrier pipe) and, less commonly, metallic (ductile iron or copper).

The local water supply company should be contacted to determine their detailed requirements and obtain approval prior of the design of water supply pipework prior to installation.

Important: Local water supply company requirements will normally take precedence over the requirements of this RSVP.

7.7 Clean Corridors

All services installed below ground in areas where soil contamination is present should be run in 'clean corridors' to enable future maintenance to be in uncontaminated soils.

Clean corridors often entail services being laid in oversized trenches containing clean bedding and backfill materials.

7.8 Ground Gas and Organic Vapour Protection

Gas/vapour protection is not required for new buildings on site.

7.9 Groundwater Remediation

Groundwater remediation is not required.

8 Verification of Remediation

This section sets out the requirements for gathering data/evidence to demonstrate that remediation meets the remediation objectives and criteria. It includes monitoring, sampling and testing criteria, and identifies all those records that should be retained to demonstrate compliance with the specification.

8.1 Verification Requirements

The elements of remediation requiring verification are as follows:

Remediation	Verification work to be undertaken
Topsoil and capping soil in garden and landscape areas	Imported natural soils to be tested for CLEA metals, speciated PAH (USEPA16) and organic matter. Re-used, recycled or manufactured soils to be tested for CLEA metals, speciated PAH (USEPA16), TPHCWH AA-splits and organic matter. Frequency of sampling and testing: 1. Gardens* -1 test every 3 plots either in situ or equivalent in stockpiles. Minimum number of tests is 7. 2. Landscaping - minimum of 1 test per 100m^3 or 1 test per 150m^2. *Frequency of testing according to the number of units requiring capping (28) is in line with NHBC publication, *Technical Extra: guidance and good practice - verification of cover soils* (2012)
Installation of upgraded water supply pipes	Contractor will keep a record of water supply pipe construction for inclusion in the verification report. Suitable documents can include delivery notes or invoices provided they refer to materials/services that can only be attributed to work at the site. Alternatively, site visits/photographic record during pipe laying.
Unforeseen contamination	In accordance with a scheme to be agreed with the Regulator.

8.2 Remediation Targets

The remediation targets to be achieved are as follows.

Aspect	Verification criteria to be achieved
Soil used as topsoil and capping in garden and landscape areas	Metals - CLEA SGV and LQM/CIEH GAC for residential use TPH and PAH compounds - LQM/CIEH GAC for residential use Soil not achieving the verification would need to be replaced or capped and alternative verified soils used.
Installation of upgraded water supply pipes	Upgraded water supply pipes installed.
Unforeseen contamination	In accordance with a scheme to be agreed with the Regulator.

9 Verification Reporting

The Verification Report is a document that provides a complete record of all remediation activities on site and the data collected as identified in the verification plan to support compliance with agreed remediation objectives and criteria. It also includes a description of the work undertaken and details of any unexpected conditions found during remediation and how they were dealt with.

9.1 Content

Aspects of the enabling and remediation works and their verification and documentation to be included in the Verification Report will be as follows:

- Results of testing of topsoil/subsoil/capping imported to site
- Plans showing verification sample locations
- Records of protected services installation
- Documentation of variations and unforeseen contamination
- Records of off site disposal of soil and groundwater
- Consents, permits and approvals
- As-built drawings
- Other records (e.g. correspondence, photographs etc)
- Results of further investigations

This list is not exhaustive and all records considered relevant to the post-remediation site condition should be included.

9.2 Statement of Final Site Completion

In addition to the provision of factual data, the Verification Report will confirm if the remediation objectives and verification criteria were met.

Where the standard of remediation falls short of the original objectives and/or verification criteria this will need to be documented to the satisfaction of the regulators.

In such circumstances it will (1) need to be demonstrated that all reasonable attempts were made to complete the remediation, (2) set out what residual risks may exist and (3) what monitoring, maintenance or other provisions may be needed to reduce risks to manageable or acceptable levels.

10 Working Practices

This section covers generic requirements for dealing with soil, groundwater and gas/vapour contamination when undertaking remediation and associated works on site.

10.1 Health and Safety

There will be provision for the health and safety of site workers during the construction phase of the development for remediation in accordance with current health and safety legislation, principally the Health and Safety at Work etc Act 1974.

The remediation is likely to be undertaken under a single contract incorporating demolition and construction. As such the remediation will come under the Construction Design and Management Regulations 1994 (CDM) and the following will be required.

- Induction of site workers
- Risk assessments
- Identification and handling of potentially hazardous materials/articles
- Personal Protective equipment to be used
- Permits to work, restricted areas, prohibited operations
- Personal hygiene, housekeeping and safety
- Actions to be taken in an emergency (Contingency Plans)

Additional guidance can be found in:

- HSE Publication HSG66: *Protection of Workers and the General Public during Development of Contaminated Land*

10.2 Dust Control

Dust can be generated by plant and machinery undertaking remedial activities, particularly in dry and windy conditions. Minimisation of dust nuisance and windblown pollution can be undertaken by one or a combination of the following.

- Damping down roads, stockpiles etc with water
- Water mist curtains
- Maintain grass, hardstanding or tree cover for as long as possible
- Screen working areas with hoarding
- Plan work to avoid double-handling
- Adopt careful handling of materials (eg. when digging through soils keep bucket heights low)
- Traffic management
- Sheet vehicles leaving site
- Avoid tracking soil onto the highway
- Sweep hardstandings to reduce dust build up
- Concrete crushing plant will not be run without an appropriate dust suppression measure and will be licensed
- Induction of operatives to cover necessary actions required for certain methods of work
- Maintain skips and haulage vehicles to a safe level, avoiding overfilling
- There will be no burning of material on site
- Waste will be dealt with in accordance with a site waste management plan.

Additional guidance can be found in:

- HSE Publication HSG66: *Protection of Workers and the General Public during Development of Contaminated Land*
- EA Pollution Prevention Guideline PPG6: *Working at construction and demolition sites*

10.3 Control of Surface Runoff

Surface runoff from the site could contain sediment and contamination in solid and dissolved phase, which could enter the drainage network on surrounding land. Minimisation of contaminated runoff can be undertaken by one or a combination of the following.

- Carefully manage damping down of dust activities to avoid runoff in the first place
- Maintain grass, hardstanding or tree cover for as long as possible
- Place stockpiles away from the watercourse and site drains
- Avoid creation of steep slopes on stockpiles etc that increase potential for runoff
- Avoid tracking soil onto the highway
- Provide temporary surface water management measures (eg. bunding, stopping off of drains, creation of settlement lagoons etc)

Additional guidance can be found in:

- EA Pollution Prevention Guideline PPG6: *Working at construction and demolition sites*
- EA Pollution Prevention Guideline: *Works and maintenance in or near water* (PPG5).

10.4 Protection of Soil and Groundwater During Remediation

Certain remediation works can inadvertently increase the extent or volume of contamination and the following practices should be adopted.

- Temporary storage of contaminated soils will be on surfaces such as hardstanding or plastic liners to prevent contamination leaching into soils
- Adopt 'Control of Surface Runoff' measures listed above
- Do not dispose of groundwater by recharging into soils where there is a risk that it is contaminated
- Carry out testing of imported soils
- Put in place procedures and facilities for refueling, vehicle maintenance, storage of hazardous substances and waste
- Any soil encountered during construction of services, foundations etc shall only be re-used in the permanent works if it is used below buildings and hardstanding areas and is demonstrated not to present a risk to human health or environmental receptors

Additional guidance can be found in:

- EA Pollution Prevention Guideline PPG1: *General guide to the prevention of water pollution*
- EA Pollution Prevention Guideline PPG5: *Works and maintenance in or near water*

- EA Pollution Prevention Guideline PPG6: *Working at construction and demolition sites*
- EA Pollution Prevention Guideline PPG7: *Refuelling facilities*

10.5 Disposal of Soil Contamination

No waste material shall be deposited off site other than at a public or private disposal site controlled or appropriately permitted by the Environment Agency.

The contractor is to comply with all legislation governing the disposal of controlled waste.

Transportation of controlled waste should only be carried out by a registered waste carrier or holder of a waste management licence.

10.6 Groundwater Disposal

Groundwater resulting from dewatering on site does not require off site disposal and unless it is contaminated can be discharged onto areas of grassland or into sumps and allowed to soak into the ground.

Discharge of groundwater to sewer or surface watercourse will require consent from the Environment Agency or local sewerage undertaker as appropriate.

10.7 Transport and Disposal Records

Records in the form of waste transfer/consignment notes for contaminated soil and groundwater together with details of receiving landfills or treatment plant licenses should be retained and submitted as part of the remediation validation process.

10.8 Working near Water

The development is close to a watercourse off site comprising the Hawkwell Brook.

Work on site will comply with the Environment Agency Pollution Prevention Guideline 5 (PPG5) *'Works and maintenance in or near water'* as appropriate.

10.9 Stockpiles

During the course of demolition/remediation/construction volumes of various materials will need to be stored at a number of locations at different stages. General guidance for stockpiles is as follows:

- Form stockpiles away from surface watercourses and drains
- Slopes to be battened back to prevent spalling and at gradients which minimise surface runoff.
- Plan stockpiling activities ahead to reduce fuel use, emissions and dust from vehicle movements and handling
- Stockpile contaminated soils on impermeable surfaces such as hardstandings or plastic sheeting (and bund where necessary)

10.10 Materials Management Plan

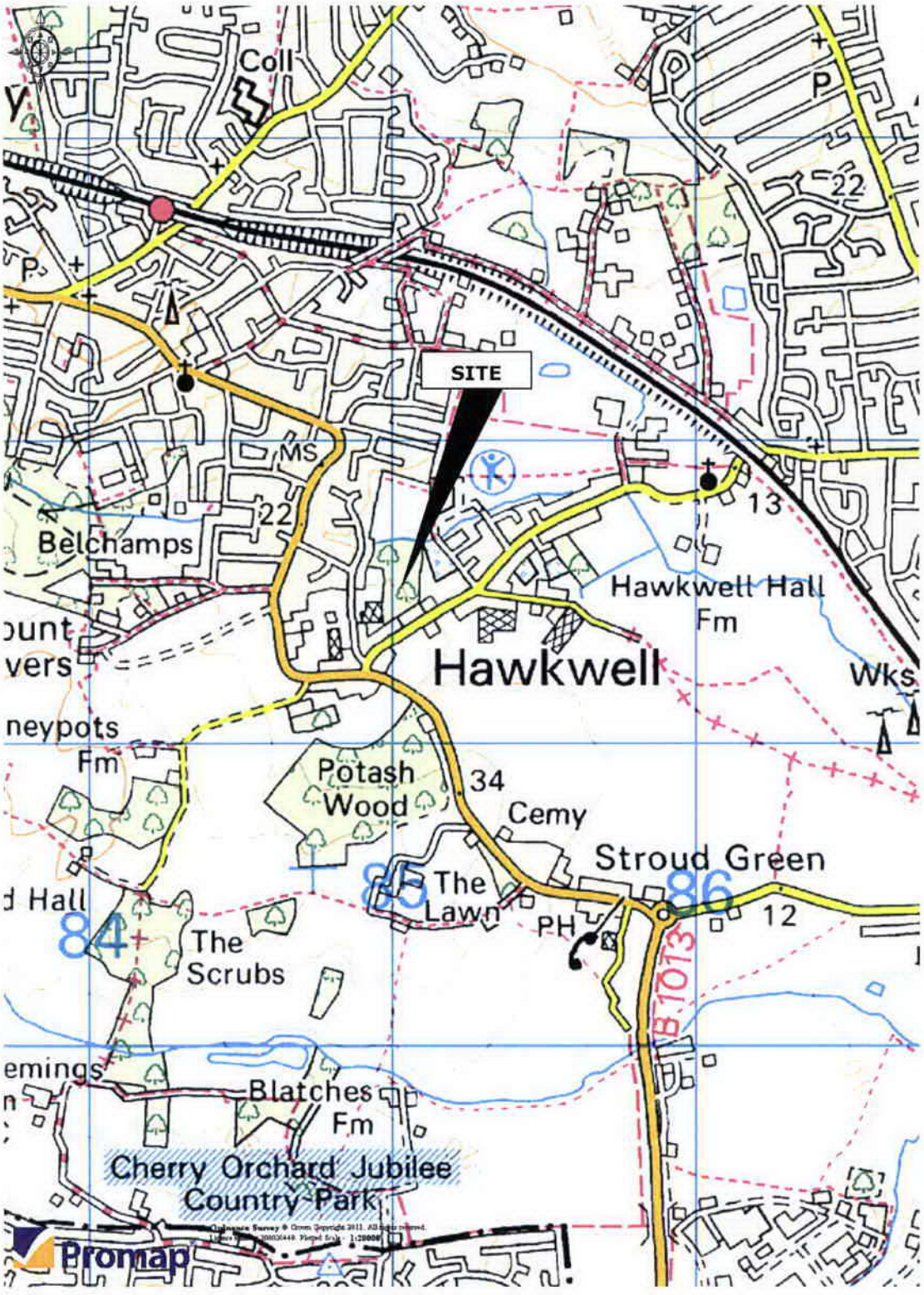
Materials arising from remediation could potentially be deemed a controlled waste and require off-site disposal even though they could be suitable for re-use within the development. A Materials Management Plan (MMP) could be required to demonstrate that the material is not a waste or has ceased to be a waste.

10.11 Site Security

Where demolition/remediation/construction is ongoing, the site and all associated plant, stores etc will be secured against prohibited access to ensure the following:

- Vehicles and plant are not interfered with and prevent contamination from fuels, oil or hydraulic fluids.
- Fuel storage tanks, valves and dispenser guns are locked
- Flammable liquids and chemicals are stored under cover in locked containers
- Remediation plant in continuous 24-hour use is not switched off or vandalised.
- Trespassers are not exposed to contaminated materials and cannot enter zones where asbestos is being stripped out
- Skips are covered and locked where possible.

Figures



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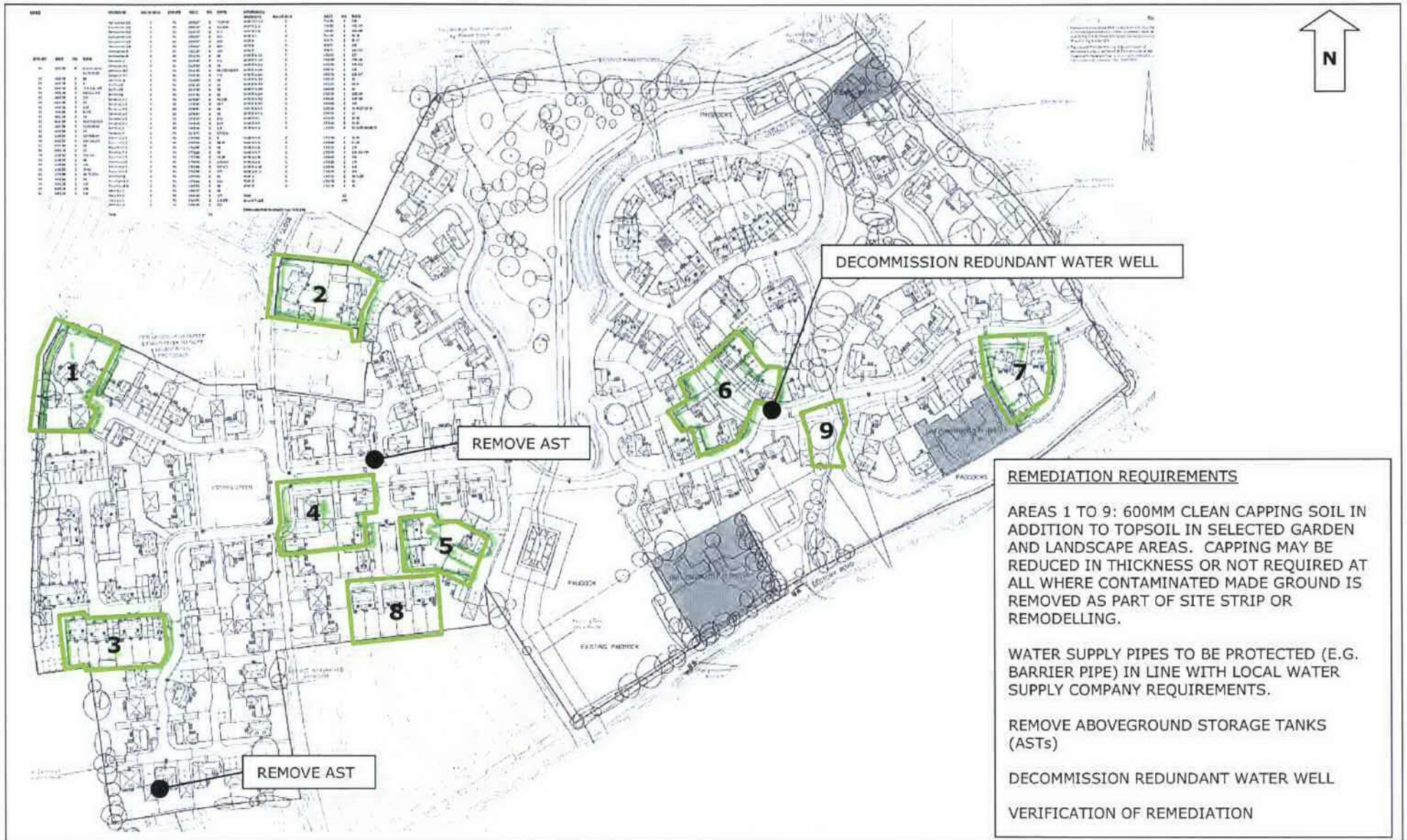
Rectory Road, Hawkwell
Site Location Plan

Job No. 724005

Figure No. 1



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Rectory Road, Hawkwell

Site Remediation Plan

Note: this drawing is not to scale

Job No. 724005

Figure No. 2

Appendices

Appendix A Strategy for Decommissioning Water Wells

MLM

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Our Ref: DMB/724005/001LR/DJG
10 June 2013

Paul Horrigan
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Barratt House
7 Springfield Lyons Approach
Springfield
Chelmsford
Essex
CM2 5EY

Rectory Road, Hawkwell
Strategy for Well Decommissioning

Introduction

MLM Consulting Ltd (MLMCL) has been instructed by Barratt Homes Eastern Counties and David Wilson Homes Eastern Counties to complete a strategy for decommissioning of a redundant well at the proposed residential development, Rectory Road, Hawkwell, Essex. A Site location plan and plan detailing the location of the redundant well are included as Figure 1 and Figure 2 respectively.

Scope of Works

MLM has undertaken the following scope of works:

- A site visit by an MLM engineer and inspection of the redundant well, including measurements of the well diameter, depth and groundwater level, supported by a photographic record;
- An overview of the ground and groundwater conditions at the site based on previous ground investigation data;
- A strategy for decommissioning the well based on the following document:
  - Environment Agency (October 2012). Good Practice for Decommissioning Redundant Boreholes and Wells.

Background

The Environment Agency (EA) has compiled the guidance document to ensure that redundant wells and boreholes are appropriately dealt with to, *'make them safe and secure and also to ensure that they don't cause groundwater pollution or loss of water supplies.'*

Well Details

A site visit was undertaken by an MLM engineer on Friday 7 June 2013. A photographic record and schematic drawing based on the observations during the site visit are provided in Appendix A, with the key observations are summarised below:

- The well is housed within a timber shed, with an electric pump positioned on a timber cross beam.
- A small diameter pipe (rising main) connects the well to the pump with a second main connecting the pump to a small header tank.

- Beneath the timber cross beam the head of the well appears to be constructed of concrete, with a diameter of approximately 1.30m.
- The well diameter reduces to approximately 0.90m and extends to a depth of approximately 3.45m below a metal grid.
- The groundwater was measured at 0.85m below the metal grid.

Based on the well details recorded during the site visit it is estimated to have a total volume of approximately 2.80m^3, with the section below groundwater comprising a volume of approximately 2.10m^3.

Local Ground & Groundwater Conditions

A ground investigation has previously been completed at the site by MLM (ref. 723382 and 724005).

Based on exploratory hole logs in the vicinity of the well (WS9, TP10, TP13 and BH3) and relevant information from the British Geological Survey and Environment Agency, the ground and groundwater conditions in the local area (over the depth horizon of the well) have been summarised in the table below:

Strata	**Summary Description**	**Depth range to base (m bgl)**	**Aquifer Designation**	**Groundwater Observations**
Made Ground	Brown sandy gravelly clay with occasional brick cobbles	0.20 – 0.35	Not applicable	No groundwater was encountered during the fieldworks but a land drain was encountered in TP10 at 1.0m bgl
Head Deposits	Firm brown sandy gravelly CLAY(1)	0.60		
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London Clay	Stiff brown mottled grey CLAY.	>7.00		

(1) Only encountered in TP10

Local Aquifer Sensitivity & Resource Potential

The EA have designated the local geological units as unproductive strata that have negligible resource potential and would not be included as a groundwater unit within the relevant River Basin Management Plan (RBMP).

Based on the Site observations and local ground and groundwater conditions it is considered likely that the well is an historical, low production abstraction, which exploits discrete groundwater bearing strata within the more granular Head Deposits and localised micro-fissures and/or mudstone units within the London Clay.

Potential Contaminant Sources

The results of the chemical analysis completed on the soils sampled in the vicinity of the well indicate that soil contaminant concentrations are generally low. Elevated concentrations of heavy metals and Polycyclic Aromatic Hydrocarbons (PAHs) were recorded in the shallow soils (0.20m bgl) in location TP13, which is located approximately 10m north of the well. However, the development will include a site strip and emplacement of a cover barrier which is likely to remove the shallow soils and potential contaminant source in this area.

Well Decommissioning

Objectives

In accordance with the EA guidance document, the decommissioning strategy has considered the information summarised in the previous sections regarding the local ground and groundwater conditions, aquifer designations and potential contaminant sources.

This data suggests that there is limited sensitivity in terms of derogating local groundwater resources or for the redundant well to act as a conduit for contaminant migration.

As such the main objective of the decommissioning is to remove the hazard of an open hole which could present a Site safety issue during the proposed development. The following decommissioning strategy is proposed:

- Removal of well head works, pump, riser and decommissioning / disconnection of the electrical supply.
- Backfilling of the well in accordance with the schematic outlined for a wide diameter well within the EA guidance:
    - Backfilling from the base of the well (3.45m bgl) to approximately 1.50m bgl using 10mm diameter pea gravel (or similar).
    - Sealing of the top 1.50mbgl to ground surface with concrete or a bentonite grout.

An engineer from MLM will be in attendance during the decommissioning works to complete a 'watching brief.' During the watching brief records will be maintained of the following:

- The groundwater level prior to backfilling;
- The depth and position of each layer of backfilling and sealing materials;
- The type and quantity of backfilling and sealing materials used; and
- Any changes to the well and/or problems encountered during decommissioning.

On completion of the works MLM will provide a brief letter report detailing the above information and verifying that the well has been decommissioned in accordance with best practice guidance. The letter report will be issued by MLM to the British Geological Survey and to the Environment Agency for their records.

Additional Considerations

The decommissioning strategy presented above has not taken into consideration factors such as the engineering properties of the backfill and/or the preferred foundation solution in the area of the well.

It is recommended that the location of the well is reviewed in relation to the proposed development and that foundations in the vicinity are designed with due consideration of the decommissioned well. For example foundations may need to span the well and/or be strengthened locally.

We trust that the foregoing satisfies your requirements, however should you have any queries or require further information, please contact the undersigned.

Yours sincerely

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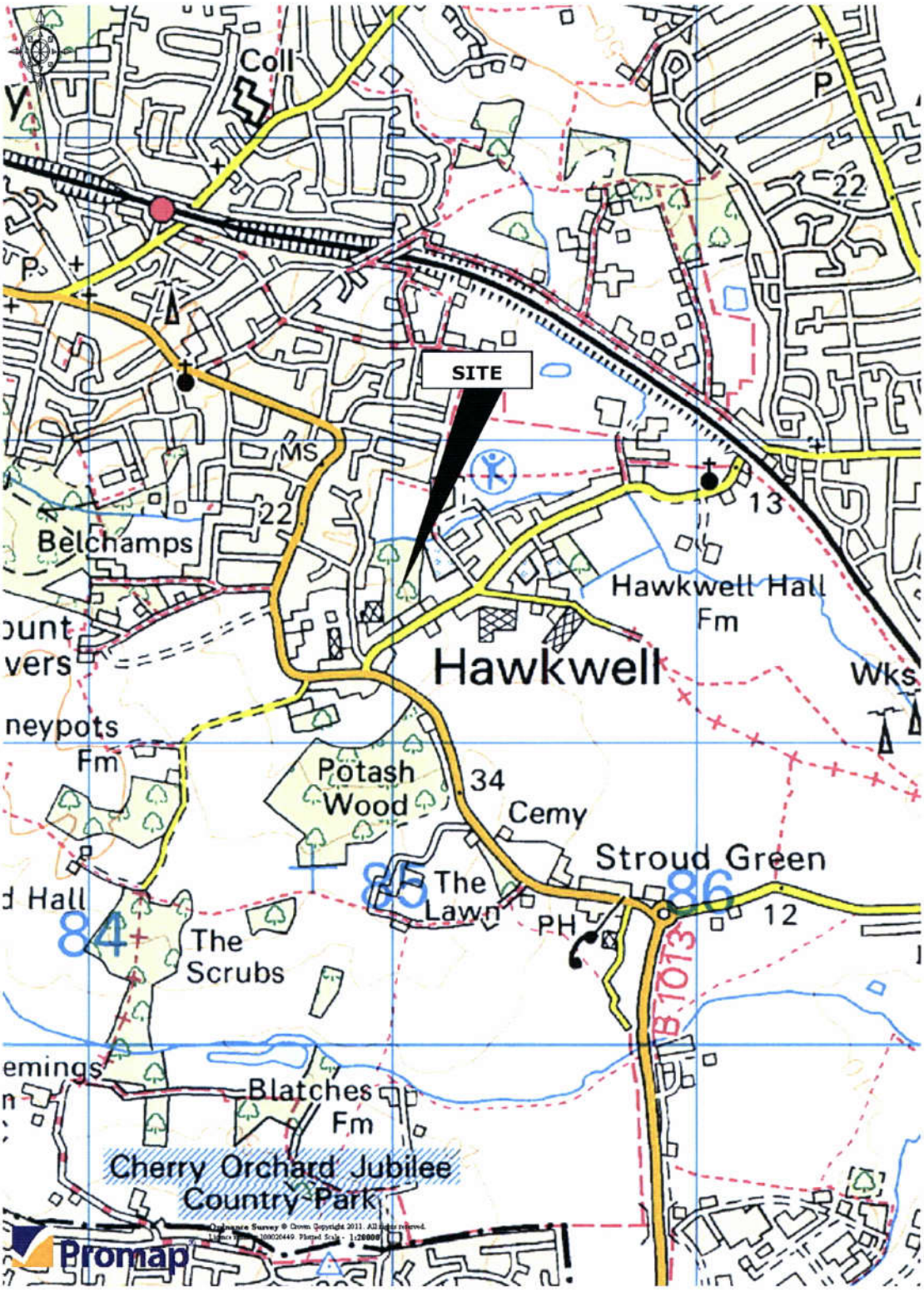
Associate Director
Tel: 01223 815600
E mail: darren.gill@mlm.uk.com

Encs Figure 1 Site Location Plan
Figure 2 Well Location Plan
Appendix A – Schematic Representation of Redundant Wells
Photographic Record

Figures



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Rectory Road, Hawkwell
Site Location Plan

Job No. 724005

Figure No. 1

NOTES

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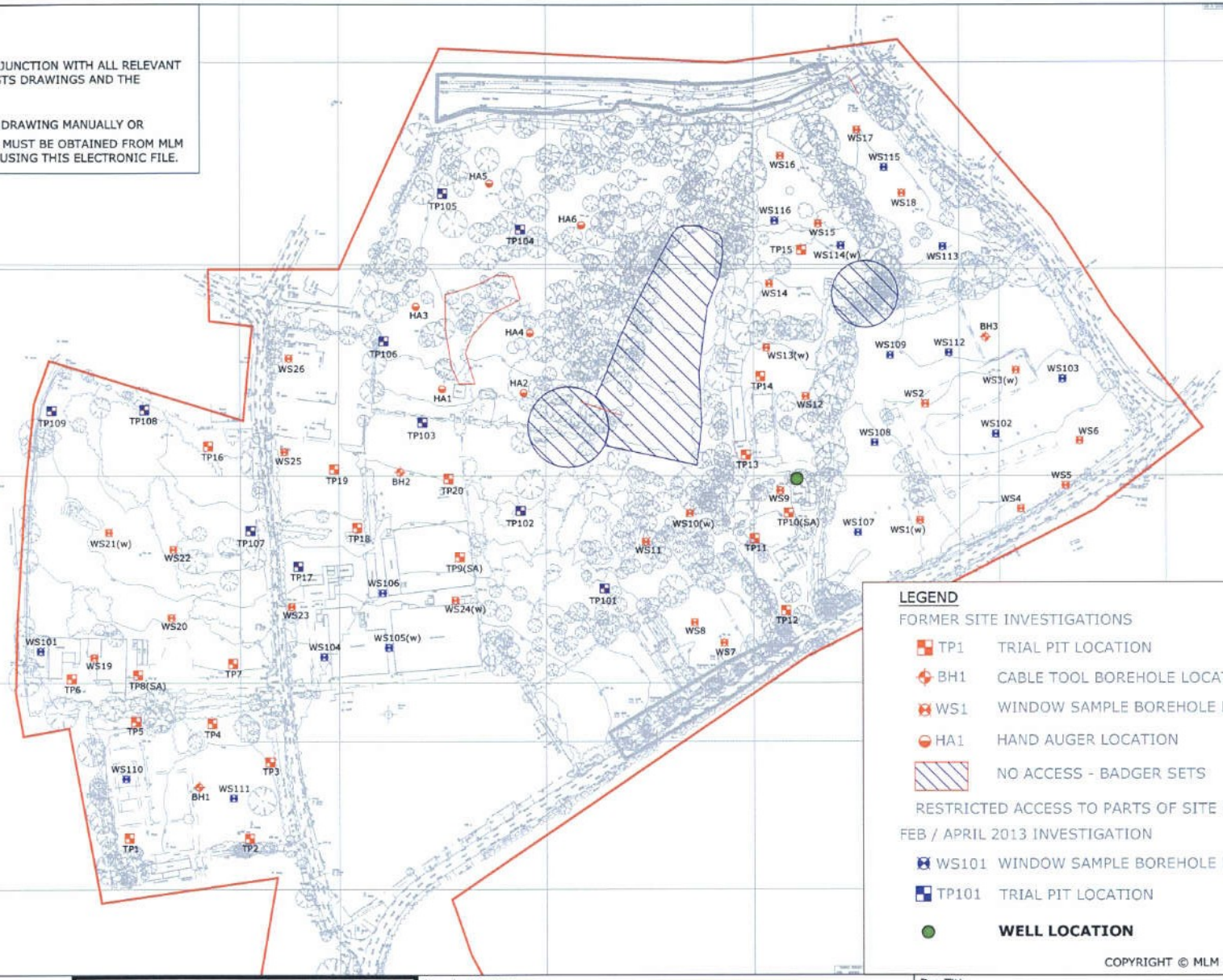

LEGEND

FORMER SITE INVESTIGATIONS

- TP1 TRIAL PIT LOCATION
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RESTRICTED ACCESS TO PARTS OF SITE DUE TO VEGETATION

FEB / APRIL 2013 INVESTIGATION

- WS101 WINDOW SAMPLE BOREHOLE LOCATION
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- **WELL LOCATION**

Rev	Date	Description	Made	Ckd
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Drawing Status: INFORMATION

Client: BARRATT HOMES (EASTERN COUNTIES)

Project: RECTORY ROAD SITE
HAWKWELL

Drg Title: WELL LOCATION PLAN

Drawn/Design	Checked	Approved	Date
HCR	CM	DJG	FEB 2013

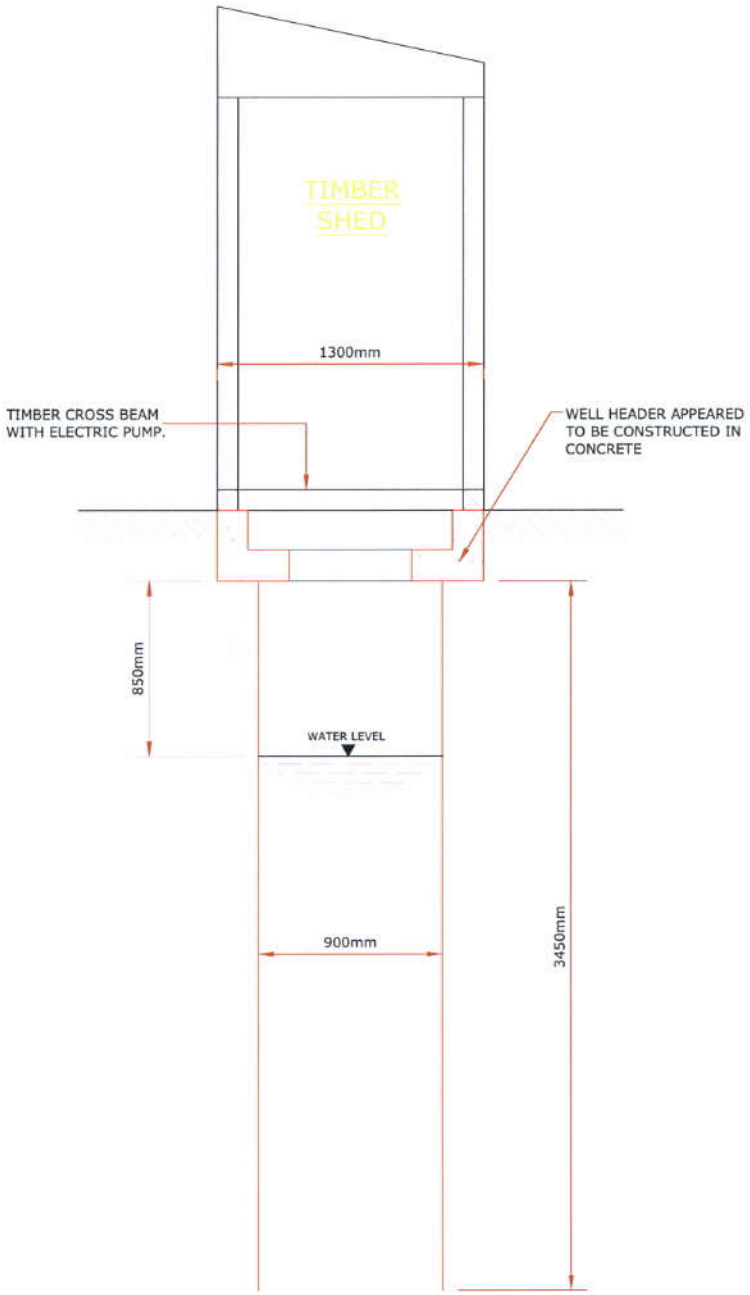
Scales: 1:2000 @ A3

Drg No.: 724005 / FIG 2

Rev: .

Appendix A

Schematic Representation of Redundant Wells
Photographic Record



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Drawn/Design	Checked	Approved	Date
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Scales: 1:25 @ A3

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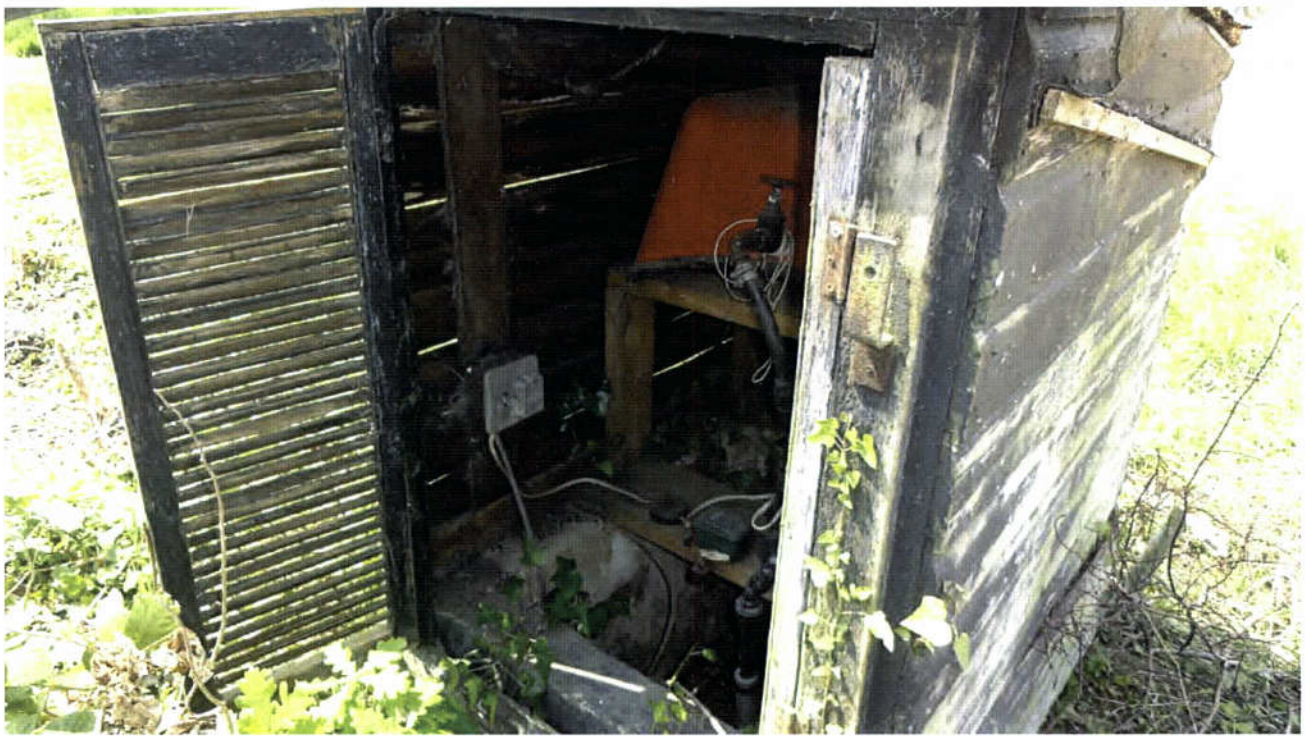
Rectory Road 724005

Photographic Record



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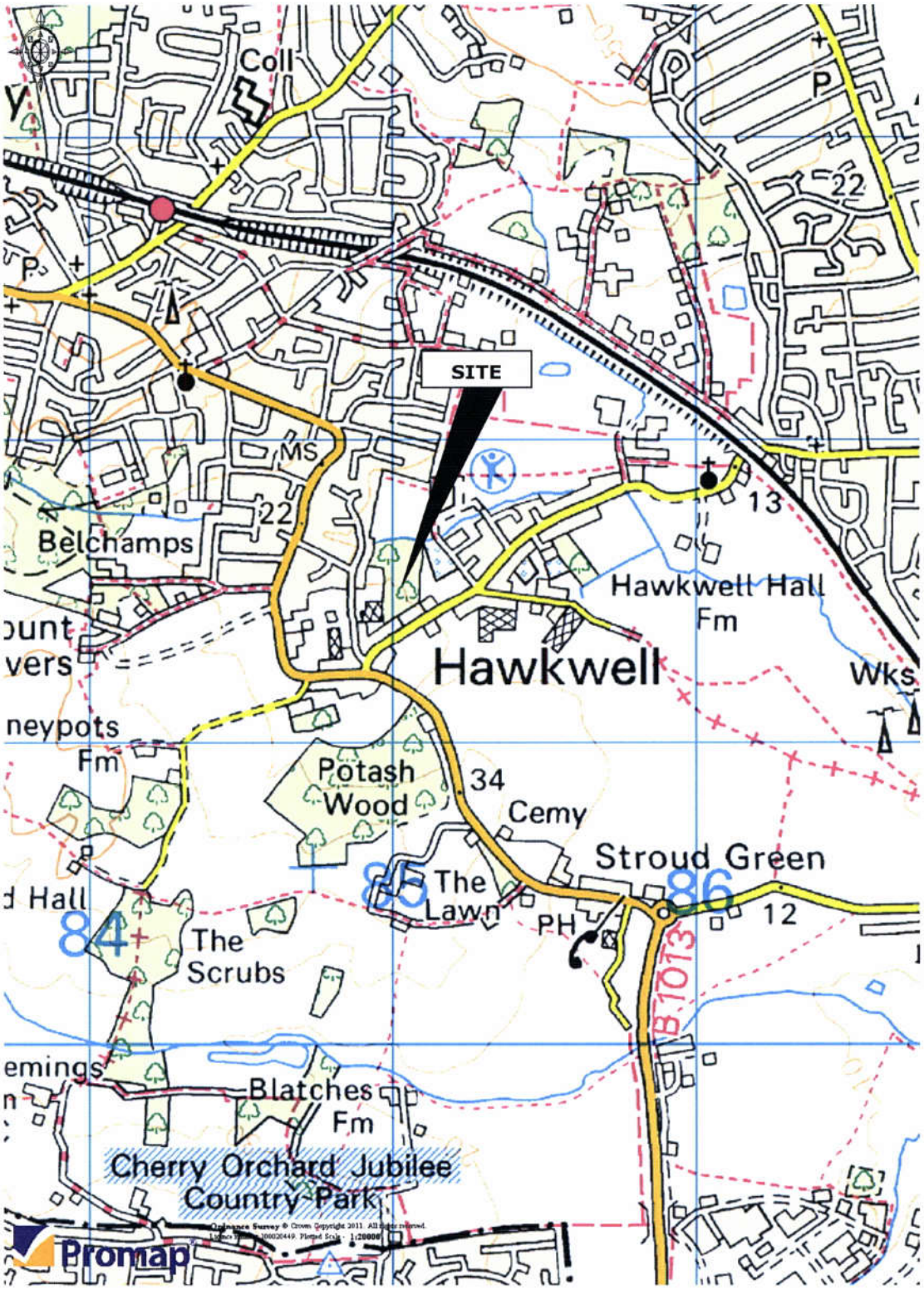

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Rectory Road, Hawkwell
Site Location Plan

Job No. 724005

Figure No. 1

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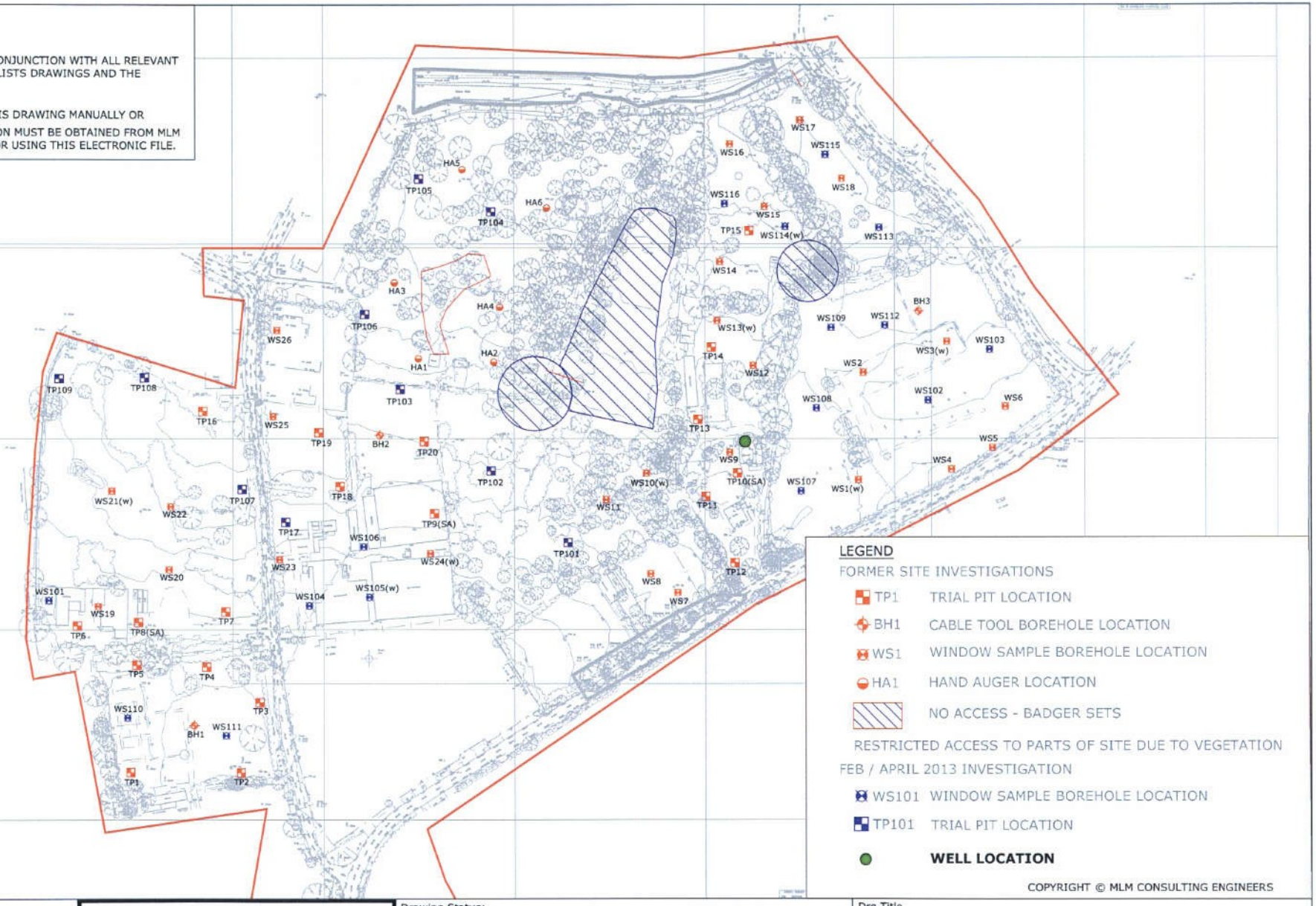

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HAWKWELL

Drg Title: WELL LOCATION PLAN

Drawn/Design	Checked	Approved	Date
HCR	CM	DJG	FEB 2013

Scales: 1:2000 @ A3

Drg No.: 724005 / FIG 2

Rev: .

Appendix A

Schematic Representation of Redundant Wells
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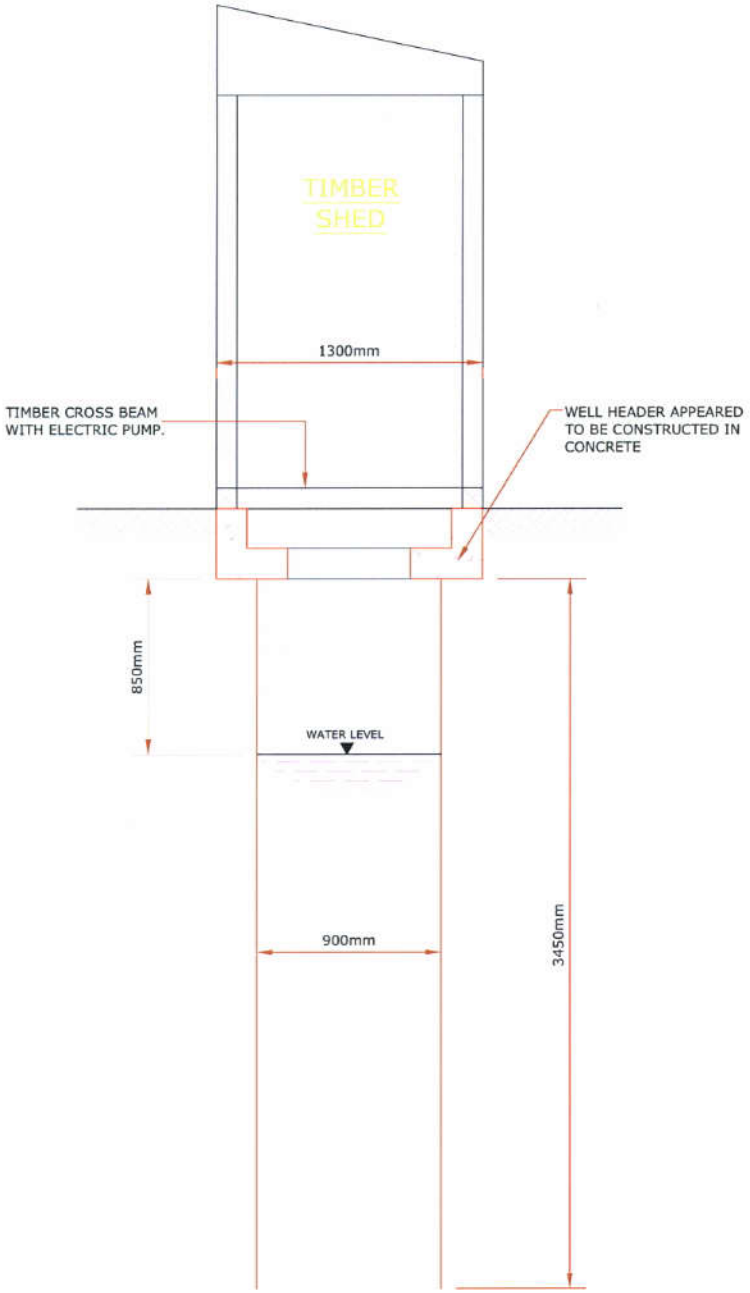

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