

Intended for
St Edward Homes Limited

Document type
Report

Date
July, 2017

GREEN PARK VILLAGE GROUND GAS RISK ASSESSMENT

GREEN PARK VILLAGE GROUND GAS RISK ASSESSMENT

Revision **R01**
Date **05/01/2018**
Made by **Damian Watkin**
Checked by **Karen Allso / Tom Smith**
Approved by **Simon Corness**
Description **Ground Gas Risk Assessment**

Ref 1620000492/RPT/016

CONTENTS

	EXECUTIVE SUMMARY	
1.	INTRODUCTION	1
2.	GAS MONITORING RESULTS - SUMMARY	2
3.	CONCEPTUAL SITE MODEL	3
4.	ASSESSMENT APPROACH	4
5.	SITE PARAMETERS	6
6.	RESULTS OF THE ASSESSMENT	9
7.	CONCLUSIONS	13

APPENDICES

Appendix 1

Figures

Appendix 2

Subfloor ventilation – air flow through the subfloor void

Appendix 3

Input parameters for pressure driven flow into ground floor living space

Appendix 4

Ground Gas Monitoring Data

EXECUTIVE SUMMARY

Ramboll UK Ltd (RUK) has been appointed by the Client, St Edward Homes Limited, to undertake a ground gas risk assessment and review the requirement for gas protection on the Phase 3 to 5 as part of the Green Park Village residential housing development in Reading. The development comprises mostly low rise residential buildings with some residential apartments in the Phases 3 and 5.

Elevated concentrations of methane and carbon dioxide have been obtained from gas monitoring in the Phase 3 to 5 development areas. The worst case gas screening values derived using the peak ground gas concentrations and peak steady state borehole flow rates would be consistent with Amber 1 / Characteristic Situation 2 indicating that gas protection would be required.

Further assessment of gas screening values for the low rise residential housing has been undertaken by revising the NHBC traffic light assessment using for site specific parameters including proposals for ventilation of the subfloor void. The results obtained indicate that the development would be classed as 'green' for the low rise residential housing based on the incorporation of subfloor ventilation. The equilibrium concentrations derived for gas in the subfloor with dilution from ventilation in accordance with Building Regulations are less than the concentrations indicated within the NHBC guidance for a 'green' site.

A quantitative assessment has also been undertaken to consider the potential risks from the vertical migration of ground gas from a source in the underlying made ground and / or alluvium into the ground floor of the low rise housing and the residential apartments via pressure driven flow. The assessment has been based on the assumption there is no dilution of gas within the subfloor (such as if all the vents were to become blocked) with migration between open joints between blocks within flooring. The results from the assessment indicate the risks from the ingress and accumulation of ground gas to existing buildings should be low from the gas regime encountered at the site with no further mitigation required for gas other than the subfloor ventilation.

The assessment has been based on a number of conservative assumptions and, therefore, the risks from gas ingress are likely to be even lower.

1. INTRODUCTION

Ramboll UK Ltd (RUK) has been appointed by the Client, St Edward Homes Limited, to undertake a ground gas risk assessment and review the requirement for gas protection as part of the Green Park Village residential housing development in Reading. This review considers potential risks from ground gas to buildings being constructed as part of development areas in Phases 3 to 5.

The site is located approximately 4 km to the south of Reading Town Centre, Berkshire.

The site location and development phases are shown in Appendix 1.

Ground gas monitoring has identified the presence of elevated methane and carbon dioxide from a number of wells installed into the made ground and alluvium at the site in Phase 3 to 5.

The development comprises mainly low rise residential buildings with a suspended ground floor and clear underfloor void of greater than 150 mm. On this basis, consideration of the potential risks from ground gas using guidance provided by the National House Building Council (NHBC) is considered appropriate for these buildings.

The assessment provides a review of the gas screening values to determine if mitigation will be required in accordance with the approach for low rise residential housing provided by the NHBC taking into account site specific parameters for the development such as subfloor ventilation. In addition, a quantitative risk assessment has been undertaken to assess the potential risks from the migration of gas into the living space of these buildings, for instance if the external vents to the subfloor were to become blocked.

The development will include a number of residential apartments in Phase 3 and Phase 5 although these are not considered to be consistent with the low rise structures in the NHBC guidance. Therefore, a quantitative risk assessment has also been undertaken to assess the potential risks from the migration of gas into the ground floor space of these structures.

Information relating to the ground conditions and gas monitoring has been obtained from the following reports, these should be referred to for more detailed information on the site conditions:

- Ramboll, June 2017. Green Park Village Ground Contamination Interpretative Report - Phase 3 ref 1620000492/RPT/012;
- Ramboll, June 2017. Green Park Village Ground Contamination Interpretative Report - Phase 4 ref 1620000492/RPT/013; and
- Ramboll, June 2017. Green Park Village Ground Contamination Interpretative Report - Phase 5 ref 1620000492/RPT/014.

2. GAS MONITORING RESULTS - SUMMARY

Six rounds of gas monitoring have been undertaken between 19th April 2017 and 24th May 2017 on wells installed in Phases 3 to 5.

The monitoring well locations are shown on Figure 2 in Appendix 1.

The highest concentration of methane was obtained from RWS609 in Phase 3 during monitoring on 24th April 2017 with a peak and steady state reading of 26.5%. The next highest result of 19.2% was also obtained in Phase 3 from RWS609 during the subsequent monitoring visit on the 5th May 2017. The highest concentrations from other monitoring wells were also obtained from Phase 3 with 15.7% from RWS607 and 12.4% from RWS606. The results for methane from other monitoring wells installed in the Phase 3 area are much lower at 1.9% or less. The peak results for methane from Phase 4 was 6.9% and 1.8% from Phase 5.

The highest concentrations of carbon dioxide were obtained from RWS639 in Phase 4 during monitoring on 19th May 2017 with a peak and steady state reading of 17.9%. The next highest results were obtained from RWS608 in Phase 3 with a peak reading of 13.1%. Concentrations above 5% carbon dioxide were obtained from 6no. wells in Phase 3, and also 3no. wells in both Phase 4 and Phase 5.

The majority of flow rates detected during monitoring visits have been low, typically at below the lower instrument detection limit (<0.1 litres / hour). The highest steady state flow rate of 0.7 litres / hour was recorded in RWS607 in Phase 3. Peak (initial) flow rates of 5.0 litres / hour and 1.4 litres / hour have been obtained from two wells (RWS610 and RWS607) during single rounds of monitoring, although these reduced to 0.2 and 0.7 litres / hour respectively during monitoring.

Although elevated methane and carbon dioxide have been encountered in a number of wells, the flow rates obtained from gas monitoring indicate that the volume of gas present beneath the site is low. This would be consistent with descriptions of ground conditions which show the presence of organic material (such vegetation and peat) within the made ground and alluvium.

3. CONCEPTUAL SITE MODEL

The following provides consideration of the potential sources of gas encountered at the site, pathways by which the gas could migrate and receptors following development at the site.

Sources

There are a number of landfills in the surrounding area, adjacent to the northern and western site boundaries. Other historic and authorised landfills are also located within 500m of the site. The following landfills are located adjacent to the site:

- Smallmead Farm landfill immediately to the north of Phase 3 to 5. This is an authorised landfill which was licensed to accept household, commercial and industrial waste and has been restored to agriculture.
- Burghfield Landfill Site A is an authorised landfill located to the west of Phase 5 which is licensed to accept material excluding inert waste. Burghfield Area D historical landfill is shown at the southern end of Burghfield Landfill Site A.

It is understood that monitoring wells close to the site boundaries adjacent to these landfills do not indicate significant lateral migration of gas from offsite sources such as these landfills is likely to be occurring¹.

On this basis, the principal source of the ground gas identified at the site is considered to be organic material within the underlying made ground and alluvium which has been identified during ground investigations.

Pathways

The main pathways for gas migration into the underfloor void and subsequently into the building space following development are:

- Vertical migration along vibro-stone columns and / or soils into the subfloor void; and
- Vertical migration from the subfloor floor into the building via joints between beam and block floors or gaps due to service penetrations.

Receptors

Potential receptors for gas ingress into structures at the site will be future site residents occupying the houses, and the building structure.

¹ Peter Brett Associates, 2015. Report on Ground Investigation for Phase 1 ref 30158 Geo RPT 02 Rev01

4. ASSESSMENT APPROACH

The assessment has been based on considering the potential risks from the migration of ground gas through the following processes:

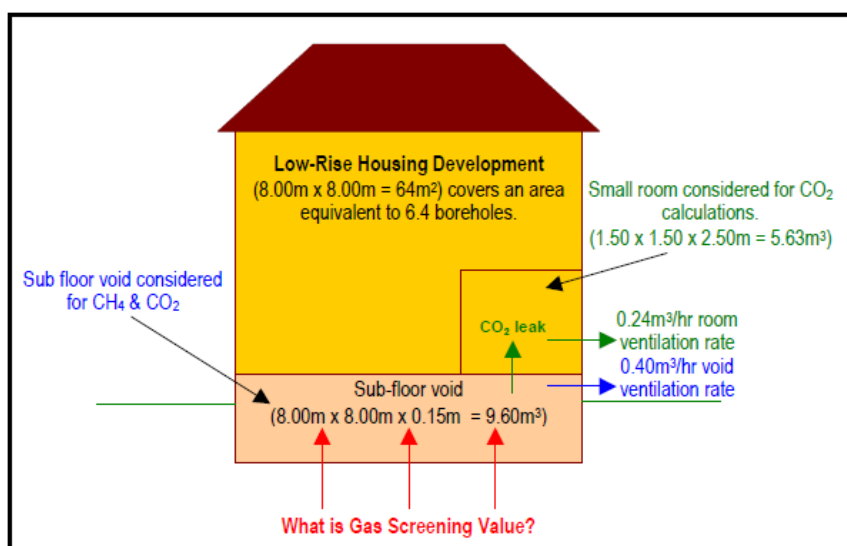
1. Review of the gas screening values derived using the NHBC 'traffic light' ² approach using site specific parameters for the buildings; and.
2. Potential for vertical migration of gas through pressure driven flow into the building living space which has been assessed using Darcy's Law.

NHBC 'Traffic Lights'

The NHBC provide a series of 'traffic lights' that are used to determine the ground gas protection measures required for low rise housing developments. The traffic lights comprise 'Green', 'Amber 1', 'Amber 2' and 'Red'. No ground gas protection measures are required for a 'green' site and passive protection measures are required for 'amber' sites. For 'red' sites standard residential housing would not normally acceptable without further ground gas risk assessment and / or possible remedial mitigation measures to reduce or remove the source of the ground gases.

The model development used in the NHBC traffic light assessment is based upon a model low-rise house with a floor plan of 8.00 m x 8.00 m, giving a floor area of 64 m². Based on the assumption that an individual 50 mm internal diameter borehole relates to an approximate area of 10 m², this would represent 6.4 boreholes for the floor plan of the house.

The following diagram shows the model residential property developed for calculating the maximum permitted equilibrium gas concentrations within the subfloor void (source: NHBC ²).



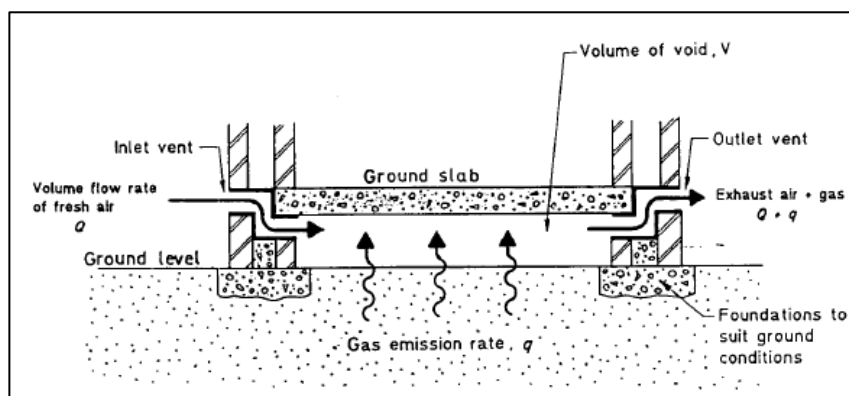
A minimum recommended sub-floor void height of 0.15m as specified in The Building Regulations 'Approved Document C', produces a sub-floor void space of 9.60m³ for a model house. As a worst-case scenario, the NHBC considered that the ventilation rate within the sub-floor void was subject to a complete volume change every 24 hours, which is considered to be highly conservative. The ventilation rate would, therefore, be 9.60m³ / 24 hours = 0.40m³/hr.

² National House-Building Council and RSK Group, 2007. Guidance on Evaluation of Development Proposals on Sites Where Methane and Carbon Dioxide are Present.

The Gas Screening Value which forms the boundary between 'Green' and 'Amber 1' is based on maximum equilibrium concentration in the subfloor for methane of 0.25% and the maximum concentration of 1.25% for carbon dioxide entering a small room inside the building from the subfloor.

The NHBC guidance indicates that "if the designer can adequately demonstrate that vent rates are greater (for example, when calculated using BS 5925³) then higher site-specific GSVs may be calculated. However, any such alternative assessment should include a sensitivity analysis to take into account the effects of occupiers blocking air vents, for example by construction of patios." It also states that the typical maximum concentrations can be exceeded in certain circumstances should the Conceptual Site Model indicate it is safe to do so and that the GSV thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.

Therefore, the approach for revising the NHBC traffic light assessment has been based on estimating the rate of subfloor ventilation (Q) following migration of gas (q) via pressure driven flow into the underfloor, and the subsequent equilibrium concentration of the gas, taking ventilation into account as indicated on the following diagram (source: CIRIA 149⁴, 1995).



The rate of subfloor ventilation from the assessment has also been used to revise the gas screening values within the NHBC's traffic light assessment to determine whether further mitigation for ground gas would be required.

Vertical Migration of Gas into Building Living Space

The second part of the assessment is based on considering the potential for gas to migrate vertically from underlying soils into the building living space, taking factors such as dilution into account to derive an equilibrium concentration for gas accumulation should vents become blocked. The risks associated with gas migration from pressure driven flow into structures at the site has been undertaken based on guidance provided in the Ground Gas Handbook (2009)⁵. A similar approach has also been adopted for the residential apartment blocks, this is considered to be acceptable as the apartment buildings will comprise a garage at ground level with one storey living space above and an external staircase providing access to the living areas.

³ British Standard Institution, 1991, Code of Practice for Ventilation Principles and Designing for Natural Ventilation. BS5925

⁴ CIRIA, 1995, Protecting Development from Methane

⁵ Source: Wilson, S., Card, G. and Haines, S, 2009. Ground Gas Handbook. Dunbeath: Whittles Publishing

5. SITE PARAMETERS

The parameters used in the assessment have been included in Appendix 1 and 2 with further justification provided below:

Foundations and Building Floor Construction

Vibro-stone columns will be installed around perimeter of each plot. The stone columns will comprise 600mm diameter with construction plans indicating in the region 43no. stone columns between two plots, assumed to comprise 22no. per plot. Plans indicate that 14no. stone columns would be present around each of the apartments / ground floor garage.

The foundations comprise beam and block flooring. The block size is 440mm x 215mm and 100mm depth. It has been assumed the blocks have been placed with the short ends on the beams with open gaps of 1.5mm around each of the long ends of the blocks which would equate to a 3mm gap between each block. However, the floor will be covered by a sand / cement mortar which will fill in the gaps so this assumption is considered conservative.

Ground Conditions - Gas Migration Pathway

As the source of the gas could be the made ground and / or organic alluvium, the depth of the source used in the assessment has been set at 2.5m depth as it will be necessary to raise the site levels by approximately 1.5 m to 2.0 m in Phase 3 to 5 for flood defence, this would increase the depth to the gas source to approximately 2.5 m to >3.0 m bgl. .

The sources of the gas are considered to be the made ground and / or alluvium which can be summarised as follows:

- Made ground: Typically comprises silty, sandy or gravelly clay; and/or
- Alluvium: Typically comprises sandy clay and peaty clay.

Although much of the existing shallow soils are more cohesive in nature, although granular made ground has been noted in a number of exploratory holes at the site.

Soil permeability is required as part of the assessment for pressure driven flow. A permeability of 1×10^{-3} m/s for the vibro-stone columns based on typical values of 3×10^{-4} to 3×10^{-2} m/s for gravel in Domenico and Swartz (1990). An internet search indicates limited information is available relating to the permeability of vibro-stone columns, with one source indicating a permeability of 8×10^{-4} m/s for stone columns following installation. It has been assumed that all of the gas migrating along the stone columns accumulates beneath the building.

A permeability of 1×10^{-6} m/s has been used for the made ground and alluvium which is considered to be higher than values typically associated with predominantly clay soils (for instance ConSim indicates a range of 10^{-11} to 10^{-9} m/s for clay with 10^{-6} m/s within the upper range for a silt or lower end of the range for a fine sand).

Gas Concentrations

Based on guidance provided within BS8485:2015⁶ and BS8576:2013⁷ the highest peak readings obtained from gas monitoring have been used for methane (26.52% within Phase 3) and carbon dioxide (17.9% within Phase 4). The peak steady state flow rate (0.7 litre / hour) has also been used in the assessment for the NHBC traffic lights (rather than the initial peak flow rate) in accordance with guidance in BS8485:2015 and BS8576:2013.

Although elevated methane and carbon dioxide concentrations have been encountered, gas monitoring indicates the volumes of gas being generated in shallow soils at the site are low or even very low.

It has also been assumed that the highest gas concentrations are present across the site / development phases and that there is no degradation or oxidation of methane near surface; these assumptions are considered to be conservative.

Building Parameters

The houses will be three storeys in height. The dimensions for the smaller of the proposed buildings have been used as this will be more conservative than using larger houses.

The parameters used in the assessment have been based on the smallest footprint for the low rise residential housing being constructed at the site, as indicated within the planning permission for the site (which is located in Phase 3):

- Plan area of 8.950 m (length) by 3.907 m (width) and 8.212 m height (to third floor ceiling joist) based on the living space of all three storeys. The ground floor living space is 2.514 m in height which has been used in this assessment.
- 0.25 m clear height for the subfloor with minimum external ventilation of 3000 mm²/m, which is greater than the minimum required ventilation indicated in Approved Document C of the Building Regulations which comprises 1500 mm²/m.

The following dimensions have been used for the residential apartments:

- Plan area for the smaller apartments of 3.040 m by 5.596 m, with height of the garage space on the ground floor between 2.442 m and 2.575 m. Access to the first floor living space is gained via open stairs located on the exterior of the building so stairwells have not been included in the assessment.

Plans showing the building dimensions have been provided in Appendix 1.

The pressure difference between the ground and inside the buildings which is used in the assessment for pressure driven flow has been based on guidance provided by the Environment Agency in SR3 (2009)⁸ for residential housing (3.1 Pa). The use of a low pressure in the assessment is considered to be consistent with the ground gas source (made ground and / or alluvium) and the low flow rates obtained from the gas monitoring. A lower or even negative pressure difference can also be created between the inside of the building and the ground due to

⁶ BS8576:2013 Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)

⁷ BS8485:2015 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings

⁸ Environment Agency, 2009. Updated technical background to the CLEA model (Science Report: SC050021/SR3)

wind effects (Venturi) on the building, internal heating (stack) and / or mechanical ventilation and air conditioning. A lower pressure difference has been used in the subfloor (0.5 Pa) based on the pressure due to wind at the top of the subfloor (height of 0.25m) and as this space will be well ventilated and comprise open vents. Pressure effects due to temperature in the subfloor are likely to be minimal.

An air exchange rate of 0.5 complete changes per hour has been used inside the living space for low rise residential housing which is based on guidance provided by the Environment Agency (2009)⁸. The air exchange rate for the ground floor garage spaces at the apartments in Phase 3 & 5 has been based on 6 complete changes per day. The garage doors will not provide an airtight seal and guidance indicates typical air exchanges for garages of up to 6 complete changes per hour.

The air exchange rate in the subfloor has been calculated as part of the ventilation assessment for the site specific screening values as part the revised NHBC 'traffic lights' assessment.

6. RESULTS OF THE ASSESSMENT

Low Rise Residential Buildings

NHBC Traffic Lights - Site Specific Gas Screening Value

Based on exceedances of the NHBC guidance for a 'Green' site for methane and carbon dioxide, further assessment has been undertaken to derive site specific screening values using proposed building parameters and calculations of the ventilation rates for the subfloor.

Calculation of the surface emission rate into the subfloor has been undertaken for pressure driven flow. Assessment of the subfloor ventilation rate has been undertaken using the approach outlined in guidance provided in BS5925:1991⁹. This is based on the subfloor building parameters outlined in Section 5 above, and a ventilation area for the subfloor of 3000mm²/m (6000mm² spaced at 2m centres) which is located on opposite sides along the shortest ends of the building.

The input parameters have been provided in Appendix 2.

The ventilation assessment indicates a void flow rate through the subfloor of 6.524 m³/hour, which is significantly higher than that assumed within the NHBC traffic light assessment (0.40 m³/hour). The ventilation rate equates to approximately 18 no. air exchanges per day in the subfloor which is greater than that assumed (one per day) in the NHBC 'traffic lights' assessment.

A review of the gas screening values derived using the NHBC 'traffic light' approach has been undertaken for site specific parameters as follows:

- Building floor plan: 35 m² which equates to an equivalent area of 3.5 boreholes.
- Subfloor volume: 8.75 m³ based on subfloor height of 0.25 m.
- Subfloor ventilation rate: 6.524 m³/hour.
- Maximum allowable gas concentration in the subfloor is based on a 'Green' site: 0.25 % for methane and 1.25 % for carbon dioxide.

The following site specific acceptable gas screening values have been obtained from the assessment::

- Methane: 4.664 litres / hour (factor of safety of 25 over worst case gas screening value derived from gas monitoring).
- Carbon dioxide: 23 litres / hour (factor of safety of 186 over worst case gas screening value from gas monitoring).

The peak gas screening values obtained from monitoring for methane and carbon dioxide are below the acceptable gas screening values derived above. The time indicated for one complete air exchange is less than 1.5 hours, providing approximately 18no. complete exchanges per day.

Equilibrium Gas Concentrations in Subfloor Void

The equilibrium gas concentrations derived for the subfloor void with 3000 mm²/m external ventilation via pressure driven flow along vibro-stone columns from a source at 2.5m depth based on the peak gas results and building parameters outlined above (subfloor void space of 8.75m³) are as follows:

⁹ BS5925:1991. Code of Practice for Ventilation Principles and Designing for Natural Ventilation

- Methane: 0.179%.
- Carbon dioxide: 0.089%.

The equilibrium results derived for gas in the subfloor are lower than the maximum equilibrium concentrations indicated by the NHBC for methane (0.25%) and carbon dioxide (1.25%) for a 'Green' site.

Vertical Migration into Building Living Space – Assuming that Vents are Blocked

A detailed quantitative risk assessment has been undertaken to consider the potential risk from the ingress of gas associated with the presence of organic material in the underlying made ground and / or alluvium at 2.5m depth (due to the need to increase the site levels by 1.5 to 2.0m for flood defence) via pressure driven flow along vibro-stone columns into new buildings based on the peak ground gas results obtained from monitoring.

The following assessment has been based on the potential for migration and accumulation within the ground floor space which comprises a volume of 87.9m³ based on 8.950m (length) by 3.907m (width) and 2.514m in height.

The assessment has also been based on gas migrating into the living space vertically along the vibro-stone columns into the subfloor void and then via open gaps between blocks in the flooring.

The input parameters used in the assessment have been provided in Appendix 3.

The results obtained from the assessment have been summarised in the following table.

Scenario	Methane	Carbon Dioxide
Gas Concentration within Building	0.00687%	0.00341%

Table 1 Calculated Equilibrium Gas Concentration

The results obtained from the assessment are very low. The result shown in Table 1 for methane is over 700 times below the lower explosive limit (5%) for methane in air. The result for carbon dioxide is also over 800 times below the level at which headaches and shortness of breath can occur (3%).

The contribution of gas migrating within soils beneath the building is much lower than derived for the VSC using a similar scenario as indicated above, for example the steady state concentration of methane calculated for the soil pathway would be 0.00004% and 0.00002% for carbon dioxide.

This assessment is still likely to be conservative as the flooring will be covered by mortar comprising sand / cement mix which will fill the gaps between the beams and blocks and reduce permeability over the open gaps assumed in the assessment

In addition, the assessment assumes all the subfloor vents are blocked so there is no attenuation in the subfloor, which is unlikely to occur. Therefore, gas concentrations within the subfloor following dilution are likely to be much lower than the peak gas concentrations assumed for this assessment.

Sensitivity – Vertical Migration into Building Living Space

BS8485:2015 indicates that a sensitivity analysis should be undertaken when a quantitative assessment of risks from gas is carried out.

The following scenario has been considered for the sensitivity analysis:

- Migration of gas via pressure driven flow along stone columns through the flooring into the ground floor WC.

Ground Floor Toilet

The development includes a ground floor toilet with the following dimensions obtained from development plans:

- Plan area of 3.8m² (1.992m x 1.907m).
- Height of 2.514m.

For the purpose of this assessment we have assumed that the air exchange rate is similar to the living space (0.5 air changes per hour) and that gas migration is between open gaps in the blocks within the floor following migration into the subfloor void along the stone columns. The equilibrium concentrations obtained for gas within the ground floor of 0.028% for methane and 0.014% for carbon dioxide.

The results of the analysis for the ground floor toilet indicate the concentrations derived for methane and carbon dioxide would be low.

Residential Apartments

Residential apartments will be constructed in Phases 3 and 5. These will comprise a block of apartments each with garage space on the ground floor and living space on the first floor. Two of the apartments will also have living space on the second floor. The subfloor will comprise a ventilated open void.

The two smaller apartments will have plan dimensions of 3.040 m by 5.596 m with the garage space being 2.442 m to 2.575 m in height (2.442m height used in the assessment). Access to the first floor living space is gained from stairs located on the outside of the building with no access from inside the garages.

Assessment of the potential for vertical migration of gas into the ground floor garage space has been undertaken using a similar approach to that above. This assessment has been undertaken based on pressure driven flow along stone columns (14 no. per apartment giving a migration area of 4m² from the ground per garage) into the subfloor void from a source at 2.5m in the underlying made ground and / or alluvium using the peak results from gas monitoring. Again, the assessment has been based on the assumption there would be no attenuation of gas within the subfloor due to dilution with migration of gas into the garage space via gaps in the flooring. Six air changes per day have been used in the assessment for the garage space.

The results give estimated equilibrium concentrations in the garage space of 0.00834% for methane and 0.00414% for carbon dioxide.

The results obtained from the assessment are very low. The result obtained for methane approximately 600 times below the lower explosive limit (5%) for methane in air. The result for carbon dioxide is also 700 times below the level at which headaches and shortness of breath can occur (3%).

This assessment is still likely to be conservative as the flooring will be covered by mortar comprising sand / cement mix which will fill the gaps between the beams and blocks and reduce permeability over the open gaps assumed in the assessment.

7. CONCLUSIONS

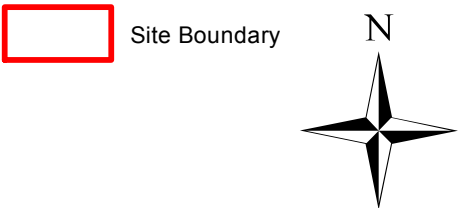
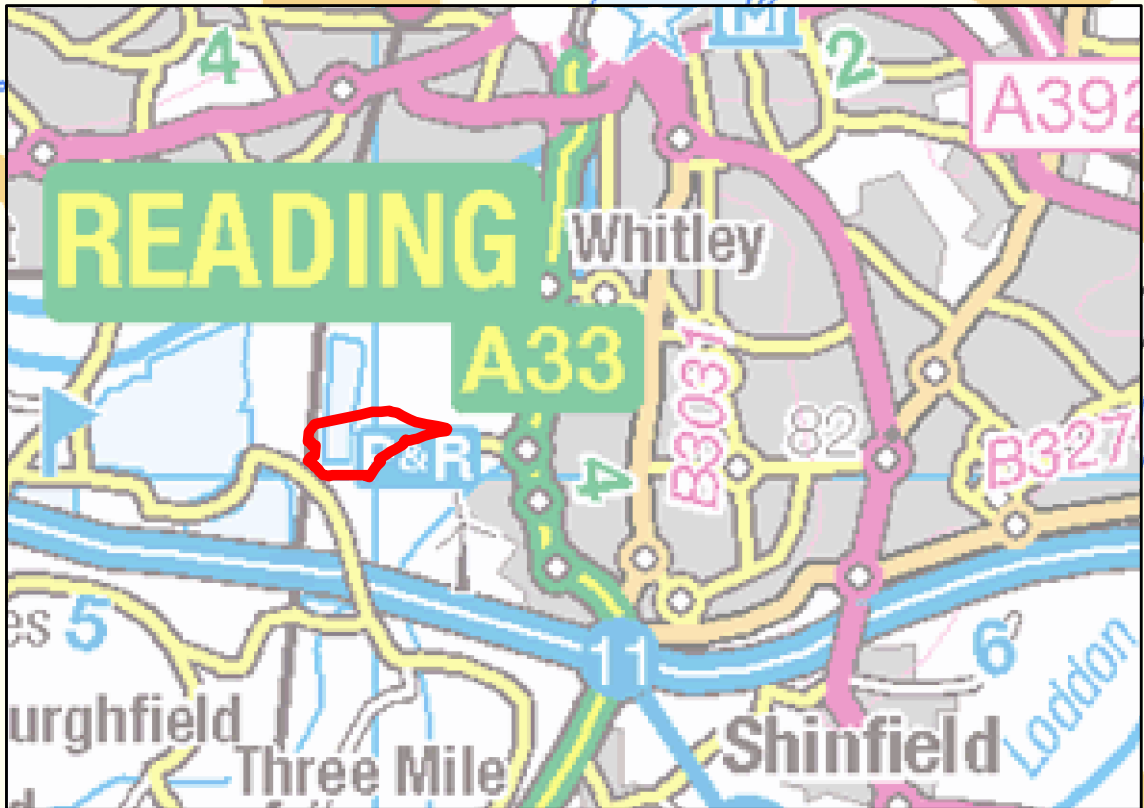
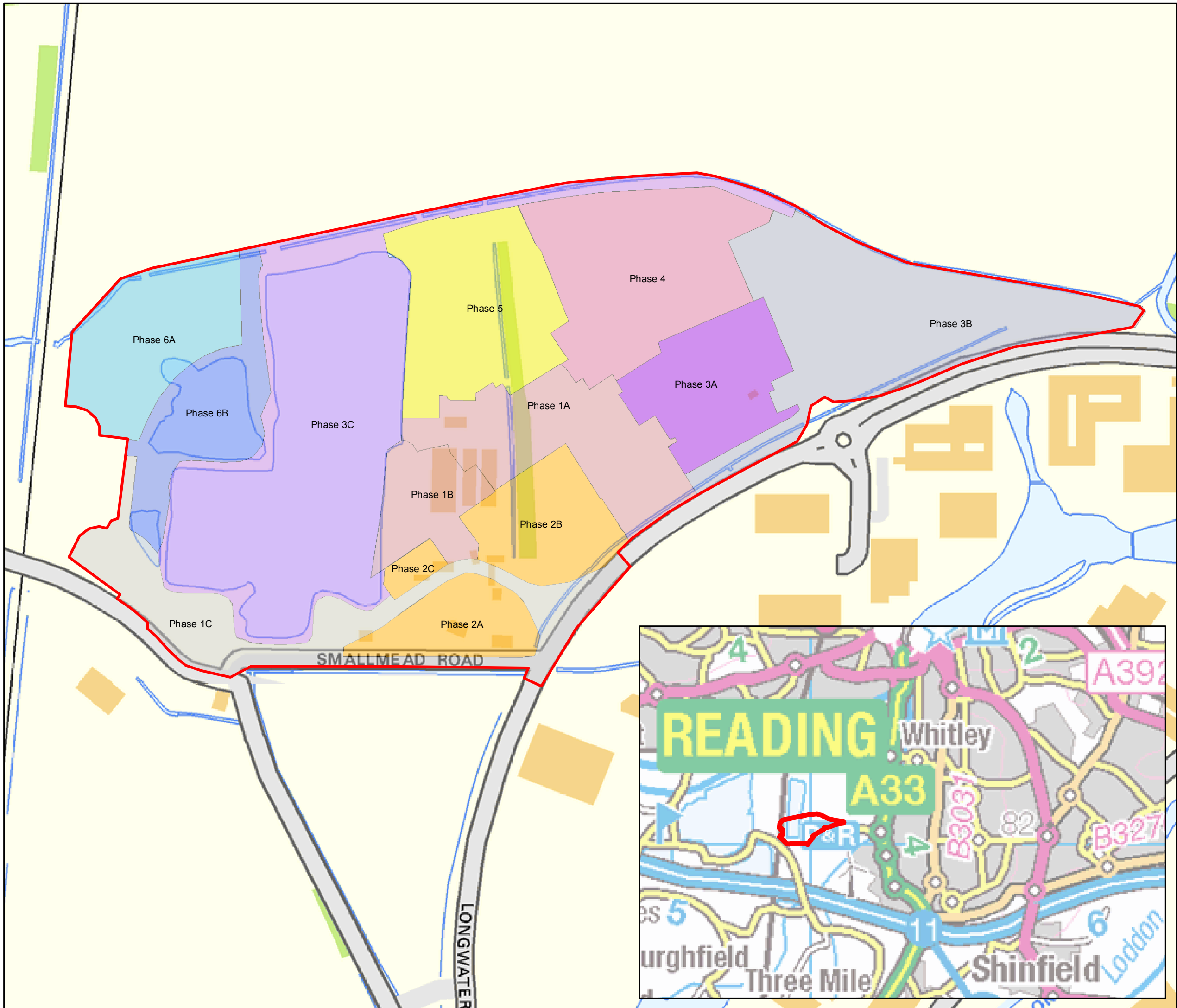
The results obtained from revising the NHBC traffic light assessment for site specific parameters indicates that the site would be classed as 'Green' for the low rise residential housing. The equilibrium concentrations derived for gas in the subfloor with dilution from ventilation in accordance with Building Regulations are less than the concentrations indicated within the NHBC guidance for a 'Green' site.

A quantitative assessment has also been undertaken to consider the potential risks from the vertical migration of ground gas from a source in the underlying made ground and / or alluvium into the ground floor of the low rise housing and the residential apartments through pressure driven flow. The assessment has been based on the assumption that there is no dilution of gas within the subfloor (such as if all the vents were to become blocked), and no attenuation by the building floor which is likely to be conservative.

The results from the assessment indicate the risks from the ingress and accumulation of ground gas to existing buildings should be low from the gas regime encountered at the site with no further mitigation required for gas other than the subfloor ventilation.

The assessment has been undertaken a number of conservative assumptions. This includes assuming the highest result obtained for methane and carbon dioxide concentrations from site monitoring exists across the site and excludes any attenuation from the floor. In addition, although precast suspended segmental subfloors such as beam and block flooring would not prevent gas ingress, the presence of mortar between the gaps should still provide some attenuation with the assumption used that open gaps are present between each of the blocks. Therefore, given the conservative nature of the assessment the risks from gas ingress are likely to be even lower.

APPENDIX 1 FIGURES



1:3,000

1:50,000

Drawn at A3

Reproduced from Ordnance Survey
digital map data © Crown copyright
2015 All rights reserved.
Licence number 100040631

Client

St Edward Homes Ltd

Project Title

Green Park Village

Project Number

1620000492

Figure Title

Site Location Plan



Tel: 023 8081 7500
Fax: 023 8081 7600

southampton@ramboll.co.uk
www.ramboll.co.uk

Date

May 2017

Prepared By

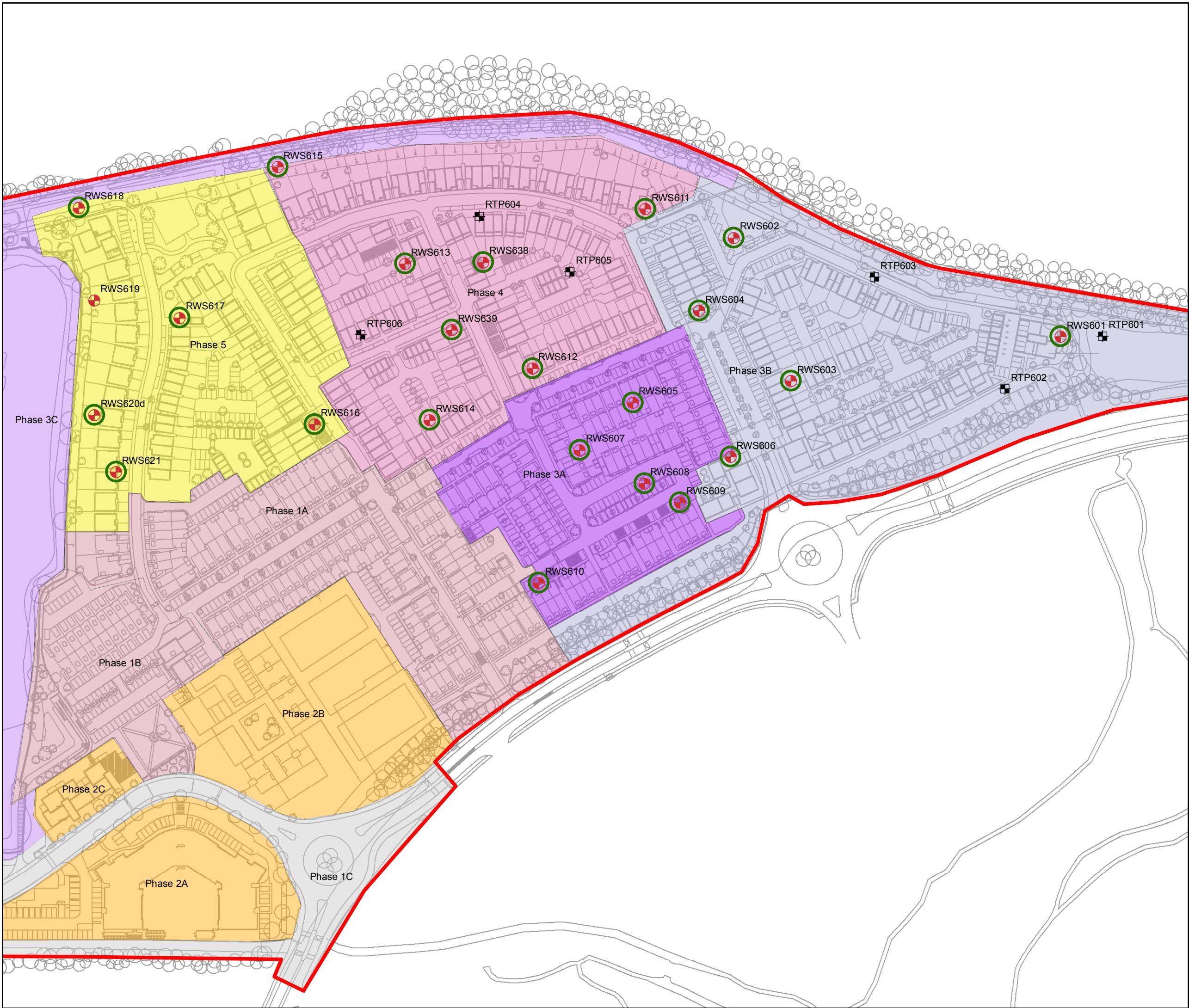
TS

Figure No.

Figure 1

Revision

-



Site Boundary

Phase 1A

Phase 1B

Phase 1C

Phase 2A

Phase 2B

Phase 2C

Phase 3A

Phase 3B

Phase 3C

Phase 4

Phase 5

Phase 6A

Phase 6B

Borehole

Trial Pit

Window Sample Borehole

Gas Monitoring Well
(Made Ground /
Superficial Deposits)

N

Drawn at A3
1:1,750Client
St Edward Homes LtdProject Title
Green Park VillageProject Number
1620000492Figure Title
**Exploratory Hole Plan
Phase 3 to 5**

RAMBOLL

Tel: 023 8081 7500 southampton@ramboll.co.uk
Fax: 023 8081 7600 www.ramboll.co.uk

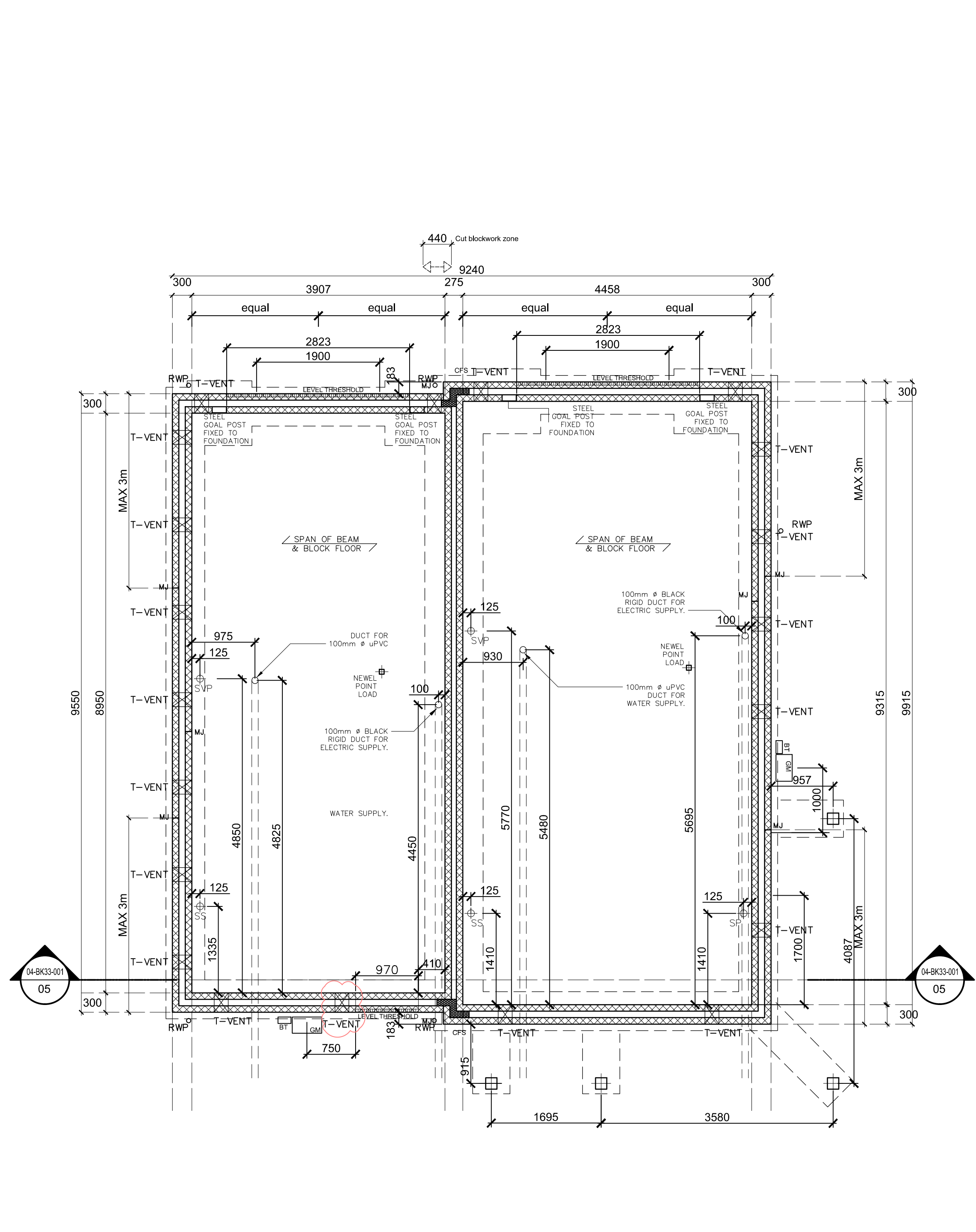
Date
July 2017

Prepared By
TS

Figure No.
Figure 2

Revision
-

N



Plot 116
House Type A1

Plot 115
House Type C2

BLOCK 33 SUB STRUCTURE G.A PLAN

SUBSTRUCTURE NOTES

1. THIS DRAWING MUST BE READ IN CONJUNCTION WITH ALL OTHER PROJECT DRAWINGS

2. ALL DETAILS AND DRAWINGS MUST BE READ IN CONJUNCTION WITH OUTLINE CONSTRUCTION SPECIFICATION.

3. BEAM AND BLOCK & FOUNDATIONS TO STRUCTURAL ENGINEER / SPECIALIST DESIGN

4. LOCATIONS OF RWP's AND SVP's TO BE COORDINATED WITH ENGINEERS DRAINAGE DESIGN.

FOUNDATIONS:

5. FOUNDATION WIDTHS AND DEPTHS TO BE DETERMINED BY THE STRUCTURAL ENGINEER, BASED UPON THE SITE INVESTIGATION REPORT / WALL FOUNDATION LOADS TO BE AGREED BY BUILDING CONTROL.

6. SOIL REPORT TO BE CHECKED FOR SPECIAL REQUIREMENTS E.G. PRECAUTIONS NECESSARY FOR SULPHATES IN SOIL ETC.

7.  DENOTES BEAM AND BLOCK SUSPENDED GROUND FLOOR SPAN DIRECTIONS.

8. BRICK VENTS TO BE ADDED AS PER MANUFACTURERS REQUIREMENTS.

9. GROUND BELOW VOID TO BE COVERED WITH WEED KILLER, AND REQUIREMENT FOR SAND BINDING/WEAK CEMENT LAYER BELOW VOID TO BE BY ENGINEER.

10. SUBSTRUCTURE KEY:

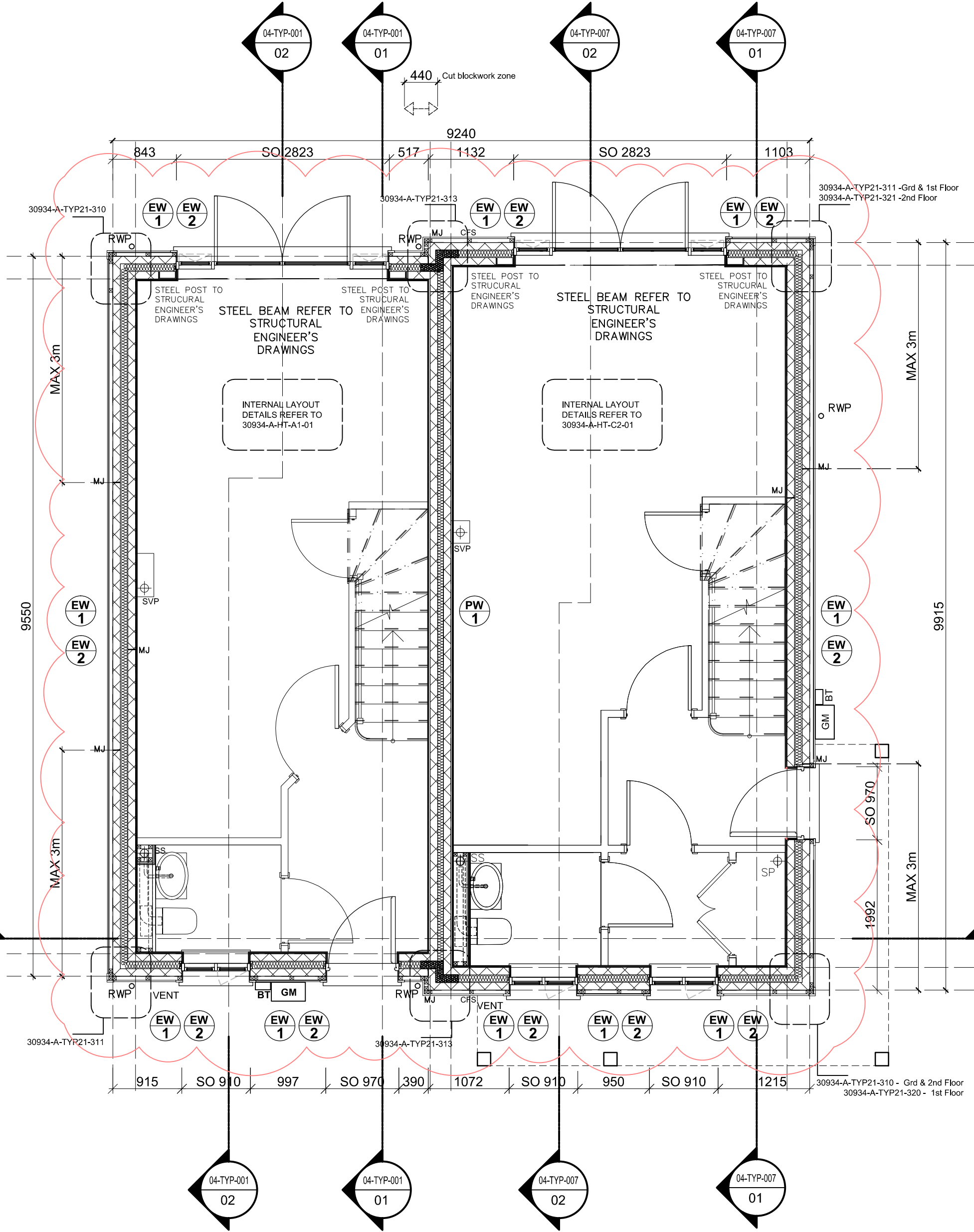
SVP - 100mm DIAMETER SOIL AND VENT PIPE
RWP - RAINWATER DOWNPIPE
T-VENT - TELESCOPIC VENTS AT MAX 2 METRE CENTRES
PATTERN AND TYPE OF AIRBRICK TO BE CONFIRMED
MJ - MOVEMENT JOINTS PLACED TO AVOID ALL STRUCTURAL MEMBERS/INTELS AS PER SE'S DESIGN

11. BELOW GROUND SERVICES CO-ORDINATION:

LOCATION AND SPECIFICATION OF INCOMING SERVICES IS INDICATIVE, FOR DETAILED DESIGN PLEASE REFER TO M&E ENGINEERS DETAILS AND SPECIFICATION

12. VENTILATION UNDER SUSPENDED FLOOR:

VOID BELOW SUSPENDED FLOOR TO BE VENTED WITH PROPRIETARY TELESCOPIC ADJUSTABLE FLOOR VENTS AT MAX 2M CENTRES TO SUIT MANUFACTURERS RECOMMENDATIONS



Plot 116
House Type A1

Plot 115
House Type C2

BLOCK 33 GROUND FLOOR G.A PLAN

CONSTRUCTION NOTES

- EW 1** EXTERNAL WALL TYPE 1
HARDIE PLANK OVERLAP WEATHERBOARD ON 50 x 50mm TREATED BATTENS ON BREATHABLE MEMBRANE AND MECHANICALLY FIXED TO OUTER LEAF (ALL FLOORS)
- EW 2** EXTERNAL WALL TYPE 2
FAIR FACED BRICKWORK OUTER LEAF TIED BACK TO INNER LEAF WITH WALL TIES AT REQUISITE INTERVALS.

GENERALLY :
OUTER LEAF 100mm MEDIUM DENSITY CONCRETE BLOCKWORK, BLOCK STRENGTH TO STRUCTURAL ENGINEER'S SPECS. 100mm BBA CERTIFIED AND BUILDING REGS COMPLIANT FULL FILL INSULATION. INNER LEAF 100mm MEDIUM DENSITY BLOCKWORK, BLOCK STRENGTH TO STRUCTURAL ENGINEER'S SPECS. FINISHED INTERNALLY WITH 12.5mm PLASTERBOARD ON 10mm DABS, 3mm SKIMMED FINISH. ALL CAVITIES TO BE CLOSED AT OPENINGS WITH THERMABATE OR SIMILAR APPROVED. TOTAL U-VALUE, REFERS TO SAP REPORT.
* ALLOW FOR TWO COURSES OF WIENERBERGER RED MULTI BRICKWORK WITH AIR VENTS BELOW DPC IN A COLOUR TO BE APPROVED
REFER TO DETAIL DRAWING 30934-A-0TYP-21-302
* WHERE NOTED REPLACE BLOCKWORK WITH 102.5mm ENGINEERING BRICKWORK & REFER TO STRUCTURAL ENGINEER'S DRAWINGS

STRUCTURAL ENGINEERING REQUIREMENTS
GOAL POST STEEL WORK EXTENDS DOWN TO FOUNDATION. TWO GOAL POSTS REQUIRED PER BLOCK LOCATED IN THE END PLOTS WHERE SHOWN.
BLOCK STRENGTH TO STRUCTURAL ENGINEER'S SPECS TO EACH BUILDING.
BALCONY DESIGN BY SPECIALIST.
ALL MOVEMENT JOINTS FOLLOW FROM FOUNDATION LEVEL THROUGH FULL HEIGHT OF THE WALL.

EW 1 INTERNAL WALL TYPE 1 - General wet environment
70mm TIMBER STUD PARTITIONS, ONE LAYER 12.5mm PLASTERBOARD EACH SIDE, 3mm SKIMMED FINISH. MOISTURE RESISTANT BOARD TO BATHROOMS AND KITCHENS MIN MASS 10kg/m². PARTITIONS BETWEEN BATHROOMS AND HABITABLE ROOMS TO BE FILLED WITH MINERAL WOOL INS. MIN THICKNESS 25mm TO COMPLY WITH APPROVED DOC. E, SECT. 5.18.

EW 2 INTERNAL WALL TYPE 2 - General dry environment
70mm TIMBER STUD PARTITIONS, ONE LAYER 12.5mm PLASTERBOARD EACH SIDE, 3mm SKIMMED FINISH. MOISTURE RESISTANT BOARD TO BATHROOMS AND KITCHENS.

EW 3 INTERNAL WALL TYPE 3 - Wet environment (Where marked in the drawing)
90mm TIMBER STUD PARTITIONS, ONE LAYER 12.5mm PLASTERBOARD EACH SIDE, 3mm SKIMMED FINISH. MOISTURE RESISTANT BOARD TO BATHROOMS AND KITCHENS MIN MASS 10kg/m². PARTITIONS BETWEEN BATHROOMS AND HABITABLE ROOMS TO BE FILLED WITH MINERAL WOOL INS. MIN THICKNESS 25mm TO COMPLY WITH APPROVED DOC. E, SECT. 5.18.

EW 4 INTERNAL WALL TYPE 4 - Dry environment (Where marked in the drawing)
90mm TIMBER STUD PARTITIONS, ONE LAYER 12.5mm PLASTERBOARD EACH SIDE, 3mm SKIMMED FINISH. MOISTURE RESISTANT BOARD TO BATHROOMS AND KITCHENS.

PW 1 PARTY WALL (ROBUST DETAIL E-WM-17)
2 SKINS OF 100mm LIGHTWEIGHT AGGREGATE BLOCKS (1350 to 1600 kg/m³), BLOCK STRENGTH TO STRUCTURAL ENGINEER'S SPECS, 75mm CAVITY, ISOVER RD PARTY WOOL ROLL OR ISOVER ROUND THE HOUSE ROLL. INTERNAL FINISH OF 12.5mm PLASTERBOARD ON 10mm DABS, WITH 3mm SKIMMED FINISH. CAVITY STOP FIR INSULATION BARRIER TO BE PROVIDED AT CAVITY ENDS AND FITTED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

GF 1 GROUND FLOOR
75mm REINFORCED SCREED ON 130mm 'CELOTEX' 'XR4000' PIR INSULATION (OR SIMILAR APPROVED) ON 1000 GAUGE DPM (1200 GAUGE IF RADON PRESENT) ON 175mm DEEP SUSPENDED FULLY GROUTED BEAM & BLOCK FLOOR. INSULATION TURNED UP AT ENDS TO AVOID COLD BRIDGING AND LAID IN ACCORDANCE WITH MANUFACTURERS GUIDELINES/SPECIFICATION. 250mm Min. SUB FLOOR VOID VENTILATED VIA TELESCOPIC VENTS AT min 2m C/C. TOTAL U-VALUE REFERS TO SAP REPORT.

F 1 INTERNAL FLOOR
22mm T & G MOISTURE RESISTANT FLOOR BOARDING SCREWED AND GLUED TO JOISTS. 19mm RESIN BONDED MARINE PLY TO ALL BATHROOMS. MIN. MASS PER UNIT AREA 15kg/m². 302mm T.J. JOISTS ON HANGERS WITH 100mm Min. MINERAL WOOL INSULATION BETWEEN, Min. DENSITY 10kg/m³. 12.5mm PLASTERBOARD, 3mm SKIMMED FINISH, TO UNDERSIDE OF JOISTS. MOISTURE RESISTANT BOARD TO BATHROOM AND KITCHEN AREAS, MIN. MASS PER UNIT AREA 10kg/m². CONSTRUCTION TO COMPLY WITH APPROVED DOC. E, Section 5.

SC 1 SLOPING CEILING
130mm 'CELOTEX' 'FR5000' PIR INSULATION BETWEEN RAFTERS, AND 30mm 'CELOTEX' 'FR5000' PIR INSULATION UNDER RAFTERS, FINISHED WITH 2no. LAYERS OF 12.5mm PLASTERBOARD, 3mm SKIMMED FINISH.
TOTAL U-VALUE REFERS TO SAP REPORT.

PR 1 PITCHED ROOF TYPE 1
MARLEY ETERNIT RIVENDALE SLATE OR PLAIN CONCRETE TILE (WOSBOROUGH RED) ROOF FINISH ON 50 X 38mm TREATED BATTENS ON BREATHABLE UNDERLAY ON PREFABRICATED TRUSSES (BY SPECIALISTS); AIR SPACE BELOW MEMBRANE VENTED AT EAVES AND RIDGE. INSULATION AT CEILING LEVEL: 2 LAYERS OF 200mm MINERAL WOOL LAID BETWEEN CEILING TIES / JOISTS, AND 300mm MINERAL WOOL LAID OVER. INSULATION TO BE LAID OVER TOP OF EXTERNAL WALL TO MEET WALL INSULATION AND FULLY CLOSE CAVITY. 12.5mm PLASTERBOARD CEILING FINISH, MOISTURE RESISTANT TO BATHROOM AREAS, 3mm SKIMMED FINISH.
TOTAL U-VALUE REFERS TO SAP REPORT.

DC 1 DORMER CHEEKS
100mm SW TREATED TIMBER STUDS AT 400c/c WITH 100mm 'CELOTEX' INSULATION FRICION FITTED BETWEEN STUDS. INTERNAL FINISH OF 12.5mm PLASTERBOARD, 3mm SKIMMED FINISH. EXTERNAL FINISH LEAD EFFECT ROLL, AS PER MANUFACTURERS DETAILS.
TOTAL U-VALUE REFERS TO SAP REPORT.

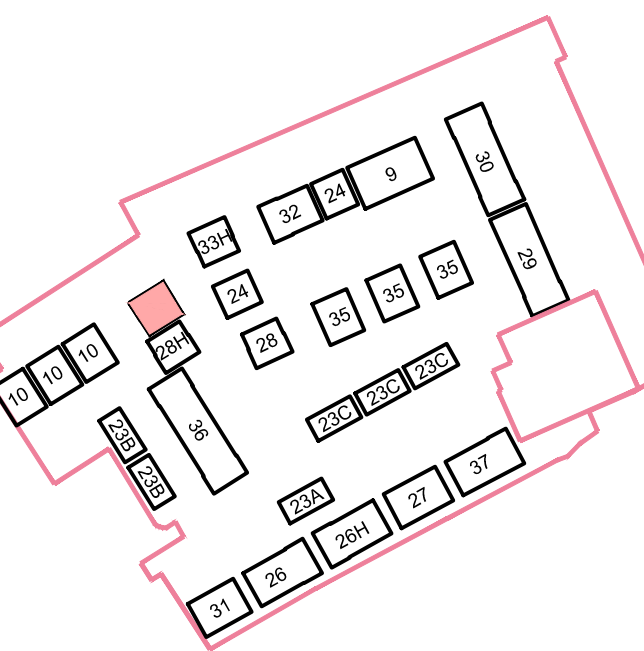
DRAWING SYMBOLS KEY:

-  CFS CAVITY FIRE STOP
-  GM GAS METER BOX
-  BT EXTERNAL BT BOX
-  RWP RAINWATER PIPE
-  SVP SOIL & VENT PIPE
-  SP SOIL PIPE
-  VENT EXTRACT VENT
-  MJ MOVEMENT JOINT
-  T-VENT TELESCOPIC VENT
-  LH LOFT HATCH

TYPICAL HOUSE TYPE REFERENCE DRAWINGS:

- HOUSE TYPE A1 / C2
30934 21 TYP A3 ROBUST DETAIL BOOK
30934 21 TYP EXTERNAL BALUSTRADES
30934 24 TYP INTERNAL STAIRCASE
30934 32 TYP HANDICAPPED INTERNAL DOORS
30934 50 TYP BOILER CURBOARD
30934 74 TYP BATHROOMS

Contractors are not to scale dimensions from this drawing



Phase 3A - Residential Housing
Key Site plan - Block Types

Phase 3A Block Reference Drawings:

- 30934-A-03-BK33-001/002 Block 33 GA Plans
30934-A-05-BK33-001/002 Block 33 Elevations
30934-A-27-BK33-001 Block 33 Roof plan

Schedule

- 30934-A-21-TYP-Series
30934-A-27-TYP-Series

Revision	Date	Description
C6	24.03.2017	Internal information stripped out, external / party wall types annotated to GF
		Stud work construction notes amended.
		Floor vents relocated to avoid dashes with incoming services
C5	10.03.2017	SUBSTRUCTURE FLOOR:
		Drainage pipes, dims, foundations updated, cross section references omitted
		GROUND FLOOR: pending for further update.
C4	10.01.2017	Air brick position amended, construction notes updated.
C3	05.12.2016	Drawing & title block correction
C2	09.11.2016	General update and full RFI insulation.
C1	25.10.2016	Line weights adjusted for clarity.
C-	30.09.2016	Construction issue
T4	07.09.2016	Structural information added
T3	02.09.2016	Superstructure issue
T2	19.08.2016	RPI issue.
T1	04.08.2016	Sub structure added, House type A3 replaced with A1.



BroadwayMalyan^{BM}

Architecture Urbanism Design

Ilex House, 10 High Street
Theale, Reading
Berkshire
RG7 5AN

T: +44 (0)118 932 3456
F: +44 (0)118 932 3461
E: Rdg@broadwaymalyan.com

www.BroadwayMalyan.com

Client
St Edward Home Ltd
Project
Green Park Village
Phase 3A

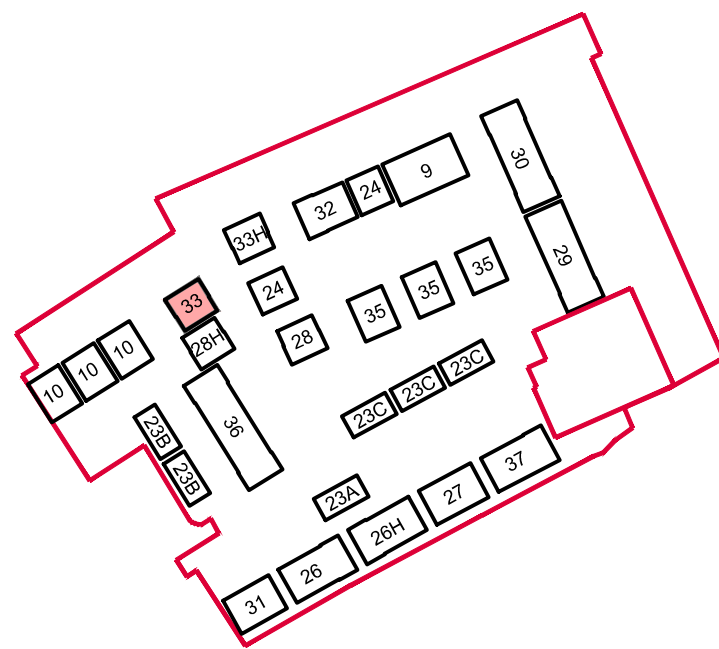
Description
GA Plans - Block 33
Sub Structure and Ground Floor Plan

CONSTRUCTION ISSUE

Scale	Drawn By	Date
1:50@A1	RS	July 16
Job Number	Drawing Number	Revision
30934	A-03-BK33-001	C6

Original size 100mm @ A1 Copyright Broadway Malyan Limited

Contractors are not to scale dimensions from this drawing



Phase 3A - Residential Housing
Key Site plan - Block Types

Phase 3A Block Reference Drawings:

30934-A-03-BK33-001/002 Block 33 GA Plans
30934-A-05-BK33-001/002 Block 33 Elevations
30934-A-27-BK33-001 Block 33 Roof plan

30934-A-31-TYP-003 Type B1 Windows & Door

Schedule
30934-A-21-TYP-001 Type A, B, G Dormer Schedule

30934-A-21-TYP - A3 ROBUST DETAILS BOOK

C3	27.03.2017	Roof vent tiles omitted, wall hatches updated
C2	10.01.2017	Line/ds detail and construction notes changed.
C1	14.11.2016	General update
C-	30.09.2016	Construction issue
T2	30.09.2016	Construction issue
T1	02.09.2016	Super-structure issue.
Revision	Date	Description



BroadwayMalyan^{BM}
Architecture Urbanism Design

Ilex House, 10 High Street
Theale, Reading
Berkshire
RG7 5AN

T: +44 (0)118 932 3456
F: +44 (0)118 932 3461
E: Rdg@broadwaymalyan.com

www.BroadwayMalyan.com

Client
St Edward Homes Ltd

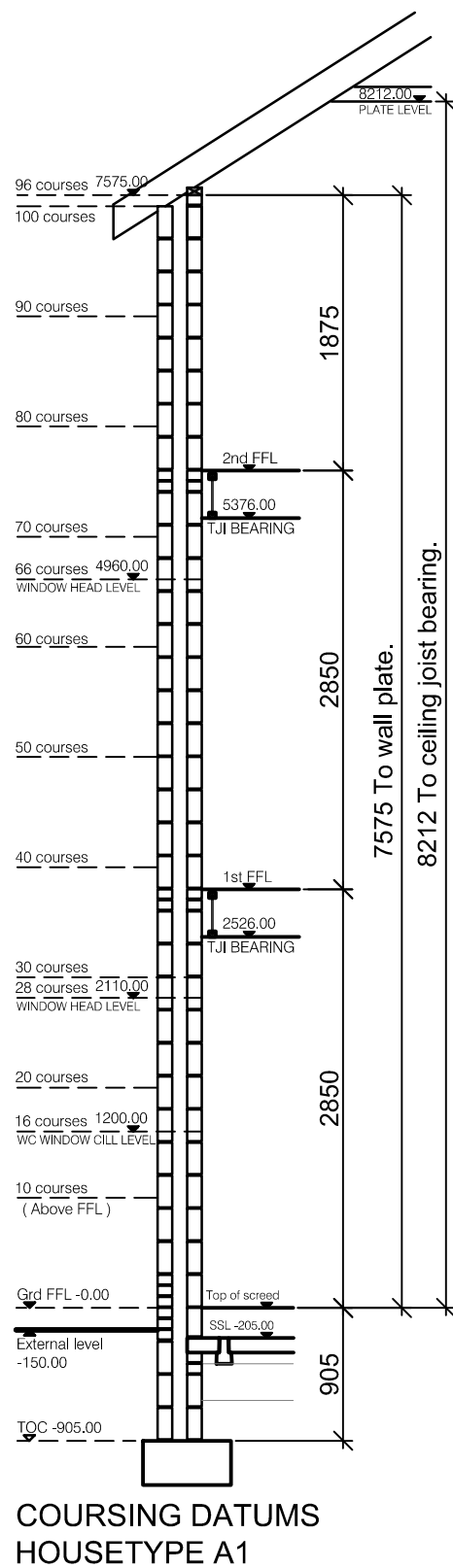
Project
**Green Park Village
Phase 3A**

Description
**GA Plans - House Type A1, C2
GA Section 05
BK 33 Plots: 115, 116**

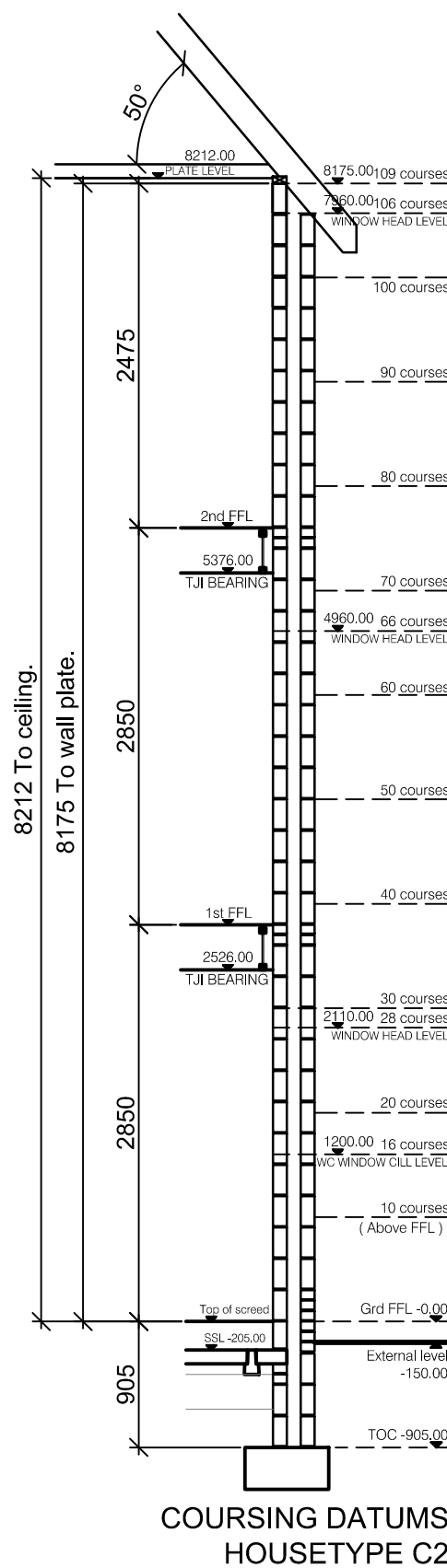
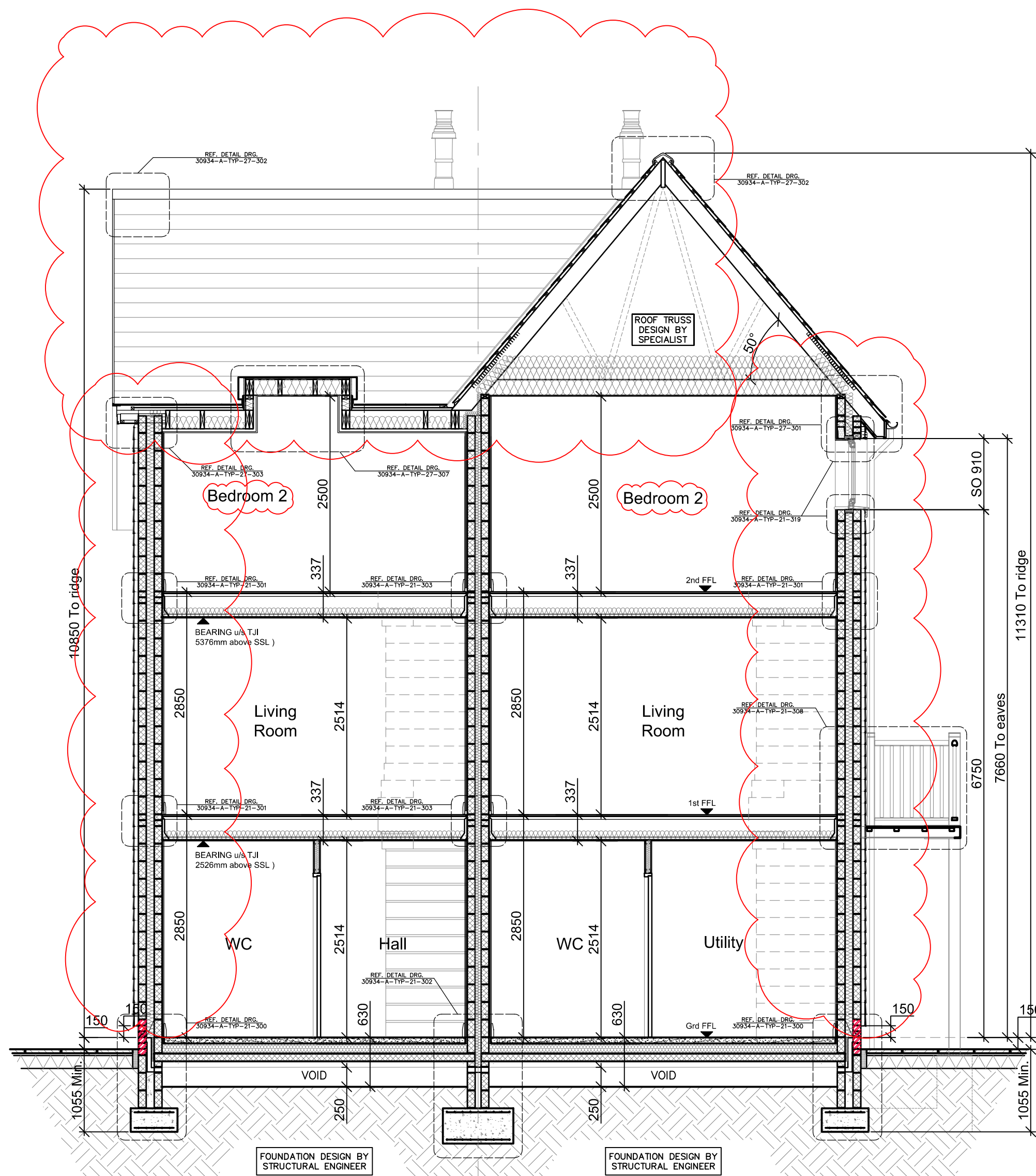
Status
CONSTRUCTION ISSUE

Scale	Drawn By	Date
1:50@A1	EG/JT	August 16
Job Number	Drawing Number	Revision
30934	A-04-BK33-001	C3

Original size 100mm @ A1 Copyright Broadway Malyan Limited



SECTION 05



CONSTRUCTION NOTES

EW 1 EXTERNAL WALL TYPE 1
"HARDIEPLANK" OVERLAP WEATHERBOARD ON 50 x 50mm
TREATED BATTENS ON BREATHER MEMBRANE AND
MECHANICALLY FIXED TO OUTER LEAF (ALL FLOORS)

EW 2 EXTERNAL WALL TYPE 2
FAIR FACED BRICKWORK OUTER LEAF TIED BACK TO INNER
LEAF WITH WALL TIES AT REQUISITE INTERVALS.

GENERALLY :
OUTER LEAF : 100mm MEDIUM DENSITY CONCRETE BLOCKWORK,
BLOCK STRENGTH TO STRUCTURAL ENGINEER'S SPECS. 100mm
BBA CERTIFIED AND BUILDING REGS COMPLIANT FULL FILL
INSULATION. INNER LEAF : 100mm MEDIUM DENSITY BLOCKWORK,
BLOCK STRENGTH TO STRUCTURAL ENGINEER'S SPECS.
FINISHED INTERNALLY WITH 12.5mm PLASTERBOARD ON 10mm
DABS. 3mm SKIMMED FINISH. ALL CAVITIES TO BE CLOSED AT
OPENINGS WITH THERMABATE OR SIMILAR APPROVED.
TOTAL U-VALUE REFERS TO SAP REPORT.
* ALLOW FOR TWO COURSES OF 'WIENERBERGER' RED MULTI
BRICKWORK WITH AIR VENTS BELOW DPC
IN A COLOUR TO BE APPROVED
REFER TO DETAIL DRAWING 30934-A-0TYP-21-302
* WHERE NOTED REPLACE BLOCKWORK WITH
102.5mm ENGINEERING BRICKWORK & REFER TO
STRUCTURAL ENGINEER'S DRAWINGS

STRUCTURAL ENGINEERING REQUIREMENTS
GOAL POST STEEL WORK EXTENDS DOWN TO FOUNDATION.
TWO GOAL POSTS REQUIRED PER BLOCK LOCATED IN THE END
PLOTS WHERE SHOWN.
BLOCK STRENGTH TO STRUCTURAL ENGINEER'S SPECS TO
EACH BUILDING.
BALCONY DESIGN BY SPECIALIST.
ALL MOVEMENT JOINTS FOLLOW FROM FOUNDATION LEVEL
THROUGH FULL HEIGHT OF THE WALL.

IW 1 INTERNAL WALL TYPE 1 - General wet environment
70mm TIMBER STUD PARTITIONS, ONE LAYER 12.5mm
PLASTERBOARD EACH SIDE, 3mm SKIMMED FINISH. MOISTURE
RESISTANT BOARD TO BATHROOMS AND KITCHENS MIN MASS
10kg/m². PARTITIONS BETWEEN BATHROOMS AND HABITABLE
ROOMS TO BE FILLED WITH MINERAL WOOL INS. MIN THICKNESS
25mm TO COMPLY WITH APPROVED DOC. E, SECT. 5.18.

IW 2 INTERNAL WALL TYPE 2 - General dry environment
70mm TIMBER STUD PARTITIONS, ONE LAYER 12.5mm
PLASTERBOARD EACH SIDE, 3mm SKIMMED FINISH. MOISTURE
RESISTANT BOARD TO BATHROOMS AND KITCHENS.

IW 3 INTERNAL WALL TYPE 3 - Wet environment
(Where marked in the drawing)
90mm TIMBER STUD PARTITIONS, ONE LAYER 12.5mm
PLASTERBOARD EACH SIDE, 3mm SKIMMED FINISH. MOISTURE
RESISTANT BOARD TO BATHROOMS AND KITCHENS MIN MASS
10kg/m². PARTITIONS BETWEEN BATHROOMS AND HABITABLE
ROOMS TO BE FILLED WITH MINERAL WOOL INS. MIN THICKNESS
25mm TO COMPLY WITH APPROVED DOC. E, SECT. 5.18.

IW 4 INTERNAL WALL TYPE 4 - Dry environment
(Where marked in the drawing)
90mm TIMBER STUD PARTITIONS, ONE LAYER 12.5mm
PLASTERBOARD EACH SIDE, 3mm SKIMMED FINISH. MOISTURE
RESISTANT BOARD TO BATHROOMS AND KITCHENS.

PW 1 PARTY WALL (ROBUST DETAIL E-WM-17)
2 SKINS OF 100mm LIGHTWEIGHT AGGREGATE BLOCKS (1350 to
1600 kg/m³). BLOCK STRENGTH TO STRUCTURAL ENGINEER'S
SPECS. 75mm CAVITY. ISOVER RD PARTY WOOL ROLL OR
ISOVER ROUND THE HOUSE ROLL. INTERNAL FINISH OF 12.5mm
PLASTERBOARD ON 10mm DABS. WITH 3mm SKIMMED FINISH.
CAVITY STOP FR INSULATION BARRIER TO BE PROVIDED AT
CAVITY ENDS AND FITTED IN ACCORDANCE WITH
MANUFACTURER'S INSTRUCTIONS.

GF 1 GROUND FLOOR
75mm REINFORCED SCREED ON 130mm 'CELOTEX' 'FR4000' PIR
INSULATION (OR SIMILAR APPROVED) ON 1000 GAUGE DPM
(1200 GAUGE IF RADON PRESENT) ON 175mm DEEP SUSPENDED
FULLY GROUTED BEAM & BLOCK FLOOR. INSULATION TURNED
UP AT ENDS TO AVOID COLD BRIDGING AND LAID IN
ACCORDANCE WITH MANUFACTURERS
GUIDELINES/SPECIFICATION. 250mm Min. SUB FLOOR VOID
VENTILATED VIA TELESCOPIC VENTS AT min 2m C/C.
TOTAL U-VALUE REFERS TO SAP REPORT.

IF 1 INTERNAL FLOOR
22mm T & G MOISTURE RESISTANT FLOOR BOARDING SCREWED
AND GLUED TO JOISTS. 19mm RESIN BONDED MARINE PLY TO
ALL BATHROOMS. MIN. MASS PER UNIT AREA 15kg/sqm. 302mm
T/J JOISTS ON HANGERS WITH 100mm Min. MINERAL WOOL
INSULATION BETWEEN. MIN. DENSITY 10kg/sqm. 12.5mm
PLASTERBOARD. 3mm SKIMMED FINISH. TO UNDERSIDE OF
JOISTS. MOISTURE RESISTANT BOARD TO BATHROOM AND
KITCHEN AREAS. MIN. MASS PER UNIT AREA 10kg/m².
CONSTRUCTION TO COMPLY WITH APPROVED DOC. E, Section 5.

SC 1 SLOPING CEILING
130mm 'CELOTEX' 'FR5000' PIR INSULATION BETWEEN RAFTERS,
AND 30mm 'CELOTEX' 'FR5000' PIR INSULATION UNDER RAFTERS.
FINISHED WITH 2No. LAYERS OF 12.5mm PLASTERBOARD, 3mm
SKIMMED FINISH.
TOTAL U-VALUE REFERS TO SAP REPORT.

PR 1 PITCHED ROOF TYPE 1
MARLEY ETERNIT RIVENDALE SLATE OR PLAIN CONCRETE TILE
(MOSBOROUGH RED) ROOF FINISH ON 50 X 38mm TREATED
BATTENS ON BREATHABLE UNDERLAY ON PREFABRICATED
TRUSSES (BY SPECIALISTS). AIR SPACE BELOW MEMBRANE.
VENTED AT EAVES AND RIDGE. INSULATION AT CEILING LEVEL : 2
LAYERS OF 200mm MINERAL WOOL LAID BETWEEN CEILING TIES
/ JOISTS, AND 300mm MINERAL WOOL LAID OVER. INSULATION
TO BE LAID OVER TOP OF EXTERNAL WALL TO MEET WALL
INSULATION AND FULLY CLOSE CAVITY. 12.5mm PLASTERBOARD
CEILING FINISH. MOISTURE RESISTANT TO BATHROOM AREAS.
3mm SKIMMED FINISH.
TOTAL U-VALUE REFERS TO SAP REPORT.

DC 1 DORMER CHEEKS
100mm S/W TREATED TIMBER STUDS AT 400c/c WITH 100mm
'CELOTEX' INSULATION FRICTION FITTED BETWEEN STUDS.
INTERNAL FINISH OF 12.5mm PLASTERBOARD, 3mm SKIMMED
FINISH. EXTERNAL FINISH LEAD EFFECT ROLL. AS PER
MANUFACTURERS DETAILS.
TOTAL U-VALUE REFERS TO SAP REPORT.

DRAWING SYMBOLS KEY:

CFS	CAVITY FIRE STOP	LH	LOFT HATCH
GM	GAS METER BOX		
BT	EXTERNAL BT BOX		
RWP	RAINWATER PIPE		
SVP	SOIL & VENT PIPE		
SP	SOIL PIPE		
VENT	EXTRACT VENT		
MJ	MOVEMENT JOINT		
T-VENT	TELESCOPIC VENT		

TYPICAL HOUSE TYPE REFERENCE DRAWINGS:

HOUSE TYPE	A1, C2
30934 21 TYP	A3 ROBUST DETAIL BOOK
30934 21 TYP	EXTERNAL BALUSTRADES
30934 24 TYP	INTERNAL STAIRCASE
30934 32 TYP	HANDED INTERNAL DOORS
30934 50 TYP	BOILER CUPBOARD
30934 74 TYP	BATHROOMS

SUBSTRUCTURE NOTES

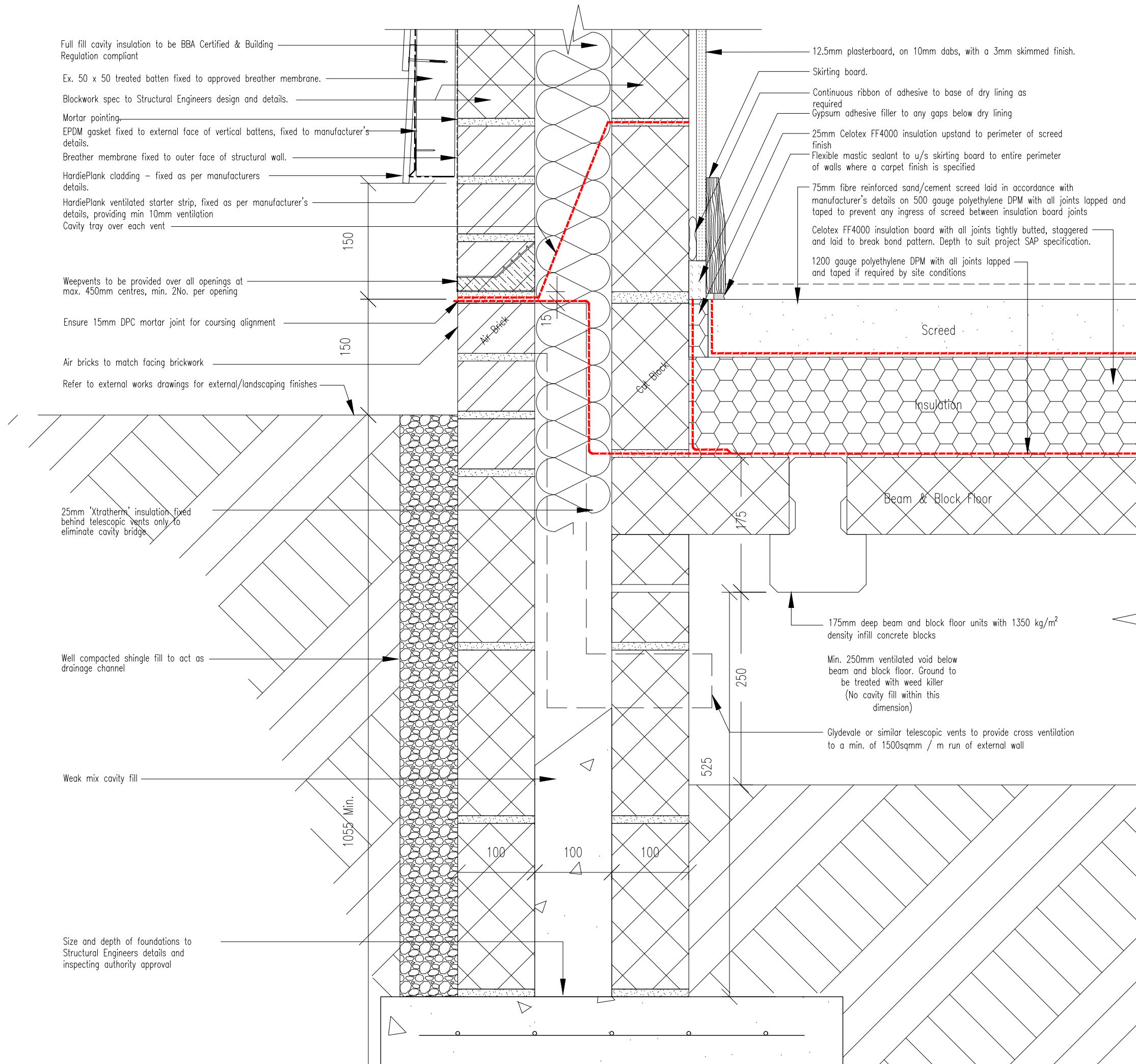
- THIS DRAWING MUST BE READ IN CONJUNCTION WITH ALL OTHER PROJECT DRAWINGS
- ALL DETAILS AND DRAWINGS MUST BE READ IN CONJUNCTION WITH OUTLINE CONSTRUCTION SPECIFICATION.
- BEAM AND BLOCK & FOUNDATIONS TO STRUCTURAL ENGINEER / SPECIALIST DESIGN
- LOCATIONS OF RWP'S AND SVP'S TO BE COORDINATED WITH ENGINEERS DRAINAGE DESIGN.
FOUNDATIONS:
- FOUNDATION WIDTHS AND DEPTHS TO BE DETERMINED BY THE STRUCTURAL ENGINEER, BASED UPON THE SITE INVESTIGATION REPORT / WALL FOUNDATION LOADS TO BE AGREED BY BUILDING CONTROL.
- SOIL REPORT TO BE CHECKED FOR SPECIAL REQUIREMENTS E.G. PRECAUTIONS NECESSARY FOR SULPHATES IN SOIL ETC.
- DENOTES BEAM AND BLOCK SUSPENDED GROUND FLOOR SPAN DIRECTIONS.
- BRICK VENTS TO BE ADDED AS PER MANUFACTURERS REQUIREMENTS.
- GROUND BELOW VOID TO BE COVERED WITH WEEED KILLER, AND REQUIREMENT FOR SAND BLINDINGWEAK CEMENT LAYER BELOW VOID TBC BY ENGINEER.

10. SUBSTRUCTURE KEY:

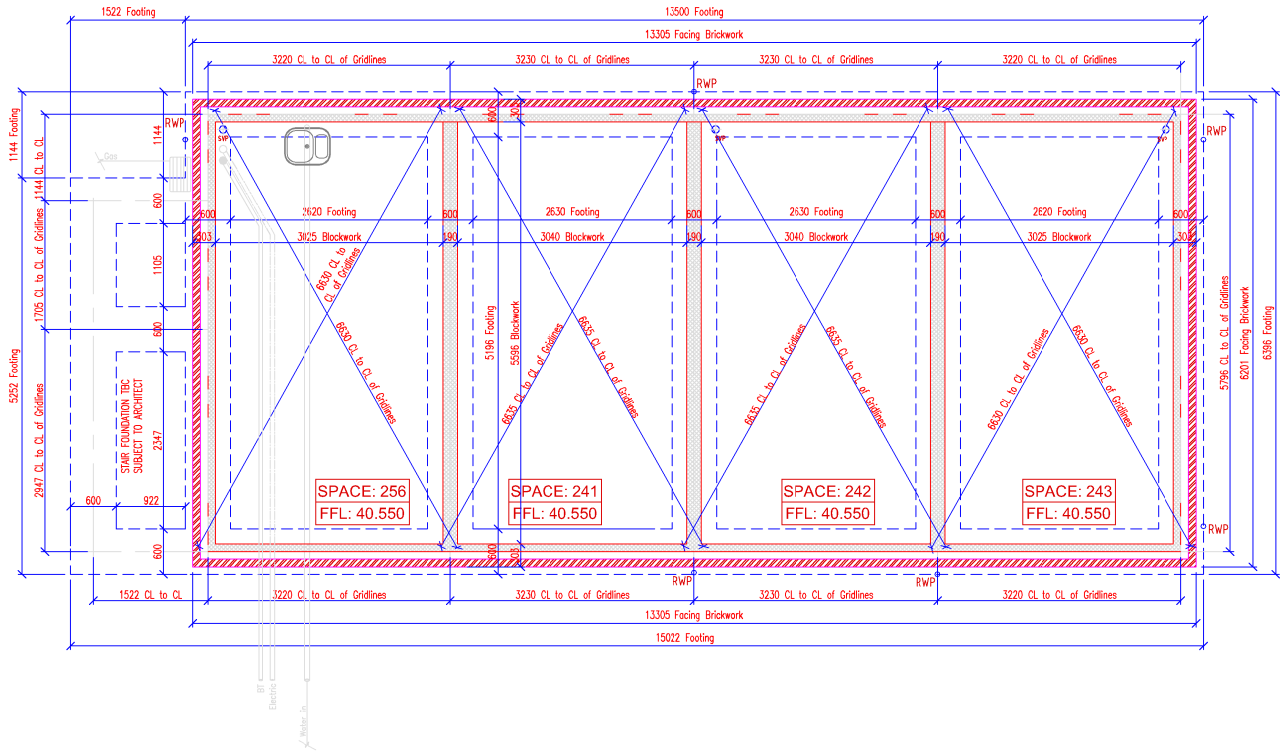
- SVP - 100MM DIAMETER SOIL AND VENT PIPE
RWP - RAINWATER DOWNPIPE
T-VENT - TELESCOPIC VENTS AT MAX 2 METRE CENTRES
PATTERN AND TYPE OF AIRBRICK TO BE CONFIRMED
MJ - MOVEMENT JOINTS PLACED TO AVOID ALL
STRUCTURAL MEMBERS/LINTELS AS PER SE'S DESIGN
11. BELOW GROUND SERVICES CO-ORDINATION:
LOCATION AND SPECIFICATION OF INCOMING SERVICES IS
INDICATIVE, FOR DETAILED DESIGN PLEASE REFER TO M&E
ENGINEERS DETAILS AND SPECIFICATION.
12. VENTILATION UNDER SUSPENDED FLOOR:
VOID BELOW SUSPENDED FLOOR TO BE VENTED WITH
PROPRIETARY TELESCOPIC ADJUSTABLE FLOOR VENTS
AT MAX. 2M CENTRES TO SUIT MANUFACTURERS
RECOMMENDATIONS

STRUCTURAL ENGINEERING REQUIREMENTS

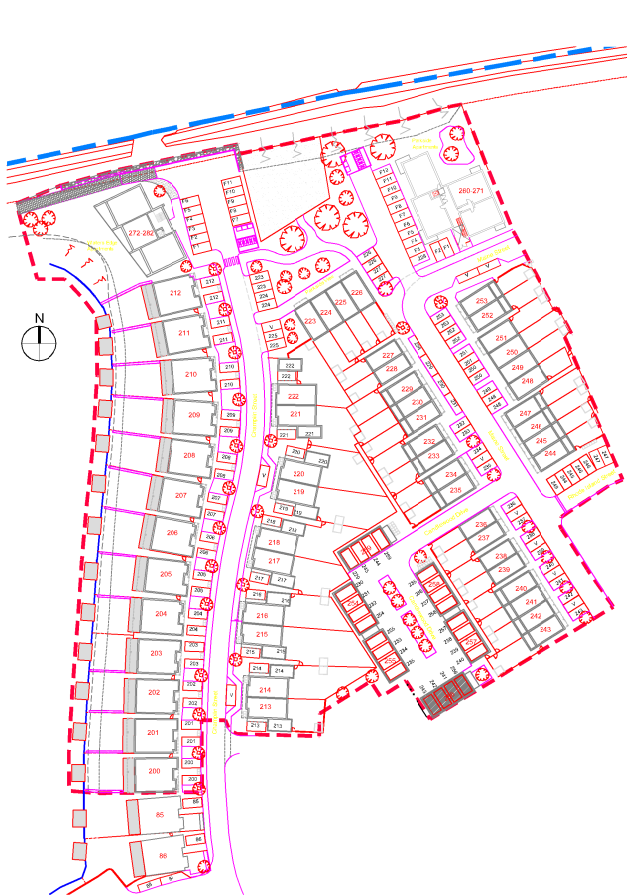
GOAL POST STEEL WORK EXTENDS DOWN TO
FOUNDATION.
TWO GOAL POSTS REQUIRED PER BLOCK LOCATED IN
THE END PLOTS WHERE SHOWN.
BLOCK STRENGTH TO STRUCTURAL ENGINEER'S SPECS
TO EACH BUILDING.
BALCONY DESIGN BY SPECIALIST.
ALL MOVEMENT JOINTS FOLLOW FROM FOUNDATION
LEVEL THROUGH FULL HEIGHT OF THE WALL



T1	TENDER ISSUE	21/04/17
REV	AMENDMENTS	DATE
TENDER ISSUE ALL DRAWING INFORMATION CONVEYED TO BE APPROVED IN WRITING BY CLIENT PRIOR TO A FORMAL CONSTRUCTION ISSUE		
St Edward Designed for life		
Green Park Village Reading Phase 5		
FOR ST EDWARD		
Construction Details Ground Floor Details External Wall Junction		
1:5 @ A3	MAR 2017	-
1573	1600	T1
Robert Rigby Architects 42 Portman Road, Reading, Berks RG30 1EA Telephone: 0118 9577010 Fax: 0118 9577019 E-Mail: enquiries@rigbyarchitects.com		



SUBSTRUCTURE PLAN



DRAWING CHECKLIST - SUBSTRUCTURE PLAN		CHECKED
1	Plot information added	
2	Finish Floor Levels added	
3	Gridline / CL added (CL's are central within external walls)	
4	Property entrance location arrow added	
5	Vent positions added	
6	Direction of span arrows added	
7	Dimensions added (Grid Lines, Brick Dimensions & Footings)	
8	Footings widths shown (in line with SE requirements)	
9	WHB & WC positions shown (+ dimensioned water intake)	
10	Kitchen sink position shown (+ dimensioned intake positions)	
11	Sink position/handling in line with Kitchen design layout	
12	SVP locations shown and dimensioned	
13	RWP positions shown	
14	Intake positions shown (Gas, Water, Telephone & Electric)	
15	Intake positions (RWP, SVP, Electric, Water) match GP plan	
16	Support for Balcony (if applicable)	
17	Load-Bearing / Non Load-Bearing walls denoted	
18	Lift Pit & Tanking requirements (if applicable)	
19	Level threshold shown	
20	-	
21	-	
22	-	
23	-	
24	-	
25	-	

For full details of construction below DPC level please refer to Structural Engineers drawings.

All Floor Levels and foundation widths denoted must be cross checked against the Structural Engineers drawing.

Air brick provision and locations shown indicatively. Exact positioning to be assessed on site and to accommodate level threshold and semi-concealed gas meter box locations.

For periscope vent detail please refer to Floor & Wall section details.

Allow provision for 110mm floor socket set below 70mm partition wall behind WHB to cloakroom.

Allow provision for 100mm Floor Socket (replacing BIG) positioned below Kitchen sink bowl to ensure clear space for unit i.e. dishwasher below sink drainer.

Where WC waste pipes penetrate external wall (not denoted on plan) allow provision for an opening to be formed to give min 50mm clearance around the pipe. Opening to be masked with rigid sheet material to prevent ingress of fill or vermin. New opening to be bridged with rocker pipe or lintel provision in accordance with structural engineers recommendations. Appropriate condition will also be applicable to SVP branches. Contractor to access on site.

Movement Joints at extreme edges of each terrace block to be positioned a minimum of 327mm (Brick and Half) from the return corner. The position of RWP's are such that they hide the movement joint behind where possible.

Symbols comprising WHB/WC/Kitchen sink/Washing Machine and principle door entrance are denoted to enable immediate reference points.

Gas Membrane information please refer to separate details. Install gas membrane and conduct / locate penetrations and membrane laps in accordance with manufacturers recommendations together with structural engineer information. If in doubt please ask.

For full details, location and setting out of structural information including block strengths, movement joints and lintels please refer to appointed structural engineers drawing issued under separate cover. If in doubt please ask.

C5	BT INTAKE ADDED	06/06/17
C4	NEW GAS METER BOX, HYPEROPTIC CABLE LINE REMOVED	15/05/17
C3	RWP'S ADDED	04/04/17
C2	NON-RELEVANT DIMENSIONS REMOVED	15/03/17
C1	CONSTRUCTION ISSUE	16/03/17
REV	AMENDMENTS	DATE

CONSTRUCTION ISSUE

ALL DRAWING INFORMATION CONVEYED TO BE APPROVED IN WRITING BY CLIENT PRIOR TO A FORMAL CONSTRUCTION ISSUE

St Edward

Designed for life

Green Park Village

Reading

Phase 5

FOR

St Edward

Block: 31

Type: G4

Plots: 256

GA Substructure Plan

150 @ A1	JAN 2017	-
1573	1131-10	C5

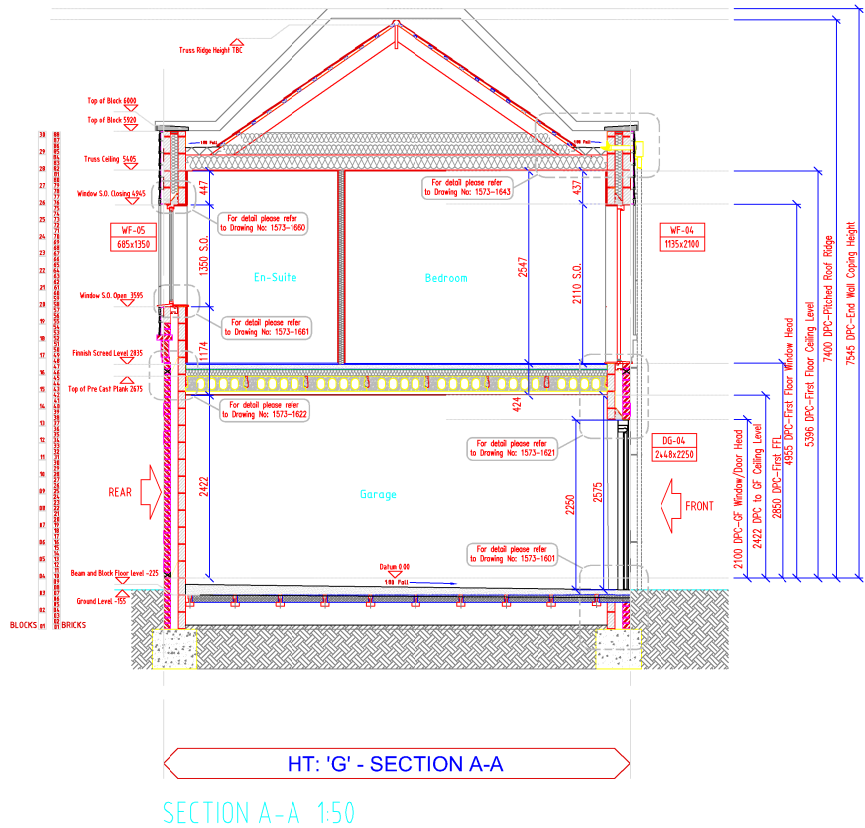
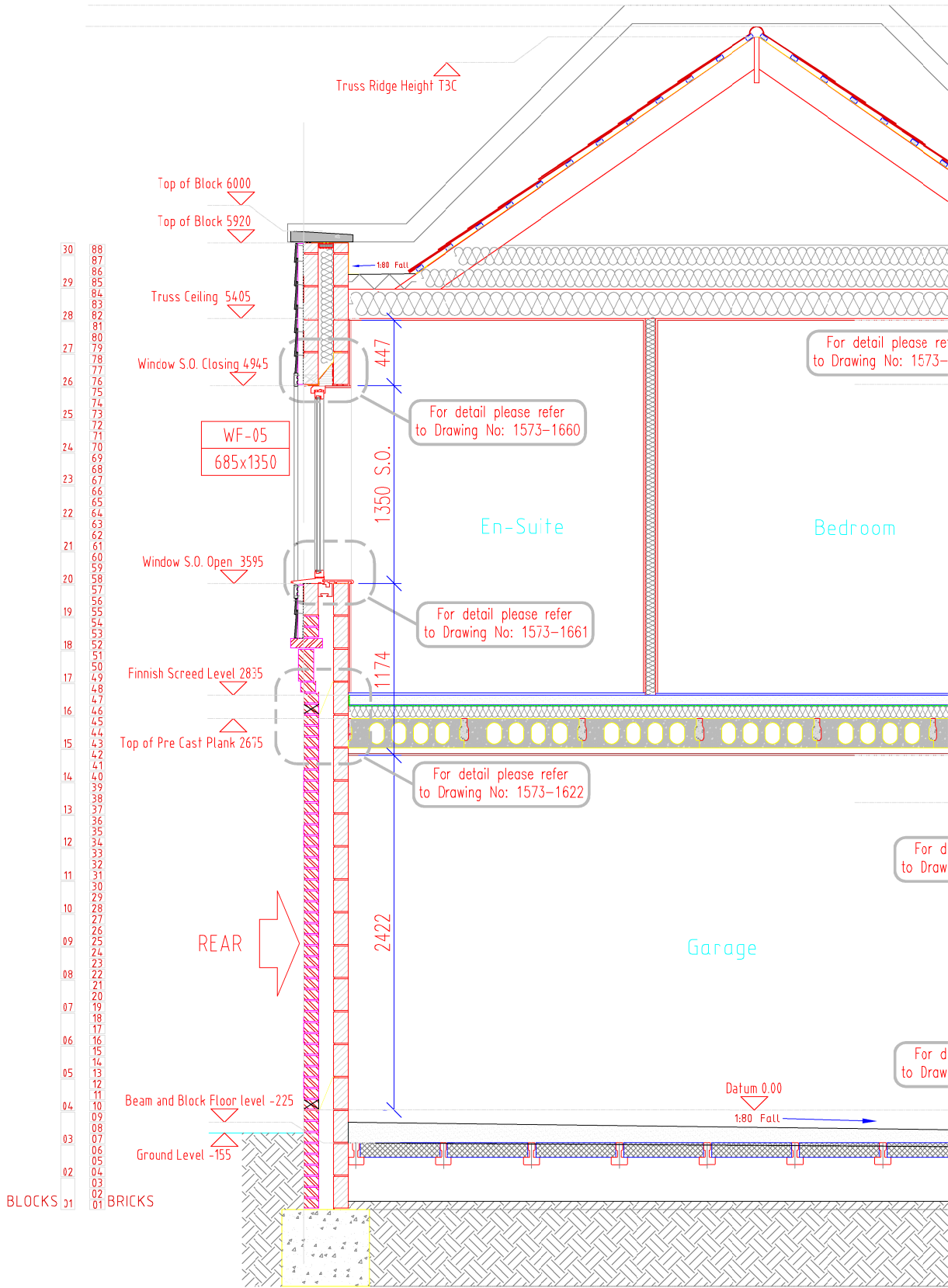
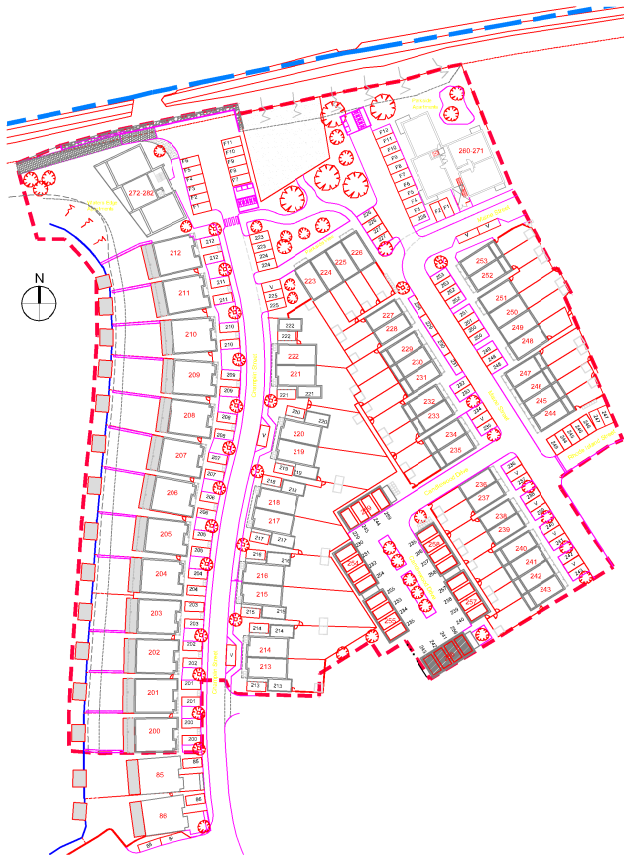
Robert Rigby Architects

42 Portman Road, Reading, Berks RG30 1EA

Telephone: 0118 9577010 Fax: 0118 9577019

E-Mail: enquiries@rigbyarchitects.com

DRAWING CHECKLIST - SECTIONS		CHECKED
1	Floor construction correct for unit type (Cube 6 vs. Block)	
2	Levels added	
3	External wall make-up correct (89mm TF vs. 160mm TF)	
4	First / Second floor make-up correct	
5	Roof pitch (& falls) checked against planning elevations	
6	Movement joints added below window cill (TF only)	
7	Full dimensions added	
8	Detail references added	
9	Staircase information added (Risers, Goings, etc)	
10	Window references added (cill height over boxing/kitchen)	
11	Brick / Block gauge added	
12	Stair detail (handrail position, min width, No. of winders)	
13	Joist design correct (Solid, F.J, T.J), 240, 241, 242...	
14	Drop ceilings shown	
15	Cavity stops shown	
16	Shelling times checked	
17	Acoustic ceiling shown	
18	Gas membrane detailed	
19	Levels shown	
20	Fire stop at upper floor junctions	
21	Fire stop at eaves	
22	Requirement for sound insulation in semi exposed floors	
23	Insulation depth in separating f/f's according to joists type	
24	Bulkhead clashes removed from over stairs	
25	-	
26	-	
27	-	
28	-	
29	-	
30	-	
31	-	
32	-	
33	-	
34	-	
35	-	



C1	CONSTRUCTION ISSUE	10/03/17
REV	AMENDMENTS	DATE
CONSTRUCTION ISSUE		
ALL DRAWING INFORMATION CONVEYED TO BE APPROVED IN WRITING BY CLIENT PRIOR TO A FORMAL CONSTRUCTION ISSUE		
St Edward		
Designed for life		
Green Park Village		
Reading		
Phase 5		
FOR		
St Edward		
Block: 31		
Type: G4		
Plots: 256		
Section A-A		
150 @ A1	JAN 2017	-
1573	1131-40	C1
Robert Rigby Architects		
42 Portman Road, Reading, Berks RG30 1EA		
Telephone: 0118 9577010 Fax: 0118 9577019		
E-Mail: enquiries@rigbyarchitects.com		

APPENDIX 2

SUBFLOOR VENTILATION – AIR FLOW THROUGH THE SUBFLOOR VOID

Parameter	Methane	Carbon Dioxide	Comments
Building Subfloor Parameters			
Length	8.95 m	8.95 m	Development plans
Width	3.907 m	3.907 m	Development plans
Subfloor Height	0.25m	0.25m	Development plans
Surface emission rate of gas beneath building			
Hydraulic conductivity of gas migration pathway – vibro-stone columns	1×10^{-3} m/s	1×10^{-3} m/s	Estimates for gravel in vibro-stone columns following placement.
Intrinsic permeability of gas migration pathway	1.02×10^{-10} m ²	1.02×10^{-10} m ²	Calculated
Unit weight of gas	7.2 N/m ³	19.4 N/m ³	Ground Gas Handbook (2009)
Viscosity of gas	1.03×10^{-5} Ns/m ³	1.4×10^{-5} Ns/m ³	Ground Gas Handbook (2009)
Pressure within the ground	0.5 Pa	0.5 Pa	Conservative assumption as calculated dynamic pressure due to wind at subfloor (at 0.25m height) based on guidance provided in Partners in Technology Passive Venting of Soil Gases Beneath Buildings Research Report (1997) is 0.1 Pa - pressure difference between gas in soils and inside the building
Vertical migration distance	2.5m	2.5m	Based on source within the made ground / alluvium
Surface area for gas migration from source (VSC) into subfloor.	6.2m	6.2m	Up to 22no. stone columns per plot, 600mm diameter each
Pressure gradient along gas migration route (i)	0.03	0.01	Calculated from pressure within the source and length of migration pathway
Gas concentration at source	26.5%	17.9%	Peak results from monitoring
Surface emission rate beneath building footprint (q)	3.35×10^{-4} m ³ /hr/m ²	1.67×10^{-4} m ³ /hr/m ²	Calculated
Calculation of Air Flow Rate through the Void (Q)			
Design wind speed being exceeded for a given proportion of time (u_m)			
Hourly mean wind speed for the site area exceeded 50% of the time (u_{50})	4.0 m/s	4.0 m/s	Figure 5 BS5925
Correction ratio for the mean wind speed (u_{50}) being exceeded for a given percentage of time - based on 80%	0.46	0.46	Table 9 BS5925 for sheltered inland areas
Design wind speed being exceeded (u_m)	1.84	1.84	Calculated
Reference Wind Speed (u_r) at Vent Height			
Factors determining mean wind speed at different heights and for different types of terrain	k:0.35 a: 0.25	k:0.35 a: 0.25	Table 8 BS5925 for an urban location
Height of subfloor vents (z)	0.15 m	0.15 m	Development plans
Reference Wind Speed at vent height (U_r)	0.401 m/s	0.401 m/s	Calculated
Calculation of Air Flow Rate through the Void (Q)			

Parameter	Methane	Carbon Dioxide	Comments
Equivalent area of openings / ventilation in subfloor (A_w)	3000 mm ² /m	3000 mm ² /m	Minimum requirement in Building Regulations
Discharge coefficient of opening (C_d)	0.61	0.61	BS5925
Reference wind speed (U_r)	0.401	0.401	Calculated
Surface pressure coefficient (C_p)	0.4	0.4	Conservative value
Air flow through the void (Q)	6.524 m ³ /hour	6.524 ³ /hour	Calculated
Equilibrium Concentration in Subfloor and Time to Reach Critical Concentration			
Critical gas concentration in subfloor	5%	3%	Assumed critical concentration
Equilibrium gas concentration in subfloor	0.179%	0.089%	Calculated
Time to fill the subfloor to the critical concentration during a period of still wind	37 hours	45 hours	Calculated – greater than period of still wind (10 hours) indicated in Ground Gas Handbook (6 hours in Partners in Technology, 1997)

APPENDIX 3
INPUT PARAMETERS FOR PRESSURE DRIVEN FLOW INTO GROUND
FLOOR LIVING SPACE

Parameter	Methane	Carbon Dioxide	Comments
Hydraulic conductivity of gas migration pathway	1×10^{-3} m/s	1×10^{-3} m/s	Estimates for gravel in vibro-stone columns following placement
Intrinsic permeability of gas migration pathway	1.02×10^{-10} m ²	1.02×10^{-10} m ²	Calculated
Unit weight of gas	7.2 N/m ³	19.4 N/m ³	Ground Gas Handbook (2009)
Viscosity of gas	1.03×10^{-5} Ns/m ³	1.4×10^{-5} Ns/m ³	Ground Gas Handbook (2009)
Pressure within the ground	3.1 Pa	3.1 Pa	Environment Agency SR3 (2009) for residential semi-detached housing - pressure difference between gas in soils and inside the building
Vertical migration distance	2.5m	2.5m	Based on source within the made ground / alluvium
Surface area for gas migration from source (VSC) into subfloor / building.	6.2m	6.2m	Up to 22no. stone columns per plot, 600mm diameter each
Pressure gradient along gas migration route (i)	0.17	0.06	Calculated from pressure within the source and length of migration pathway
Gas concentration at source	26.5%	17.9%	Peak results from monitoring
Volume of Gas Migrating from beneath the building footprint	0.0727 m ³ /hr	0.0362 m ³ /hr	Calculated
Equilibrium Concentration in Receptor			
Gap area between flooring	1.452m	1.452m	925 blocks (440mm x 215mm) with 2mm gaps adjacent to the long ends of each block
Height of building space	2.514m	2.514m	Development plans
Length of building space	8.950m	8.950m	Development plans
Width of building space	3.907m	3.907m	Development plans
Number of air exchanges per hour	0.5	0.5	Environment Agency SR3 (2009) for residential housing
Equilibrium gas concentration in building	0.00687%	0.00341%	Calculated

APPENDIX 4

GROUND GAS MONITORING DATA

Ground Gas Risk Assessment
1620000492 Green Park Village

Notes: Assessment based on Guidance published in CIRIA C665 "Assessing risks posed by hazardous ground gases to buildings"

Information from Table 8.5 of CIRIA C665

Characteristic Situation 1 Conditions

Gas Screening Value (CH4 or CO2) <0.7
Typically methane <1% by volume
Typically carbon dioxide <5% by volume

Characteristic Situation 2 Conditions

Gas screening values (CH4 or CO2) <0.7
Borehole air flow rate <70l/h

Characteristic Situation 3 Conditions

Gas screening values (CH4 or CO2) <3.5

Approach

Maximum concentrations and flow rates are used in the assessment below (minimum values for oxygen)

Where no detectable flow the instrument limit of detection is used (0.1l/hr)

Where concentrations are recorded below LoD, the instrument LoD is used in the assessment (0.5%)

BH ID	Phase	Height m OD	Response Zone	Water Depth mbgl	Water Depth mAOD	Round	Date	Atmos. Pressure mB	Gas Flow l/h	SS CH4 %v/v	SS CO2 %v/v	SS O2 %v/v	SS CO ppm	SS H2S ppm	VOCs ppm	CH4 Peak %v/v	CO2 Peak %v/v	O2 Min %v/v	GSV CH4	GSV CO2	Characteristic Situation CH4	Characteristic Situation CO2
RWS601	3	38.972	0.5 to 3.0 MG and RTD	1.49	37.48	1	19.04.2017	1032	0.0	0.1	10.5	7.9	1	0	0.6	0.2	10.5	7.9	0.00	0.00	1	2
				1.49	37.48	2	25.04.2017	1010	0.0	0.1	10.9	8	2	0	0.7	0.2	10.9	8	0.00	0.00	1	2
				1.49	37.48	3	05.05.2017	1019	0.0	0.1	6.8	13.3	1	0	0.3	0.1	6.8	13.3	0.00	0.00	1	2
				1.55	37.42	4	15.05.2017	1019	0.0	0.1	7.5	12.2	2	0	1.1	0.1	7.5	12.2	0.00	0.00	1	2
				1.90	37.07	5	19.05.2017	1007	0.0	0.2	7.2	11	3	0	-	0.2	7.2	11	0.00	0.00	1	2
				1.87	37.10	6	24.05.2017	1022	0.0	0.1	8	11.2	3	0	0.9	0.1	8	15.6	0.00	0.00	1	2
RWS602	3	39.121	1.5 to 4.0 ALV and RTD	1.92	37.20	1	19.04.2017	1032	0.0	0.1	1	19.4	2	1	1.2	0.1	1	19.2	0.00	0.00	1	1
				1.90	37.22	2	25.04.2017	1010	0.0	0.1	1	19.8	1	0	1.1	0.1	1	19.8	0.00	0.00	1	1
				1.94	37.18	3	05.05.2017	1019	0.0	0.1	0.7	20	1	0	0.5	0.1	0.7	20	0.00	0.00	1	1
				1.95	37.17	4	15.05.2017	1019	0.0	0.1	1.7	19.5	1	0	0.7	0.1	1.7	17.3	0.00	0.00	1	1
				1.85	37.27	5	19.05.2017	1007	0.0	0.2	0.6	20.4	1	0	0.6	0.2	0.8	16.4	0.00	0.00	1	1
				1.90	37.22	6	24.05.2017	1022	0.0	0	0.4	19.6	3	1	0.5	0	0.7	19.3	0.00	0.00	1	1
RWS603	3	39.275	2.5 to 4.0 ALV and RTD	2.17	37.11	1	19.04.2017	1032	0.0	0.1	1.2	18.8	1	1	1.1	0.1	1.3	14.5	0.00	0.00	1	1
				2.18	37.10	2	25.04.2017	1010	0.0	0.1	0.9	19.6	1	0	0.7	0.1	0.9	18	0.00	0.00	1	1
				2.35	36.93	3	05.05.2017	1019	0.0	0.1	2.1	18.4	1	0	0.8	0.1	2.1	18.3	0.00	0.00	1	1
				2.26	37.02	4	15.05.2017	1019	0.0	0.1	1.7	19.9	1	0	-	0.1	1.7	18.9	0.00	0.00	1	1
				-	-	5	19.05.2017	Borehole area flooded - inaccessible										0.00	0.00	-	-	
				2.58	36.70	6	24.05.2017	1022	0.0	0.1	0.7	18.4	2	0	-	0.1	0.9	16.4	0.00	0.00	1	1
RWS604	3	39.976	2.5 to 4.0 ALV and RTD	2.85	37.13	1	19.04.2017	1032	0.0	0.2	1.3	15	3	1	2.2	0.2	1.3	12.8	0.00	0.00	1	1
				2.86	37.12	2	25.04.2017	1010	0.0	0.2	1.5	15.1	2	0	1.8	0.2	1.6	14.5	0.00	0.00	1	1
				2.86	37.12	3	05.05.2017	1019	0.0	0.1	2.2	14.8	1	0	0.4	0.1	2.2	14.7	0.00	0.00	1	1
				2.85	37.13	4	15.05.2017	1019	0.0	0.3	4.6	9.4	2	0	1.3	0.3	4.6	9.4	0.00	0.00	1	1
				2.65	37.33	5	19.05.2017	1007	0.0	0.2	1.7	16.9	0	0	1	0.3	3.4	13.9	0.00	0.00	1	1
				2.75	37.23	6	24.05.2017	1022	0.0	0.2	0.9	16.5	2	1	0.7	0.2	1.4	14.3	0.00	0.00	1	1
RWS605	3	39.974	2.5 to 3.65 - MG, ALV and RTD	-	-	2	25.04.2017	Borehole Buried and Inaccessible										0.00	0.00	-	-	
				-	-	3	05.05.2017											0.00	0.00	-	-	
				-	-	4	15.05.2017											0.00	0.00	-	-	
				-	-	5	19.05.2017											0.00	0.00	-	-	
				-	-	6	24.05.2017											0.00	0.00	-	-	
				-	-	1	19.04.2017											0.00	0.00	-	-	
RWS606	3	40.037	1.7 to 3.0 - MG and RTD	2.79	37.25	1	19.04.2017	1032	0.0	0.3	1.1	19.1	2	0	1.3	0.3	1.2	17.7	0.00	0.00	1	1
				2.94	37.10	2	25.04.2017	1010	0.1	1.4	7.5	6.2	3	0	1.1	1.4	7.5	6.2	0.00	0.01	2	2
				2.92	37.12	3	05.05.2017	1019	0.0	0.5	2.5	15.7	1	0	0.5	0.5	2.5	15.7	0.00	0.00	1	1
				2.94	37.10	4	15.05.2017	1019	0.0	0.6	1.5	18.8	1	0	0.8	0.6	1.7	16.8	0.00	0.00	1	1
				2.80	37.24	5	19.05.2017	1007	0.0	11.2	10.3	0.2	3	0	0.1	11.2	10.3	0.2	0.00	0.00	2	2
				Dry	Dry	6	24.05.2017	1022	0.0	12.4	9.4	2.4	4	0	0.2	12.4	9.4	2.4	0.00	0.00	2	2
RWS607	3	40.353	1.5 to 4.1 - MG , ALV and RTD	3.02	37.33	1	19.04.2017	1032	0.0	2.3	3.9	15.3	3	0	0.9	2.5	3.9	15.3	0.00	0.00	2	1
				3.27	37.08	2	25.04.2017	1010	0.0	4.3	4.7	14	1	0	0.7	4.5	4.9	14	0.00	0.00	2	1
				2.31	38.04	3	05.05.2017	1019	0.0	3.3	4.9	14.3	2	0	0.8	3.3	4.9	14.3	0.00	0.00	2	1
				3.26	37.09	4	15.05.2017	1019	0.0	2.7	3.3	16.6	1	0	0.5	2.8	3.4	16.5	0.00	0.00	2	1
				3.10	37.25	5	19.05.2017	1007	1.4	8.2	3.6	9.7	1	0	0.3	8.2	3.6	9.7	0.11	0.05	2	1
				3.15	37.20	6	24.05.2017	1022	0.0	12.9	6.1	5.8	5	0	0.2	15.7	7.4	5.8	0.00	0.00	2	2
RWS608	3	39.901	1.5 to 4.0 - MG , ALV and RTD	3.00	36.90	1	19.04.2017	1032	0.0	0.1	9.7	5.8	2	0	2.1	0.2	13.1	5.8	0.00	0.00	1	2
				-	-	2	25.04.2017	Gas tap/bung removed										0.00	0.00	-	-	
				3.01	36.89	3	05.05.2017											0.00	0.00	-	-	
				2.98	36.92	4	15.05.2017											0.00	0.00	-	-	
				2.85	37.05	5	19.05.2017	1007	0.0	0.1	10.9	6.3	0	0	0.2	0.1	12.5	7.9	0.00	0.00	1	2
				2.96	36.94	6	24.05.2017	1022	0.0	0.1	0.7	18.2	3	0	0.3	0.1	0.8	18.2	0.00	0.00	1	1
RWS609	3	40.218	1.0 to 2.0 - MG	3.04	37.18	1	19.04.2017	1032	0.0	2.1	2.4	11	2	0	1.1	2.4	2.5	11	0.00	0.00	2	1
				2.90	37.32	2	25.04.2017	1010	0.0	26.5	9.4	0.6	1	0	0	26.5	9.4	0.6	0.00	0.00	2	2
				Dry	Dry	3	05.05.2017	1019	0.0	19.1	8.7	1.1	3	0	0	19.2	8.7	1.1	0.00	0.00	2	2
				Dry	Dry	4	15.05.2017	1019	0.0	1.1	2.7	12.2	1	0	0.7	1.1	2.7	12.2	0.00	0.00	2	1
				Dry	Dry	5	19.05.2017	1007	0.0	4.8	2.6	14.6	0	0	0.2	5.7	2.6	14.6	0.00	0.00	2	1
				Dry	Dry	6	24.05.2017	1022	0.0	0.1	0.6	18	0	0	0.4	1	0.6	16.6	0.00	0.00	2	1
RWS610	3	40.364	1.5 to 4.0 - MG, ALV and RTD	1.65	38.71	1	19.04.2017	1032	5.0	0.2	1.6	19.3	5	0	2.9	0.2	1.6	17.1	0.01	0.08	1	2
				Dry	Dry	2	25.04.2017	1010	0.0	1.7	12.3	3.9	4	0	1.2	1.9	12.3	3.9	0.00	0.00	2	2
				Dry	Dry	3	05.05.2017	1019	0.0	0.1	6.3	17.2	0	0	0.9	0.2	6.4	16.9	0.00	0.00	1	2
				-	-	4	15.05.2017	Gas tap/bung removed										0.00	0.00	-	-	
				-	-	5	19.05.2017	Borehole removed										0.00	0.00	-	-	
				-	-	6	24.05.2017											0.00	0.00	-	-	

Ground Gas Risk Assessment
1620000492 Green Park Village

Notes: Assessment based on Guidance published in CIRIA C665 "Assessing risks posed by hazardous ground gases to buildings"

Information from Table 8.5 of CIRIA C665

Characteristic Situation 1 Conditions

Gas Screening Value (CH4 or CO2) <0.7

Typically methane <1% by volume

Typically carbon dioxide <5% by volume

Characteristic Situation 2 Conditions

Gas screening values (CH4 or CO2) <0.7

Borehole air flow rate <70l/h

Characteristic Situation 3 Conditions

Gas screening values (CH4 or CO2) <3.5

Approach

Maximum concentrations and flow rates are used in the assessment below (minimum values for oxygen)

Where no detectable flow the instrument limit of detection is used (0.1l/hr)

Where concentrations are recorded below LoD, the instrument LoD is used in the assessment (0.5%)

Key for Shading

	CO2 > 5% by volume
	CH4 > 1% by volume
	GSV < 0.07l/hr i.e. CS1
	GSV > or = 0.07l/hr i.e. CS2
	GSV > or = 0.7l/hr i.e. CS3

BH ID	Phase	Height m OD	Response Zone	Water Depth	Water Depth	Round	Date	Atmos. Pressure	Peak Gas Flow	SS CH4	SS CO2	SS O2	SS CO	SS H2S	VOCs	CH4	CO2	O2	GSV CH4	GSV CO2	Characteristic Situation CH4	Characteristic Situation CO2
				mbgl	mAOD			mB	l/h	%v/v	%v/v	%v/v	ppm	ppm	ppm	Peak %v/v	Peak %v/v	Min %v/v				
RWS611	4	39.997	1.5 to 4.0 MG, ALV and RTD	2.79	37.21	1	19.04.2017	1032	0.0	0.1	1.2	10.2	3	1	2.4	0.1	1.2	10.2	0.000	0.000	1	1
				2.82	37.18	2	26.04.2017	1010	0.1	0.1	2	5.4	3	1	1.5	0.1	2	5.2	0.000	0.002	1	1
				2.83	37.17	3	05.05.2017	1019	0.0	0.1	2	8	2	0	1.2	0.1	2	8	0.000	0.000	1	1
				2.80	37.20	4	15.05.2017	1019	0.1	0	2.2	9.1	2	0	1.7	0.2	2.2	9.1	0.000	0.002	1	1
				2.67	37.33	5	19.05.2017	1007	0.0	0.6	2.9	3	4	0	1.1	0.6	2.9	3	0.000	0.000	1	1
				2.81	37.19	6	24.05.2017	1022	0.0	0.1	2.7	8.1	4	1	1.3	0.1	2.7	8.1	0.000	0.000	1	1
RWS612	4	40.267	2.0 to 4.0 MG, ALV and RTD	3.09	37.18	1	19.04.2017	1032	0.0	0.2	0.4	14.4	3	0	1.6	0.2	0.4	14.4	0.000	0.000	1	1
				3.10	37.17	2	26.04.2017	1010	0.0	0.1	0.5	10.1	1	0	1.4	0.2	0.6	10.1	0.000	0.000	1	1
				3.13	37.14	3	05.05.2017	1019	0.0	0.1	0.7	15	2	0	0.8	0.1	0.7	14.9	0.000	0.000	1	1
				3.12	37.15	4	15.05.2017	1019	0.0	0.1	0.9	15	1	0	0.7	0.1	0.9	15	0.000	0.000	1	1
				2.95	37.32	5	19.05.2017	1007	0.0	0.1	0.6	11.8	1	0	0.6	0.1	0.6	11	0.000	0.000	1	1
				3.00	37.27	6	24.05.2017	1022	0.0	0	0.2	16.1	1	0	0.6	0	0.1	16.1	0.000	0.000	1	1
RWS613	4	38.173	0.5 to 3.0 MG and RTD	1.01	37.16	1	19.04.2017	1032	0.0	0.2	0.5	20	2	0	0.5	0.2	0.5	19.9	0.000	0.000	1	1
				1.06	37.11	2	26.04.2017	1010	0.0	0.1	0.1	19.8	2	0	0.5	0.1	1	19.8	0.000	0.000	1	1
				1.07	37.10	3	05.05.2017	1019	0.0	0.1	0.7	18.9	2	0	0.3	0.1	0.7	18.9	0.000	0.000	1	1
				1.00	37.17	4	15.05.2017	1019	0.0	0.1	3	13.3	1	0	0.3	0.1	3	13.3	0.000	0.000	1	1
				0.85	37.32	5	19.05.2017	1007	0.0	0.1	7	4.1	0	0	0.2	0.1	7	4.1	0.000	0.000	1	2
				1.33	36.84	6	24.05.2017	1023	0.0	0	4.9	7.2	5	1	0.4	0	4.9	7.2	0.000	0.000	1	1
RWS614	4	38.605	0.5 to 4.0 MG, ALV and RTD	1.41	37.20	1	19.04.2017	1032	0.1	0.1	2.4	17.7	1	0	0.6	0.2	2.4	17.7	0.000	0.002	1	1
				1.45	37.16	2	26.04.2017	1010	0.0	0.1	3.1	17.1	1	0	0.5	0.1	3.1	17.1	0.000	0.000	1	1
				1.49	37.12	3	05.05.2017	1019	0.0	0.1	4.1	15.1	2	0	0.3	0.1	4.1	15.1	0.000	0.000	1	1
				1.46	37.15	4	15.05.2017	1019	0.0	0.1	3.4	17	1	0	0.3	0.1	3.4	17	0.000	0.000	1	1
				1.27	37.34	5	19.05.2017	1007	0.0	0.1	1.8	9.9	1	0	0.2	0.1	1.8	9.9	0.000	0.000	1	1
				1.37	37.24	6	24.05.2017	1022	0.0	0	2.8	15	3	0	0.6	0	2.8	15	0.000	0.000	1	1
RWS615	4	38.658	0.5 to 4.0 ALV and RTD	1.85	36.81	1	04.04.2017	1020	0.0	0.2	6.2	14.1	3	0	-	0.2	6.2	14.1	0.000	0.000	1	2
				1.49	37.17	2	19.04.2017	1032	0.1	0.1	8.1	13	2	0	0.7	0.2	8.1	13	0.000	0.008	1	2
				1.55	37.11	3	26.04.2017	1010	0.0	0.1	8.6	13.1	2	0	0.5	0.1	8.6	13.1	0.000	0.000	1	2
				1.59	37.07	4	05.05.2017	1019	0.0	0.1	8.1	13.7	2	0	0.6	0.1	8.1	13.7	0.000	0.000	1	2
				1.55	37.11	5	15.05.2017	1019	0.0	0.1	10.9	11	1	0	0.5	0.1	10.9	11	0.000	0.000	1	2
				1.42	37.24	6	19.05.2017	1007	0.0	0.2	11.3	7.2	0	0	0.5	0.2	11.3	7.2	0.000	0.000	1	2
RWS638	4	38.279	0.5 to 2.9 MG, ALV and RTD	1.10	37.18	1	19.04.2017															
				1.14	37.14	2	26.04.2017	1014	0.0	0.1	0.3	20.5	1	0	6	0.1	0.3	20.5	0.000	0.000	1	1
				1.14	37.14	3	05.05.2017	1019	0.0	0.1	0.3	20.5	2	0	0.5	0.1	0.3	20.5	0.000	0.000	1	1
				1.26	37.02	4	15.05.2017	1019	0.0	0.1	0.3	17.9	3	0	1.7	0.1	0.3	17.9	0.000	0.000	1	1
				-	-	5	19.05.2017															
				1.19	37.09	6	24.05.2017	1023	0.0	0	0.4	19.6	1	0	0.3	0	0.4	19.6	0.000	0.000	1	1
RWS639	4	38.616	0.5 to 3.7 MG, ALV and RTD	1.45	37.17	1	19.04.2017															
				1.49	37.13	2	26.04.2017	1014	0.0	0.5	7.9	9.8	2	0	0.8	0.5	7.9	9.8	0.000	0.000	1	2
				1.49	37.13	3	05.05.2017	1019	0.0	0.1	1.8	15.4	2	0	0.5	0.1	1.8	15.4	0.000	0.000	1	1
				1.47	37.15	4	15.05.2017	1019	0.0	0.1	0.5	18.7	1	0	1.2	0.1	0.5	18.7	0.000	0.000	1	1
				1.27	37.35	5	19.05.2017	1007	0.0	6.9	17.9	0	2	0	0.2	6.9	17.9	0	0.000	0.000	2	2
				1.38	37.24	6	24.05.2017	1023	0.0	0	0.5	19.9	4	1	0.4	0	0.5	19.9	0.000	0.000	1	1

Worst Case	0.1	6.9	17.9	0	5	1	6	6.9	17.9	0	0.007	0.018	2	2
------------	-----	-----	------	---	---	---	---	-----	------	---	-------	-------	---	---

italics - response zone full saturated

italics height - approximate from topo survey

Ground Gas Risk Assessment
1620000492 Green Park Village

Notes: Assessment based on Guidance published in CIRIA C665 "Assessing risks posed by hazardous ground gases to buildings"

Information from Table 8.5 of CIRIA C665

Characteristic Situation 1 Conditions

Gas Screening Value (CH4 or CO2) <0.7

Typically methane <1% by volume

Typically carbon dioxide <5% by volume

Characteristic Situation 2 Conditions

Gas screening values (CH4 or CO2) <0.7

Borehole air flow rate <70l/h

Characteristic Situation 3 Conditions

Gas screening values (CH4 or CO2) <3.5

Key for Shading

CO2 > 5% by volume

CH4 > 1% by volume

GSV < 0.07l/hr i.e. CS1

GSV > or = 0.07l/hr i.e. CS2

GSV> or = 0.7l/hr i.e. CS3

Approach

Maximum concentrations and flow rates are used in the assessment below (minimum values for oxygen)

Where no detectable flow the instrument limit of detection is used (0.1l/hr)

Where concentrations are recorded below LoD, the instrument LoD is used in the assessment (0.5%)

BH ID	Phase	Height m OD	Response Zone	Water Depth mbgl	Water Depth mAOD	Round	Date	Atmos. Pressure mB	Peak Gas Flow l/h	SS CH4 %/v	SS CO2 %/v	SS O2 %/v	SS CO ppm	SS H2S ppm	VOCs ppm	CH4	CO2	O2	GSV CH4	GSV CO2	Characteristic Situation CH4	Characteristic Situation CO2
																Peak %v/v	Peak %v/v	Min %v/v				
RWS615	485	39.66	0.5 to 4.0 m AIV and RTD	1.85	37.81	1	04.04.2017	1020	0.0	0.2	6.2	14.1	3	0	-	0.2	6.2	14.1	0.00	0.00	1	2
				1.49	38.17	2	19.04.2017	1032	0.1	0.1	8.1	13	2	0	0.7	0.2	8.1	13	0.00	0.01	1	2
				1.55	38.11	3	25.04.2017	1010	0.0	0.1	8.6	13.1	2	0	0.5	0.1	8.6	13.1	0.00	0.00	1	2
				1.59	38.07	4	05.05.2017	1019	0.0	0.1	8.1	13.7	2	0	0.6	0.1	8.1	13.7	0.00	0.00	1	2
				1.55	38.11	5	15.05.2017	1019	0.0	0.1	10.9	11	1	0	0.5	0.1	10.9	11	0.00	0.00	1	2
				1.42	38.24	6	19.05.2017	1007	0.0	0.2	11.3	7.2	0	0	0.5	0.2	11.3	7.2	0.00	0.00	1	2
RWS616	485	39.73	0.5 to 4.5 m MG, ALV and RTD	2.59	37.14	1	27.03.2017	1017	0.0	1.8	8.3	14.4	6	1	2.2	1.8	8.3	14.4	0.00	0.00	2	2
				2.05	37.68	2	04.04.2017	1020	0.0	0.4	1.3	18.2	2	0	-	0.4	1.3	18.2	0.00	0.00	1	1
				2.52	37.21	3	05.05.2017	1019	0.0	0.1	1	18.3	2	0	0.4	0.1	1	18.3	0.00	0.00	1	1
				2.63	37.10	4	15.05.2017	1019	0.0	0.1	0.8	17.7	1	0	0.3	0.1	0.8	17.7	0.00	0.00	1	1
				2.45	37.28	5	19.05.2017	1007	0.0	1.6	0.8	7	2	0	0.5	1.6	0.8	7	0.00	0.00	2	1
				2.70	37.03	6	24.05.2017	1022	0.0	0.1	0.4	19.1	2	0	0.4	0.1	0.4	19.1	0.00	0.00	1	1
RWS617	5	40.4	1.5 5.0 m MG, ALV and RTD	3.30	37.10	1	27.03.2017	1017	0.0	0	3.3	4.2	5	10	2.7	0	3.3	4.2	0.00	0.00	1	1
				3.37	37.03	2	04.04.2017	1020	0.0	0.2	0.4	19	3	0	-	0.2	0.4	19	0.00	0.00	1	1
				3.47	36.93	3	19.04.2017	1032	0.0	0.2	1.1	17.2	3	0	0.9	0.2	1.1	17.2	0.00	0.00	1	1
				3.45	36.95	4	26.04.2017	1010	0.0	0.1	3.5	11.5	2	0	0.9	0.1	3.6	12.9	0.00	0.00	1	1
				3.24	37.16	5	05.05.2017	1019	0.0	0.1	4.3	5.5	3	0	0.8	0.1	4.3	5.5	0.00	0.00	1	1
				3.25	37.15	6	15.05.2017	1019	0.0	0.1	4	12	2	2	0.8	0.1	4	12	0.00	0.00	1	1
RWS618	5	38.62	1.0 to 3.5 m ALV, RTD and LMBE	1.79	36.83	1	27.03.2017	1017	0.0	0	3.6	15.6	2	1	2.1	0	3.6	15.6	0.00	0.00	1	1
				1.85	36.77	2	04.04.2017	1020	0.0	0.2	0.1	20.7	2	0	-	0.2	0.1	20.7	0.00	0.00	1	1
				1.96	36.66	3	19.04.2017	1032	-0.1	0.2	2.1	18.4	1	0	0.4	0.2	2.2	18.2	0.00	0.00	1	1
				1.97	36.65	4	26.04.2017	1010	0.0	0.1	5.7	12.6	2	0	0.7	0.1	5.7	12.6	0.00	0.00	1	2
				1.94	36.68	5	05.05.2017	1019	0.0	0.1	5.6	1.8	2	0	0.5	0.1	5.6	13.8	0.00	0.00	1	2
				1.92	36.70	6	15.05.2017	1019	0.0	0.1	1.8	16.9	1	0	0.3	0.1	1.8	16.9	0.00	0.00	1	1
RWS620	5	40.18	2.0 to 5.0 m MG, ALV and RTD	3.30	36.88	1	04.04.2017	1020	0.0	0.2	0.4	19.8	3	0	-	0.2	0.4	19.8	0.00	0.00	1	1
				3.41	36.77	2	26.04.2017	1014	0.0	0.1	0.6	20.3	1	0	0.3	0.1	0.6	20.2	0.00	0.00	1	1
				3.30	36.88	3	05.05.2017	1019	0.0	0.1	0.1	21.2	1	0	0.4	0.1	0.1	21.2	0.00	0.00	1	1
				3.36	36.82	4	15.05.2017	1019	0.0	0.1	0.3	19.7	2	0	0.7	0.1	0.3	19.7	0.00	0.00	1	1
				3.12	37.06	5	19.05.2017	1007	0.0	0.1	0.2	18.2	2	0	0.8	0.1	0.2	18.2	0.00	0.00	1	1
				—	—	6	24.05.2017	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
RWS621	5	40.3	1.0 to 7.5 m MG, ALV, RTD and LMBE	3.32	36.98	1	04.04.2017	1020	0.0	0.1	0	18.3	11	0	-	0.1	0.1	18.3	0.00	0.00	1	1
				3.41	36.89	2	26.04.2017	1014	0.0	0.1	1.5	18.1	1	0	0.8	0.1	1.5	18.1	0.00	0.00	1	1
				3.24	37.06	3	05.05.2017	1019	0.0	0.1	1.2	19.1	1	0	0.7	0.1	1.7	15.9	0.00	0.00	1	1
				3.28	37.02	4	15.05.2017	1019	0.0	0.1	0.2	20.6	2	0	0.9	0.1	0.2	20.6	0.00	0.00	1	1
				2.96	37.34	5	19.05.2017	1007	0.0	0.1	0.3	20.9	1	0	0.2	0.1	0.3	20.9	0.00	0.00	1	1
				—	—	6	24.05.2017	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Worst Case	0.1	1.8	11.3	1.8	11	10	2.7	1.8	11.3	4.2	0.0018	0.0113	2	2
------------	-----	-----	------	-----	----	----	-----	-----	------	-----	--------	--------	---	---