WEB :www.calcinotto.co.uk
EMAIL :admin@calcinotto.co.uk
TEL :+44 (0) 1202 237 237
ADDRESS :Jonsen House, 43 Commercial Road, Poole Dorset BH14 0HU

calcinotto


# 3336

**Imperial College London**
**Private Ground on Udney Park Road,**
**Teddington,**
**London, TW11 9BB**

**Block A Basement Ventilation Strategy**

For

**Quantum Land and Property Ltd**

**REPORT REFERENCE**

3336/S/1707/01

**PROJECT NUMBER**

JB 3336

**PROJECT TITLE**

Imperial College London
Private Ground on Udney Park Road,
Teddington,
London, TW11 9BB

**CLIENT**

Quantum Land and Property Ltd

| | | | |
|---|---|---|---|
| **Issue No:** | 1 | | |
| **Prepared By:** | Julian Calcinotto<br>*Director* | | |
| **Date:** | June/ July 2017 | | |
| Checked By: | Matthew Singleton<br>*Director* | | |
| **Date:** | 12th July 2017 | | |
| **Issue Status** | Final | | |

## CONTENTS



**Appendices**

## 1 Executive Summary

1.1 Calcinotto have been appointed to prepare a Basement Ventilation Strategy in connection for the new apartment block (A) in the Block A apartment block with basement within the proposals for the redevelopment of the former ICL Private ground site off Udney Park Road, Teddington, in the London Borough Upon Thames, the nearest postcode is TW11 9BB.

1.2 The strategy discusses the intended ventilation to the basement of Block A.

1.3 Any drawings and calculations prepared at this time are based upon the planning drawings and should not be relied upon as a detailed design for construction.

1.4 This document has been prepared for the sole use of Quantum Land and Property Ltd to support the Planning Application for the construction of an assortment of properties. The contents should not be relied upon by others without the written authority of Calcinotto Limited.

## 2 Introduction

2.1 Site Location

Calcinotto Consulting Engineers have been appointed by Quantum Land and Property Ltd to undertake a review for a drainage strategy for the development of a greenfield site in Teddington. The development comprises of no. residential properties with associated parking, access and landscaping. The site under development has an area of circa 5.2 ha approx. (12.8 acres). This site has a Post Code of TW11 9BB. The national grid reference for the site is TQ 16437 70857 (E = 516437, Y = 170857). The layout of the site is detailed on Quantum Homes Architects Dwg 900 SK-02 Appendix A.

For a general site location and the site boundary see figures 1 and 2 below.


**Figure 1 – Site Location**


**Figure 2 – Site Location**

2.2 This report is made in support of a Planning Submission for the proposed development.

## 3 Existing Site

### 3.1 Existing Use

3.1.1 The existing site is currently private open space with 1 no. building on the plot which houses the old Club house.

3.1.2 The site is bounded by Fullerton Court to the north, Kingston Lane to the east, Udney Park Road to the west and Cromwell Road to the south.

### 3.2 Foul and Surface Water Drainage

3.2.1 The site has some minimal foul and surface water drainage serving the existing clubhouse building which discharges out into Udney Park Road. It is assumed there may be some form of land drainage serving the playing fields but there is nothing visible at ground level and therefore has not been picked up within the topographic survey.

## 4 Proposed Development

### 4.1 Development Proposals

The mixed use development within the creation of the Teddington Community Sports Ground Community Company establishes the following three main areas of the proposal:

1. Assisted living, extra care community with GP Surgery
2. Open Parkland with community Orchard and outdoor gym
3. Community sports facilities

Proposed community sports facilities will comprise of the following:

- A full size Third Generation artificial grass pitch (3G AGP)
- Natural grass playing pitch provision
- Tennis Courts / MUGA
- Community pavilion containing changing rooms, kitchen, bar and server, flexible use community rooms and crèche

## 5 Background to Ventilation

When designing a naturally ventilated underground car park, the most common challenge is incorporating a sufficient number of openings to make the design comply with Building Regulations. Approved Document F specifies that the ventilation requirement will be satisfied if the openings at each car parking level have an aggregate area equal to at least 1/20$^{th}$ of the floor area at that level, of which at least half should be in two opposing walls. Sometimes this just is not possible and it is necessary to adopt the alternative approach in which the ventilation strategy is designed to limit the concentration of carbon monoxide to an acceptable level over a set number of hours. With mixed residential developments, this alternative approach is often appropriate as car park usage is intermittent and there is less likelihood of a build up of pollutants.

## 6 Ventilation Issues

Car park ventilation systems have to control the exhaust gases emitted by vehicles but must also take into account possible fuel spillages and the venting of smoke in the event of a fire.

## 7 Natural Ventilation

The performance of natural ventilation depends on many factors including site layout and orientation, size and siting of air vents, height and proximity of neighbouring buildings, and local wind conditions. When these are favourable, natural ventilation will provide both a mean level of air change and be able to cope with peak conditions. Where conditions are not ideal there will be periods when it is unable to cope with heavy loads and ventilation rates will fall below a desirable level. In these circumstances it is necessary to understand just how low those rates could fall and what impact this would have on air quality and the health and safety of users.

## 8 Concentrations of Pollutants

As well as the overall ventilation rate, it is necessary to consider the distribution of pollutant concentrations within the car park. The assumption that the air is 'well-mixed', i.e. the concentrations are uniform, is often used when predicting concentrations. However, it is important to examine the factors that may contribute to non-uniform mixing and to determine the sensitivity of the predicted concentrations to assumptions about the degree of mixing. The two interacting factors that contribute to the degree of mixing are (a) the air flow pattern within the space and (b) the location of the pollutant sources.

## 9 Air Flow

The principle factor that influences the pattern of air flow is the distribution of air inlets. The strength of the mixing effect will depend upon the speed of the incoming air and the size of the inlet opening. With natural ventilation, the speed increases proportionally with the square root of the applied pressure difference. Air extract points have a much lower effect on air movement but their location relative to inlets may be important. Other factors to take into account include the geometry of the space, convective flows and intermittent turbulent flows.

## 10 Source Points

With car parks, the pollutant source is moving for much of the time and the distribution will depend on the routes vehicles have to take. For example, if there is a single entry and exit point, there will be a higher generation of pollutant on travel paths in the immediate vicinity. At the same time, the complex interaction of air flow and pollutant sources makes it very difficult to predict pollutant distribution. An elongated space with openings at one end is likely to have a non-uniform distribution, while a single pollutant source close to the openings will have a much lower concentration than if it were away from these.

## 11 Determining the True Situation

Predictions of ventilation rate based on estimates of the effective area of openings and of surface pressure coefficients. The latter can be obtained from existing published data; however the coefficient values will be sensitive to local topographical features and the height and form of neighbouring buildings. It is therefore necessary to judge the suitability of existing data and in the light of this, to ascertain the need for wind tunnel tests.

In this instance, The British Research Establishment has established that there is no need to undertake a wind speed data check from the local meteorological statistic office. Instead by determining the expected use pattern of the car park, it will be possible to predict the variation in hourly mean CO concentrations over a 10 year period, assuming that the pollutants were uniformly distributed. From this, the percentage of time that 1 hour and 8 hour mean CO concentrations exceeded 50ppm and 100ppm respectively can then be determined.

*Approved Document F specifies that the ventilation requirement will be satisfied if the openings at each car parking level have an aggregate area equal to at least $1/20^{th}$ of the floor area at that level, of which at least half should be in two opposing walls (Paragraph 2.8). This may often be difficult to achieve in practice, particularly if the car park is below ground level.

It is sometimes the case that sufficient ventilation is provided even if the opening area and distribution requirement is not fulfilled; for example, residential use where the car park is not used as frequently as a shopping centre car park. Approved Document F also allows an alternative approach, in which the requirement will be satisfied if the mean predicted pollutant levels are calculated and the ventilation designed to limit the concentration of carbon monoxide to not more than 50 parts per million average over an eight hour period and peak concentrations, such as by ramps and exits, not to go above 100 parts per million for periods not exceeding 15 minutes.

## 12 Human Exposure to Carbon Monoxide

When inhaled carbon monoxide, which is colourless and odourless, combines with haemoglobin in the blood to form caboxyhaemoglobin (COHb) which inhibit the oxygen carrying capacity of the blood. Levels of below 5% COHb in the blood are likely to have only minor, unnoticeable effects on physical performance and no effects on vigilance after exposure. At 10% to 20%, symptoms such as breathlessness on exertion will occur and at 30% symptoms such as severe headaches, dizziness, dimness of vision, disturbed judgment and nausea occur. Levels above 60% can lead to coma, respiratory failure and death. Typical levels found in the population at large are of the order of 1% due to general exposure to carbon monoxide. Tobacco smokers have higher concentrations typically in the range 4-8%.

Levels of COHb in the blood are determined both by the level of carbon monoxide in the inspired air and the length of time exposure. Thus higher levels can be tolerated for shorter periods. The World Health Authority guideline concentrations for exposure to limit COHb levels to 5%. Lower levels of 90ppm for 15 minutes; 25ppm for 1 hour and 9ppm for 8 hours are suggested by WHO to achieve the much lower levels of 2.5% to 3% COHb. A recent extensive review of criteria for air quality in enclosed car parks by Burnett and Chan considers a wide range of guidelines, research and medical data on carbon monoxide exposure. They note, in particular that the WHO guidelines come with the provision that they ".....should be considered as desirable rather than maximum acceptable limits". Burnett and Chan note that the car park users carrying objects to and from a vehicle (light work) and exposed to 100ppm for a duration of 15 minutes are subject to a very low health risk and conclude that in car parks "...it should be possible to allow levels up to 200ppm for durations of up to 15 minutes".

**References**

1. Health and Safety Executive, EH40/2000 – Occupational Exposure Limits 2000.
2. Figures from a client, based on data provided by the AA (Automobile Association) 1995.
3. Taken from: Building Regulations, B3 Special Provision, Section 12, Naturally Ventilated 12.6.

## 13 Basement Ventilation Strategy

As previously described in the background section, a basement can be ventilated using a variety of different methods which have been listed below:

- Natural Ventilation
- Mechanical Ventilation
- Combined Natural and Mechanical

The three options all provide suitable solutions however, when considering the correct choice for a specific site all the factors including site layout, orientation, size and siting of vents, height and proximity of neighbouring buildings, and local wind conditions. When these factors are favourable, natural ventilation will provide both a mean level of air change and be able to cope with peak conditions, and it is on that basis that we are to proceed with the design. The reasons for this choice are as follows:

- Sustainable Choice
- Cost Effective
- Easy to construct
- Building ideally positioned for good air flow
- Sizes of outlets positioned equally around the building
- Venting Provided at roof of basement (better vented)
- Good strength of air mixing as good wind conditions and generous inlet size

The total area of the basement is circa 2106m$^2$. The Approved Document F states that ventilation will be satisfied if the openings at each car parking level have an aggregate area to at least 1/20$^{th}$ of the floor area at that level which at least half should be in two opposing walls.

**1/20$^{th}$ Floor Area – 105.3m$^2$**
**1/40$^{th}$ Floor Area – 52.65m$^2$**

Please note that all vents have been designated a nominal height of 1.8m and 2.3m. The obstructions have been calculated and included into the calculations in order to prevent miscalculation.

| | | |
|---|---|---|
| (A) | Opening 9.0m x 2.3m | = 20.7m2 |
| (B) | Opening 6.9m x2.1m | = 14.5m2 |
| (C) | Opening 7.10m x 2.3m | = 16.2m2 |
| (D) | Opening | = 30.7m2 |
| (E) | Opening 1.8 x 1.8m | = 3.24m2 |
| (F) | Opening 7.3 x 1.8m | = 13.14m2 |
| (G) | Opening 7.3 x 1.8m | = 13.14m2 |
| (H) | Opening 3.8 x 1.8m | = 6.84m2 |

| **Side 1 East** | | | **Side 2 West** | | |
|---|---|---|---|---|---|
| (A) x 1 | = | 20.7m2 | (B) x 1 | = | 14.5m2 |
| (C) x 1 | = | 16.2m2 | (D) x 1 | = | 30.7m2 |
| (E) x 1 | = | 3.24m2 | (G) x 1 | = | 13.14m2 |
| (E) x 1 | = | 3.24m2 | (H) x 1 | = | 6.84 m2 |
| (F) x 2 | = | 13.14m2 | **Total** | | **65.18m$^2$** |
| **Total** | | **56.52m$^2$** | | | |

It can be seen that sufficient cross ventilation has been provided and we would proposed a few colt basement air blowers in the corner positions to move use.

**Appendix A**

Architects Site Plan

# PLANNING



Do Not Scale, Use figure dimensions.

Check all dimensions on site before work proceeds, report discrepancies to Architect.

If In Doubt Ask!!

NOTES:

Location Plan
Scale - 1:5000

| Rev | Date | Description | Initials |
|---|---|---|---|

Quantum Group

Quantum House, 170 Charminster Road, Charminster, Bournemouth, BH8 9RL
Email: info@quantumhomes.co.uk | Web: www.quantumhomes.co.uk
Tel: 01202 531635 | Fax: 01202 531650

Project:

Former Imperial College Private Ground , Udney Park Road, Teddington

Drawing Title:

Proposed Site Plan

Discipline:

ARCHITECTURAL

| Drawn by: | Checked by: |
|---|---|
| JC | SH |

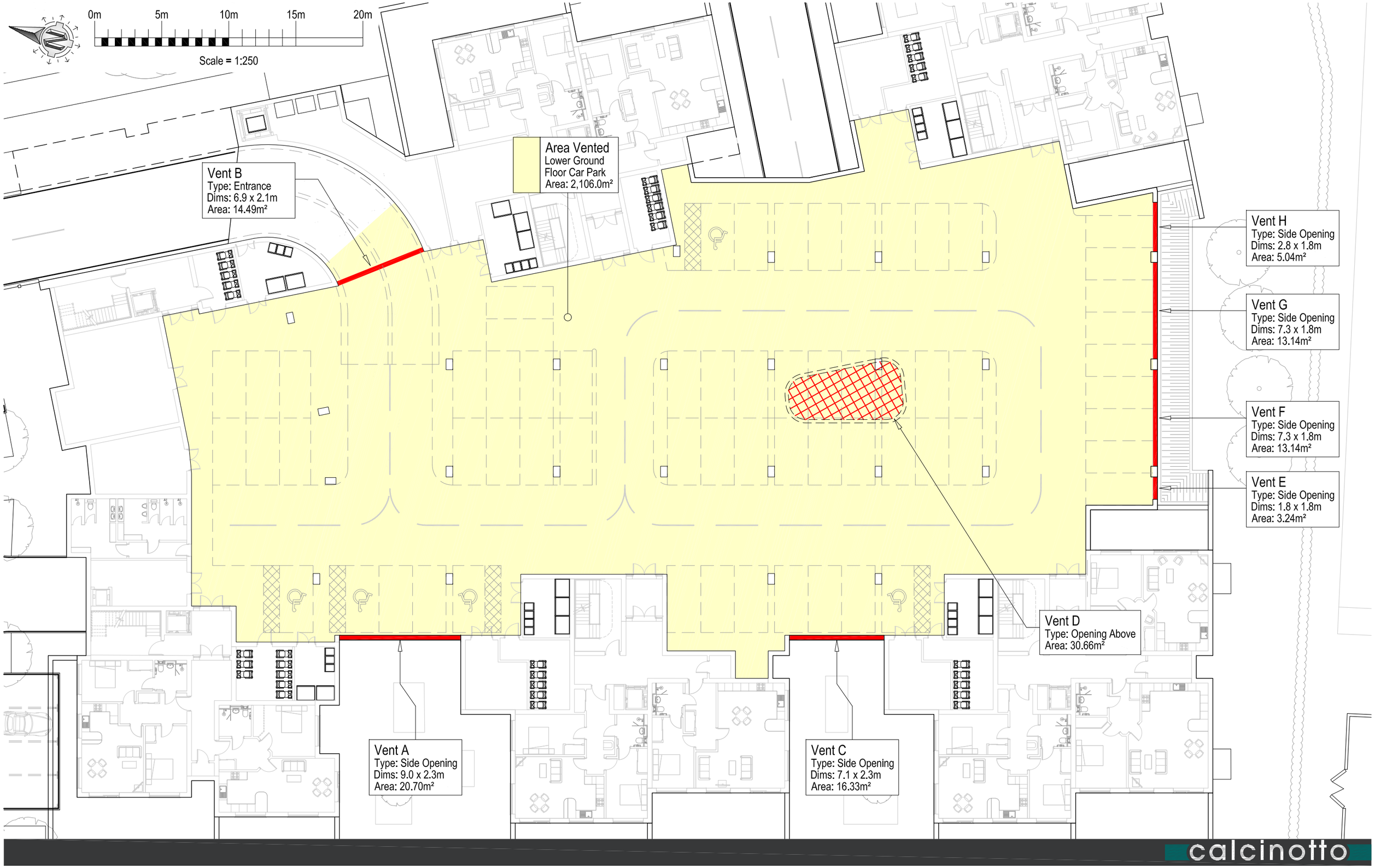
| Scale: | Date: |
|---|---|
| 1:500@A1 | Aug 2017 |

Drawing Number: 900-P200

Revision: .

**Appendix B**

Architects Basement Plan With Marked up Ventilation Areas




**ADDRESS** : Calcinotto (Head Office)
Jonsen House,
43 Commercial Road,
Poole,
Dorset
BH14 0HU

**TEL** : (01202) 237237
**FAX** : (01202) 740650

**EMAIL** : admin@calcinotto.co.uk
**WEB** : www.calcinotto.co.uk

| Rev | Date | Description | Initials |
|---|---|---|---|
| P1 | 13.07.17 | Drawn | GEB |

CONSULTING STRUCTURAL CIVIL AND ENVIRONMENTAL ENGINEERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Project: | Former ICL Private Ground | Date: | Jul' 17 | Scale: | 1:250 | Job Ref: | 3336 |
| Title: | Lower Ground Floor Car Park Ventilation Plan | Drawn By: | GEB | Rev: | P1 | Drwg No: | SK200 |

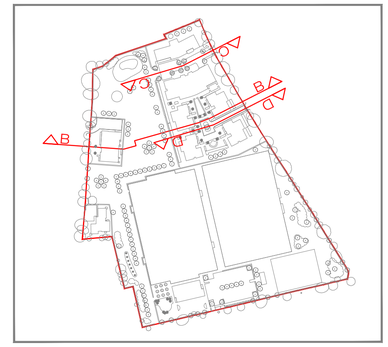
**Appendix C**

Architects Sections through buildings

When Scaled correctly this bar measures 100mm.


Proposed North Elevation C:C
(Section through vehicular entrance to surgery)


Proposed North Elevation / Section D:D
(Section through main vehicular entrance)




Site Plan - Section Line Positions


Proposed Site Section B:B (continued)


Proposed Site Section B:B

0m
1:200
10m
20m
30m

# PLANNING



Do Not Scale, Use figure dimensions.

Check all dimensions on site before work proceeds, report discrepancies to Architect.

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NOTES:

| Rev | Date | Description | Initials |
|---|---|---|---|

Quantum Group

Quantum House, 170 Charminster Road, Charminster, Bournemouth, BH8 9RL
Email: info@quantumhomes.co.uk | Web: www.quantumhomes.co.uk
Tel: 01202 531635 | Fax: 01202 531650

Project:

Former Imperial College Private Ground , Udney Park Road, Teddington

Drawing Title:

Site Section B:B
Proposed West Elevation,
North Elevation C:C & D:D

Discipline:

ARCHITECTURAL

Drawn by: PL

Checked by: SH

Scale: 1:200@A1

Date: July 2017

Drawing Number: 900-SK04

Revision: .

When Scaled correctly this bar measures 100mm.


Proposed West Elevation A:A (continued)


Proposed West Elevation A:A (continued)


Proposed West Elevation A:A

0m 10m 20m 30m
1:200

# PLANNING

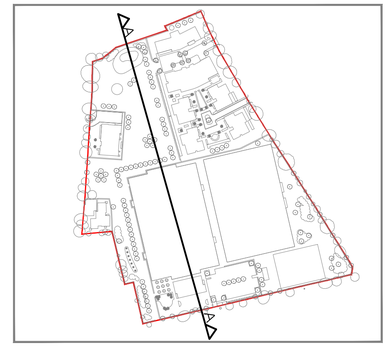


Do Not Scale, Use figure dimensions.

Check all dimensions on site before work proceeds, report discrepancies to Architect.

If In Doubt Ask!!

NOTES:




Site Plan - Section Line Positions

| Rev | Date | Description | Initials |
|---|---|---|---|

Quantum Group

Quantum House, 170 Charminster Road, Charminster, Bournemouth, BH8 9RL
Email: info@quantumhomes.co.uk | Web: www.quantumhomes.co.uk
Tel: 01202 531635 | Fax: 01202 531650

Project:

Former Imperial College Private Ground , Udney Park Road, Teddington

Drawing Title:

Site Section A:A
Proposed West Elevation

Discipline:

ARCHITECTURAL

Drawn by: PL

Checked by: SH

Scale: 1:200@A1

Date: July 2017

Drawing Number: 900-SK03

Revision: .