# CoPlan Estates & Reigate and Banstead Borough Council

# Marketfield Road, Redhill

# Noise Assessment

## April 2016

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# 1.0 Introduction

## 1.1 Purpose of this Report

This report presents the findings of a noise assessment undertaken for the proposed mixed use development at Marketfield Road, Redhill on behalf of CoPlan Estates and Reigate and Banstead Borough Council (RBBC).

With relevance to this assessment, a summary of the proposed development is as follows:

- 4,276 sq m GEA Retail Space;
- 6 screen cinema;
- 154 residential dwellings comprising 63 one and 88 two bedroom apartments and 3 studio units;
- Circa 47 space car parking spaces in the basement level of the residential scheme and an area for 154 cycle stores;

A visual representation of the plots referred to within this assessment is presented below and a proposed layout plan is presented on SK02a to SK02h in Appendix B. The report will support a full planning application.

A description of the existing noise environment in and around the site is provided. Noise surveys have been undertaken and the results used to verify predictions of the short-term and long-term effects of noise. The noise levels from the proposed development have been predicted at local representative receptors using CADNA noise modelling software which incorporates CRTN and ISO 9613 methodologies and calculations.

A list of acoustic terminology and abbreviations used in this report is provided in Appendix A and a set of location plans and noise contour plots relevant to the assessment are presented in Appendix B.

## 1.2 Legislative Context (England)

PPG24 was replaced by NPPF on 27 March 2012. With regard to noise and planning NPPF contains the following 4 short statements (section 123):

A. Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;

B. Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;

C. Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and

D. Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

In support of the NPPF, Planning Practice Guidance (PPG): Noise was launched in March 2014. The overall aim of this guidance is, tying in with the principles of the NPPF and the Explanatory Note of the Noise Policy Statement for England, to, *'identify whether the overall effect of noise exposure is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.'*

A summary of the effects of noise exposure associated with both noise generating developments and noise sensitive developments is presented within the NPPG and repeated as follows:

**Table 1.1 Noise Exposure Hierarchy**

| Perception | Examples of Outcomes | Increasing Effect Level | Action |
|---|---|---|---|
| Not noticeable | No Effect | No Observed Effect | No Specific Measures Required |
| Noticeable and not intrusive | Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life. | No Observed Adverse Effect | No Specific Measures Required |
| Lowest Observed Adverse Effect Level | | | |
| Noticeable and intrusive | Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows for some of the time because of the noise. Potential for non-awakening sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life. | Observed Adverse Effect | Mitigate and reduce to a minimum |
| Significant Observed Adverse Effect Level | | | |
| Noticeable and disruptive | The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area. | Significant Observed Adverse Effect | Avoid |
| Noticeable and very disruptive | Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory | Unacceptable Observed Adverse Effect | Prevent |

## 1.3 Local Planning Policy

With specific regard to noise, the Reigate and Banstead Local Plan: Core Strategy (July 2014) has the following relevant policy:

*Policy CS10: Sustainable Development*

*"Development will:*
...8.Be designed to minimise pollution, including air, noise and light, and to safeguard water quality...."

*The Borough Local Plan 2005 has the following relevant policy*

*Policy Ho 10*

*"Development will not normally be permitted in areas subject to noise and/or vibration unless measures are undertaken as part of such development to reduce to an acceptable level the effect of such noise and/or vibration upon the intended occupiers of such development."*

## 2.0 Assessment Criteria

In order to enable the assessment of the proposed development in terms of LOAEL and SOAEL, Table 2.1 presents equivalent noise levels and associated actions with the target noise level criteria identified. In establishing the relevant criteria for the purpose of this assessment, guidance provided within the following documents has been referred to:

- BS 8233: (2014) – "Sound and noise reduction for buildings – Code of Practice"
- BS 4142: 2014 – 'Methods for rating and assessing industrial and commercial sound'
- World Health Organisation 'Guidelines on Community Noise' 1999

**Table 2.1 Noise Level Criteria and Actions**

| Effect Level | Assessment | Noise Level Criteria |
|---|---|---|
| Lowest Observed Adverse Effect Level (LOAEL) | Building Services Plant | Noise Rating Level ($L_{Aeq,T}$) is 10 dB below the background noise level ($L_{A90,T}$). |
| | Deliveries | Internal noise levels within habitable rooms are below:<br><br>Bedrooms: 30 $dBL_{Aeq,8hours}$ / 60$dBL_{Amax}$<br>Living Rooms: 35 $dBL_{Aeq,16hours}$ |
| | Proposed Residential Receptors | Internal noise levels within habitable rooms are below:<br><br>Bedrooms: 30 $dBL_{Aeq,8hours}$<br>Living Rooms: 35 $dBL_{Aeq,16hours}$<br><br>External Amenity Space:<br>50 $dBL_{Aeq,16hours}$ |
| Significant Observed Adverse Effect Level (SOAEL) | Building Services Plant | Noise Rating Level ($L_{Aeq,T}$) is 10 dB above the background noise level ($L_{A90,T}$). |
| | Deliveries | Internal noise levels within habitable rooms are below:<br><br>Bedrooms: 30 $dBL_{Aeq,8hours}$ / 60$dBL_{Amax}$<br>Living Rooms: 35 $dBL_{Aeq,16hours}$ |
| | Proposed Residential Receptors | Internal noise levels within habitable rooms exceed:<br><br>Bedrooms: 30 $dBL_{Aeq,8hours}$<br>Living Rooms: 35 $dBL_{Aeq,16hours}$<br><br>External Amenity Space, depending on context:<br><br>55 $dBL_{Aeq,16hours}$ |

# 3.0 Assessment Methodology

## 3.1 Noise Modelling Methodology

Three dimensional noise modelling has been undertaken based on the monitoring data to predict source noise levels at a large number of locations both horizontally and vertically. CADNA noise modelling software has been used. This model is based on the Department of Transport Calculation of Road Traffic Noise (CRTN) and ISO 9613 noise propagation methodology.

The modelling software calculates noise levels based on the emission parameters and spatial settings that are entered. Input data, assumptions and model settings as given in the table below have been used.

**Table 3.1 Modelling Parameters Sources and Assumptions**

| Parameter | Source | Details |
|---|---|---|
| Horizontal distances – around site | Ordnance Survey | Ordnance Survey |
| Ground levels | Ordnance Survey | 5m OS Contours and site |
| Building heights | WYGE Observations | 8 m / 12m height for existing properties. Proposed buildings as per elevations drawings |
| Receptor positions | WYGE | 1 m from façade, height specified in Section 3.3 |
| Reflections | WYGE | First order reflections have been applied based on mirror image sources |
| Absorbent Ground | CADNA | Frequency dependant ground absorption has been applied based on values specified in VDI 2714/16 clause 6.3. |
| Proposed Plans | PRP | Proposed Site plans Drawing Ref AA3983<br>Elevations and internal layouts for all levels |

It is acknowledged that a number of these assumptions will affect the overall noise levels presented in this report. However, it should be noted that certain assumptions made, as identified above, are worst case.

## 3.2 Model Input Data

### 3.2.1 HGV Delivery Event Noise Data

Noise of a delivery event has been known to vary from site to site by as much as 22 dB $L_{Aeq}$ at 3 m distance even with the same vehicle type. Similarly, individual events using the same vehicle and at the same store have been recorded to vary by as much as 14 dB.

As such, the following worst-case calculations have been based on measurements of refrigerated, articulated HGVs delivering consumables. All measurements were undertaken in free-field conditions. In addition to noise from the unloading process, the levels used in the assessment include noise from the vehicle pulling up to the unloading bay, manoeuvring into position and then pulling away once unloading/loading is complete, together with other sources such as trolleys and reversing alarms. The calculations are based on a one event per hour within each of the two service yards.

*Delivery Vehicle Docking and Unloading*

- *Daytime $L_{Aeq,1hr}$ Noise Level*

  5 minutes at $L_p$ 75 dB at 3 m distance (vehicle arriving and manoeuvring)
  38 minutes at $L_p$ 70 dB at 3 m distance (vehicle unloading)
  2 minutes at $L_p$ 72 dB at 3 m distance (vehicle leaving)
  15 minutes of quiet (associated with documentation and waiting with engine off)

  $L_{Aeq(60\ mins)}$ = $10\log(1/60)(5\text{mins} \times 10^{0.1 \times 75dB} + 38\text{mins} \times 10^{0.1 \times 70dB} + 2\text{mins} \times 10^{0.1 \times 72dB})$
  = 69.8 dB at 3 m distance

- *Night-time $L_{Aeq,15min}$ Noise Level*

  5 minutes at $L_p$ 75 dB at 3 m distance (vehicle arriving and manoeuvring)
  10 minutes at $L_p$ 70 dB at 3 m distance (vehicle unloading)

  $L_{Aeq(15\ mins)}$ = $10\log(1/15)(5\text{mins} \times 10^{0.1 \times 75dB} + 10\text{mins} \times 10^{0.1 \times 70dB})$
  = 74.1 dB at 3 m distance

- *$L_{Amax}$ Noise levels*

  $L_{Amax}$ used is as 85.4dB at 3 m distance

### 3.2.2 Building Services Plant (BSP) Noise Data

As the proposed plant design and end users are not confirmed at this stage a detailed plant noise assessment cannot be undertaken. Therefore, point sources have been defined in the model to represent potential plant associated with the proposed development within the designation external plant areas. The maximum sound pressure levels of the point sources at 3 and 10 metres were estimated in the model as a

conditional maximum level that the noise levels at nearby receptors were predicted to meet the required criteria which is outlined in Section 5.1.

### 3.2.3 Traffic Noise Data

All roads expected to make a significant contribution, have been included within this assessment. Noise emissions from existing traffic flows have been derived from verification of the measured noise levels, along with observations made during the site survey and/or WYG Environment (WYGE) experience of similar road systems. Estimates of the vehicle speeds have been made based upon the speed restrictions currently in force in the area.

### 3.2.4 Model Verification

The model was verified by modelling the monitoring locations for the 'existing' weekday scenario. Daytime and night-time $L_{Aeq}$ and night-time $L_{Amax}$ scenarios have been verified. The comparison between the monitoring and modelling results are shown in the tables below.

**Table 3.2 Modelled vs. Monitored Results $L_{Aeq;\ daytime\ 07:00 – 23:00}$**

| Location | Monitored $L_{Aeq}$ | Modelled $L_{Aeq}$ | Difference between Monitored and Modelled Results |
|---|---|---|---|
| ST1 | 63.8 | 63.1 | -0.7 |
| ST2 | 70.3 | 70.9 | 0.6 |
| ST3 | 62.3 | 64.9 | 2.6 |
| ST4 | 70.3 | 70.5 | 0.2 |
| ST5 | 63.7 | 62.8 | -0.9 |
| ST6 | 53.9 | 53.7 | -0.2 |

All values are sound pressure levels in dB re: $2x\ 10^{-5}$ Pa

**Table 3.3 Modelled vs. Monitored Results $L_{Aeq;\ night\text{-}time\ 23:00– 07:00}$**

| Location | Monitored $L_{Aeq}$ | Modelled $L_{Aeq}$ | Difference between Monitored and Modelled Results |
|---|---|---|---|
| ST1 | 52.7 | 53.2 | 0.5 |
| ST2 | 61.9 | 61.2 | -0.7 |
| ST3 | 54.4 | 55.1 | 0.7 |
| ST4 | 60.3 | 59.7 | -0.6 |
| ST5 | 50.5 | 52.8 | 2.3 |

All values are sound pressure levels in dB re: $2x\ 10^{-5}$ Pa

**Table 3.4 Modelled vs. Monitored Results $L_{Amax;\ night\text{-}time\ 23:00–07:00}$**

| Location | Monitored $L_{Amax}$ | Modelled $L_{Amax}$ | Difference between Monitored and Modelled Results |
|---|---|---|---|
| ST1 | 67.8 | 66.7 | -1.1 |
| ST2 | 86.4 | 83.8 | -2.6 |
| ST3 | 69.4 | 71.5 | 2.1 |
| ST4 | 76.2 | 75.3 | -0.9 |
| ST5 | 65.7 | 66.8 | 1.1 |

All values are sound pressure levels in dB re: $2x\ 10^{-5}$ Pa

The verification points show a divergence between monitored and modelled results of no more than 3 dB; therefore all models are assumed to be suitably verified.

### 3.1.1 Model Input Data – Construction Phase

Information regarding noise emissions from equipment used during the construction phase has been obtained from Annex C of BS 5228-1:2009 + A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*. This annex presents a range of current sound level data on typical site equipment and common site activities.

This data is obtained by field measurements for items of plant in actual use on construction and open sites in the UK. Levels quoted in the database are based on an average (logarithmic) of measured sound levels, and where appropriate have been derived from more than one model of similarly sized plant. The results are presented as un-weighted octave band activity $L_{eq}$ levels, and overall A-weighted activity $L_{eq}$ levels in dB. All sound pressure levels are standardized to 10 metres from the plant.

The items of plant and associated noise levels shown in the tables below have been used for the purposes of this assessment and consider the range of typical activities likely to be employed during the construction phase of the proposed development. Items of mobile plant have been positioned in the areas on the development site that are close to both existing and proposed residential dwellings.

**Table 3.5 Mobile Plant Construction Phase**

| Mobile Plant | BS 5228-1:2009 Annex C Ref. | Octave Band Sound Pressure Levels (Hz) | | | | | | | | Model Input $L_{Aeq}$ at 10 m |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 63 | 125 | 250 | 500 | 1K | 2K | 4K | 8K | |
| Wheeled Loader x1 | Table C.2 No.26 | 87 | 82 | 77 | 78 | 73 | 70 | 64 | 57 | 79 dB |
| Articulated Dump truck x2 | Table C.2 No.33 | 85 | 87 | 77 | 75 | 76 | 73 | 69 | 62 | 81 dB |
| Tracked Excavator x1 | Table C.2 No.19 | 95 | 84 | 79 | 73 | 70 | 68 | 64 | 57 | 77 dB |
| Road Roller x1 | Table C.5 No.19 | 87 | 85 | 75 | 73 | 75 | 73 | 69 | 63 | 80 dB |

## 3.3 Sensitive Receptors

The table below summarises receptor locations that have been selected to represent worst-case existing residential receptors with respect to direct noise from the proposed store. Upper floor facades (adjacent and facing the proposed development) of nearest existing properties have been represented. The locations of existing receptors are shown on SK01 in Appendix B whilst the locations of the proposed receptors are shown on SK02a to SK02h in Appendix B.

**Table 3.6 Receptor Locations**

| Ref. | Description | Closest Source | Approximate Distance To Source (m) | Assessed Height (m) |
|---|---|---|---|---|
| R1 | 5, The Arcade | Delivery Line Source | 5 | 5.5 |
| R2 | Flat 20, Station Road | Delivery Line Source | 23 | 5.5 |
| R3 | Flat 26b, Station Road | Delivery Line Source | 24 | 5.5 |
| R4 | Flat 30, Station Road | Delivery Line Source | 7 | 5.5 |

## 3.4 Tranquillity Rating

An assessment of the existing tranquillity level of the site has been based on the mapping data published by Campaign to Protect Rural England (CPRE). This uses a colour coded system and a 500m assessment grid for the whole of England, and a tranquillity rating of between 1 and 10 is assigned (1 being least tranquil and 10 being most).

# 4.0 Noise Survey

## 4.1 Noise Survey Methodology

A monitoring survey was undertaken to characterise baseline ambient noise levels currently experienced on the site and to establish the relative local background and traffic noise levels.

Equipment used during the survey included:

| | | | |
|---|---|---|---|
| Rion NL-52 | Environmental Noise Analyser (WYG17) | s/n | 1043466 |
| Rion NC-74 | Sound Calibrator | s/n | 35046823 |

The measurement equipment was checked against the appropriate calibrator at the beginning and end of the measurements, in accordance with recommended practice and no drift was observed. The accuracy of the calibrators can be traced to National Physical Laboratory Standards, calibration certificates for which are available on request.

A baseline attended monitoring survey was undertaken at six locations (as specified in the following table and shown in SK01 of Appendix B) from Tuesday 29th March 2016 to Wednesday 30th March 2016. Attended short term measurements were undertaken at five locations during the day, evening and night-time periods with one additional location measured during the day period.

Measurements were taken in general accordance with BS 7445-1:2003 *The Description and Measurement of Environmental Noise: Guide to quantities and procedures*..

**Table 4.1 Noise Monitoring Locations**

| Ref | Description | Grid Reference | |
|---|---|---|---|
| | | X | Y |
| ST1 | Between 18 and 12 High Street | 527962.5 | 150591.1 |
| ST2 | East of 35 Knowles House | 527924.8 | 150463.9 |
| ST3 | Southwest corner of car park on Marketfield Road | 527984.2 | 150478.4 |
| ST4 | Marketfield Way east of car park | 528021.9 | 150525.7 |
| ST5 | North of 26b Station Road | 528017.5 | 150621.3 |
| ST6 | The Belfry Multi-Storey Car Park | 527833.0 | 150584.5 |

## 4.2 Noise Survey Results

Existing ambient noise levels around the site are dominated by road traffic noise on Marketfield Way, High Street and Cromwell Road. Rail noise from passing trains to the east of site, footfall noise and car parking also contribute to the ambient noise climate.

Ambient and background noise levels are usually described using the $L_{Aeq}$ index (a form of energy average) and the $L_{A90}$ index (i.e. the level exceeded for 90% of the measurement period) respectively. Road traffic noise is generally described using the $L_{A10}$ index (i.e. the level exceeded for 10% of the measurement period).

**Table 4.2. Meteorological Conditions during the Survey**

| Survey Location/ | Date & Time | Temperature | Wind Speed | Wind Direction | Cloud Cover (Oktas) | Dominant Noise Source |
|---|---|---|---|---|---|---|
| Day ST1 | 30/03/2016 11:18 | 11 ºC | 3-5 m/s | SW | 2 | Footfall noise from pedestrians, traffic in the background. |
| Day ST2 | 30/03/2016 11:35 | 11 ºC | 3-5 m/s | SW | 2 | Road traffic noise on Cromwell Road and High Street. |
| Day ST3 | 30/03/2016 11:51 | 11 ºC | 3-5 m/s | SW | 3 | Roads traffic noise from Marketfield Way and car park. |
| Day ST4 | 30/03/2016 12:07 | 12 ºC | 3-5 m/s | SW | 3 | Road traffic noise from Marketfield Way. |
| Day ST5 | 30/03/2016 12:34 | 12 ºC | 3-5 m/s | SW | 4 | Footfall noise from pedestrians, traffic in the background. |
| Day ST6 | 30/03/2016 13:01 | 12 ºC | 3-5 m/s | SW | 4 | Cars parking up and distant traffic. |
| Evening ST1 | 29/03/2016 21:13 | 6 ºC | 4-5 m/s | SW | 7 | Distant traffic and aircraft noise. |
| Evening ST2 | 29/03/2016 21:32 | 6 ºC | 4-5 m/s | SW | 7 | Road traffic noise on Cromwell Road and Marketfield Way. Aircraft. |
| Evening ST3 | 29/03/2016 21:49 | 6 ºC | 4-5 m/s | SW | 7 | Road traffic noise on Marketfield Way, Cromwell Road and other roads. Aircraft. |
| Evening ST4 | 29/03/2016 22:07 | 6 ºC | 4-5 m/s | SW | 7 | Road traffic noise on Marketfield Way and occasional aircraft noise. |
| Evening ST5 | 29/03/2016 22:25 | 6 ºC | 4-5 m/s | SW | 7 | Road traffic noise on Marketfield Way and Princess Way. |
| Night ST1 | 30/03/2016 00:37 | 5 ºC | 1-3 m/s | SW | 7 | Road traffic noise from various roads. |
| Night ST2 | 30/03/2016 00:56 | 5 ºC | 1-3 m/s | SW | 7 | Road traffic noise from Cromwell Road, Marketfield Way and rail noise. |
| Night ST3 | 30/03/2016 01:14 | 5 ºC | 1-3 m/s | SW | 7 | Occasional vehicle on Marketfield Way and Cromwell Road. Rail noise. |
| Night ST4 | 30/03/2016 01:31 | 5 ºC | 1-3 m/s | SW | 7 | Occasional car on Marketfield Way and rail noise. |
| Night ST5 | 30/03/2016 01:48 | 5 ºC | 1-3 m/s | SW | 7 | Distant traffic and rail noise. |
| Late Night ST1 | 30/03/2016 02:07 | 5 ºC | 1-3 m/s | SW | 7 | Occasional distant traffic noise. |
| Late Night ST2 | 30/03/2016 02:25 | 5 ºC | 1-3 m/s | SW | 7 | Occasional distant traffic noise. |
| Late Night ST3 | 30/03/2016 02:42 | 5 ºC | 1-3 m/s | SW | 7 | Occasional distant traffic noise. |
| Late Night ST4 | 30/03/2016 03:00 | 5 ºC | 1-3 m/s | SW | 7 | Occasional road traffic noise. |
| Late Night ST5 | 30/03/2016 03:17 | 5 ºC | 1-3 m/s | SW | 7 | Occasional distant traffic noise. |

The results of the statistical measurements and frequency measurements conducted during the survey are summarised in the following table. All values are sound pressure levels in dB (re: 2 x $10^{-5}$ Pa).

**Table 4.3 Results of Baseline Noise Monitoring Survey (Average Levels)**

| Period | Duration (T) | Monitoring Date and Times | Location | $L_{Aeq,T}$ (dB) | $L_{Amax,T}$ (dB) | $L_{Amin,T}$ (dB) | $L_{A10,T}$ (dB) | $L_{A90,T}$ (dB) |
|---|---|---|---|---|---|---|---|---|
| Day 07:00 - 19:00 | 15 Mins | 30/03/2016 11:18 | ST1 | 63.8 | 85.6 | 54.4 | 63.9 | 60.0 |
| | 15 Mins | 30/03/2016 11:35 | ST2 | 70.3 | 85.6 | 54.1 | 72.9 | 61.6 |
| | 15 Mins | 30/03/2016 11:51 | ST3 | 62.3 | 84.3 | 51.7 | 64.6 | 56.9 |
| | 15 Mins | 30/03/2016 12:07 | ST4 | 70.3 | 82.9 | 54.8 | 73.4 | 62.0 |
| | 15 Mins | 30/03/2016 12:34 | ST5 | 63.7 | 88.6 | 55.2 | 65.3 | 59.3 |
| | 15 Mins | 30/03/2016 13:01 | ST6 | 53.9 | 75.8 | 46.8 | 55.7 | 49.4 |
| Evening 19:00 - 23:00 | 15 Mins | 29/03/2016 21:13 | ST1 | 56.8 | 75.6 | 47.6 | 59.4 | 50.9 |
| | 15 Mins | 29/03/2016 21:32 | ST2 | 62.9 | 80.3 | 47.2 | 67.0 | 51.0 |
| | 15 Mins | 29/03/2016 21:49 | ST3 | 61.0 | 76.1 | 48.5 | 63.8 | 52.5 |
| | 15 Mins | 29/03/2016 22:07 | ST4 | 68.0 | 79.1 | 49.3 | 71.8 | 57.7 |
| | 15 Mins | 29/03/2016 22:25 | ST5 | 62.6 | 72.4 | 50.6 | 67.1 | 54.6 |
| Night-time 23:00 - 07:00 | 15 Mins | 30/03/2016 00:37 | ST1 | 52.7 | 67.8 | 37.8 | 54.4 | 40.4 |
| | 15 Mins | 30/03/2016 00:56 | ST2 | 56.7 | 75.8 | 39.1 | 59.0 | 40.5 |
| | 15 Mins | 30/03/2016 01:14 | ST3 | 54.4 | 69.4 | 42.2 | 58.9 | 43.8 |
| | 15 Mins | 30/03/2016 01:31 | ST4 | 60.3 | 76.2 | 40.6 | 64.4 | 43.6 |
| | 15 Mins | 30/03/2016 01:48 | ST5 | 50.5 | 62.9 | 40.9 | 54.4 | 45.8 |
| | 15 Mins | 30/03/2016 02:07 | ST1 | 47.2 | 64.0 | 37.3 | 48.8 | 48.8 |
| | 15 Mins | 30/03/2016 02:25 | ST2 | 61.9 | 86.4 | 39.2 | 50.2 | 40.6 |
| | 15 Mins | 30/03/2016 02:42 | ST3 | 53.3 | 69.2 | 41.9 | 54.6 | 43.0 |
| | 15 Mins | 30/03/2016 03:00 | ST4 | 53.9 | 74.0 | 41.0 | 51.9 | 42.4 |
| | 15 Mins | 30/03/2016 03:17 | ST5 | 49.7 | 65.7 | 42.4 | 51.5 | 44.7 |

All values are sound pressure levels in dB re: 2x $10^{-5}$ Pa

# 5.0 Assessment of Key Effect

## 5.1 Construction Noise

Noise levels from potential construction activity associated with the development of the site have been assessed in accordance with BS 5228-1:2009 + A1 2014 criteria which indicate if a significant effect is likely to occur at noise sensitive properties.

Point sources representing all likely items of plant have been represented in the model and in the case of mobile plant these have been placed in worst case location with respect to nearby noise sensitive premises. Worst case assumptions regarding the 'on-time' of individual plant items have also been made and represented in the calculations. In order to ensure that the assessment is worst case, it is assumed that all proposed construction activity is occurring simultaneously.

The principal contractor will also liaise with nearby residents to ensure that the hours of working will be planned in advance and communicated appropriately.

**Significance based on fixed limits**

The table below shows predicted levels of construction noise at existing noise sensitive properties for comparison with the recommended noise limit criteria.

**Table 5.1 Construction Noise Assessment Results (Fixed Limits Method)**

| Ref | Construction Noise Level (dB(A)) | Criteria (dB(A)) | Within Recommended fixed noise limit |
|---|---|---|---|
| R1 | 75 | 75 | Yes |
| R2 | 66 | 75 | Yes |
| R3 | 72 | 75 | Yes |
| R4 | 66 | 75 | Yes |

The results indicate that the noise levels at the façades of the existing noise sensitive properties would be at or within the recommended criteria. Noise levels within the fixed limit criteria are likely to result in internal conditions where conversation would not be difficult.

## 5.2 Building Services Plant Noise Assessment

The assessment compares the predicted noise levels from proposed building service plant (BSP) with the existing measured background noise $L_{A90}$ at the surrounding existing residential receptors. Given experience of similar types of assessment it has been assumed that a tonal character correction is not required. However, at this stage this cannot be verified and therefore, a 3 dB correction (specified in 9.2 of BS 4142) has been added to create the plant 'Rating Level at Receptor'. The representative existing measured background noise level for each receptor has been established from the baseline measurements.

As details relating to proposed BSP are currently not known, noise from a series of predictions were made by defining different sound power levels at vertical area sources representative of noise breakout from within plant/service areas and point sources representative of ground floor external retail plant. When the sound pressure levels are set as shown in Table 5.2 (which are considered to be achievable), the rating levels at all the representative receptors are predicted to be at or below the background levels during the period when the plant would be operational as shown in Table 5.3.

**Table 5.2 Proposed Emission Limits for BSP as Modelled**

| BSP Location | Noise Emission Limit - Sound Pressure Level* | |
|---|---|---|
| | Daytime ($L_{Aeq,1hour}$) | Night-time ($L_{Aeq,15mins}$) |
| Cinema Plant x2 | 61.7 dB(A) at 3 m *OR* 53.0 dB(A) at 10 m | 47.7 dB(A) at 3 m *OR* 39.0 dB(A) at 10 m |
| Ground Floor Retail x6 | 61.9 dB(A) at 3 m *OR* 51.4 dB(A) at 10 m | 51.9 dB(A) at 3 m *OR* 41.4 dB(A) at 10 m |

**Table 5.3 BS4142 BSP Assessment - Proposed BSP (Existing receptors)**

| Reference | Existing Measured Background $L_{A90}$ | | Specific noise rating level from plant | | BS 4142 Score | |
|---|---|---|---|---|---|---|
| | Daytime | Night-time | Daytime ($L_{Aeq,1hour}$) | Night-time ($L_{Aeq,,15mins}$) | Daytime | Night-time |
| R1 | 57 | 43 | 57 | 43 | 0 | 0 |
| R2 | 57 | 43 | 45 | 32 | -12 | -11 |
| R3 | 57 | 43 | 53 | 41 | -4 | -2 |
| R4 | 57 | 43 | 46 | 34 | -11 | -9 |

All values are sound pressure levels in dB re: $2x\ 10^{-5}$ Pa.

All calculations used to derive the above tables (including averaging of background noise levels and predicted source noise levels) have been undertaken to 1 decimal place to avoid perpetuation of rounding errors. However, in accordance with BS4142 Para 8.6, the levels are expressed as integers (with 0.5 dB being rounded up). This may mean that the arithmetic in the above table may appear to be up to 1 dB incorrect due to this rounding.

Based on the predicted noise rating levels, when compared to the existing background noise level, predicted noise levels at all receptors fall within the LOAEL during both daytime and night-time periods. This includes the assumption that all plant will be operational continuously during all periods.

## 5.3 Delivery Noise Assessment (Northern Servicing Area)

The assessment compares the predicted noise levels from proposed deliveries to the northern service yard with the existing measured background noise $L_{A90}$ at the surrounding existing residential receptors. Given experience of similar types of assessment a +6 dB correction (specified in 9.2 of BS 4142) has been added to create the plant 'Rating Level at Receptor' to account for impulsive characteristics of the noise that may be clearly perceptible at nearby receptors. The representative existing measured background noise level for each receptor has been established from the baseline measurements. As it is not considered that the servicing area to the north would be used during the night-time period, a daytime assessment has been undertaken. Predicted noise levels with respect to deliveries at future residential receptors are taken into account within the cumulative noise level assessment presented in Section 5.5.

**Table 5.4 BS4142 Delivery Assessment - Proposed Northern Service Area (Existing receptors)**

| Reference | Existing Measured Background $L_{A90}$ | Specific noise rating level from deliveries | BS 4142 Score |
|---|---|---|---|
| | Daytime | Daytime ($L_{Aeq,1hour}$) | Daytime |
| R1 | 57 | 59 | 2 |
| R2 | 57 | 45 | -12 |
| R3 | 57 | 57 | 0 |
| R4 | 57 | 46 | -11 |

All values are sound pressure levels in dB re: 2x $10^{-5}$ Pa.

All calculations used to derive the above tables (including averaging of background noise levels and predicted source noise levels) have been undertaken to 1 decimal place to avoid perpetuation of rounding errors. However, in accordance with BS4142 Para 8.6, the levels are expressed as integers (with 0.5 dB being rounded up). This may mean that the arithmetic in the above table may appear to be up to 1 dB incorrect due to this rounding.

The results of the above assessment show that worst case delivery noise rating levels would be up to 2 dB above the measured background noise levels at the nearest sensitive receptors. This indicates that within the context of the development and the existing use of the service area as a car park/servicing area, there would not be a significant effect at the nearest receptors

## 5.4 Delivery Noise Assessment (Southern Servicing Area)

The assessment compares the predicted noise levels from proposed deliveries to the southern service yard with the existing measured background noise $L_{A90}$ at the surrounding existing residential receptors. Given experience of similar types of assessment a 6 dB correction (specified in 9.2 of BS 4142) has been added to create the plant 'Rating Level at Receptor' to account for impulsive characteristics of the noise that may be clearly perceptible at nearby receptors. The representative existing measured background noise level for each receptor has been established from the baseline measurements. As it is likely that this enclosed, dedicated service area could be used during the night-time period, a daytime and night-time assessment

has been undertaken. Predicted noise levels with respect to deliveries at future residential receptors are taken into account within the cumulative noise level assessment presented in Section 5.5.

**Table 5.5 BS4142 Delivery Assessment - Proposed Southern Service Area (Existing receptors)**

| Reference | Existing Measured Background $L_{A90}$ | | Specific noise rating level from deliveries | | BS 4142 Score | |
|---|---|---|---|---|---|---|
| | Daytime | Night-time | Daytime ($L_{Aeq,1hour}$) | Night-time ($L_{Aeq,,15mins}$) | Daytime | Night-time |
| R1 | 57 | 43 | 13 | 18 | -44 | -26 |
| R2 | 57 | 43 | 13 | 17 | -44 | -26 |
| R3 | 57 | 43 | 14 | 19 | -43 | -25 |
| R4 | 57 | 43 | 13 | 17 | -44 | -26 |

All values are sound pressure levels in dB re: 2x $10^{-5}$ Pa.

All calculations used to derive the above tables (including averaging of background noise levels and predicted source noise levels) have been undertaken to 1 decimal place to avoid perpetuation of rounding errors. However, in accordance with BS4142 Para 8.6, the levels are expressed as integers (with 0.5 dB being rounded up). This may mean that the arithmetic in the above table may appear to be up to 1 dB incorrect due to this rounding.

Table 5.4 shows the results of the delivery noise assessment for the southern, enclosed service yard. The results show that the noise rating levels are predicted to be at least 25 dB below the representative background noise levels at all receptors. This falls below the lowest observed adverse effect level.

### 5.4.1 Night-Time $L_{Amax}$ Noise Intrusion Assessment

Internal noise levels within existing dwellings have been assessed both with windows open, where a reduction from a partially open window of 10 dB has been used, and with windows closed where an assumption of glazing with specification $R_w$ 30 dB (e.g 6/12/6mm double glazing or equivalent) has been used. Noise levels from the proposed southern service yard have been included within this assessment.

The results presented in Table 5.5 below show the predicted noise intrusion levels at existing properties to the north of the site. The recommended WHO/BS 8233 internal noise levels are met at the sensitive receptors for the night-time $L_{Amax}$, for both a windows open and windows-closed scenario.

**Table 5.6 Night-time Noise Intrusion Levels $L_{Amax}$**

| Location | External $L_{Amax}$ Noise Level at 1 metre from façade | Internal $L_{Anax}$ with windows open | Internal $L_{Amax}$ with windows closed | Criteria Internal $L_{Amax}$ |
|---|---|---|---|---|
| R1 | 23.5 | 13.5 | 0.0 | 45 |
| R2 | 23.3 | 13.3 | 0.0 | 45 |
| R3 | 24.5 | 14.5 | 0.0 | 45 |
| R4 | 23.3 | 13.3 | 0.0 | 45 |

All values are sound pressure levels in dB re: 2x $10^{-5}$ Pa.

## 5.5 Proposed Residential Receptors

Noise modelling has been undertaken based on the verified daytime and night-time $L_{Aeq}$ and $L_{Amax}$ scenarios as outlined in Section 3.2.5. The model includes the influence of existing sources of noise from vehicles using the local road network, noise from pedestrians and proposed and existing commercial premises within the high street and the nearby railway. Proposed sources of noise comprising daytime use of the northern service area and daytime and night-time use of the southern service area have also been included.

### 5.5.1 Noise Intrusion Assessment

The assessment has considered receptor positions located along all proposed residential facades and floors. The predicted internal noise levels based on the noise modelling scenario are presented in Appendix C where an assumption of standard double glazing (6mm / 12mm / 6mm: $R_w$ 30dB) has been used. The recommended WHO/BS 8233 internal noise levels are generally met across the site during the daytime and night-time, assuming a windows-closed scenario however certain eastern façades facing Marketfield Way are predicted to exceed the relevant criteria with windows closed. In order to achieve the recommended internal noise criteria, a range of mitigation measures are outlined in Section 6.1 of this report; SK02a to SK02h in Appendix B show where enhanced glazing would be required for bedrooms and living rooms of the proposed development.

As shown in the tables presented within Appendix C, for the majority of proposed receptors during both daytime and night-time periods, noise levels are predicted to be within the target criteria of 35 $dBL_{Aeq,16hours}$ for living rooms and 30 $dBL_{Aeq,8hours}$ for bedrooms with standard double glazing and an alternative means of ventilation. Alternative ventilation can be provided in several ways from acoustic trickle vents (which need to have a minimum sound reduction equal to or greater than the glazing), to other passive ventilation systems or mechanical ventilations systems.

For living rooms and bedrooms exposed to road traffic noise on Marketfield Way, enhanced glazing will be required. The required glazing specifications are presented in the relevant tables in Appendix C and the areas that require enhanced glazing are illustrated on SK02a to SK02h with upper example glazing specification being 6mm / 16mm / 10mm ($R_w$ 37dB). As a result, noise levels in all internal habitable spaces will achieve 30 $dBL_{Aeq,8hours}$ (night-time) and 35 $dBL_{Aeq,16hours}$ (daytime).

With regard to proposed commercial / retail uses on the ground and first floors the separating floor construction will be constructed to meet airborne sound insulation requirements of the Building Regulations and the internal ambient noise levels recommended in BS 8233. Therefore, there will be no adverse impact associated with noise transfer into the upper storey sensitive spaces.

### 5.5.2 External Amenity

The results presented in Appendix C show that daytime $L_{Aeq}$ noise levels at some balconies located on the northern, eastern and southern façades of the development are predicted to exceed the BS 8233 guideline upper limit (55 dB).

However, BS8233 recognises that these guidelines values "*are not achievable in all circumstances where development may be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited*".

Although predicted noise levels on some balconies are in excess of 55 dB, the noise experienced is considered not to be of such a level as to prohibit the use of these spaces. The decision as to whether the balconies are utilised should lie with the occupant with most favouring the option of private external space than no private external space at all.

## 5.6 Tranquillity Assessment

An assessment of the existing tranquillity level of the site has been based on the mapping data published by Campaign to Protect Rural England (CPRE). This uses a colour coded system and a 500m assessment grid for the whole of England, and a tranquillity rating of between 1 and 10 is assigned (1 being least tranquil and 10 being most). By reference to these maps the development is assessed as falling into Zone 1. Therefore the site is not located in an area prized for its tranquillity value. In addition, the development will not restrict access to areas of greater tranquillity.

# 6.0 Conclusions of Noise Assessment

*NPPF 123 A & B*

In considering the NPPF test in section 123, points A & B. The proposed development is not expected to have an 'adverse impact' on health or quality of life. Noise intrusion assessments of the deliveries have shown that $L_{Aeq}$ and $L_{Amax}$ noise levels are predicted to be within BS 8233 criteria at existing sensitive receptor locations on the basis of worst case assumptions.

Noise rating levels from proposed building services plant have been predicted and it has been demonstrated that emission limits considered to be achievable for the plant installation will result in predicted noise levels at or below the background noise level at nearby existing noise sensitive receptors. Therefore, the proposed development will not have a 'significant adverse impact' on health or quality of life.

With regard to proposed residential receptors, in accordance with NPPF (123) point B, it is considered that all 'adverse impacts on health and quality of life' (relating to noise) are mitigated by the use of an appropriate glazing strategy with alternative means of ventilation which is compliant with Building Regulations. The suggested glazing and ventilation specifications will be achievable.

*NPPF 123 C & D*

An assessment of the existing tranquillity level of the site has been undertaken and identified that the site is not highly prized for its tranquillity and recreational value in terms of noise. No businesses are located nearby the site which would be adversely affected by the proposals.

*Planning Practice Guidance: Noise*

Noise levels at both existing and proposed receptors are predicted to fall below the Significant Observed Adverse Effect Level (SOAEL) during both daytime and night-time periods.

*Local Planning Policy*

The noise assessment demonstrates that the proposed development will be designed to reduce the effects of noise upon future occupiers and minimise levels of noise generation. Therefore, the proposals are compliant with Reigate and Banstead Local Plan and Borough Local Plan.

# Appendices

# Appendix A – Acoustic Terminology and Abbreviations

An explanation of the specific acoustic terminology referred to within this report is provided below.

dB — Sound levels from any source can be measured in frequency bands in order to provide detailed information about the spectral content of the noise, i.e. whether it is high-pitched, low-pitched, or with no distinct tonal character. These measurements are usually undertaken in octave or third octave frequency bands. If these values are summed logarithmically, a single dB figure is obtained. This is usually not very helpful as it simply describes the total amount of acoustic energy measured and does not take any account of the ear's ability to hear certain frequencies more readily than others.

dB(A) — Instead, the dBA figure is used, as this is found to relate better to the loudness of the sound heard. The dBA figure is obtained by subtracting an appropriate correction, which represents the variation in the ear's ability to hear different frequencies, from the individual octave or third octave band values, before summing them logarithmically. As a result the single dBA value provides a good representation of how loud a sound is.

$L_{Aeq}$ — Since almost all sounds vary or fluctuate with time it is helpful, instead of having an instantaneous value to describe the noise event, to have an average of the total acoustic energy experienced over its duration. The $L_{Aeq,\ 07:00\ -\ 23:00}$ for example, describes the equivalent continuous noise level over the 12 hour period between 7 am and 11 pm. During this time period the $L_{pA}$ at any particular time is likely to have been either greater or lower that the $L_{Aeq,\ 07:00\ -\ 23:00}$.

$L_{Amin}$ — The $L_{Amin}$ is the quietest instantaneous noise level. This is usually the quietest 125 milliseconds measured during any given period of time.

$L_{Amax}$ — The $L_{Amax}$ is the loudest instantaneous noise level. This is usually the loudest 125 milliseconds measured during any given period of time.

$L_n$ — Another method of describing, with a single value, a noise level which varies over a given time period is, instead of considering the average amount of acoustic energy, to consider the length of time for which a particular noise level is exceeded. If a level of x dBA is exceeded for say. 6 minutes within one hour, then that level can be described as being exceeded for 10% of the total measurement period. This is denoted as the $L_{A10,\ 1\ hr}$ = x dB.

The $L_{A10}$ index is often used in the description of road traffic noise, whilst the $L_{A90}$, the noise level exceeded for 90% of the measurement period, is the usual descriptor for underlying background noise. $L_{A1}$ and $L_{Amax}$ are common descriptors of construction noise.

$R_w$ — The *weighted sound reduction index* determined using the above *measurement* procedure, but weighted in accordance with the procedures set down in BS EN ISO 717-1. Partitioning and building board manufacturers commonly use this index to describe the inherent sound insulation performance of their products.

An explanation of abbreviations used within this report is provided below.

CADNA – Computer Aided Noise Abatement

DMRB – Design Manual for Roads and Bridges

HGV – Heavy Goods Vehicle

PPG – Planning Practice Guidance

UDP – Unitary Development Plan

UKAS – United Kingdom Accreditation Service

WYGE – WYG Environment

# Appendix B – Sketches

SK01 Noise Monitoring and Existing Sensitive Receptor Locations

SK02a Proposed Residential Receptors First Floor

SK02b Proposed Residential Receptors Second Floor

SK02c Proposed Residential Receptors Third and Fourth Floor

SK02d Proposed Residential Receptors Fifth Floor

SK02e Proposed Residential Receptors Sixth Floor

SK02f Proposed Residential Receptors Seventh Floor

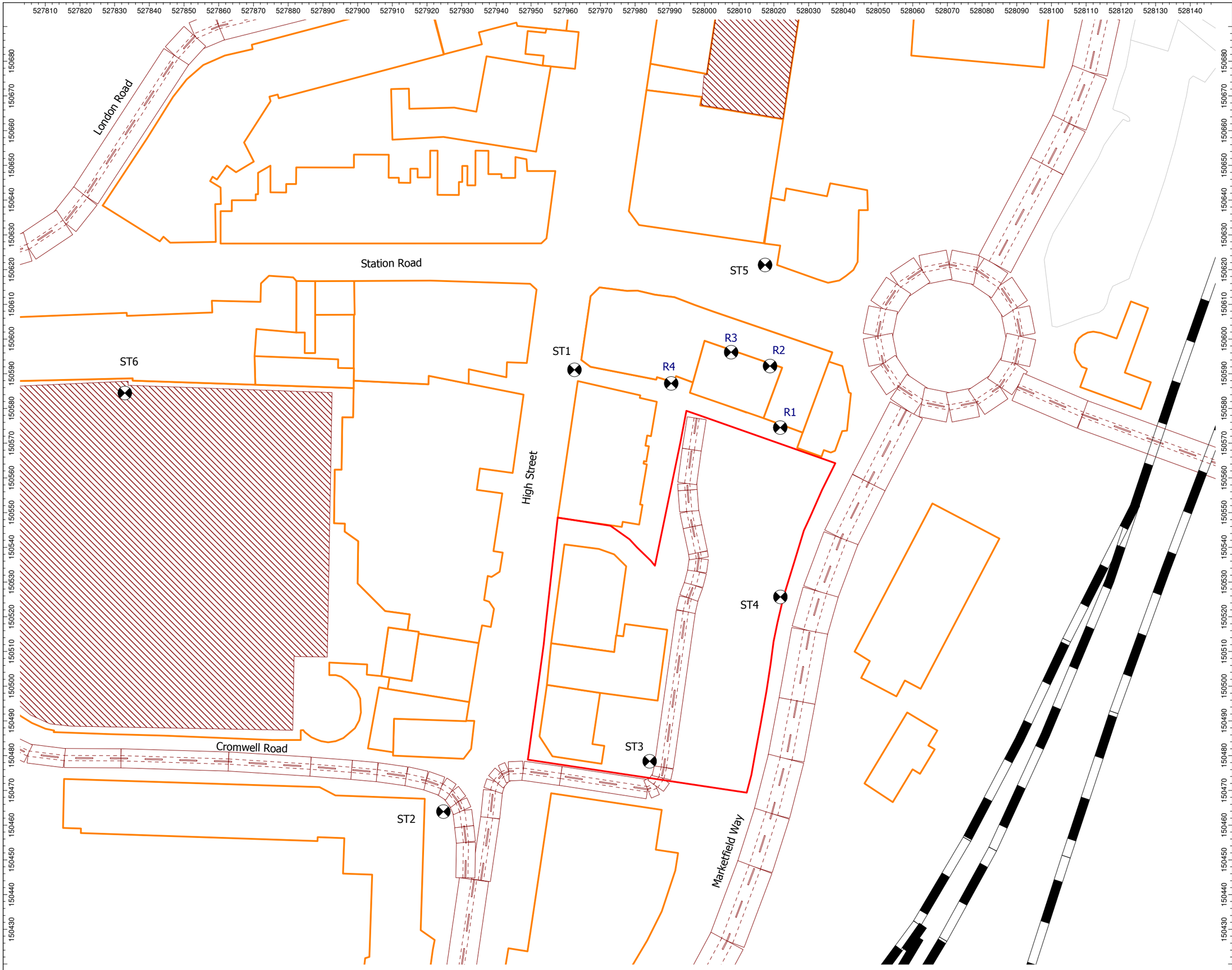
SK02g Proposed Residential Receptors Eighth and Ninth Floor

SK02h Proposed Residential Receptors Tenth and Eleventh Floor

SK03 Daytime $L_{Aeq}$ Noise Levels

SK04 Night-time $L_{Aeq}$ Noise Levels

SK05 Construction Noise Plant and Receptor Locations




Client:
CoPlan Estates and Reigate and Banstead Borough Council

Project:
Marketfield Road Redhill

Project Number:
A095445

Drawing Title / Scenario:
Noise Monitoring and Existing Sensitive Receptor Locations

Drawing Number:
SK01

Key:

Site Boundary:

Scale : Not to scale

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Executive Park
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Anstey
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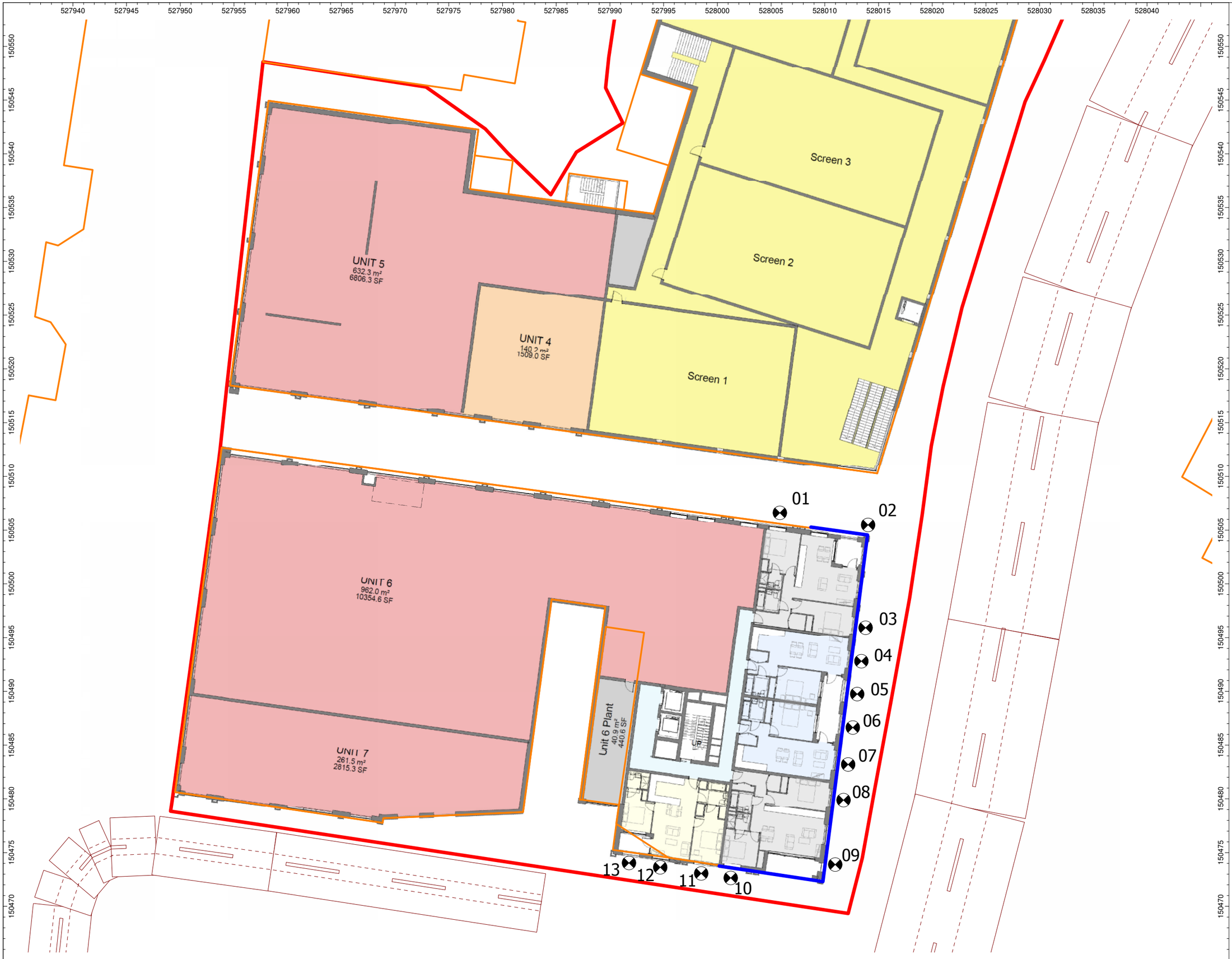
LE7 7GR
Tel 0116 234 8000




Client:
CoPlan Estates and Reigate and Banstead Borough Council

Project:
Marketfield Road
Redhill

Project Number:
A095445

Drawing Title / Scenario:
Proposed Residential Receptors
First Floor

Drawing Number:
SK02a

Key:

Site Boundary:

Enhanced Glazing:

Scale : Not to scale

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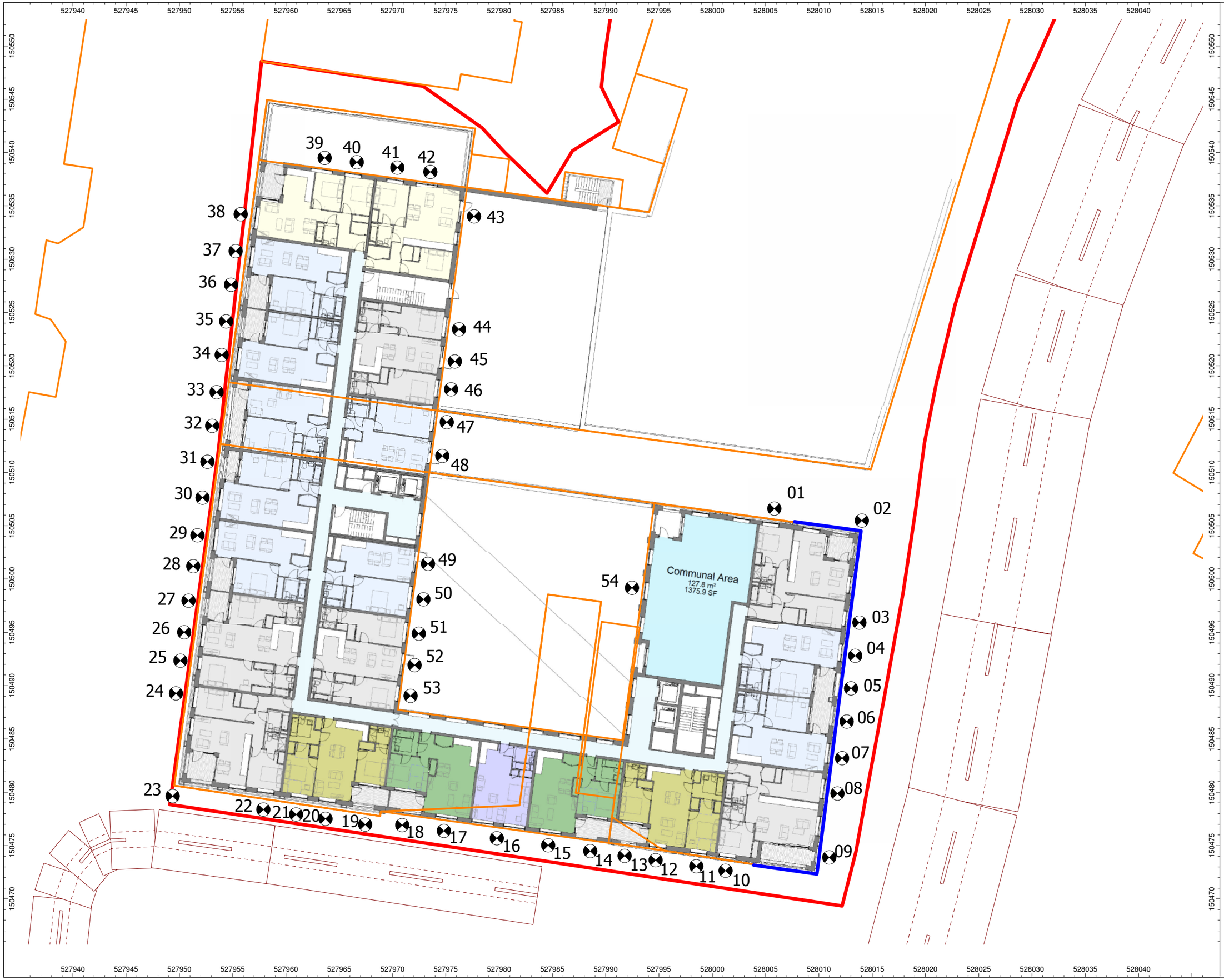


Client:
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Project:
Marketfield Road
Redhill

Project Number:
A095445

Drawing Title / Scenario:
Proposed Residential Receptors
Second Floor

Drawing Number:
SK02b

Key:

Site Boundary:

Enhanced Glazing:

Scale : Not to scale

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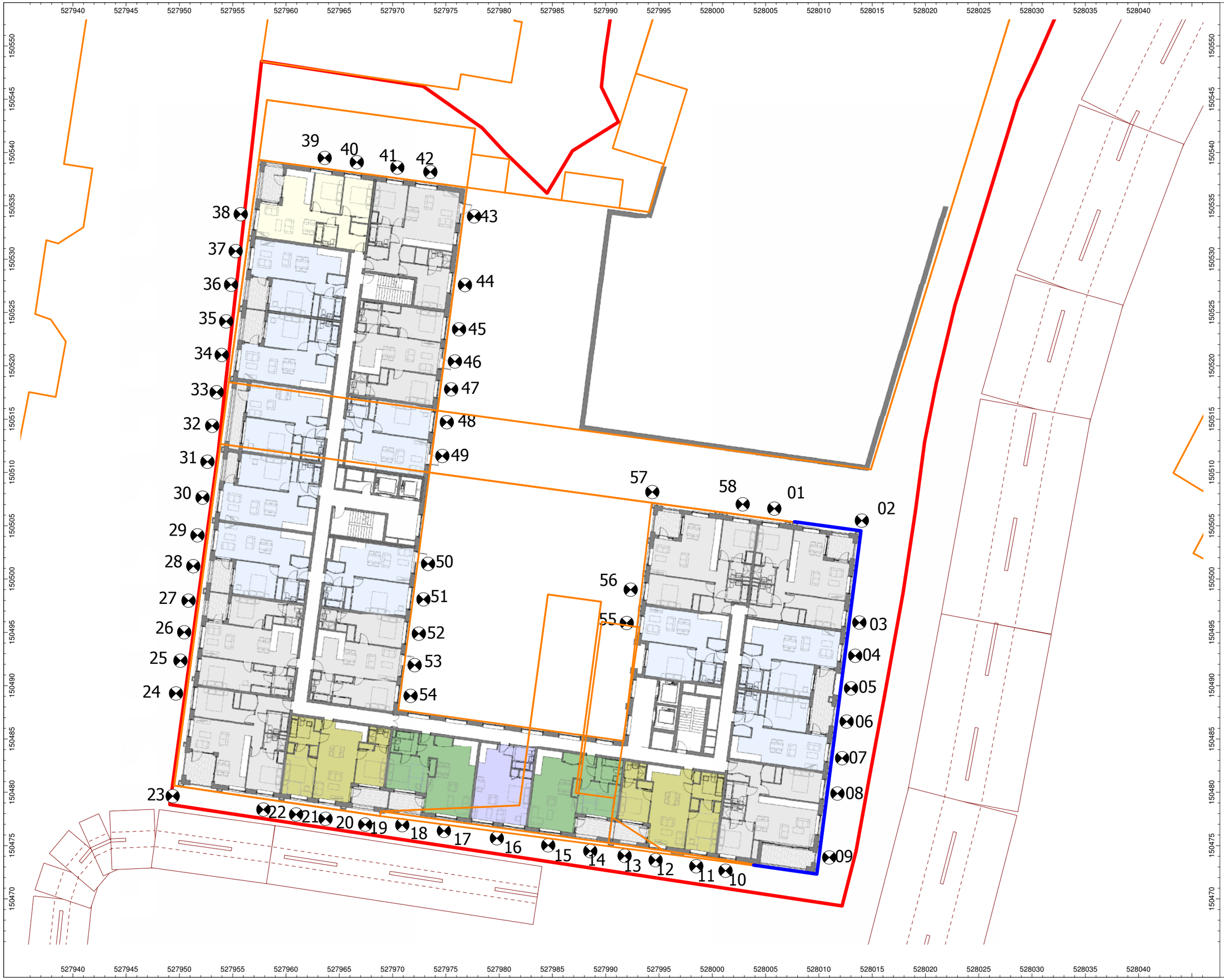


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Project:
Marketfield Road
Redhill

Project Number:
A095445

Drawing Title / Scenario:
Proposed Residential Receptors
Third and Fourth Floor

Drawing Number:
SK02c

Key:

Site Boundary:

Enhanced Glazing:

Scale : Not to scale

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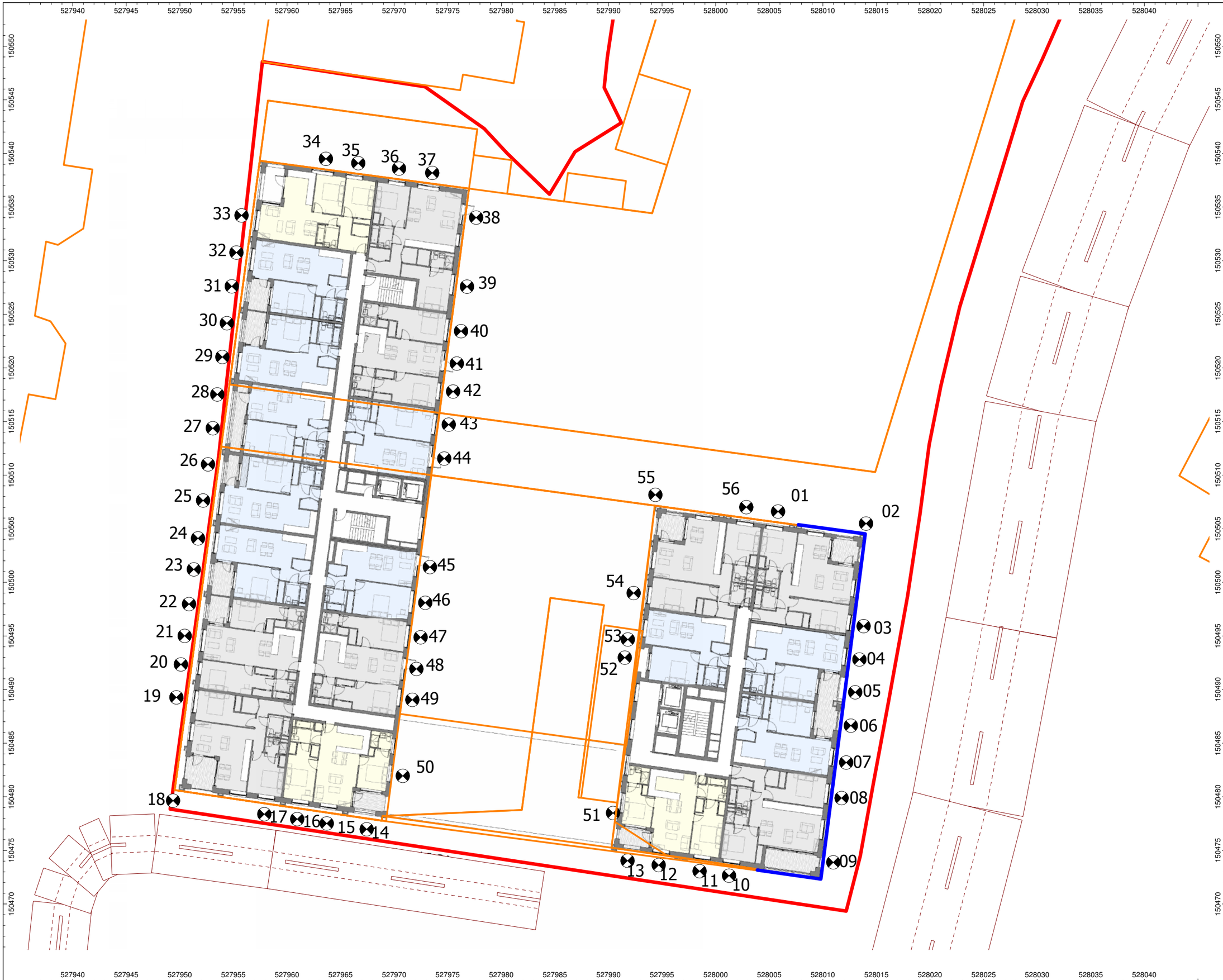


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Project:
Marketfield Road
Redhill

Project Number:
A095445

Drawing Title / Scenario:
Proposed Residential Receptors
Fifth Floor

Drawing Number:
SK02d

Key:

Site Boundary:

Enhanced Glazing:

Scale : Not to scale

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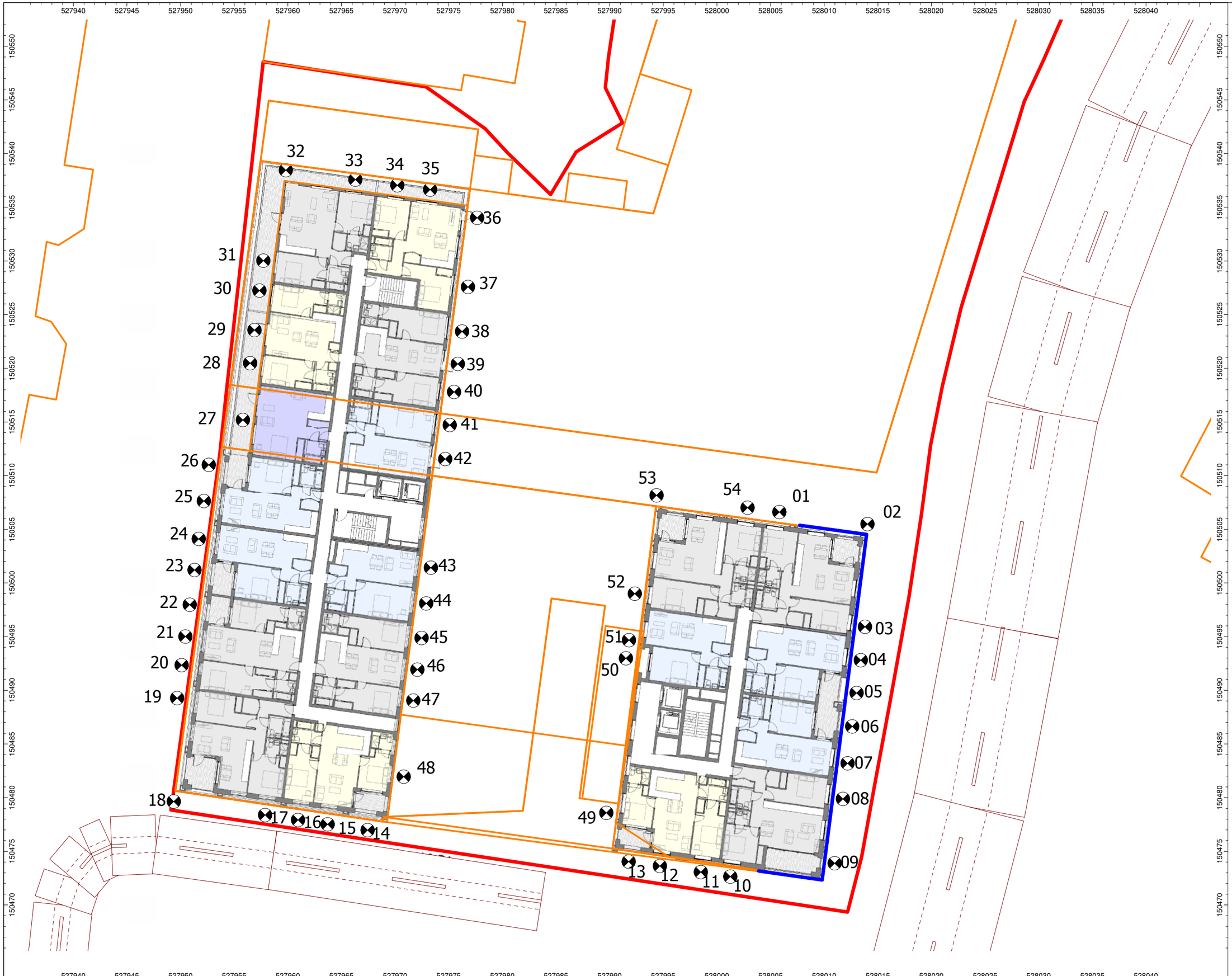


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Project:
Marketfield Road
Redhill

Project Number:
A095445

Drawing Title / Scenario:
Proposed Residential Receptors
Sixth Floor

Drawing Number:
SK02e

Key:

Site Boundary:

Enhanced Glazing:

Scale : Not to scale

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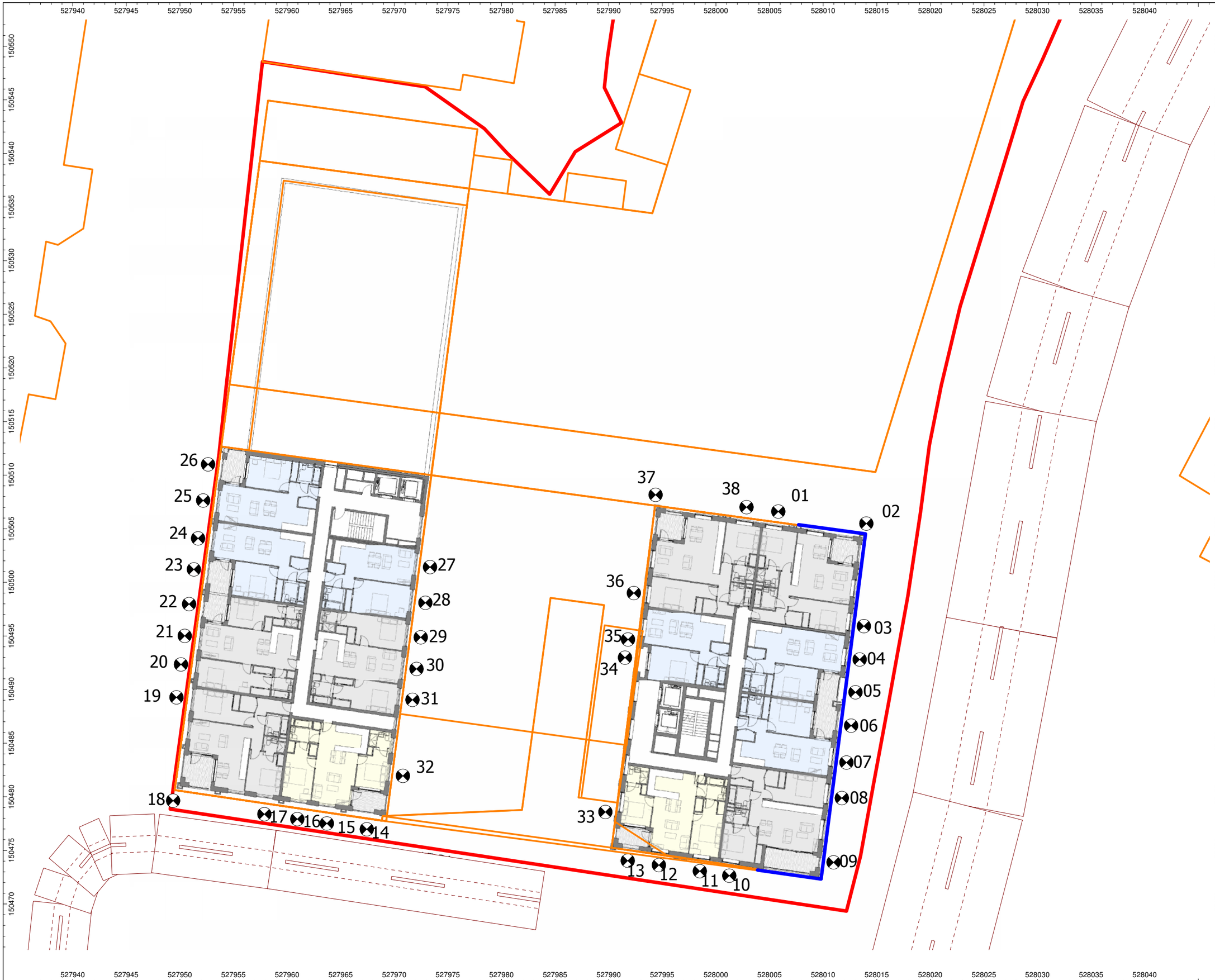


Client:
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Project:
Marketfield Road
Redhill

Project Number:
A095445

Drawing Title / Scenario:
Proposed Residential Receptors
Seventh Floor

Drawing Number:
SK02f

Key:

Site Boundary:

Enhanced Glazing:

Scale : Not to scale

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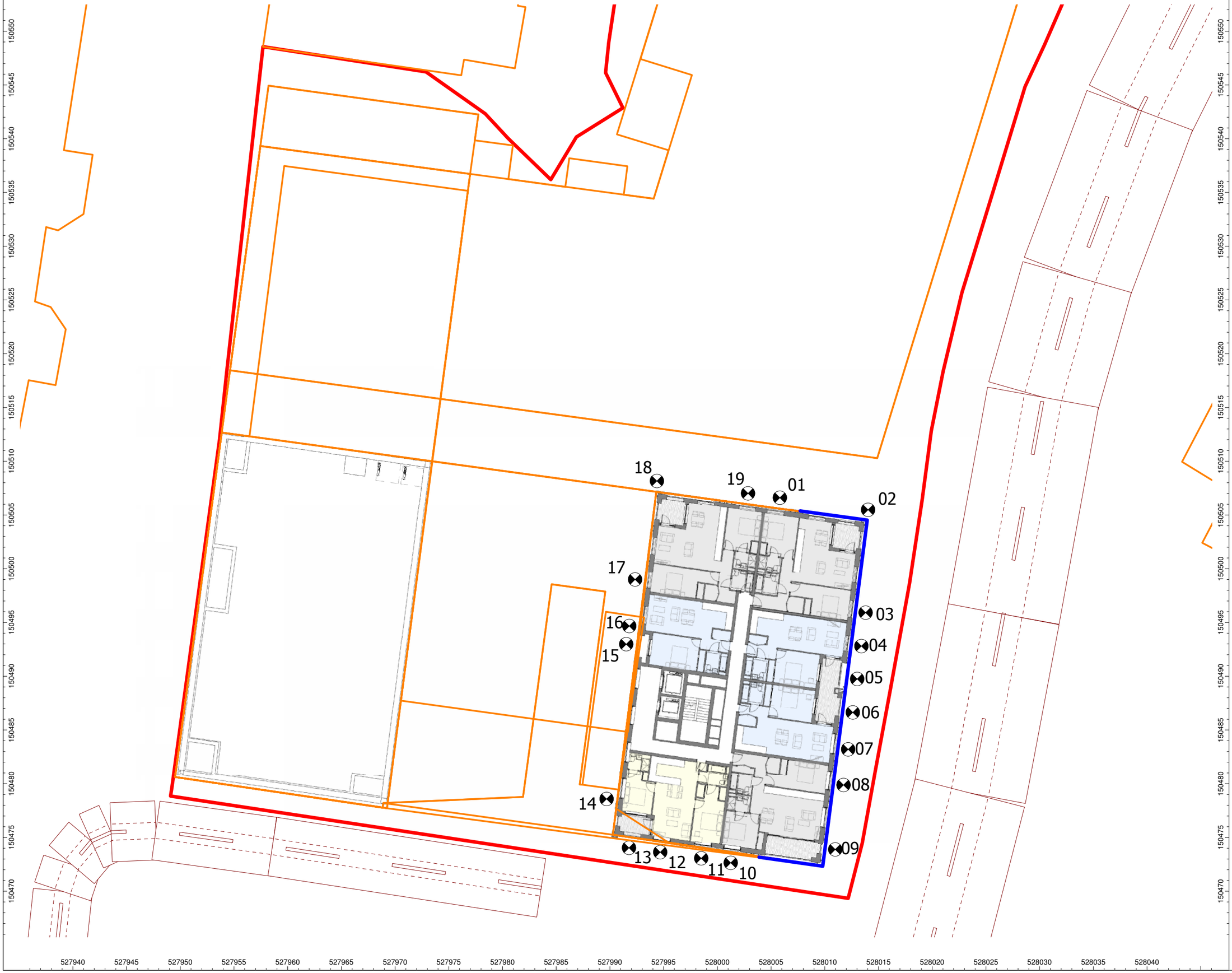


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Project:
Marketfield Road
Redhill

Project Number:
A095445

Drawing Title / Scenario:
Proposed Residential Receptors
Eighth and Ninth Floor

Drawing Number:
SK02g

Key:

Site Boundary:

Enhanced Glazing:

Scale : Not to scale

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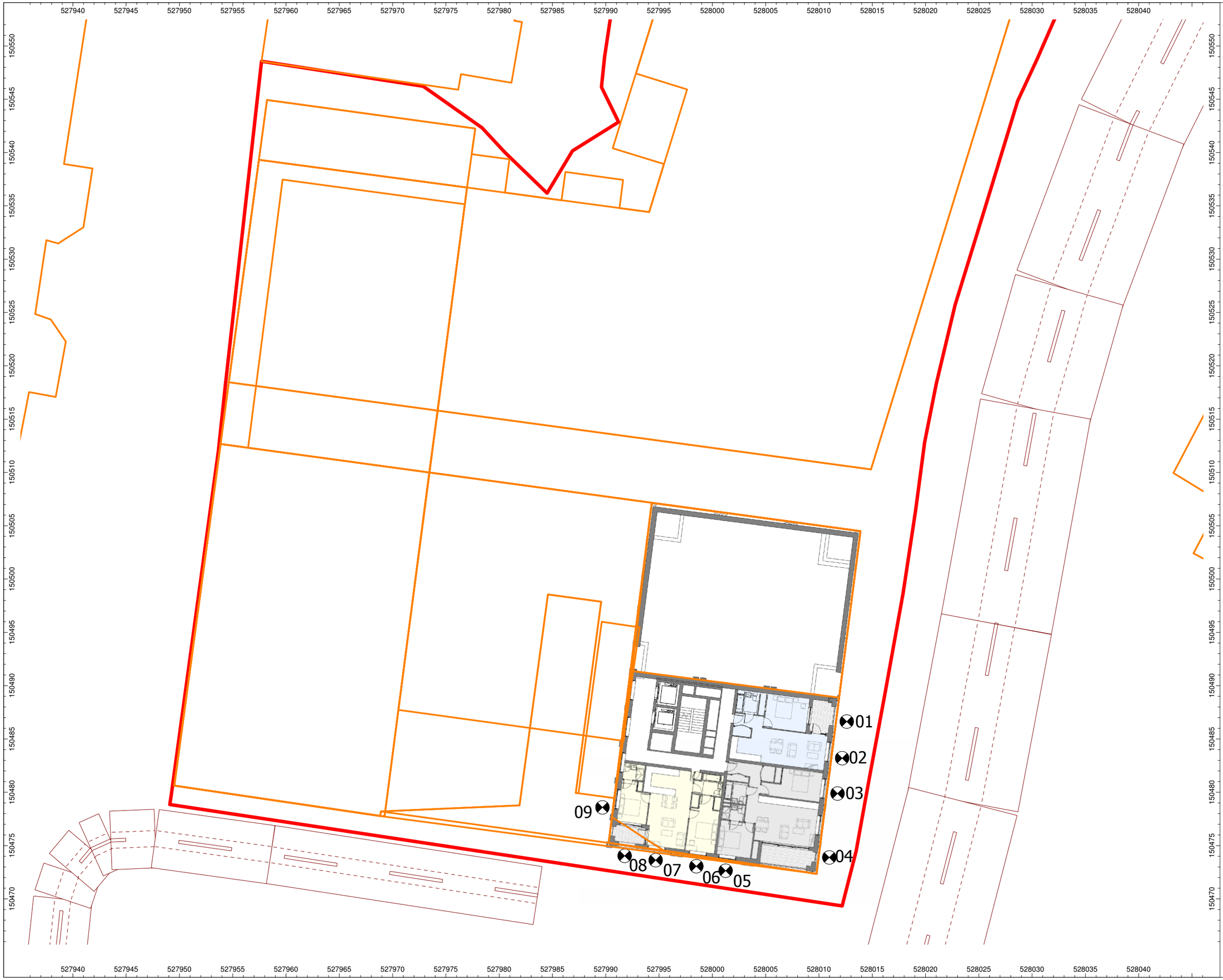


Client:
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Project:
Marketfield Road
Redhill

Project Number:
A095445

Drawing Title / Scenario:
Proposed Residential Receptors
Eighth and Ninth Floor

Drawing Number:
SK02g

Key:

Site Boundary:

Enhanced Glazing:

Scale : Not to scale

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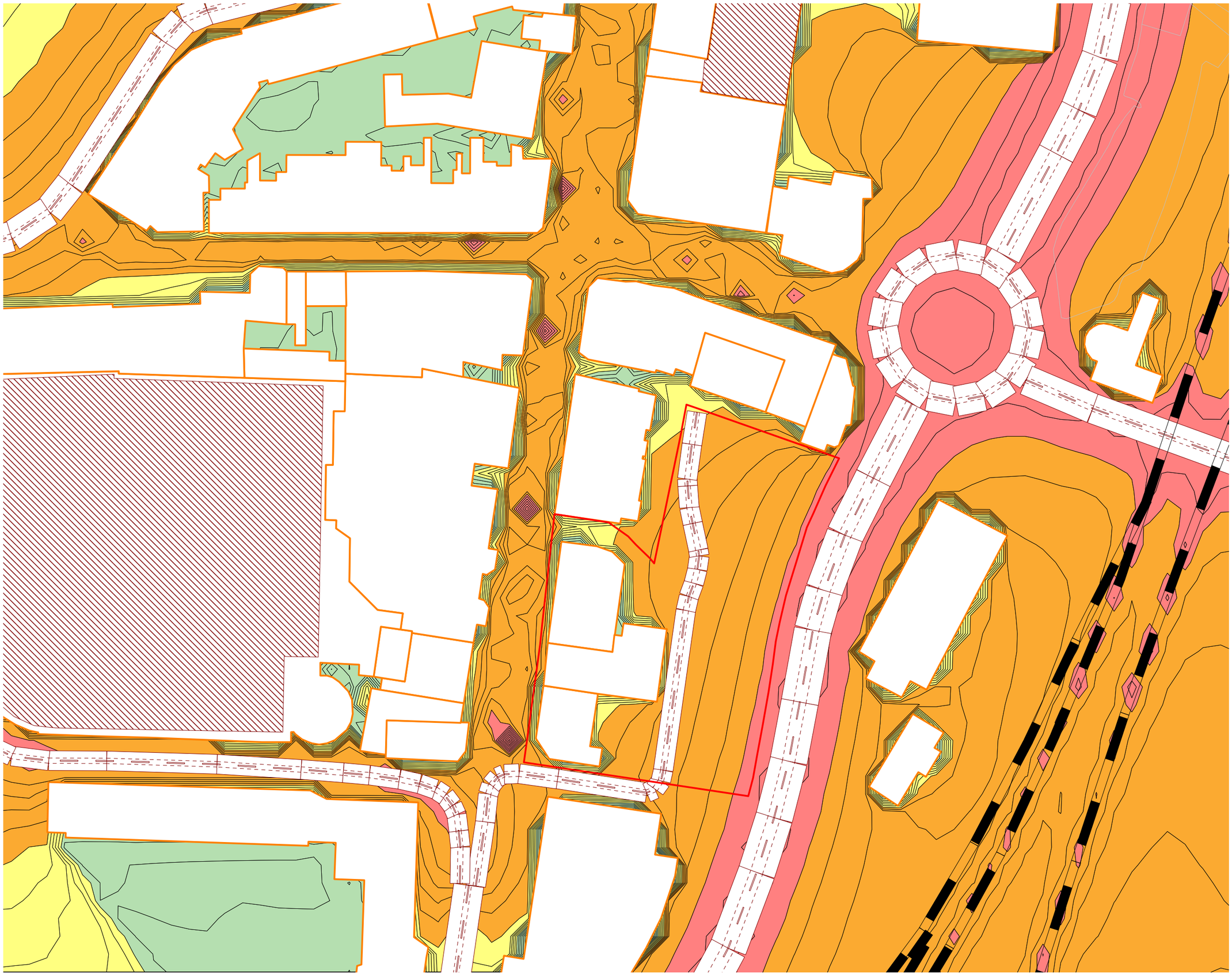


Client:
CoPlan Estates and Reigate and Banstead Borough Council

Project:
Marketfield Road
Redhill

Project Number:
A095445

Drawing Title / Scenario:

Daytime LAeq
Noise Levels

Drawing Number:
SK03

Key:

- 0.0 - 50.0 dB
- 50.0 - 60.0 dB
- 60.0 - 70.0 dB
- >70.0 dB

Scale : Not to scale

Please note: Noise contour plots are for illustrative purposes only

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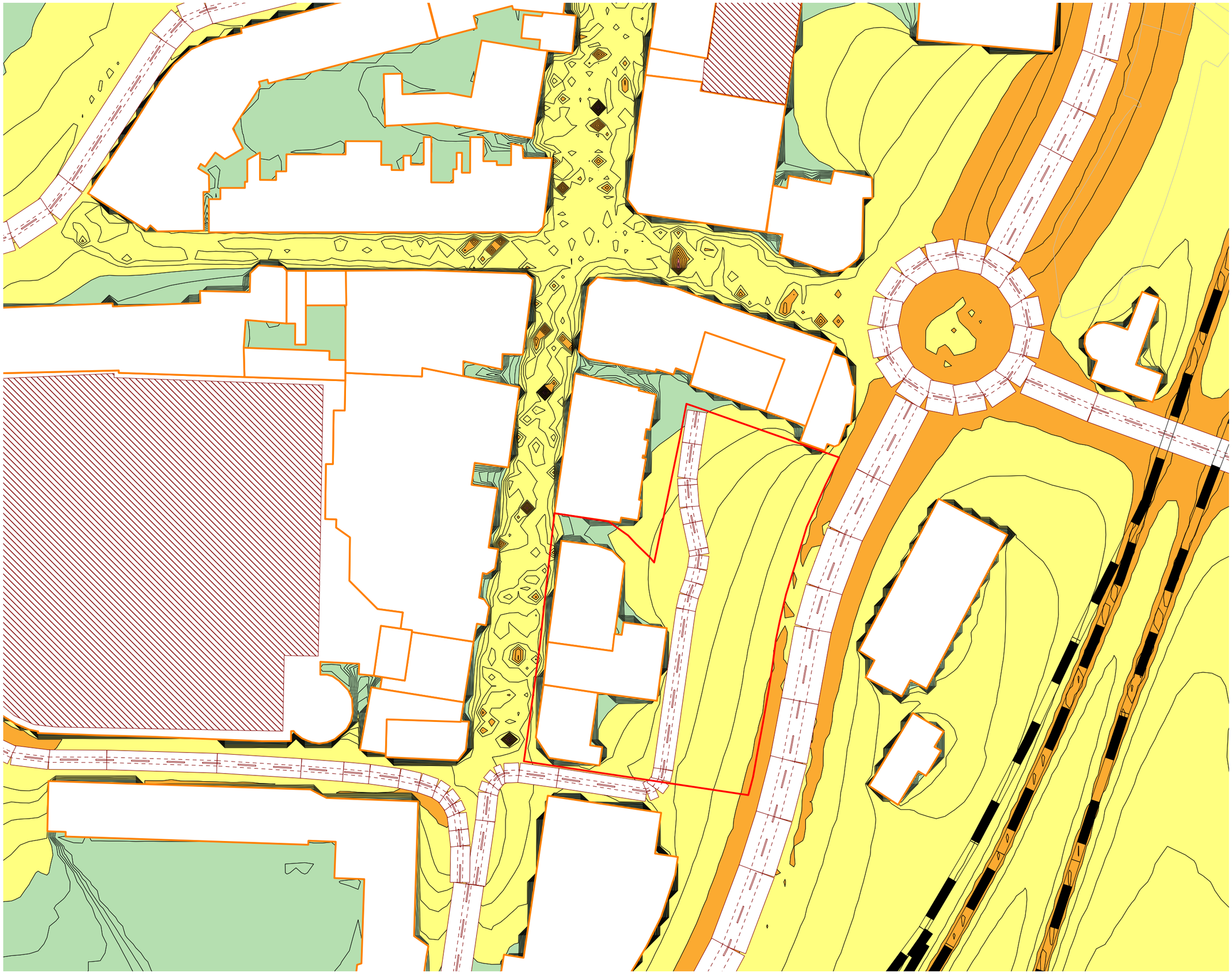


Client:
CoPlan Estates and Reigate and Banstead Borough Council

Project:
Marketfield Road
Redhill

Project Number:
A095445

Drawing Title / Scenario:

Night-time LAeq
Noise Levels

Drawing Number:
SK04

Key:

- 0.0 - 50.0 dB
- 50.0 - 60.0 dB
- 60.0 - 70.0 dB
- >70.0 dB

Scale : Not to scale

Please note: Noise contour plots are for illustrative purposes only

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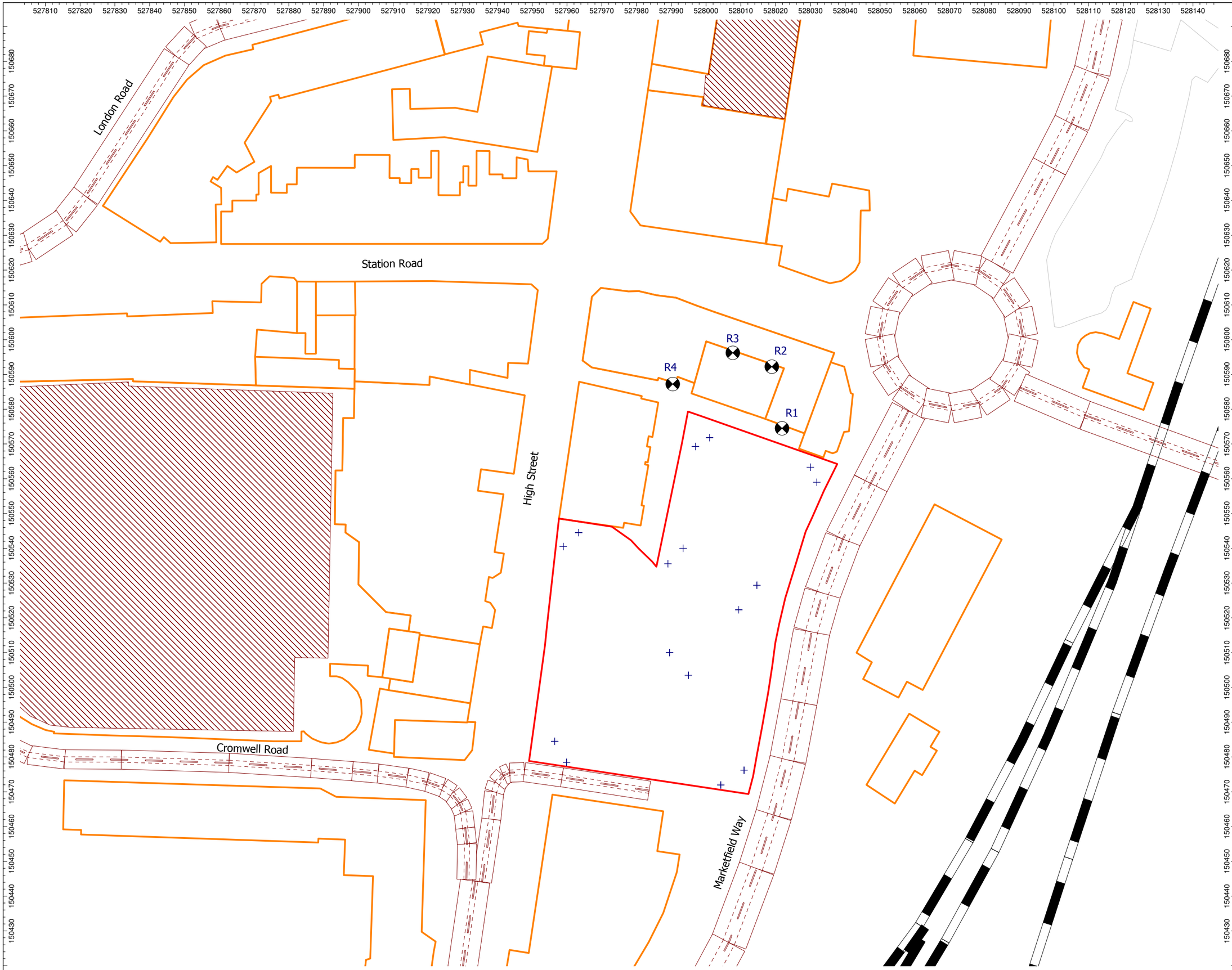


Client:
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Project:
Marketfield Road Redhill

Project Number:
A095445

Drawing Title / Scenario:
Construction Noise Plant and Receptor Locations

Drawing Number:
SK05

Key:

Site Boundary:

Plant Location: +

Scale : Not to scale

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Anstey
Leicestershire
LE7 7GR
Tel 0116 234 8000

# Appendix C – Predicted Internal Noise Levels

**Table A1 First Floor Receptor Alternative Ventilation and Enhanced Glazing Requirements**

| Location | Daytime External $L_{Aeq}$ | Night-Time External $L_{Aeq}$ | External $L_{Amax}$ | Recommended Glazing Specification (SRI) to Achieve BS 8233 $L_{Aeq}$ 'good' 30 dB and $L_{Amax}$ 45 dB Target Levels | Alternative Ventilation Required? |
|---|---|---|---|---|---|
| First 01 | 60.3 | 49.9 | 65.1 | 30.0 | **Yes** |
| First 02 | 68.8 | 58.2 | 73.5 | **34.0** | **Yes** |
| First 03 | 69.3 | 58.7 | 74.1 | **35.0** | **Yes** |
| First 04 | 69.4 | 58.7 | 74.1 | **35.0** | **Yes** |
| First 05 | 69.4 | 58.8 | 74.2 | **35.0** | **Yes** |
| First 06 | 69.5 | 58.9 | 74.3 | **35.0** | **Yes** |
| First 07 | 69.6 | 58.9 | 74.4 | **35.0** | **Yes** |
| First 08 | 69.7 | 59.0 | 74.5 | **35.0** | **Yes** |
| First 09 | 70.1 | 59.4 | 74.9 | **36.0** | **Yes** |
| First 10 | 65.3 | 55.2 | 71.8 | **31.0** | **Yes** |
| First 11 | 64.7 | 54.8 | 71.5 | 30.0 | **Yes** |
| First 12 | 64.1 | 54.3 | 71.2 | 30.0 | **Yes** |
| First 13 | 63.7 | 54.0 | 71.1 | 30.0 | **Yes** |

**Table A2 Second Floor Receptor Alternative Ventilation and Enhanced Glazing Requirements**

| Location | Daytime External $L_{Aeq}$ | Night-Time External $L_{Aeq}$ | External $L_{Amax}$ | Recommended Glazing Specification (SRI) to Achieve BS 8233 $L_{Aeq}$ 'good' 30 dB and $L_{Amax}$ 45 dB Target Levels | Alternative Ventilation Required? |
|---|---|---|---|---|---|
| Second 01 | 60.6 | 50.4 | 65.4 | 30.0 | **Yes** |
| Second 02 | 68.2 | 57.8 | 73.0 | **34.0** | **Yes** |
| Second 03 | 68.6 | 58.1 | 73.4 | **34.0** | **Yes** |
| Second 04 | 68.6 | 58.1 | 73.4 | **34.0** | **Yes** |
| Second 05 | 68.7 | 58.2 | 73.4 | **34.0** | **Yes** |
| Second 06 | 68.8 | 58.3 | 73.5 | **34.0** | **Yes** |
| Second 07 | 68.8 | 58.3 | 73.6 | **34.0** | **Yes** |
| Second 08 | 68.9 | 58.4 | 73.7 | **34.0** | **Yes** |
| Second 09 | 69.2 | 58.7 | 74.0 | **35.0** | **Yes** |
| Second 10 | 65.0 | 55.0 | 71.6 | 30.0 | **Yes** |
| Second 11 | 64.5 | 54.6 | 71.4 | 30.0 | **Yes** |
| Second 12 | 63.9 | 54.2 | 71.2 | 30.0 | **Yes** |
| Second 13 | 63.6 | 54.1 | 71.2 | 30.0 | **Yes** |
| Second 14 | 63.8 | 59.7 | 73.8 | 30.0 | **Yes** |
| Second 15 | 63.6 | 60.8 | 74.6 | 30.0 | **Yes** |
| Second 16 | 63.1 | 58.9 | 73.6 | 30.0 | **Yes** |
| Second 17 | 62.4 | 53.4 | 71.8 | 30.0 | **Yes** |
| Second 18 | 62.3 | 53.0 | 72.0 | 30.0 | **Yes** |
| Second 19 | 62.3 | 53.1 | 72.4 | 30.0 | **Yes** |
| Second 20 | 62.3 | 53.3 | 72.8 | 30.0 | **Yes** |
| Second 21 | 62.4 | 53.4 | 73.1 | 30.0 | **Yes** |
| Second 22 | 62.6 | 53.6 | 73.5 | 30.0 | **Yes** |
| Second 23 | 63.6 | 54.7 | 74.6 | 30.0 | **Yes** |
| Second 24 | 60.4 | 51.5 | 71.2 | 30.0 | **Yes** |
| Second 25 | 60.1 | 51.1 | 70.4 | 30.0 | **Yes** |
| Second 26 | 59.9 | 50.8 | 69.8 | 30.0 | **Yes** |
| Second 27 | 59.7 | 50.5 | 69.3 | 30.0 | **Yes** |
| Second 28 | 59.5 | 50.2 | 68.7 | 30.0 | **Yes** |
| Second 29 | 59.3 | 50.0 | 68.1 | 30.0 | **Yes** |
| Second 30 | 59.2 | 49.8 | 67.7 | 30.0 | **Yes** |
| Second 31 | 59.1 | 49.6 | 67.2 | 30.0 | **Yes** |
| Second 32 | 59.0 | 49.5 | 66.8 | 30.0 | **Yes** |
| Second 33 | 58.9 | 49.3 | 66.4 | 30.0 | **Yes** |
| Second 34 | 58.8 | 49.2 | 66.0 | 30.0 | **Yes** |
| Second 35 | 58.7 | 49.1 | 65.7 | 30.0 | **Yes** |
| Second 36 | 58.7 | 49.0 | 65.5 | 30.0 | **Yes** |
| Second 37 | 58.6 | 49.0 | 65.2 | 30.0 | **Yes** |
| Second 38 | 58.6 | 48.9 | 65.0 | 30.0 | **Yes** |
| Second 39 | 49.2 | 38.7 | 52.8 | 30.0 | **Yes** |
| Second 40 | 48.9 | 38.0 | 52.2 | 30.0 | **Yes** |
| Second 41 | 49.4 | 37.9 | 52.2 | 30.0 | **Yes** |
| Second 42 | 50.6 | 38.1 | 52.5 | 30.0 | **Yes** |
| Second 43 | 52.6 | 38.1 | 52.8 | 30.0 | **Yes** |
| Second 44 | 48.4 | 38.0 | 52.8 | 30.0 | **Yes** |
| Second 45 | 48.3 | 38.1 | 52.9 | 30.0 | **Yes** |
| Second 46 | 48.5 | 38.3 | 53.1 | 30.0 | **Yes** |
| Second 47 | 51.9 | 41.8 | 56.6 | 30.0 | **Yes** |
| Second 48 | 51.5 | 41.5 | 56.3 | 30.0 | **Yes** |
| Second 49 | 37.7 | 30.1 | 45.2 | 30.0 | **Yes** |
| Second 50 | 37.7 | 30.5 | 45.4 | 30.0 | **Yes** |
| Second 51 | 37.6 | 30.8 | 45.7 | 30.0 | **Yes** |
| Second 52 | 43.2 | 34.5 | 49.1 | 30.0 | **Yes** |
| Second 53 | 42.7 | 34.2 | 48.9 | 30.0 | **Yes** |
| Second 54 | 37.5 | 30.3 | 45.0 | 30.0 | **Yes** |

**Table A3 Third and Fourth Floor Receptor Alternative Ventilation and Enhanced Glazing Requirements**

| Location | Daytime External $L_{Aeq}$ | Night-Time External $L_{Aeq}$ | External $L_{Amax}$ | Recommended Glazing Specification (SRI) to Achieve BS 8233 $L_{Aeq}$ 'good' 30 dB and $L_{Amax}$ 45 dB Target Levels | Alternative Ventilation Required? |
|---|---|---|---|---|---|
| Third 01 | 62.0 | 51.9 | 66.8 | 30.0 | **Yes** |
| Third 02 | 67.7 | 57.4 | 72.5 | **33.0** | **Yes** |
| Third 03 | 68.0 | 57.7 | 72.8 | **33.0** | **Yes** |
| Third 04 | 68.0 | 57.7 | 72.8 | **33.0** | **Yes** |
| Third 05 | 68.1 | 57.7 | 72.8 | **34.0** | **Yes** |
| Third 06 | 68.1 | 57.7 | 72.9 | **34.0** | **Yes** |
| Third 07 | 68.2 | 57.8 | 72.9 | **34.0** | **Yes** |
| Third 08 | 68.2 | 57.8 | 73.0 | **34.0** | **Yes** |
| Third 09 | 68.5 | 58.1 | 73.3 | **34.0** | **Yes** |
| Third 10 | 64.7 | 54.8 | 71.4 | 30.0 | **Yes** |
| Third 11 | 64.3 | 54.5 | 71.3 | 30.0 | **Yes** |
| Third 12 | 63.7 | 54.0 | 71.1 | 30.0 | **Yes** |
| Third 13 | 63.4 | 53.8 | 71.1 | 30.0 | **Yes** |
| Third 14 | 63.1 | 54.9 | 71.5 | 30.0 | **Yes** |
| Third 15 | 62.8 | 54.9 | 71.6 | 30.0 | **Yes** |
| Third 16 | 62.5 | 54.3 | 71.7 | 30.0 | **Yes** |
| Third 17 | 62.3 | 53.0 | 71.7 | 30.0 | **Yes** |
| Third 18 | 62.2 | 53.0 | 72.0 | 30.0 | **Yes** |
| Third 19 | 62.2 | 53.1 | 72.3 | 30.0 | **Yes** |
| Third 20 | 62.3 | 53.2 | 72.7 | 30.0 | **Yes** |
| Third 21 | 62.3 | 53.3 | 73.0 | 30.0 | **Yes** |
| Third 22 | 62.5 | 53.5 | 73.4 | 30.0 | **Yes** |
| Third 23 | 63.5 | 54.6 | 74.6 | 30.0 | **Yes** |
| Third 24 | 59.9 | 51.1 | 71.0 | 30.0 | **Yes** |
| Third 25 | 59.5 | 50.6 | 70.2 | 30.0 | **Yes** |
| Third 26 | 59.3 | 50.3 | 69.6 | 30.0 | **Yes** |
| Third 27 | 59.0 | 49.9 | 69.1 | 30.0 | **Yes** |
| Third 28 | 58.8 | 49.6 | 68.5 | 30.0 | **Yes** |
| Third 29 | 58.6 | 49.4 | 67.9 | 30.0 | **Yes** |
| Third 30 | 58.5 | 49.2 | 67.4 | 30.0 | **Yes** |
| Third 31 | 58.3 | 49.0 | 67.0 | 30.0 | **Yes** |
| Third 32 | 58.2 | 48.8 | 66.5 | 30.0 | **Yes** |
| Third 33 | 58.1 | 48.7 | 66.2 | 30.0 | **Yes** |
| Third 34 | 58.0 | 48.5 | 65.7 | 30.0 | **Yes** |
| Third 35 | 57.9 | 48.4 | 65.4 | 30.0 | **Yes** |
| Third 36 | 57.9 | 48.3 | 65.2 | 30.0 | **Yes** |
| Third 37 | 57.8 | 48.2 | 64.9 | 30.0 | **Yes** |
| Third 38 | 57.8 | 48.1 | 64.6 | 30.0 | **Yes** |
| Third 39 | 51.8 | 41.1 | 55.1 | 30.0 | **Yes** |
| Third 40 | 51.3 | 40.3 | 54.5 | 30.0 | **Yes** |
| Third 41 | 52.4 | 40.1 | 54.4 | 30.0 | **Yes** |
| Third 42 | 53.6 | 40.3 | 54.7 | 30.0 | **Yes** |
| Third 43 | 54.5 | 40.5 | 55.1 | 30.0 | **Yes** |
| Third 44 | 51.1 | 40.3 | 55.0 | 30.0 | **Yes** |
| Third 45 | 50.6 | 40.2 | 55.0 | 30.0 | **Yes** |
| Third 46 | 50.7 | 40.4 | 55.2 | 30.0 | **Yes** |
| Third 47 | 51.5 | 41.3 | 56.1 | 30.0 | **Yes** |
| Third 48 | 52.6 | 42.5 | 57.3 | 30.0 | **Yes** |
| Third 49 | 52.4 | 42.4 | 57.2 | 30.0 | **Yes** |
| Third 50 | 47.7 | 38.0 | 52.7 | 30.0 | **Yes** |
| Third 51 | 47.3 | 37.7 | 52.4 | 30.0 | **Yes** |
| Third 52 | 46.9 | 37.4 | 52.2 | 30.0 | **Yes** |
| Third 53 | 46.4 | 37.0 | 51.7 | 30.0 | **Yes** |
| Third 54 | 45.7 | 36.5 | 51.2 | 30.0 | **Yes** |
| Third 55 | 39.7 | 32.4 | 46.3 | 30.0 | **Yes** |

| Location | Daytime External $L_{Aeq}$ | Night-Time External $L_{Aeq}$ | External $L_{Amax}$ | Recommended Glazing Specification (SRI) to Achieve BS 8233 $L_{Aeq}$ 'good' 30 dB and $L_{Amax}$ 45 dB Target Levels | Alternative Ventilation Required? |
|---|---|---|---|---|---|
| Third 56 | 39.8 | 32.1 | 45.9 | 30.0 | **Yes** |
| Third 57 | 56.8 | 46.9 | 61.6 | 30.0 | **Yes** |
| Third 58 | 60.3 | 50.3 | 65.1 | 30.0 | **Yes** |
| Fourth 01 | 63.1 | 53.1 | 67.9 | 30.0 | **Yes** |
| Fourth 02 | 67.2 | 57.0 | 72.0 | **33.0** | **Yes** |
| Fourth 03 | 67.4 | 57.2 | 72.2 | **33.0** | **Yes** |
| Fourth 04 | 67.5 | 57.2 | 72.2 | **33.0** | **Yes** |
| Fourth 05 | 67.5 | 57.2 | 72.2 | **33.0** | **Yes** |
| Fourth 06 | 67.5 | 57.3 | 72.3 | **33.0** | **Yes** |
| Fourth 07 | 67.6 | 57.3 | 72.3 | **33.0** | **Yes** |
| Fourth 08 | 67.6 | 57.3 | 72.4 | **33.0** | **Yes** |
| Fourth 09 | 67.9 | 57.6 | 72.6 | **33.0** | **Yes** |
| Fourth 10 | 64.3 | 54.4 | 71.2 | 30.0 | **Yes** |
| Fourth 11 | 63.9 | 54.2 | 71.1 | 30.0 | **Yes** |
| Fourth 12 | 63.5 | 53.8 | 71.0 | 30.0 | **Yes** |
| Fourth 13 | 63.2 | 53.6 | 71.0 | 30.0 | **Yes** |
| Fourth 14 | 63.0 | 53.7 | 71.1 | 30.0 | **Yes** |
| Fourth 15 | 62.7 | 53.6 | 71.2 | 30.0 | **Yes** |
| Fourth 16 | 62.4 | 53.3 | 71.4 | 30.0 | **Yes** |
| Fourth 17 | 62.2 | 52.9 | 71.6 | 30.0 | **Yes** |
| Fourth 18 | 62.1 | 52.9 | 71.9 | 30.0 | **Yes** |
| Fourth 19 | 62.1 | 53.0 | 72.2 | 30.0 | **Yes** |
| Fourth 20 | 62.2 | 53.1 | 72.6 | 30.0 | **Yes** |
| Fourth 21 | 62.2 | 53.2 | 72.9 | 30.0 | **Yes** |
| Fourth 22 | 62.4 | 53.4 | 73.3 | 30.0 | **Yes** |
| Fourth 23 | 63.3 | 54.4 | 74.4 | 30.0 | **Yes** |
| Fourth 24 | 59.6 | 50.9 | 71.0 | 30.0 | **Yes** |
| Fourth 25 | 59.1 | 50.3 | 70.1 | 30.0 | **Yes** |
| Fourth 26 | 58.8 | 49.9 | 69.5 | 30.0 | **Yes** |
| Fourth 27 | 58.5 | 49.5 | 68.9 | 30.0 | **Yes** |
| Fourth 28 | 58.3 | 49.2 | 68.3 | 30.0 | **Yes** |
| Fourth 29 | 58.1 | 48.9 | 67.8 | 30.0 | **Yes** |
| Fourth 30 | 57.9 | 48.7 | 67.3 | 30.0 | **Yes** |
| Fourth 31 | 57.8 | 48.5 | 66.8 | 30.0 | **Yes** |
| Fourth 32 | 57.6 | 48.3 | 66.3 | 30.0 | **Yes** |
| Fourth 33 | 57.5 | 48.1 | 66.0 | 30.0 | **Yes** |
| Fourth 34 | 57.4 | 48.0 | 65.5 | 30.0 | **Yes** |
| Fourth 35 | 57.3 | 47.9 | 65.2 | 30.0 | **Yes** |
| Fourth 36 | 57.3 | 47.8 | 64.9 | 30.0 | **Yes** |
| Fourth 37 | 57.2 | 47.7 | 64.7 | 30.0 | **Yes** |
| Fourth 38 | 57.1 | 47.6 | 64.4 | 30.0 | **Yes** |
| Fourth 39 | 53.5 | 42.9 | 57.1 | 30.0 | **Yes** |
| Fourth 40 | 53.6 | 42.5 | 56.8 | 30.0 | **Yes** |
| Fourth 41 | 53.8 | 42.4 | 56.7 | 30.0 | **Yes** |
| Fourth 42 | 54.9 | 42.6 | 57.1 | 30.0 | **Yes** |
| Fourth 43 | 55.4 | 42.8 | 57.5 | 30.0 | **Yes** |
| Fourth 44 | 54.0 | 42.5 | 57.3 | 30.0 | **Yes** |
| Fourth 45 | 52.9 | 42.6 | 57.4 | 30.0 | **Yes** |
| Fourth 46 | 53.2 | 43.0 | 57.8 | 30.0 | **Yes** |
| Fourth 47 | 53.6 | 43.4 | 58.2 | 30.0 | **Yes** |
| Fourth 48 | 53.9 | 43.8 | 58.6 | 30.0 | **Yes** |
| Fourth 49 | 53.5 | 43.5 | 58.3 | 30.0 | **Yes** |
| Fourth 50 | 50.3 | 40.4 | 55.2 | 30.0 | **Yes** |
| Fourth 51 | 50.0 | 40.2 | 54.9 | 30.0 | **Yes** |
| Fourth 52 | 49.9 | 40.1 | 54.8 | 30.0 | **Yes** |
| Fourth 53 | 49.5 | 39.8 | 54.5 | 30.0 | **Yes** |
| Fourth 54 | 48.9 | 39.3 | 54.0 | 30.0 | **Yes** |

| Location | Daytime External $L_{Aeq}$ | Night-Time External $L_{Aeq}$ | External $L_{Amax}$ | Recommended Glazing Specification (SRI) to Achieve BS 8233 $L_{Aeq}$ 'good' 30 dB and $L_{Amax}$ 45 dB Target Levels | Alternative Ventilation Required? |
|---|---|---|---|---|---|
| Fourth 55 | 41.0 | 33.4 | 47.2 | 30.0 | **Yes** |
| Fourth 56 | 41.1 | 33.1 | 46.8 | 30.0 | **Yes** |
| Fourth 57 | 58.3 | 48.3 | 63.0 | 30.0 | **Yes** |
| Fourth 58 | 61.6 | 51.6 | 66.4 | 30.0 | **Yes** |

**Table A4 Fifth Floor Receptor Alternative Ventilation and Enhanced Glazing Requirements**

| Location | Daytime External $L_{Aeq}$ | Night-Time External $L_{Aeq}$ | External $L_{Amax}$ | Recommended Glazing Specification (SRI) to Achieve BS 8233 $L_{Aeq}$ 'good' 30 dB and $L_{Amax}$ 45 dB Target Levels | Alternative Ventilation Required? |
|---|---|---|---|---|---|
| Fifth 01 | 63.2 | 53.2 | 67.9 | 30.0 | **Yes** |
| Fifth 02 | 66.7 | 56.6 | 71.5 | **32.0** | **Yes** |
| Fifth 03 | 66.9 | 56.7 | 71.7 | **32.0** | **Yes** |
| Fifth 04 | 66.9 | 56.8 | 71.7 | **32.0** | **Yes** |
| Fifth 05 | 66.9 | 56.8 | 71.7 | **32.0** | **Yes** |
| Fifth 06 | 67.0 | 56.8 | 71.7 | **32.0** | **Yes** |
| Fifth 07 | 67.0 | 56.8 | 71.8 | **32.0** | **Yes** |
| Fifth 08 | 67.0 | 56.9 | 71.8 | **32.0** | **Yes** |
| Fifth 09 | 67.3 | 57.1 | 72.0 | **33.0** | **Yes** |
| Fifth 10 | 63.9 | 54.1 | 70.9 | 30.0 | **Yes** |
| Fifth 11 | 63.7 | 53.9 | 70.9 | 30.0 | **Yes** |
| Fifth 12 | 63.3 | 53.6 | 70.8 | 30.0 | **Yes** |
| Fifth 13 | 63.0 | 53.4 | 70.8 | 30.0 | **Yes** |
| Fifth 14 | 62.0 | 52.9 | 72.1 | 30.0 | **Yes** |
| Fifth 15 | 62.0 | 53.0 | 72.5 | 30.0 | **Yes** |
| Fifth 16 | 62.1 | 53.1 | 72.7 | 30.0 | **Yes** |
| Fifth 17 | 62.2 | 53.3 | 73.1 | 30.0 | **Yes** |
| Fifth 18 | 63.0 | 54.2 | 74.1 | 30.0 | **Yes** |
| Fifth 19 | 59.5 | 50.9 | 71.1 | 30.0 | **Yes** |
| Fifth 20 | 58.9 | 50.2 | 70.2 | 30.0 | **Yes** |
| Fifth 21 | 58.5 | 49.7 | 69.4 | 30.0 | **Yes** |
| Fifth 22 | 58.2 | 49.2 | 68.8 | 30.0 | **Yes** |
| Fifth 23 | 57.9 | 48.9 | 68.2 | 30.0 | **Yes** |
| Fifth 24 | 57.7 | 48.6 | 67.6 | 30.0 | **Yes** |
| Fifth 25 | 57.5 | 48.3 | 67.1 | 30.0 | **Yes** |
| Fifth 26 | 57.3 | 48.1 | 66.6 | 30.0 | **Yes** |
| Fifth 27 | 57.2 | 47.9 | 66.2 | 30.0 | **Yes** |
| Fifth 28 | 57.1 | 47.8 | 65.8 | 30.0 | **Yes** |
| Fifth 29 | 56.9 | 47.6 | 65.3 | 30.0 | **Yes** |
| Fifth 30 | 56.9 | 47.5 | 65.1 | 30.0 | **Yes** |
| Fifth 31 | 56.8 | 47.4 | 64.8 | 30.0 | **Yes** |
| Fifth 32 | 56.7 | 47.3 | 64.5 | 30.0 | **Yes** |
| Fifth 33 | 56.7 | 47.2 | 64.2 | 30.0 | **Yes** |
| Fifth 34 | 55.0 | 44.5 | 58.9 | 30.0 | **Yes** |
| Fifth 35 | 54.6 | 44.3 | 58.7 | 30.0 | **Yes** |
| Fifth 36 | 55.2 | 44.2 | 58.7 | 30.0 | **Yes** |
| Fifth 37 | 55.8 | 44.5 | 59.0 | 30.0 | **Yes** |
| Fifth 38 | 56.2 | 44.7 | 59.3 | 30.0 | **Yes** |
| Fifth 39 | 55.3 | 44.5 | 59.3 | 30.0 | **Yes** |
| Fifth 40 | 55.1 | 44.6 | 59.4 | 30.0 | **Yes** |
| Fifth 41 | 55.0 | 44.9 | 59.6 | 30.0 | **Yes** |
| Fifth 42 | 55.1 | 45.0 | 59.8 | 30.0 | **Yes** |
| Fifth 43 | 55.1 | 45.0 | 59.8 | 30.0 | **Yes** |
| Fifth 44 | 54.9 | 44.9 | 59.6 | 30.0 | **Yes** |
| Fifth 45 | 52.6 | 42.7 | 57.4 | 30.0 | **Yes** |
| Fifth 46 | 52.5 | 42.6 | 57.3 | 30.0 | **Yes** |
| Fifth 47 | 52.5 | 42.6 | 57.4 | 30.0 | **Yes** |
| Fifth 48 | 52.5 | 42.7 | 57.4 | 30.0 | **Yes** |
| Fifth 49 | 52.7 | 42.8 | 57.6 | 30.0 | **Yes** |
| Fifth 50 | 55.9 | 46.5 | 61.0 | 30.0 | **Yes** |
| Fifth 51 | 56.0 | 48.7 | 67.4 | 30.0 | **Yes** |
| Fifth 52 | 44.1 | 35.8 | 50.5 | 30.0 | **Yes** |
| Fifth 53 | 43.7 | 35.4 | 49.8 | 30.0 | **Yes** |
| Fifth 54 | 43.2 | 34.8 | 48.7 | 30.0 | **Yes** |
| Fifth 55 | 59.5 | 49.5 | 64.3 | 30.0 | **Yes** |
| Fifth 56 | 62.5 | 52.5 | 67.3 | 30.0 | **Yes** |

**Table A5 Sixth Floor Receptor Alternative Ventilation and Enhanced Glazing Requirements**

| Location | Daytime External $L_{Aeq}$ | Night-Time External $L_{Aeq}$ | External $L_{Amax}$ | Recommended Glazing Specification (SRI) to Achieve BS 8233 $L_{Aeq}$ 'good' 30 dB and $L_{Amax}$ 45 dB Target Levels | Alternative Ventilation Required? |
|---|---|---|---|---|---|
| Sixth 01 | 63.0 | 53.0 | 67.8 | 30.0 | **Yes** |
| Sixth 02 | 66.3 | 56.2 | 71.0 | **32.0** | **Yes** |
| Sixth 03 | 66.4 | 56.3 | 71.2 | **32.0** | **Yes** |
| Sixth 04 | 66.4 | 56.3 | 71.2 | **32.0** | **Yes** |
| Sixth 05 | 66.4 | 56.3 | 71.2 | **32.0** | **Yes** |
| Sixth 06 | 66.4 | 56.3 | 71.2 | **32.0** | **Yes** |
| Sixth 07 | 66.5 | 56.4 | 71.2 | **32.0** | **Yes** |
| Sixth 08 | 66.5 | 56.4 | 71.3 | **32.0** | **Yes** |
| Sixth 09 | 66.7 | 56.6 | 71.5 | **32.0** | **Yes** |
| Sixth 10 | 63.5 | 53.8 | 70.7 | 30.0 | **Yes** |
| Sixth 11 | 63.3 | 53.6 | 70.7 | 30.0 | **Yes** |
| Sixth 12 | 63.0 | 53.3 | 70.7 | 30.0 | **Yes** |
| Sixth 13 | 62.8 | 54.0 | 70.9 | 30.0 | **Yes** |
| Sixth 14 | 61.9 | 53.0 | 72.0 | 30.0 | **Yes** |
| Sixth 15 | 61.9 | 52.9 | 72.3 | 30.0 | **Yes** |
| Sixth 16 | 62.0 | 52.9 | 72.6 | 30.0 | **Yes** |
| Sixth 17 | 62.1 | 53.1 | 72.9 | 30.0 | **Yes** |
| Sixth 18 | 62.8 | 54.0 | 73.9 | 30.0 | **Yes** |
| Sixth 19 | 59.5 | 50.9 | 71.3 | 30.0 | **Yes** |
| Sixth 20 | 58.9 | 50.2 | 70.4 | 30.0 | **Yes** |
| Sixth 21 | 58.4 | 49.7 | 69.6 | 30.0 | **Yes** |
| Sixth 22 | 58.0 | 49.1 | 68.9 | 30.0 | **Yes** |
| Sixth 23 | 57.6 | 48.7 | 68.2 | 30.0 | **Yes** |
| Sixth 24 | 57.3 | 48.3 | 67.6 | 30.0 | **Yes** |
| Sixth 25 | 57.1 | 48.1 | 67.1 | 30.0 | **Yes** |
| Sixth 26 | 57.0 | 47.8 | 66.5 | 30.0 | **Yes** |
| Sixth 27 | 53.3 | 43.6 | 58.5 | 30.0 | **Yes** |
| Sixth 28 | 53.2 | 43.8 | 60.8 | 30.0 | **Yes** |
| Sixth 29 | 53.3 | 43.9 | 60.7 | 30.0 | **Yes** |
| Sixth 30 | 53.4 | 44.0 | 60.5 | 30.0 | **Yes** |
| Sixth 31 | 53.5 | 44.1 | 60.4 | 30.0 | **Yes** |
| Sixth 32 | 56.2 | 46.2 | 61.2 | 30.0 | **Yes** |
| Sixth 33 | 55.5 | 45.5 | 60.0 | 30.0 | **Yes** |
| Sixth 34 | 55.7 | 45.6 | 60.2 | 30.0 | **Yes** |
| Sixth 35 | 56.0 | 45.9 | 60.5 | 30.0 | **Yes** |
| Sixth 36 | 57.1 | 46.3 | 60.9 | 30.0 | **Yes** |
| Sixth 37 | 56.7 | 46.1 | 60.9 | 30.0 | **Yes** |
| Sixth 38 | 56.5 | 46.2 | 61.0 | 30.0 | **Yes** |
| Sixth 39 | 56.6 | 46.3 | 61.1 | 30.0 | **Yes** |
| Sixth 40 | 56.4 | 46.3 | 61.1 | 30.0 | **Yes** |
| Sixth 41 | 56.4 | 46.3 | 61.1 | 30.0 | **Yes** |
| Sixth 42 | 56.3 | 46.3 | 61.1 | 30.0 | **Yes** |
| Sixth 43 | 55.0 | 45.1 | 59.9 | 30.0 | **Yes** |
| Sixth 44 | 55.2 | 45.3 | 60.1 | 30.0 | **Yes** |
| Sixth 45 | 55.7 | 45.8 | 60.5 | 30.0 | **Yes** |
| Sixth 46 | 56.2 | 46.2 | 61.0 | 30.0 | **Yes** |
| Sixth 47 | 56.8 | 46.9 | 61.7 | 30.0 | **Yes** |
| Sixth 48 | 58.8 | 49.2 | 63.8 | 30.0 | **Yes** |
| Sixth 49 | 57.3 | 48.9 | 67.1 | 30.0 | **Yes** |
| Sixth 50 | 50.0 | 40.6 | 55.6 | 30.0 | **Yes** |
| Sixth 51 | 49.4 | 40.0 | 54.8 | 30.0 | **Yes** |
| Sixth 52 | 47.7 | 38.5 | 52.9 | 30.0 | **Yes** |
| Sixth 53 | 60.4 | 50.5 | 65.2 | 30.0 | **Yes** |
| Sixth 54 | 62.5 | 52.6 | 67.3 | 30.0 | **Yes** |

**Table A6 Seventh Floor Receptor Alternative Ventilation and Enhanced Glazing Requirements**

| Location | Daytime External $L_{Aeq}$ | Night-Time External $L_{Aeq}$ | External $L_{Amax}$ | Recommended Glazing Specification (SRI) to Achieve BS 8233 $L_{Aeq}$ 'good' 30 dB and $L_{Amax}$ 45 dB Target Levels | Alternative Ventilation Required? |
|---|---|---|---|---|---|
| Seventh 01 | 62.8 | 52.8 | 67.6 | 30.0 | **Yes** |
| Seventh 02 | 65.8 | 55.8 | 70.6 | **31.0** | **Yes** |
| Seventh 03 | 65.9 | 55.9 | 70.7 | **31.0** | **Yes** |
| Seventh 04 | 65.9 | 55.9 | 70.7 | **31.0** | **Yes** |
| Seventh 05 | 65.9 | 55.9 | 70.7 | **31.0** | **Yes** |
| Seventh 06 | 66.0 | 55.9 | 70.7 | **31.0** | **Yes** |
| Seventh 07 | 66.0 | 55.9 | 70.8 | **31.0** | **Yes** |
| Seventh 08 | 66.0 | 56.0 | 70.8 | **31.0** | **Yes** |
| Seventh 09 | 66.2 | 56.2 | 71.0 | **32.0** | **Yes** |
| Seventh 10 | 63.2 | 53.5 | 70.5 | 30.0 | **Yes** |
| Seventh 11 | 63.0 | 53.3 | 70.4 | 30.0 | **Yes** |
| Seventh 12 | 62.7 | 53.2 | 70.5 | 30.0 | **Yes** |
| Seventh 13 | 62.5 | 53.6 | 70.7 | 30.0 | **Yes** |
| Seventh 14 | 61.8 | 52.9 | 71.9 | 30.0 | **Yes** |
| Seventh 15 | 61.8 | 52.8 | 72.2 | 30.0 | **Yes** |
| Seventh 16 | 61.8 | 52.9 | 72.4 | 30.0 | **Yes** |
| Seventh 17 | 61.9 | 52.9 | 72.7 | 30.0 | **Yes** |
| Seventh 18 | 62.6 | 53.7 | 73.6 | 30.0 | **Yes** |
| Seventh 19 | 59.7 | 51.1 | 71.6 | 30.0 | **Yes** |
| Seventh 20 | 59.0 | 50.4 | 70.7 | 30.0 | **Yes** |
| Seventh 21 | 58.6 | 49.9 | 70.0 | 30.0 | **Yes** |
| Seventh 22 | 58.0 | 49.2 | 69.1 | 30.0 | **Yes** |
| Seventh 23 | 57.5 | 48.7 | 68.3 | 30.0 | **Yes** |
| Seventh 24 | 57.2 | 48.3 | 67.6 | 30.0 | **Yes** |
| Seventh 25 | 56.9 | 47.9 | 67.1 | 30.0 | **Yes** |
| Seventh 26 | 56.7 | 47.7 | 66.5 | 30.0 | **Yes** |
| Seventh 27 | 57.1 | 47.2 | 62.0 | 30.0 | **Yes** |
| Seventh 28 | 57.3 | 47.4 | 62.2 | 30.0 | **Yes** |
| Seventh 29 | 57.6 | 47.7 | 62.5 | 30.0 | **Yes** |
| Seventh 30 | 58.0 | 48.1 | 62.9 | 30.0 | **Yes** |
| Seventh 31 | 58.4 | 48.5 | 63.3 | 30.0 | **Yes** |
| Seventh 32 | 59.4 | 49.8 | 64.5 | 30.0 | **Yes** |
| Seventh 33 | 57.4 | 48.7 | 67.3 | 30.0 | **Yes** |
| Seventh 34 | 51.3 | 41.9 | 57.2 | 30.0 | **Yes** |
| Seventh 35 | 50.9 | 41.6 | 56.5 | 30.0 | **Yes** |
| Seventh 36 | 50.4 | 41.0 | 55.6 | 30.0 | **Yes** |
| Seventh 37 | 61.2 | 51.3 | 66.0 | 30.0 | **Yes** |
| Seventh 38 | 62.4 | 52.5 | 67.2 | 30.0 | **Yes** |

**Table A7 Eighth and Ninth Floor Receptor Alternative Ventilation and Enhanced Glazing Requirements**

| Location | Daytime External $L_{Aeq}$ | Night-Time External $L_{Aeq}$ | External $L_{Amax}$ | Recommended Glazing Specification (SRI) to Achieve BS 8233 $L_{Aeq}$ 'good' 30 dB and $L_{Amax}$ 45 dB Target Levels | Alternative Ventilation Required? |
|---|---|---|---|---|---|
| Eigth 01 | 62.6 | 52.6 | 67.3 | 30.0 | **Yes** |
| Eigth 02 | 65.5 | 55.5 | 70.2 | **31.0** | **Yes** |
| Eigth 03 | 65.5 | 55.5 | 70.3 | **31.0** | **Yes** |
| Eigth 04 | 65.5 | 55.5 | 70.3 | **31.0** | **Yes** |
| Eigth 05 | 65.5 | 55.5 | 70.3 | **31.0** | **Yes** |
| Eigth 06 | 65.5 | 55.5 | 70.3 | **31.0** | **Yes** |
| Eigth 07 | 65.5 | 55.5 | 70.3 | **31.0** | **Yes** |
| Eigth 08 | 65.6 | 55.6 | 70.3 | **31.0** | **Yes** |
| Eigth 09 | 65.8 | 55.8 | 70.6 | **31.0** | **Yes** |
| Eigth 10 | 62.8 | 53.1 | 70.2 | 30.0 | **Yes** |
| Eigth 11 | 62.6 | 53.0 | 70.3 | 30.0 | **Yes** |
| Eigth 12 | 62.4 | 53.1 | 70.4 | 30.0 | **Yes** |
| Eigth 13 | 62.3 | 53.2 | 70.5 | 30.0 | **Yes** |
| Eigth 14 | 57.5 | 48.8 | 67.5 | 30.0 | **Yes** |
| Eigth 15 | 51.8 | 42.7 | 58.9 | 30.0 | **Yes** |
| Eigth 16 | 51.3 | 42.1 | 57.8 | 30.0 | **Yes** |
| Eigth 17 | 50.9 | 41.6 | 56.3 | 30.0 | **Yes** |
| Eigth 18 | 61.5 | 51.5 | 66.3 | 30.0 | **Yes** |
| Eigth 19 | 62.3 | 52.3 | 67.0 | 30.0 | **Yes** |
| Ninth 01 | 62.4 | 52.4 | 67.1 | 30.0 | **Yes** |
| Ninth 02 | 65.1 | 55.1 | 69.9 | **31.0** | **Yes** |
| Ninth 03 | 65.1 | 55.1 | 69.9 | **31.0** | **Yes** |
| Ninth 04 | 65.1 | 55.1 | 69.9 | **31.0** | **Yes** |
| Ninth 05 | 65.1 | 55.1 | 69.9 | **31.0** | **Yes** |
| Ninth 06 | 65.1 | 55.1 | 69.9 | **31.0** | **Yes** |
| Ninth 07 | 65.1 | 55.1 | 69.9 | **31.0** | **Yes** |
| Ninth 08 | 65.2 | 55.2 | 69.9 | **31.0** | **Yes** |
| Ninth 09 | 65.4 | 55.4 | 70.2 | **31.0** | **Yes** |
| Ninth 10 | 62.5 | 52.9 | 70.0 | 30.0 | **Yes** |
| Ninth 11 | 62.4 | 52.8 | 70.1 | 30.0 | **Yes** |
| Ninth 12 | 62.1 | 52.8 | 70.2 | 30.0 | **Yes** |
| Ninth 13 | 62.0 | 52.9 | 70.3 | 30.0 | **Yes** |
| Ninth 14 | 57.6 | 48.8 | 67.7 | 30.0 | **Yes** |
| Ninth 15 | 52.4 | 43.4 | 60.0 | 30.0 | **Yes** |
| Ninth 16 | 52.0 | 43.0 | 59.0 | 30.0 | **Yes** |
| Ninth 17 | 51.4 | 42.4 | 57.3 | 30.0 | **Yes** |
| Ninth 18 | 61.5 | 51.6 | 66.3 | 30.0 | **Yes** |
| Ninth 19 | 62.1 | 52.2 | 66.9 | 30.0 | **Yes** |

**Table A8 Tenth and Eleventh Floor Receptor Alternative Ventilation and Enhanced Glazing Requirements**

| Location | Daytime External $L_{Aeq}$ | Night-Time External $L_{Aeq}$ | External $L_{Amax}$ | Recommended Glazing Specification (SRI) to Achieve BS 8233 $L_{Aeq}$ 'good' 30 dB and $L_{Amax}$ 45 dB Target Levels | Alternative Ventilation Required? |
|---|---|---|---|---|---|
| Tenth 01 | 64.7 | 54.7 | 69.5 | 30.0 | **Yes** |
| Tenth 02 | 64.7 | 54.7 | 69.5 | 30.0 | **Yes** |
| Tenth 03 | 64.8 | 54.8 | 69.6 | 30.0 | **Yes** |
| Tenth 04 | 65.0 | 55.0 | 69.8 | 30.0 | **Yes** |
| Tenth 05 | 62.2 | 52.6 | 69.8 | 30.0 | **Yes** |
| Tenth 06 | 62.0 | 52.5 | 69.9 | 30.0 | **Yes** |
| Tenth 07 | 61.9 | 52.5 | 70.0 | 30.0 | **Yes** |
| Tenth 08 | 61.8 | 52.7 | 70.2 | 30.0 | **Yes** |
| Tenth 09 | 57.8 | 49.0 | 68.0 | 30.0 | **Yes** |
| Eleventh 01 | 64.4 | 54.4 | 69.2 | 30.0 | **Yes** |
| Eleventh 02 | 64.4 | 54.4 | 69.2 | 30.0 | **Yes** |
| Eleventh 03 | 64.4 | 54.4 | 69.2 | 30.0 | **Yes** |
| Eleventh 04 | 64.7 | 54.7 | 69.5 | 30.0 | **Yes** |
| Eleventh 05 | 61.8 | 52.3 | 69.6 | 30.0 | **Yes** |
| Eleventh 06 | 61.8 | 52.3 | 69.7 | 30.0 | **Yes** |
| Eleventh 07 | 61.6 | 52.3 | 69.8 | 30.0 | **Yes** |
| Eleventh 08 | 61.6 | 52.4 | 70.0 | 30.0 | **Yes** |
| Eleventh 09 | 58.0 | 49.2 | 68.3 | 30.0 | **Yes** |