

Highgate School – Millinson Sports Centre

Overheating Assessment



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Executive Summary

This report details the methodology and assessment of the dynamic overheating assessment of the proposed development of Mallinson Sports Centre Complex located on Bishopswood Road. The phased redevelopment of the Mallinson Sports Centre will include extensive refurbishment of existing buildings and extensions to create new indoor sports, drama and assembly space (dry sports hall 2). This report aims to demonstrate compliance with both CIBSE TM52 defining criteria of thermal comfort, and CIBSE TM49 urban climate projections.

The overheating assessment has been carried out in accordance with the guidance set out in CIBSE TM52, CIBSE TM49 with inputs from The Building Regulations Approved Part O: Overheating, Building Bulletin 101 (BB 101), London Plan (Policy SI 4) and the National Planning Policy Framework (DCLG, July 2021).

Dynamic Simulation Modelling (DSM) of the building has been carried out on all relevant areas, to appraise the thermal comfort likely to be experienced based on scheme design and the passive and active measures introduced to help regulate temperatures in the warmer months. The predicted internal temperature was simulated considering all aspects of occupancy, solar gain and predicted internal heat gains. Specific weather files have been applied to the model to assess the building performance against urban heat island effects and projected future climate conditions.

Proposed ventilation strategy for the development includes mechanical ventilation with heat recovery, natural ventilation and mixed mode ventilation.

The calculation results show that all tested rooms meet the TM52 thermal comfort overheating criteria using the main TM49 weather file (DSY1) for the 'future near extreme summer', demonstrating that the building is resilient to overheating during its lifetime.

The two sports hall are assessed with two scenarios and two sets of results are provided:

- Result 1: Sports Halls 1&2 are used as Dry sports hall with average occupancy
- Result 2: Sports Halls 1&2 are used as large classroom during exams with higher occupancy

Type of Development

The Phase 1 swimming pool and changing room works were completed (2021) and are in use. The swimming pool and changing room facilities will remain open during phases 2 and 3 works.

The proposed works will modernise this important indoor sports facility with alterations and extensions and significantly extend the life of the retained elements of the existing building, additionally providing significant improvements for accessibility, energy efficiency and reduction of the carbon footprint of the whole Development.

1 Introduction

- 1.1 Peter Deer and Associates Ltd (PDA) have been appointed to undertake the design stage overheating analysis for the proposed development of Mallinson Sports Centre (MSC).
- 1.2 This report presents an analytical study of the potential overheating risks in normally occupied areas. The scope of this study is to report on the likely overheating risk and assess the overheating risk via current CIBSE weather file data for London Heathrow.
- 1.3 The dynamic method for assessing overheating involves using computer simulation software to model and analyse the thermal behaviour of a building over time, particularly during periods of high external temperatures. This method considers a variety of factors, such as the building's design, orientation, materials, insulation, glazing, ventilation strategies, and occupancy patterns. By simulating the building's response to changing external conditions and internal heat gains, the dynamic method provides a more comprehensive and accurate assessment of the potential for overheating compared to simpler steady-state calculations.
- 1.4 Dynamic simulation software models how heat is transferred within and around a building, including how solar radiation enters through windows, how heat is conducted through walls and roofs, and how mechanical ventilation systems affect indoor air temperatures. It also considers the thermal mass of the building, which can help moderate temperature fluctuations by absorbing and releasing heat slowly.
- 1.5 Dynamic thermal simulations have been used adopting the methodology of CIBSE TM52: *The limits of thermal comfort: avoiding overheating (2013)* to determine whether there is a risk of overheating. Appropriate mitigation measures have been recommended to reduce the overheating risk and thus providing comfortable thermal conditions during occupied hours.
- 1.6 Overheating assessment for the proposed development at Highgate School has been carried out to check compliance with building regulations Part O, CIBSE TM52 and BB101

Site

- 1.7 The Mallinson Sports Centre (MSC), part of the Bishopswood Road campus of the school estate, is close to other principal school buildings such as the Mills Centre, the Dining Hall, the Pre-Prep School, and the Junior School.

Site address

Mallinson Sports Centre

Bishopwood Road,

London.

N6 4PH
- 1.8 The main building comprises the Pool Hall and associated changing rooms, which was the first building on the site in 1969, followed by the main sports hall with associated ancillary accommodation, gym, entrance hall, central offices and other sports spaces completed in 1989.
- 1.9 The overriding aim of the design seeks to transform this building and create enhanced building aesthetics within the Conservation Area while providing all the sports and ancillary-related facilities that the school will need shortly.

- 1.10 The intention is to retain the essential elements of the existing building that have significant long-term value and condition, provide spaces of the required technical standard, and integrate them with alterations and extensions into a unified whole, a single sports centre.
- 1.11 The new sports hall is the principal component of the proposed Development of the school's indoor sports facilities. As part of the work, the school intends to demolish the existing Fives and Squash court buildings to open a large area within the site that can be more efficiently and architecturally developed. Integrated with these works are to build a new sports centre building comprising an indoor sports hall, teaching classrooms and staff offices.
- 1.12 The design of the hall is to accommodate a National standard netball court within the dry sports hall 2, one that will allow Premier League games to be played. There is an aspiration nationally for netball courts of this standard, for a sport that is increasing in popularity. Many other sports courts will fit within this same interior footprint.

The Vision

- 1.13 The proposed Development is auxiliary to several other applications in various parts of the school. The vision behind all the proposed developments at the school is set out in the planning statement accompanying the applications, an extract of which is reproduced as follows:

“Being both a Charity and a School, sustaining and further improving what Highgate does for the benefit of its pupils and pupils of partner schools elsewhere within the borough is never finished business.”
“The school has, over the last 15 years or so, been undertaking an extensive programme of modernising and renewing its extensive and mixed stock of buildings and facilities to meet the educational and other demands of a 21st Century establishment. Significant funds have been invested over that period, and the programme will continue over the next decade.”
“This programme combines the continuing need to maintain, both in terms of safety and appearance, the buildings on several sites and in varying degrees of condition, with the need to provide essential, flexible, good quality and long-lasting educational facilities for its varied educational and charitable objectives, as well as catering for its diverse pupil-body, which meets the different educational and supporting requirements for each of the three Schools to satisfy Department of Education (DfE) and other statutory requirements.”



Figure 1 Aerial View of the site in Red



Figure 2 Site Location in Context (Open Street Map)

The Proposed Works

- 1.1
- The new extensions will create a larger building with various sports facilities, including a second sports hall, which will also be used for other School events, parent evenings, examinations, and assemblies.
- 1.2
- The principle of a single secure point of access at the south end is to be maintained, with a larger and more open entrance and foyer fronting the all-weather pitches. Once inside the foyer via a draught lobby, the main Sports Centre reception desk immediately controls the area, which will always be staffed during regular operational hours. The desk will be open within the space to create a friendly and welcoming impression for pupils and visitors and improve visibility. It is anticipated that turnstiles will be used to control and monitor access into the sports centre – Turnstiles are provided at the west entrance next to the second hall. Turnstiles and entry doors would all be linked to the building fire alarm and detection system and default to open in the event of a fire for emergency egress.
- 1.3
- As a result of the proposed extensions, new lifts will allow complete accessibility for disabled users to all areas of the building which is not currently wheelchair accessible.
- 1.4
- Generally, during the school Day, the main doors will be openable, the entry doors being on automatic electric opening systems for disabled and Part M access. After School hours, it is anticipated that the main doors at both entrances will have access security control, operated by coded entry devices with magnetic closing locks. An option being investigated is to have the entry systems operated by pupil and staff cards, which will also serve several other functions in the school.
- 1.5
- The proposed works in this submission include:
 - The Fives Court and Squash Courts building is being demolition at the site's north end. The removal of the outer games court area and high chain-link fencing.
 - New north-west extension for a second indoor sports hall with associated:
 - new circulation corridor,
 - viewing gallery,
 - access stairs and lift,

- ancillary spaces for storage and plant, and
 - A teaching block extension for 'Combined Cadet Force' and 'Outdoor Education' classrooms, offices, and associated storage.
- A new south extension to the existing sports hall for eight (8) no. New external covered Fives Courts with run-off area.
- New southwest extension and alterations to the existing building to create an enhanced entrance with a foyer, reception, and café. Including a bespoke staircase down to the current changing rooms.
- New roof to sports hall 1 with new roof lights adding natural daylight to the and improved thermal comfort.
- The courtyard between the pool hall and sports hall 1 will be covered to provide additional space. The space provides indoor squash courts and forms connections back to the changing rooms, with ancillary external storage for sports.
- The external surrounding is improved with new hard and soft landscaping around the site's perimeter, including removing three trees. The trees will be replaced with new semi-mature trees and form an entrance courtyard area at the new south main entrance.

- 1.6
- The recently completed swimming pool project is the first phase of these works and provides the changing room facilities for the following sports hall phases.

Natural Ventilation

- Maintain indoor air quality and balanced humidity by providing fresh air via natural means
- Purge ventilation to provide rapid air change rate during the day, allowing heat trapped in high spaces to be replaced with cooler fresh air.
- Provide natural night-time purge ventilation to cool the building structure

Demand controlled mechanical ventilation system with heating and heat recovery is required to:

- Provide heating & fresh air to sports halls in winter
- Remove moisture and maintain space humidity when fully occupied or during high-activity sports.
- Recover heat energy from the sports hall
- Aid heat removal from the space in the summer months

Strategy for mitigating overheating risk TM52 overheating analysis

- 1.14
- Dynamic Simulation Modelling (DSM) of the building has been carried out on all relevant areas, to appraise the thermal comfort likely to be experienced based on scheme design and the passive and active measures introduced to help regulate temperatures in the warmer months. The predicted internal temperature was simulated considering all aspects of occupancy, solar gain and predicted internal heat gains. Specific weather files have been applied to the model to assess the building performance against urban heat island effects and projected future climate conditions.

Heating/cooling system description

- Fast Acting air distribution heating in the sports halls. To avoid heating the space when not in use.
- Multi-split air source heat pumps to provide heating and cooling in the fitness, dance studio, and cardio room.

- Heating from low surface temperature radiators in the Classroom and circulation spaces. Heating is provided by air to water, air source heat pumps.
- Domestic hot water uses the swimming pool gas boiler and fast heat recovery energy-efficient plate heat exchanger hot water cylinders.

Location of mechanical ventilation fans/heat recovery units/heat pumps.

- No plant is visible from Bishopwood and Broadlands Roads.
- The air handling plant for sports hall (2) is located on the flat roof of the corridor between the sports hall and the swimming pool viewing gallery.
- The proposal is to relocate the air handling unit supplying the second swimming pool changing room.
- The Plan is to replace Spart hall (1) heating and ventilation equipment with a new energy-efficient unit with variable speed fans, heat recovery and ductwork.
- The designer will select the external heat pump condenser unit for low noise operation and, where required, fit the additional acoustic attenuation.

2 Planning Policies

National Planning Policy

2.1 The National Planning Policy Framework ('NPPF') was published in July 2021 and superseded the previous versions. Paragraphs 153 within the Framework states the importance of mitigating the overheating risk of proposed developments (Table 1 1).

Planning for Climate Change

153. Plans should take a proactive approach to mitigating and adapting to climate change, considering the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

Table 1 Paragraph 153 National Planning Policy Framework (July 2021)

2.2 Climate change means London is already experiencing higher than historical average temperatures and more severe hot weather events. This, combined with a growing population, urbanisation, and the urban heat island effect, means that London must manage heat risk in new developments, using the cooling hierarchy above. The cooling hierarchy applies to major developments, and the principles can also be applied to minor development.

2.3 Maintaining thermal comfort conditions in the face of climate change and increasing temperatures is one of the greatest challenges to be addressed by designers. The main objective is to achieve thermal comfort and minimise summertime overheating without using air conditioning systems, which typically have associated greenhouse gas emissions and impact the urban heat island effect.

London Plan

2.4 The London Plan is the Mayor's planning strategy for Greater London. It sets borough-level housing targets and identifies locations for future growth of London-wide importance.

2.5 The London Plan is the overall strategic Plan for London, setting out an integrated economic, environmental, transport and social Framework for the Development of London over the next 20 to 25 years.

2.6 The London Plan is part of the Development Plan. The policies have been drafted to allow London to implement this ambitious London Plan as soon as possible. There is no requirement for the policies to be repeated locally. However, some instances require a local approach within the overall policy context. The London Plan sets out where this is the case.

2.7 The London Plan provides the strategic framework for making all these decisions. It guides boroughs' Development Plans to ensure they work toward a shared vision for London. It establishes policies that allow everyone involved in new developments to know what is expected.

Policy SI 4 Managing Heat Risk

- A) Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials, and the incorporation of green infrastructure.
- B) Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:

1) reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation, and the provision of green infrastructure

2) minimise internal heat generation through energy efficient design

3) manage the heat within the building through exposed internal thermal mass and high ceilings

4) provide passive ventilation

5) provide mechanical ventilation

6) provide active cooling systems.

Table 2 GLA London Plan Policy SI 4 (March 2021)

2.8 In managing heat risk, new developments in London face two challenges – the need to ensure London does not overheat (the urban heat island effect) and that individual buildings do not overheat.

2.9 The urban heat island effect is caused by the extensive built-up area absorbing and retaining heat day and night, leading to parts of London being several degrees warmer than the surrounding area. This can become problematic on the hottest days of the year as daytime temperatures can reach well over 30°C and not drop below 18°C at night. These circumstances can lead many people to feel too hot or unable to sleep, but for certain health conditions and 'at risk' groups, such as some young or elderly Londoners, the effects can be serious and worsen health conditions.

2.10 Green infrastructure can mitigate urban heat island effect by shading roof surfaces and through evapotranspiration. Development proposals should incorporate green infrastructure in line with Policy G1 Green infrastructure and Policy G5 Urban greening.

2.11 Passive ventilation should be prioritised, considering external noise and air quality in determining the most appropriate solution. The increased use of air conditioning systems is not desirable as these have significant energy requirements and, under conventional operation, expel hot air, thereby adding to the urban heat island effect. If active cooling systems, such as air conditioning systems, are unavoidable, then the systems should be designed to reuse the waste heat they produce. Future district heating networks are expected to be supplied heat from waste heat sources such as the building cooling systems.

London Borough of Haringey Policies

2.12 Haringey's Local Plan is made up of several individual planning policy documents. These are Haringey's Local Plan Strategic Policies 2013 – 2026 (formerly the Core Strategy) March 2013. Consolidated with alterations since 2017 – sets out the Council's spatial strategy and critical policies for the future Development of the Borough through to 2026;

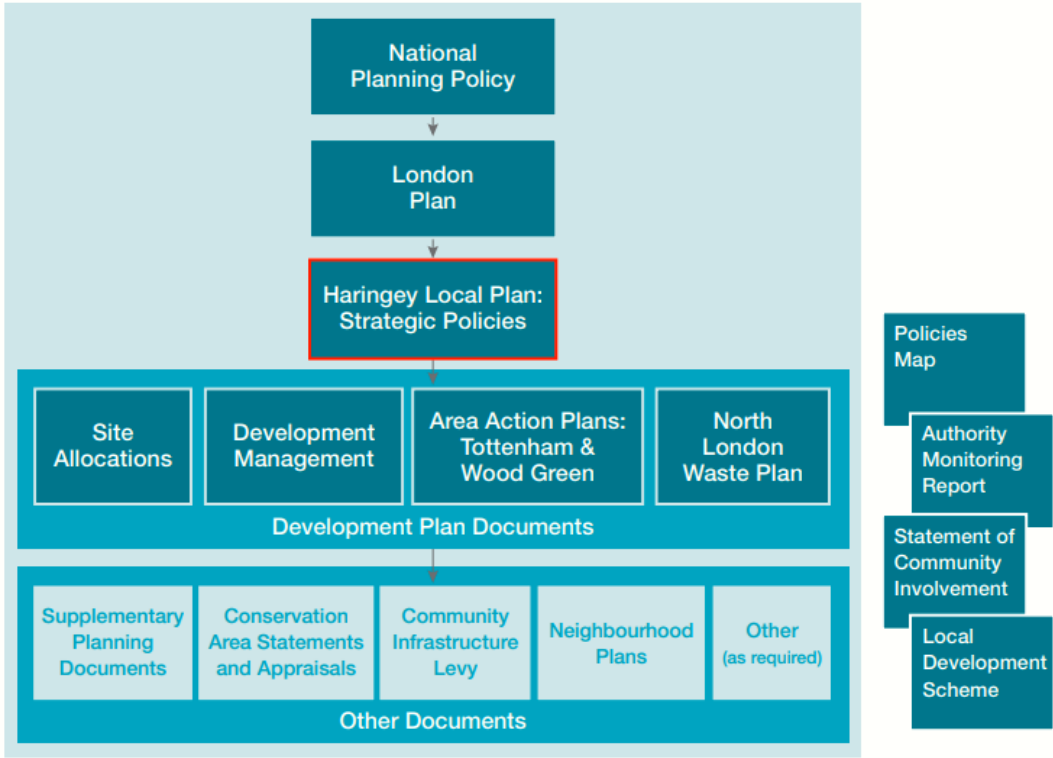


Figure 3 Haringey Local Plan

Development Management DPD (Adopted July 2017)

- 2.13 The Development Management Plan sets out Haringey's spatial strategy for managing Development and growth in the Borough up to 2026. The Local Plan provides a positive framework for ensuring that housing, employment, infrastructure, and other needs are met to contribute to sustainable Development in both the Borough and Greater London. Several key objectives, which are set across five overarching themes, as follows, guide the Local Plan:
- People at the heart of change;
 - An environmentally sustainable future;
 - All share economic vitality and prosperity;
 - Safer for all; and
 - Healthier people with a better quality of life.

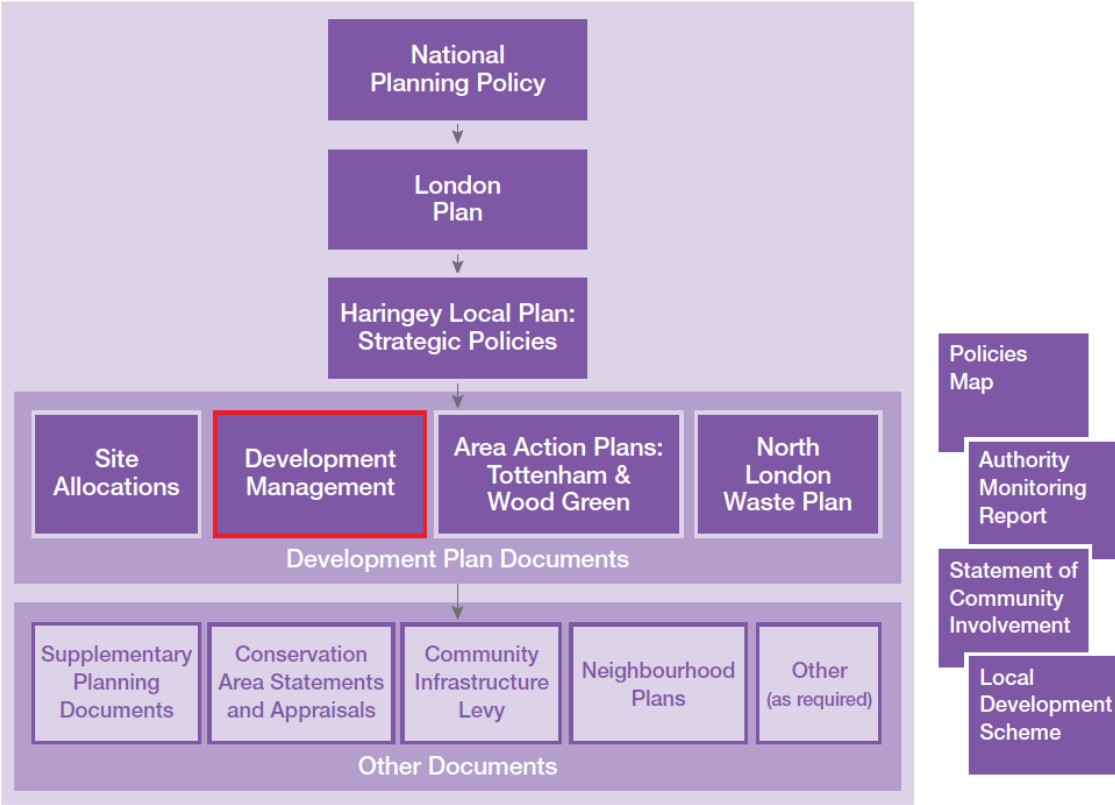


Figure 4 London Borough of Haringey Policy Hierarchy

Policy DM21: Sustainable Design,

- 2.14 The principles of sustainable design, layout and construction are set out in London Plan (2021). The principles cut across a few policies in this Local Plan, and all proposals should positively respond to them by engaging with the Haringey Development Charter (see Policy DM1). Applying sustainable design principles can help improve the environmental performance of buildings, making them more resilient to climate change and mitigating their effect on it. Sustainable design and construction, therefore, provide clear environmental advantages. It also offers social and economic benefits. Sustainable design results in more efficient buildings with cheaper operating costs, which benefits future owners or occupiers, particularly those at risk of fuel poverty.

Policy DM21: Sustainable Design, Layout and Construction	
A)	All new Development, including building and landscape works, will be expected to consider and implement a sustainable design, layout, and construction techniques. Proposals should: a) Apply the energy hierarchy to minimise energy use to meet and, if possible, exceed minimum carbon dioxide reduction requirements; b) Apply the cooling hierarchy to reduce the potential for overheating and limit reliance on mechanical air conditioning systems; c) Maximise opportunities to enhance biodiversity on-site, including through appropriate landscaping, Sustainable Drainage Systems, living roofs and green walls d) Wherever possible, use building materials with high environmental performance ratings; and e) Seek opportunities for locally sourced labour.
B)	The Council will support appropriate measures to retrofit existing homes and non-residential buildings sustainably.
C)	Proposals that fail to demonstrate adequate consideration for sustainable design, layout and construction techniques will be resisted.
D)	Consideration will be given to using carbon offset payments, to be secured by planning obligations, where it can be demonstrated that proposals cannot meet carbon dioxide emission reduction targets on-site.

Table 3 London Borough of Haringey Policy DM21

Overheating and cooling

- 2.15 Development proposals should seek to integrate the cooling hierarchy following sustainable design, layout, and construction principles. Helping to ensure that buildings are better equipped to manage their cooling needs in Energy efficient ways over their lifetime. This policy applies the cooling hierarchy set out in the London Plan:
2. Minimise internal heat generation through Energy efficient design

3. Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls

4. Manage the heat within the building through exposed internal thermal mass and high ceilings

5. Passive ventilation

6. Mechanical ventilation

7. Active cooling systems (ensuring they are the lowest carbon options)

8. Sustainable retrofitting

Building Regulations Part O

- 2.16 Part O of the UK Building Regulations, titled "Security Against Overheating," focuses on the necessity for new buildings to be designed and constructed in a manner that minimises the risk of overheating. It mandates that sufficient thermal comfort should be achieved, even during exceptionally warm weather, without relying solely on energy-intensive cooling systems. This regulation encourages the adoption of passive design strategies, intelligent architectural features, and effective ventilation to naturally manage internal temperatures.

3 Overheating Assessment Methodology and Criteria

- 3.1 The Dynamic Simulation Modelling (DSM) software Design Builder with Energy Plus V8.9 has been utilised to carry out the overheating assessment for the building.
- 3.2 An axonometric view of the Design Builder model for the proposed development is provided in Figure 2. A 3-dimensional model of the proposed development. The inputs and assumptions used in the simulations are covered in the following sections.

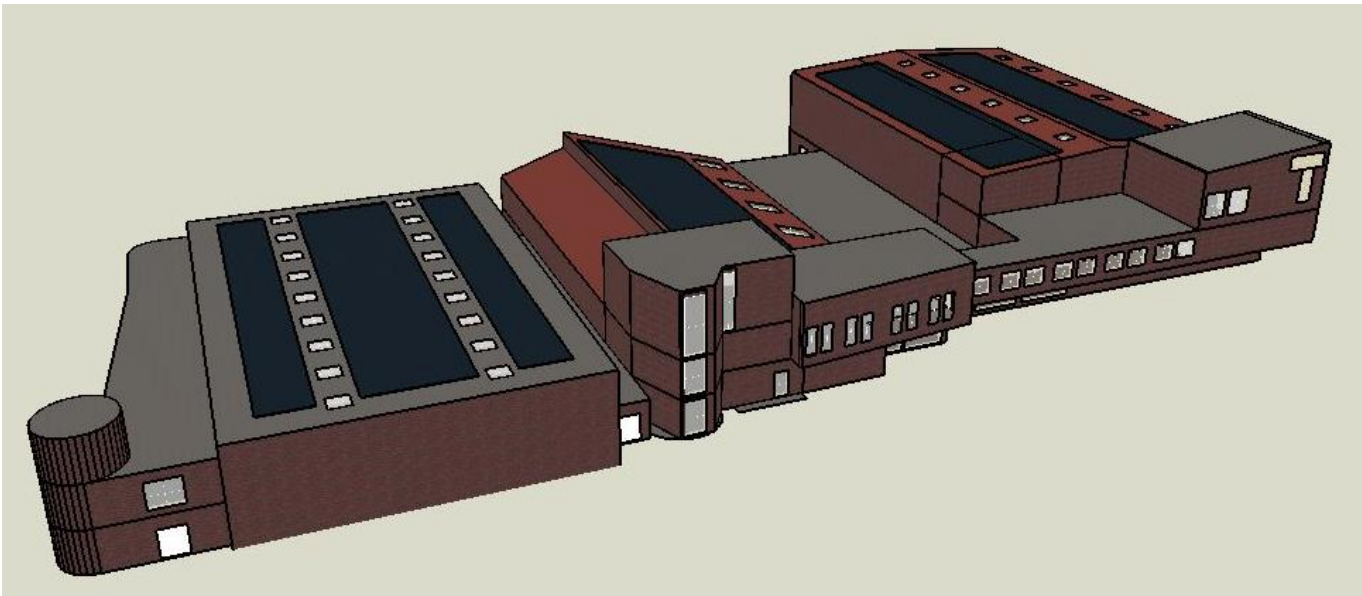


Figure 5 Design Builder Model

- 3.3 The process for using DSM tools for predicting the overheating risk is that a model of the building is created adopting the building geometry, internal layout, location and orientation of the building, construction details, internal gains, ventilation details and weather data.
- 3.4 The assessments were conducted using computer software, but it must be noted that building dynamic simulations provide an estimate of the building performance. As a result, simulation results only represent an interpretation of the potential performance of the building and operational performance cannot be accurately predicted from the results.

Building Fabric

- 3.5 Wall construction is generally in solid masonry cavity wall construction, with external clay-facing bricks or Portland stone facings.
- 3.6 Windows are to be aluminium or aluminium/timber composite windows or curtain walling systems, with double-glazed glass units. The glazing will include security glazing tape, dedicated security sealant or gasket and a secure mechanical fixing system – in general, all glass units will consist of safety glass, laminated, and toughened in compliance with Part N and beyond – this will apply to glass at all levels, as the sports activities will also require safety glass.
- 3.7 Roofs are constructed with a base which might be CLT panels or profiled metal sheeting, fixed to the main structural frame, and finished with rigid insulation and bituminous flat roof weatherproofing systems. In

many cases, this will be combined with green roof systems, including extensive roof build-ups and drainage layers.

- 3.8 The building fabric parameters are not finalised at this early stage but the overheating assessment has been carried out on the assumption that building fabric will comply with the minimum standards listed in Approved Document L as below.

Element	Proposed U Values
Wall (New)	0.26 W/m²K
Wall (Existing)	2.30 W/m²K
Windows	1.60 W/m²K
Glass G factor	0.4
Roof	0.18 W/m²K
Floor	0.18 W/m²K
Air permeability Rates	5.0 m³/m².h @50Pa

Table 4 Building Fabric Parameters Used in DSM

Internal Design Criteria

- 3.9 The following occupancy schedule & internal gains were applied to the model when assessing overheating risk.

Area	Internal Gains	Occupancy Schedule
Teaching Areas	4.70W/m²	8:00 – 18:00hrs
Dry Sports Halls	1.94W/m²	8:00 – 18:00hrs
Office & Admin Areas	11.99W/m²	8:00 – 18:00hrs
Gyms & Studios	14.14W/m²	8:00 – 18:00hrs
Circulation Areas	2.0W/m²	8:00 – 18:00hrs
Cafe	18.54W/m²	8:00 – 18:00hrs

Table 5 Internal Design Criteria

- 3.10 The occupancy pattern throughout the day/academic year is likely to vary significantly and would be difficult to predict accurately, therefore the occupancy pattern used in the modelling allows variable occupancy from 25% to 100% from 8am to 6pm to consider after school activities as well as use of sports complex during school hours.

GLA London Plan Cooling Hierarchy

- 3.11 GLA’s cooling hierarchy has been followed to ensure suitable passive measures have been incorporated into the design before considering any active cooling. Dynamic modelling includes the passive measures designed into the proposed scheme.
- 3.12 Detailed design of the heating distribution pipework will ensure that pipe runs are minimised and avoid normally occupied spaces as much as possible to reduce the risk of overheating.
- 3.13 Energy efficient lighting will be utilised throughout the development to minimise energy consumption as well as internal heat gains from lighting.
- 3.14 Solar gains entering the building will be minimised by designing features such as external shading, solar control glazing and green roofs.

- 3.15 Overhanging pitched roof protruding 700mm from the external wall of the building has been modelled to provide external shading.
- 3.16 No internal blinds or other means of shading have been considered in the modelling.
- 3.17 Passive ventilation via openable windows has been modelled as the preferred means of heat removal from internal spaces.
- 3.18 Openable windows that are proposed as bottom hung have been modelled with a 150mm opening distance and 65% discharge coefficient to avoid any security concerns.
- 3.19 Windows are modelled to be open only during occupied hours.
- 3.20 Rooflights in Sports Hall 1 have been modelled as openable to reduce overheating risk during the use of sports hall for exams with a very high occupancy. It is recommended that a minimum of 25% of roof light area is openable.
- 3.21 Figure 6 to Figure 9 below indicates Design Builder model elevations with openable windows.



Figure 6 South West Elevation

(All windows openable by 150mm except windows highlighted in yellow which are 100% openable)

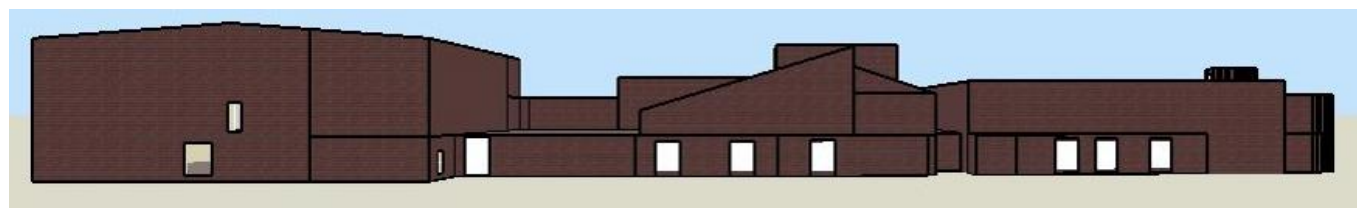


Figure 7 North East Elevation

(All windows openable by 150mm)



Figure 8 North West Elevation

(All windows openable by 150mm)



Figure 9 South East Elevation

(All windows openable by 150mm)

Ventilation Strategy

- 3.22 The ventilation proposal for the refurbishment and extension of the Millinson Sports centre is a mixed-mode ventilation strategy. Mixed-mode ventilation uses both natural ventilation and mechanical ventilation. The building controls system and occupants will be able to select the appropriate ventilation option to suit the activities taking place in the space.
- 3.23 Mix-mode ventilation is a term that describes where it is possible to use both natural and mechanical ventilation options in buildings. In the case of sports halls, natural ventilation is the primary ventilation method as sports halls are large volumes with a small but active occupancy. Most of the spaces are passive and do not require substantial heat input.
- 3.24 The sports hall will also be used for events with large numbers of people when mechanical ventilation may be beneficial to control space temperature and humidity.
- 3.25 Sports halls are also used as examination rooms when the hall is required to be heated and thermally comfortable for students sitting at an exam for up to three hours.
- 3.26 Sports Halls tend to overheat in summer from heat gains through the large roof area and roof lights. A natural ventilation strategy is to be developed to enable the natural purging of heat and night cooling. The designers propose ventilation shafts, automated windows, and roof lights to provide high-and low-level openings to create air exchange without mechanical ventilation. Using a green living roof retaining rainwater helps reduce heat gain into the space below.
- 3.27 Natural ventilation uses openings through the structure to promote airflow through the building. The air movement is driven by the pressure differences between the inside and outside of the building. The pressure differences are created when there is a temperature difference between the inside and outside of the building or wind passing over the building.
- 3.28 Mechanical ventilation uses fans to drive the air through the building, creating a controllable internal environment. The fans are often located in a box external to the building allowing heat exchange between extract and supply air streams.
- 3.29 Mechanical ventilation systems can filter the air passing into the building, creating a cleaner environment.
- 3.30 As a controllable system, it can increase ventilation rates in response to heating requirements or activity within sports halls. Recirculating air helps to increase the rate at which the space heats up. Supplying and extracting a greater volume of fresh removes airborne pollutants and reduce humidity
- 3.31 The classrooms, dry Sports Halls, Gallery to Sports Hall, Squash courts, Gyms, Café area, and office spaces are to be provided with a mixture of natural & mechanical ventilation known as a mix mode system. These will be provided with manually openable windows and mechanical ventilation units controlled by sensors measuring room temperature, relative humidity and, in higher occupancy spaces, Carbon dioxide levels.
- 3.32 Several Air Handling Units (AHU) will be utilised to provide mechanical ventilation as part of the mixed-mode approach.
- 3.33 Although Natural ventilation is the primary method, sports hall will require mechanical ventilation when used as an assembly hall, examination room or competition space. The air handling unit is the hall's primary heating system, as the AHU can quickly heat space and control humidity and pollutants.
- 3.34 Indoor air quality will be maintained using mixed-mode ventilation using a combination of mechanical ventilation in winter and natural ventilation in the summer months through high-level roof vents and low wall vents in the dry sports hall.

3.35 The development will be zoned as below

Zone	System	Control
Swimming pool	AHU rapid space heating, mixed fresh air, control of humidity, air temperature	The Building system controls multiple sensors. Sports staff can make temperature adjustments from the computer in the staff office.
Changing room	AHU rapid space heating, constant fresh supply humidity, air temperature sensors, changing rooms kept under positive pressure.	The Building system controls multiple sensors. Sports staff can make temperature adjustments from the computer in the staff office.
Dry Sports hall & Squash courts	AHU rapid space heating, mixed fresh air, control of humidity, air temperature. High-level windows and roof lights are fitted with automated actuators.	The Building system controls multiple sensors. Sports staff can make temperature adjustments from the computer in the staff office.
Dance and fitness studio	Refrigerant fan-coil units. Mechanical ventilation with heat recovery. Some high-level windows are fitted with automated window openers. Linked to temperature humidity and Carbon Dioxide Sensor	Local Space temperature control via wall-mounted controller with space reset to set point every hour. Temperature control from a computer in the staff office and BMS.
Classrooms	Low Surface temperature radiators. Mechanical ventilation with heat recovery. Some high-level windows are fitted with automated window openers. Linked to temperature humidity and Carbon Dioxide Sensor	Local Space temperature control via wall-mounted controller with space reset to set point every hour. Temperature control from a computer in the staff office and BMS.
Circulation spaces	Mechanical ventilation with heat recovery. Low Surface temperature radiators. Some high-level windows are fitted with automated window openers and linked to temperature.	Temperature control from a computer in the staff office and BMS.
Storage area	Low Surface temperature radiators. Mechanical ventilation with heat recovery.	Temperature control from a computer in the staff office and BMS.

Table 6 Proposed Ventilation Strategy

4 CIBSE and BB101 Requirements

- 4.1 Overheating is assessed using CIBSE TM52. The following three criteria detailed below provide a robust yet balanced assessment of the risk of overheating of buildings in UK. TM52 stipulates that a room or building that fails any two of the three criteria is classed as overheating.
- 4.2 CIBSE TM52 uses adaptive comfort principles for buildings in free-running mode. This, means, that the thermal comfort is not based on not exceeding a single limiting temperature, but the acceptable indoor comfort temperature is a function of outdoor temperature. The maximum acceptable temperature (Tmax) can be calculated from the running mean of the outdoor temperature (Trm) using the formula:

$$T_{max} = 0.33 T_{rm} + 21.8$$
- 4.3 The criteria are all defined in terms of ΔT the difference between the actual operative temperature in the room at any time (Top) and Tmax the limiting maximum acceptable temperature. ΔT is calculated as:

$$\Delta T = T_{op} - T_{max}$$
- 4.4 **Criterion 1: Hours of Exceedence (He):**
 The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1K or more during the occupied hours of a typical non-heating season (1 May to 30 September). The number of hours (He) during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours.
- 4.5 **Criterion 2: Daily Weighted Exceedence (We):**
 The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and its duration. This criterion sets a daily limit for acceptability. The weighted exceedence (We) shall be less than or equal to 6 in any one day where:

$$We = (\sum he) \times WF = (he_0 \times 0) + (he_1 \times 1) + (he_2 \times 2) + (he_3 \times 3)$$
 where the weighting factor wf = 0 if $\Delta T \leq 0$, otherwise

$$WF = \Delta T$$
, and hey is the time (h) when $WF = y$
- 4.6 **Criterion 3: Upper Limit Temperature (Tupp):**
 The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable. To set an absolute maximum value for the indoor operative temperature the value of ΔT shall not exceed 4 K. The absolute maximum value of the indoor operative temperature is expressed as Tupp.

$$T_{upp} = T_{max} + 4$$
- 4.7 In order to demonstrate that the proposed spaces are not at risk of overheating, two of the three criteria must be met.
- 4.8 For this analysis, CIBSE DSY1 2020 (50th. percentile range) weather data set for London Heathrow (LHR) has been used to reflect the semi urban location of the site, defined as being outside of the GLA Central Activity Zone.

5 Results and Conclusions

5.1 The results of the overheating calculations are set out in the tables below. These include assessment of building performance against the current design summer year for London (DSY1) to demonstrate compliance.

Room/Area	Level	Criterion 1 (%)	Criterion 2 (K.hr)	Criterion 1 (hrs)	Pass/Fail
Hall2	Lower Ground	0	0	0	Pass
Class1	Ground	0	0	0	Pass
Ofc1	Ground	0	0	0	Pass
Ofc2	Ground	0	0	0	Pass
Cardio	Ground	0.28	6	0	Pass
Entrance2	Ground	0	0	0	Pass
Hall1	Ground	0	0	0	Pass
Squash court 1	Ground	0.49	4.5	0	Pass
Squash court 2	Ground	0	0	0	Pass
Class1	First	0	0	0	Pass
Class2	First	0	0	0	Pass
Ofc1	First	0	0	0	Pass
Ofc2	First	2.03	6	0	Pass
Entrance1	First	0	0	0	Pass
Gym1	First	1.53	17	0	Pass
Gym2	First	2.87	19.5	0	Pass
Ofc1	First	0	0	0	Pass
Ofc2	First	0	0	0	Pass
Ofc3	First	0	0	0	Pass
Cafe	Second	0.34	0.5	0	Pass

Table 7 TM52 Results with Normal Occupancy and Openable Windows

Room/Area	Level	Criterion 1 (%)	Criterion 2 (K.hr)	Criterion 1 (hrs)	Pass/Fail
Hall2	Lower Ground	0	0	0	Pass
Class1	Ground	0	0	0	Pass
Ofc1	Ground	0	0	0	Pass
Ofc2	Ground	0	0	0	Pass
Cardio	Ground	0.26	5.5	0	Pass
Entrance2	Ground	0	0	0	Pass
Hall1	Ground	0.74	3	0	Pass
Squash court 1	Ground	0.49	4.5	0	Pass
Squash court 2	Ground	0	0	0	Pass
Class1	First	0	0	0	Pass
Class2	First	0	0	0	Pass
Ofc1	First	0	0	0	Pass
Ofc2	First	2.03	6	0	Pass
Entrance1	First	0	0	0	Pass
Gym1	First	1.53	17	0	Pass
Gym2	First	1.93	19	0	Pass
Ofc1	First	0	0	0	Pass
Ofc2	First	0	0	0	Pass
Ofc3	First	0	0	0	Pass
Cafe	Second	0.34	0.5	0	Pass

Table 8 TM52 Results with High Occupancy in Sports Hall (Exams) and Openable Windows + Rooflights

- 5.2 This report details the methodology and findings of the dynamic overheating assessment of the proposed development of Mallinson Sports Centre Complex.
- 5.3 No active cooling is required to mitigate the overheating risks therefore it is proposed to utilise openable windows for purge ventilation and a mechanical ventilation system maintain indoor air quality. Passive measures such as high efficiency building fabric and enhanced solar control glazing specifications, and the use of external shading in the form of overhanging roof have been fully explored.
- 5.4 The dynamic overheating assessment of all occupied areas across the proposed scheme demonstrates compliance with the criteria listed in CIBSE TM59 and CIBSE TM52 using the DSY1 weather file.

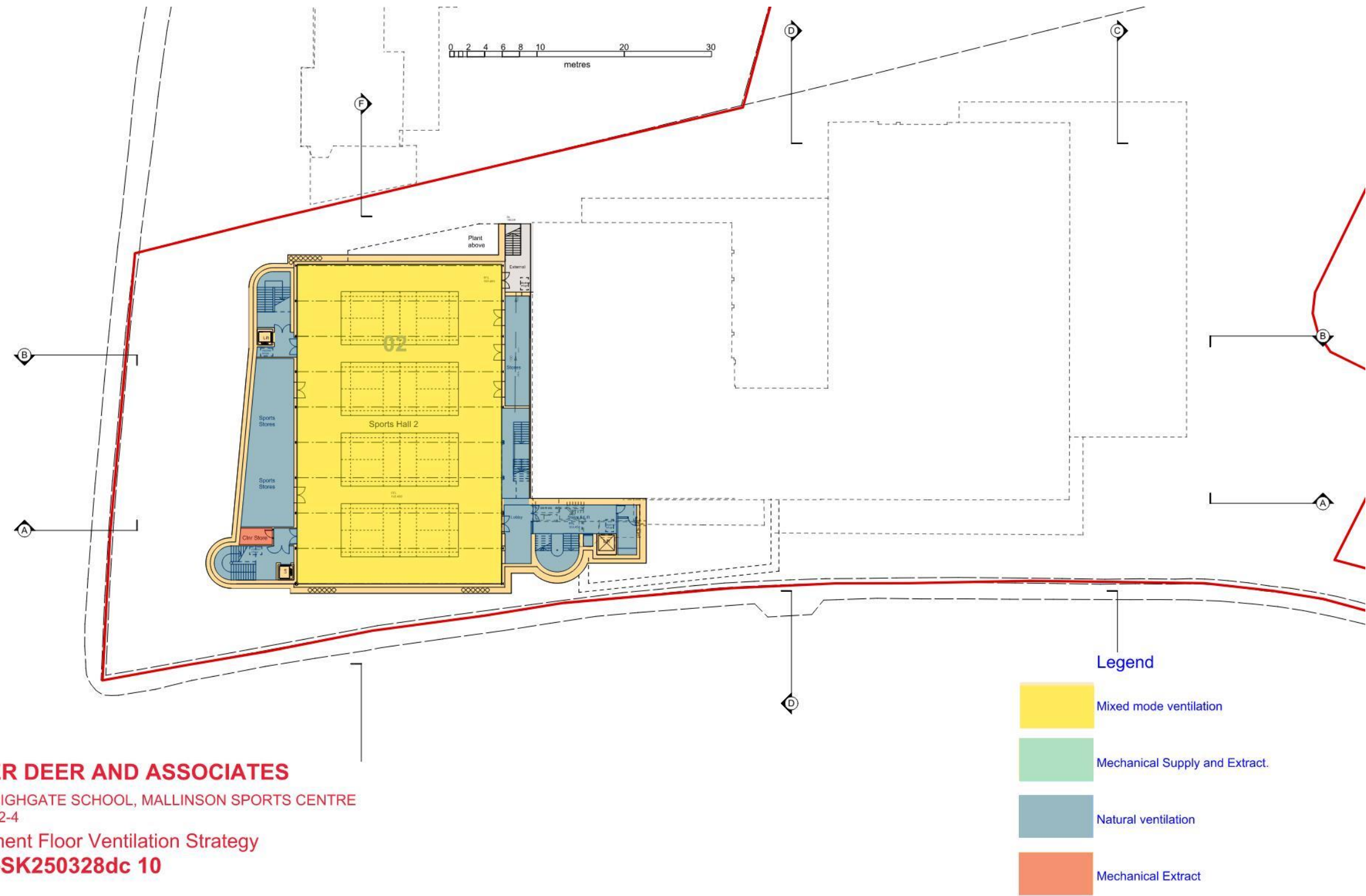
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Appendices

Appendix A Proposed Ventilation Strategy17

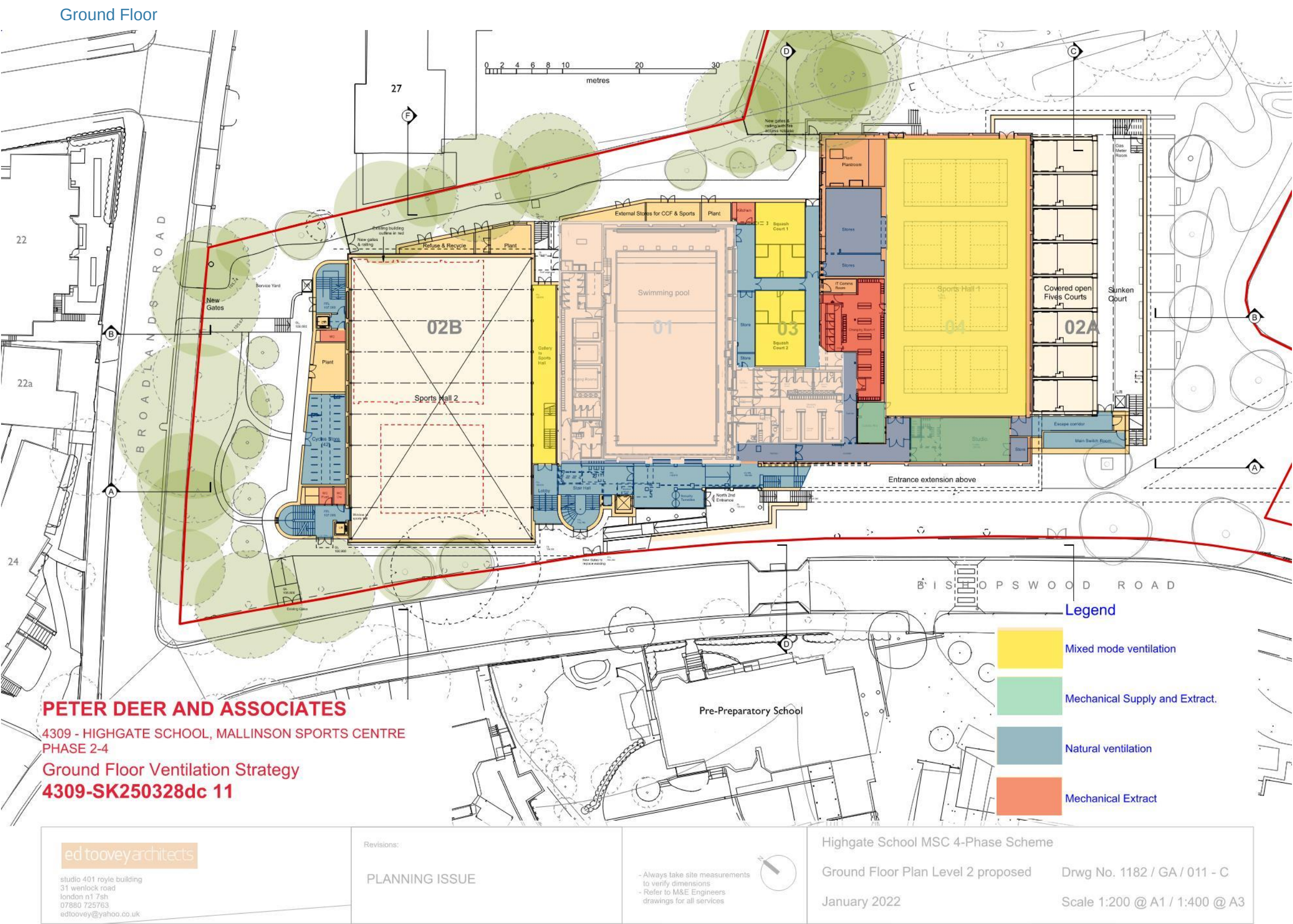
Appendix A Proposed Ventilation Strategy

Basement Floor

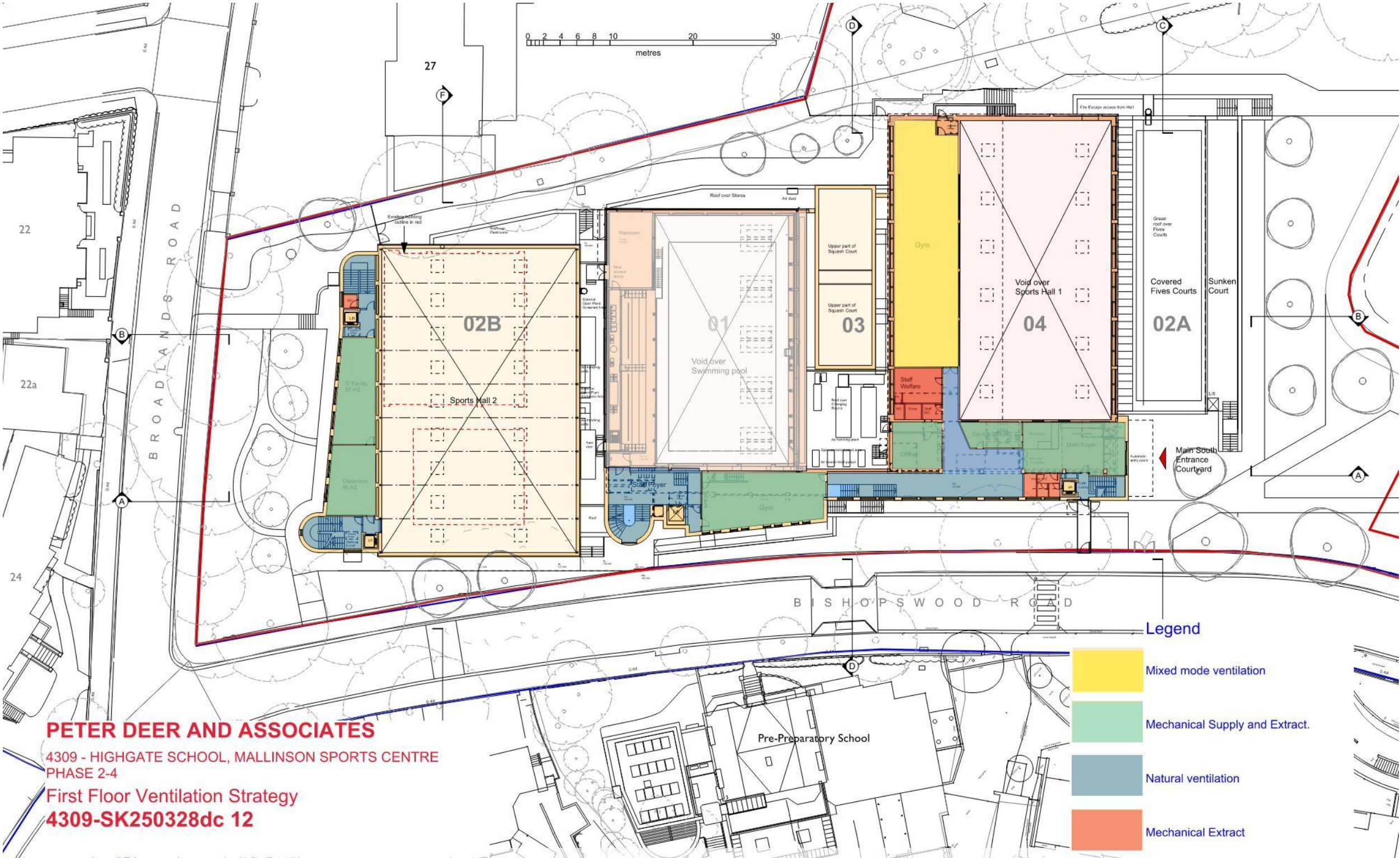


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PHASE 2-4
Basement Floor Ventilation Strategy
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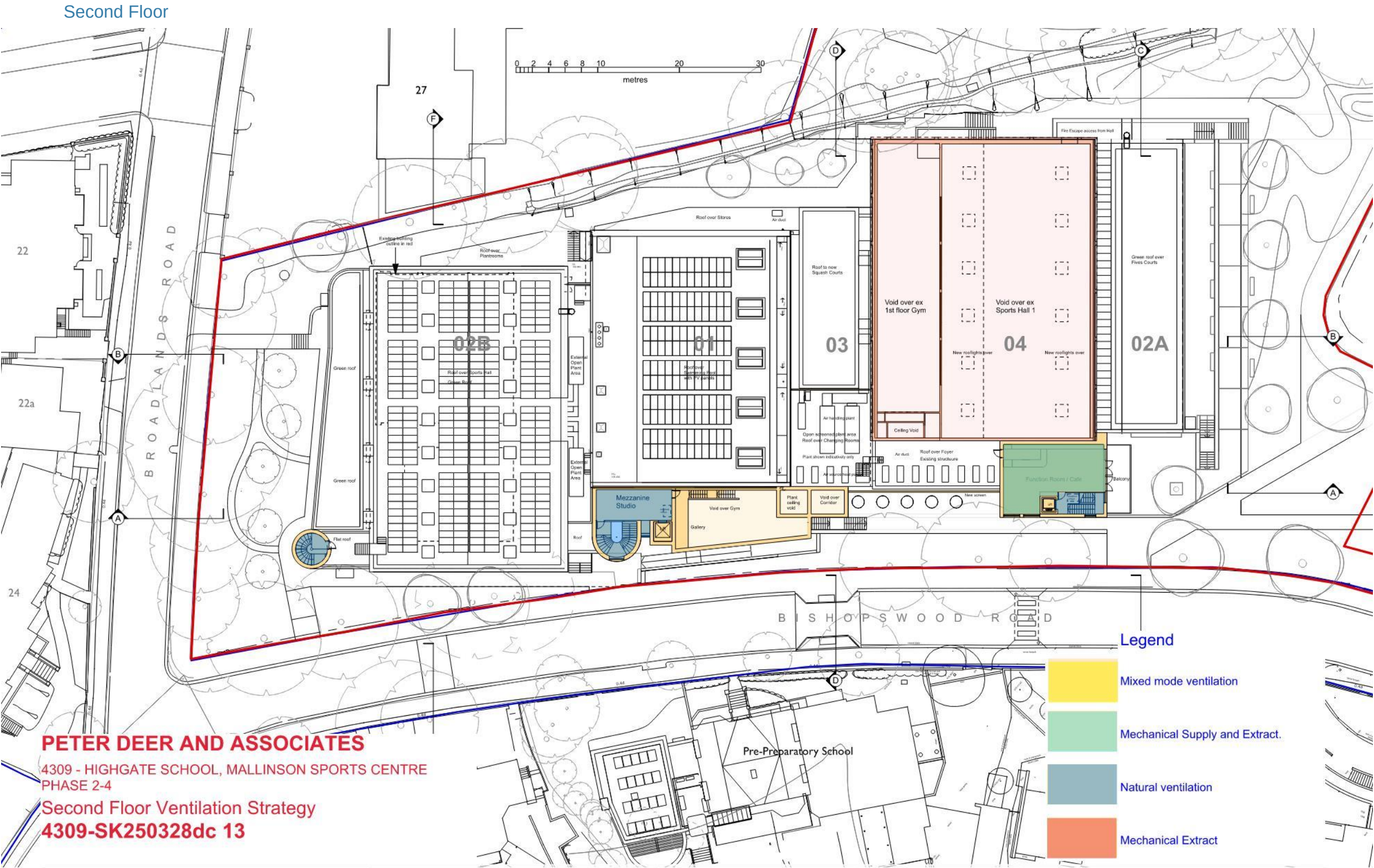
ed toovey architects studio 401 royle building 31 wenlock road london n1 7sh 07880 725763 edtoovey@yahoo.co.uk	Revisions: PLANNING ISSUE	~ Always take site measurements to verify dimensions ~ Refer to M&E Engineers drawings for all services	Highgate School MSC 4-Phase Scheme Basement Plan Level 1 proposed January 2022 Drwg No. 1182 / GA / 010 - C Scale 1:200 @ A1 / 1:400 @ A3
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First Floor



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ed toovey architects studio 401 royle building 31 wenlock road london n1 7sh 07880 725763 edtoovey@yahoo.co.uk	Revisions: PLANNING ISSUE	- Always take site measurements to verify dimensions. - Refer to M&E Engineers drawings for all services	Highgate School MSC 4-Phase Scheme Second Floor Plan Level 4 proposed Drwg No. 1182 / GA / 013- C January 2025 Scale 1:200 @ A1 / 1:400 @ A3
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