



CHRIST'S COLLEGE NEW LIBRARY

FEASIBILITY STUDY

02.03.2010

DRAFT

RICK MATHER ARCHITECTS

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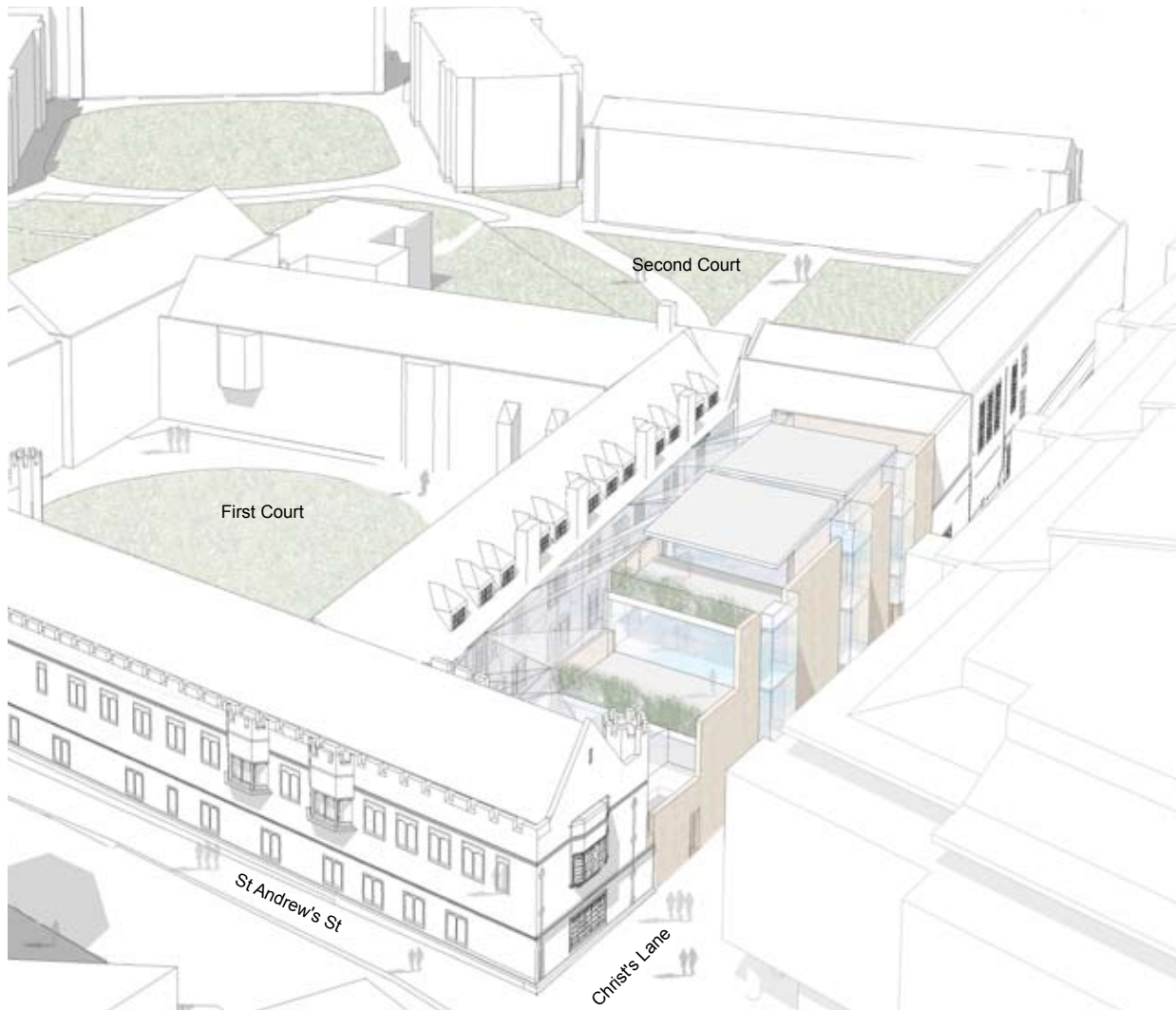
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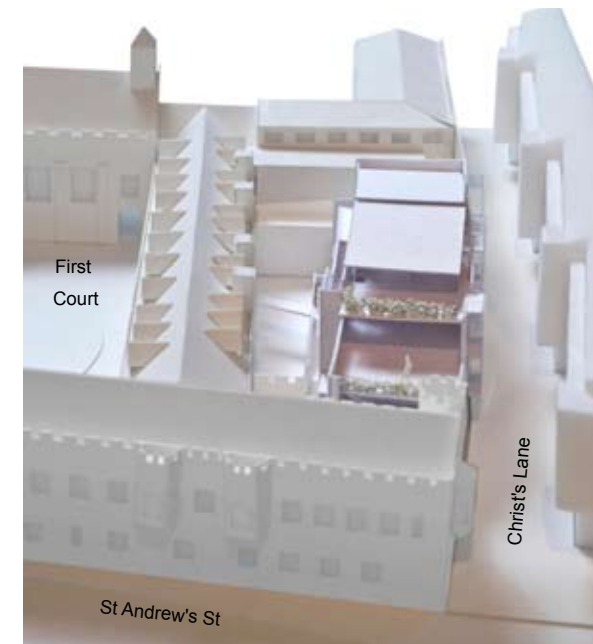
Rick Mather Architects were appointed in July 2009 following a thorough selection process, beginning with a list of a dozen architects. Since their appointment their new extension to the Ashmolean has met with acclaim. Our brief to them was to produce material suitable for fundraising. They have taken the design only as far as that: very considerable additional work will be needed before any construction can begin.



New Library Reading Room

We consider that Rick Mather Architects have produced an exciting design. Among its features are:

- It provides a building that the College can be proud of, with an improved entrance from First Court.
- It offers the prospect of many more students being attracted to work in the new building, as it offers a combination of traditional formal library working areas, less formal seating, discussion spaces and a cafe.
- Experience elsewhere has been that many students like to work in a cafe environment. It will also offer a new place for everybody in the College to meet: students, Fellows and support staff.
- The design makes maximum use of precious College land on the domus site.
- The space in the building is increased from c.405 sq.m to c.1200 sq.m, and so provides much-needed additional space for staff and students.
- It is highly eco-friendly.
- The space will be flexible and easily adaptable to other use, as the need might arise.
- Opening up the Old Library and making use of K4 will provide a new and very attractive working area and make public access easier to handle.



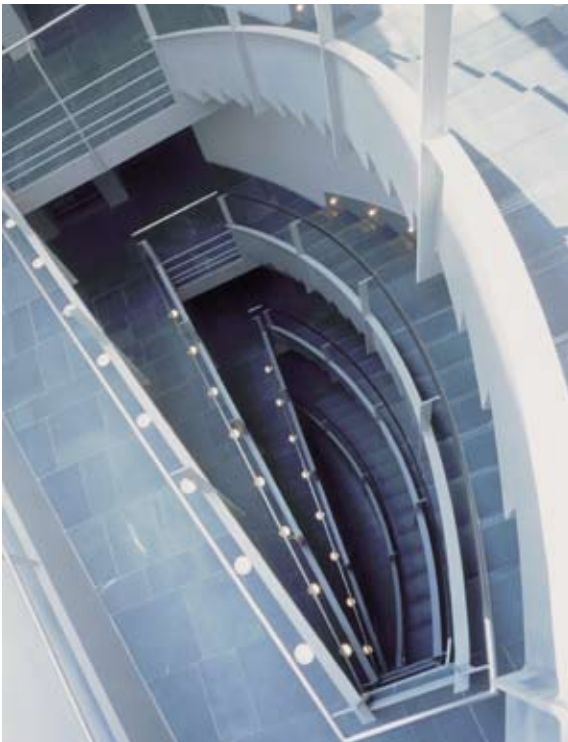
New Library in Context

RICK MATHER ARCHITECTS

Rick Mather leads a busy international architectural, masterplanning and urban design practice. Completed work spans both new build and renovation with a special interest in the cultural and education sectors. This is combined with a recognised and innovative expertise in the intelligent re-interpretation of existing, often listed structures and in sustainable low energy building.

Recently completed projects include the £61 million expansion and renovation of the Ashmolean Museum, and a new music auditorium for Corpus Christi College, Oxford.

Award winning projects include the renovation and extension of the Dulwich Picture Gallery, the Wallace Collection, the National Maritime Museum in London.



New buildings at Keble College, Oxford



Recently completed Ashmolean Museum, Oxford



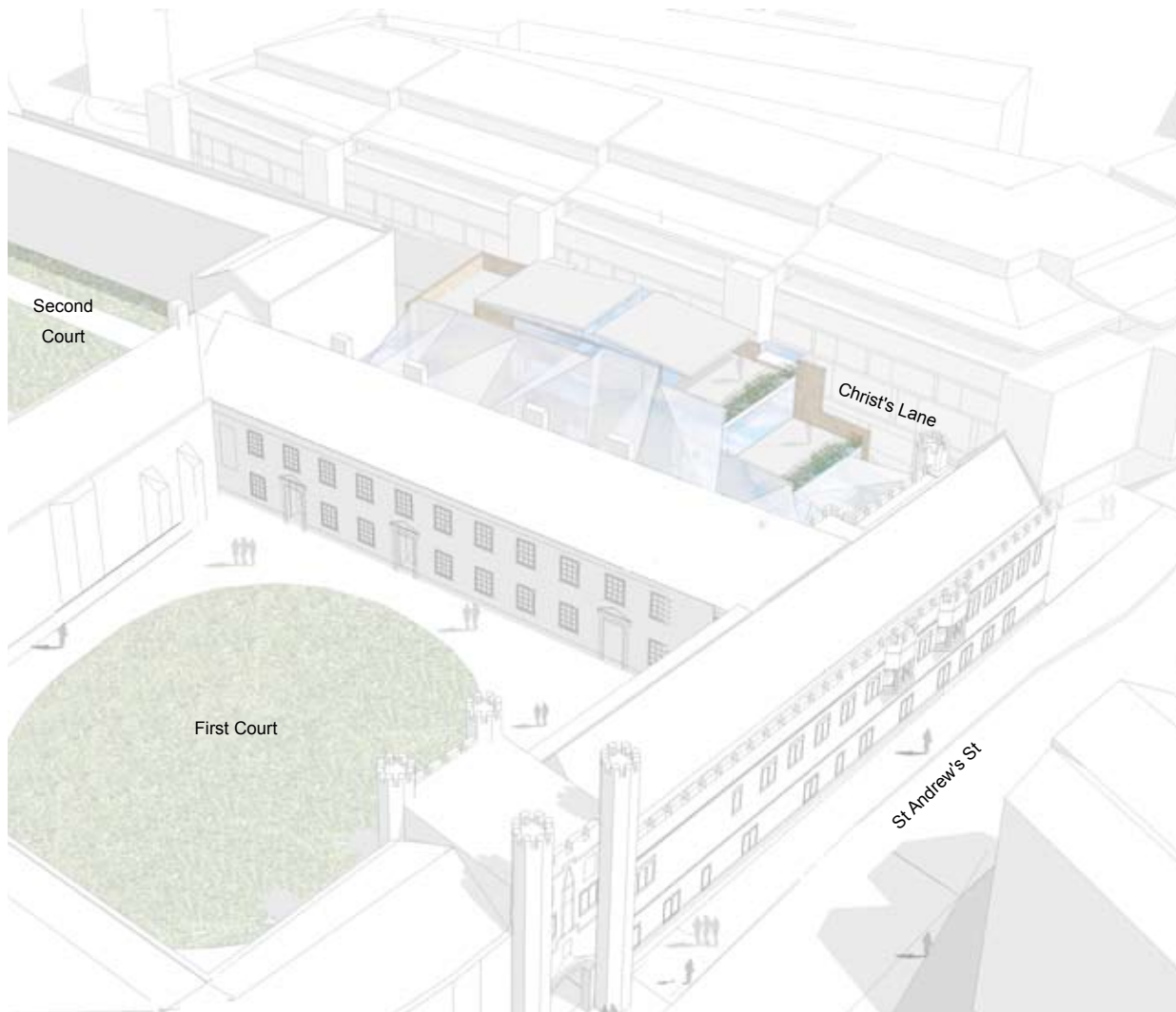
New Auditorium within city wall, Corpus Christi College, Oxford

INTRODUCTION

Rick Mather Architects have been asked to prepare this report outlining the design approach for a New Library project for Christ's College, Cambridge.

The proposed site for the New Library is an opportunity to build on a unique site in one of Cambridge's oldest Colleges - accessed directly from First Court. The brief calls for the creation of an inspiring new library which will serve the College community into the future.

The enclosed proposals meet all of the requirements of the brief whilst at the same time respecting the context and making as little physical impact as possible.

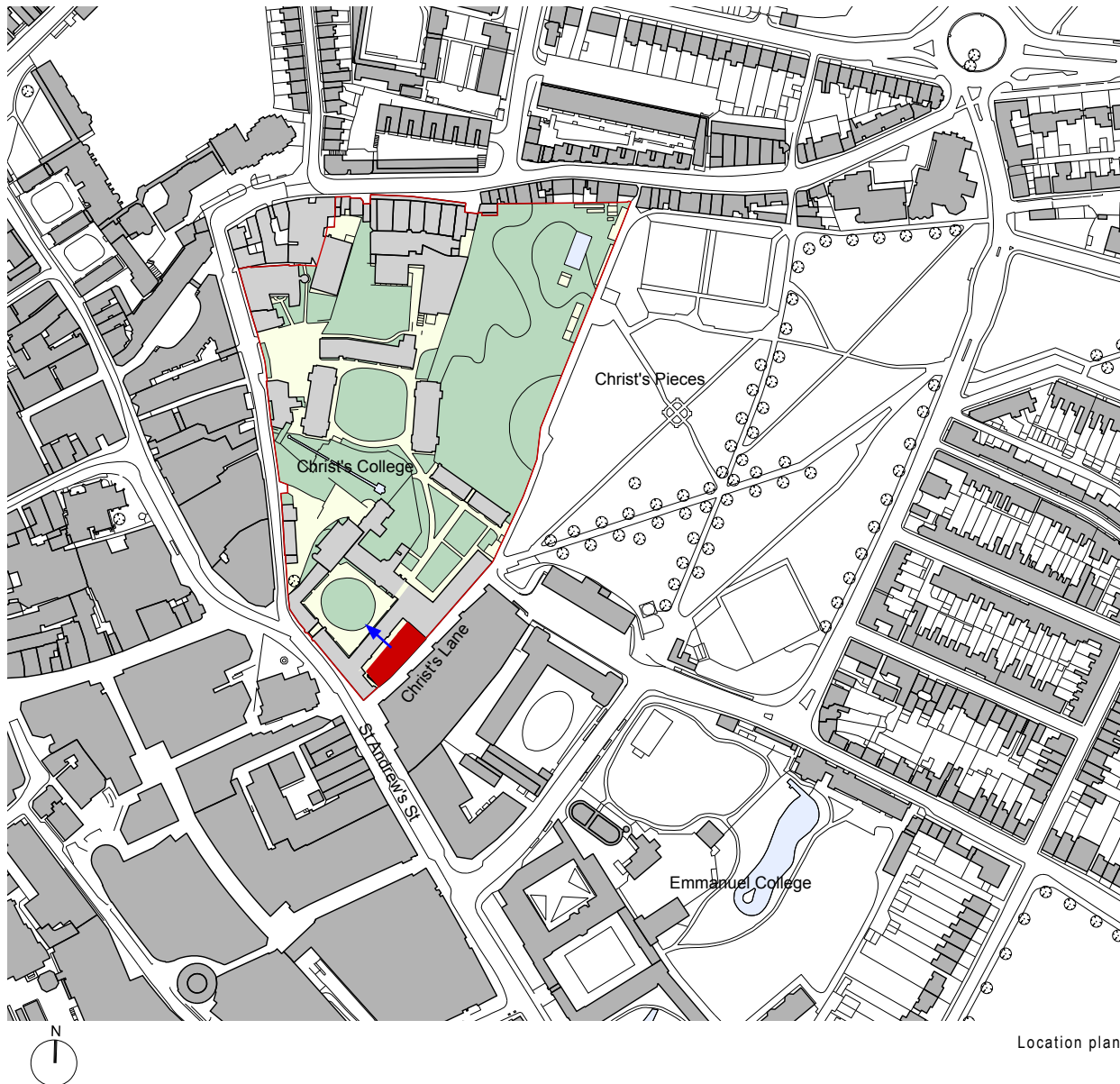


Proposed Aerial View from the West

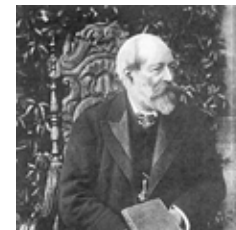
SITE

The small site lies in the southern corner of the college, nestling between existing First Court buildings and later kitchen extensions. A buff brick wall presently separates the site from Christ's Lane. The site is largely occupied by the existing library dating from the 1970s.

The College's desire to place the library at the heart of its academic community has led to the choice of this site over others. Its position will allow the library to have a first court presence along with other key College functions such as Chapel and Hall. It will also allow a direct connection with the Old Library designed by Bodley in 1895



Location plan.



"It is not in church work alone that Mr. Bodley has won his laurels. The addition to King's College, Cambridge, and the restoration of the library at Christ's College, and many other buildings show the same delicate care, the same longing for simplicity, truth, and repose."

W.M. Fawcett, Vice-President RIBA, presenting the 1899 Royal Gold Medal to Mr. G. F. Bodley

EXISTING LIBRARY ISSUES

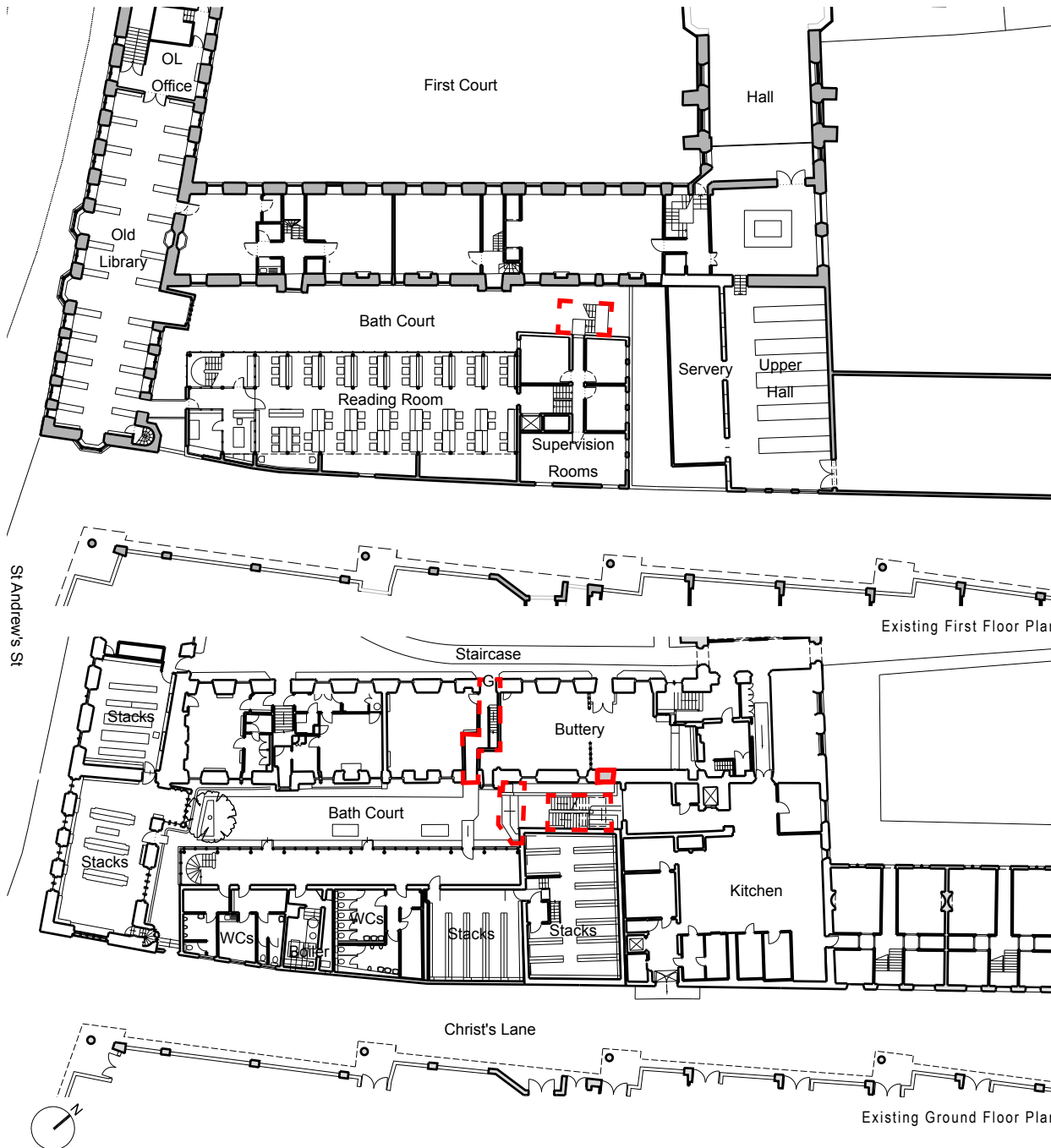
The existing library buildings fail to fulfil the College's need.

The existing collection of buildings include a converted lecture theatre, a 1970s library & bathroom building, and an 1895-7 library converted and extended from First Court.

The present reading room suffers from overheating in the warm months and only caters for around 60 readers when full. Book storage is almost at capacity and the staff facilities are minimal.

The highlighted issues include:

- Circuitous route through Staircase G
- The fire escape stair within the courtyard
- Blocked doorway into Buttery
- Multiple level changes in courtyard





Inactive Library facade



No breathing space for Bodley Library



Overbearing presence of plant

EXISTING LIBRARY ISSUES

The New Library presents the opportunity to improve existing College conditions and in the process improve the profile of the library within the College Community. Key amongst these issues is creating a clear direct First Court presence.



Fire escape compromises library court and blocked up historic doorway



Christ's Lane facade



Signs are required where architecture should speak for itself



Circuitous entry to existing Library court

EXISTING LIBRARY POSITIVE ATTRIBUTES

The New Library should take key positive attributes of the existing site and enhance them through creative design to best effect. The elements highlighted are not exhaustive but highlight key design drivers.

The potential to create a New Library adjacent to perhaps the oldest wall in College presents an inviting opportunity to make a statement about the College's past, present, and future in a single new building.



Potential to incorporate historic wall of First Court range



Potential First Court presence



Potential Buttery link



Potential to make the most of the Bodley Library

THE BRIEF

The brief calls for an interesting mix of reader spaces along with both open, and closed access shelving. Staff facilities are to be improved, and a purpose built rare books reading room with associated storage is also required. The new building is connected with the first floor of the Bodley Library in order that the two buildings can be used in conjunction.

The design provides:

117 Reader spaces in various configurations including:

24 Comfy seats

68 Seats in covered courtyard

4 Supervision / meeting rooms

2 Discussion rooms

1 Large meeting room

2 Set of toilets for intervals in hall

1 Purpose small built manuscripts store

Rare books reading room

Exhibition space

Generous staff accommodation, including tea area and store

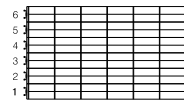
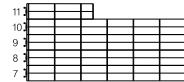
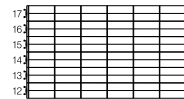
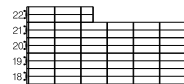
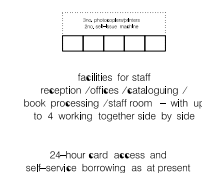
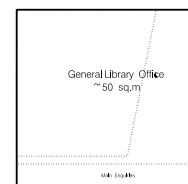
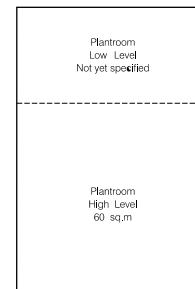
Shelving meeting the recommended split:

25% - 625 Linear metres open rolling shelves

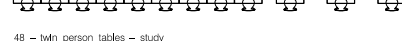
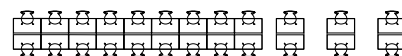
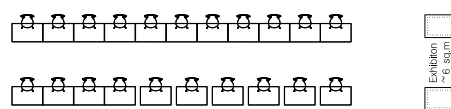
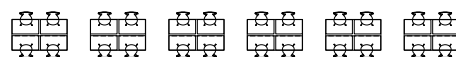
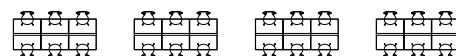
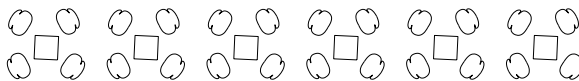
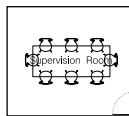
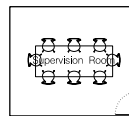
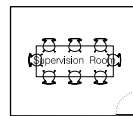
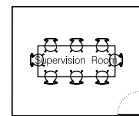
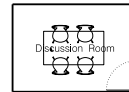
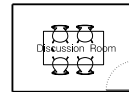
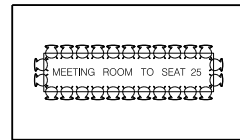
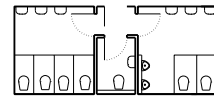
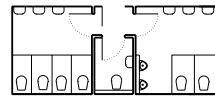
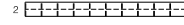
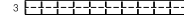
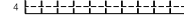
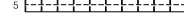
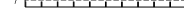
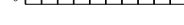
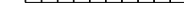
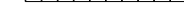
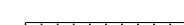
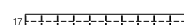
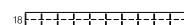
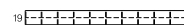
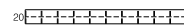
25% - 625 Linear metres closed rolling shelves

50% - 1250 Linear metres of open access

New Library site boundary



625 linear metres
on open rolling shelving



1250 linear metres
Proposed College 2500m split:
50% Open
25% Open Rolling
25% Closed Rolling

141 Desk Spaces
(1 desk for every 3 undergraduates)
flexible / designated laptop or
laptop free areas / group work /
use of larger materials like maps and charts

Site shown with Brief requirements at the same scale on one level

EXECUTIVE SUMMARY ENVIRONMENTAL CREDENTIALS

The New Library would employ several environmental measures to reduce its energy footprint. More detail can be found in the appendix but key features are:

- Ground Source Heat Pump for heating and cooling
 - Peak cooling loads achieved with adiabatic low energy ventilation system with energy recovery.
 - High thermal mass of structure to absorb, store and later radiate heat, stabilising the internal temperature.
 - Low energy luminaires such as LED's and fluorescent type lamps.
 - U-values to exceed building regulation requirements.
 - Tightly sealed facade to prevent air leakage.
-



Covered Court created from Bath Court



New Library entrance from First Court

OPTIONS APPRAISAL

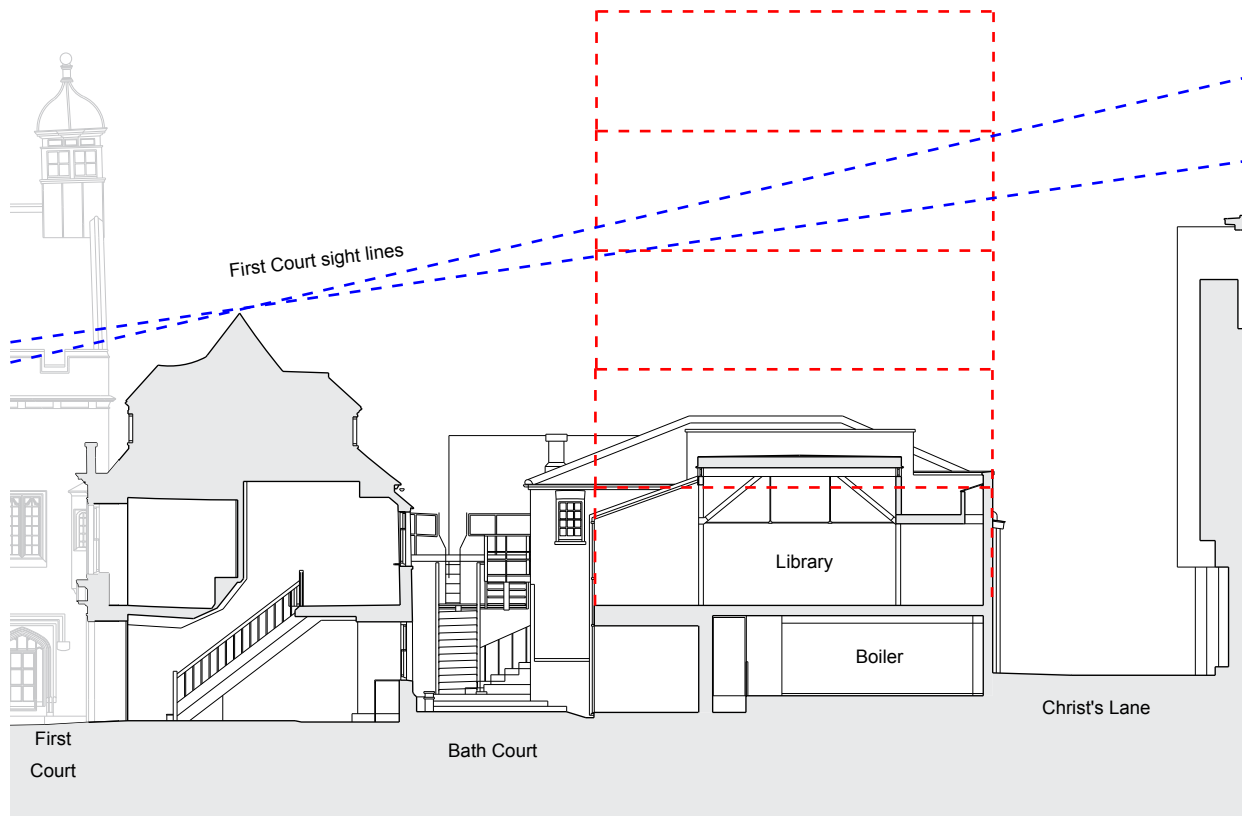
RETAIN EXISTING LIBRARY

The existing library fails to fulfil the needs of the College as outlined earlier in this document.

Refurbishing the existing library and converting the bathrooms into book storage would provide between 1/4 and 1/3 of the stated brief.

The existing library would need to have 4 1/2 floors more to fulfil the brief requirement. However this could not simply be 'added' to the top of the existing structure as it could not support it - it would need to be built afresh.

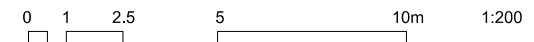
The other issue would be the interruption of sight lines from First Court as shown in the diagram as well as 'overpowering' Christ's Lane.



Section showing existing Library and expansion required to accommodate brief.



Existing Library facade to Christ's Lane

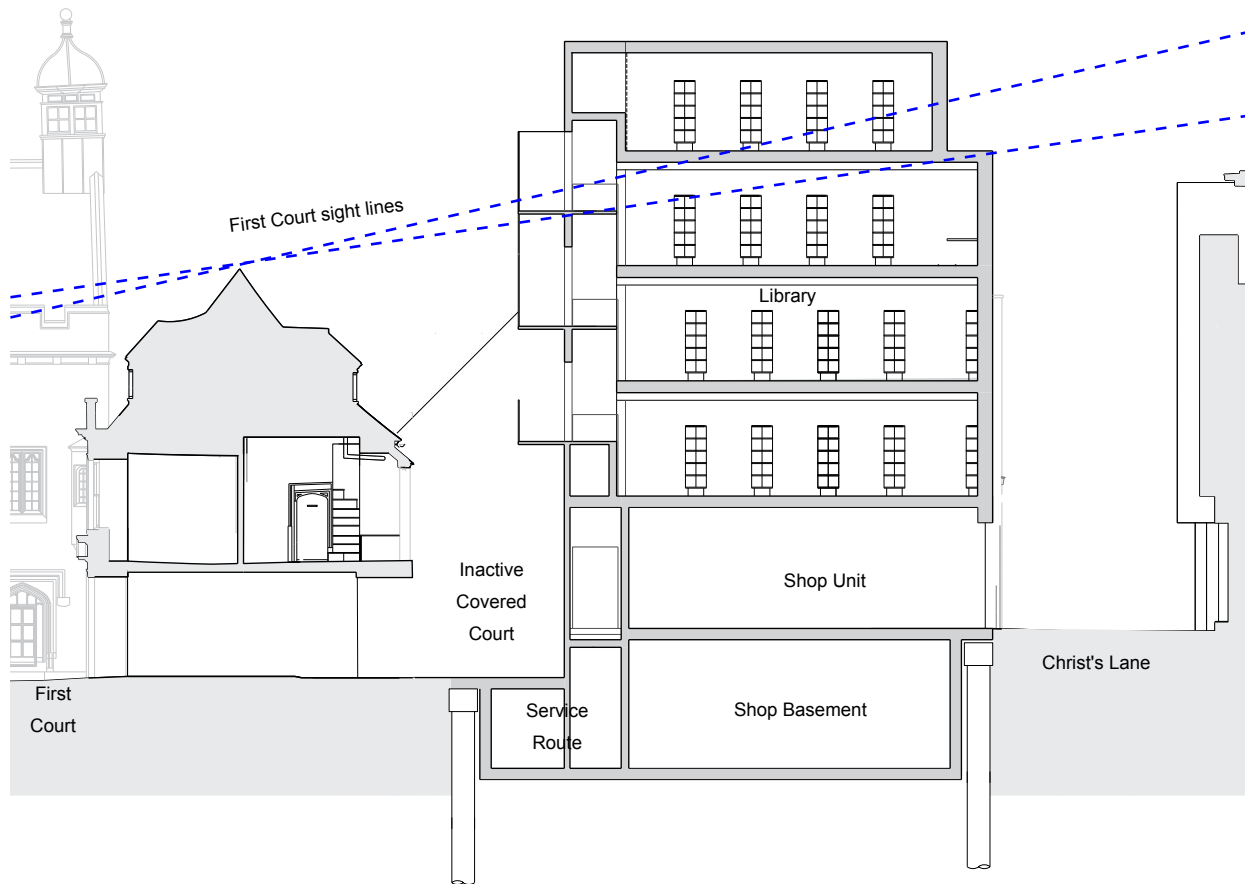


OPTIONS APPRAISAL

SHOP OPTION

The possibility of incorporating shops into a proposal was explored to help enliven Christ's Lane & provide potential income for the College.

As the section shows incorporating shops means a much larger proposal and also creates a blank facade - the rear of the shops - to College. Because the shops need a large floor-to-ceiling height (higher than a library) in both ground and basement, and the shops' datum is Christ's Lane - 1m above library court - a combined proposal ends up dwarfing Christ's lane and compromising views from First Court.



Section showing combined Shops and Library and relationship to sight lines from First Court



Effect of inserting shops below Library on facade to Christ's Lane

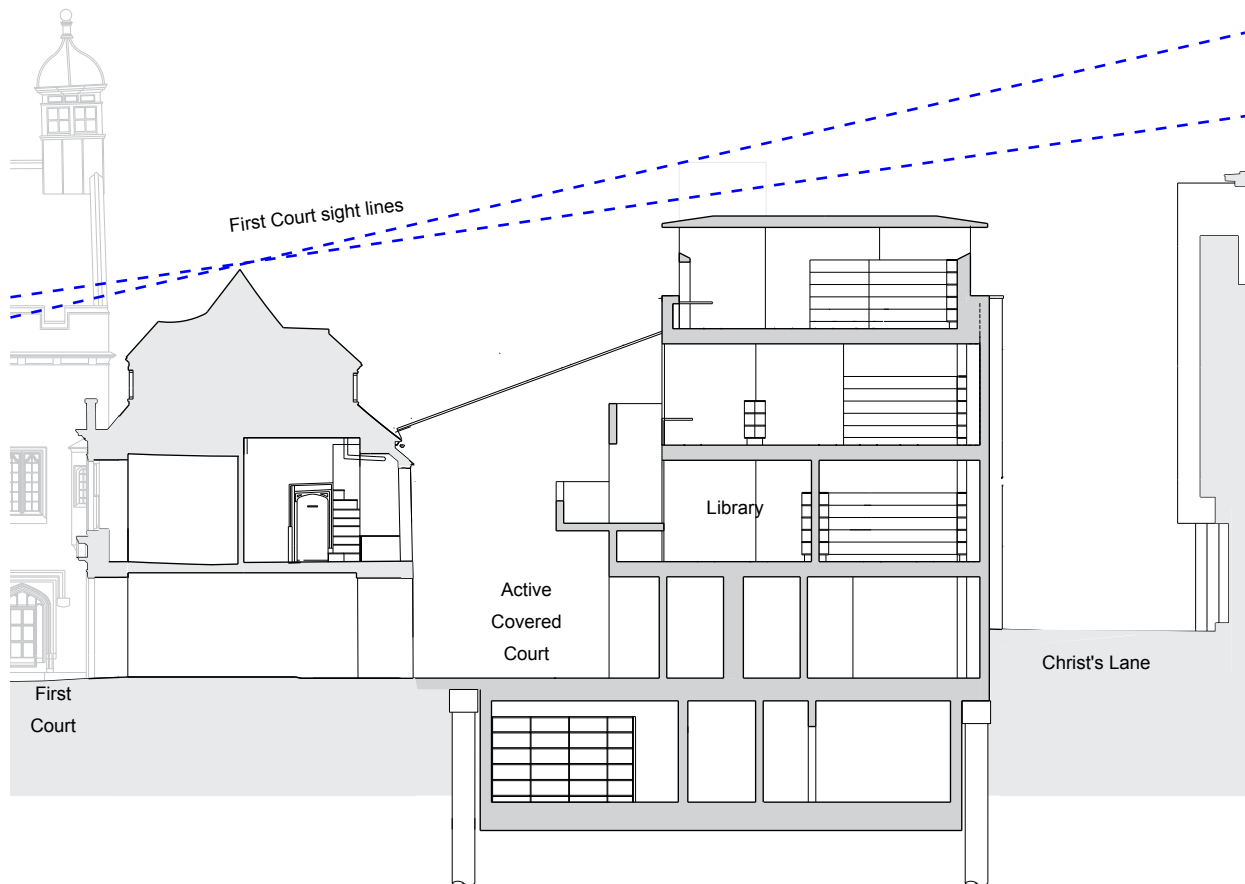
OPTIONS APPRAISAL

LIBRARY OPTION

The final option places a new build library on the site of the existing library & lecture theatre buildings.

The section shows how the library is lower than the shop option as its datum is library court and the floor-to-ceiling height can be lower. As the library can address library court it is possible to 'activate' this space by covering it and making an interstitial space between the cafe/buttery and the library 'proper' - A new communal space for the College.

It does not interfere with the sight lines from First Court and still provides a level of interaction with Christ's Lane through the use of large bay windows.

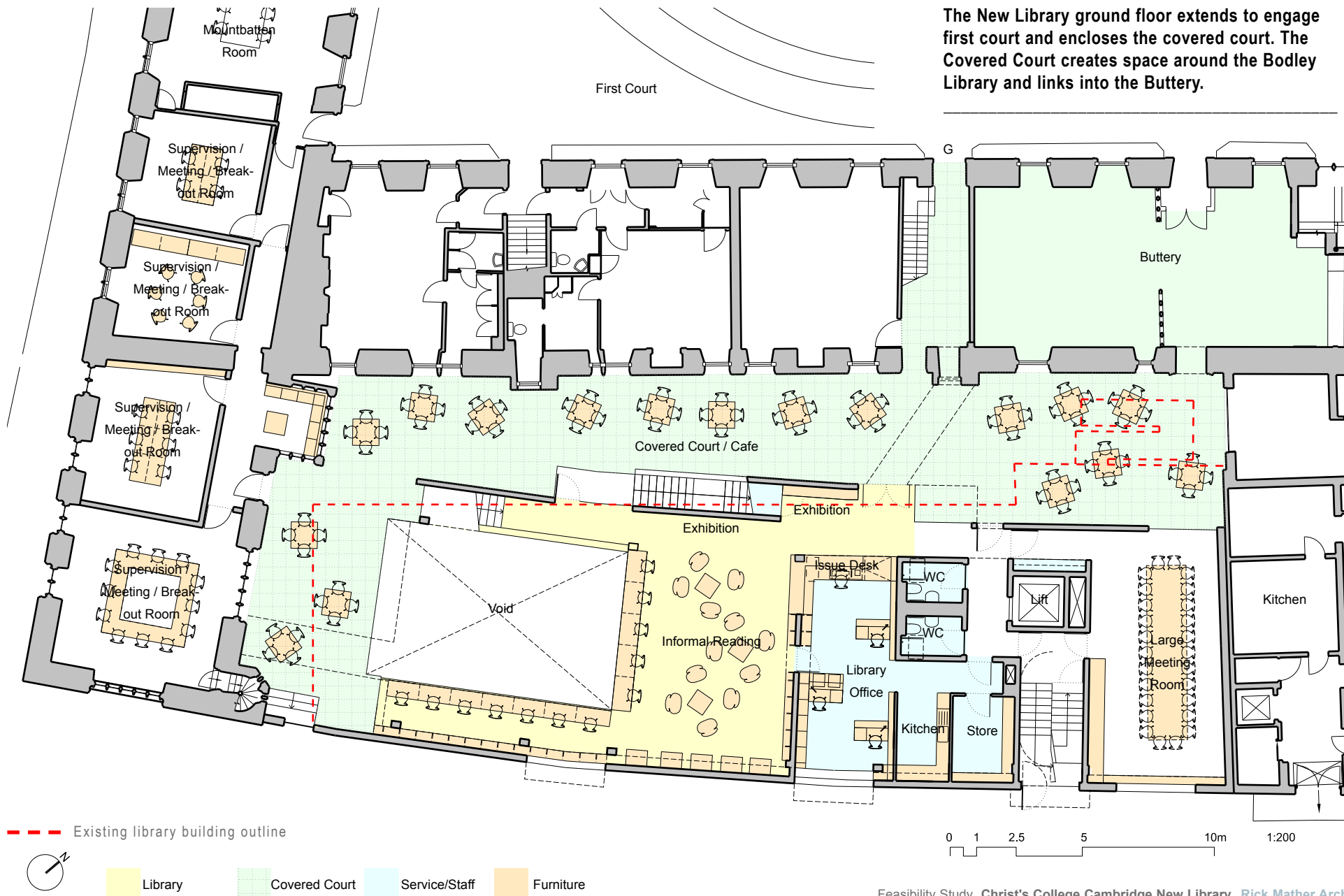


Section showing New Library sitting under sight lines from First Court and appropriately scale for Christ's Lane



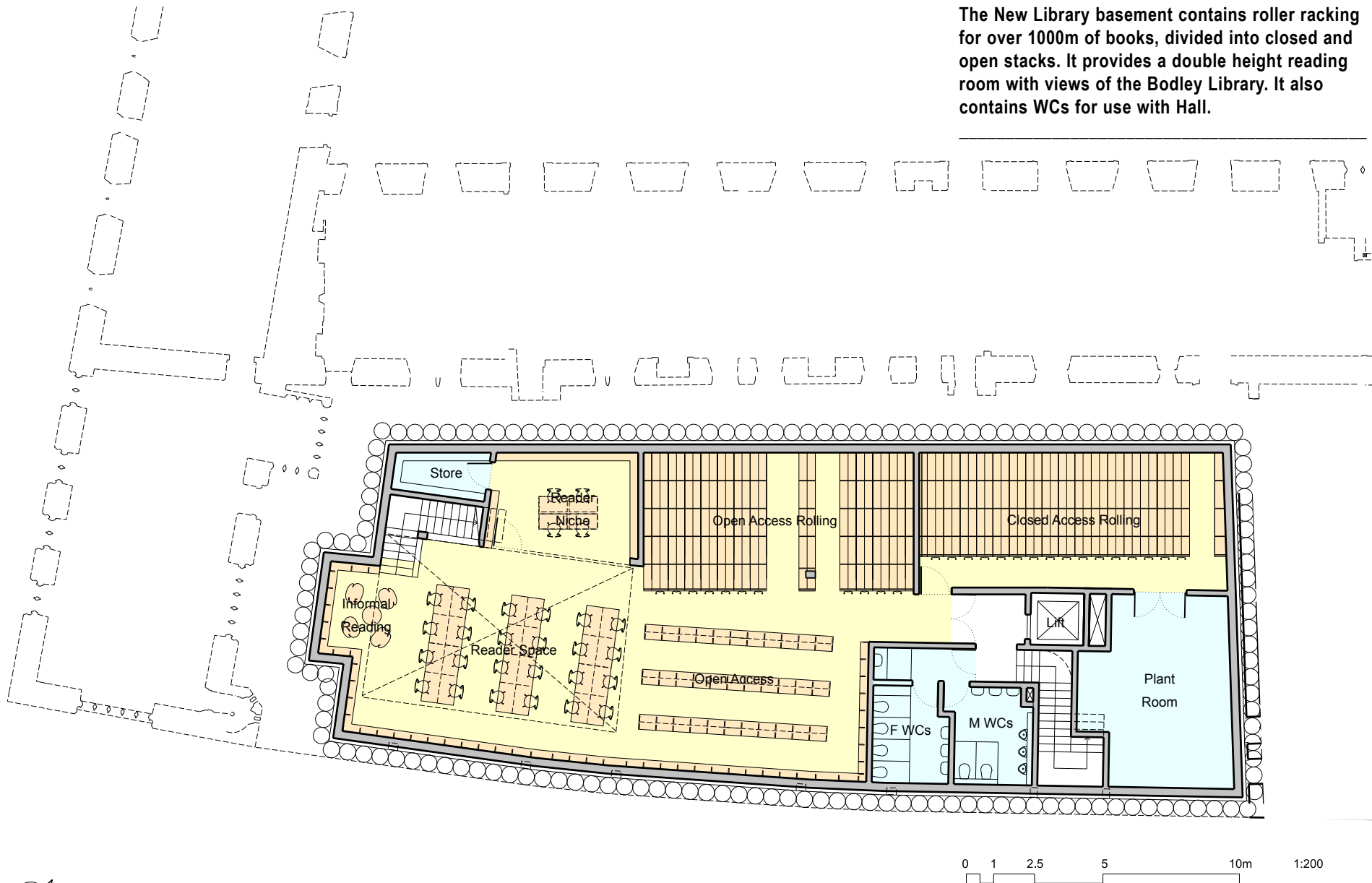
New Library proposed facade to Christ's Lane

PROPOSED GROUND FLOOR



PROPOSED BASEMENT

The New Library basement contains roller racking for over 1000m of books, divided into closed and open stacks. It provides a double height reading room with views of the Bodley Library. It also contains WCs for use with Hall.



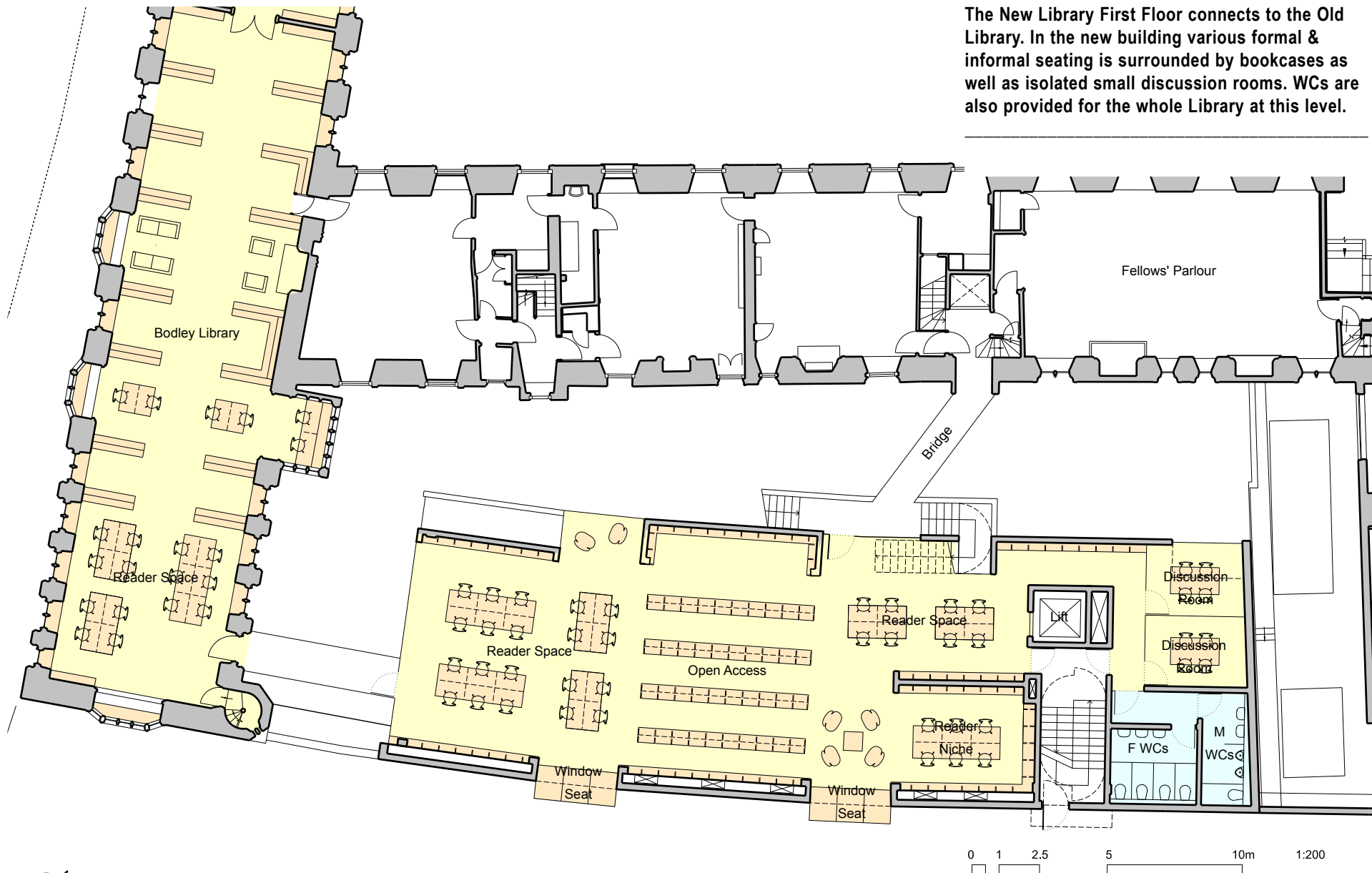
Library

Service/Staff

Furniture

PROPOSED FIRST FLOOR

The New Library First Floor connects to the Old Library. In the new building various formal & informal seating is surrounded by bookcases as well as isolated small discussion rooms. WCs are also provided for the whole Library at this level.



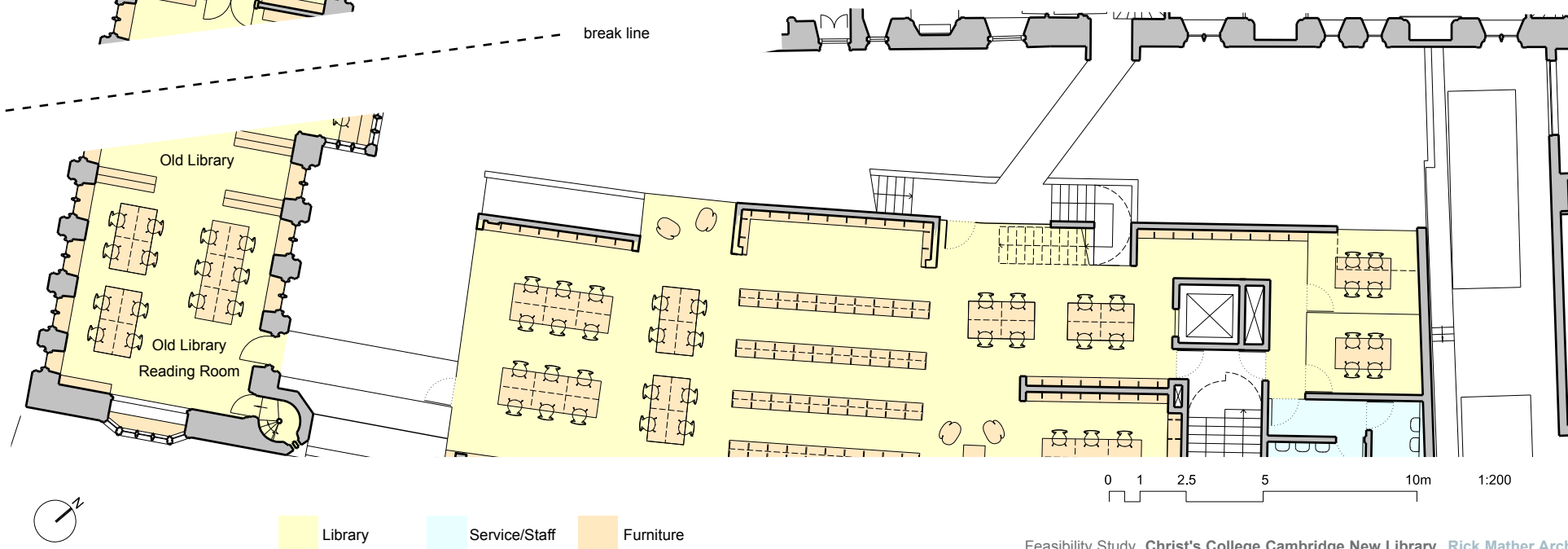
PROPOSED FIRST FLOOR OLD LIBRARY



Royal Horticultural Society pressed flower study room

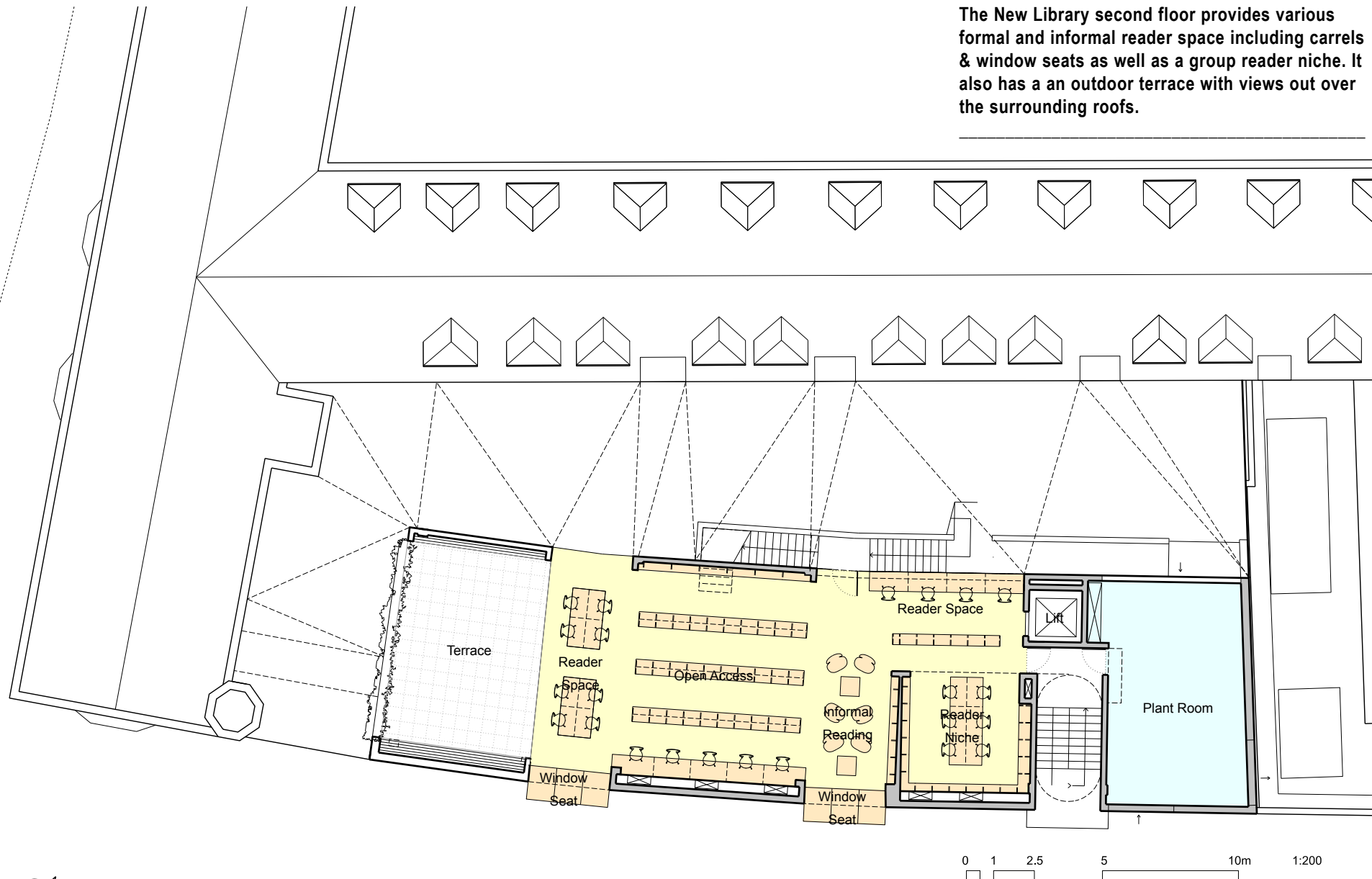
The New Library First Floor connects to the Bodley Library where a new 'Milton Study Suite' is created. K4 could be transformed into an Archive study room with a direct link to the Muniment Room. The existing Manuscripts store could be converted into an atmospherically controlled store for the College's most valuable documents. The existing Old Library Office could also become a reading room. Both of these rooms could be accessed independently from First Court enabling visiting groups to arrive without interrupting study in the New Library.

The Old Library is also shown with the central aisle cleared and a new 'reading room' shown at the Christ's Lane end allowing students to work within historic surroundings if they so choose.



PROPOSED SECOND FLOOR

The New Library second floor provides various formal and informal reader space including carrels & window seats as well as a group reader niche. It also has a an outdoor terrace with views out over the surrounding roofs.



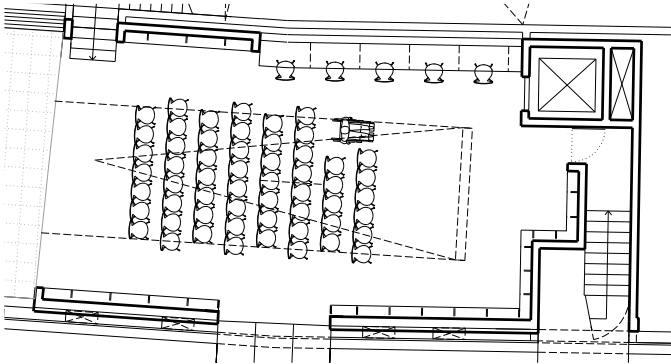
Library

Terrace

Service/Staff

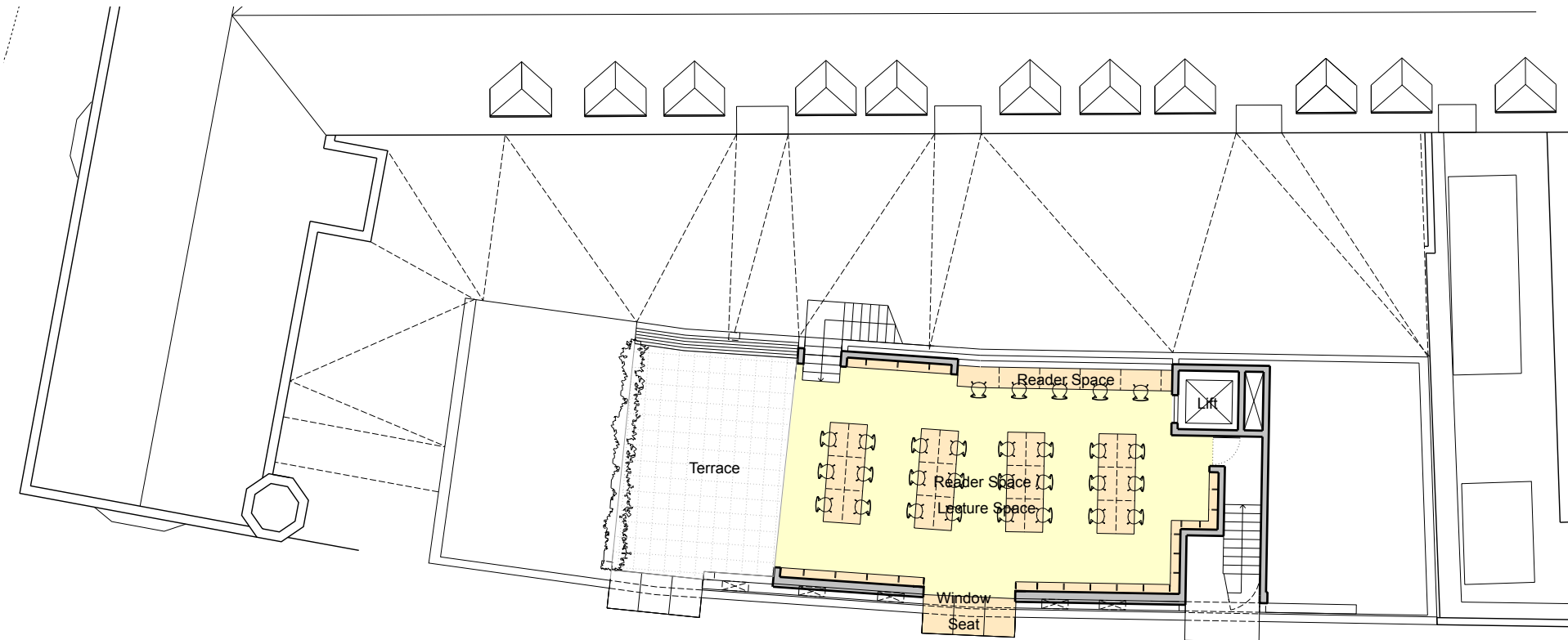
Furniture

PROPOSED THIRD FLOOR



Alternative arrangement for lecture

The New Library Third Floor is flexible and can provide various reader spaces or act as a lecture room for over 50 with projection. It also has an outdoor terrace with views of the Cambridge skyline.



0 1 2.5 5 10m 1:200



Library

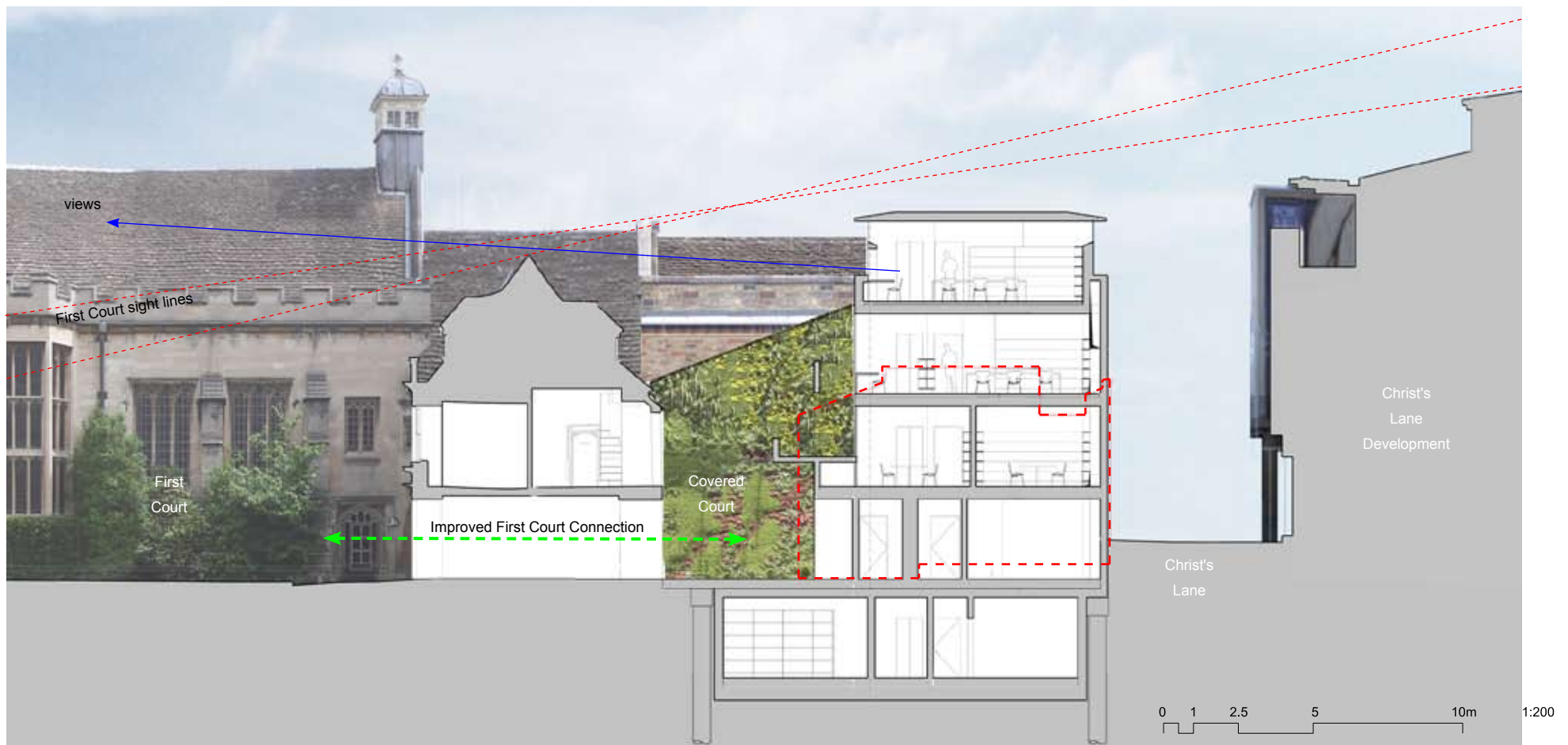
Terrace

Service/Staff

Furniture

SECTION

The section shows how the New Library steps back from the First Court Range and Christ's Lane, and falls below views from First Court. The Covered Court roof is supported from the New Library. Rearranging staircase G would allow a more direct connection with First Court, raising the Library's presence on First Court.



SECTION FROM CHRIST'S LANE

The section shows how the New Library steps back from the Old Library providing south facing terraces at 2nd and 3rd floor levels. The double height reading room gives views up to the Bodley Library, and the other floors have views through to the covered court and the patina of the old wall.



0 1 2.5 5 10m 1:200

ELEVATION CHRIST'S LANE

The Christ's Lane elevation takes cues from the Bodley Library and uses bay windows to create animation along the lane. The parapet wall height is taken from the Upper Hall building and then steps down to acknowledge the Old Library. A light coloured stone, or brick could be used to relate to the College's other buildings on Christ's Lane.



ILLUSTRATIVE VIEWS CHRIST'S LANE

The view along Christ's Lane shows the new bay windows, following Bodley's precedent, creating animation and adding a glass note to an otherwise solid elevation. The parapet wall height is taken from the Upper Hall building and then steps down to give the Bodley Library 'breathing space'.



Christ's Lane view with existing library



Christ's Lane view with New Library showing bay windows

ILLUSTRATIVE VIEWS FIRST COURT ENTRANCE

The New Library's presence on First Court could be improved through rearranging staircase G. The existing 1960s/70s staircase could be replaced to give a clear route, and view, into the covered court. Alternatively a new bridge across Library court could give access to the 1st floor landing of staircase G. (shown far right below)



Circuitous entry to existing Bath Court



Proposed rearranged staircase to New Library Court



Alternative bridge proposal showing clear route to New Library Court

ILLUSTRATIVE VIEWS COVERED COURT

The New Library, along with the First Court range, creates the Covered Court. This space can function independently of the Library and allows all year use, links to the Buttery, and enlivens a presently inactive space which can be used as a cafe.



Existing view showing external staircase and many level changes.



Proposed view showing Covered Court Cafe-
A hive of activity at the heart of the College

ILLUSTRATIVE VIEW 1ST FLOOR READING ROOM

The New Library creates framed views of the existing buildings surrounding the covered court. Bodley's Old Library is visible from the 1st floor reading room as well as views back to the First Court range.



New Library first floor Reading Room with views to Bodley facade and First Court range

APPENDIX

Service Engineering

Structural Engineering

Cost Statement



View over old library showing new library



Air returned for energy recovery -
summer / winter

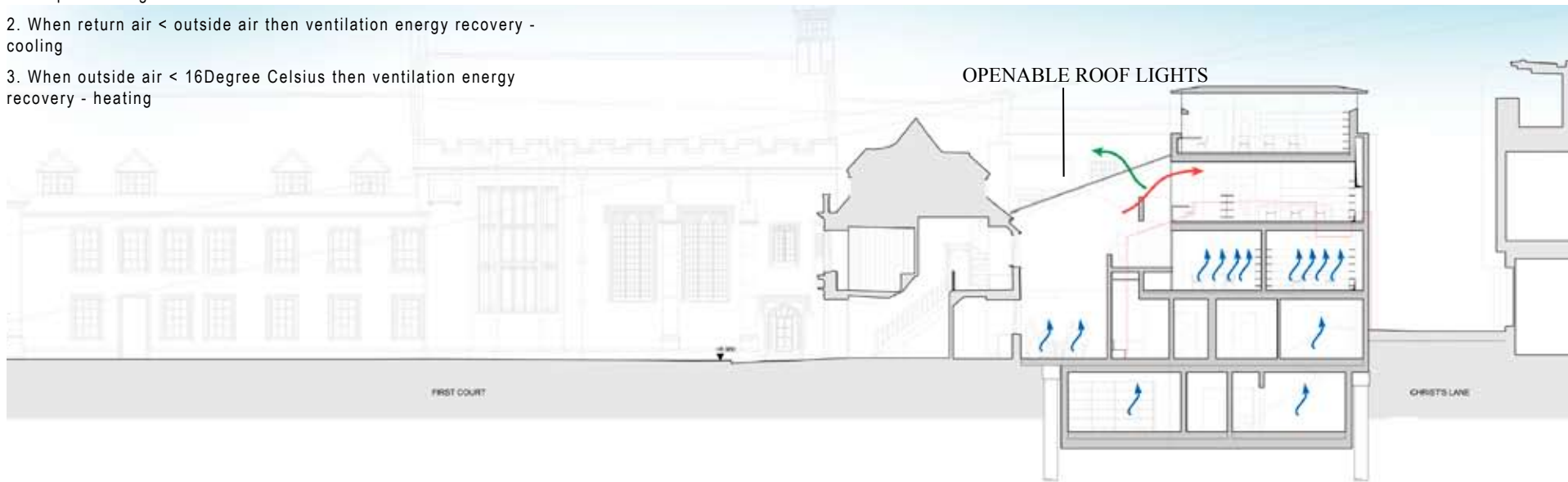


Air to outside - Spring / Autumn
connectivity to outside

1. When return Air > outside air and outside air > 16 Degree Celsius
then open roof lights - turn off extract fan

2. When return air < outside air then ventilation energy recovery -
cooling

3. When outside air < 16Degree Celsius then ventilation energy
recovery - heating



The form and structure of the New Library have been considered in order to design out as many engineering services as possible. The library will achieve this with high levels of thermal insulation around a heavyweight structure, an airtight envelope and effective use of glazing for daylight to minimise carbon dioxide emissions utilising passive solar design and low energy solutions. Significantly reducing the overall energy consumption will maximise the contribution of the proposed renewable technologies.

The library's close proximity to a busy shopping street and the presence of street buskers prevents openable fenestration if quiet study is required. Therefore the Library in the main will be mechanically ventilated using a displacement system. This type of system functions by introducing air at low velocity at low level at a

temperature only slightly cooler than the desired room air temperature. Natural convection from heat sources, such as occupants and equipment, then cause the air to move upwards where it is exhausted at high level.

This ventilation strategy works well with the heavyweight concrete frame to maximise the structure's thermal performance. This is essential in reducing plant size as the thermal mass of the structure can absorb, store and later radiate heat, stabilising the internal temperature of the building. Exposed concrete absorbs much of this heat, and can reduce day time temperature by up to 5°C.

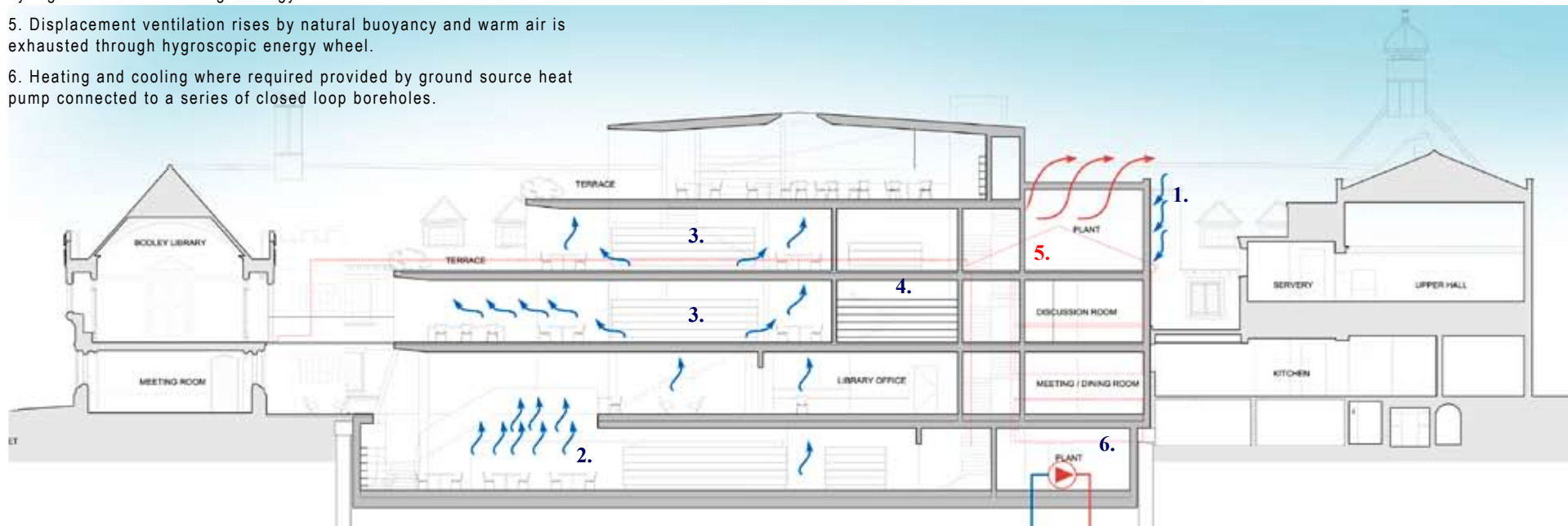
When circumstances permit, such as summer and winter, energy is recovered efficiently by the ventilation system and used to temper the incoming supply air. A further benefit of the

system is the use of full fresh air in both winter and summer without any energy-cost penalty.

The covered courtyard space will make use of a mix-mode ventilation approach. This can be described in simple terms as a combination of natural ventilation and mechanical systems that provides thermal comfort in either passive (natural) or active (mechanical) modes. The benefits of the system will mainly be seen in spring and autumn when the temperature is mild enough to have the windows open to maintain comfortable internal temperatures.

The renewable energy type proposed for the Library development is a ground source heat pump utilising vertical bore pipework. Ground source heat pumps (GSHP) extract heat from the ground.

1. Fresh air drawn through adiabatic ventilation plant.
2. Supply air to basement from raised floor.
3. Supply Air to uppers floors from beneath book cases.
4. Exposed concrete soffit absorbs some heat during the daytime released by night time 'free' cooling strategy.
5. Displacement ventilation rises by natural buoyancy and warm air is exhausted through hygroscopic energy wheel.
6. Heating and cooling where required provided by ground source heat pump connected to a series of closed loop boreholes.



The lighting throughout the Library will consist generally of low energy luminaires such as LED's and fluorescent type lamps. General control will be a combination of automatically responding to daylight level and occupant presence/absence detection.

While the proposals set out in this document may vary as the design progresses, the essence of energy efficient and renewable energy measures will remain priorities. The design proposals set out in this report will be continued through the project in order for the Library to demonstrate a practical, sustainable and ultimately energy efficient building within its location constraints.

It is also proposed to incorporate renewable energy technologies as part of new building. The location, and building type do, however, make the inclusion of some renewables less effective in contributing to the reduction of the building's carbon emissions.

Options explored but discounted include:

Solar Collectors – potential visual impact and limited hot water demand for hand washing.

Photovoltaics – potential visual impact and area would provide minimal electrical contribution of building total demand.

Biomass Boilers – concerns with space available

for storage, discharge of fumes requiring a tall flue and delivery of the biomass itself.

Wind Turbines – visual impact and built environment reduces effectiveness due to interrupted air paths.

Combined Heat and Power – concerns with attenuating noise from the engine generator. Also efficient sizing to suit base heat load would mean additional heating sources would also be required.

As part of the development the old heating plant serving the majority of first court will be relocated and replaced with new modulating condensing boilers reducing the current energy demands.

STRUCTURAL ENGINEERING



Elevated view showing New Library over Old Library with Christ's Lane development to the right

The structural scheme has been developed with Rick Mather Architects and Mott MacDonald service engineers to provide a building that has high thermal mass up to and including the third floor, and with a lightweight, well insulated construction at the top level.

Substructure

It is anticipated that the new basement will be constructed using reinforced concrete contiguous piled retaining walls that can be installed from ground level. Some of the piles will extend to sufficient depth to be able to carry the vertical loads from the superstructure above. Reinforced concrete piles will also be required under the internal columns and walls. The basement slab will be constructed using reinforced concrete and will be keyed into the piled wall. It is anticipated that the ground water table is above the level of the basement slab. So it will need to be designed to resist upwards water pressures. This also means that we recommend that the basement be lined with a drained cavity and raised floor.

A geo-technical site investigation will be required to confirm the required diameter and depth of the piles, the level of the ground water table, and the nature, depth and width of the foundations of the existing buildings.

Superstructure

The superstructure is constructed up to the third floor level using a reinforced concrete frame with flat concrete slabs. The exposed soffits of the slabs will provide thermal mass. Stability is provided by concrete shear walls. The top level will be constructed using structural steel columns, with steel beams and metal decking for the roof.

Courtyard Roof

Various options for supporting the roof have been considered. It is proposed that the framing of the roof will be provided using steel beams, which will be integrated into the overall form of the roof planes. It is proposed that those roof beams should be propped by inclined struts that are connected to the new building at the floor levels. This would avoid the need to apply new loads to the existing buildings. It may be necessary in some locations to apply vertical loads to the existing walls. If this proved necessary, it would be ensured that these loads were applied axially to these walls, so that there will only be a small increase in the compressive stresses, but that any additional bending would be avoided. This would need to be developed as the design progresses.