BRANDON UNIVERSITY

John R. Brodie Science Centre

Preliminary Assessment & Conceptual Design Recommendations for Brandon University

February 2019

prairie architects inc.

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Crosier Kilgour & Partners

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Part 1 - Executive Summary

Overview
In June of 2018, Brandon University commissioned Prairie Architects Inc. to undertake a preliminary assessment of the Faculty of Science within the John R. Brodie Science Centre. The five-storey, 139,546 sf building was constructed in 1970 with the intent of creating flexibility and maximizing shared spaces between each of the departments within the Faculty. Nearly 50 years later, the existing infrastructure no longer fully supports today's modern demands of science and technology education and research within the faculty, and while the original intent of flexibility remains today, there are many current constraints that limit the Faculty of Science in this regard. As such, Prairie Architects Inc., along with a team consisting of Manshield Construction, Wolfrom Engineering Ltd., SMS Engineering and Crosier Kilgour & Partners, was tasked to make conceptual design recommendations related to the current and future teaching and research space needs of the Faculty of Science and broader Brandon University community.

Summary of Process
The process began with an existing building condition assessment, after which specific user and departmental information was gathered via an online survey and department chair interviews. All the collected data was compiled as a quantitative and qualitative user data summary. Based on the findings, as well as pre-established $20M and $40M development budget thresholds, two conceptual design approaches were developed to maximize the use of existing structures and make the most efficient use of existing resources.

Recommendations
Each of the conceptual design recommendations presented in this report maximize the use of the current John R. Brodie Science Centre and make the most efficient use of existing resources.

The $20M recommendation contemplates a 'refresh' of the existing building for essential infrastructure related upgrades including hazardous materials abatement, building envelope upgrades and repair, code compliance and mechanical and electrical system upgrades. After accommodating these upgrades, a modest amount remains in the budget to account for some new furniture, fixtures and equipment and selected new finishes. However, the $20M recommendation leaves little room for addressing some of the key programmatic, functional or layout concerns and does not allow for a more significant building modernization.

The $40M recommendation radically re-envisions the existing building with a complete retro-fit of the space within the existing building's structure and shell. The concept was borne out of an assessment of the existing space allocation and utilization. Based on this assessment, it was determined that there are inherent opportunities to create a more efficient layout for departments; to consolidate circulation and improve wayfinding; to use space more efficiently; and ultimately to reallocate the area savings to better and higher use. The scope of work includes a full hazardous materials abatement, new mechanical and electrical systems, complete code upgrades, and a fully modernized building with new furniture and equipment. The $40M recommendation addresses the desired functional planning and programmatic concerns as well as occupant safety, health and well-being with completely new systems, layouts and fit-up. It transforms the existing floors by repurposing the area allocated to the existing central service corridor, pushing the classroom and laboratory spaces to the perimeter, and carving a large light-filled central atrium vertically through the entirety of the building. The planning not only makes more efficient use of space, but also improves the amount of daylight in regularly occupied spaces, enhances wayfinding opportunities, creates tacit learning opportunities through enhanced physical connections, facilitates informal and formal meeting and interdepartmental collaboration, addresses occupant safety and security, and improves ventilation and energy efficiency with a sustainably re-envisioned plan, centred around a light-filled atrium.

Buildings are responsible for an enormous amount of global energy use and according to the 2018 Global Status Report, building construction and operations account for 36% of global final energy use and 40% of energy-related carbon dioxide (CO2) emissions in 2017. The sustainable approach of the $40M recommendation creates quantifiable benefits in direct area savings and space efficiencies, as well as long term operational and maintenance cost savings. As a deep retro-fit of an existing Brandon University asset, the $40M recommendation is both fiscally and environmentally responsible. A retro-fit of the John R. Brodie Science Centre addresses head-on, recommendations made by the Canadian Green Building Council in response to the Vancouver Declaration on Clean Growth and Climate Change, which committed Canada to meeting or exceeding the federal government's 2030 target of a 30% reduction below 2005 levels of GHG emissions.

Future Expansion and Growth

This report addresses strategies for meeting future need and growth. Although the original findings informing the user data summary did not indicate the need for a significant amount of increased space over and above current provisions in the existing building, subsequent feedback indicated that future growth and expansion opportunities should be considered. Part 7 of this report outlines three different levels of growth and expansion feasibility including: increased utilization; an expansion of the fifth floor; and a four-storey new construction addition to the north of the existing John R. Brodie Science Centre.

Part 2 - Existing Building Assessment

Section 1.0 Background and Overview

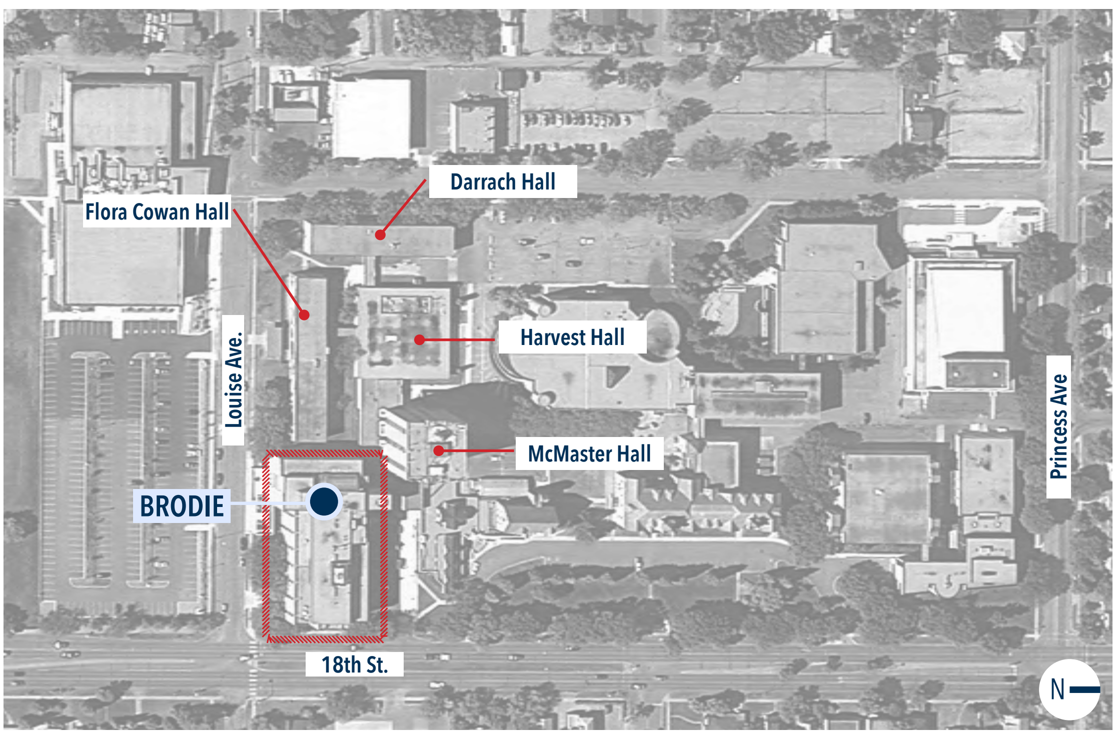
The existing John R. Brodie Science Centre was constructed in 1970, officially opening in May of 1972, and is located at the south east corner of the Brandon University Campus.

The Brandon University 1971-72 Yearbook, "Sickle", notes that the facility cost $3.75 million and was a replacement to the "Old Science Building constructed in 1922 and the H Huts brought to the campus in 1956 to accommodate the overflow of science students." The publication further describes that the building was planned with a central core and peripheral corridors so that each floor could be divided in a system of discipline-pairing. The intent was for flexibility and maximum sharing of space and facilities. For example, the third floor housed geography with the related disciplines of botany and zoology and it was stated that, "pairing the two biological sciences allow(ed) for unusually high utilization, including the sharing of labs, microscopes, and other facilities."

While the original intent of maintaining a facility with flexibility and sharing of space still remains today, there are many current constraints that limit the Faculty of Science in this regard, to which this report will address. In order to begin the assessment, an overall understanding of the building and its site is necessary.

Site & Context

The existing John R. Brodie Science Centre is situated at the corner of 18th Street and Louise Avenue, in the south east corner of the approximately 14.3 acre site of the Brandon University Campus (refer to attached campus map). The site fronts onto Louise Avenue to the south and 18th Street to the east. The lower level opens to an exterior sunken plaza to the north and, connected via an underground level called the "Down Under", there is access to McMaster Hall (co-ed residence), Flora Cowan Hall (women's residence) and Darrach Hall (men's residence) via the main dining hall, Harvest Hall to the west of the John R. Brodie Science Centre.



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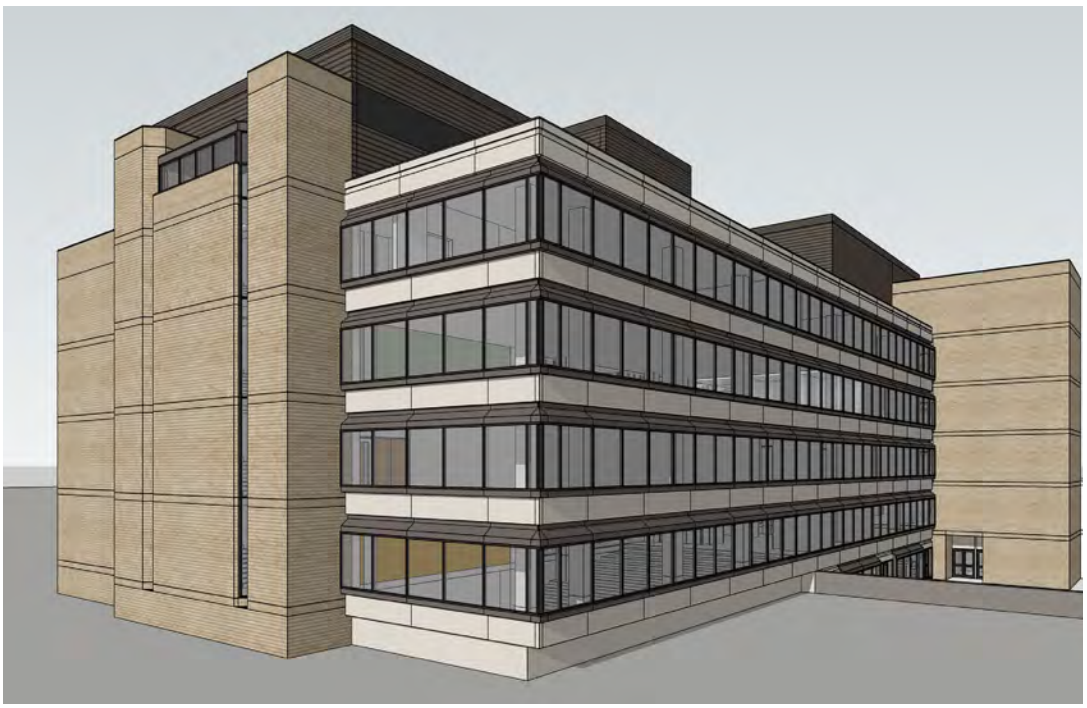
left: Brandon University Campus, with the John R. Brodie Science Centre at the corner of 18th Street and Louise Avenue



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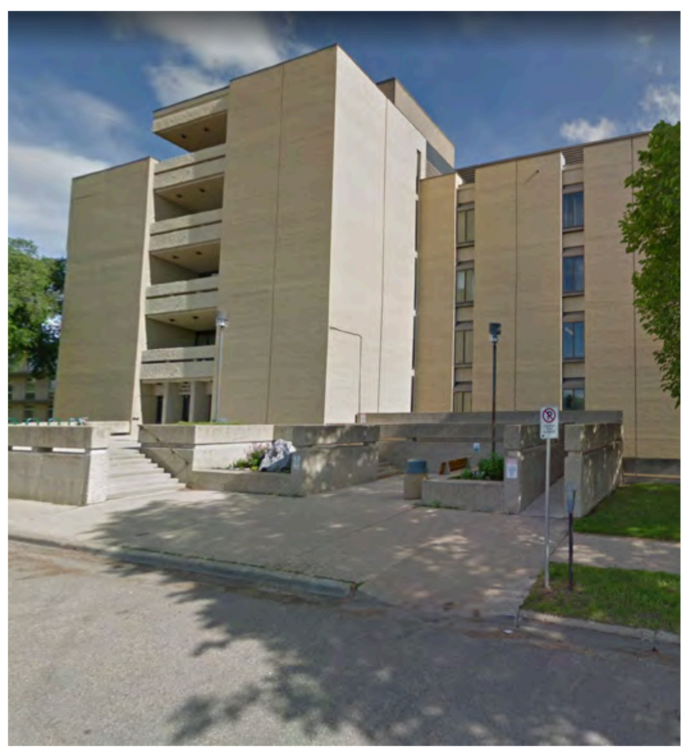
3D computer modelling of existing building. top: view from 18th Street showing the north and east facades; bottom: view from Louise Avenue, showing the south facade.

Services & Utilities

The existing building is serviced by a 15" diameter storm drainage system that connects to the mains on Louise Avenue. The sanitary sewer is connected via an 8" diameter line to an existing catch basin on Louise Avenue. Two 6" water supply lines are routed from the main on Eighteenth street into the building for domestic water and fire protection services. Natural gas is piped from the main on Louise to the facility to provide natural gas for processes. Originally, a 6" high pressure steam line from the central powerhouse provided heating and humidification to the building, which is now a low pressure line. The condensate is returned to the powerhouse through a 3" condensate return line. Chilled water generated within the John R. Brodie Science Centre is distributed to five other buildings on campus through the 6" and 8" distribution piping, including McMaster Hall, Harvest Hall, Darrach Hall, Flora Crown Hall, the Knowles Douglas building and the Healthy Living Centre.

Electrically, 4160 volt, 3 phase electrical service is provided from the Dining Hall main distribution to the John R. Brodie Science Centre main distribution, "Distribution A" located in the penthouse mechanical room via 5kV cable routed through the pedestrian street tunnel. The emergency power distribution system in the building feeds several buildings on campus including McMaster Hall and Dining Hall. Original construction drawings show telephone service provided from the main telephone cabinet in the Dining Hall to the John R. Brodie Science Centre main telephone cabinet in room GM3 via Cat3 cable in a 3" conduit routed through the pedestrian street tunnel.



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top: Exterior sunken plaza to the north of the building; middle: curtain wall glazing on north facade; bottom: Main entry on Louise Avenue showing balconies and typical punched windows on south facade

Current Layout and Organization of Departments

The organizational structure of the Faculty of Science is comprised of eight departments and one program.

The departments include:
- Applied Disaster and Emergency Studies
- Biology
- Geography
- Geology
- Mathematics and Computer Science
- Physics and Astronomy
- Psychology

The programs include:
- Environmental Science
- Master of Science Environmental and Life Sciences (MELS)

In general the six storey John R. Brodie Science Centre is organized departmentally and per floor. A typical floor distributes spaces according to use. The main north-south corridor is located on the west side of the building providing access to approximately the 1/3 of the building predominantly containing classrooms, seminar and meeting rooms as well as offices as shown in dark blue in the diagram below. The remaining 2/3 of the building to the east is typically divided into different zones of use and circulation:
- teaching laboratories and classrooms are on the north side of the building (shown in green in the diagram below), accessed off a perimeter corridor along the north exterior window wall;
- a central service and circulation spine, which provides storage and access to both the teaching and research laboratories;

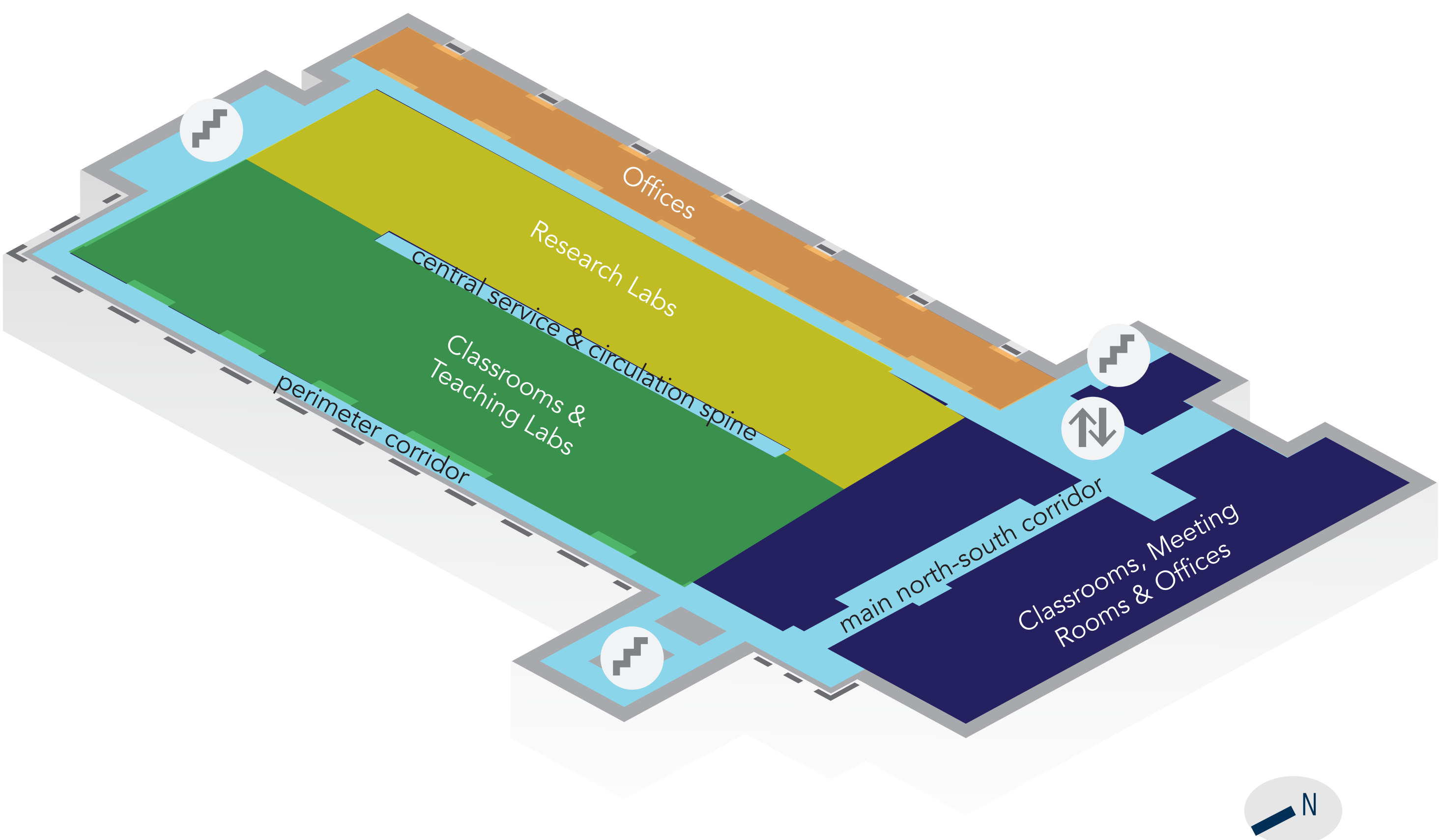

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diagram above: shows the general space distribution and layout per floor

- internalized research laboratories and/or classrooms depending on the floor level (shown in yellow); and
- across the hall, offices along the south side of the building (shown in orange).

There are three exit stairs located at each the north, east and south ends of the building as well as two elevators, which service all six levels of the building. Each floor has variation in layout and organization depending on the department it serves. The following is a per floor breakdown of area and use:

Ground Floor - 24,752 sf
- Biology
- Psychology
- Mathematics & Computer Science,
- Geography
- Applied Disaster & Emergency Studies, and Geology.

First Floor - 24,951 sf
- Psychology
- Mathematics & Computer Science
- Geography
- Administration

Second Floor - 25,026 sf
- Chemistry,
- Physics & Astronomy
- Geology

Third Floor - 25,026 sf
- Biology
- Geography
- Geology

Fourth Floor - 25,026 sf
- Biology
- Physics & Astronomy
- Geography
- MELS

Fifth Floor - 14,765 sf
- Biology
- Administration (Staff Room)
- IT Server Room
- Mechanical Room.

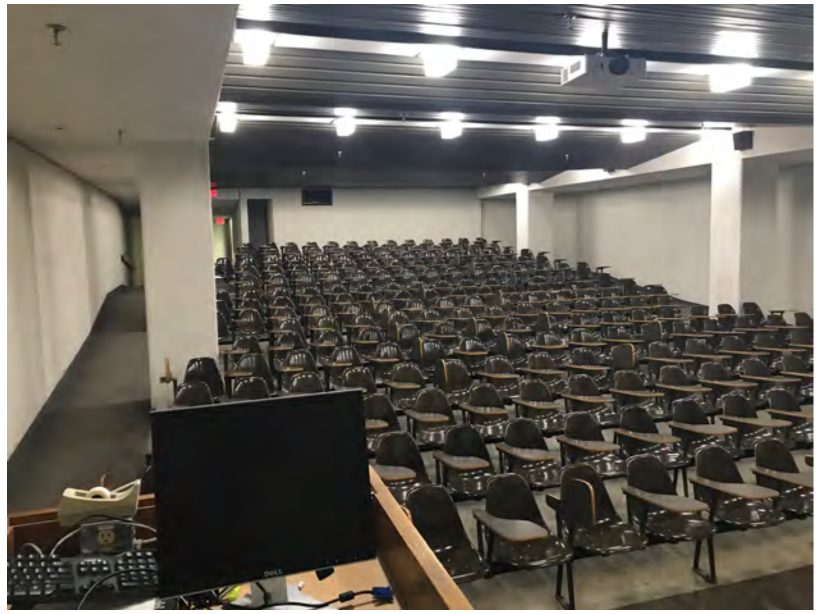
TOTAL - 139,546 sf

Additionally, there are two departments that have space outside of the John R. Brodie Science Building. Applied Disaster and Emergency Studies (ADES) has an Emergency Operations Lab (EOL) in the lower level of Harvest Hall. The Geology department has a Core Sampling Lab located at the north west side of the Knowles-Douglas Students' Union Centre, adjacent to and accessible from parking Lot 1 for delivery of samples.

top: ADES Emergency Operations Lab, located on the lower level of Harvest Hall; bottom: Geology Core Sampling Lab, located in the north east side of the Knowles-Douglas Students' Union Centre

Existing Building Plans and Photographs

Brandon University provided access to the original drawings dated, January 26, 1970. Working with these drawings as the starting point, the following pages illustrate the layout of spaces on a per floor basis. The photos shown on the corresponding pages are representative of the spaces on each floor, many of which were captured with a 360 degree camera.

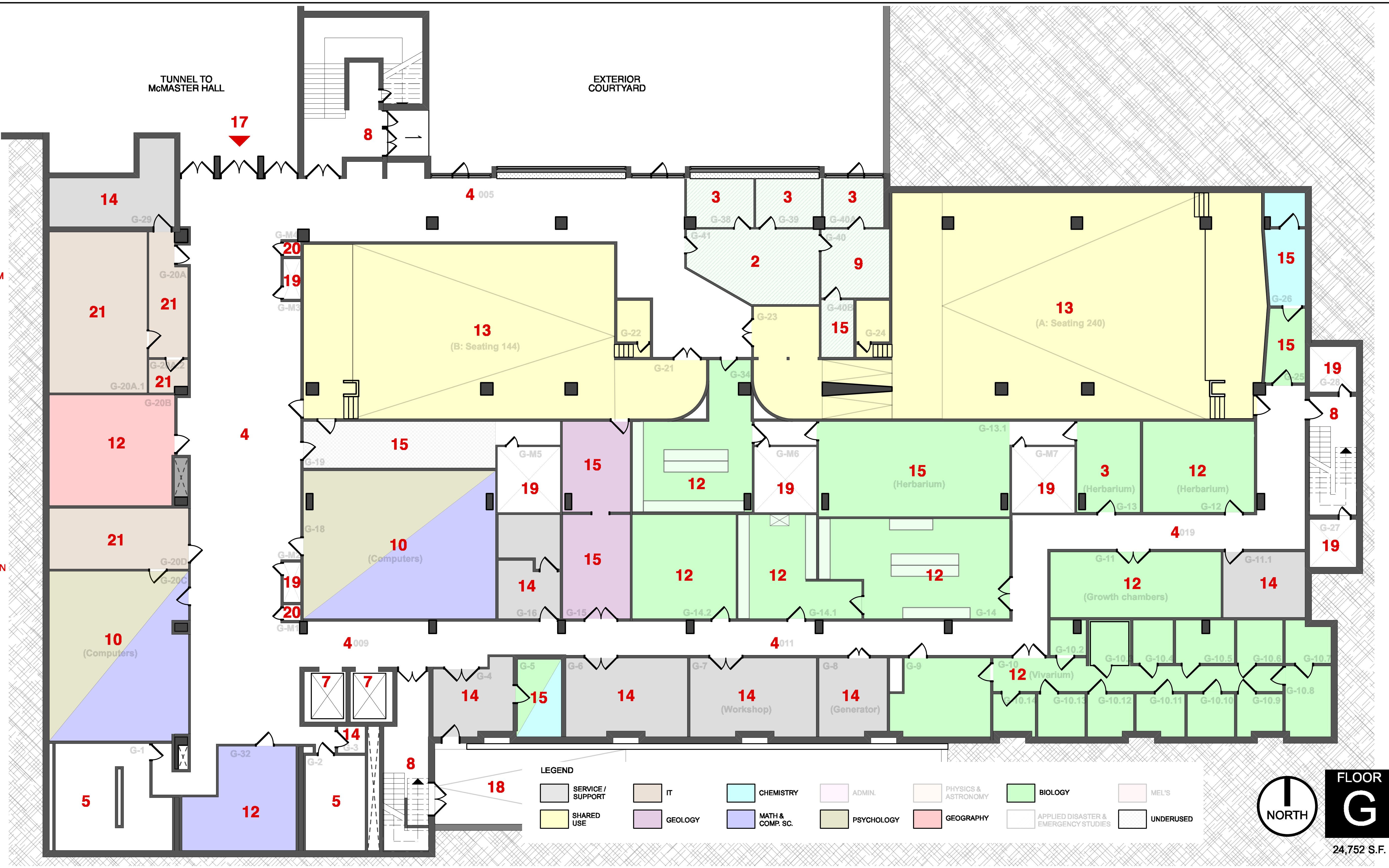


Ground Floor

top: Lecture Theatre G-23; middle: Corridor 005 with view to exterior courtyard; bottom: main north-south corridor looking north toward McMaster Hall

below: typical interior corridor with lockers (Corridor 011)

1. ENTRANCE HALL
2. ADMINISTRATION
3. OFFICE
4. CIRCULATION
5. PUBLIC WASHROOMS
6. FLEXIBLE MEETING ROOM
7. ELEVATORS
8. STAIRCASE
9. MEETING SPACE
10. CLASSROOM
11. TEACHING LAB
12. RESEARCH LAB
13. LECTURE THEATRE
14. SERVICE SPACE
15. STORAGE / PREP.
16. GALLERY / DISPLAY
17. ENTRANCE
18. RAMP
19. SHAFT
20. ELECTRICAL
21. IT
22. PHASE 3 CONSTRUCTION
23. MAIL / COPY
24. MULTI-PURPOSE ROOM
25. WORKSHOP
26. ANTI ROOM
27. GREENHOUSE & PREP
28. MECHANICAL ROOM
29. STAFF ROOM
30. ROOF
31. ATRIUM LIGHTWELL
32. BALCONY
33. STUDENT CLUB
34. SOUND BOOTH



BRANDON UNIVERSITY

JOHN R. BRODIE SC. CENTRE
EXISTING BUILDING

Louis Ave. & 18th Street, Brandon, MB

scale:	1:200
date issued:	2019.01.31
proj. #:	2018.23
rev. #:	R-0

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First Floor

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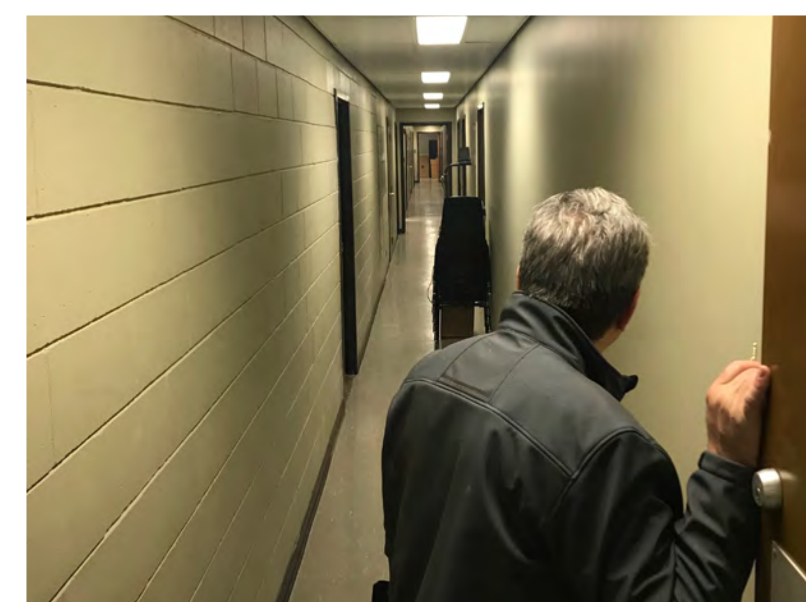
top: typical classroom; middle: main north-south corridor looking north toward connection to McMaster Hall; bottom: Central Corridor 1-CORR2-2



top: typical student research area; bottom: Corridor 156 with offices to the south

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1. ENTRANCE HALL
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Second Floor

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top: Geology X-Ray and Micro Analytical Facility Research 2-48; middle: Research Lab (renovated)

top: Physics Workshop 2-18; bottom: typical equipment storage area off of central service corridor

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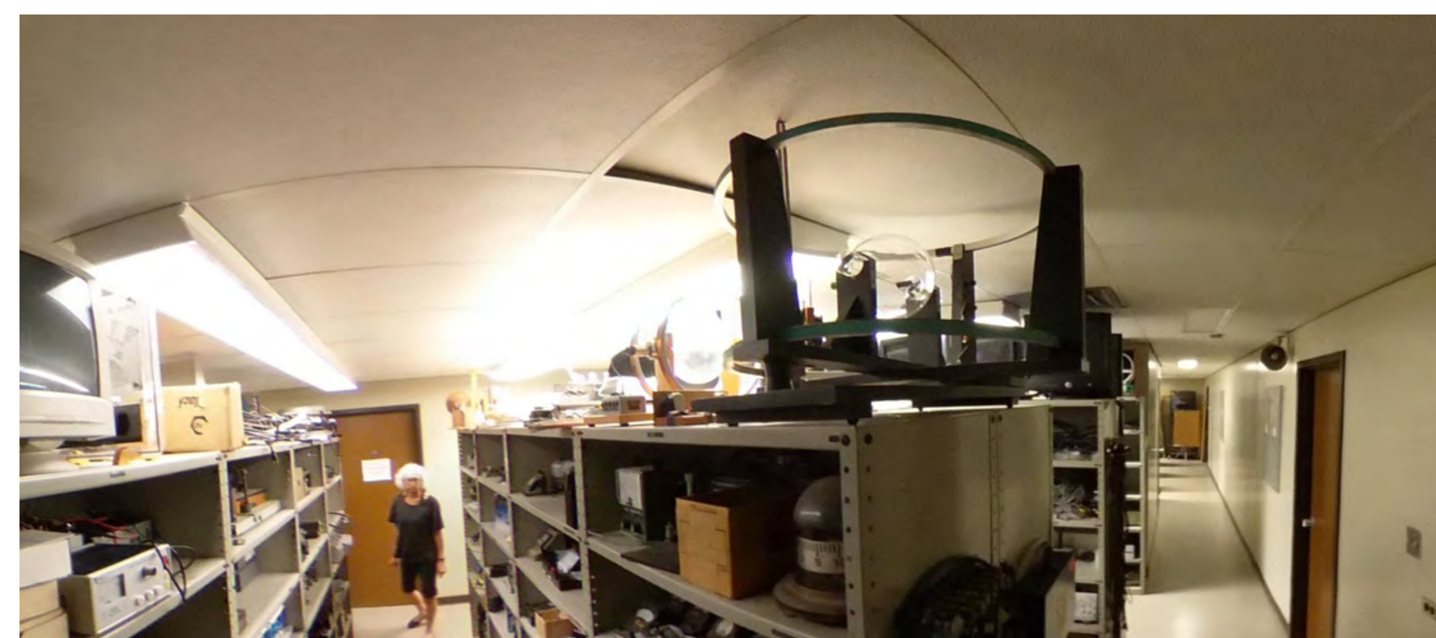

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Third Floor

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top: typical teaching laboratory; middle: Shared Classroom 3-47 with Geology display; bottom: Level 2 Research Lab 3-21.

top: Botany, Anatomy & Cytology Classroom Lab 3-27; bottom: classroom with new furniture

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34. SOUND BOOTH

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Fourth Floor

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top: Typical Chemistry Teaching Lab; middle: Chemistry Research Lab (renovated); bottom: typical central service corridor with electrical service panel and mechanical access.

top: Chemistry Research Lab (old); bottom: typical laboratory fume hood.

V

1. ENTRANCE HALL
2. ADMINISTRATION
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Fifth Floor

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top: Faculty Lounge 5-4; middle: Botany Greenhouse 5-09; bottom: Biology Research Lab 5-6.

top: Mechanical Room 5-5 plumbing; bottom: Mechanical Room 5-5 chilled water supply and return

V

1. ENTRANCE HALL
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Site

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Exterior plaza to the north of the John R. Brodie Science Centre

South-facing front of building along Louise Avenue, with main entry and loading dock access
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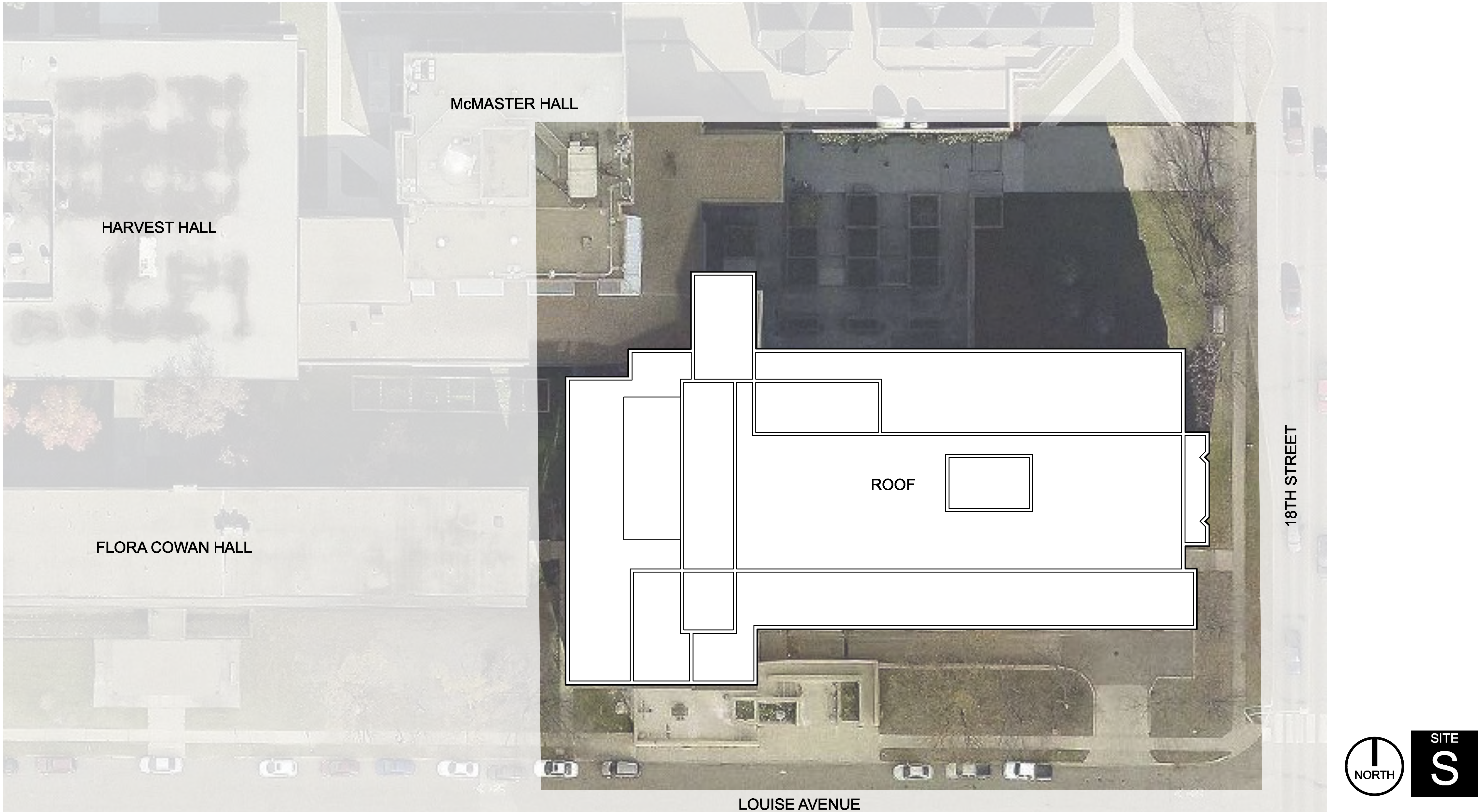

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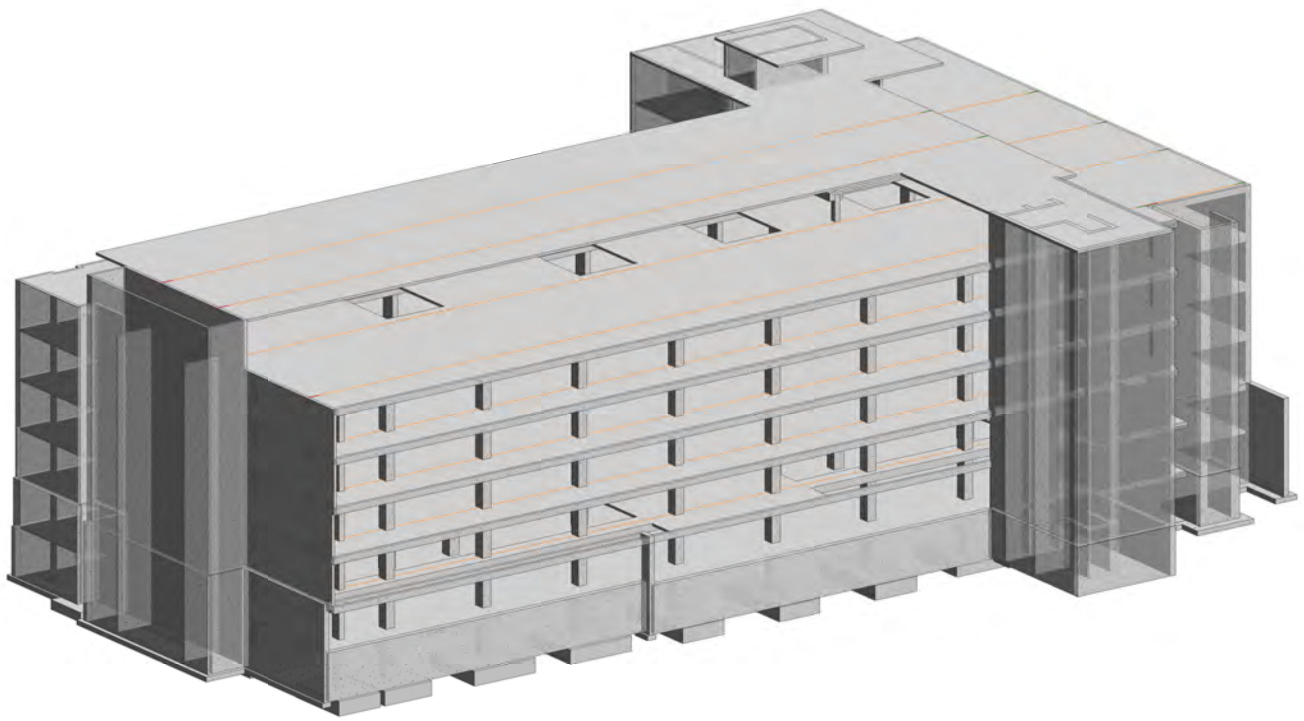
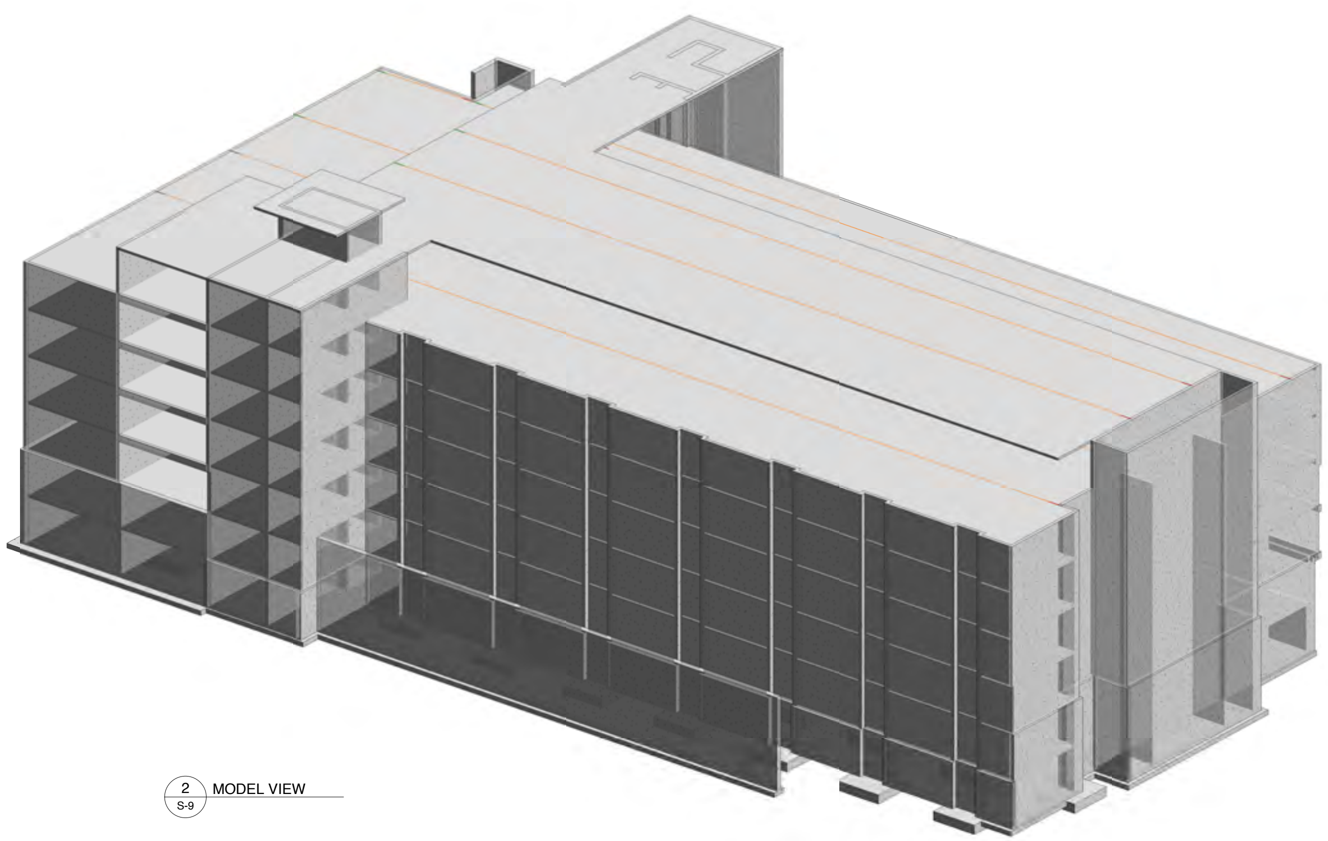
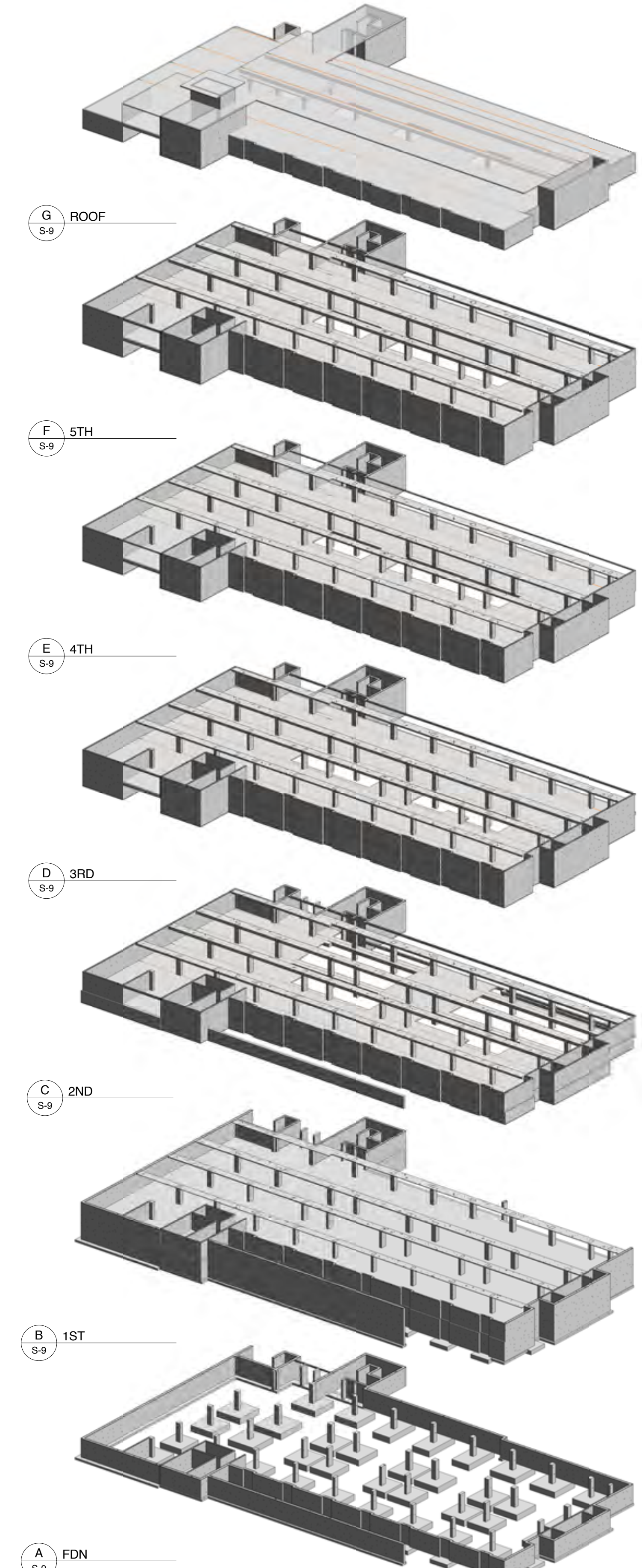


1 MODEL VIEW
S-9



2 MODEL VIEW
S-9



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BRANDON, MB

DRAWING TITLE

MODEL VIEWS

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MNF		S-9
FILE NO. W18139	DATE NOV. 2018	REVISION NO.

Section 2.0 Building Structure

Introduction

Prairie Architects Inc. commissioned Wolfrom Engineering Ltd. to provide Structural Engineering services for Brandon University to evaluate the existing structure to best determine how to proceed with upgrading the existing facility, build new or a combination of both. The structural assessment is a high-level review in support of the architectural assessment.

General Overview

The John R. Brodie Science Centre is a five storey reinforced concrete structure. Original drawings S-1 through S-11 dated on January 26, 1970 were provided by Brandon University and were utilized for this building condition assessment. Portions of the structure were viewable at multiple locations throughout the facility and appeared to match design drawings. No additional selective demolition or testing such as ground penetrating radar for confirmation of the placement of the steel reinforcement within the concrete, was completed at this stage, however it is recommended for future design development stages of the project that this be completed. It is also recommended that a geotechnical drilling program and report be completed for future design development.

Existing Loading Allowances

All publicly occupied floor levels were designed to suit live loading of 100 psf. Mechanical duct shafts were designed as 50 psf live loading. Roofs were designed to meet National Building Code requirements of the time, with loading for upper roofs noted as 36 psf. As per the current 2011 Manitoba Building Code, public circulation areas and lecture halls are required to have a minimum 100 psf live loading occupancy, with classrooms with or without fixed seats requiring 50 psf, and laboratories requiring 75 psf live loading. Thus, all areas currently meet or exceed the minimum live loading requirements as per known intended occupancies.

Foundation

The original engineer, GBR Associates, designed the building to suit Brandon's soil conditions, utilizing interior pad footing and perimeter strip footings on the underlying sandy soils for support of the building elements. With a maximum interior pad size of 15'-0"x 15'-0", and ranging in depth from 12" to 36" deep, footings were designed to suit a maximum service loading of 5000 psf, at a typical elevation 6'-4" below ground floor top of slab elevation.

Ground Floor Level

The ground floor level typically consists of a 5" reinforced concrete slab on grade on 6" of compacted granular, with the slab noted in good condition where exposed. The slab thickens to 12" deep below existing masonry wall locations. It is expected the slab could largely be reused where new elevations allow, or rerouting of below grade services is not required. A knock-out panel is present along gridline A between gridlines 17 and 19, which could be utilized for construction access if/ as required. Exterior sunken landscaping to the north and loading dock to the south also consists of slab on grade construction. A french drain style gravel filled trench is located approximately 6' around the building perimeter to manage below grade water, with a 4" weeping drain also noted along the top of the perimeter footing.

First Floor Level

The first floor consists of cast in place reinforced structural slab with integral concrete joists and beams. The floor varies between 5" to 6" in the majority of locations, with joists typically running in a north south orientation, spaced at 24" on centre and are typically another 20" deep for an overall floor assembly of 26" depth. Primary beams run along column lines east west with additional secondary beams around existing openings or locations requiring additional support. Beams are supported on a grid of interior concrete columns ranging in size from a maximum noted 28"x28" plan dimensions, and supported at exterior walls with lesser columns, concrete wall, or cantilevered slab with edge beams. Floor structural elements appeared in good condition where observed.

Second to Fourth Floor Levels

Second to fourth floor are very similar to each other, with some minor variations to suit local requirements. Floor structure is of similar cast in place reinforced concrete beam and integral joist structure. Floor structural elements appeared in good condition where observed.

Penthouse/Fifth Floor/Lower Roof Level

This floor level is of similar structure type to floors below. Floor structural elements appeared in good condition where observed. Mezzanines also occur over the elevator area and within a small portion of the penthouse, constructed of similar structure.

Upper Roof Level

The upper Roof also consists of cast in place reinforced concrete joist and beam, of lesser sizing to suit the reduced loading requirements. Additional capacity is noted below the cooling tower location and at other roof mounted mechanical locations. Exterior walls surrounding the penthouse incorporate structural steel framing complete with infill light framed metal walls. Roof structural elements appeared in good condition where observed.

Exterior Walls, Elevator Shaft and Stairwells

Cast in place concrete forms the majority of framing for circulation elements such as stairwell walls, stair landings and treads, and elevator walls. Stairwells appear monolithic between floor levels and appeared in good structural condition where observed. Generally connection of cladding and exterior elements is outside of our scope, however it was noted that repointing of the brick cladding is likely required along the upper west corner of the south façade and should be further reviewed.

General Structural Recommendations

In general, the building's robust concrete frame structure is very suitable for adaption and reuse as a science based teaching facility. No structural items of concern were noted where primary structure was exposed and viewable. The structural elements requiring adaption include: front entry and loading dock guardrails, balcony railings and selective facade repair as noted above.

Section 3.0 Building Envelope

Crosier Kilgour & Partners was commissioned by Prairie Architects Inc to conduct an assessment of the John R. Brodie Science Centre building envelope, and provide a limited building envelope review for the facility, which included a Thermographic Survey. Refer to Appendix E for Thermographic Scans and Photographs.

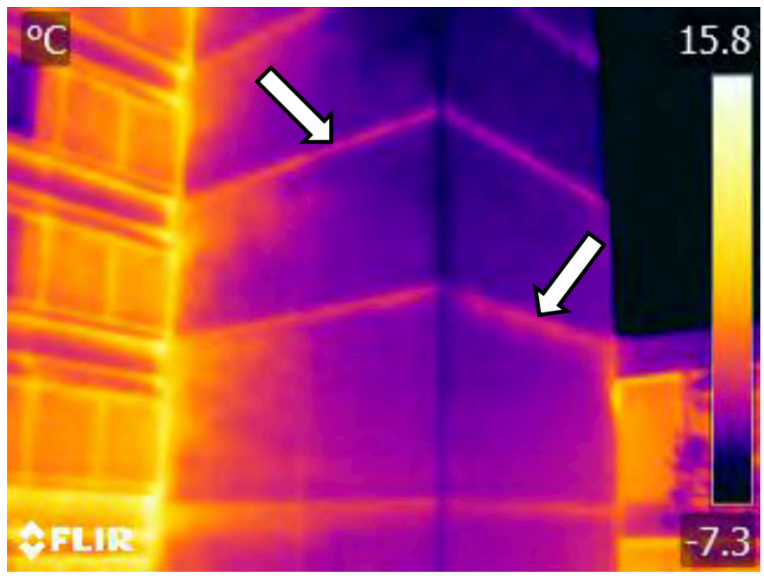
Thermographic Survey

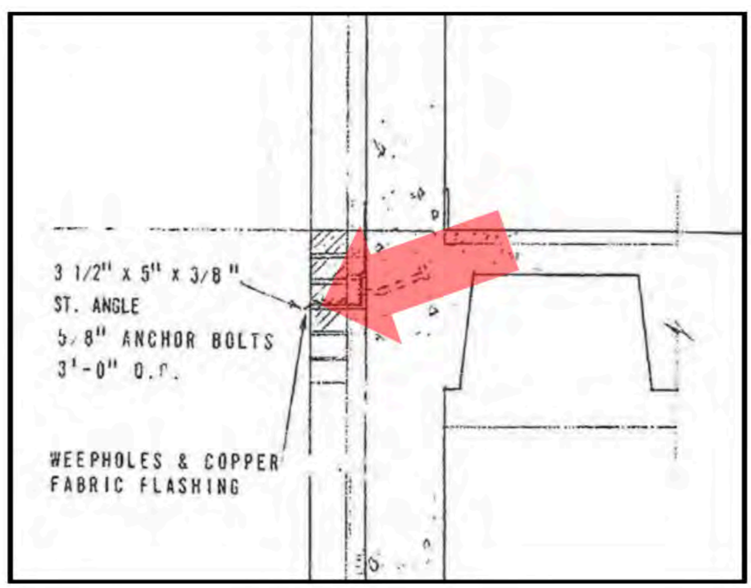
The scan was completed by Chris Richter, C.E.T., a Certified Level III Thermographer. Images were captured starting at approximately 6:15 a.m. on October 15, 2018 to minimize the effects of solar radiation on the cladding assembly.
At the time of the scan the outside air temperature was -10°C and the relative humidity was approximately 85%. The wind was from the southwest at around 12 km/h and the sky was clear. A copy of the weather data from Environment Canada has been included in Section 6 of this report for reference.
The building was positively pressurized using the mechanical system to aid in the identification of minor air leakage locations. Positive pressure of approximately 0.5" WC or 124 Pascal was achieved starting at approximately 3:00 am and maintained until people began entering the building around 7:00 am.

The thermographic scan uses infrared sensing photographic equipment to "observe" and record variations in the temperature of the exterior of the building. Thermal patterns created by such things as air leakage, thermal bridging, missing insulation or moisture within the wall assembly can be identified.

Thermal bridging occurs at locations where members of the wall assembly span between the warm interior and cold exterior surfaces. These thermal bridges create a more direct path for heat flow and cause elevated temperatures on the exterior surface of the cladding during cold weather. The thermal anomalies created by these members are usually linear and relatively uniform in appearance.

A typical example of thermal bridging can be seen at the cladding shelf angle supports in the image below. Also shown below is a detail of the wall section from the original design drawings which identifies the shelf angle at a typical floor slab. The connection of the shelf angle to the concrete structure creates a direct thermal bridge from the interior to the exterior resulting in decreased thermal resistance at these locations.





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top: Image showing a typical example of thermal bridging at floor slab locations; bottom: Image from original building drawings showing the typical shelf angle detail.

The anomalies caused by thermal bridges, are typical and are generally expected in this type of construction. While modern construction details have been refined to minimize the extent of thermal bridging, it can never be completely eliminated.

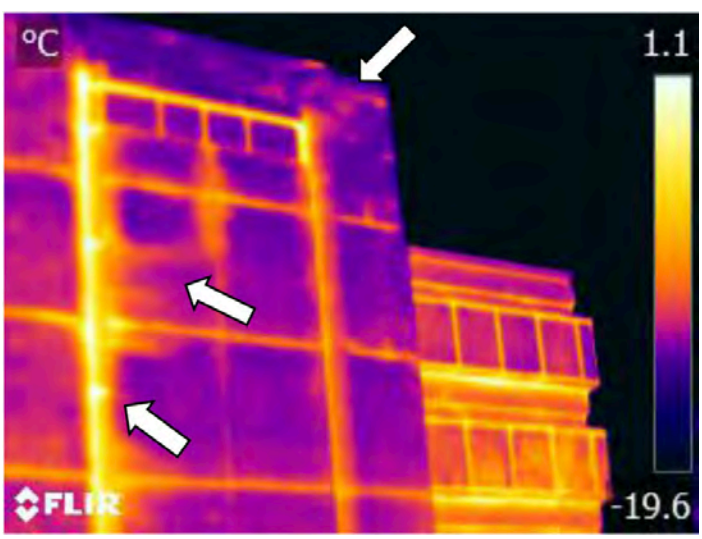
Thermal anomalies caused by air leakage are typically more random in appearance. These anomalies can appear as intense bright spots where a concentrated air leak occurs. Alternately, they can appear as plumes or fingers where the leakage is more disbursed. A good example of both types of air leakage anomalies is shown in the image below, left.

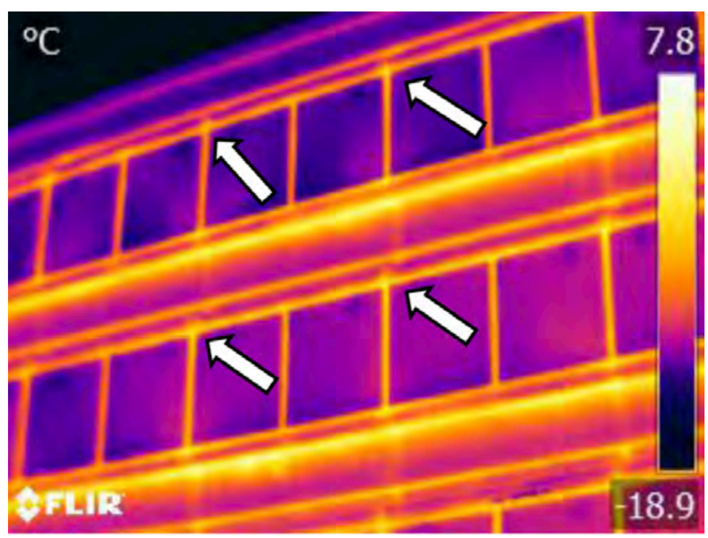
Concentrated air leaks appear as an intense light source such as those along the edge of the window framing on the left side of the above image. Additionally, wide-spread, multi-fingered plume-like anomalies caused by air leakage into the wall assembly can be seen at other locations in the centre and near the top of the wall. Concentrated air leakage was noted at glazing mullions at the southeast corner soffit of the building as seen in the image below, right. It is important to note the relative intensity of the air leak suggests direct communication with the building interior. Additionally, the fact that several anomalies are visible in this one image suggests that the problem is likely widespread.

Air leakage can have a detrimental impact of the performance and longevity of the envelope. When air leakage occurs during cold weather, it can deposit large amounts of moisture within the wall assembly in the form of ice and frost. When temperatures moderate in early spring, these accumulations melt typically causing damage to interior finishes. If left unchecked, additional deterioration will occur and can include damage to structural components. Biological or mould growth may also occur.

Thermal anomalies consistent with air leakage were observed at various locations around the facility particularly around windows on all elevations. Photograph Nos. 57, 69, 79, 121 and 133 in Appendix E show typical examples of the conditions observed. As discussed above, this type of air leakage can cause deterioration of the building enclosure components in addition to increasing building operating costs.

A review of the original building design drawings shows that the primary air seal at the door and window assemblies is generally achieved by using two beads of flexible sealant.





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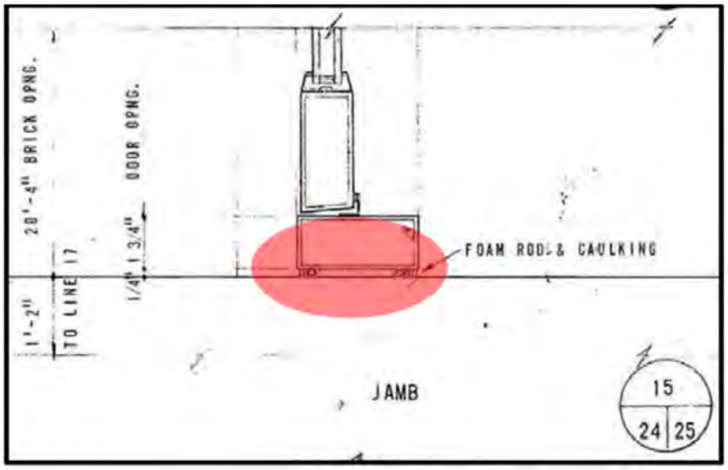
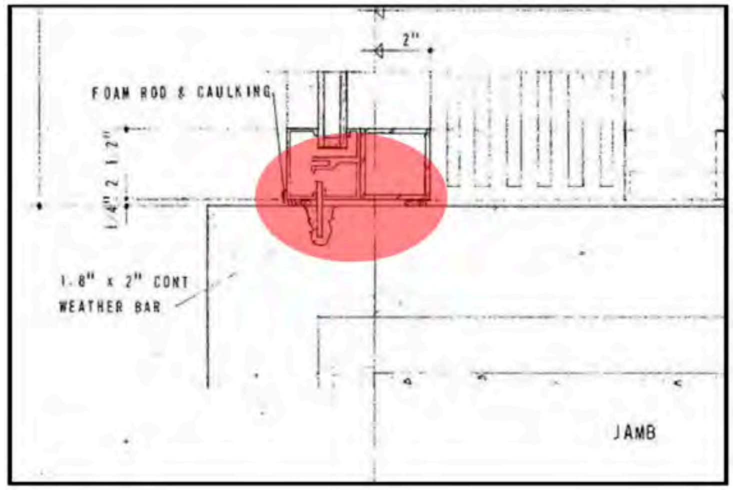
above left: Image showing air leakage at the east elevation. Both direct and indirect (disbursed) air leakage patterns can be seen at the windows and across the wall surface; above right: Image showing air leakage at glazing mullions on the north elevation.





above left: Detail of typical door jamb seal using "foam rod and caulking" on both the interior and exterior frame joints; above right: Detail of typical window jamb seal utilizing "foam rod and caulking" on both interior and exterior faces. Also note the continuous weather bar insert into a rough cut reglet. Time has likely compromised the integrity of the weather bar.

While a continuous "weather bar" is identified in some of the window details, it does not appear that the installation of this component is consistent throughout the cladding assembly. Refer to the above images.

Thermographic Scan Summary and Conclusions

The scan conducted revealed that anomalies caused by both air leakage and thermal bridging are present on all elevations of the building specifically:

- Thermal bridging was observed at cladding connections such as masonry support angles. Refer to Photograph No. 29 in Appendix E for a typical example.
- Significant air leakage was noted at joints between windows and adjacent walls. See Photograph No. 53 in Appendix E.
- Air leakage is occurring at building penetrations such as mechanical components. Refer to Photograph No. 69 in Appendix E for a typical example.
- Significant air leakage at wall transitions and intersections was observed at various locations including at the west end of the north wall as shown in Photograph No. 145 in Appendix E.
- Air leakage between window frame components such as at mullion joints is occurring as seen in Photograph No. 151 in Appendix E.

Based on the analysis of the images, air leakage is widespread over most of the building façade and is typically occurring at window terminations, glazing assemblies, wall penetrations and wall construction transitions. A review of the original building drawings suggests that detailing of the exterior wall assembly to minimize the potential for air leakage may not have been as comprehensive as is typically the case today. Long-term deterioration of components such as flexible caulking and window seals or gaskets has also likely happened thereby allowing air exfiltration and infiltration to occur.

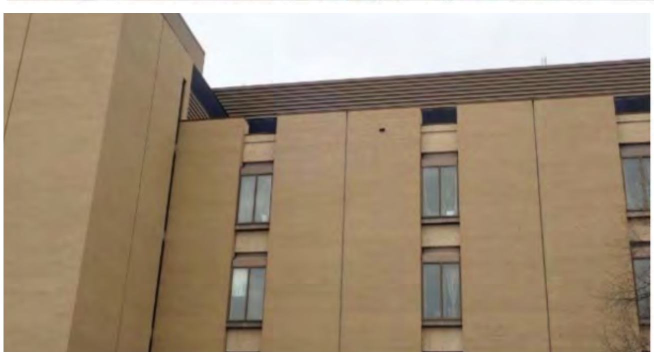
General Building Envelope Recommendations

Remediation of the overall exterior wall assembly including air sealing measures and rehabilitation, or replacement of window and curtain wall components is recommended to minimize air leakage, reduce operating costs, improve occupant comfort, lessen the potential for damage to structural components and enhance the overall performance of the building enclosure.

Building Envelope Site Review

Following the Thermographic Survey, a site visit was completed on November 21, 2018 with the purpose of providing assessment and comment on the condition of building envelope related components, such as the fenestration, cladding and roof assembly, including to rationalize the identified anomalies from a completed thermographic scan. The following summarizes the observations and comments. Refer also to and Appendix F for Building Envelope Review Photographs.

The scope of the assessment was based on a visual review of the building exterior from grade level, review of representative areas on the building interior, and a general review of the roof assembly. No penetrative cut test or inspection recesses into the existing components were completed. Supporting photographs illustrate some of the observations made during the visit and can be referred to in Appendix F. The following summarizes in point form, our significant observations. For clarity, each building envelope component is listed separately.



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top: (Photograph 1 in Appendix F) Overview of curtain wall system along the north elevation; bottom: (Photograph 2 in Appendix F) Showing typical office windows along the south elevation

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(Photograph 4 in Appendix F) Water streak marks along curtain wall mullion and stain marks on ceiling tiles (showing north elevation)

Review of Fenestration

An aluminum framed curtain wall system provides the environmental separation along the corridors and stairwells on each floor at the north and east elevation (refer to photograph #1 in Appendix F). Aluminum framed fixed windows, with curtain wall framing, are provided for the vision assembly into office spaces on each floor along the south and west elevation (refer to photograph #2 in Appendix F). At the south balconies, aluminum storefront wall assembly are utilized for the exterior wall system, which include fixed glazing vision units and doors.

The sealed glazing units were observed on-site at numerous locations to consists of double-glazed units incorporating a spacer bar. During our interior review at a few locations along the curtain wall, we observed the manufacturing date stamp on the glass edge indicating the year 1971. This indicates that the glazing units and curtain wall framing are original to the building. As per site discussion with the site representative, numerous failed and broken sealed glazing units have occurred on-site and were replaced in the past.

During the interior visual review of the sealed glazing units, it was noted that approximately seven (7) sealed glazing units showed visible signs that a hermetic seal failure exists. Failure

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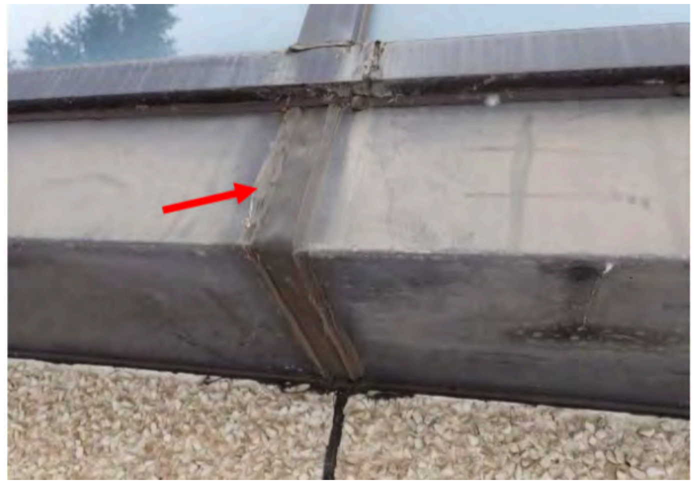
(Photograph 6 in Appendix F) Stains and deteriorated finish on the insulated metal panels. Note sealant applied at curtain wall mullion caps.



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(Photograph 8 in Appendix F) Silicone strip seal applied over the insulated metal panel joints and sealed to the panels with sealant.

was noted in the form of frost, fogging or condensing within the glazing panes, and broken glass (refer to photograph #3 in Appendix F).

Water streak marks were noted along vertical curtain wall frames at numerous locations along the north elevation, including stain marks were visible at a few ceiling tile locations (refer to Photograph #4 in Appendix F). This indicates that either past or current water infiltration might be occurring through the existing curtain wall system.

During the review of the exterior, it was observed that sealant had been applied at exterior curtain wall mullion caps and sealed glazing unit interfaces at most locations (refer to Photograph #5 & #6 in Appendix F). Based on the existing drawings, this was done over the past years, as the existing drawing details do not show that sealant be applied at these locations. This indicates that the glazing system went to a face seal system, possible due to the occurred water/moisture and air infiltrations.

The curtain wall system is protruding (cantilevered) past the floor line and existing drawing details indicate that insulated metal panels are installed above and below the curtain wall system. Stains and deteriorated finish on the metal panels were observed at numerous locations, indicating water/moisture infiltration in the wall assembly below and above the curtain wall (refer to Photograph #6 & #7 in Appendix F).

At vertical joints of the insulation metal panels (above and below the curtain wall) the existing drawing details show the installation of sealant on a foam backer rod. However, on-site it was observed that a silicone strip seal was applied over the joint and sealed to the panels with sealant (refer to Photograph #8 in Appendix F). The strip seal appears to have been installed, over the past years, in addition to the sealant at the panel joint and to provide protection against potential water and air infiltration at the panels.

At numerous locations along all elevations, the existing rough opening sealant was noted to be deteriorated with gaps or cracked/split sealant (refer to Photograph #9 in Appendix F). Isolated locations were observed to have no sealant along the exterior rough opening (refer to Photograph #10 in Appendix F). All these conditions are revealing gaps and voids for water to potentially infiltrate into the wall assembly and interior space around the window rough openings.

As shown in photographs #1 & #2, the cladding above and below the fenestration system has a stone dash finish, damaged finish was noted at isolated locations (refer to Photograph #11 in Appendix F).

Fenestration Recommendations

Given that the numerous deficiencies noted above are relating to the age of the existing fenestration system and the fact that past completed repairs where undertaken to address water and air infiltrations at the curtain wall system, it is felt that replacement of the curtain wall system is warranted and will provide the Owner with the most appropriate long-term solution.

Removal and replacement of existing sealant at rough openings, sealed glazing units and metal panels are unlikely to provide any effective long-term solution, especially due to the observed amount of past repairs and sealant application already completed at the curtain wall system. Also, sealant is considered a maintenance item which would require continuous monitoring and regular repairs.

The typical anticipated life span of a sealed glazing unit is approximately 25 years. The sealed units and framing of the curtain wall system are still original to the building, from the year 1971. Thus, the original glazing units have far exceeded their anticipated life expectancy and are at the end of the useful service life, as they have been in service for approximately 47 years. Therefore, further and additional sealed glazing unit failures can be expected and will occur in the future.

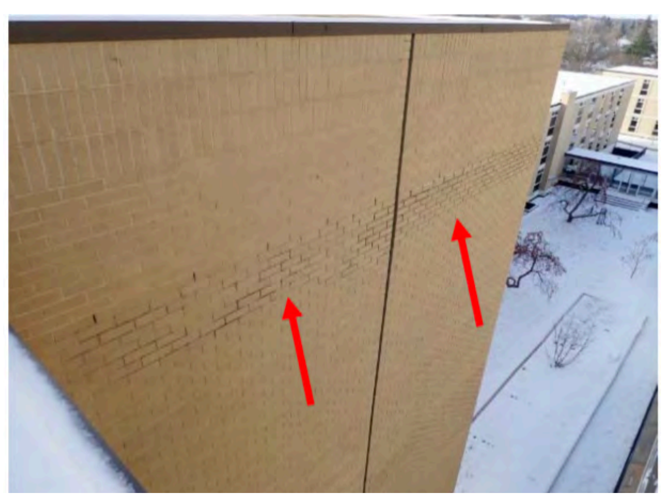
Also note that important improvements in the thermal efficiencies of sealed glazing units and aluminum framing have been achieved since the manufacture of the existing systems. Full replacement of the curtain wall system will allow for a new air/weather seal between the framing and rough openings to control/address the observed air leakage and provide important improvement to the overall building envelope.

Review of Brick Veneer

Deterioration of mortar joints, in the form of open/cracked joints, was observed predominately above and below the brick shelf angles at the floor lines (refer to photograph #12 in Appendix F). No soft joint (sealant) was noted to be present at the steel shelf angles and the exposed edge of the angels has been covered with mortar (refer to photograph #13 in Appendix F). Weep holes in the brick veneer were noted to be located above each shelf angel along the floor lines, the location is consistent with the existing drawing detail.

Cracked and damaged bricks were observed at isolated locations only, mainly along the exterior corner of the east and south balcony side walls at the south elevation (refer to photograph #14 & #15 in Appendix F). Deteriorated mortar joints were also present at this location, including different bricks were observed indicating signs that past repairs have been completed (refer to photograph #15 in Appendix F). Conditions of other major shifting or displaced brick units were not observed and overall the brick appears to be in general good condition.

At vertical brick control joints (+/- 2” wide) a metal flashing is installed (refer to photograph #16 in Appendix F) and sealed to the adjacent brick with sealant. Locations with deteriorated sealant at some control joints. Replacement of the existing sealant with new is recommended along the contractor joints.



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(Photograph 12 in Appendix F) Deterioration of mortar joints below the brick shelf angles at the floor line.

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(Photograph 15 in Appendix F) Cracked and damaged bricks along exterior corner of the balcony side wall at the south elevation. Note the different brick installed at this location;

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top: (Photograph 17 in Appendix F) Dislodged metal flashing along roof parapet; bottom: (Photograph 18 in Appendix F) Dislodged metal cap flashing along the roof parapet. Note the missing metal flashing at the brick control joint.

Brick Veneer Recommendations

Maintenance of the mortar joints is required to ensure that the face-shield approach of the cladding and wall assembly is maintained. Therefore, all open, loose and deteriorated masonry joints between the bricks are recommended to be repaired/repointed. Repairs to the observed cracked and damaged bricks should also be completed to restore and maintain the integrity of the walls.

A soft joint, which consist of flexible sealant, is recommended to be provided at the wall locations where the steel shelf angle is located along the floor lines. Sealant will provide a separation between two different materials and will be capable to take any movement along the joint.

Review of Roof Assembly

A review of the roof assembly was very limited due to the present snow cover on the roof membrane at the time of the site visit. Dislodged metal cap flashing, with gaps and voids, were noted at isolated locations along the south and north roof parapet (refer to photograph #17 & #18 in Appendix F). Site representative indicated that over the past years roof replacements and repairs were completed throughout the different roof sections at this building.

Roof Assembly Recommendations

Potential water infiltration into the roof assembly and interior can occur through observed voids/ gaps in metal flashings. Therefore, repairs are recommended to be completed under a general building maintenance item to this facility.

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Sediment staining on existing ceiling tiles

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Fume hoods original to the building

Section 4.0 Mechanical

Introduction

Prairie Architects Inc. commissioned SMS Engineering to provide services for Brandon University to help determine how to proceed with upgrading the existing facility, building new or a combination of both. The mechanical assessment is a high-level review in support of the architectural assessment.

Scope

The scope of this section of the report is to provide a written summary of:

- The apparent physical condition of the mechanical systems.
- Any observed faults or deficiencies in the mechanical systems.
- General compliance of the mechanical systems with current codes.

Exclusions

This report is based on a review of the available construction drawings and a brief visual inspection of the sites to determine general quality of the systems. No functional or operational checks were made on any systems or components.

The performance levels of the systems were not verified and the references to system capacities are based on information from the original design documents.

When this building was built it was common to use materials that are now considered hazardous. Such material included PCBs in fluorescent light fixtures and a number of asbestos products. It might be assumed that such materials exist in the mechanical system. We are not aware of any regulatory order to remove hazardous material. We would expect that special precautions will be required when removal of hazardous material takes place during alterations, all in accordance with existing regulations that are practiced by competent contractors.

The drawings reviewed are not considered as-built and site verification of the as-built condition is not included in this report.

Any costs associated with remedial work will be determined in collaboration with a construction manager.

Mechanical Systems Description

Plumbing

General

The building plumbing systems have been maintained in operating conditions. Very little upgrading was noticed excluding newer electric domestic water heaters which were recently installed. Plumbing fixtures and systems overall are dated and of the general era from which the building was constructed. Piping systems for the primary plumbing systems are aged and deteriorating. The piping appears to be replaced as it fails.

Drainage

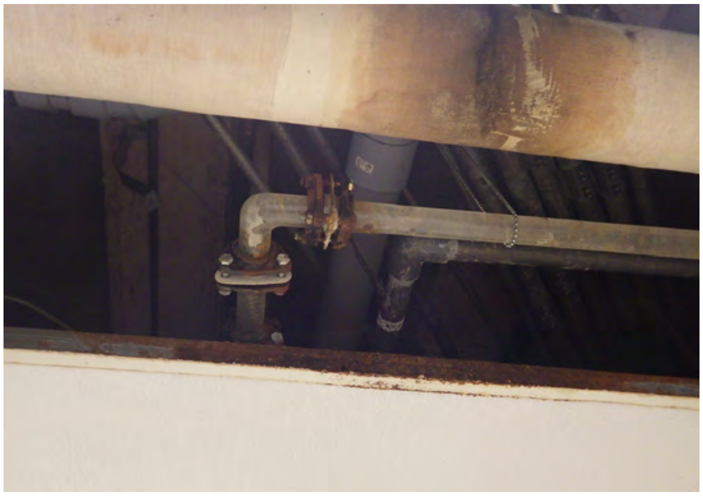
The cast iron soil/waste piping is deteriorating and is being replaced as it fails. The same is occurring for the glass acid waste.

Specialty systems

Specialty systems such as the acid waste and distilled water systems have been maintained. The glass acid waste piping system will continually become harder to find replacement parts for. The distilled water system seems to have newer piping in locations but it was unclear if that was maintenance related. The distilled water system is aged and the quality with respect to CFU counts is unknown. No visible growth was evident on the portions which could be examined.

Plumbing Recommendations

To renovate the building or to re-build a new



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Aging glass acid waste piping system

building would be of similar needs. Only minor components would be kept for a complete restoration meaning the plumbing materials needed would be similar for a new build or restoration. Essentially in both cases the system components, equipment, and any appurtenances would be new. The restoration option may provide limitations to the flexibility and design of the systems and may have undesired architectural needs to hide the plumbing systems component's. Typically a renovation would have a higher cost per square foot and likely the cost of such in this building would still be higher than a new building.

General Changes

- Acid waste system – Replace in entirety with new solvent or fusion joined plastic acid waste drainage system. Due to chemicals being mixed from non-diluted vessels it is necessary to maintain this system.

- Distilled Water system – With such significant renovations planned, the system would need to be extensively renovated likely requiring significant disinfection and risk of overall contamination which cannot be reconciled. The system would be replaced with a new Reverse Osmosis (RO) system utilizing a central circulated (pumped) water distribution. Materials would likely be PVDF piping, and an approximate 100 US gallon storage tank would be used. The RO unit would be sized to replace with loss in the tank (~80% empty) within a one hour period; this may differ dependent on the final users needs. Outlets would be circulated faucets to minimize potential contamination.

- Drainage Systems (sanitary and storm) – Due to the piping systems showing signs of deterioration where repairs have been necessary the piping would be replaced in its entirety. PVC piping would be used for replacement with fire rated PVC being used in all plenums and other areas required by code. It may be safer to utilize fire rated PVC in all areas to ensure no improper use of materials during maintenance or future renovations occurs. At times renovations change ceilings to a plenum, which, then require all of the piping to be replaced as a result to fire rated PVC.

- Domestic Water Systems – While the water heaters are newer, placing them into a substantial renovation is not necessarily desired. Upon final completion of the renovation the tanks may actually be at or near the end of their useful lives and will require preventative replacement. Installing new will provide a new warranty period commencing with completion of the renovation. The cost of replacing the water heaters is minor in comparison to the overall budget and will remove early replacement under a preventative maintenance program planning.

Fire Protection

The building is not currently sprinklered. To meet current codes the entire facility would need to be upgraded such that the building is completely sprinklered.

Heating

Heating Plant

The building is heated via central steam from the powerhouse. The steam is converted to glycol within the penthouse mechanical room. The fluid is distributed throughout the building by pumps located in the mechanical room.

General Building Heating
The building is heated by perimeter radiation elements.

Piping and valves are in fair condition, the insulation at fittings contains asbestos.

Heating of Ventilation Air
The ventilation air is heated by the hydronic loop. The coils in the air handling units are used to pre-heat the air to 55°F (13°C).

The supply air is further tempered at the zone level by hydronic reheat coils in the terminal units.

Heating Recommendations
Depending on the requirements of the configuration, the perimeter radiation would be replaced with radiant panel systems.

Ventilation

General Building Ventilation
Two main air handling units located in the penthouse provide air supply to the majority of the building. The units use the penthouse as a return plenum and mix the return and outside air at the air handler mixing box. The supply air is ducted through shafts to terminal units located throughout the facility. The acoustic lining within the terminal units is deteriorating, the dust formed from the breakdown may have adverse effects on the air quality and possibly experimentation in the labs. Based on the existing drawings and site observation, it appears that the terminal units only are lined with acoustic insulation. One air handling unit for the ground floor vivarium has a section of acoustic lining, but other than this instance, noise is typically addressed through the use of duct silencers instead of acoustic insulation. It is recommended that all ductwork be cleaned if it is to be reused.

Two return fans draw air back to the penthouse plenum and either relieve the air to the outdoors or return to the plenum.

Sanitary exhaust is collect and ducted up to the mezzanine in the penthouse mechanical room where the fan terminates with a gooseneck on the roof.

Fume hood exhausts are ducted via stainless steel ductwork to fans in the penthouse and discharged up through the roof to stacks to disperse any contaminants.

Humidification is provided by direct steam injection to the air stream within the air handling units.

Special Ventilation Systems
Most of the fume hoods are original to the building. There are a number of units that have been added over time.

It was noted that perchloric acid was being used. Depending on the quality and concentration of the acid, a proper perchloric acid system should be used for that chemical.

A dedicated air handling unit and exhaust system is provided for the vivarium in the lower level.

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Rooftop cooling tower and exhaust vents

A dedicated heating and ventilation system is used for the greenhouse. The systems appear to be at the end of their useful service life.

Ventilation Recommendations
It is recommended that the existing terminal boxes are replaced with new devices that have suitable acoustic lining for the application. The systems should be rebalanced to ensure that airflows are balanced within the facility.

Refrigeration and Air Conditioning

General Building System
The building is cooled by a chilled water system that provides chilled water to the cooling coils in the air handing units.

Chilled water
The existing York centrifugal chiller was installed approximately 17 years ago and is in good condition. The machine was installed within a new refrigeration machine room contained within the existing mechanical penthouse. The chilled water created is distributed to a number of buildings on the campus.

The Baltimore Air Coil cooling tower was installed at the same time as the new chiller and is in fair condition.

The pumps are in good condition. They have been retrofitted with variable frequency drives on the secondary loop to minimize energy consumption in distributing chilled water to the campus.

Special Systems
The Brandon University server is located in the computer room connected to the penthouse mechanical room. The computer room air conditioning unit is provided with an air cooled condenser system where the outdoor condenser is used during cooling season and the condenser located in the penthouse reclaims heat by rejecting heat to the building return air system.

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Chiller located in 5th Floor Penthouse Mechanical Room

Environmental Control and Monitoring System (E.C.M.S.)

General Building Systems
Automated Logic provides the direct digital control system for the campus. The existing pneumatic controls are monitored by the DDC system. A number of new controllers have been installed to improve the existing control sequences.

Control Recommendations
Upgrade the controls further to provide better controllability of the HVAC systems to optimize energy consumption throughout the facility.

General Mechanical Recommendations

- If the existing air systems are to remain, consideration should be given to the inclusion of a combined exhaust system such that the heat from exhausts can be reclaimed. The new exhaust system would enhance dispersion of contaminants by a combination of dilution and high-plume exhaust.
- The plumbing systems should be replaced as they are at the end of their useful service life.
- The heating systems can be improved by revising the characteristics of the end-use devices and increasing the efficiency of the system.

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Typical lab recessed fixture

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Typical panel board

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Typical recessed linear corridor fixture

Section 5.0 Electrical

Introduction
Prairie Architects Inc. commissioned SMS Engineering to provide services for Brandon University to help determine how to proceed with upgrading the existing facility, building new or a combination of both. The electrical assessment is a high-level review in support of the architectural assessment.

Scope
This scope of this section of the report is to provide a written summary of:

- The apparent physical condition of the electrical systems.
- Any observed faults or deficiencies in the electrical systems.
- General compliance of the electrical systems with current codes.

Exclusions
This report is based on a review of the available construction drawings and a brief visual inspection of the sites to determine general quality of the systems. No functional or operational checks were made on any systems or components.

The performance levels of the systems were not verified and the references to system capacities are based on information from the original design documents.

When this building was built it was common to use materials that are now considered hazardous. Such material included PCBs in fluorescent light fixtures and a number of asbestos products. It might be assumed that such materials exist in the electrical system. We are not aware of any regulatory order to remove hazardous material. We would expect that special precautions will be required when removal of hazardous material takes place during alterations, all in accordance with existing regulations that are practiced by competent contractors.

The drawings reviewed are not considered as-built and site verification of the as-built condition is not included in this report.

Any costs associated with remedial work will be determined in collaboration with a construction manager.

Electrical Systems Description

Lighting and Controls
Interior Lighting
Lighting is provided primarily by T8 fluorescent fixtures. Generally, it appears that the original T12 fixtures were upgraded to T8 (presumably re-lamped with T8 lamps and ballast replaced). Various types of fluorescent fixtures are provided in different areas of the building. Recessed troffer type fixtures are provided in labs and offices. Main corridors are provided with recessed linear fixtures and surface mounted decorative fixtures. Suspended fixtures are provided in mechanical/electrical rooms, and the main IT room. Vapour tight fixtures are provided in wet locations such as the vivarium rooms in the basement.
Incandescent fixtures are provided in mechanical chases and electrical closets and at the entrances (pot lights).

Recessed 2' x 2' LED fixtures are provided in the south corridor on the second, third and fourth floor.

Lighting control is provided by line voltage switches, except for the two large lecture theatres (rooms G-21 and G-23) which have local low voltage lighting control systems.

Lighting fixtures are original in most areas and are generally in poor condition with discoloured lenses.

As part of any building renovation, an upgrade to LED lighting is recommended. This will result in better quality of light and improved energy efficiency.

Exterior lighting was not reviewed.

Emergency and Exit Lighting

Emergency Lighting Systems

Emergency lighting is provided by fixtures connected to the central emergency power generator.

Generator powered emergency lighting is provided in stairwells, corridors, penthouse mechanical room, generator room and the lecture theatres (rooms G-21 and G-23).

As part of a major building renovation, emergency lighting fixtures should be replaced with new LED fixtures as discussed in the Interior Lighting Section.

Red exit lights are provided at exits and along egress routes throughout the building. Exit lights are connected to emergency power, backed up by the emergency generator.
Generally, the exit lights are in acceptable condition.

As part of a major building renovation, the existing red exit lights will need to be replaced with green pictogram type exit lights, to comply with current Code.

Power Distribution

Distribution

4160 volt, 3 phase electrical service is provided to the Brodie building main distribution, "Distribution A" located in the penthouse mechanical room from a breaker in the Dining Hall 4160 volt distribution. Distribution A is manufactured by Federal Pacific and is original to the building. It has four sections. Section 1

^ 600V Main Distribution A

^ Motor Control Centre MCC-1

consists of a 600 amp main fused switch (fuse size unknown). Section 2 is a 2500 KVA 4160-600V dry type transformer. Section 3 contains metering and a 600 volt air circuit breaker section with 50H-2 air circuit breakers feeding the chiller, 120/208V main Distribution B and MCC-1. There is no room in Section 3 for additional air circuit breakers. Section 4 is an 800 amp CDP section with room for additional breakers.

A 120/208V distribution, Distribution B is located in the penthouse mechanical room, fed from Distribution A via a 1000KVA dry type transformer within the Distribution B lineup. Distribution B feeds sub distribution CDPs on each level which typically feed the local branch circuit panelboards on that level.
Three MCCs are located in the penthouse mechanical room. MCC-1 and MCC-2 are original to the building and are beyond their expected life. Replacement should be considered in the near future. MCC-3 was installed in approximately 2001 as part of the Chiller replacement project. It appears to be in good condition.
Distribution equipment is generally in acceptable condition but original to the building and beyond its expected life.

It was observed that fire stopping is missing from several penetrations through floors.

Power Wiring and Cabling
Wiring is generally original to the building and beyond its expected life.

Distribution Recommendations
It is recommended that all original distribution wiring and equipment including the main distributions, CDPs, MCCs and panelboards are replaced with new. Non-original equipment will be reviewed on an individual basis for fitness for reuse.

It is recommended that a short circuit, coordination and arc flash study is conducted as part of any renovation project.

^
Diesel generator

It is recommended that all penetrations through fire separations be fire stopped.

Emergency Power Distribution

Distribution
A 156 kVA/125 kW 600 volt, 3 phase diesel powered Caterpillar D333 standby emergency power generator is provided in room G-8 in the basement. The diesel fuel tank is also located in room G-8, beside the generator.

Connected loads include:

- Elevators
- Ventilation and cooling for main IT room
- UPS Units #1, 2 and 3
- Emergency / exit lights
- Panel B in McMaster Hall
- Panel EE in McMaster Hall
- Panel EX in Dining Hall

The generator appears to be original to the building and beyond its expected service life. A test report conducted in 2010 states that the 150 amp output breaker on the generator had tripped at 123 amps, indicating that the breaker is faulty and should be replaced. It is unknown whether the breaker has been replaced.

One 250A/600V/3 phase automatic transfer switch (ATS) is located in the penthouse mechanical room. The ATS is connected to the emergency distribution panel, Distribution E which feeds a mixture of life safety and non-life safety loads. Current Code requires a separate transfer switch for life safety loads.

UPS

Two UPS units (UPS #1 and UPS #2) are provided in the penthouse mechanical room and serve the main IT room. A third UPS unit was reported to be present in the building for the NMR unit. The NMR UPS was not observed during the site review, and Brandon University staff reported that it is slated for replacement.

UPS #1 appears to be approximately 10 years old and in good condition. UPS #2 appears to be less than 5 years and in excellent condition. New batteries were installed in UPS #1 and #2 in 2015.

Emergency Power Distribution Recommendations

It is recommended that the existing generator is replaced with new and the emergency power distribution equipment reconfigured to meet current Codes. This would include provision of a separate life safety transfer switch and separation of life safety and non-life safety loads.

It is recommended that all original emergency distribution equipment including Distribution E and downstream panelboards are replaced with new panels suited to the proposed renovation project requirements.

Fire Alarm System

The fire alarm system control panel is a Potter PFC 9000 addressable control panel located in room G-M-1 in the basement. Audible notification is provided by bells. Visible notification is not provided. A remote annunciator was observed at the main entry doors (south entrance). The original construction drawings show a second remote annunciator in room G-27 at the east exit door from the stairwell (this was not confirmed on site).

A chemical suppression system is provided in the main IT room in the penthouse. It is connected to the fire alarm system for monitoring.

The fire alarm system appears to be in acceptable condition. It was reported that the system was replaced in 2006. It is unknown

^
Fire alarm control panel

whether all of the field devices were replaced or whether the fire alarm system wiring was replaced at that time.

The fire alarm system is monitored 24 hours a day by XL Alarms.
Brandon University staff reported that the fire alarm system in each building on campus is standalone and reports directly to the monitoring agency (no campus central reporting or monitoring).

Fire Alarm Recommendations
It is recommended that the fire alarm system is replaced if the building undergoes a major renovation. The new system would provide visible notification (strobes) as required by the current Manitoba Building Code. As well, audible notification would be provided by horns and horn/strobe combination devices.

Security and CCTV Systems

Magnetic locks were observed on interior doors leading to McMaster Hall and exterior doors at the south entrance. The magnetic locks are used to prevent unauthorized access to the building at night. The magnetic locks are used in conjunction with the card access system to allow authorized access during secure hours.

An interlock is provided so that the magnetic locks release upon signal from the fire alarm system.

A Kantech card access system is provided in the building for access control at exterior doors, the IT room, mechanical rooms and other critical rooms.

It was reported that exterior doors are likely equipped with door contacts connected to the security system. The location of the central security panel is not known.

Brandon University staff reported that CCTV cameras in the building are connected to a main Digital Video Recorder (DVR) located in

^
Typical fire alarm notification bell

McMaster Hall. There is likely a mix of digital and analog cameras present.

Security and CCTV Recommendations
As part of any major renovation, it is recommended that the magnetic locks are removed and electric strikes are instead used to secure required doors. This would improve safety for building occupants and would likely be preferred by the Authority Having Jurisdiction.

Network and Communications

The main IT room for the campus is located in the penthouse level of the Brodie building. A secondary data closet was observed in room 3-44-1.

As part of any major renovation to the building, the campus network equipment will need to be kept operational in its current location or relocated to ensure continuity of service.

Wireless access points were observed at various locations in the building. Adequacy of coverage is unknown.

Meridian digital telephone handsets were observed, indicating a Meridian PBX telephone system is provided for the building (possibly for the whole campus).

Public Address System

Public address speakers were observed in corridors throughout the building. The local public address system was reported to be operational and part of the campus-wide system. Local or campus-wide pages can be made over certain telephone handsets.

General Electrical Recommendations

- Light fixtures are at the end of their expected life. It is recommended that new LED fixtures are provided.

- A new lighting control system is recommended for the large auditorium classrooms. Lighting control should be reviewed for other areas such as corridors and common areas.

- Red exit lights do not meet current Code and may be required to be replaced with green pictogram type exit lights as part of the proposed building renovation. Since this is an interconnected building, this requirement should be reviewed with the AHJ.

- Electrical distribution equipment is beyond its expected life. It is recommended that the 600V main distribution, Distribution A and 120/208V main distribution, Distribution B are retrofitted in place. All other electrical distribution panels and wiring should be replaced, with the exception of MCC-3 (installed around 2002).

- Fire stopping should be provided around all electrical penetrations through fire separations (e.g. floors).

- It is recommended that a short circuit, coordination and arc flash study is conducted as part of any renovation project.

- The emergency generator is beyond its expected life and should be replaced with a unit sized appropriately for the future needs of the renovated Brodie building and other buildings connected to the generator.

- Emergency power distribution equipment is typically beyond its expected life and should be replaced.

- It is recommended that the fire alarm system is replaced with a new system complete with horn/strobe notification devices for audible and visible notification.

- For improved safety, it is recommended that magnetic locks are replaced with electric strike door hardware tied into the card

Section 6.0 Furnishings, Equipment, Interior Finishes and Function

The intent of this section is to provide a visual assessment of the key finishes within the John R. Brodie Science Centre as well as a commentary on the functional requirements of the major types of space. The condition of interior finishes is generally evaluated on a subjective basis, based on the reviewer's experience and discussions with Brandon University and Faculty of Science key personnel. The condition of the interior finish may be critical for aesthetic, or functional issues or reasons of health and safety.

Functional performance is concerned with user needs and whether appropriate functional and spatial considerations are provided to support these needs. As a result, an understanding of the users of the John R. Brodie Science Centre and their activities within the building (time, location, organization) is critical for evaluating the degree to which the facility is successful in meeting user needs and expectations.

Furnishings and Equipment

The furnishings and equipment in the building were assessed and an inventory was drafted on a per room basis by each department. Refer to Appendix D for the draft inventory, which identifies the following categories per item:

- item identification;
- room location;
- number of items;
- estimated date of replacement;
- estimated cost to replace item;
- ability for item to be temporarily off-line / placed in storage during transition time;
- whether or not manufacturer involvement is required for moving and storage of the item;
- special conditions required for storage;
- duration of time the department/program could function with item in storage; and
- an indication of items that are defunct / not utilized and can be disposed of.

Asbestos Containing Material

In 2005, Pinchin Environmental Ltd. was retained by Brandon University to conduct an asbestos-containing building materials survey of the John R. Brodie Science Centre. The survey was commissioned as an update to a previous asbestos materials survey conducted by Pinchin in November, 1989. The primary goal of the survey was to detail the location, condition, and type of asbestos-containing materials (ACMs) present within the building, including asbestos materials previously identified in a previous November, 1989 survey report. Refer to Appendix B.

In general, asbestos containing materials were identified within the building in a number of areas including:

- vinyl floor tiles, present throughout the building,
- rainwater and drainage piping located throughout the building,
- mechanical piping insulation,
- heat exchanger insulation,
- insulation on fittings of pipes present throughout all floors of the building,
- the insides of fume hoods; and
- plaster ceilings and wall finishes (although not specifically sampled, the report indicates that the use of asbestos in plaster during construction of the building's era was both widespread and random in nature).

As an inventory update to the original survey prepared by Pinchin Environmental dated September 5, 2006, Brandon University retained Tesseract Environmental Consulting Inc. (TEC) to conduct the biennial condition assessment of the asbestos containing materials in 2016. Refer to Appendix B.

While TEC noted that many of the items listed in Good Condition in the report could be safely managed in place, there were some recommendations for damaged items, which include:

- to remove or repair damaged floor tiles as soon as practicable. Floor tiles can be safely removed or repaired using Type 1 precautions.
- to remove or repair damaged mechanical fittings as soon as practical. Repair or removal of any ACM fittings or straight run insulation can be safely undertaken using Type 2 or Glove Bag precautions. For any large-scale abatement of multiple mechanical lines, precautions should be increased to Type 3 procedures.
- if disturbance or removal of material must occur, Transite materials may be removed following Type 1 precautions.
- on-going plaster or drywall repairs will be needed as damage is noted. TEC recommended repair of previously noted damaged areas. Repair of damaged drywall or plaster materials can be safely undertaken using Type 1 precautions. Removal of less than 1m2 of drywall or plaster materials may be undertaken using Type 2 precautions, while removal of greater than 1m2 must be undertaken using Type 3 precautions.

Interior Finishes and Functional Overview

The functional overview is a broad assessment of the current functions accommodated in the building. It involves a review of the building's ability to accommodate the use intended. The review methodology involved an overview of the building plans, multiple walk-throughs during which time the investigators made judgments on the functional requirements, and related discussions with the users and operators to review known issues, problems and complaints.

Components & Characteristics Assessed

The following components were assessed as part of the review:

- interior walls and partitions,
- floors,
- ceilings,
- doors,
- exterior walls and window surrounds
- stairwell condition of treads and landings, and
- furnishings and equipment

The characteristics that were assessed include:

- suitability for use intended and condition of finish.
- useful service life remaining, where relevant

Building Inspection

The process of inspection involved multiple walk-throughs during which time the investigators made judgments on the condition of interior finishes, furniture and equipment. Photographic documentation of the John R. Brodie Science Centre and it's components was compiled in the form of 360-degree photos, which further aided in the investigation.

Legend

Floor covering:
CPT = Carpet
SV = Sheet Vinyl
SC = Sealed Concrete
R = Rubber
SSV = Safety Sheet Vinyl
CT = Ceramic Tile
VT = Vinyl Tile
EPX = Epoxy

Walls / Ceiling:
CB = Concrete Block
GWB = Gypsum Board
ACT = Acoustic Ceiling Tile
EXP = Expose Structure
LM = Linear Metal
STC = Stucco
CIP = Cast-in-place Concrete

Finishes:
P = Paint
GLZ = Glazing
CE = Ceramic Tile
EP = Epoxy Paint
ST = Steel

Interior Finishes and Functional Overview Matrix

Space Type	Finish(es)	Condition	Comments on Functional Requirements	Known issues, problems and complaints
2 Lecture Halls (Rooms: G-21 / G-23)				
Floors	CPT & SC	CPT end of life, sealed concrete	. Brodie's (2) lecture theatres are the largest available on campus and used by all faculties. . Modern technology for Audio / Visual equipment required to support current lecture classrooms needs. . Seats require power for student tablets and computers. . User friendly controls for various lighting modes / needs. . Improve theatre acoustics	. Seating original to building and does not accommodate all body types. . Sloped floor and raised podium ongoing concern. . Lecture theatres floors are lowest point in basement and are known to flood . Current seating capacity of Theatre 'A' at 240 persons and Theatre 'B' at 144 persons inadequate for campus demand. . Ambient lighting levels are low and lack controllability. . Audio / Visual equipment is dated . Projection rooms offer limited use and primarily serve slide carousel displays . Theatre B has a good screen size but rarely write on board because screen is in the way, can only write on either side.
Ceilings	LM / STC	Poor - Original LM. lighting & controllability poor		
Doors	ST	Good		
Walls	CB & STC	Poor - Dated stucco finish		
29 Classrooms (Rooms: G-20C/G-18 ; 1-35/1-48/1-49/1-52/1-53/1-54/1-50 ; 2-23/2-44/2-30/2-31/2-48/2-33/2-34/2-35; 3-42/3-44/3-47/3-18/3-24/3-25/3-26 ; 4-22/4-47)				
Floors	VT CPT (1-48)	Poor - Original VT CPT - end of life	. Typical classroom equipped with white-boards and/or cork-boards, some with chalkboards, arranged on 2 or 3 walls. . Classrooms used for Geology require masonite topped desks to withstand rock sample abuse. . Some classrooms contain departmental related posters and materials displayed on walls. . Geology requires access to rock sample storage and microscopes adjacent to teaching classrooms (currently 2-44 and 2-48). . Modifiable / flexible classrooms with modern technology to support current lecture classrooms needs. . Ideally more large and small screens that do not obstruct boards. . Sufficient Power available to allow students to plug-in phones, tablet, and/or laptops.	. Basement computer classrooms G-18 and G-20 are cosmetically dated and lack any natural light. . ACT stained with HVAC airborne contaminants typical throughout . Typical classroom has dated wood desks with masonite tops or fixed desks arranged in rows. . Classrooms are centrally located in building opposite corridors with no access to perimeter walls for daylight access. . Physics & Astronomy electronics and magnetism classrooms require small desktop equipment for student teaching. . Classrooms are too cramped, i.e. 1-52 and 1-53, and instructors are not able to flow through aisles to answer questions. . Physics & Astronomy classrooms 2-33, 2-34, and 2-35 can accommodate 12 to 15 students, too small for student loads.
Ceilings	ACT	Poor - Original ACT		
Doors	ST	Good		
Walls	CB/CIP (Basement) CB/GWB (all other)	Good		
12 Seminar / Meeting Rooms (Rooms: G-40 ; 1-24/1-82/1-62/1-27 ; 2-37/2-48A/2-48B ; 3-48A/3-48B ; 4-48A/4-48B)				
Floors	VT CPT (1-82)	Poor - Original VT Poor - Original CPT	. Need for small meeting rooms available for staff / student meetings of 6 to 8 people. . White-board / cork-board available . Student Club rooms available for most departments adjacent to department teaching and research labs on most floors. . ADES currently has a small meeting room adjoining their office and reception area. Room is equipped with a white-boards, TV/VCR, and round table for 4 people.	. Improperly furnished and small meeting rooms with no access to daylight . Windowless meeting rooms . Typical club rooms located in re-purposed corridor space on the north-west perimeter walls with ample access to daylight and views.
Ceilings	ACT	Good - ACT in ADES Poor - Original ACT Poor - Original LM		
Doors	ST	Good		
Walls	GWB/CB	Good		

Space Type	Finish(es)	Condition	Comments on Functional Requirements	Known issues, problems and complaints
10 Teaching Laboratories (Rooms: 012 ; 2-32 ; 3-30/3-32 ; 4-24/4-25/4-28/4-31/4-26/4-34/4-35)				
Floors	VT	Poor - Original VT	. Physics & Astronomy classroom lab have desk height workstations with gas and power supply. Perimeter casework with access to water. . Geology core lab facility is currently not in Brodie building but could be relocated in basement if access to natural light is available along with a clean room for fine polishing and access to loading ramp for sample deliveries. . Chemistry would benefit from bench top steam tap and vacuum in 4-25, 4-28 and 4-24. . Ideal to allow (3) labs to open up to each other with open concept and ability to close off when necessary (4-25 , 4-26, and 4-31) . Chemistry would benefit from front of class bench for display / teaching. . Movable tables preferred and equipped with power receptacles . Flexible lighting for better presentation . Controllability of HVAC in 2-32 to turn off air supply to reduce air current interference	. Case-goods and counters are original to building and in very poor condition . Fume hoods typically are original to building and in very poor condition . Water pressure on 4th floor is a problem, can't create pressure.
Ceilings	ACT	Poor - Original ACT		
Doors	ST	Good		
Walls	CB/GWB	Good		
42 Research Laboratories (Rooms: G-14/G-14.1/G-14.2/G-32/G-34/G-20B ; 1-31/1-25/1-26.1/1-55/1-63/1-64/1-65/1-66/1-68/1-68.1/1-69 ; 2-19/2-21/2-22/2-24/2-25/2-26/2-28/2-29/2-36/2-42/2-46 ; 3-19/3-20/3-21/3-22/3-23/3-27/3-28 ; 4-18/4-19/4-20/4-20.2/4-21/4-23/4-43 ; 5-8/5-6/5.6.1/5-7)				
Floors	SV CPT (1-31) EPX (1-25/1-26.1)	Poor - Original CPT Poor - Original SV Poor - Original Epoxy	. Basement Biology research laboratories have been upgraded within the past 10 years . Fume hood and small quantities of gas storage . Case goods with workbenches typical in laboratories . Physics & Astronomy require an optics lab with small cubicles with blackout requirements and also requires access to electronics for teaching. . Room 2-46 was renovated in 2009 to accommodate a new Electron Microscope. . Geology Lab G-20D equipped for Video conferencing . Psychology research lab to simulate real world environments and assist with interview/consultation of the public . Geology research labs are equipped with research materials stored on shelves, counters for material sample work, and one computer equipped desk. . Physics student research rooms are equipped with research materials stored on shelves, computer equipped desk and white-boards. . Psychology would benefit from (4) or (5) 8'x10' soundproof testing rooms with adjoining office. . Dish-washing room and equipment would be ideal	. Research Laboratories are all centrally located and have no access to daylight . Chemical fume hoods upgraded in the basement lab but most other labs throughout building have original hoods . Basement labs are equipped with standard ACT, non-washable surface, with non-vapour tight florescent lighting fixtures and in some instances non-chemical resistant counter surfaces. . Laboratories are all centrally located and have no access to daylight . G20B lacking proper ceiling height and acoustic treatment for proper Video conferencing use . Geology labs are dated and original to building. . NMR Lab (2-19) Upgraded in the past 10 years but contains original unused magnet and a dated Spectroscope. . Chemistry needs own autoclave, currently share (2) Biology autoclaves, with better ventilation. . Biology needs a crushed ice machine and better water supply, scaling is a current problem.
Ceilings	ACT (Typical) GWB (1-25/1-26.1) EXP (2-24 to 2-28)	Poor - Original ACT (Typical) Poor - Original GWB EXP - Painted CIP in labs		
Doors	ST	Good		
Walls	CB/GWB	Good		
1 Sound Booth (Rooms: 1-30A (incl. 1-28 & WC)				
Floors	CPT	Fair	. Historically used by the Psychology department	. Booth is underutilized and now serves as an informal meeting / lounge space
Ceilings	CPT	Fair		
Doors	ST	Fair		
Walls	CPT	Fair		

Space Type	Finish(es)	Condition	Comments on Functional Requirements	Known issues, problems and complaints
Public Spaces (Corridors / Stairwells / Elevators)				
Floors	VT	Poor - Original VT	. Locker storage on ground floor level in corridors . Bench seating along north glazing typical on all levels . Wayfinding signage at elevator lobby and public areas . Geology and Botany display cases	. Original Floor tiles are ACM . Lineal metal tile ceilings in north-south corridor are dated . Most recently renovated areas have walls constructed in GWB, not CB . Stairwells are hidden and not easily located with no visual connection from North-South corridor . Lack of wayfinding signage
Ceilings	ACT/STC/LM	ACT in poor condition, STC dated finish, LM dated		
Doors	ST	Good		
Walls	CB/GWB	Good		
Administration (Rooms: G-41 ; 1-5/1-41/1-72/1-72.1/1-4/1-36/1-42/1-46/1-47 ; 2-5 ; 3-5/3-41 ; 4-39A)				
Floors	VT CPT (1-72/1-72.1)	VT original to building	. ADES reception to act as the campus front door with increased community interaction. . Copier and mail room centrally located on main floor . Small copier and supplies room located on each floor . Faculty of Science Main office to be visually accessible from the main entrance.	. ADES space was added within the basement corridor space in the past 10 years and as such, group is isolated from the remaining department. . Faculty of Science Main office is far and hidden from the public entrance . Offices are located on exterior walls but have limited access to daylight and views through small narrow windows.
Ceilings	ACT	Good - Newer		
Doors	ST	Good		
Walls	GWB	Good		
Staff Room (Rooms: 5-4 / 1-32 (incl. 1-33/1-34))				
Floors	VT	Poor - Original VT	. Staff room to provide opportunity for cross collaboration between departments and act as an informal meeting space . Provide a place to work not distracted by students, an escape from noisy corridors, a change of scene, a break-out area, a library to store important documents . Staff rooms are to boost the morale of educators	. Room 1-32 is used as informal staff room and is internal with no access to daylight but has own kitchenette and washroom. . Staff room on the fifth floor is remote and isolated
Ceilings	ACT	Poor - Original ACT		
Doors	ST	Good		
Walls	GWB/CB	Good		
3 Workshops (Rooms: 2-18 ; 4-33/4-40/4-41/4-42)				
Floors	VT	Poor - Original VT	. Workshop 2-18 used for the manufacture of specialized equipment for Physics & Astronomy use but also manufacture for other Departments . Workshop 4-42 used for the storage, servicing, maintenance and preparation of Geography field equipment. . Workshop 4-33 used for the repair of Chemistry glassware and equipment.	. Exhaust system specialized for woodworking or lathe may be required. . Venting nozzle for small soldering not present . Original workbenches are dated
Ceilings	EXP	EXP - Painted CIP in labs		
Doors	ST	Good		
Walls	CB	Good		

Space Type	Finish(es)	Condition	Comments on Functional Requirements	Known issues, problems and complaints
Biology Vivarium (Rooms: G-10 / G-9)				
Floors	SV	Good	. Vivarium was added to original building in 1976 and recently renovated in 2007. . Vivarium used for animal research including small rodent and aquatic life. . Lab requires adequate airflow based on regulation standards. . Remote / inconspicuous access to lab with animal specimens would be an asset. . Vapour tight fixtures and washables surfaces required.	. Vivarium mechanical system not meeting laboratory standards . Laboratories are all either centrally located or on the ground floor and have no access to daylight . Floors are not coved for easy cleaning and contamination control
Ceilings	GWB/EXP	Good		
Doors	ST	Good		
Walls	CB	Good		
Biology Herbarium (Rooms: G-11/G-12/G-13/G13.1)				
Floors	VT (office)/ SC (Stor./ Growth Ch.)	Poor - Original VT	. Storage of plant material used for teaching purposes. . Growth chambers used for plant growth.	. Herbarium archive sample storage is on the ground floor and has restricted and remote access. . Due to quantity of stored material, only a small fraction of samples, 10-25%, are being used for teaching purposes. . Growth chambers are very large and occupy a large room.
Ceilings	ACT (Office/Stor.) EXP (Growth Ch.)	Poor - Original ACT		
Doors	ST	Good		
Walls	CB/GWB (Office) CB (Growth Ch.)	Good		
Greenhouse (Rooms: 5-9/5-10)				
Floors	SC	Poor - Original SC	. Access to controlled natural light and water to promote plant life growth. . Accurate temperature and moisture control required. . Surfaces require to be easily washable and moisture resistant. . Prep area required for workbench and equipment storage. . Availability to hydroponic growth lighting. . Open use to campus	. HVAC unit at end of life, unit replacement required. . Wall and floor surfaces damaged due to presence of moisture and humidity. . Newer roof completed in 2017
Ceilings	GLZ	Good		
Doors	ST	Good		
Walls	CB	Poor - Moisture Damage		
Master of Science Environmental and Life Sciences (MELS) (Rooms: 4-43 / 4-39)				
Floors	VT	Poor - Original VT	. Requires research desks/cubicles to accommodate approximately 23 students (current load). . Small Lounge central and kitchenette area for student break / informal meeting . Research library and SMART board . Could benefit from more visibility and through traffic on main floor to showcase research work taking place.	. Insufficient desk space to accommodate all students
Ceilings	ACT	Poor - Original ACT		
Doors	ST	Good		
Walls	CB	Good		

Space Type	Finish(es)	Condition	Comments on Functional Requirements	Known issues, problems and complaints
70 Offices (Rooms: G-38/G-39/G-40A ; 1-6/1-7/1-8/1-9/1-10/1-11/1-12/1-13/1-14/1-15/1-16.1/1-16.2/1-70A//1-70/1-73/1-74/1-75/1-76/1-77/1-78/1-79/1-80/1-81/1-83 ; 2-4/2-6/2-7/2-8/2-9/2-10/2-11/2-12/2-13/2-14/2-15/2-16/2-17/2-43 ; 3-4/3-6/3-7/3-8/3-9/3-10/3-11/3-12/3-13/3-14/3-15/3-16/3-17/3-43 ; 4-4/4-5/4-6/4-7/4-8/4-9/4-10/4-46/4-11/4-12/4-13/4-14/4-15/4-16/4-17)				
Floors	VT	Poor - Original VT	. Offices require direct access to students, research space and lecture rooms. . Located throughout the building typically grouped per departments and on floors with most relevant spaces to department. . Require access to daylight and thermal control of individual spaces . Geology requires (4) additional offices; (2) Geophysics, (1) Geo-scientist, and (1) for a Research Chair.	. Paint colour white throughout, no accent walls. . Concrete Block provides an institutional finish. . Offices are typically located on exterior walls but have limited access to daylight and views through small narrow windows. . Belief that the line-up of offices along south corridor is not ideal and not conducive to interaction as there are no classroom down corridor and no reason for students to go there.
Ceilings	ACT	Poor - Original ACT		
Doors	ST	Good		
Walls	CB	Good - Institutional		
IT (Rooms: G-20A/G-20A.1/G-20A.2/G-20D ; 5-6)				
Floors	VT/Raised Floor System	Poor - Original VT	. General computer servicing / support room . Campus server room located on the fifth floor in a dedicated room . Dedicated smaller research rooms for student use	. Basement IT rooms appear to be temporary / makeshift servicing space . Inadequate cooling noted in some rooms . Fifth floor server room to be relocated off-campus in future
Ceilings	ACT	Poor - Original ACT		
Doors	ST	Good		
Walls	GWB/CB	Poor GWB CB Good		
27 Storage / Ancillary Spaces (Rooms: G-5/G-15/G-19/G-25/G-26/G-40B ; 1-26/1-59/1-71 ; 2-49/2-27/2-45/2-39/2-A/2-B/2-C ; 3-45/3-29/3-31/3-34/3-36/3-39/3-40/3-46 ; 4-34/4-37/4-38/4-44)				
Floors	EPX (1-26)		. Room 1-26 was historically used by the Psychology department . Geology will require additional storage space for Geophysics	. Access to basement Chemical and Biological storage rooms require walking through building from fourth floor to basement to access. Final disposal requires specialized disposal services. . Storage 1-26 and G-19 underutilized and empty . Rooms 1-56 through 1-61 historically study / observation rooms no longer in use. . Rough sample facility in basement (G-15) needs to be expanded in size to provide more working room. . Radio Isotope Storage 2-39 used infrequently
Ceilings	GWB (1-26)			
Doors	ST			
Walls	CB			
12 Washrooms (Rooms: G-1/G-2 ; 1-1/1-2 ; 2-2/2-3 ; 3-1/3-2 ; 4-1/4-2 ; 5-2/5-3)				
Floors	CT	Poor - Original CT	. Universal toilet rooms are to be provided on each floor . Increased number of washroom fixtures are required to accommodate large capacity of Lecture Theatres	. Washroom finishes are mostly original to the building including plumbing fixtures and toilet partitions. . Available washroom facilities not adequate for building occupant load . Accessible requirements are not addressed including but not limited to availability of accessible stalls, clearances, and fixture heights.
Ceilings	GWB	Dated but clean		
Doors	ST	Good		
Walls	CB (some GWB)	Dated and Institutional		

Space Type	Finish(es)	Condition	Comments on Functional Requirements	Known issues, problems and complaints
Mechanical Penthouse (Rooms: 5-5)				
Floors	SC	Good	. New chiller addition completed in 2001 which serves the Brodie building and a large portion of the remaining campus. . Servicing of existing fume hood motors accessed within penthouse	. Refer to Mechanical and Electrical Reports for additional comments.
Ceilings	EXP	Good		
Doors	ST	Good		
Walls	ST	Good		
Service Spaces (Rooms: Workshop G-7 / Jan. Storage G-6 / Generator G-8 / Loading G-4 / Services G-11.1 / Service G-29 / Central Corridor on floors 1 through 4)				
Floors	SC VT (Central corridors)	Poor - Original VT	. General storage area with open steel shelving . Typically see mechanical lines and electrical panels . The intent of the central corridors was to interconnect the research rooms to the classrooms via a 'back-of-house' concept . Dedicated service elevator (freight) would be useful for transport of hazardous materials and chemicals	. Ramp access no longer required by faculty of science . Ramp has been know to be primary access to water flooding basement . Under lit space with minimal lights . Central corridors have largely gone underutilized in most cases and are not an efficient means of shared storage with classrooms and research labs. . The (3) large service shafts that run through each floor are under-utilized and take up a lot of valuable area.
Ceilings	EXP ACT (Central corri-dors)	Poor - Original ACT		
Doors	ST/CB	Good		
Walls	CB / CIP / GWB	Good		

Section 7.0 Life Safety

The fire and life safety features in a building can be viewed as consisting of three principal elements:

- passive elements,
- active elements, and
- organizational elements.

The **passive fire protection elements** include such features as spatial separations, structural fire resistance, fire separations, closures, interior finishes, and means of egress.

The **active fire protection elements** include sprinklers, standpipes, alarms, smoke and heat detectors, voice communication, special elevators and smoke control/ventilation systems.

The **organizational fire protection elements**, which involve emergency planning, evacuation procedures, commitment to maintenance schedules and periodic verifications of the mechanical and electrical equipment, and safe practices for storage of hazardous materials are not covered in the scope of this report.

Passive Fire Protection Elements

As described above, the passive fire protection elements are architectural in nature and will be covered in this section of the report.

Building Classification - The existing 6 storey structure, completed in 1972, with an area of 2,323 m2 (25,005 sq. ft.) per floor plate, includes a full basement and would be classified with a Major Occupancy classification as A (Assembly Occupancy), Division 2 Classification for Schools and Colleges with Laboratories as a minor occupancies classified as F (Industrial), Division 3 (Low-hazard) Classification. The current Manitoba Building Code does not include a classification for a Group A, Division 2 building with 6 storeys, in non-combustible material construction, without a sprinkler system.

As such, the building classification, under the current Manitoba Building Code, is 3.2.2.24 for a Group A, Division 2 Classification, up to 6 Storeys, Any Area, Sprinklered.
A building under this classification:

- must be of non-combustible construction;
- is not more than 6 storeys in building height;
- has no restrictions on building area; and
- is required to be sprinklered throughout.

The existing Brodie building does not meet all the requirements of this classification, primarily due to the fact that it is not fully sprinklered. For compliance to the Code, a sprinkler system is required to be provided throughout the existing building.

The building with an estimated occupant load above the main of 1211 occupants / 1.8 x 4.368M of stair width = 154 with is less than 300 as stipulated by Code and as such would not be classified as a High Building, which would trigger more stringent requirements.

Railings and Guards - At the exterior main entrance it was noted that existing 33.5" high guardrail condition around the front entrance landing did not meet current code requirements, as it is climbable and less than 42". This condition also occurs between existing site grading and the exterior loading dock.
It is strongly recommended that this area of the building be upgraded to meet Code, with temporary guardrails such as top mounted aluminum posts with pickets or glazing be installed prior to any additional renovation work.

Existing balcony railings were also noted at 39.5" high from finish floor level, less than the current code requirement of 42.1". It was noted by the owner that balconies are currently locked an inaccessible to the public.

Structural Fire resistance - Construction is comprised of non-combustible materials consisting of structural concrete framing of

^
Typical stairwell and non-compliant handrail

^
above: steel stud framing in existing mechanical shafts. Note fire damper at floor level to maintain floor to floor fire separation; below: fire hose cabinet

the main and upper levels, including roof assembly, with concrete block interior and exterior walls, brick cladding, and cast-in-place concrete supporting structure. As such, The fire separation for the floors and supporting structure above the basement requires a 1 hour fire separation throughout and is achieved via the cast-in-place concrete structure.

Major Fire Separations - The John R. Brodie Science Centre is currently separated from McMaster Hall with a 2 hour firewall along the north elevation at gridline N between gridlines 17 & 19 at ground floor and main floor levels.

Closures - The Fire Separation between the two buildings is achieved via corridor doors at both ground and main floor levels, which are equipped with door closure devices that release upon fire alarm signal. These magnetic locks are provided in the following locations:

- south side at the main entry doors on the first floor with access to Louise Avenue;
- north side on both the lower ground and first levels with access to McMaster Hall;
- south side at the lower level loading dock doors;
- north side at the lower level exterior plaza doors; and
- the lower level south-east access to 18th Street.

No mechanical system interconnection was observed and no fire damper closure devices were observed.

Means of Egress - The John R. Brodie Science Centre has three cast-in-place enclosed stairwells on the north, south and east ends of the building, which run from the fifth floor down to the ground level and all three exit directly out to grade. Furthermore, each floor area is directly connected to three access to exits and secondary exits from the ground and main floor levels through interconnected corridors to

^
life safety console across from elevator bank that contains a drinking fountain, clock system, alarm pull station, bell and fire extinguisher

^
top: view through to McMaster Hall from ground floor corridor; bottom: sprinklers installed in ground floor Lecture Theatres

McMaster Hall.

Interior Finishes - The John R. Brodie Science Centre, as per Classification 3.2.2.24, does not permit non-combustible material in its construction. Consistent with current Code, no materials, such as wood, were observed. As such, it was assumed that all walls not constructed in concrete block were comprised of steel studs clad in gypsum wall board as observed in the exposed mechanical shafts.

Access for Fire Fighting - Access for firefighting is found at Main floor and ground floor level vial 2 streets; Louise Avenue to the South and 18th Avenue to the East. However, despite not being sprinklered throughout as per todays Code requirements, the ground floor level was fully sprinklered to address the increased occupant load found in both Lecture Theater 'A' room G-23 and Lecture Theater 'B' room G-21. A Standpipe system is currently installed with hose stations throughout the building.

Active Fire Protection Elements

Fire Protection

The ground floor is fully sprinklered and all the floors above are served by a stand-pipe system. The fire hose cabinets are distributed throughout the floor plate typically adjacent exits. The risers are in four location. On the south side of the facility the fire hose cabinets are located across from the elevator bank in the console that contains a drinking fountain and the clock system. On the east side of the building the firehoses are to the south of the stairwell, similarly on the north side the firehoses are adjacent the main stairwell. There are also hose cabinets located within the core aisle between laboratory spaces. The penthouse floor appears to have two firehose cabinets one in the corridor adjacent the elevators to the west and the other on the east stairwell.

Smoke Control Strategy

A review of the annual fire alarm test report shows an inadequate quantity of fire detectors in the building. Fire detectors must be provided in all storage rooms, service rooms and elevator shafts. Heat detectors provided at the top of the stair shafts and in the elevator machine room must be replaced by smoke detectors.

Building Code Matrix

The following pages provide a more detailed building code matrix that address: general project description, major and minor occupancies, building area, number of storeys, sprinklering, and occupant load; building fire safety; safety within floor areas; exits; vertical transportation; service facilities; health requirements; and barrier-free design, which is also addressed in more detail in Section 8.0 of this report.

<

example of magnetic locks located on lower ground and first floor doors that release upon fire alarm signal.

NATIONAL BUILDING CODE MATRIX (2010) with Manitoba Amendments (MBC)   DATE: 2019-02-04

PROJECT NAME / DESCRIPTION:
EXISTING JOHN R. BRODIE CENTRE, BRANDON MANITOBA
6 STOREY 1972 SCIENCE BUILDING

NBC REFERENCE
(REFERENCES ARE TO DIVISION B UNLESS NOTED
[A] FOR DIVISION A OR [C] FOR DIVISION C

ITEM	**3.1. GENERAL**				ARTICLE
1.	PROJECT DESCRIPTION:	[ ] NEW [ ] ADDITION	[X] ALTERATION [ ] CHANGE OF USE	[X] PART 3	1.3.3.1-.3 [A] & 1.3.5.1. 1)
2.	MAJOR OCCUPANCY(S): OTHER:	A-2 SCHOOLS AND COLLEGES -			3.1.2.1 (1) & 3.2.2.6.
3.	FIRE SEPARATIONS REQUIRED:	0 HR FIRE SEPARATION BETWEEN MAJOR OCCUPANCIES			3.1.3.1. & 3.2.2.7.
4.	MINOR OCCUPANCY(S):	F-3 LABORATORIES	APPROX. 743.2 S.M.		3.2.2.8.
5.	FIREWALLS:	2 HR FIRE SEPARATION	LOCATION: GL N BTW GL 19 & 17	[ ] N/A	3.1.10.
6.	BUILDING AREA: (25,005 sf.f)	EXISTING 2323	NEW 0	TOTAL 2323 SQ.M	1.4.1.2 [A]
7.	NUMBER OF STOREYS:	ABOVE GRADE BELOW GRADE CRAWLSPACE ROOFTOP OCCUPANCY	- 5 - 1 [ ] YES [ ] YES	 [X] NO [X] NO	1.4.1.2 [A] & 3.2.1.1 3.2.2.9. 3.2.2.13.
8.	MEZZANINES:	[ ] YES	[X] NO		3.2.1.1. 3) - 8) & 3.2.8.2.
	INTERCONNECTED FLOOR SPACE:	[ ] YES	[X] NO		3.2.8
9.	SPRINKLERED:	[X] YES (*PARTIAL)	[ ] NOT REQUIRED		
10.	FACING # OF STREETS:	2	[X] FIREFIGHTER ACCESS		3.2.2.10 & 3.2.5.
11.	FIRE BLOCKS:	[ ] ATTIC, 600m2, 60m	[ ] CRAWLSPACE, 600 m2, 30m MIN DIM	[X] NA	3.1.11.1., 3.1.11.5 & 3.1.11.6.
12.	OCCUPANT LOAD (Based On):	[X] AREA	[ ] NO. OF PEOPLE		3.1.17.1.

	ROOM	*AREA (M2)*	*AREA/ PERSON*	*# of PPL*
BASEMENT FLOOR	AUDITORIUM #1	201.1	0.75	269
	AUDITORIUM #2	274.2	0.75	366
	CLASSROOMS (5)	462.6	1.85	251
	STORAGE	99.9	46	3
	OFFICES (12)	114.9	9.3	13
	RESEARCH ROOMS (5)	347.8	4.6	76
	MAINTENANCE	156.8	46	4
	CORRIDOR W/ OCCUPANCY	120.1	3.7	33
			SUB-TOTAL	**1015**
MAIN FLOOR	AUDITORIUM #1	0	0.75	0
	AUDITORIUM #2	0	0.75	0
	CLASSROOMS (4)	255.5	1.85	139
	MPR	67.9	0.75	91
	OFFICES (11)	131.7	9.3	15
	RESEARCH ROOMS (5)	47.8	4.6	11
	GALLERY	87.7	0.4	220
	APPLIED DISASTER	82	9.3	9
	SCIENCE ADMIN	44.7	9.3	5
	RURAL MENTAL HEALTH	33.8	9.3	4
	CORRIDOR W/ OCCUPANCY	36.4	3.7	10
			SUB-TOTAL	**504**
SECOND FLOOR	NMR LAB	62.2	4.6	14
	LECTURE ROOM (2)	224.5	1.85	122
	CLASSROOMS (6)	301	1.85	163
	OFFICES (19)	219.6	9.3	24
	RESEARCH ROOMS (11)	415.5	4.6	91
	STUDENT LOUNGE	21.6	1.85	12
	CORRIDOR W/ OCCUPANCY	21.1	3.7	6
			SUB-TOTAL	**432**

THIRD FLOOR	GENERAL CHEM. LAB	112	4.6	25
	SPECTRO. LAB	62.5	4.6	14
	CHEM. RESEARCH	41.2	4.6	9
	LARGE RESEARCH LAB	210.6	4.6	46
	RESEARCH PREP	29.1	9.3	4
	TEACHING LAB (3)	349.9	4.6	77
	CLASSROOMS (3)	310.7	1.85	168
	OFFICES (10)	113.3	9.3	13
	STUDENT LOUNGE	21.6	1.85	12
	STORAGE (8)	222.3	46	5
	CORRIDOR W/ OCCUPANCY	0	3.7	0
			SUB-TOTAL	**373**
FOURTH FLOOR	RESEARCH LAB #1 TO #5	562.4	4.6	123
	CLASSROOM LAB (2)	143	4.6	32
	CLASSROOMS (2)	212.1	1.85	115
	OFFICES (21)	246.1	9.3	27
	STUDENT LOUNGE	21.6	1.85	12
	STORAGE (8)	237.7	46	6
	CORRIDOR W/ OCCUPANCY	0	3.7	0
			SUB-TOTAL	**315**
FIFTH FLOOR	STAFF LOUNGE	62.3	1.85	34
	BOTANY GREENHOUSE	106	4.6	24
	RESEARCH LABS (3)	75	4.6	17
	IT SERVER ROOM	75.6	46	2
	MECHANICAL ROOM	630.6	46	14
			2	0
			SUB-TOTAL	**91**
			TOTAL	**2730**

ITEM	**3.2. BUILDING FIRE SAFETY**			ARTICLE
13.	BUILDING CLASSIFICATION:	**A-2** UP TO 6 STOREYS, ANY AREA, SPRINKLERED	**3.2.2.24**	3.2.2.20. - 3.2.2.88.
	permitted	☐ COMBUSTIBLE / ☒ NON-COMB.	☐ BOTH	
	actual	☐ COMBUSTIBLE / ☒ NON-COMB.	NBC/ULC DES. LISTING	
	FLOOR ASSEMBLIES:	1 HR FRR FIRE SEP.		
	MEZZANINES:	1 HR FRR FIRE SEP.		3.2.1.6.
	LOAD BEARING BEAMS AND COLUMNS:	1 HR FRR FIRE SEP.		
	ROOF ASSEMBLY:	0 HR FRR FIRE SEP.		3.1.14.2.
14.	FLOOR ABOVE BASEMENT:	1 HR FRR FIRE SEPARATION	☐ N/A	3.2.2.9., 3.2.1.4 & 3.2.1.5
15.	OCCUPANCY ON ROOF: N/A	1 HR FRR FIRE SEPARATION OF FLOOR SUPPORTING OCCUPANCY		3.2.2.13.
16.	SPATIAL SEPARATION:	EXISTING CONDITION TO BE MAINTAINED		3.2.3.1. A to E & 3.2.3.7. 1) & 2)
17.	FIRE ALARM REQUIRED:	☒ YES ☐ NO	*See Mechanical*	3.2.4.
18.	EMERGENCY LIGHTING REQUIRED:	☒ YES ☐ NO	*See Electrical*	3.2.7.
19.	EXIT SIGNAGE REQUIRED:	☒ YES ☐ NO	*See Electrical*	3.4.5.
20.	PROVISIONS FOR FIRE FIGHTING:			3.2.5.
	ACCESS TO ABOVE GRADE STOREY :	☒ YES	☐ NO ☐ N/A	3.2.5.1.
	ACCESS TO BASEMENT :	☒ YES	☐ NO ☐ N/A	3.2.5.2.
	ACCESS TO ROOF :	☒ YES	☐ NO ☐ N/A	3.2.5.3.
	ACCESS ROUTES :	☒ YES	☐ NO ☐ N/A	3.2.5.4. & 3.2.5.5.
	WATER SUPPLY IS ADEQUATE :	☒ YES	☒ SERVICED ☐ CISTERN	3.2.5.7.
	STANDPIPE SYSTEM REQUIRED :	☒ YES	☐ NO ☐ N/A	3.2.5.8.
	HYDRANT WITHIN 45 M OF FIRE DEPT. CONNECTION :	☒ YES	☐ NO ☐ N/A	3.2.5.15.
21.	HIGH BUILDING: +/-20M FROM GRADE	☐ YES ☒ NO		3.2.6.
		1211 OCCUPANT LOAD ABOVE MAIN / 1.8 *4.368M OF STAIR WIDTH = 154 (Less than 300		3.2.6.1 1)a.ii
22.	ADD. REQS FOR MEZZANINES:	☐ YES ☒ NOT APPLICABLE		3.2.8.

ITEM	**3.3. SAFETY WITHIN FLOOR AREAS**			ARTICLE
23.	SEPARATION OF SUITES:	0 HR FRR FIRE SEP.		3.3.1.1. & 3.3.4.2.
24.	2 MEANS OF EGRESS REQUIRED:	ROOFTOP ☒ YES	☐ N/A	3.3.1.3. & 3.3.1.5.

25.	PUBLIC CORRIDOR SEPARATIONS:	0 HR FRR FIRE SEP.	[X] N/A		3.3.1.4. & 3.3.4.2.
26.	JANITOR ROOMS:	1 -	[ ] N/A	[ ] SPRINKLERED	3.3.1.21.
27.	COMMON LAUNDRY ROOMS:	0 -	[X] N/A	[ ] SPRINKLERED	3.3.1.22.
28.	WELDING AND CUTTING ROOMS:	0 -	[X] N/A		3.3.1.25.

29.	TENANT STORAGE ROOMS:	0 -	[X] N/A	[ ] SPRINKLERS REQUIRED	3.3.4.3.
30.	REPAIR GARAGE:	[ ] YES	[X] N/A		3.3.5.5.
31.	STORAGE GARAGE	[ ] YES	[X] N/A		3.3.5.6.

32.	STC RATINGS FOR RESIDENTIAL SUITES: N/A		3.3.4.6.

33.	HAZARDOUS SUBSTANCES:	[X] YES	[ ] NO	3.3.1.2.
34.	STORAGE OF DANGEROUS GOODS:	[X] YES	[ ] NO	3.3.6.2.
35.	INDOOR STOR. OF COMP. GASES:	[X] YES	[ ] NO	3.3.6.3.
36.	FLAMMABLE/COMB. LIQUIDS:	[X] YES	[ ] NO	3.3.6.4.

ITEM	**3.4. EXITS**				ARTICLE
37.	2 EXITS REQUIRED:	[X] YES	[ ] NO		3.4.2.1.
38.	NUMBER OF EXITS PROVIDED:	4 Main floor area			
		4 Basement Area			
39.	NUMBER OF EXITS at MEZZANINE:	0 (Indicate #)	[X] N/A		3.4.2.2.

40.	DISTANCE BETWEEN EXITS:	58.5 M (Length) > 1/2 DIAGONAL =		36.9 M (Distance must be not less than 9m)	3.4.2.3.
41.	TRAVEL DISTANCE:	60 M			3.4.2.5.
42.	DEAD END-CORRIDORS:	M (Distance)	[X] NONE		3.3.1.9. 7)

43\. EXIT WIDTH: 3.4.3.2.

DOORWAYS, RAMPS, CORRIDORS	### PERSONS X	6.1 mm per person	=	10461.5 mm REQ.	
(Actual)	900 DOOR WIDTH X	12 # OF DOORS	=	10800 mm PROVIDED	
		6.1 mm per person	=	147.5 PERSONS/EXIT	
BASEMENT:	### PERSONS X	6.1 mm per person	=	6191.5 mm REQ.	
(Actual)	900 DOOR WIDTH X	11 # OF DOORS	=	9900 mm PROVIDED	
		6.1 mm per person	=	147.5 PERSONS/EXIT	
MINIMUM CORRIDOR WIDTH	1100 mm				3.3.1.9. & 3.4.3.2. A.&B.
MINIMUM DOOR WIDTH	825 mm				3.4.3.2. A.&B. & 3.3.8.3.
MINIMUM RAMP WIDTH	1100 mm			[X] N/A	3.4.3.2. A.&B.
STAIRS	### PERSONS x	8 mm per person	=	13720 mm REQ.	
(Actual)	### mm STAIR WIDTH	3 # OF STAIRS	=	13104 mm PROVIDED	
		8 mm per person	=	546 PERSONS/EXIT	
MINIMUM STAIR WIDTH	1100 mm				3.4.3.2. A.&B.

44.	FIRE SEPARATION OF EXITS:	1 HR FRR FIRE SEP.		3.4.4.1.
45.	EXIT THROUGH LOBBY:	0 -	[X] N/A	3.4.4.2.
46.	HORIZONTAL EXIT:	[X] YES	[ ] NO	3.4.1.6. & 3.4.6.10.

ITEM	**3.5. VERTICAL TRANSPORTATION**		[ ] N/A		
47.	ELEVATOR SHAFT:	1 HR FRR FIRE SEP.			3.5.3.1.
48.	ELEVATOR MACHINE ROOM:	1 HR FRR FIRE SEP.	[ ] N/A		3.5.3.3.
49.	ELEVATOR SIZE:	APPROX. 1737 mm X 2438 mm		2 ELEVATORS PROVIDED	3.5.4.1.

ITEM	**3.6. SERVICE FACILITIES**				
50.	SERVICE ROOM (fuel-fired):	1 HR FRR FIRE SEP.			3.6.2.1.
51.	SERVICE (other) ROOM:	1 HR FRR FIRE SEP.		*Specify Type:* FIRE PUMP ROOM	
52.	INCINERATOR ROOM:	0 -	[X] N/A		3.6.2.4.
53.	REFUSE (garbage) STORAGE ROOM:	0 -	[X] N/A		3.6.2.5.
54.	VERTICAL SERVICE SHAFT	1 HR FRR FIRE SEP.	[ ] N/A		3.6.3.1.

ITEM	**3.7. HEALTH REQUIREMENTS**				
55.	RESIDENTIAL OCCUPANCY:	[ ] YES	[X] N/A		3.7.2.2.11)
56.	NUMBER OF W/C REQUIRED:	### PERSONS / 2	1365 PER SEX	*Assembly Spaces*	Table 3.7.2.2.A.
		FEMALE W/C	22 REQ.	18 PROVIDED	
		FEMALE LAV	11 REQ.	10 PROVIDED	
		MALE W/C	12 REQ.	17 PROVIDED	2/3 ARE URINALS
		MALE LAV	6 REQ.	7 PROVIDED	

ITEM	**3.8. BARRIER-FREE DESIGN**				
57.	BARRIER FREE PROTECTION:	[ ] SPRINKLERED	[ ] N/A		3.3.1.7.
58.	BARRIER FREE PATH OF TRAVEL:	[X] YES	[ ] NO	[X] PROVIDED BY ELEVATOR	3.8.1.2., 3.8.1.3. & 3.8.2.1.
59.	BARRIER FREE WASHROOM:	[ ] YES	[X] NO		3.8.2.3.
60.	AUTO-DOOR OPERATORS:	[X] YES	[ ] N/A		3.8.3.3. 5)

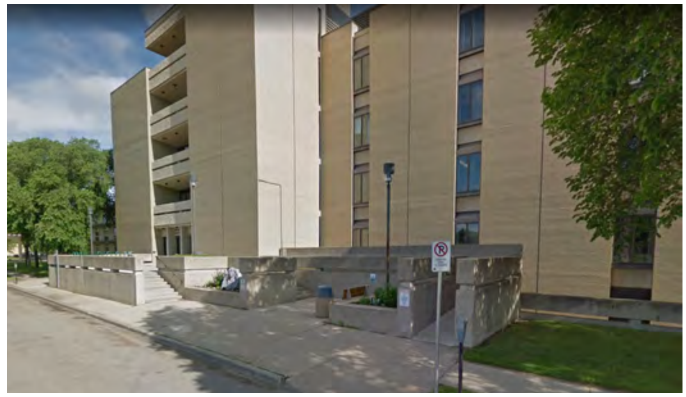
Section 8.0 Barrier Free Compliance and Elevators

Compliance with Barrier-Free Requirements

The ultimate goal of a functional evaluation is to determine the effectiveness and efficiency of relationships between building, environment, people and activities, measured against established criteria. One such criteria is the effectiveness in providing a barrier-free environment that meets code.

The following components have been assessed relative to barrier-free requirements:

- pedestrian approach to the building from off-site and on-site, including approaches from the street, connected buildings, and nearby parking facilities
- major features of the building and its site, and the general use of the building
- orientation and wayfinding systems, including building identification, street identification, directories, information and reception centres, focal and other visual, tactile, and audible wayfinding elements
- public and private entrances including adequacy of ramp slopes, stair design, landing sizes, handrails, clear openings at doors and passageways, vestibule space for wheelchair maneuvering, ease of door opening, and hazards for visually impaired and blind people
- academic and research areas such as lecture halls, classrooms, teaching laboratories and research laboratories
- circulation and public use areas including lobbies, reception areas, horizontal circulation (corridors), vertical circulation (stairs, ramps, elevators)
- support areas such as washrooms, lounges, filing and storage rooms
- administrative areas such as offices
- secured services spaces including janitorial, loading, storage and mechanical and electrical spaces



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top: view of main entrance off of Louise Avenue; bottom: access to concrete ramp at main entry on south side of building

Pedestrian Approach

The south entrance concrete stairs, landing and ramp form the primary public entrance. The existing ramp is compliant in width, however it does not provide adequate handrails on each sides nor is it equipped with colour, texture and tone differences from the surrounding surfaces. A ramp slope is required to be 1:12 however, the existing ramp is currently too steep with a slope of 1:9. Level areas on the ramp are present but Code requirements state that these levels must not be less than 1500 x 1500 at intermediate landings and 1500 x 1800 at directional changes. The existing ramp landings are 1219 x 1219 at intermediate landings and 1448mm x 1448 at direction changes representing a shortfall in dimension of 281mm to 352mm respectively. To meet current Code, handrails must be between 865mm and 965mm

^
Retrofitted automatic door operator and removal of interior vestibule door at south main entry

^
Current room identification signage, which does not meet code requirements

in height and guards 1,070mm in height. The existing guards are currently installed at 760mm in height, which represents a 310mm shortfall.

Building and Site Features
The existing building is served by a south entrance off of Louise Avenue, the only public entrance accessed directly off the street, and two internal entrances from McMaster Hall to the north with ground floor and first floor level entries. As such, more than 50% of the pedestrian entrances are barrier-free and provide public access to the building. The south main entrance is accessed at an elevated level and accessed from the street by an exterior ramp. The two north entrances to the building are level and accessed directly from adjoining interior corridors. A barrier-free path of travel is provided from the adjoining parking area on the south side of Louis Avenue with a roll down curb off the street providing access to the main entrance ramp to the building. The existing curb ramp is not installed with colour, texture and tone differences from the surrounding surfaces. The existing exterior plaza to the north of the building does not meet barrier-free requirements.

Main Entrances
The main entrance to the John R. Brodie Science Centre is off Louise Avenue through three sets of double doors. The west-most set of double doors has been retrofitted with an automatic door operator and in order to achieve the required clear clearance between doors, the interior set of vestibule doors was eliminated. In addition, entrance to the building is provided to the north. The entry doors at both the lower ground level and first levels have been equipped with magnetic hold opens and as such, these doors remain open throughout the day creating an unobstructed path of barrier-free travel.

Orientation and Wayfinding
The entrance to the John R. Brodie Science Centre is not delineated with the use of different texture and colour from the surrounding areas marking the path of travel i.e. hard surfaces and soft. As such, the reception area, classrooms,

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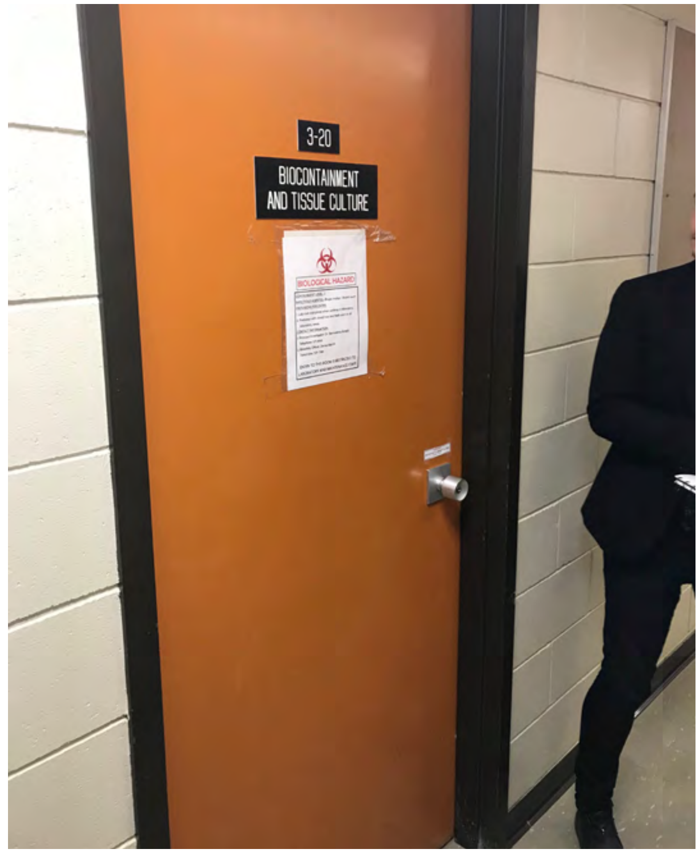
Non-compliant drinking fountain, which does not meet barrier-free dimensional requirements



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Non-compliant knob door handles that require fine manual dexterity, such as grasping, pinching or twisting.

laboratories, offices and elevator access may be difficult to locate. Wayfinding signage is currently located at each floor level, opposite the elevators, however the font is not large format and there is no raised text, graphics, or braille information available. None of the current signage incorporates the international symbol of accessibility to indicate the location of barrier-free facilities. Currently, there the room identification signage is not located on the latch side of door and does not include raised text, graphics, and braille per code requirements. In the event of an activated alarm, no visual alerting equipment is currently present for people with hearing impairments, i.e. strobe lights.

Circulation & Public Use Areas

Drinking Fountains (MBC 3.8.3.16) located in the public corridors are included in the fire hose cabinet consoles and are non-compliant as they do not provide sufficient space around, nor clear space under, and are located above the required barrier-free mounting height for access by persons with mobility issues or using a wheelchair. All fire extinguishers and alarm pulls should be reachable whether seated or standing with controls located between 900mm and 1200mm high. Refuge areas are currently provided in all existing stairwells, offering a safe area that will hold occupants until they can exit or firefighters can evacuate them. Door handles are to be operable with one hand and must not require fine manual dexterity, such as grasping, pinching or twisting. As such, the current facility is non-compliant as knob handles are present throughout and should instead be equipped with lever handles or push plate / door pulls.

Doorways & Doors

Major circulation routes, particularly the entrances to the public washrooms, are non-compliant with current Code requirements that necessitate a 600 mm clear space on the pull side of the door. Some of the existing areas may be modified by the renovations to the existing space, at which time doorways might be able to be reconfigured to provide required

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Typical washroom captured with 360 degree camera

clear spaces. Alternate approaches are the installation of power door operators at locations where the surrounding walls make compliance impossible, or investigation of potentially removing the doors, and leaving a clear opening, depending on location and review of sightline or other privacy issues.

Support Areas - Washrooms, Water Closets and Universal Toilet Rooms

(MBC 3.8.3.8, 3.8.3.9, 3.8.3.11, 3.8.3.12)
Existing washrooms include over-size toilet stalls intended as barrier-free stalls. These stalls are non-compliant according to current requirements for barrier-free stalls, as they do not meet the current dimensional requirements, and are not served by a compliant barrier-free path of travel (related to issues of clearances at doorways, noted above). There are no compliant Universal Toilet Rooms currently in the building. Barrier-free requirements, including provision of at least one Universal Toilet Room, can be addressed through renovation of existing washrooms, or might be more practical to address by the addition of new washrooms (as required to meet current requirements for total fixture counts) as part of the addition and renovations. Existing washrooms would be allowed to remain non-compliant, if compliant barrier-free facilities are added on the same floor level, within 45 metres.

Academic and Research Areas

Lecture Theatres A & B do not meet barrier-free code requirements as they are not currently equipped with assisted listening devices. Accessible seating is currently not integrated into the general seating plan as all seats with integrated flip-down writing surfaces are fixed. With lecture theatre occupant loads between 101 and 200 persons, a minimum of three spaces should be allocated for wheelchairs to meet current code. Additionally, many of the classrooms are furnished with fixed table tops that have minimal clearances that are inadequate for barrier-free access. Lab casework found in teaching and research labs typically do not offer a barrier-free section with the required lower counter height and clear space below.

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Non-compliant Lecture Theatre stage, with no barrier-free access

Administrative Areas
The existing Science Reception counter is non-compliant with current requirements for use by the public, as it does not include a barrier-free section with the required counter height and clear space under the counter.

Service Areas
The current Manitoba Building Code requires that a barrier-free path of travel be provided throughout the building, with exceptions to service spaces.

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top: fixed classroom tables with minimal clearances, inadequate for barrier-free access; bottom: fixed Lecture Theatre seating, with flip-down writing surfaces that do not meet barrier-free requirements

Elevators

The John R. Brodie Science Centre has two passenger elevators that access all six levels of the building. They are original to the building and do not provide dedicated service or freight use.

In November 2018, Otis Canada Inc. provided a report outlining options for elevator upgrades for capital planning purposes. The report includes some immediate options as well as consideration for a future, larger modernization project. The information provided from the Otis report was used to define the scope and cost for the conceptual design recommendations presented in this report. The recommendations related to performance, safety and interior upgrades, including addition/upgrade of:

- new door operators, which rely on digital closed-loop technology to continuously monitor the door speed and positioning to ensure that door performance matches predefined profiles for opening, closing, stopping and reversing.
- new door restrictors - Elevator codes in North America generally require evacuation deterrent devices on elevators. Door restrictors are devices that prevent passengers from opening the elevator doors if the elevator stops between floors. The collapsible door restrictor works in conjunction with a hoistway door angle to deter passengers from exiting the car outside the landing zone.
- door protection system, which uses infrared emitters and detectors to continuously scan the elevator entrance for interrupted beams. If any beam in the curtain is interrupted, the system will reopen the elevator door instantly. It complies with the B44- Appendix E and ADA requirements for non-contact detection.
- access alert alarm, which is a practical and industry first safety enhancement that can be applied to elevator equipment worldwide. Similar to the seatbelt alarm found in a car, an alarm sounds when anyone enters the hoistway. The alarm continue to sound until it is physically switched off. The alarm also sounds when the car is placed in inspection mode.

Part 3 - User Data Summary

Section 1.0 User Survey

Background
The existing John R. Brodie Science building no longer meets the needs of the Faculty of Science, nor the broader Brandon University community. In order to produce a high-level assessment and functional space plan, it was necessary to determine the current use of space, current and future space needs and address any potential gaps that may exist, in order to understand why and how the existing building no longer meets the needs.

Process
In addition to the existing building condition assessment, the team gathered more specific facility user-focused information to compile a quantitative and qualitative User Data Summary. To do this, an online survey was distributed on Monday, September 17, 2018 and remained accessible to Faculty of Science students, faculty and staff, researchers and administrators for one week. The survey identified a series of specific questions related to a participant's role and time spent in the Brodie Science Centre; the layout and provision of the spaces; how the building impacts the work and research that is carried out; user comfort with respect to temperature, ventilation, lighting and noise levels; and thoughts on the outdoor space and environmental sustainability.

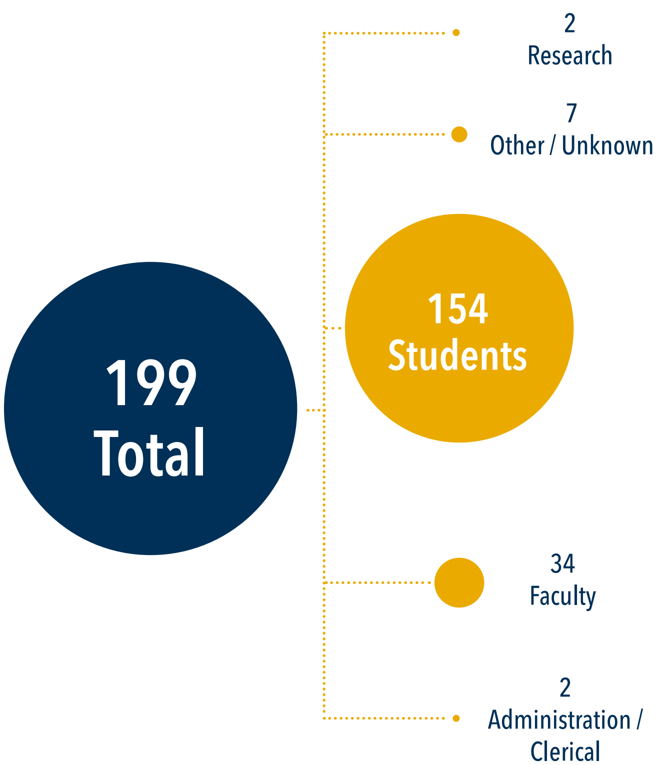
Intent
The online survey solicited directly from users, in their own words, a vision for a future Brodie Science Centre. The intent of the process was to facilitate participation in the design of a re-envisioned John R. Brodie Science Centre not only for the Faculty of Science, but also for the broader Brandon University community. It was an opportunity for students, researchers, faculty and administration to think about goals and preferences for the re-imagined space: what works and what doesn't? How could the space(s) be improved? It was an opportunity for the consulting team to learn about the building directly from participants, and incorporate comments into conceptual design recommendations that will take the Faculty of Science and the broader Brandon University community into the future with premiere teaching and research spaces that will attract and retain the best and the brightest.

The survey questions were drafted to form an understanding of the concerns, preferences, and priorities of respondents. The questions were categorized into a series of topics related to layout, thermal comfort and air quality, lighting, acoustics, sustainability, outdoor environment, and vision. General questions at the beginning of the survey identified a respondent's role as either administration/office/clerical, faculty/educator, student, research, or visitor/other; how long a respondent had worked/attended the Brodie Building; how many hours per day they spend in the building; and whether or not the respondent has formal and informal interaction with people from other departments. Examples of formal interaction were given as collaborative research, meetings and shared classes, etc. Examples given as informal interaction included conversations, socializing, etc.

Findings

General

In total, there were 199 respondents that participated in the online survey in September of 2018. A large majority of the responses were from students, who comprised over 77% of respondents. Faculty made up 17% of the responses, while the balance of responses were from researchers, administration and clerical and other/unknown categories.



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Composition of Survey Respondents

There was representation from each of the departments in the surveyed responses, with the highest number of respondents declaring that they were from the departments of Biology and Psychology, which comprised nearly half of the overall responses.

The survey results showed that 138 respondents (70%) spend less than 6 hrs/day in the building and 169 respondents (85%) have been at Brandon University for 5 years or less.

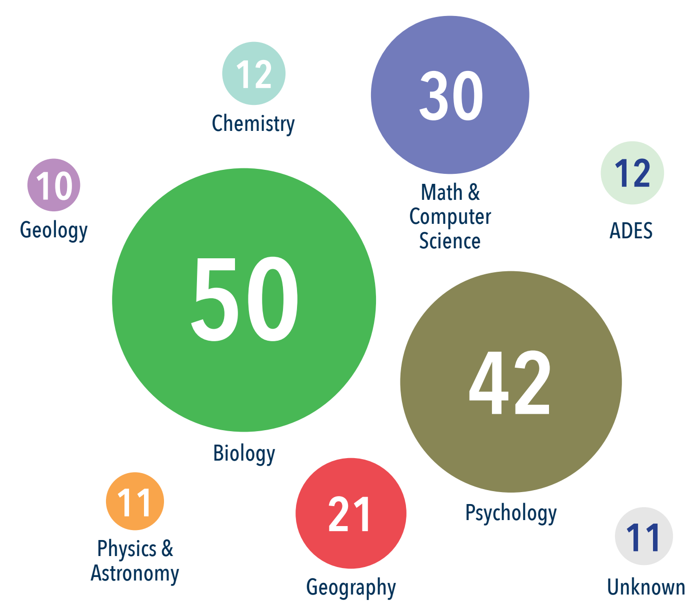
A majority of respondents indicated that they have both formal and informal interaction with other departments.

Layout, Aesthetics & Availability of Spaces

Although a majority of respondents indicated that they have interdepartmental interaction, only 22% of respondents reported being satisfied with the availability of informal gathering/collaboration spaces in the existing building.

Generally respondents did not focus their written responses to issues related to the layout of the space when asked, however the areas of dissatisfaction appeared mostly similar between students and faculty:

- The existing furniture, in either the classrooms or offices, generated the greatest level of dissatisfaction amongst the majority of respondents. A common student response was the lack of circulation space between desks or within the Lecture Halls.
- The Brodie Centre's dated aesthetics (paint, finishes, etc.) were a common concern.
- The lack of natural daylight was identified by all groups, specifically lacking within offices



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Breakdown of respondents by department

"The faculty lounge is the only ... space that facilitates informal interactions with others outside my department."

"We do need additional space for small meetings - for planning & collaborating..."

"Teaching space is dilapidated, poorly equipped ... and generally an embarrassment when compared to other universities ... Our largest lecture theaters are the worst examples.."

and classrooms.

- Dissatisfaction of classrooms being too small, the lack of available meeting spaces, and poor lighting was shared by both groups.
- Students identified the lack of available electrical outlets and after hour access to building as a concern.
- The poor quality of the lecture halls / teaching spaces were noted in responses.

Equipment

The survey reported that 58% of Faculty/ Educators are dissatisfied with the equipment available to them to teach. While some comments indicated that the majority of equipment was good enough for classroom demonstrations and lab activities, many respondents feel that the teaching equipment is antiquated, limited in number and of poor quality. Some Faculty indicated that they either had to purchase their own equipment, or borrow from their research labs to expose students to up to date techniques.

Thermal Comfort & Air Quality

For respondents spending more than 6 hrs/ day in the building, air quality and thermal comfort were of increasing concern. In the written comment sections, Faculty/Educator respondents noted that the air quality, air conditioning and general temperature in the building are problematic.

Lighting & Acoustics

A majority of Faculty/Educator respondents indicated that they were dissatisfied with the acoustics in their workspace and that the noise level from voices and activities in adjoining spaces, echoes, mechanical equipment and ventilation noises and noises from outside, interfered with their ability to conduct their work. While a majority of respondents indicated that they were dissatisfied with the amount of natural daylight in their workspace, most were neutral on the visual comfort of the lighting (glare, reflections, contrast and brightness) and felt that the lighting quality in the building neither enhanced nor interfered with their ability to get their job done.

Sustainability

An overwhelming majority of respondents (95%) indicated that environmental sustainability was important to them, with access to natural light, energy efficiency, use of water efficient fixtures and improved ventilation listed as the top priorities. Over half of the respondents indicated that they were dissatisfied with the amount of natural daylight in their spaces and 82% felt that having indirect visual access to the outdoors was of importance.

"It is VERY unpleasant to work 40+ hrs a week in a stuffy, dirty, smelly environment!"

"Experiments have been halted due to temperature in the lab on some occasions."

Vision

The closing question in the interview asked respondents to comment on their vision for the Brodie Building. Many of the responses highlighted the need for a modernization. The visions ranged from renovation of the existing building to enhance the functionality, appeal, and/or extent of space; to a new building; to a strategic plan to develop, enhance and expand the scientific and technological research and teaching capacity at Brandon University. A selection of the range of comments includes:

- “More welcoming, inspiring and less institutional. A University is a place of learning and should inspire and engage and enhance learning.”
- “...must come up with a comprehensive vision and strategy that captures the imagination of our stakeholders, funders, industry, communities, and especially government.”
- “Innovative in trying to facilitate dialogue and collaboration between Departments in research/teaching in Science.”
- “a brand new building, possibly alongside the current building”
- “A functional building, with collaborative spaces, adequate teaching spaces where the environment is comfortable and conducive to learning. A building where our offices are also comfortable, with proper lighting, airflow and heating/cooling. And finally a space where we have room to conduct research.”
- “I hope to see a knowledge learning/sharing gathering space. Fundamentally, I believe that it is people inside that makes a building appealing and inviting. A building filled up with multi purpose rooms and some labs may be sufficient.”
- “A building that represents what it is taught inside, STEM. A modern, sustainable melting pot of knowledge and cultures.”
- “The Faculty of Science needs a new, modern showcase building that will impress, attract and serve students in even greater numbers. Renovation of the Brodie building can only occur when new space is available to allow us to carry on with our courses especially the laboratories.”
- “Updated spaces where students can study and spend time between and after classes.”
- “I would stay at school longer and likely participate in clubs and other activities if I felt safer.”
- “A modern, safe building built for doing science. Teaching and research do not have to be housed in the same building.”
- “a completely new LEED certified building offering modern teaching and research spaces, and a science museum. Tear down the Brodie”
- “A light, functional, airy, comfortable, workplace with an open concept.”
- “lots of shared student spaces for studying, research, group work, computer use, etc.”
- “Having enough space to encourage growth and provide the best experience for our students and faculty”
- “the Brodie Building should be re-purposed into modern, well equipped generic teaching space for BU and a new Science Building should be built to the South of Brodie containing offices and research & teaching labs. Simply giving Brodie a face lift is short sighted and a false economy”
- “Sustainable development should be a priority”

Section 2.0 Department Chair Interviews

Process

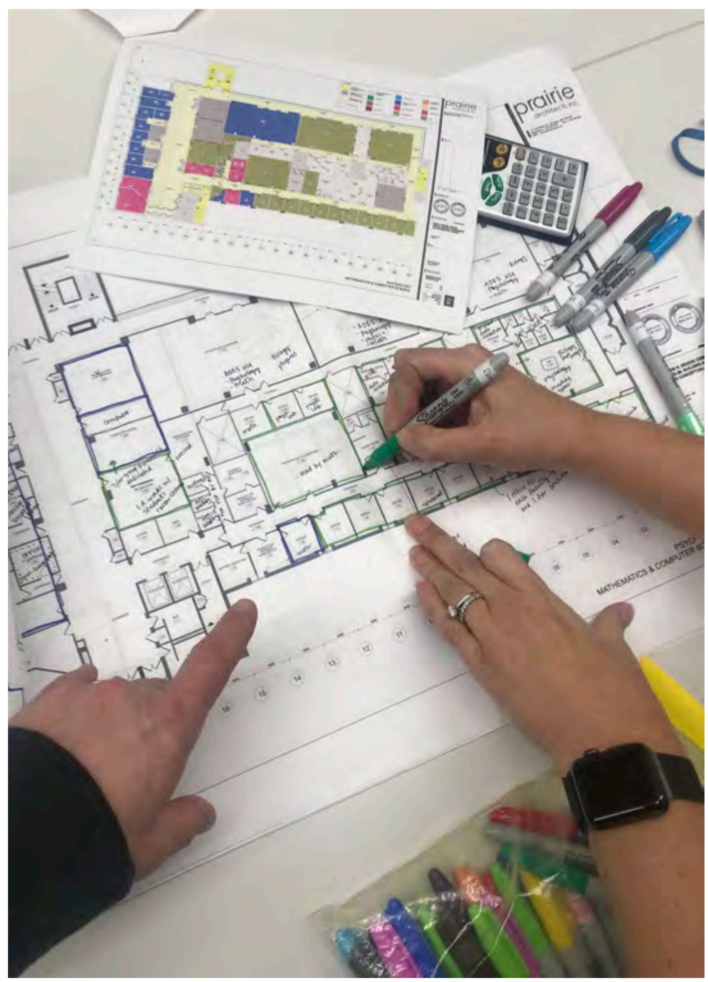
Over the course of two full-day sessions spanning from October 9th, 2018 to October 10th, 2018, Prairie Architects Inc., with the Dean of Science in attendance at each interview, met individually with each of the eight Faculty of Science Department chairs, one program lead and the Brandon University Deans for an overall campus-wide perspective. The nine consulted Faculty of Science groups consisted of the Departments of Geology, Chemistry, Mathematics & Computer Science, Psychology, Physics & Astronomy, Geography, Biology, Applied Disaster & Emergency Studies (ADES), and Masters of Science Environmental and Life Sciences (MELS). The Deans Meeting addressed students that have a requirement to take hours in applied science and therefore make use of the John R. Brodie Science Centre lecture theatres, classrooms and/or laboratories. The group included the acting Vice-President, Dean of Education, University Registrar, Dean of Students, Dean of Music, acting University Librarian, and the Dean of Health Studies.

Intent

The interview process sought to ascertain the current functional requirements of each department, review individual uses within the building, followed by open discussion around future needs and facility changes. Furthermore, the one hour interview process established the intent of the John R. Brodie Science Centre Assessment and Concept Design Report process followed by a more focused discussion.

The discussions began by addressing the department / program's numbers, which included the number of enrolled students as well as the number of faculty and researchers. Interviews reviewed each department's current space use within the existing building including space used outside of the building, spaces with a shared access, spaces used for research, and any under-utilized spaces. Review discussions addressed adequacy of the spaces available in the John R. Brodie Science Centre for classrooms, laboratories, storage, offices, and meeting / seminar rooms. Additionally, a review of specialized equipment was undertaken.

To facilitate the assessment process, each department was provided ahead of time with existing building floor plans showing each departments preliminary building use. As such, during the course of our discussions a master set of existing building floor plans was edited capturing the discussion comments with the objective of establishing an up to date John R. Brodie Science Centre Existing Building program allocation floor plans as contained within this report.
The interview process with the larger focused



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Updating the existing Brodie building plans to reflect actual space use

campus group addressed their general impressions of the Brodie Science Centre. During the interview process, the group discussed their use of the existing building, identifying the spaces with most frequent uses and any cross curriculum uses. General review with thoughts in respect of type and availability of classrooms and lecture spaces on campus and a discussion on what types of spaces would other faculties, and Brandon University as a whole, find valuable in a re-imagined Brodie Science Centre.

The interview process concluded by addressing any components of department work/studies/ research that needed uninterrupted operation or that was schedule sensitive, i.e. on a term basis, cyclical, seasonal, etc.

Findings

A summary of the need that was communicated by each department during the interviews is as follows:

Applied Disaster & Emergency Studies (ADES)

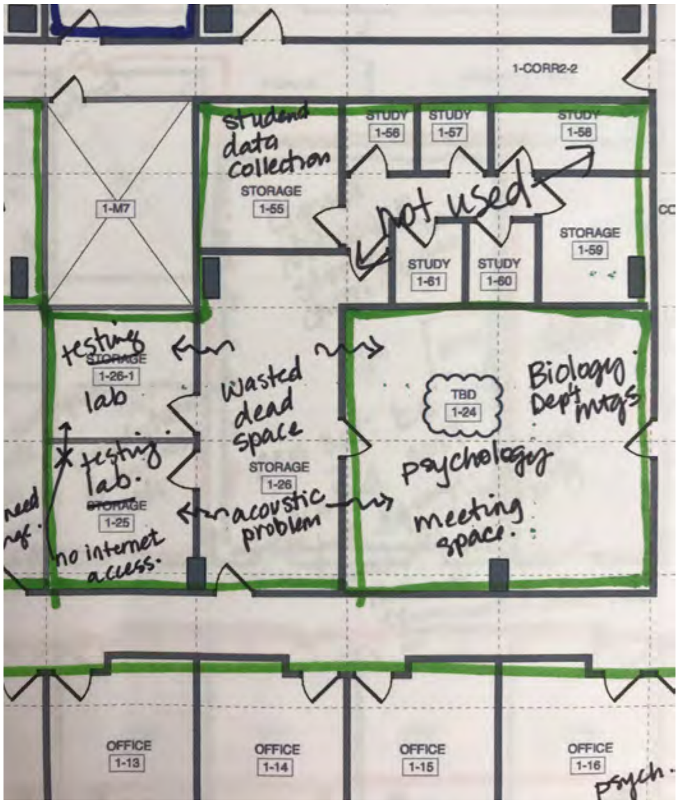
- 3 faculty (+2 future) / 35 Students (Majors)
- Department currently located in the basement of the Brodie building which has created a general sense of isolation from remaining Departments.
- Emergency Operations Lab (EOL) is located outside of Brodie building and preference would be to relocate within building to a larger lab.
- Need for a smaller seminar room
- Potential for improved community outreach and branding and/or sponsorship.
- No underused spaces identified.
- There are no components of work that need to maintain uninterrupted operation.

Geology

- 4 faculty (1 tenured) / 2 Instructional Associates / 1 lab Major / 30 Students (Majors)
- Preference to have department spaces including classrooms, offices, labs and student spaces all within the same area.
- Core lab facility is currently not located within the building, current space meets needs, but if it was to be relocated would need sufficient access to sunlight and clean polishing lab space with good ventilation.
- Expressed a need for three additional offices; two additional Geophysics, one for Environmental Geo-scientist and one for a Research Chair.
- Need for larger and modern Palaeontology teaching lab for 40 students equipped with current technology.
- Need one large shared multi-use room that can act as a lab lecture space equipped with current technology and tiered bench seating for 60 students.
- Ability to showcase faculty work and a ceramic mushroom collection.
- Adjacent storage for teaching sample storage is required.
- There are no components of work that need to maintain uninterrupted operation.
- No underused spaces were identified.
- Strong concerns with any short or long term interruptions to department operations

Psychology

- 8 faculty / 1 Instructional Associate / 340 Students (150 Majors & 190 Minors)
- Need classrooms that are modifiable, flexible, and equipped with current technology.
- Would like 4 or 5 small soundproof testing rooms.
- Need a small meeting room for faculty and student meetings.
- Under-used spaces identified include a large student club room, storage rooms, and observations rooms.
- Moving to temporary space for 1 year would be tolerable.



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left: close-up of first floor plan mark-ups within the Department of Psychology; right: third floor plan mark-ups within the Departments of Geography and Biology

Mathematics & Computer Science
- 10 faculty / 3 Instructional Associates / 126 Students (45 Majors & 81 Minors)
- Preference to have mixed department spaces including classrooms, offices, labs and student spaces.
- Need classroom equipped with current technology for phone, tablet or laptop power.
- Need more informal gathering spaces with chairs, couches, tables and power outlets.
- Moving to temporary space for 1 year would be acceptable.

Biology
- 12 faculty / 180 Students (120 Majors & 60 Minors)
- Additional research space is required
- Identified equipment need of a 3rd autoclave for Chemistry, crushed ice machine, purified water source, and dishwasher.
- Herbarium under-utilized and sample storage inventory is too extensive.
- Larger staff meeting room
- Moving to temporary space for 1 year would be acceptable but research labs would be non-operation for duration of renovation.

Geography
- 8 faculty / 74 Students (34 Majors & 40 Minors)
- Map room is located in Campus library and is available to the public, good location.
- Moving to temporary space would be acceptable but equipment access would be required.

MELS
- 23 Students (Majors)
- Join office and MELS student space would be ideal
- More student workspaces required
- Need more informal gathering spaces with chairs, couches, tables and power outlets.
- New growth chamber open to other departments

- Greenhouse under-utilized
- Moving to temporary space not addressed.

Chemistry

- Faculty breakdown not addressed
- Dedicated freight elevator would be useful to address dangerous waste storage / disposal and equipment loading.
- More fume hoods, vacuum pump filtration, steam tap, better water pressure, and double distilled water.
- Interconnected and partition-able labs
- Front of room bench display.
- Moving to temporary space was not addressed.

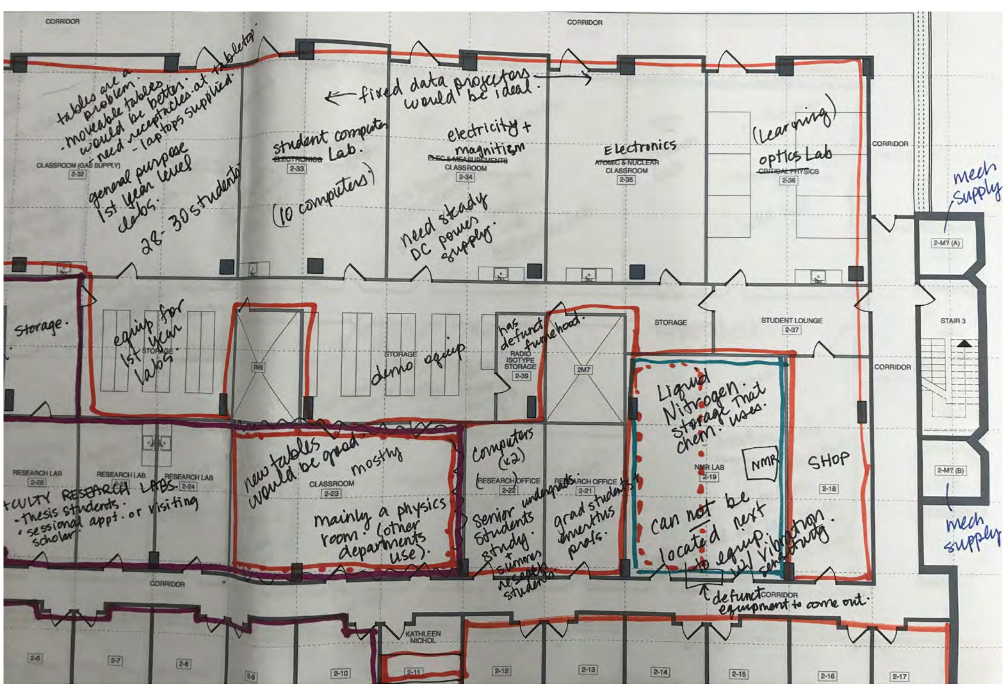
Physics & Astronomy

- 4 faculty / 2 Instructional Associates / 50 Students (25 Majors & 25 Minors)
- Need more office and research space for growth
- Workshop needs more space
- Need classrooms that accommodate more than 15 students
- Potential to interconnect 2 classroom with partition if better storage available
- Improved mechanical airflow and control required
- Better meeting room required
- Need a large "studio physics" lecture space equipped with current technology and tiered bench seating.
- Radio isotope storage under-utilized
- Moving to temporary space would require access to workshop and equipment.

Brandon University Deans Group

In addition to interviewing each department within the Faculty of Science, a meeting was held with Brandon University Deans from all faculties, recognizing shared use of the John R. Brodie Science Centre. The group discussed a variety of topics, including:

- Need improved gathering/meeting student spaces for study / clubs / lunches for science and campus student use
- Need improved "Centralized Classroom Scheduling" software for better room utilization
- Need larger lecture halls with better seating and work surface
- Moving to temporary space was not addressed.



< close-up of second floor plan mark-ups within the Department of Physics and Astronomy

Part 4 - Functional Space Program

Section 1.0 - Existing Space Allocation and Utilization

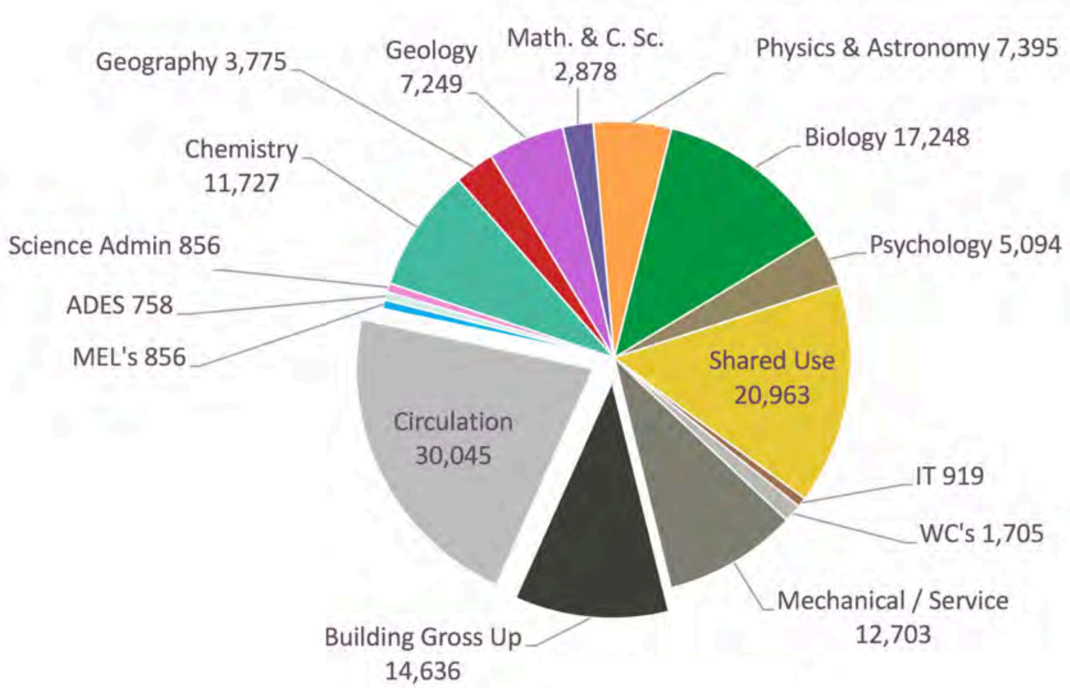
Existing Space Allocation

In order to comprehensively account for each of the spaces within the John R. Brodie Science Centre and accurately assign ownership to one or more departments or use categories, a functional space program was created. The functional space program for the building is included on the following pages and includes a breakdown of each department as well as IT, shared use space, service and washrooms, circulation, underutilized space and gross up. Within these categories, each space/use type is defined and the quantity and location by room number is noted. Areas are reported in both square footage values as well as a sub-total percentage for each department or use category.

Space / Use Type	Qty	Location	Area (sf)	Area (%)
APPLIED DISASTER AND EMERGENCY STUDIES				
Offices	3	G-38 / G-39 / G-40A	286	
Teaching Lab (EOL)	1	012 Harvest Hall Basement	*550 not included in area calculation below	
Meeting	1	G-40	144	
Reception	1	G-41	271	
Storage	1	G-408	57	
		SUB TOTAL	**758**	**0.6%**
CHEMISTRY				
Offices	7	4-11 / 4-12 / 4-13 / 4-14 / 4-15 / 4-16 / 4-17	945	
Research Labs w/ support space	7	2-19 / 4-18 / 4-19 / 4-20 / 4-20.2 / 4-21 / 4-23	2,419	
Teaching Labs	7	4-24 / 4-25 / 4-28 / 4-31 / 4-26 / 4-34 / 4-35	6,271	
Prep Rooms	3	4-27 / 4-29 / 4-32	698	
Workshop	1	4-33	187	
Storage	5	G-26 / G-5 / 4-36 / 4-37 / 4-38	1,207	
		SUB TOTAL	**11,727**	**9%**
GEOGRAPHY				
Offices	10	1-83 / 3-43 / 4-4 / 4-5 / 4-6 / 4-7 / 4-8 / 4-9 / 4-10 / 4-46	1,319	
Classrooms	1	3-44	870	
Research Labs	3	4-43 / G-20B / 5-8	876	
Workshops	3	4-40 /4-41 /4-42 /	562	
Storage	1	3-45	148	
		SUB TOTAL	**3,775**	**3%**

GEOLOGY				
Offices	7	2-4 / 2-6 / 2-7 / 2-8 / 2-9 / 2-10 / 2-43	950	
Classrooms	3	2-30 / 2-31 / 2-48	2,644	
Research Labs	7	2-24 / 2-25 / 2-26 / 2-28 / 2-29 / 2-42 / 2-46	2,833	
Core Sampling Lab	1	located to the north west of the Knowles-Douglas Students' Union Centre	not included in area calculation below	
Storage	4	G-15 / 2-49 / 2-27 / 2-45	822	
		SUB TOTAL	**7,249**	**6%**
MATHEMATICS AND COMPUTER SCIENCE				
Offices	11	1-6 / 1-70 / 1-73 / 1-74 / 1-75 / 1-76 / 1-77 / 1-78 / 1-79 / 1-80 / 1-81	1,511	
Classrooms	4	G-20C / G-18 / 1-49	1,057	
Research Labs	1	G-32	310	
		SUB TOTAL	**2,878**	**2%**
MELS				
PHYSICS AND ASTRONOMY				
Offices	7	2-11 / 2-12 / 2-13 / 2-14 / 2-15 / 2-16 / 2-17	945	
Classrooms	5	2-33 / 2-34 / 2-35 / 2-36	2,764	
Research Labs	3	2-19 / 2-21 / 2-22 / 4-18	1,031	
Teaching Labs	1	2-32	1,393	
Workshops	1	2-18	347	
Storage	4	2-39 / 2-A / 2-B / 2-C	916	
		SUB TOTAL	**7,396**	**6%**
BIOLOGY				
Offices	13	3-4 / 3-6 / 3-7 / 3-8 / 3-9 / 3-10 / 3-11 / 3-12 / 3-13 / 3-14 / 3-15 / 3-16 / 3-17	1,762	
Classrooms	4	3-18 / 3-24 / 3-25 / 3-26	4,033	
Research Labs	14	G-14 / G-14.1 / G-14.2 / G-34 / 3-19 / 3-20 / 3-21 / 3-22 / 3-23 / 3-27 / 3-28 / 5-6 / 5-6.1 / 5-7	5,030	
Teaching Labs	2	3-30 / 3-32	1,745	
Herbarium	1	G11 / G-12 / G-13 / G13.1	1,384	
Storage/Prep.	5	G-5 / G-25 / 3-29 / 3-31 / 3-34 / 3-36 / 3-39 / 3-40 /	2,021	
		SUB TOTAL	**15,975**	**13%**
PSYCHOLOGY				
Offices	12	1-7 / 1-8 / 1-9 / 1-10 / 1-11 / 1-12 / 1-13 / 1-14 / 1-15 / 1-16.1 / 1-16.2 / 1-70A	1,596	
Classrooms	3	G-20C / G-18 / 1-48	1,427	
Research Labs	9	1-31 / 1-25 / 1-26.1 / 1-55 / 1-63 / 1-64 / 1-65 / 1-66 / 1-68 / 1-68.1 / 1-69	1,164	
Meeting Room	1	1-27	232	
Storage	1	1-71	222	
		SUB TOTAL	**4,641**	**4%**
SCIENCE ADMINISTRATION				
Offices	4	1-5 / 1-41 / 1-72 / 1-72.1	856	
		SUB TOTAL	**856**	**0.7%**

INFORMATION TECHNOLOGY (IT)				
IT Rooms	5	G-20A / G20A.1 / G-20A.2 / G-20D / 5-6	919	
		SUB TOTAL	**919**	**1%**
SHARED USE				
Lecture Theatres	2	G-21 / G-23	4,845	
Greenhouse & Prep	1	5-9 / 5-10	1,124	
Classrooms	11	1-35 / 4-22 / 3-42 / 3-47 / 4-47 / 2-23 / 2-44 / 1-52 / 1-53 / 1-54 / 1-50	10,607	
Test Rooms	3	1-43 / 1-44 / 1-45	115	
Meeting Room	1	1-24	477	
Copier/Supplies/Mail	9	1-4 / 1-36 / 1-42 / 1-46 / 1-47 / 2-5 / 3-5 / 3-41 / 4-39A	950	
Staff Room	1	5-4	692	
Student Lounge/ Clubs/Study	9	1-82 / 1-62 / 2-37 / 2-48a / 2-48b / 3-48A / 3-48B / 4-48A / 4-48B	964	
		SUB TOTAL	**19,774**	**16%**
SERVICE & WASHROOMS				
Washrooms	12	G-1 / G-2 / 1-1 / 1-2 / 2-2 / 2-3 / 3-1 / 3-2 / 4-1 / 4-2 / 5-2 / 5-3	1,705	
Janitor Storage	7	G-6 / G-3 / 1-3 / 2-1 / 3-3 / 4-3 / 5-1	396	
Workshop	1	G-7	300	
Service/Support	4	G-11.1 / G-29 / G-4 / G-8	732	
Electrical Closet	3	M1 / M4 /M8	36	
Mechanical Shafts	5	M2 / M3 / M5 / M6 / M7	3,550	
Mechanical Penthouse	1	5-5	7,491	
		SUB TOTAL	**14,210**	**11%**
CIRCULATION				
Ground Floor	1	-	5,571	
Main Floor	1	-	6,741	
Second Floor	1	-	5,359	
Third Floor	1	-	5,346	
Fourth Floor	1	-	5,235	
Fifth Floor	1	-	1,793	
		SUB TOTAL	**30,045**	**24%**
UNDER UTILIZED SPACE				
Custodial Room	1	G-16	198	
Vivarium	1	G-10 / G-9	1,273	
Psychology Staff Room	1	1-32	224	
Sound Booth	1	1-30A	229	
Storage	5	G-19 / 1-26 (incl. 1-56/1-57/1-58/1-59/1-60/1-61) / 1-59 / 4-44 / 3-46	1,189	
		SUB TOTAL	**3,113**	**3%**
BUILDING GROSS-UP				
			14,636	
		SUB TOTAL	**14,636**	**12%**
		TOTAL	**138,808**	**100%**



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existing area distribution per department ** departments of Psychology and Biology include "Under-Utilized Spaces"

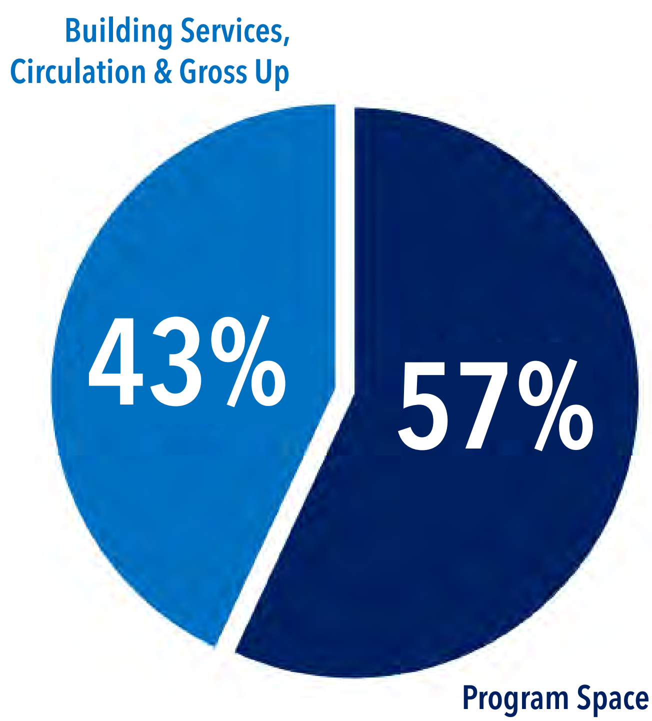
Findings

Through a review of the existing spaces and departmental allocations, it was discovered that there are a number of areas within the building that may be allocated to one department, but actually have shared use between many departments. Additionally, investigation found that there are some spaces, such as the vivarium on the ground floor, and some equipment, such as the NMR in 2-19, that are allocated to certain departments but no longer fully utilized or required for that specific department. As such, a closer analysis of the space utilization was carried out.

Existing Space Utilization

Overall

As previously highlighted in Part 2 of this report, the current distribution of space in the John R. Brodie Science Centre is largely organized departmentally and per floor. When all the areas of the spaces in the building were evaluated, it was determined that the space currently allocated to building services, circulation and gross-up is high relative to the space allocated



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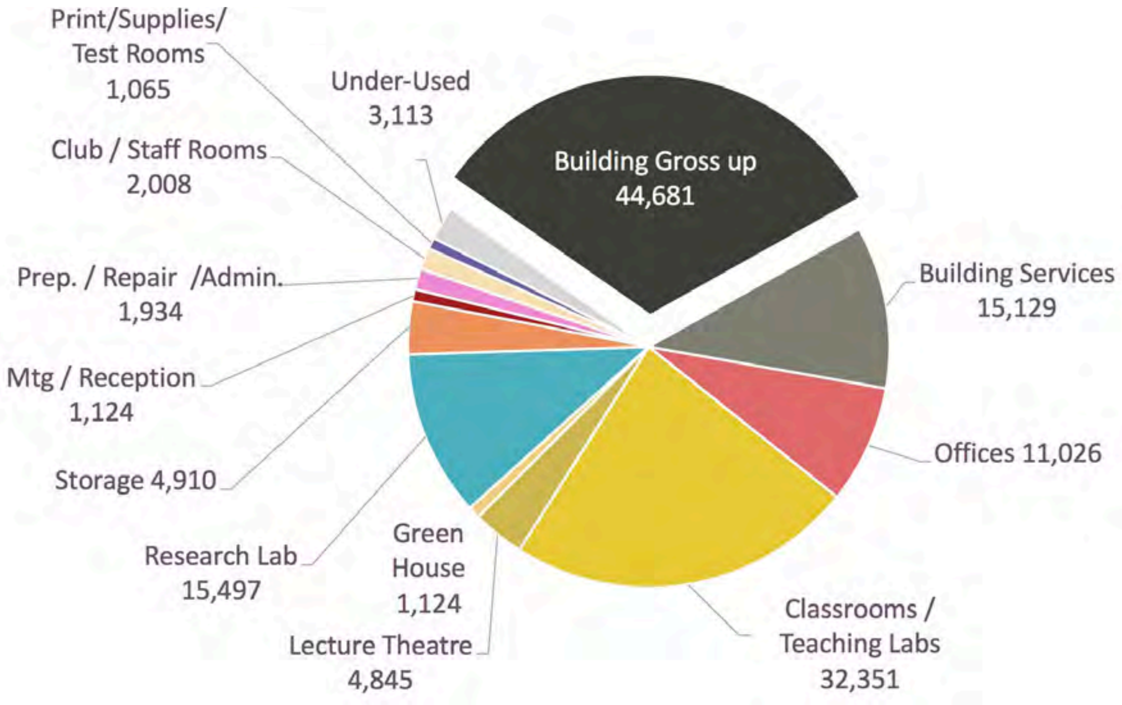
Existing ratio of program and non-program space



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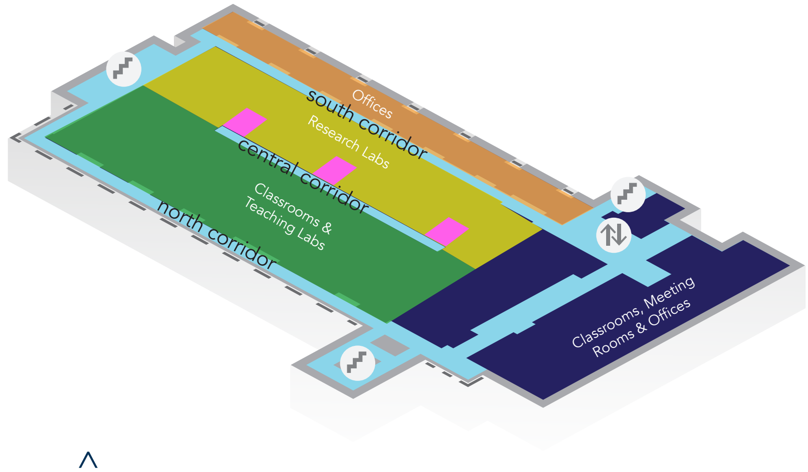
existing area distribution per type / use category ** "Under-Utilized Spaces" are broken out as a separate category

to program space. At 43%, the building services, circulation and gross-up factor for the John R. Brodie Science Centre is high compared to a range of 25% - 35%, which is where a typical similar building could fall. The ADES and Geology off-site programs are not included in this ratio as the intent was to analyse utilization within the John R. Brodie Science Centre.

Under-Utilized Spaces

Through a review of the existing spaces and departmental allocations, a number of areas within the building were identified as under-utilized and were broken out as a separate category in the functional space program on the previous pages. These areas included space like G-16 on the lower level, which appears to be for Physical Plant use rather than dedicated use for the Brodie Building; the vivarium on the lower level (G-9 and G-10) categorized within the Department of Biology, but not fully utilized primarily due to having insufficient mechanical systems to meet regulatory requirements; and spaces within the Department of Psychology, including Sound Booth 1-30A, which is currently not used and Staff Room 1-32, which was noted to be better served as shared use between a number of departments. In addition, there were a number of spaces that were identified in the storage use category but were noted as under-utilized for a variety of reasons. Some examples of these spaces include 1-26 (including 1-56, 1-57, 1-58, 1-58, 1-59, 1-60 and 1-61) which were once used as Psychology testing rooms but no longer adequately suit research methods and present safety and security concerns so they have become storage rooms. Other examples include storage areas in the building that are currently not well-used, such as 3-46 in the Department of Geography.

There are functions associated with the Departments of Applied Disaster (ADES) and Emergency Studies and Geology that have teaching and research spaces not located in the John R. Brodie Science Centre. The areas reported in the pie charts above account for the existing areas within the John R. Brodie Science Centre only, and do not include the off-site program spaces. During review and site tours, it was noted that Geology's core sampling research lab to the north west of the Knowles-Douglas Students' Union Centre is well-suited in it's location and would not need to be re-located to the John R. Brodie Science Centre, but would benefit from the addition of a clean room and a polishing room. On the other hand, the Emergency Operations Lab for Applied Disaster and Emergency Studies was identified as benefiting from being co-located with the rest of the ADES program in the John R. Brodie Science Centre.



Existing layout of the John R. Brodie Science Centre

Service & Washrooms

The services spaces in the building are largely under-utilized relative to the amount of area they account for. The three large mechanical shafts (shown in pink in the diagram to the right) in the centre of the building account for 2,650sf over five stories, which could be more effectively allocated to other program use with the introduction of a modern system configuration.

The number of washroom facilities in the building do not meet current code requirements and as a result, the utilization of these spaces is extremely high, especially during transition periods between classes.

Circulation

Although there is minor variation from floor to floor in layout, each level contains three distinct east-west corridors:

- the north corridor, providing access to the north classroom and teaching spaces;
- the central corridor, providing access to the service spaces as well as storage and equipment for the adjacent labs and teaching spaces; and
- the south corridor, providing access to the perimeter offices and internal research labs

Each of these corridors present unique challenges. The north corridor has the most public use with students using it to access the classrooms and teaching labs. Its location along the north exterior wall is inefficient in that it is single loaded with program on one side only. The central corridor is the most restricted access, with limited access for service and select faculty and research personnel. Although it may present convenience for the research and teaching labs to have shared access to storage through this corridor, it also presents a safety and security challenge, which was noted in the survey and interviews. The south corridor primarily serves faculty and researchers and is not as frequently used by students. It is only 4'-4" in width, which presents challenges as it is the main access for delivery of equipment and materials from the elevators into the research labs as well as the inevitable location for informal meetings and conversations between faculty, researchers and students.

Conclusions

Based on the existing space allocation and utilization, there are opportunities to:

- effect more efficient space planning of departments;
- consolidate circulation and improve wayfinding;
- use space more efficiently (i.e. underused spaces include the psychology observation rooms, vivarium, herbarium, generous mechanical penthouse); and
- reallocate the area savings to better and higher use

Part 5 - Conceptual Design Recommendations

Section 1.0 - The Framework

The Task

Prairie Architects Inc. was commissioned to undertake a preliminary assessment of the John R. Brodie Science Centre and make conceptual design recommendations related to the current and future teaching and research space needs of the Faculty of Science and broader Brandon University community. The mandate was to prepare conceptual design recommendations that would maximize the use of existing structures and make the most efficient use of resources to meet the current and future needs of the Faculty and the University. Two alternative budget thresholds were mandated at $20M and $40M, with a requirement of producing the corresponding high level Class D cost estimates inclusive of hard and soft costs, for each design approach.

The Process

The first step was to establish the allowable cost per square foot, given the overall building area of 135,000sf for each budget threshold.

The $20M Concept

The $20M budget translates to approximately $148/sf. This includes the "essential" building work such as the asbestos abatement, building envelope work, and mechanical and electrical upgrades were accounted for, with a modest amount remaining in the budget to account for some new furniture, fixtures and equipment and selected new finishes (i.e. some new flooring and/or paint). It is clear that the $20M budget leaves little room for addressing some of the key programmatic, functional or layout concerns and would not allow for a more significant building modernization. Consequentially, the $20M alternative became a building "Refresh" Concept.

A New Build Concept

In recognition of the limited scope and the shortcomings of the "Refresh" Concept, and knowing that it did not meet any of the desired programmatic or functional criteria that was communicated during the consultation process, a new build approach was further explored. As a basis for comparison, the recently completed Richardson College for the Environment (RCFE) at the University of Winnipeg was evaluated to extrapolate what the cost per square foot would be for purpose-built new construction of a post-secondary science building. Built in 2010, RCFE had a project cost of $55M for 120,000sf, equating to a cost per square foot of $458. Accounting for inflation (12%) and a larger area requirement of 135,000sf for the John R. Brodie Science Centre, translates to a cost of $69.3M ($513/sf) to build a comparable new facility. In addition to this however, there would still be the cost associated with addressing the already determined "essential" building work in the Brodie Building totaling nearly $20M, as well as the cost to back-fill another Faculty or University use into the existing space. As a result, it was determined that a new build option did not meet the $20M and $40M budget parameters and was not a viable option to consider.

Understanding that the $20M 'Refresh' alternative did not address all of the key programmatic, functional or layout concerns, and that a new build alternative was not viable within the parameters of the assessment, the next step was to establish an option that allowed for a full modernization within the existing building. The goal was to achieve the benefits of a purpose-built space without having to incur the costs associated with building new. Leveraging the existing building structure and shell, which had been determined earlier in the process to be in a feasible approach, the John

R. Brodie Science Centre was completely re-envisioned.

The $40M Concept
The $40M budget yields a cost per square foot of approximately $296 and given that the existing building structure and shell would be reused, the approach was to completely 'gut' and renovate the space within. The scope of work results in a full abatement, new mechanical and electrical systems, complete code upgrades, and a fully modernized building with new furniture and equipment. The 'Re-Envision" Concept addresses the desired functional planning and programmatic concerns as well as occupant safety, health and well-being with completely new systems, layouts and fit-up within the existing building structure and shell.

Section 2.0 - The $20M 'Refresh' Concept

The Concept

The scope of work for the $20M alternative was established by assessing the dollar per square foot value available for the building. As previously reported, the project budget, including soft costs equates to approximately $148/sf and priority was placed on the "essential" building scope of work, which is detailed on the previous page, in section 1.0.

Cost

Based on investigations that were conducted on site, review of the asbestos, elevator, roof and generator study reports, as well as interviews with Brandon University Physical Plant, dollar per square foot allowances were allocated to each of the following categories:

- **Demolition** - scope includes multiple selective areas of demolition per floor to provide access to mechanical and electrical components, facilitate the asbestos abatement process, provide new openings in existing walls, remove old doors and frames to replace with new, demolish existing walls designated for new construction, etc.
- **Asbestos abatement** - scope includes abatement of prescribed materials in isolated areas per floor. Governed by the ongoing occupancy of spaces, this requires multiple set-ups and tear-downs of positively pressurized areas supplemented by multiple inspections prior, during and after each abatement period.
- **Mechanical upgrades** - scope includes addressing the mechanical systems to the extent where they are modified to achieve code compliance.
- **Electrical upgrades** - scope includes addressing the electrical systems to the extent where they are modified to achieve code compliance.
- **Building Envelope** - scope includes addressing masonry re-pointing, providing new externally applied sealant to masonry, exposed joints and curtain wall to address thermal leakage, addressing various roof penetrations and assumed areas of failure.
- **Decanting** - scope includes an allowance of 4 portable off-site trailers that allow for temporary space accommodation while the renovation occurs in small zones at a time
- **Furniture, Fixtures and Equipment (FF&E)** - scope includes items such as a/v and communications equipment, security and alarm systems and furnishings and is further broken down in the table on the following page.
- **General Expenses** include the cost to carry out the estimated 18 month construction period including Contractor Construction Management Fees
- **Project Contingency** at 10%
- **Tenant Improvement** - scope includes minor framing and drywall work to facilitate selective room layout changes on all floors; revised ceiling layouts; selective area upgrades to the exterior wall vapour retardant and thermal retention; upgrade of select doors, frames and hardware to meet code as well as some new doors to accommodate selected room layout changes; painting of new walls and touch-ups as required; code upgrades to the fire suppression system with revised branches and head locations to accommodate selective room layout changes; and new flooring in high-traffic areas and areas requiring layout changes.
- **Soft Costs** covering the architectural and engineering consulting fees for the project.

In addition, a 2.5%/year escalation factor should be accounted for. Assuming a 2021 construction start, an additional $819,150 would be added to the Class D cost estimate for the 'Refresh' Alternative.

$20M 'Refresh' Concept
Class D Costing Breakdown

Demolition	$1,215,000	$9 / SF
Asbestos Abatement	$2,160,000	$16 / SF
Mechanical Upgrade	$3,375,000	$25 / SF
Electrical Upgrade	$3,375,000	$25 / SF
Building Envelope	$810,000	$6 / SF
Decanting	$307,200	4 Portables
Furn., Fixtures, Equipment	$1,000,000	lump sum
Cash Allowances	$72,000	lump sum
Contingency	$1,652,300	10%
General Expenses	$1,099,500	18 Mo.
Insurance, Bonds & Permit	$406,600	
Contractor CM Fee	$634,000	4%
Tenant Improvement (T.I.)	**$2,065,000**	**$15 / SF**
Hard Costs	**$18,171,600**	**$135/ SF**
Soft Costs	$1,828,400	10%
TOTAL	**$20,000,000**	**$148/SF**
+Escalation (2021 start)	**$819,150**	**2.5%/yr**

A breakdown of the $20M 'Refresh' budget is located on the facing page and a full Class D estimate can be found in Appendix H.

Implementation and Phasing

The phasing strategy for the $20M 'Refresh' Concept involves multiple, small-scaled stages to facilitate on-going operations of the building. An allowance of 4 portable off-site trailers has been made in the budget to allow for temporary space accommodation while the renovation of specific areas occurs. Some of the work, depending on the nature of disruption, could be implemented overnight during the summer months or on weekends to limit the disruption to the greatest extent possible. In this option, much of the phasing scope is governed by the asbestos abatement and the ongoing occupancy of spaces, which requires multiple set-ups and tear-downs of positively pressurized areas supplemented by multiple inspections prior, during and after each abatement period.

In addition to the 4 portable off-site trailers, and based on discussions during the department chair interviews, some faculty will prefer to work from remote and home offices, or conduct field research during the period of renovation to their space. Additionally, finding temporary space on or off campus to accommodate larger classrooms, may be desired and as such, further discussion with Brandon University would be required.

$20M 'Refresh' FFE Items

Card Access Systems
Exterior Signage - Sign Plinths, etc.
Interior Way-finding Signage
Motorized Blinds

A/V Equipment

Screens
Projectors
Sound Systems
PA Systems

Communications

Data Cabling (Empty conduits with pull string is typically part of base building work.)

Server Racks and Equipment

Security Systems / Alarm Systems

CCTV Cameras and Monitors

Furnishings

Proprietary / Modular Furniture
Demountable Partitions
Unfixed Seating (Benches / Chairs)
Lab Equipment

$20M 'Refresh' Cash Allowances

Concrete Testing
Roof Inspections
Building Envelope Inspections
Temporary Classrooms and Facilities
Hazardous Material Assessments & Inspections

Contingency Items

Design Continuation
Authority Having Jurisdiction
Concealed Conditions

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top: Furniture, Fixture and Equipment inclusions for the $20M 'Refresh' Concept; bottom: Cash Allowance inclusions for the $20M 'Refresh' Concept

Section 3.0 - The $40M 'Re-Envision' Concept

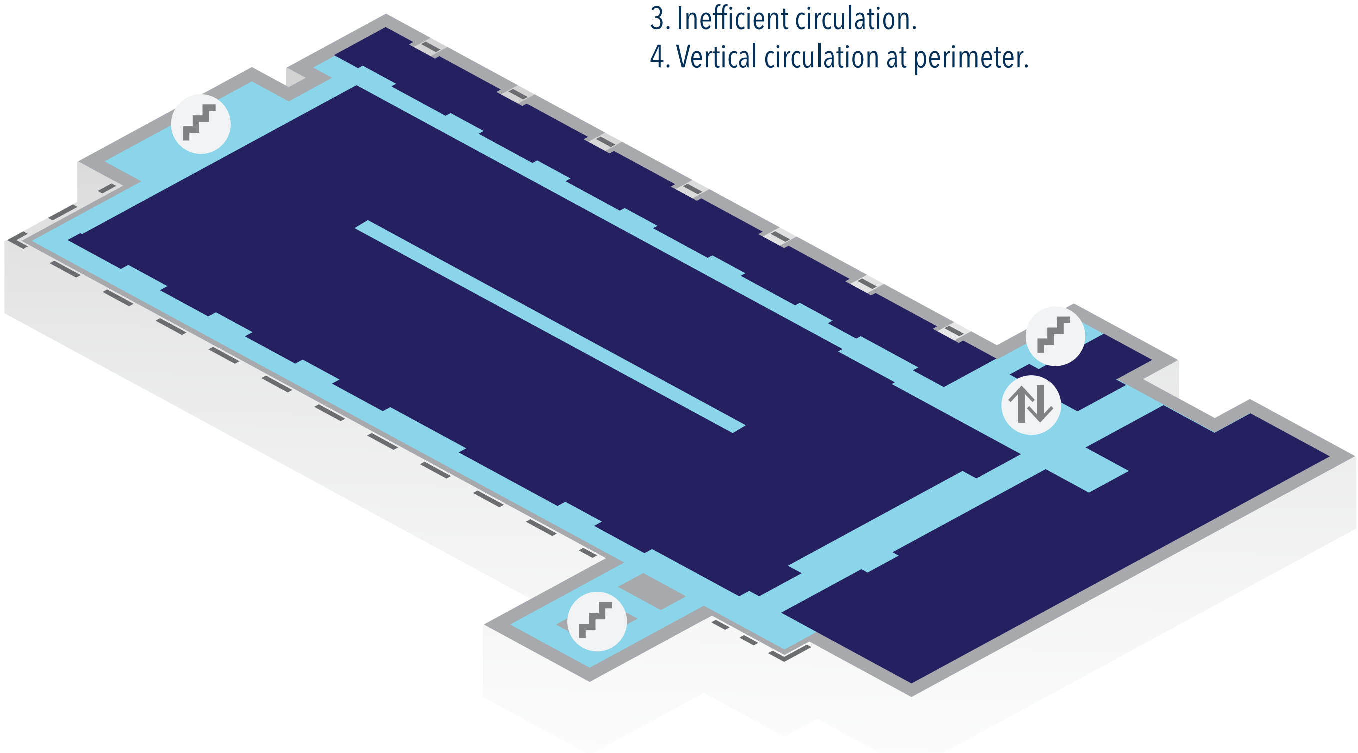
The Concept

The scope of work for the $40M 'Re-Envision' concept was established by assessing the dollar per square foot value available for the building. At $40M, the project budget including soft costs equates to a cost per square foot budget of $296. The concept leverages the existing building structure and shell and completely demolishes and renovates the space within. The scope of work results in a full hazardous materials abatement, new mechanical and electrical systems, complete code upgrades, and a fully modernized building with new furniture and equipment. The 'Re-envision' concept addresses the desired functional planning and programmatic concerns as well as occupant safety, health and well-being with completely new systems, layouts and fit-up within the existing building structure and shell.

The concept was borne out of assessing the conclusions of the existing space allocation and utilization. Based on this assessment, it was determined that there are opportunities to create a more efficient layout for departments; to consolidate circulation and improve wayfinding; to use space more efficiently (i.e. underused spaces include the psychology observation rooms, vivarium, herbarium, generous mechanical shafts and penthouse); and ultimately to reallocate the area savings to better and higher use.

Typical Existing Floor

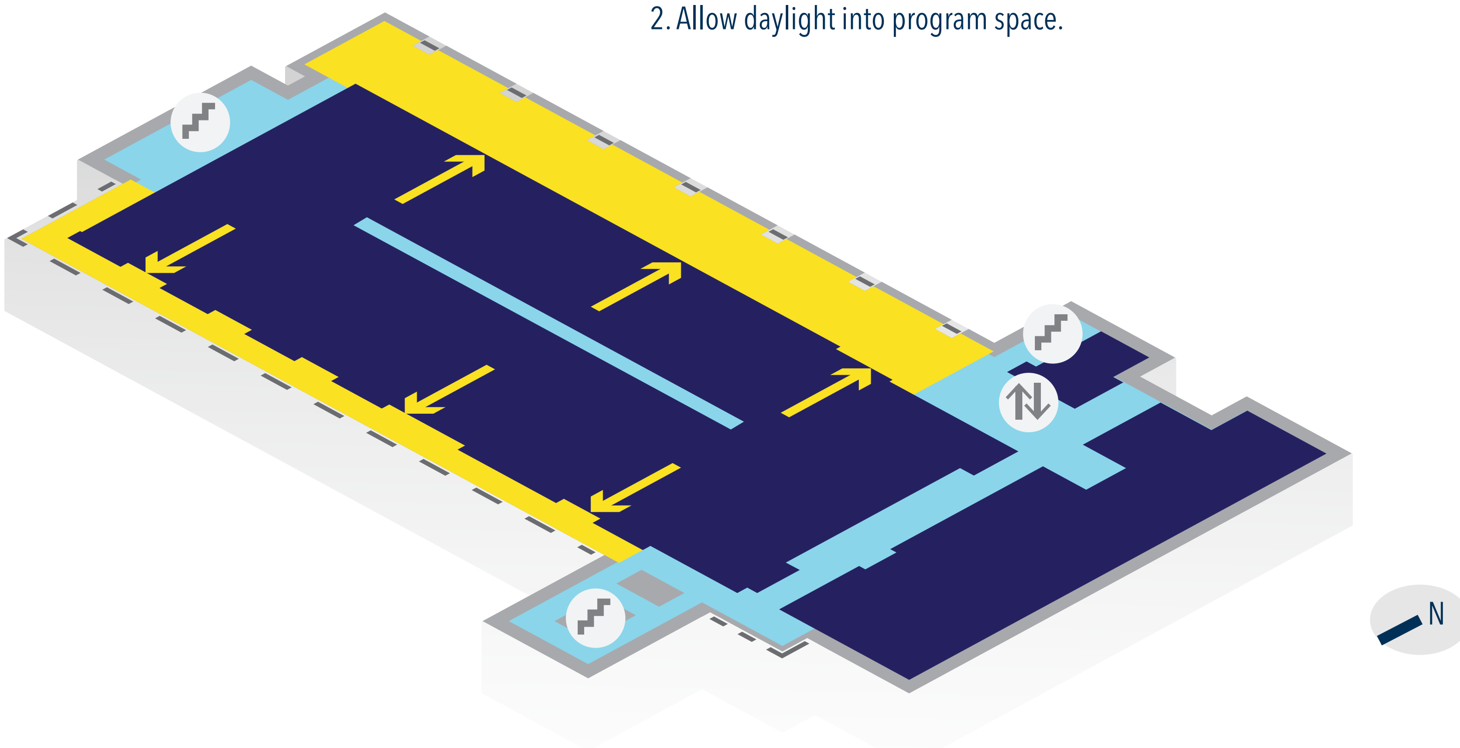
1. Program centred on floor and surrounded by circulation.
2. Little daylight in program space.
3. Inefficient circulation.
4. Vertical circulation at perimeter.



The diagrams below and on the following pages highlight how the 'Re-Envision' concept transforms the existing layout of a typical floor plan in a series of planning moves. The five planning moves not only make more efficient use of space, but also improve the amount of daylight in regularly occupied spaces, enhance wayfinding opportunities, create tacit learning opportunities through enhanced physical connections, facilitate informal and formal meeting and interdepartmental collaboration, address occupant safety and security, and improve ventilation and energy efficiency with a sustainably re-envisioned plan, centred around a light-filled atrium. Each of the planning interventions proposed create benefits that are both quantitative and qualitative in nature. Qualitative benefits include a fully modernized building with all new spaces and finishes. Quantitative benefits are not only realized in the direct area savings and space efficiencies, but also in the long term operational and maintenance cost savings and sustainable approach. As a sustainable facility, which is first and foremost focused on health, indoor environmental quality is a priority. The measures able to be employed in the re-envisioned concept contribute to better air quality, which can be attributed to less asthma and environmental illnesses as well as less absenteeism, and in turn lead to students having greater attention spans and higher performance outcomes with greater retention rates of faculty, students and staff.

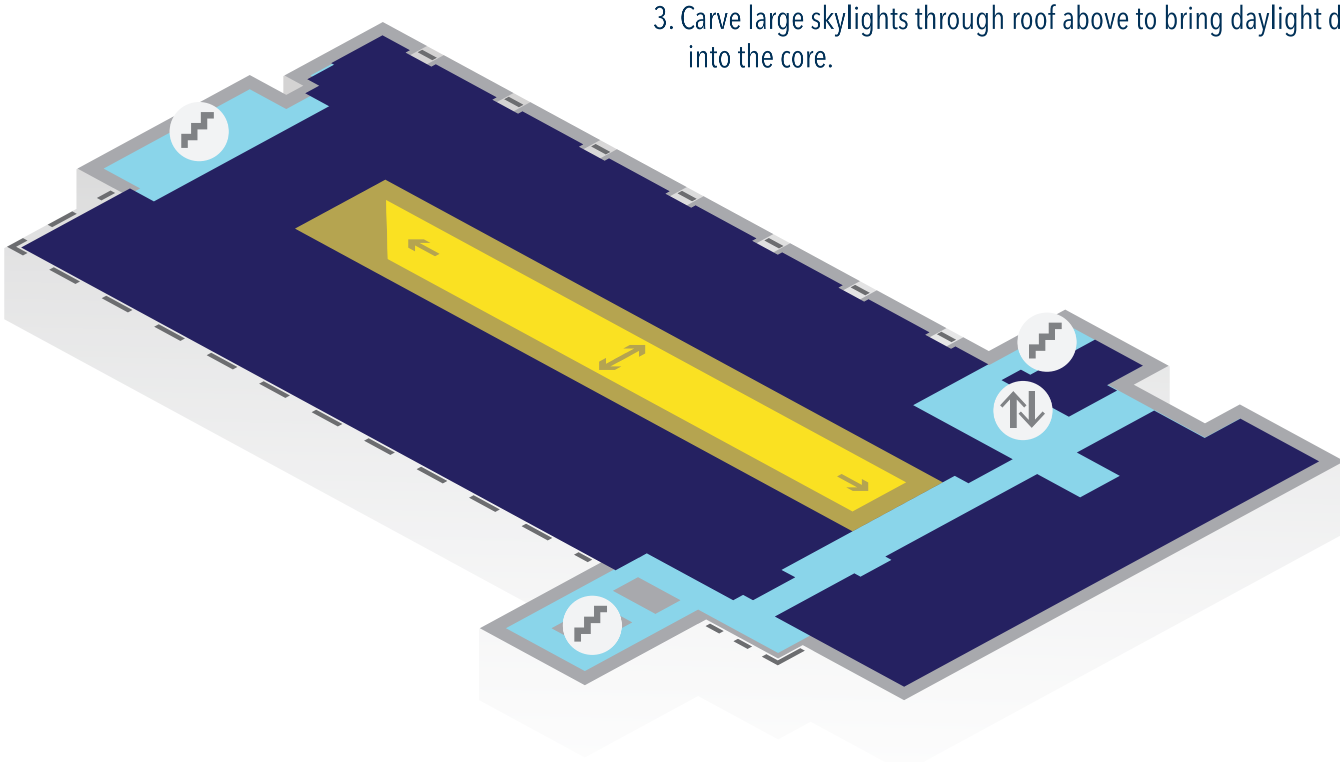
1 Extend Program to Windows

1. Push program from centre of building to the perimeter.
2. Allow daylight into program space.



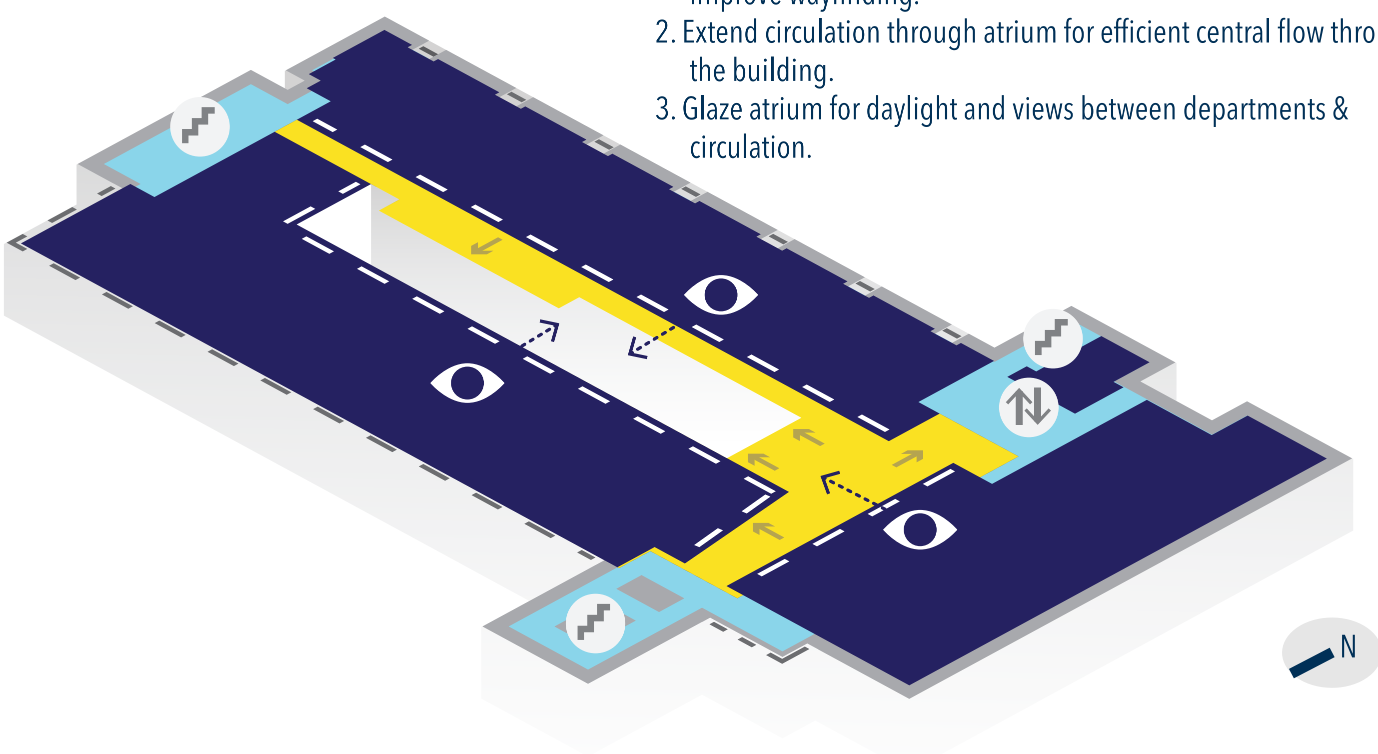
2 Carve Out Atrium & Skylights

1. Eliminate existing central corridor.
2. Carve central atrium space vertically through the entire building.
3. Carve large skylights through roof above to bring daylight deep into the core.



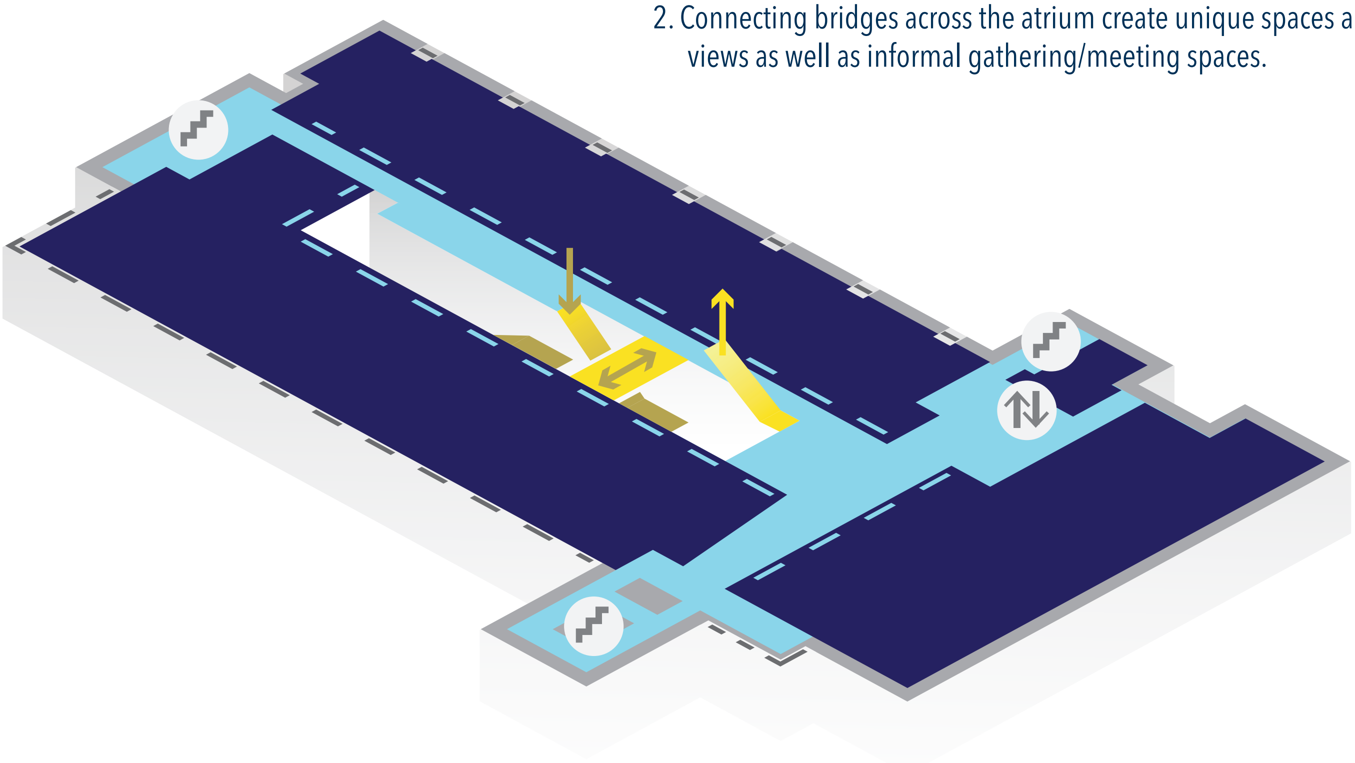
3 Create Efficient Central Circulation + Visual Connections

1. Expand existing circulation east to open up flexible space and improve wayfinding.
2. Extend circulation through atrium for efficient central flow through the building.
3. Glaze atrium for daylight and views between departments & circulation.



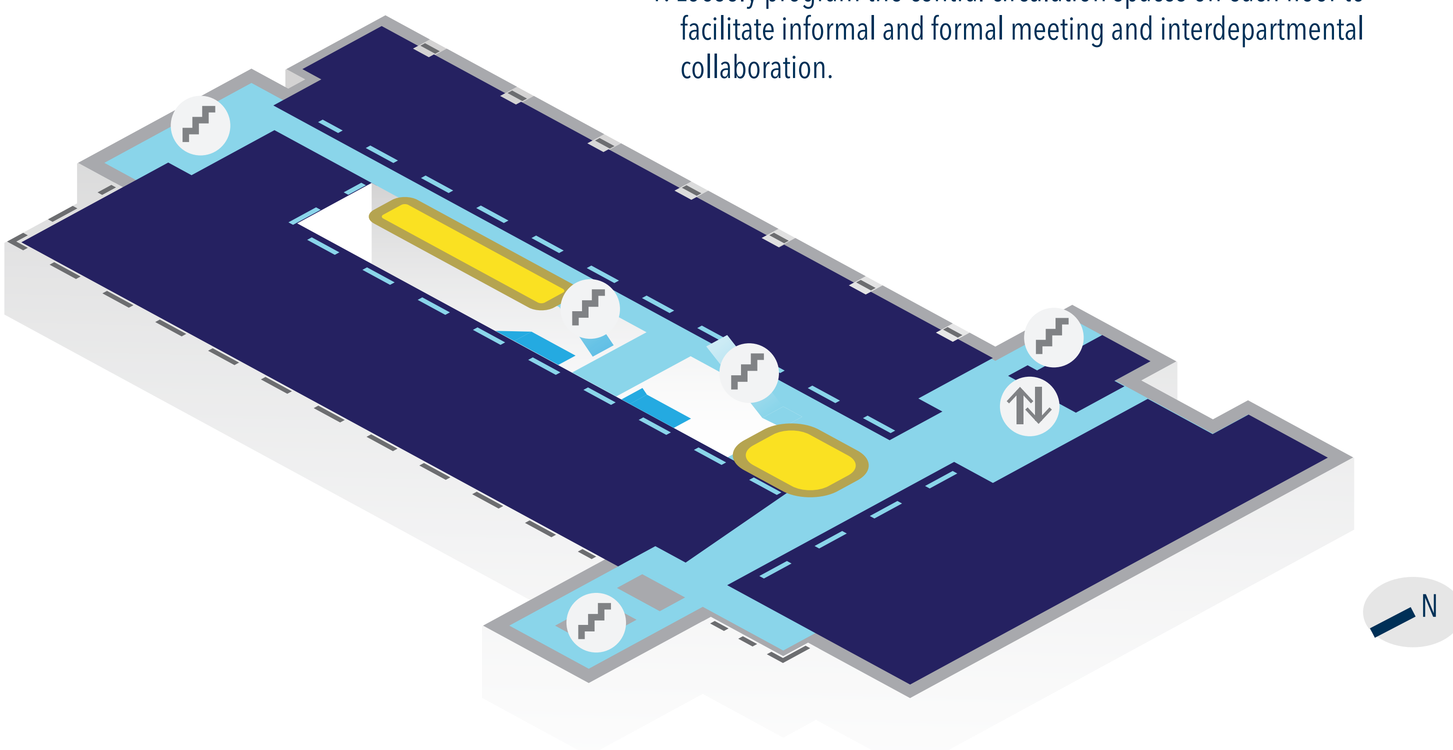
4 Enhance Physical Connections

1. Refocus vertical circulation to central atrium for improved wayfinding, interdepartmental connection, and visibility.
2. Connecting bridges across the atrium create unique spaces and views as well as informal gathering/meeting spaces.



5 New Meeting & Social Space

1. Loosely program the central circulation spaces on each floor to facilitate informal and formal meeting and interdepartmental collaboration.

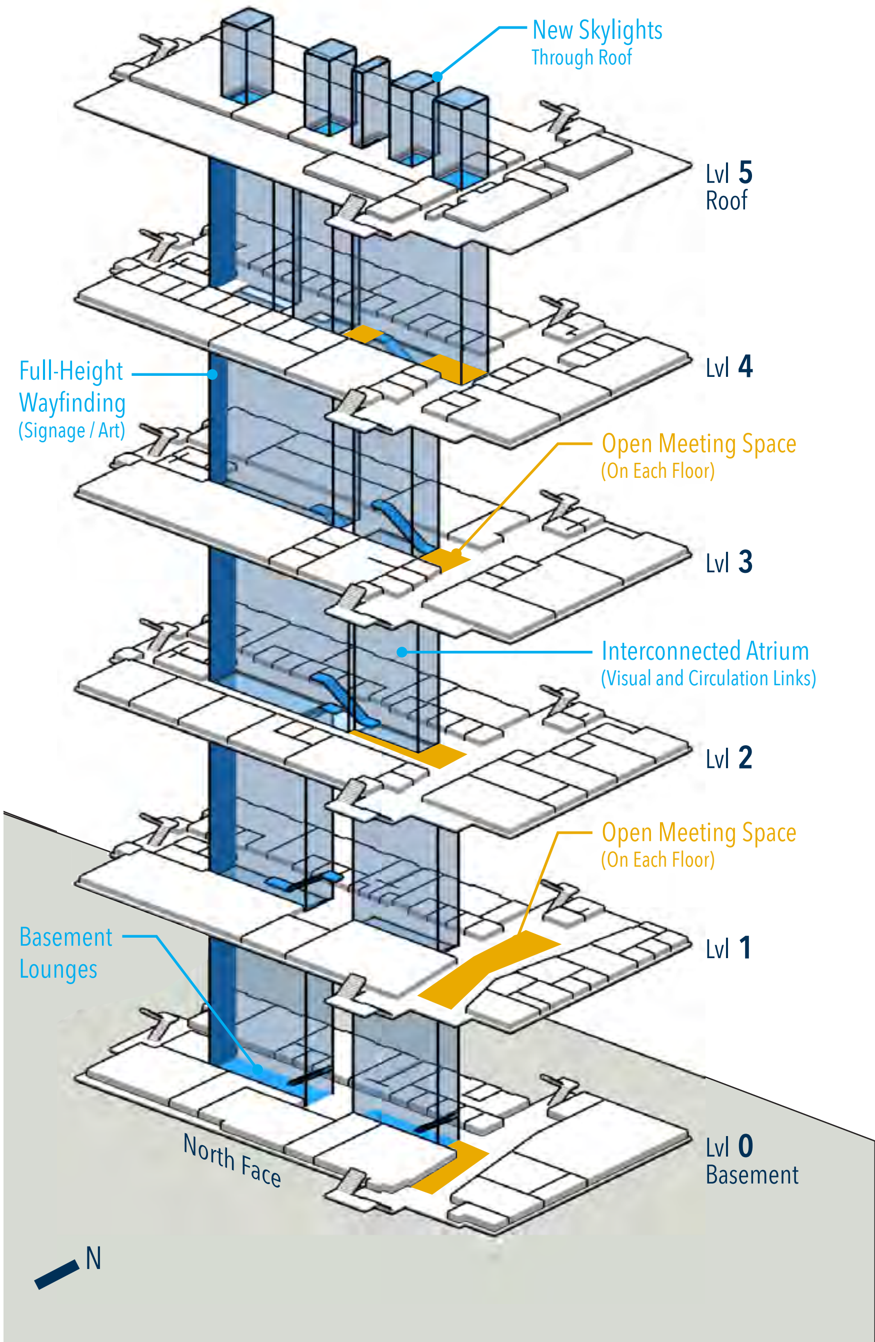


The Atrium

The introduction of a central atrium organizes departments around an open central circulation spine, optimizes space planning and creates additional opportunities for:

- **wayfinding** - building occupants are able to orient themselves more easily within the centralized atrium. The full height of the west wall becomes an optimal location for signage and graphics that identify which floors departments are located on.
- **safety and security** - the use of interior glazing on all levels, looking into the atrium creates a safer environment for occupants to always be visible to others in the building.
- **informal gathering and collaboration zones** - a variety of breakout and informal gathering spaces are created around the atrium, fostering interdepartmental collaboration. Additionally, in a largely commuter-based campus, the spaces allow for students to study and hang-out between classes.
- **daylight** - with the creation of new skylights through the roof, natural daylight is brought deep within the floor plates to give more of the regularly occupied spaces access to daylight.
- **indoor air quality** - integrated into the atrium volume, a new mechanical exhaust system enhances the dispersion of contaminants by a combination of dilution and high-plume exhaust.

A further breakdown of the mechanical efficiencies are detailed on the following pages.



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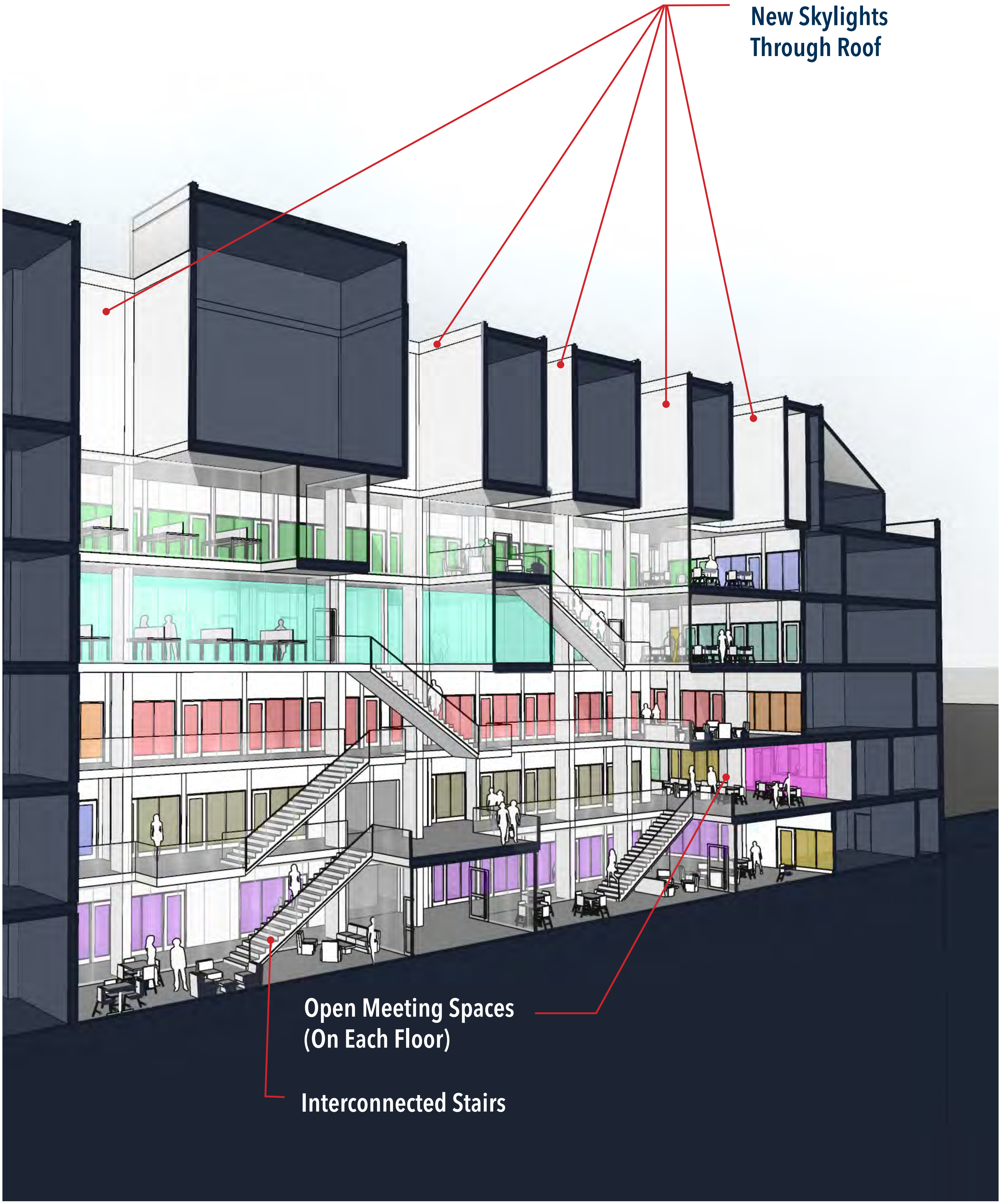
Volume of the proposed atrium in the $40M 'Re-Envision' Concept



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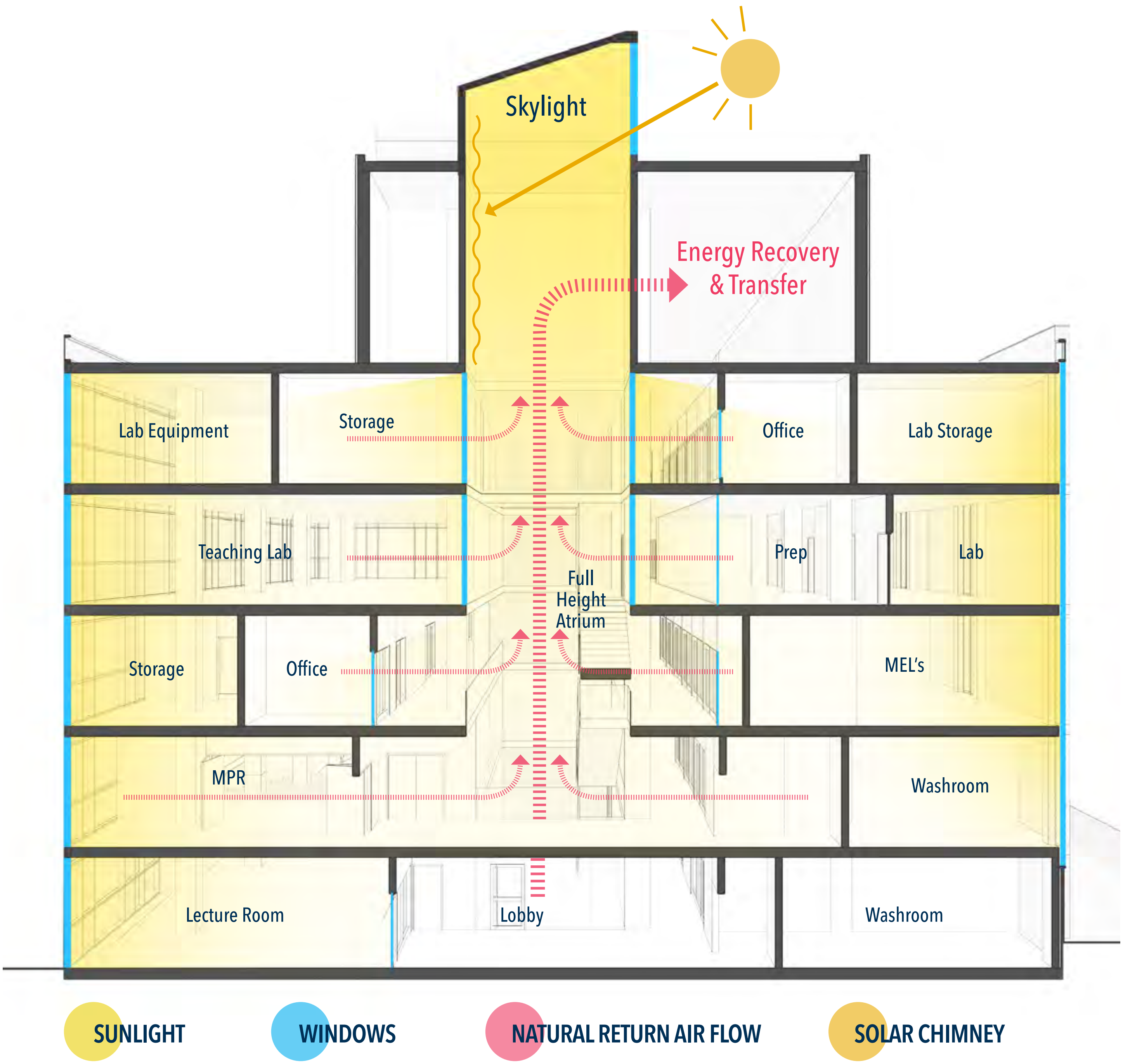
Section cut through the proposed atrium in the $40M 'Re-Envision' Concept, looking south

Mechanical Efficiencies
The proposed full-height central atrium in the $40M 'Re- Envision' Concept creates natural stack-effect ventilation and becomes the principal route for return air flow. In addition to creating an exciting space within the building, the central atrium also significantly reduces heating, ventilation and air-conditioning (HVAC) loads, translating to a far more energy efficient building.

The proposed mechanical system uses a high efficiency energy recovery ventilation unit to provide make up air to the building. The ventilation air is supplied to new fan coil units in 'clean' type 1 spaces, defined as classrooms, offices etc. The exhaust air is then relieved from these spaces through the atrium back to the mechanical room, where it is filtered and conditioned to provide make-up air for the exhaust in the type 2 areas, defined as laboratories and washrooms. This air is essentially used twice before being exhausted



from the building, reducing the total energy required for make-up air conditioning.

To further enhance energy conservation, a heat-recovery chiller is proposed to provide simultaneous heating and cooling while reducing added energy consumption. A heat recovery chiller is used in lieu of an air side economizer as the cooling process via the chiller provides free heating at a lower overall energy input. The heat recovery chiller also affords the opportunity to provide year-round chilled water to increase thermal comfort opportunities for building occupants.

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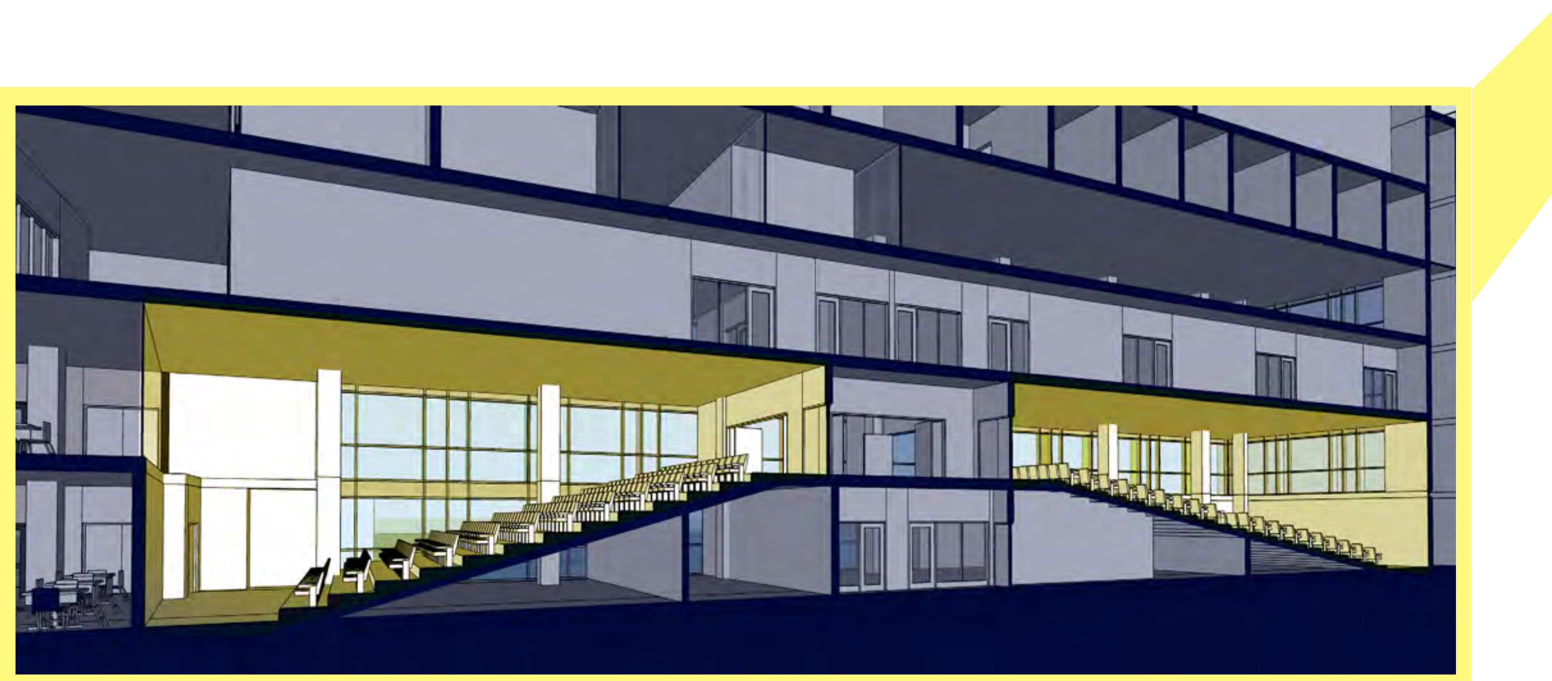
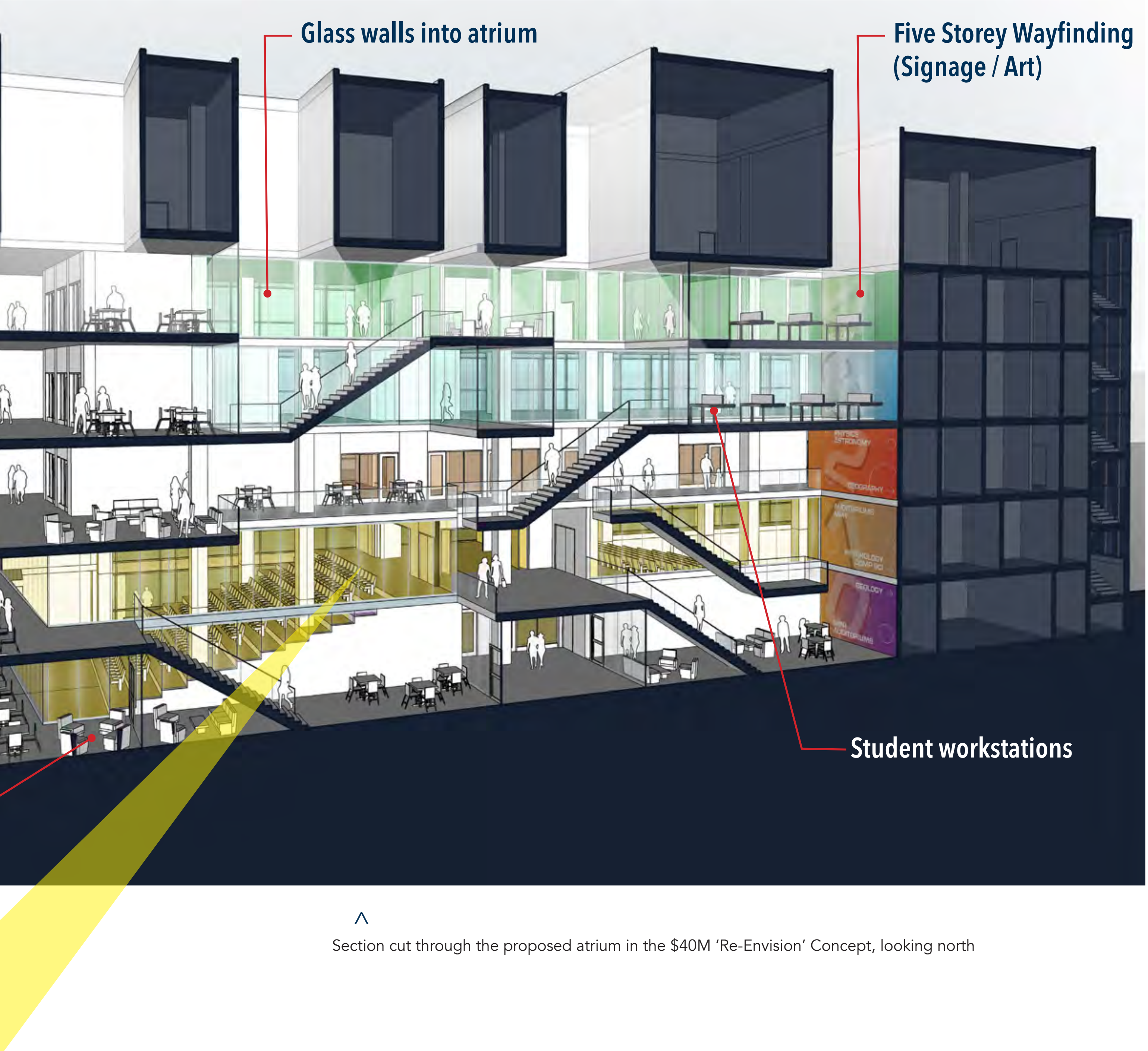
Section cut through the working model of the proposed atrium in the $40M 'Re-Envision' Concept, looking east

Space Allocation
Generally, the allocation of use per floor is re-organized so that the most public uses are on the lower levels, with the more secure and specialized spaces on the upper levels. The two existing lecture theatres are enlarged in the $40M 'Re-Envision' Concept. The theatres remain in their original locations on the ground floor, but they are expanded to the north exterior wall and transformed into double-height spaces. As a result, there is opportunity to have windows into the lecture theatres along the north wall and to have direct access to them from the central atrium on both the ground floor and first floor levels.

The double-height spaces improve site lines, allow for more efficient and streamlined access; and create expanded zones for transitioning between scheduled classes. There is the ability to use the main floor space between the theatres as break-out of flex space depending on the function. When desired, public access could be granted for the atrium and Lecture Theatres, with adequate washrooms, access and 'lock-off' zones.





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Section cut through the proposed atrium in the $40M 'Re-Envision' Concept, looking north

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Section cut through the proposed double height Lecture Theatres in the $40M 'Re-Envision' Concept, looking north

The Exterior

The $40M 'Re-Envision' Concept completely replaces the curtain wall on the north side of the building and proposes to add curtain wall to a portion of the east, which creates an opportunity to modernize the exterior image. The existing building facades are transformed with more extensive curtain wall, bringing natural daylight into a majority of the new program areas that are now pushed to the perimeter of the building, providing a safer and more secure work environment and exposing the interdisciplinary and applied STEM functions of the building to the broader Brandon community. Furthermore, there is an opportunity to expand the windows on the south facade to bring more daylight into the larger classroom and laboratory functions proposed along the south perimeter of the building. There is also an opportunity to enclose the existing exterior balconies and reclaim this area to create flexible meeting spaces on each floor.

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top: view of the north-east corner of the $40M 'Re-Envision' Concept, with new curtain wall glazing and vertical fins; bottom: view of the south facade and new entry to the building off of Louise Street.


JOHN R. BRODIE SCIENCE CENTRE

Cost

As with the $20M 'Refresh' Concept, based on investigation that was conducted on site, review of the asbestos, elevator, roof and generator study reports, as well as interviews with Brandon University Physical Plant, dollar per square foot allowances were allocated to each of the following categories, but this time for the larger $40M scope:

- **Demolition** - scope includes complete and concurrent demolition of each floor per phase, including existing walls and ceilings, etc. The new openings in floors for the central atrium and the lecture theatres are created as well as the required exterior south entrance demolition.
- **Asbestos abatement** - scope includes a complete and concurrent phased abatement on each floor of the identified hazardous materials. The set-up and tear-downs of pressurized areas are fewer in quantity compared to the $20M 'Refresh' Concept, as much larger areas are addressed during each phase. Subsequently, fewer inspections are also required.
- **Mechanical upgrades** - scope includes a complete upgrade of the mechanical systems to provide a new system with centralized controls, localized heat recovery and ventilation units, newly integrated return air system facilitated by the central atrium performing as a plenum, reconfigured chiller and hydronic system and new fire protection system.
- **Electrical upgrades** - scope includes a complete upgrade of the electrical system to provide new wiring and cabling for power distribution, new MCC units (replacing 2 of 3), new pathways and circuit integration to achieve efficiencies, new lighting package (LED throughout), new data systems, new fire alarm system, new back-up generator, etc.
- **Building Envelope** - scope includes upgrading the roof insulation R-value, masonry re-pointing, and new curtain wall on the north and south elevations as well as the east stairwell.
- **Decanting** - scope includes an allowance of 12 portable off-site trailers that allow for temporary space accommodation while the renovation occurs in one zone at a time
- **Furniture, Fixtures and Equipment (FF&E)** - scope includes items such as a/v and communications equipment, security and alarm systems and furnishings and is further broken down in the adjacent table.
- **General Expenses** include the cost to carry out the estimated 24 month construction period including Contractor Construction Management Fees
- **Project Contingency** at 10%
- **Tenant Improvement** - includes a complete framing and boarding scope to address all new room and ceilings on all floors; creation of new mechanical shafts and circulation pathways; complete upgrade of the exterior wall assembly with new insulation and vapour barrier, etc.; all new doors, frames and hardware; new painting and flooring throughout; all new washroom facilities; a completely new fire suppression system to accommodate the newly renovated facility in accordance with program specific integration (dry systems, chemical systems, etc.); a new millwork package that provides display cases and itemized storage, rolling partitions and tables for re-configurable spaces, and custom pieces for auditoriums and gallery spaces; new skylights and conjoining shafts through the fifth level that provide vertical lighting to the basement level through area lightwells on each floor; new stairs and landings through a new central atrium providing vertical interconnection; glazed aluminum railings at all new stairs and landings; complete fire rated interior glazing package at the perimeter of the atrium at the ground, third, fourth and fifth levels as well as the two-storey lecture theatre elevation facing into the atrium; new seating throughout the renovated lecture theatres; acoustic treatment package for lecture

$40M 'Re-envision' Alternative
Class D Costing Breakdown

Demolition	$2,025,000	$15 / SF
Asbestos Abatement	$1,350,000	$10 / SF
Mechanical Upgrade	$4,860,000	$36 / SF
Electrical Upgrade	$5,380,000	$40 / SF
Building Envelope	$2,220,500	$16 / SF
Decanting	$553,200	12 Portables
Furn., Fixtures, Equipment	$2,125,000	lump sum
Cash Allowances	$667,000	lump sum
Contingency	$3,297,800	10%
General Expenses	$1,557,000	24 Mo.
Insurance, Bonds & Permit	$500,270	
Contractor CM Fee	$1,264,600	4%
Tenant Improvement	**$10,476,190**	**$78 / SF**
Hard Costs (Before T.I.)	**$36,276,560**	**$269 / SF**
Soft Costs	$3,723,620	10%
TOTAL	**$40,000,000**	**$296 / SF**
+Escalation (2021 start)	**$1,667,300**	**2.5%/yr**

theatres; and foldable partitions to create multiple layout configurations.
- **Soft Costs** covering the architectural and engineering consulting fees for the project as well as third party reports, assessments and testing fees.

In addition, a 2.5%/year escalation factor should be accounted for. Assuming a 2021 construction start, an additional $1,667,300 would be added to the Class D cost estimate for the 'Re-Envision' Concept.

Cash Allowances
Concrete Testing
Compaction Testing
Pile Testing
Roof Inspections
Curtain Wall / Storefront
Building Envelope Inspections
Temporary Building Heat
Temporary Power Consumption
Civil Testing
Site Refurbishment
Heating and Hoarding
Firestopping Inspections
Hazardous Material Assessments
Permitting
Contingency Items
Design Continuation
Authority Having Jurisdiction
Concealed Conditions

$40M 'Re-Envision' FFE Items
Card Access Systems
Exterior Signage - Sign Plinths, etc.
Interior Way-finding Signage
Motorized Blinds
A/V Equipment
Screens
Projectors
Sound Systems
PA Systems
Communications
Data Cabling (Empty conduits with pull string is typically part of base building work.)
Server Racks and Equipment
Security Systems / Alarm Systems
CCTV Cameras and Monitors
Furnishings
Proprietary / Modular Furniture
Demountable Partitions
Unfixed Seating (Benches / Chairs)
Lab Equipment

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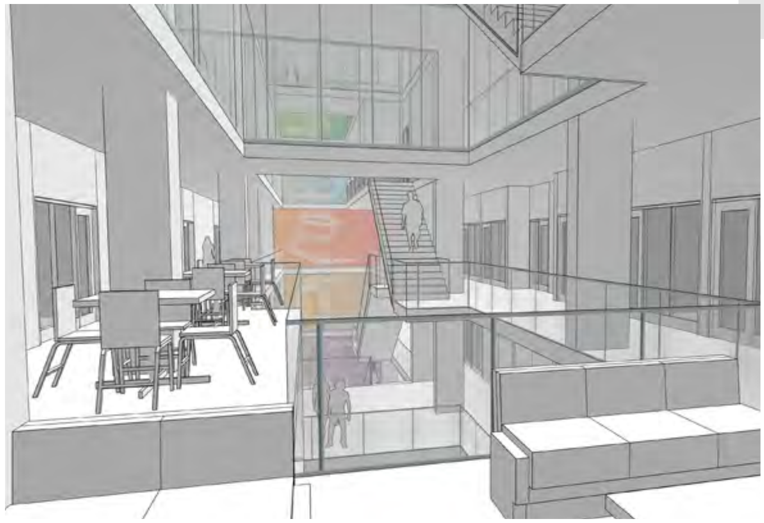
above left: Cash Allowance inclusions for the $40M 'Re-Envision' Concept; right: Furniture, Fixture and Equipment inclusions for the $40M 'Re-Envision' Concept

Use and Space Distribution

An analysis of the current ratio between programmed space and the building gross-up determined that at 43%, there is a disproportionate amount of space allocated to building services, circulation and gross-up. Typically, for a building like the Brodie Centre, the range of non-programmed space should be in the range of 25% - 35%. By creating a more efficient floor layout organized around a central atrium, the amount of area that is attributed to circulation, which currently comprises 69% of the building gross up, not only decreases, but is also greatly enhanced by organizing it around the daylight-filled atrium with informal gathering spaces scattered throughout. The image and photographs to the right provide a comparison of existing and proposed approaches to circulation.

In addition to decreasing the amount of area allocated to circulation, the $40M 'Re-Envision' Concept creates interconnected space which includes the central atrium as well as the double-height lecture theatres on the ground level. The result is a 5% increase in programmed space relative to building services, circulation and gross-up.



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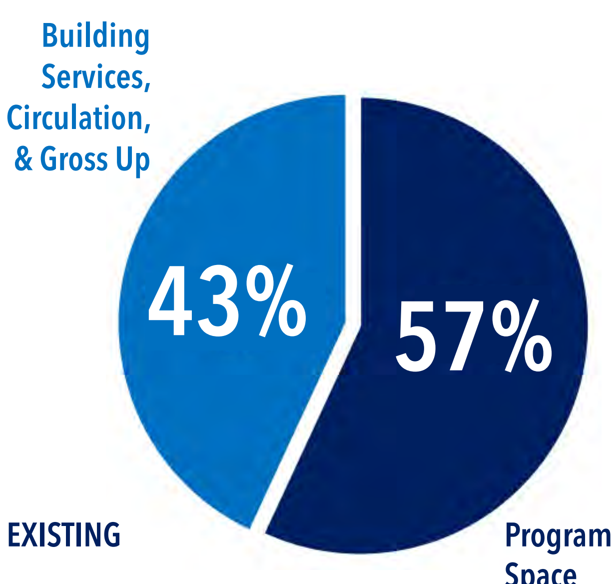
top: proposed central atrium with consolidated circulation; bottom: typical existing corridors, running east-west in the existing building



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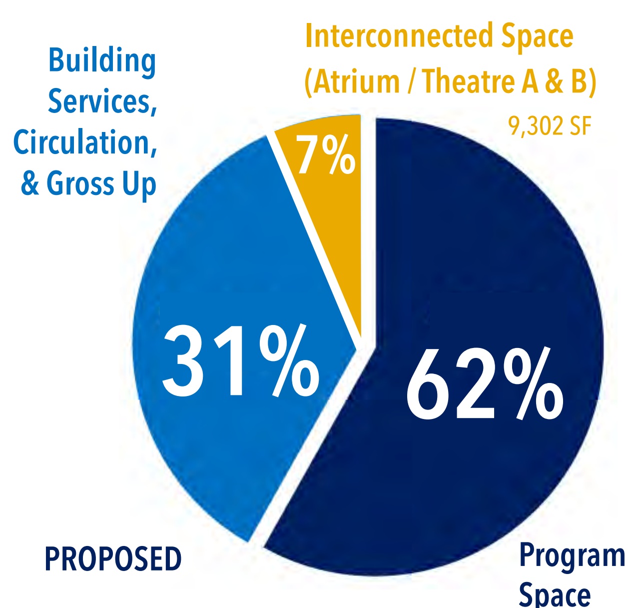
Existing ratio of program and non-program space



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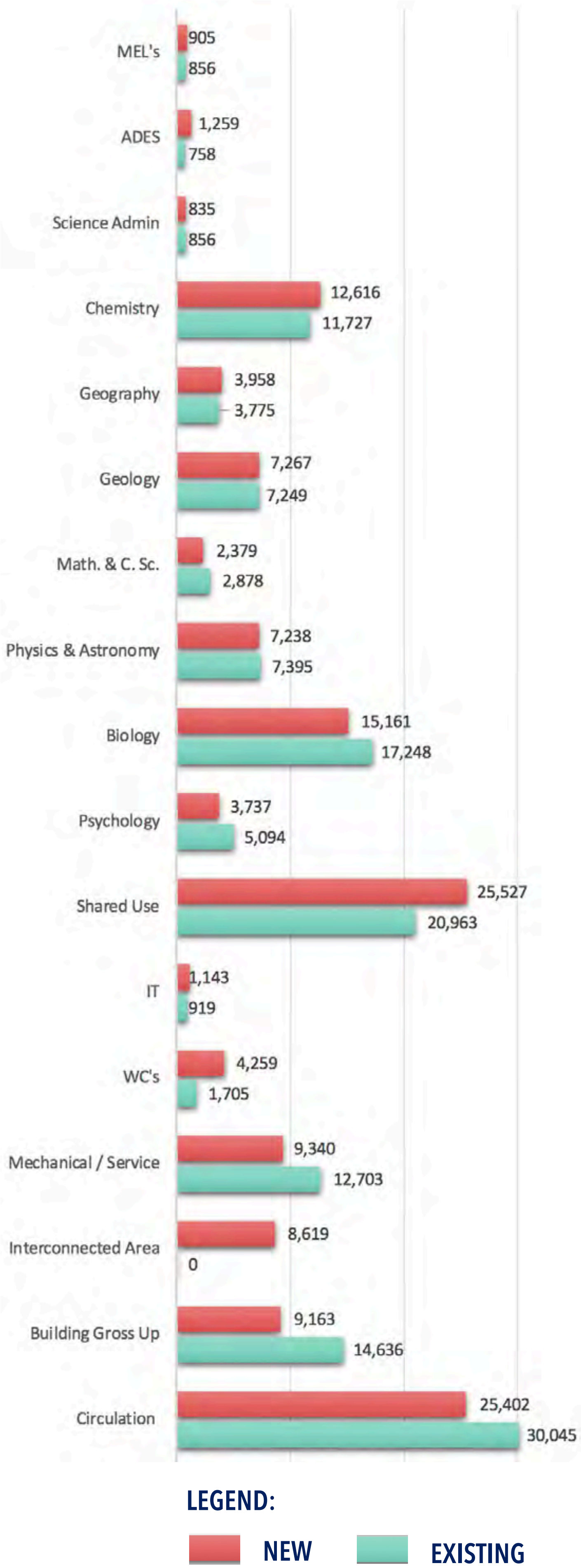
Proposed ratio of program and non-program space



Area Distribution per Department

Although the amount of program space increases overall in the $40M 'Re-Envision' Concept, there are varying impacts on different departments. The adjacent bar graph illustrates the comparison of the distribution of space between the existing and proposed planning on a per department and program basis.

MELS

- existing area is 856 sf;
- proposed area is 905 sf;
- MELS is proposed to be centrally located on the main floor to have a direct connection the main entry and capitalize on foot traffic to market their research; and
- access to nearby shared meeting space on the other side of Science Administration as well as on other floors.

ADES

- existing area is 758 sf not including approx. 550 sf Emergency Operations Lab (EOL), which is currently located in the lower level of Harvest Hall;
- proposed area is 1,308 sf, including the EOL;
- access to nearby shared meeting space on the other side of Science Administration; and
- located on the main floor near the front entry

Science Administration

- existing area is 856 sf;
- proposed area is 835 sf; and
- centrally located on main floor near front entry and across from atrium.

Chemistry

- existing area is 11,727 sf;
- proposed area is 12,616 sf;
- existing rooms 4-25, 4-28, and 4-31 have the ability to open into each other and the area of these teaching labs had an increase; and
- located on the third floor and organized around the central atrium, with shared use on other floors.

Geography

- existing area is 3,775 sf;
- proposed areas is 3,958 sf; and
- located on the second floor on the south side of the atrium, with shared use on other floors

Geology

- existing area is 7,249 sf not including the core sampling research located outside the John R. Brodie Science Centre;
- proposed area is 7,267 sf, which also does not include core sampling research lab; and
- located on the ground floor and directly adjacent to two classrooms that are categorized under "shared", complete with storage for rocks, samples, etc. The intent is that these rooms are predominately for use by Geology, but that they could also serve other departments, as required.

Math and Computer Science

- existing area is 2,878 sf;
- proposed area is 2,379 sf;
- currently, there are eleven offices that range in size from 211sf to 104 sf. The proposed plan keeps the same number of offices, but all are at the standard size (117 sf) applied to all departments;
- offices are located on the fourth floor with classrooms (shared with Psychology) on the main floor, with shared use on other floors; and
- The overall area allocation between the existing 1-49, 1-50, G-18, G-20C, and G-32 is captured as follows:
  - » 1-49 at 261 sf is part of an increased allocation to G-18 and G-20C (see below)
  - » 1-50 is currently 457 sf proposed as part of a shared allocation
  - » G-18 is currently shared with Psychology and has increased by 75 sf
  - » G-20C is currently shared with Psychology and has increased by 181 sf
  - » G-32 is currently 310sf and is proposed as part of a shared allocation on the ground floor.

Physics and Astronomy

- existing area is 7,396 sf;
- proposed area is 7,238 sf; and
- located on the second floor on the north side of the atrium with shared use on other floors.

Biology

- existing area is 15,975 sf;
- proposed is 15,161 sf; and
- located on the fourth floor, and organized around the central atrium, with shared use on other floors.

Psychology

- existing area is 4,641 sf;
- proposed area is 3,737 sf
- there are a number of spaces currently attributed to Psychology that are not counted in the existing area allocation and instead captured in the Under-Utilized Spaces category below;
- the shortfall between existing and proposed area (904 sf) was originally assumed to be absorbed in the Shared Use category, however based on subsequent information collected at the Open House, it is likely that additional area will need to be allocated to Psychology. One potential option is to carve out space from the interconnected allocation on ground floor and re-allocate it to psychology.

Shared Use

- existing area is 19,774 sf;
- proposed area is 25,527 sf;
- the significant increase in this space alleviates pressure on the individual departments and programs and creates a range of different sized meeting, seminar and teaching space;
- the ground floor Lecture Theatres increase in size.

Under-Utilized Spaces

- existing area is 3,113 sf
- comprised of G-16 Custodial Room, G-9 and G-10 Biology Vivarium, 1-32 Psychology Staff Room including 1-33 kitchenette and 1-34

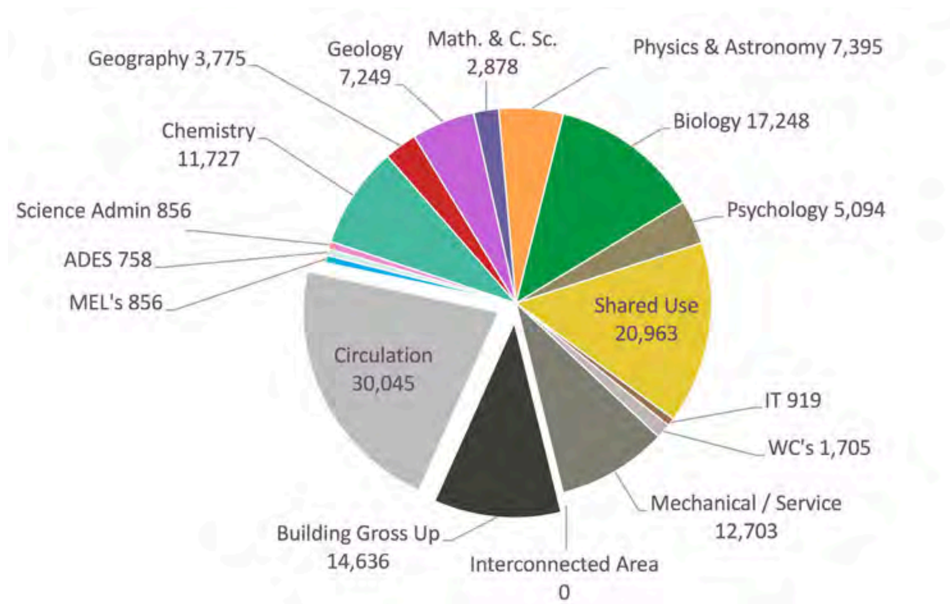
washroom, 1-30A Sound Booth including 1-28 and washroom, and five storage rooms G-19 and 1-26 including 1-6, 1-57, 1-58, 1-59, 1-60, 1-61, 1-59, 4-44 and 3-46.

Service Space

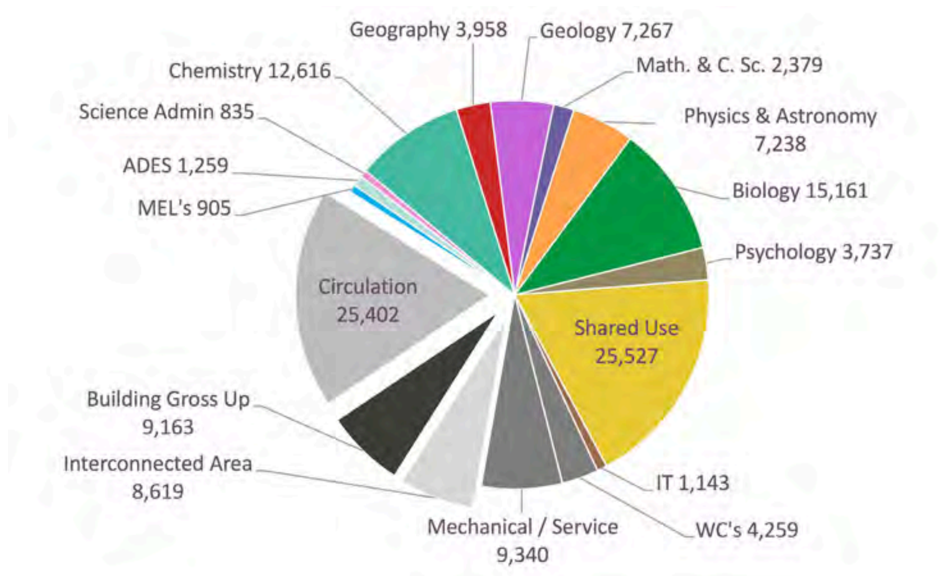
- existing area is 14,210 sf;
- proposed area is 13,599 sf;
- the washroom allocation of space increases from 1,705 sf to 4,259 sf to meet code;
- the fifth floor mechanical penthouse decreases in area due to the light wells that pass through the floor for the newly created skylights

Information Technology (IT)

- existing area is 919 sf;
- proposed area is 1,143 sf

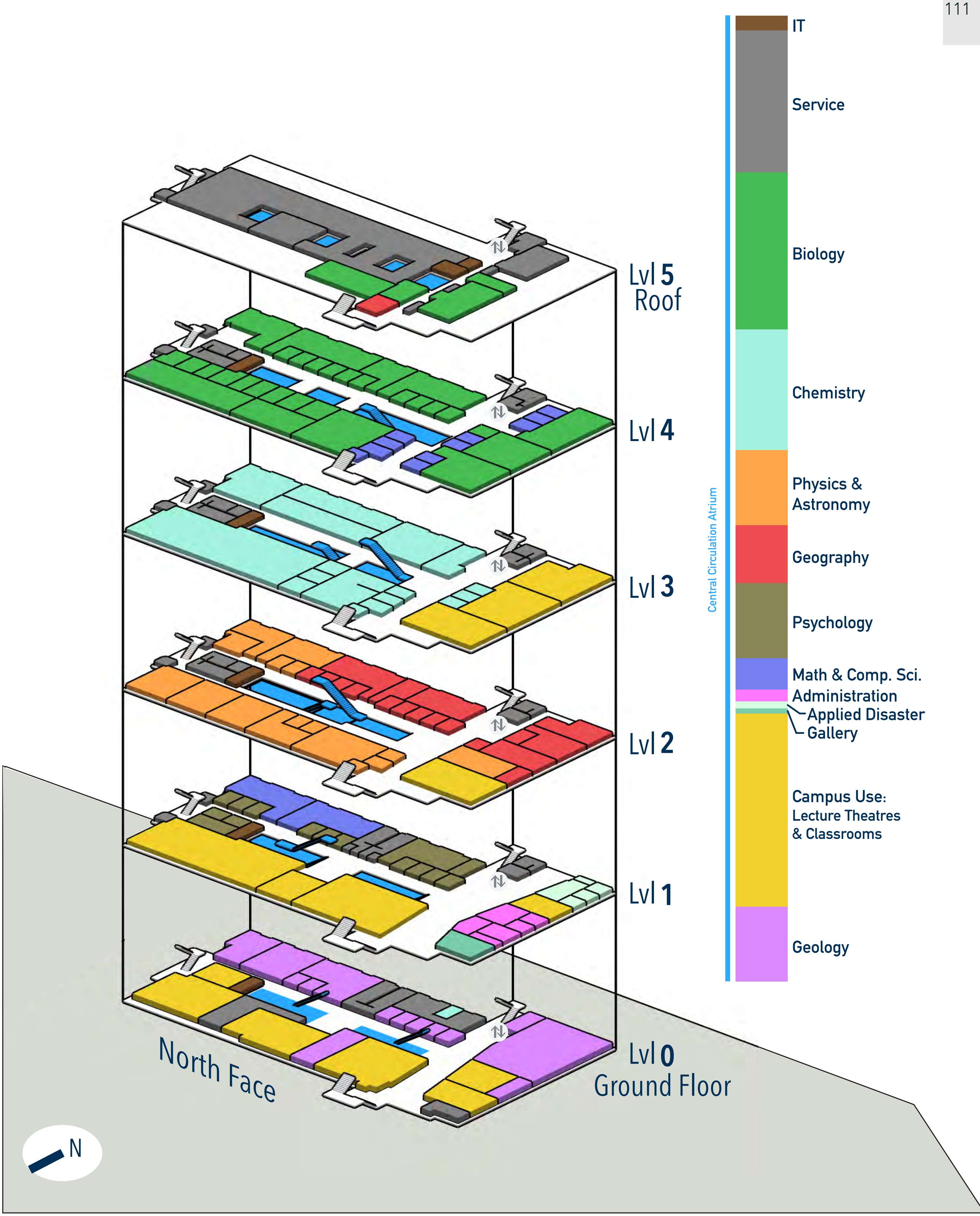


EXISTING



PROPOSED

top: existing area distribution per department; bottom: proposed area distribution per department
** Departments of Psychology and Biology include "Under-Utilized Spaces" in calculations


IT
Service
Biology
Chemistry
Physics &
Astronomy
Geography
Psychology
Math & Comp. Sci.
Administration
Applied Disaster
Gallery
Campus Use:
Lecture Theatres
& Classrooms
Geology
Central Circulation Atrium
Lvl 5
Roof
Lvl 4
Lvl 3
Lvl 2
Lvl 1
Lvl 0
Ground Floor
North Face
N

1. ENTRANCE HALL
2. ADMINISTRATION
3. OFFICE
4. CIRCULATION
5. PUBLIC WASHROOMS
6. FLEXIBLE MEETING ROOM
7. ELEVATORS
8. STAIRCASE
9. MEETING SPACE
10. CLASSROOM
11. TEACHING LAB
12. RESEARCH LAB
13. LECTURE THEATRE
14. SERVICE SPACE
15. STORAGE
16. GALLERY / DISPLAY
17. ENTRANCE
18. RAMP
19. SHAFT
20. ELECTRICAL
21. IT
22. PHASE 3 CONSTRUCTION
23. MAIL / COPY
24. MULTI-PURPOSE ROOM
25. WORKSHOP
26. ANTI ROOM
27. GREENHOUSE & PREP
28. MECHANICAL ROOM
29. STAFF ROOM
30. ROOF
31. ATRIUM LIGHTWELL

BRANDON UNIVERSITY

JOHN R. BRODIE SC. CENTRE
CONCEPTUAL DESIGN
Louis Ave. & 18th Street, Brandon, MB

scale: 1:200
date issued: 2019.01.31
proj. #: 2018.23
rev. #: R-0

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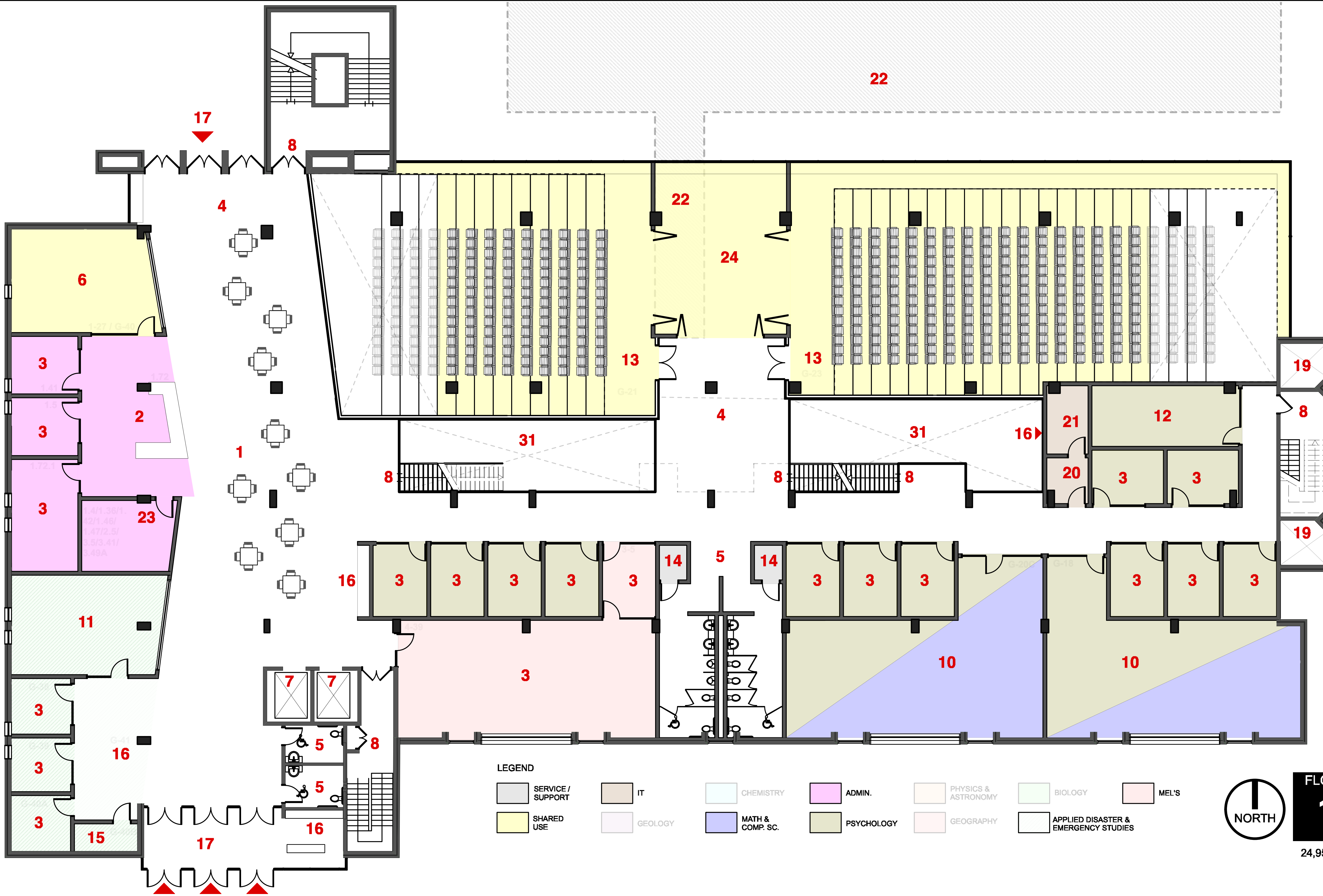

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FLOOR 5
14,765 S.F.

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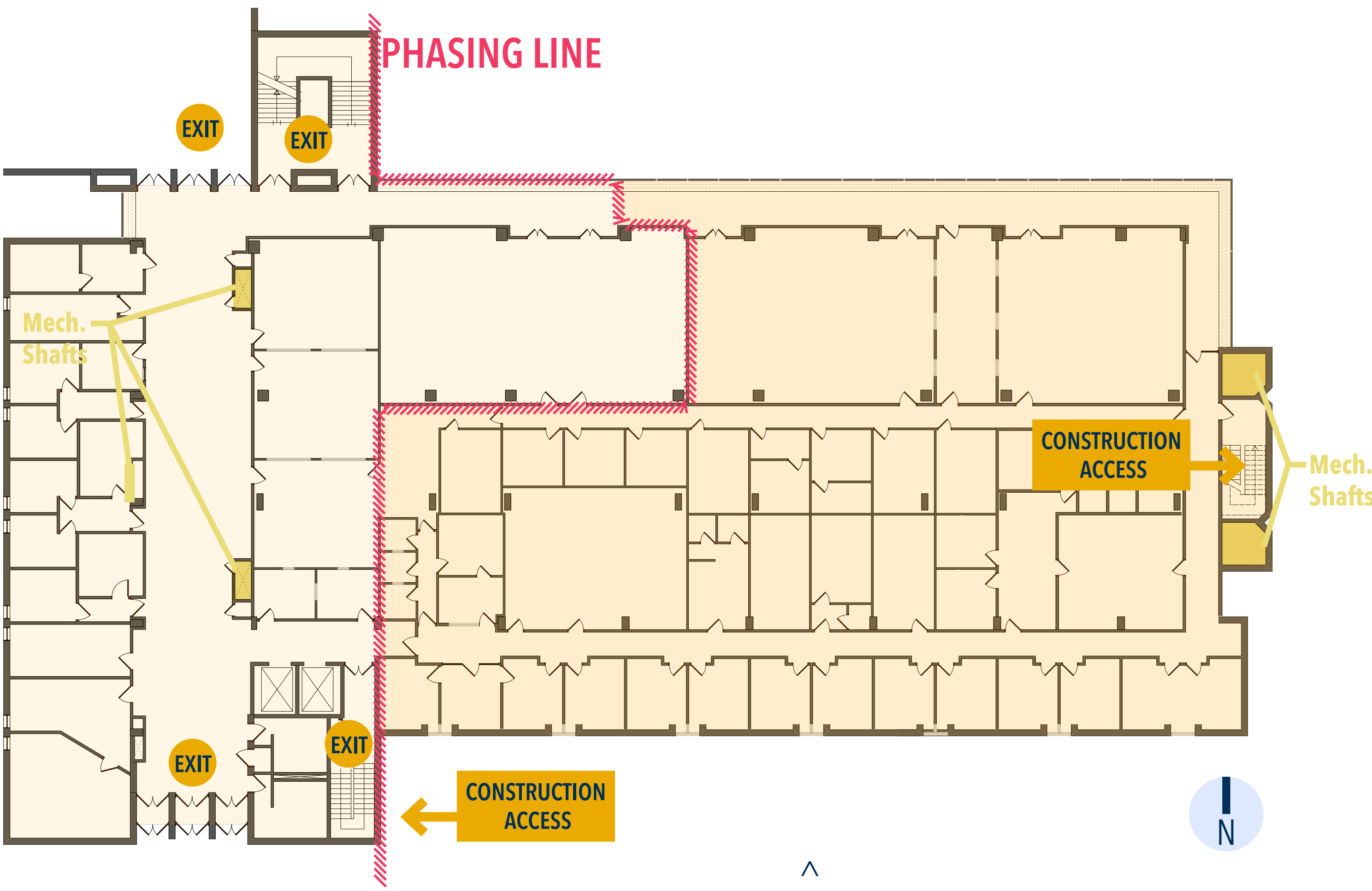
Implementation and Phasing

The phasing strategy for the $40M 'Re-Envision' Concept involves two larger phases of work as opposed to the $20M 'Refresh' phasing which will require multiple, small-scaled stages. As a result, the allowance for portable off-site trailers was increased from 4 to 12, to allow for an increase in temporary space accommodation while the more extensive two phases of renovation work occur. In this concept, the building is divided into two zones, which facilitates large extents of renovation at a time. While one zone is renovated, the other remains operational. The asbestos abatement scope of work is handled more comprehensively and efficiently in the larger zones with fewer required inspections. Comparatively, the $20M 'Refresh' Concept, requires multiple set-ups and tear-downs of positively pressurized areas supplemented by multiple inspections prior, during and after each abatement period.

As with the $20M 'Refresh' Concept, in addition to the 12 portable off-site trailers and based on discussions during the department chair interviews, some faculty may prefer to work remotely and from home offices, or conduct field research during the period of renovation to their space. Additionally, finding temporary space on or off campus to accommodate larger class sizes, may be even more desirable with the lecture spaces being renovated more intensively.

The existing layout of the building is ideal for two phases of construction. With the provision and layout of the exits and mechanical shafts, there is an ideal "phasing line" that allows renovation to occur on one side of the building, while the other side remains operational. The layout enables the existing systems to remain in place while new systems are installed and eventually made operational.



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general phasing concept (existing first floor level shown)

The first phase of work includes the portion of the building to the east of the phasing line. In this phase of work, a majority of the heavy demolition in the creation of the interconnected floors occurs. On each of the main through fifth floors, 17’ wide openings are cut to allow for the central atrium, and the main floor is further modified at the east-most Lecture Theatre A to create the new double-volume space. At the roof level, new penetrations are made to allow for the skylights into the central atrium. The entirety of the walls, systems and finishes are demolished with a concurrent asbestos abatement program. During this phase of work, the building would remain occupied west of the phasing line, serviced by the existing mechanical shafts and the north and south exits.

The second phase of work includes the portion of the building to the west of the phasing line. In this phase of work, the remaining interconnected floor is created in Lecture Theatre B by cutting the main floor to create the double-volume space. As in phase one, the entirety of the walls, systems and finishes are demolished with a concurrent asbestos abatement program. During this phase of work, the building would be occupied in it’s newly renovated state east of the phasing line and serviced by the new mechanical and electrical systems as well as the east and south exits.

Since the south exit stair and elevators need to remain accessible to each major phase of construction, it is assumed that these spaces would be renovated one at a time following the first two major phases to minimize disruption.

A further, more detailed highlights of the structural, mechanical and electrical phasing are as follows, with detailed plans of each floor on subsequent pages:

Structural Phasing

Phase one:

1. The majority of new atrium openings during phase one are aligned with existing concrete beams and do not require additional structure for support;
2. Any new steel beams and steel columns will be erected and in place prior to cutting new atrium openings in floor slabs, or provide temporary shoring from foundation continuous vertically to new opening;
3. New footings will be provided as required at new columns supporting edges of new floor openings (Lecture Hall A);
4. Additional structural work for exterior upgrades and renovation work required.

Phase two:

1. New footings will be provided as required at new columns supporting edges of new floor openings (Lecture Hall B); and
2. Additional structural work for exterior upgrades and renovation work required.

Mechanical Phasing

The existing split mechanical system easily facilitates the project to be separated into two phases. The ventilation system on the west side can remain operational until phase two while the ventilation system on the east side can be demolished and replaced with new system with heat-recovery.

Phase one:

1. Install dedicated zone-level fan coils for individual space thermal control;
2. New Heat-Recovery Chiller to replace existing;
3. New Plumbing Systems & High Quality Water Systems installed throughout;
4. New fire protection systems installed throughout; and
5. New atrium spaces to be incorporated into existing return air system.

Phase two:

1. Convert west side ventilation system to match upgrades and changes on east side;
2. Retrofit atrium and existing return air system to suit final HVAC configuration.

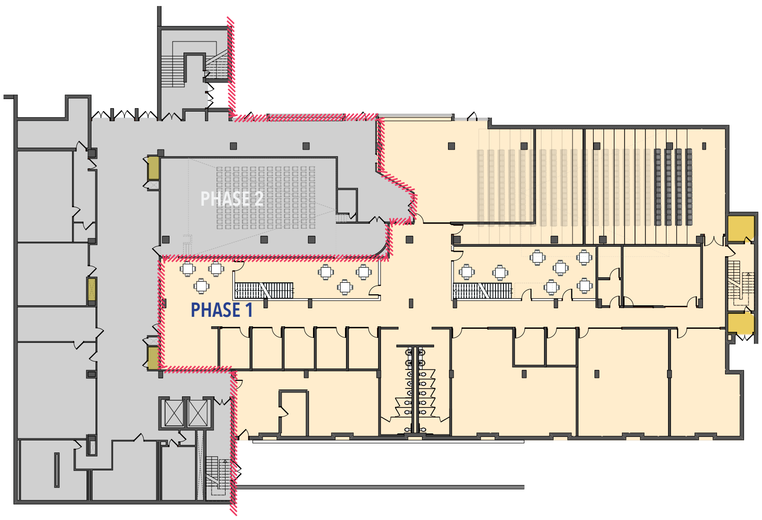
Electrical Phasing

Phase one:

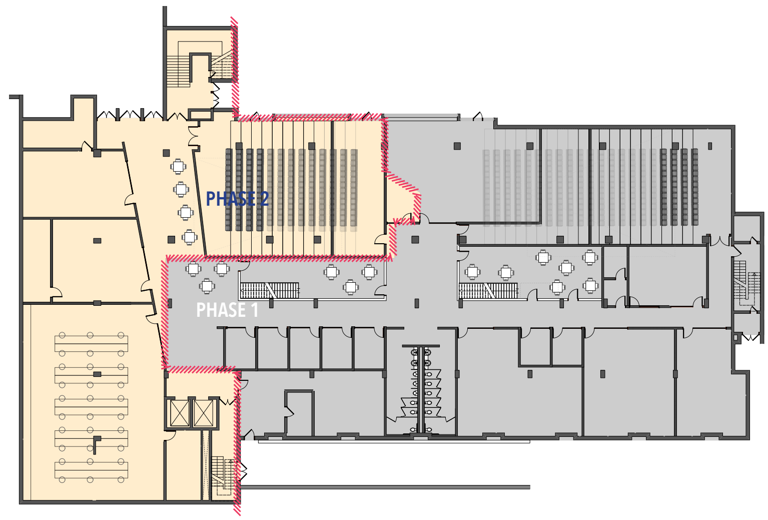
1. New Emergency Generator and distribution. Existing Generator will operate until Phase two is complete;
2. New Fire Alarm Control Panel and fire alarm devices. Existing will operate until Phase two is complete;
3. Refurbishment of Distributions A & B to support electrical distribution redesign;
4. Motor Control Centres 1 & 2 to be replaced.
5. Stacked IT / Electrical Rooms to be constructed.
6. New power / cabling, electrical, IT systems in Phase one area. Existing systems remain operational in Phase two area. Removed existing & extend new power / cabling, electrical, and IT systems into Phase two area; and
7. Upgrade lights & fixtures.

Phase two:

1. Switch from existing Emergency Generator to new and remove existing;
2. Switch from existing FACP to new, remove existing and extend new fire alarm systems into Phase two area;
3. Remove existing & extend new power / cabling, electrical, and IT systems into Phase two area; and
4. Upgrade lights & fixtures.

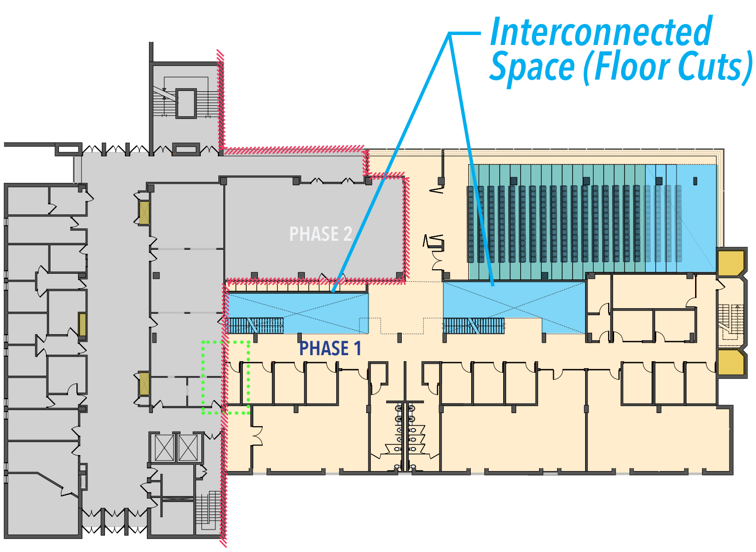


Phase 1

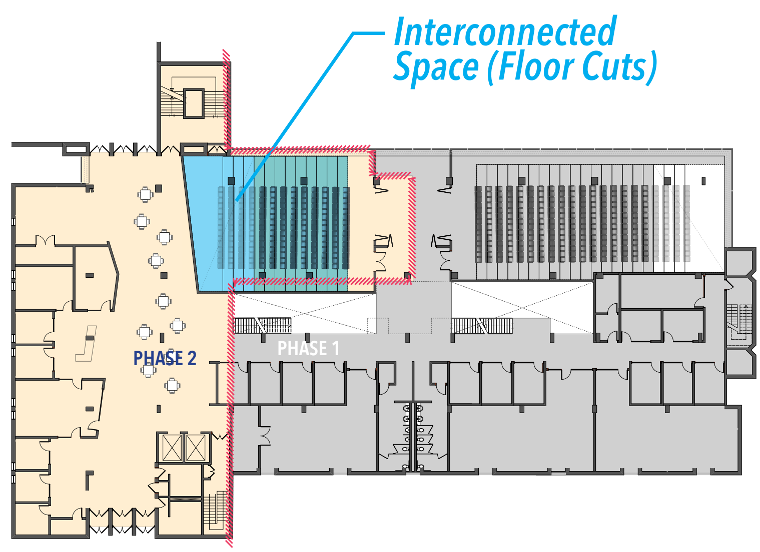


Phase 2

Ground Floor Phasing



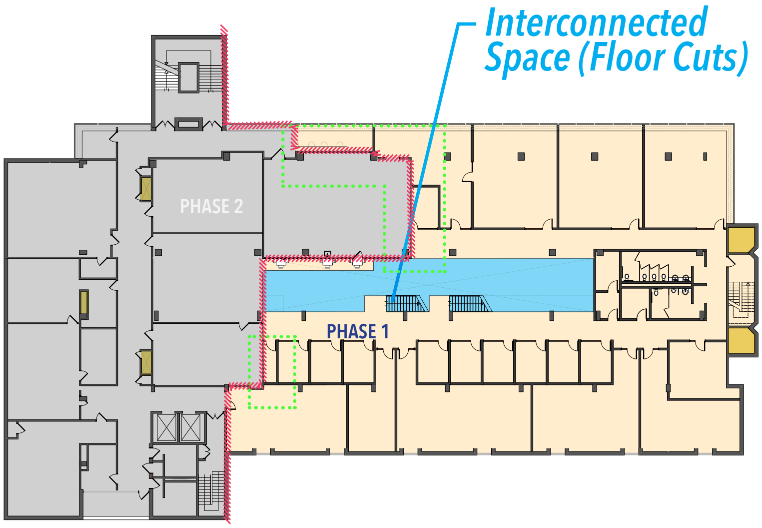
Phase 1



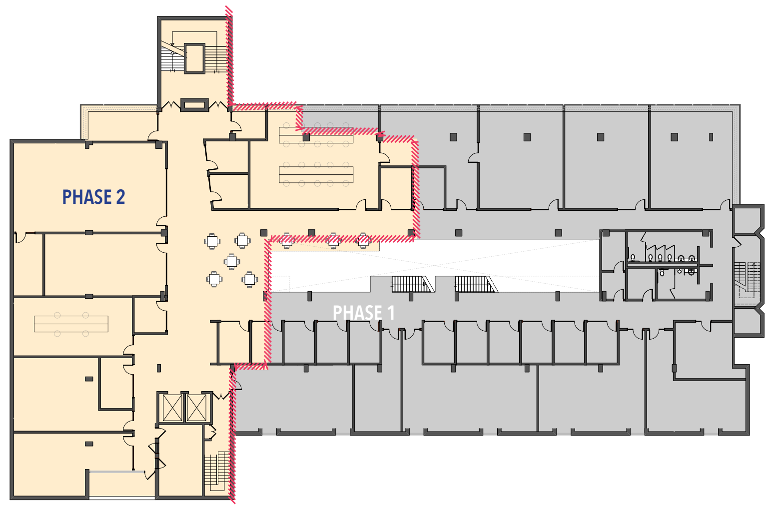
Phase 2

Main Floor Phasing

N

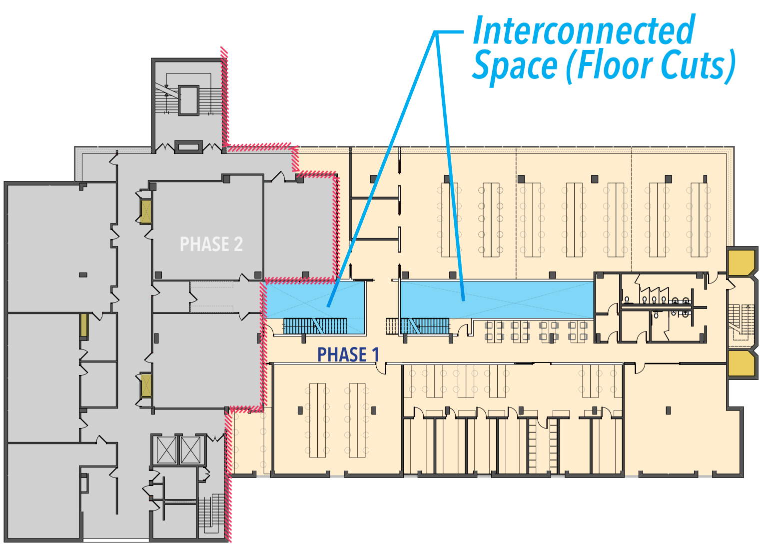


Phase 1

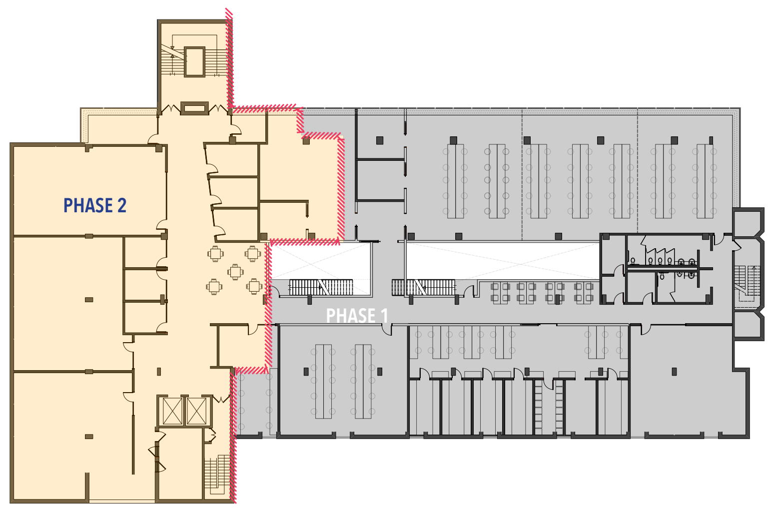


Phase 2

Second Floor Phasing



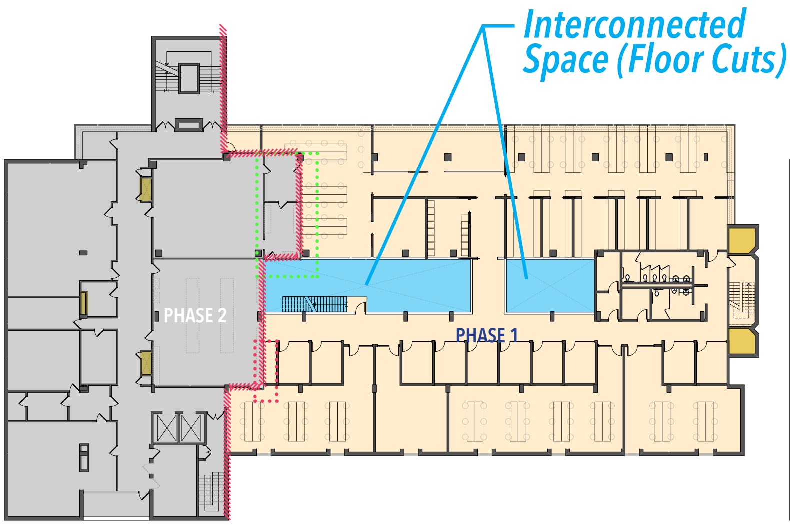
Phase 1



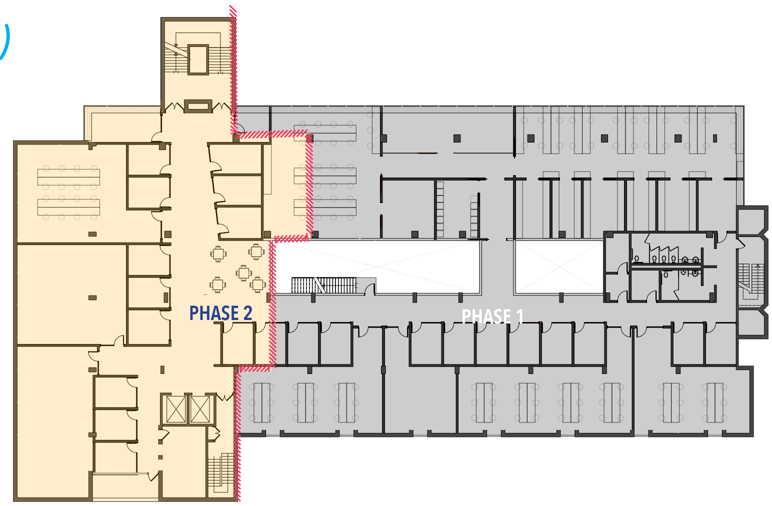
Phase 2

Third Floor Phasing

N

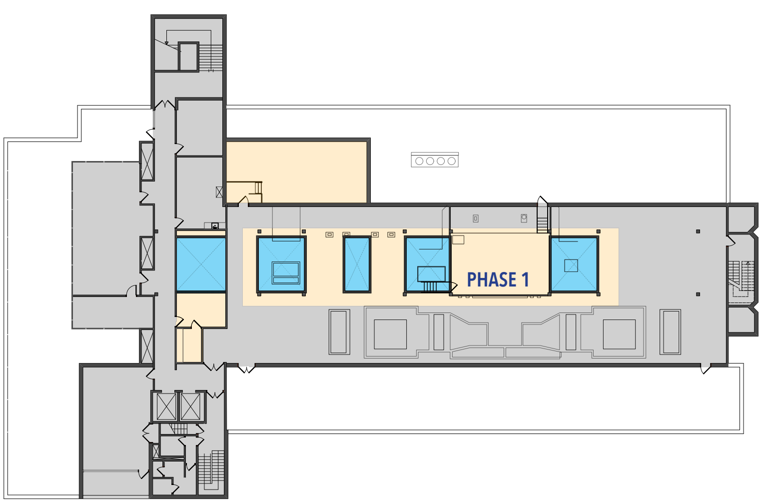


Phase 1



Phase 2

Fourth Floor Phasing



Phase 1

Fifth Floor Phasing

Sustainability

"Buildings have a substantial impact on the health and wellbeing of people and the planet. They use resources, generate waste and are costly to maintain and operate. Green building is the practice of designing, constructing and operating buildings to maximize occupant health and productivity, use fewer resources, reduce waste and negative environmental impacts, and decrease life cycle costs."

- Canadian Green Building Council (CaGBC)

Buildings are responsible for an enormous amount of global energy use and according to the 2018 Global Status Report, building construction and operations account for 36% of global final energy use and 40% of energy-related carbon dioxide (CO2) emissions in 2017. In response to the Vancouver Declaration on Clean Growth and Climate Change, which committed Canada to meeting or exceeding the federal government's 2030 target of a 30% reduction below 2005 levels of GHG emissions, the Canadian Green Building Council (CaGBC) made recommendations aimed at meeting the targets while fueling the growth of Canada's sustainable building industry. One such recommendation included investing in and providing incentives for energy efficiency improvements in existing buildings to reach high-performance energy efficiency. As such, the $40M 'Re-Envision' Concept for the John R. Brodie Science Centre, which is a deep retro-fit of a Brandon University existing asset, addresses the CaGBC's recommendations head-on.

According to the US Green Building Council (USGBC), *"upfront investment in green building makes properties more valuable, with an average expected increase in value of 4 percent. By virtue of lowered maintenance and energy costs the return on investment from green building is rapid: green retrofit projects are generally expected to pay for itself in just seven years."*

LEED

Understanding the enormous impact that buildings have on the environment and climate change, makes the case for exploring a sustainable framework for design and construction. LEED (Leadership in Energy and Environmental Design) is an evaluation of environmental performance from a whole building perspective over a building's life cycle. It is a performance-oriented rating system where sustainable strategies are implemented that are relevant and important to a specific project and a building's operation. The current version of the rating system, LEEDv4, is divided into eight environmental categories containing multiple strategies available to integrate into design as both mandatory prerequisites and optional credits. Although there are many synergies between credits, this system is not designed to have projects achieve all credits available. For instance, including one strategy in the design may actually hinder pursuing another. This makes the Integrated Design Process critical in establishing project goals and discovering impacts of decisions across all disciplines involved.

The following list provides an overview of each of the eight environmental categories within the LEED v4 rating system applicable to the $40M 'Re-Envision' Concept.

- **Location and Transportation -** Well-located buildings that recognize existing patterns of development and land density are able to leverage existing infrastructure—public transit, street networks, pedestrian paths, bicycle networks, services and amenities, and existing utilities. A redevelopment of the existing John R. Brodie Science Centre achieves this and reduces the strain on the environment from the material and ecological costs that accompany the creation of new infrastructure and hardscape.

- **Sustainable Sites -** Low-impact development methods that minimize construction pollution, reduce heat island effects and light pollution, and mimic natural water flow patterns to manage rainwater runoff are recognized within this category. The deep retro-fit of the $40M 'Re-Envision' Concept contributes the low-impact development.

- **Water Efficiency -** This category addresses water holistically, looking at indoor use, outdoor use, specialized uses, and metering. The section is based on an "efficiency first" approach to water conservation. Within the $40M 'Re-Envision' Concept, all new plumbing fixtures are provided to increase water efficiency and achieve reduction in potable water use.

- **Energy and Atmosphere** - This category approaches energy from a holistic perspective, addressing energy use reduction and energy-efficient design strategies. Energy efficiency in the $40M 'Re-Envision' Concept is achieved through strategies such as passive heating and cooling, natural ventilation, and high-efficiency HVAC systems partnered with smart controls further reduce a building's energy use. The central atrium greatly reduces heating, ventilation and air-conditioning (HVAC) loads, translating to significant improvements in the building's energy efficiency.

- **Materials and Resources** - Next to reducing the source of building and construction waste, building and material reuse is the next most effective strategy because reusing existing materials avoids the environmental burden of the manufacturing process. The $40M 'Re-Envision' Concept re-uses the existing building concrete structure and materials such as the exterior brick veneer, which avoids the production and transportation of new materials. As it takes many years to offset the associated GHG through increased efficiency of the building, reusing the existing building's structure and envelope is an extremely sustainable approach.

- **Indoor Environmental Quality** - Green buildings with good indoor environmental quality protect the health and comfort of building occupants. High-quality indoor environments also enhance productivity, decrease absenteeism and improve the building's value. This category addresses the myriad of design strategies and environmental factors such as air quality, lighting quality, acoustic design, control over one's surroundings, that influence the way people learn, work, and live. Much of the online survey feedback related to dissatisfaction with the indoor environment. The deep retro-fit of the $40M 'Re-Envision' Concept addresses the indoor environmental quality through improved air quality with the atrium and new mechanical HVAC systems, improved lighting quality with increased access to natural daylight, and improved controls for occupant comfort.

- **Innovation and Design Process** - Sustainable design strategies and measures are constantly evolving and improving. The purpose of this LEED category is to recognize projects for innovative building features and sustainable building practices and strategies. Though early in the conceptual design phase, the $40M 'Re-Envision' Concept is well-positioned to implement strategies for green building education and post-construction occupant comfort surveys as well as exemplary performance in energy efficiency and water use reduction.

- **Regional Priority** - Water conservation, energy efficiency and the redevelopment of existing urban sites are considered regional priorities within the prairies in the LEED v4 rating system. This is achieved in the $40M 'Re-Envision' Concept not only through new and efficient HVAC and electrical systems and increased insulation levels, but also through providing ample access to natural daylight and views to the outdoors.

Part 6 - Facilitated Participatory Design Process

Section 1.0 - Science Faculty Planning Committee

Process & Intent

Following the completion of the existing building assessment, user data analysis, best practice research, functional space program and space allocation and utilization, conceptual design recommendations for the $20M and $40 budget concepts were produced and presented to the Faculty in early December 2018. The Science Faculty Planning Committee, which has a member from each Department and is chaired by the Dean of the Faculty of Science, was invited to participate in the process. Serving as an oversight committee for the project, the Committee was invited to give feedback related to the research and findings of the architects and their consultants, as well as comment on the conceptual design recommendations prior to the broader public Open House held on January 15, 2019.

Findings and Summary

The presentation was informal in nature and allowed for questions and discussion to occur throughout. A number of topics were discussed:

- understanding the scale of the atrium was critical for members of the Committee. It was felt that the scale should not be too vast and that the width of the atrium should be appropriate for the existing building, otherwise the atrium could be viewed as inefficient use of space. Once the Committee understood that the proposed atrium was approximately 17' wide and fit within an existing structural bay, there was a sense of comfort that it was not out of proportion for the building.
- it was perceived that the proposed approach resulted in a shortfall of available teaching space. However, it was identified that an increase in the utilization rate of these spaces combined with scheduling efficiencies would make more efficient use of existing space, without the need to add additional space.
- the quantity of space types (i.e. offices) was scrutinized to ensure that departmental need was being met in the conceptual design recommendations. It was discussed that all of the program elements that were communicated in the Departmental Chair Interviews were being maintained, but that some of the spaces were perhaps re-categorized under "Shared Spaces" rather than a particular department.
- it was communicated that the conceptual design recommendations were only representative of one potential iteration of design, and that ultimately the next steps in the process would be have further consultation with each department and user group to more fully develop the design.

There were a number of perspectives relative to the establishment of the $20M and $40M budget thresholds. Some on the committee expressed concern that the top end of the budget was perhaps arbitrary and insufficient. The shortcomings of limiting the budget to $40M at the top end were identified and there was discussion of the potential opportunities for a new construction addition to accommodate expanded programming if the budget were higher.

In follow-up to the meeting, the Chair of the Science Faculty Planning Committee communicated that there were many on the Committee that felt that the $40M 'Re-Envision' Concept presented a spectacular and transformative opportunity for the John R. Brodie Science Centre.

Section 2.0 - Public Open House

Process

Following the December 2018 session with the Science Faculty Planning Committee, the presentation was re-formatted to suit the broader audience of an Open House and enable feedback to be easily solicited, collected and analyzed. Over 60 feet of large format presentation materials were produced to facilitate large groups of people to engage in the process and were organized into the following categories:

- existing building status,
- user survey and opinions,
- best practice examples and relevant projects,
- an overview and comparison of the different conceptual design options, and
- the proposed concept, layout, phasing and programming of the $40M 'Re-Envision' Concept.

Each of the sections contained designated areas for participants to write comments on stickie notes. Additionally, four members of the consulting team circulated and were available to answer specific questions and engage in discussions with the participants.

The Open House session took place on Tuesday, January 15, 2019, and was structured to allow for mingling and review of the concepts from 12:15pm to 12:45pm; with a formal presentation by the architects from 12:45pm to 1:15pm; followed again by an opportunity to mingle and review the concepts and engage in conversation with the consulting team to answer questions that the participants had.

Intent

The intent of the public Open House was to solicit feedback from students, faculty and staff relative to the conceptual design recommendations prior to finalizing a report for submission to the Brandon University Board of Governors in March 2019.

Findings

Relative to the Existing Building Status and User Survey sections, there were comments relative to the need for washroom and breastfeeding areas on all floors and one that concurred with the user survey responses, stating that students deserve a better, more modern building.

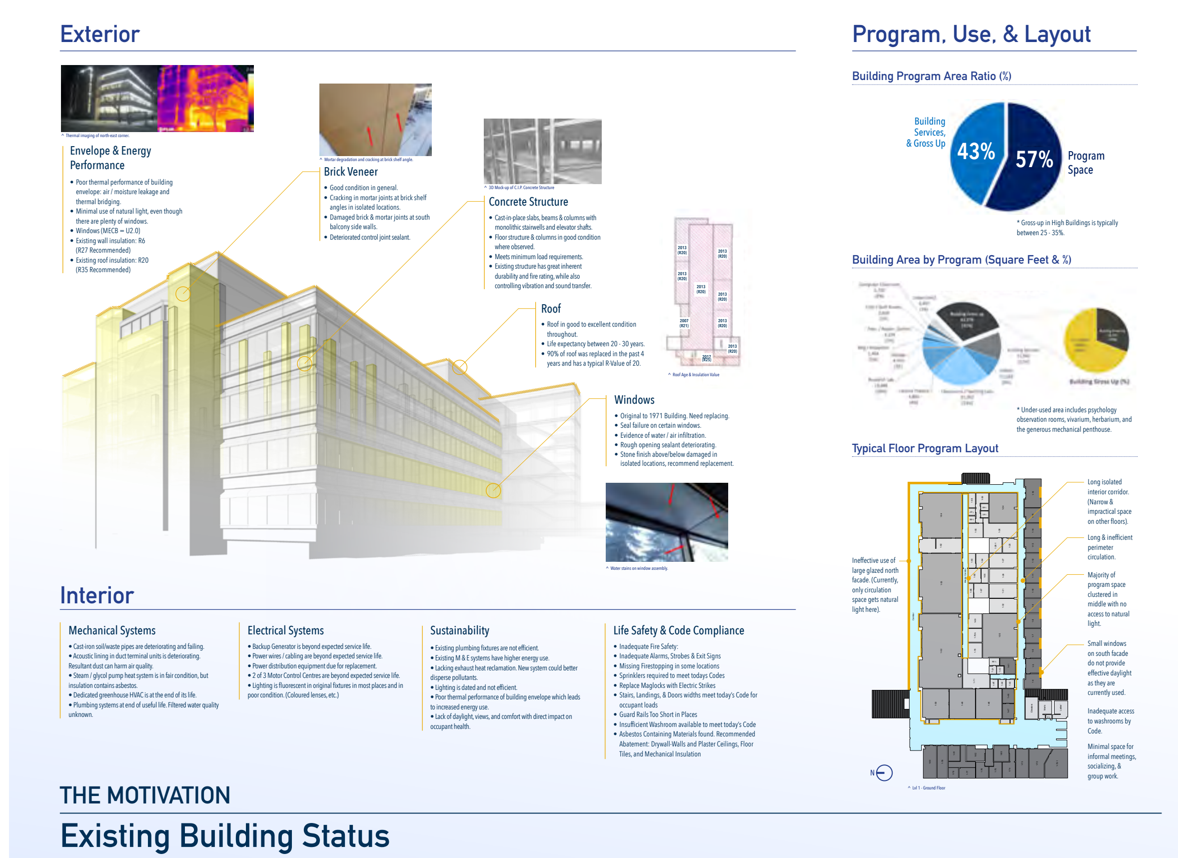
Relative to the sections that presented the proposed $40M 'Re-Envision' Concept (shown as Concept C on the facing page), many participants expressed that they loved the idea of the proposed atrium and the transformative effect it would have on the existing building. Additionally, there was one participant that expressed concern over the noise that would be generated during the renovation period.

There were suggestions to add glazing to the north stair in similar fashion to the east stair, for safety. Additionally, suggestions were made for abundant electrical charging outlets in all meeting and study areas. There were comments relative to providing privacy for the offices; concern about potential glare into classrooms and biology and chemistry lab spaces; updating technology in classrooms and lecture theatres and providing more explicit space for students.

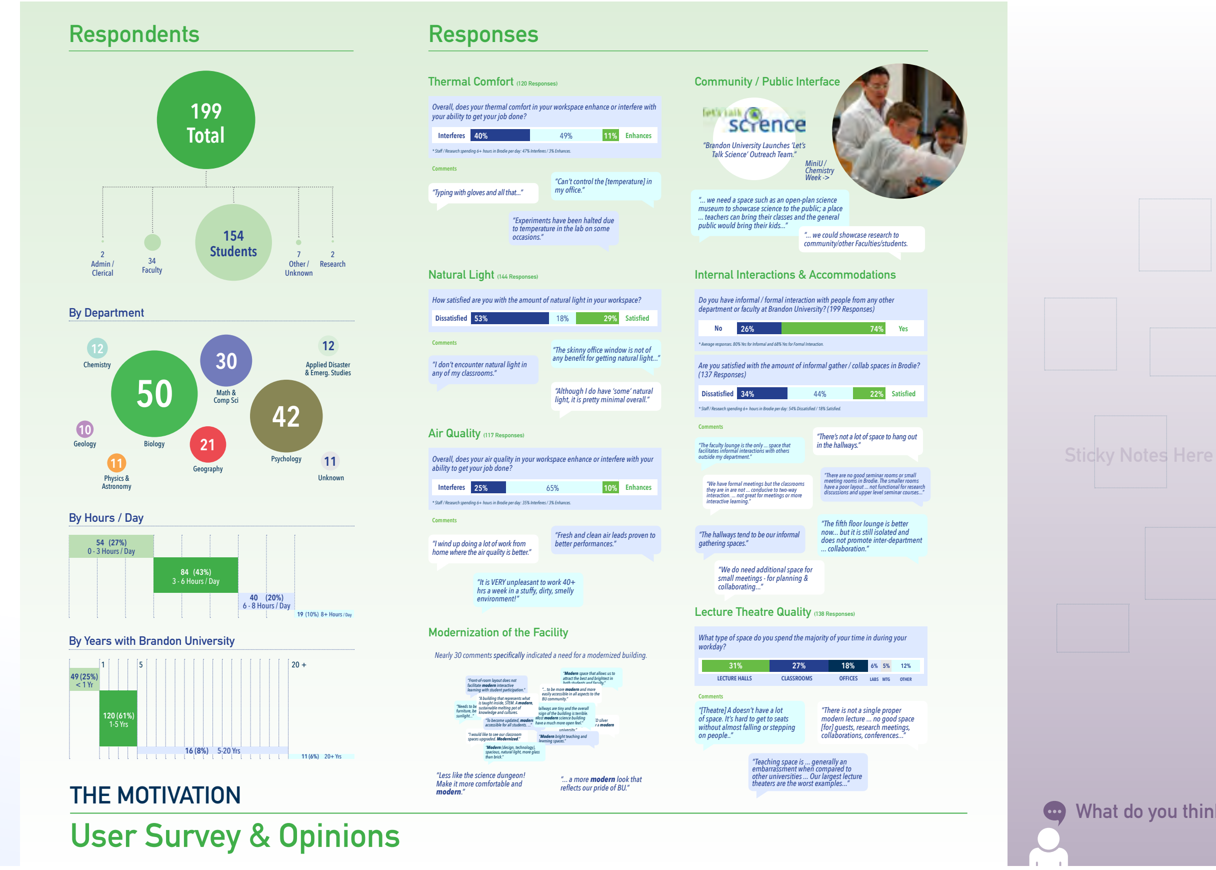
There were a number of comments and discussion regarding the amount of space allocated to the Department of Psychology. It was noted that future requirements for laboratory and research space were not accommodated and that the concept proposal should take into account the nature of the Department.

The most significant number of comments received through the Open House process were relative to the proposed programming and ability to accommodate future growth. There were questions asked relative to where potential new science and grad programs would go and a comment that the provision for office and lab space would need to be greater than what currently exists. One participant noted that the proposed department square footage allocations were based on present research laboratory need and questioned what the future need requirements would be.

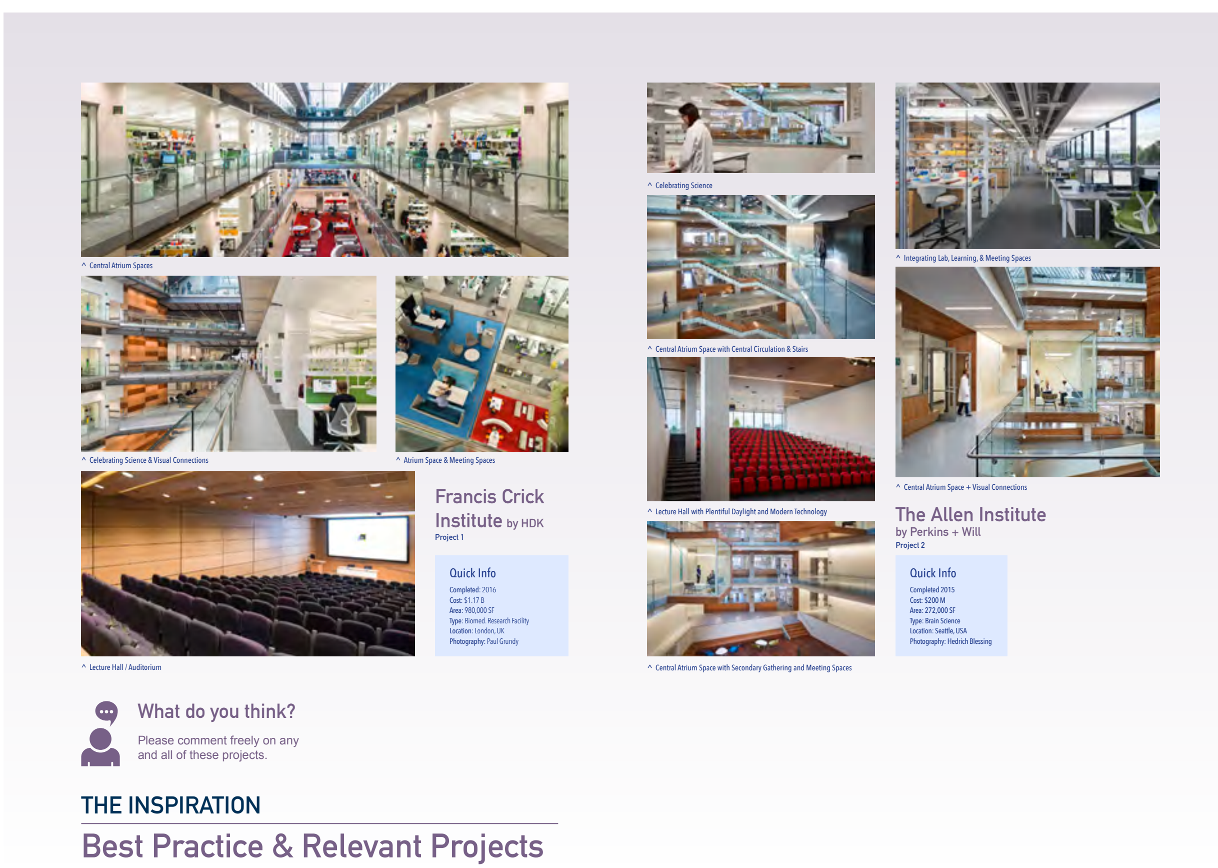
The discussions and feedback solicited through both phases of the Participatory Design Process, prompted the need to re-visit the potential growth and expansion opportunities for the proposed conceptual design recommendations.



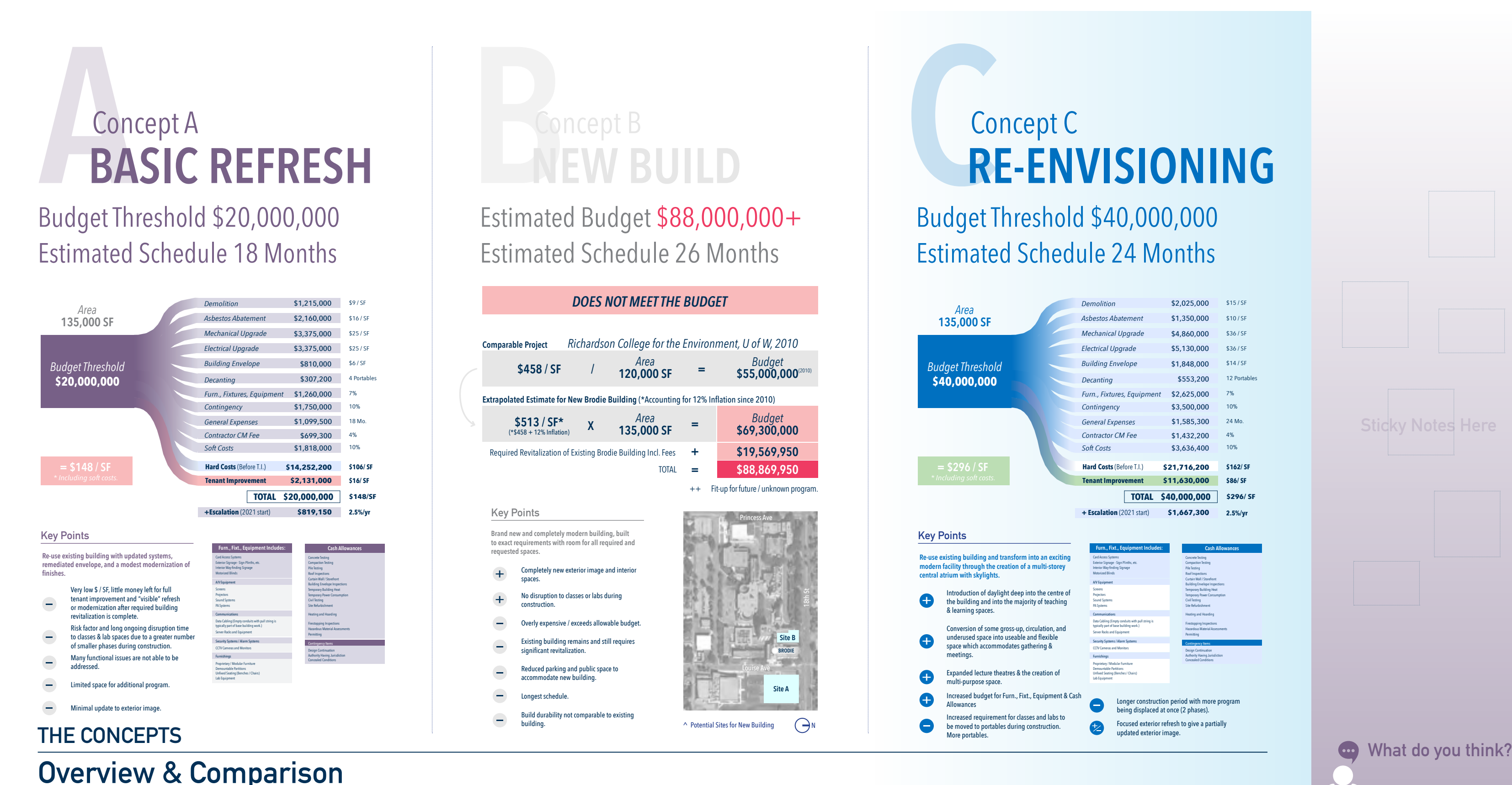
Open House presentation material showing an overview of the existing building investigation conducted



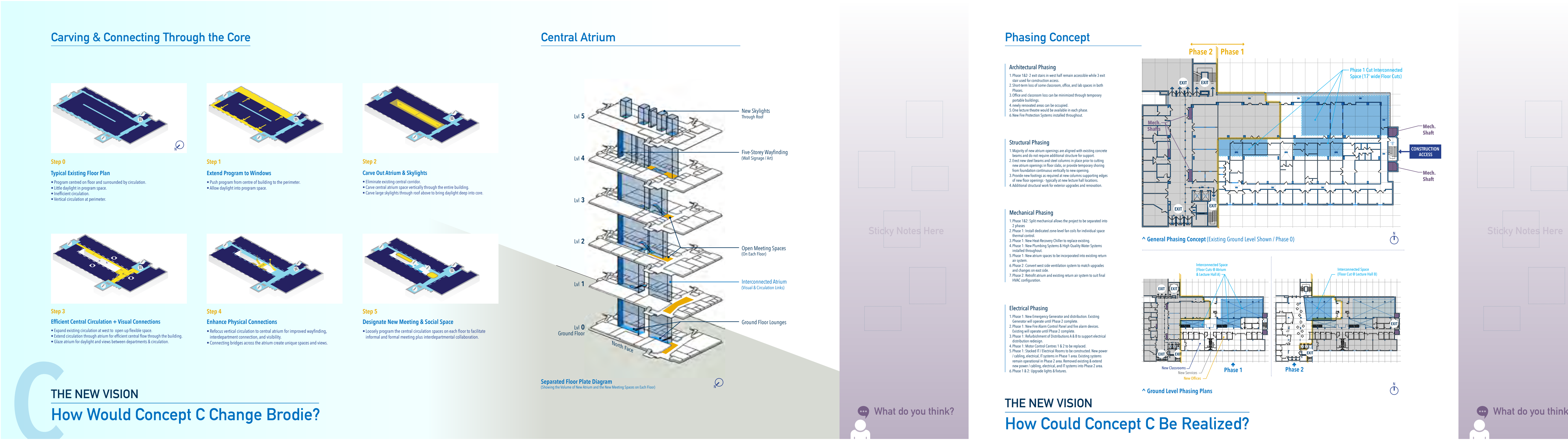
Open House presentation material showing a summary of the online survey that was conducted



A portion of the Open House presentation material showing some best practice examples of relevant projects



Open House presentation material showing a cost summary comparison between the $20M 'Refresh' Concept (Concept A) and the $40M 'Re-Envision' Concept (Concept C), with a new build scenario (Concept B) illustrated to show that it is not viable within the budget parameters.



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Open House presentation material showing the vision $40M 'Re-Envision' Alternative with a central atrium and highlighting the phasing concept for implementing the vision.

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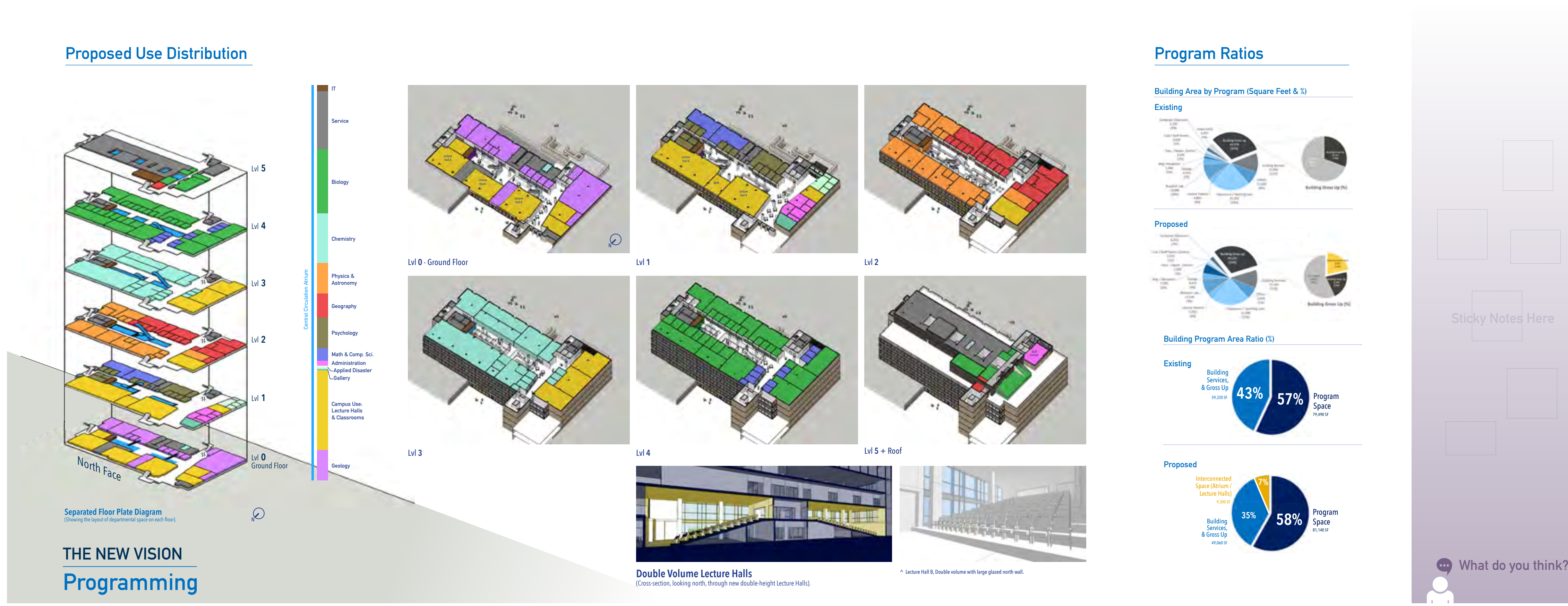
Open House presentation material showing the proposed use distribution and programming of the $40M 'Re-Envision' Alternative



Part 7 - Growth and Expansion

Section 1.0 - Future Growth and Expansion Opportunities

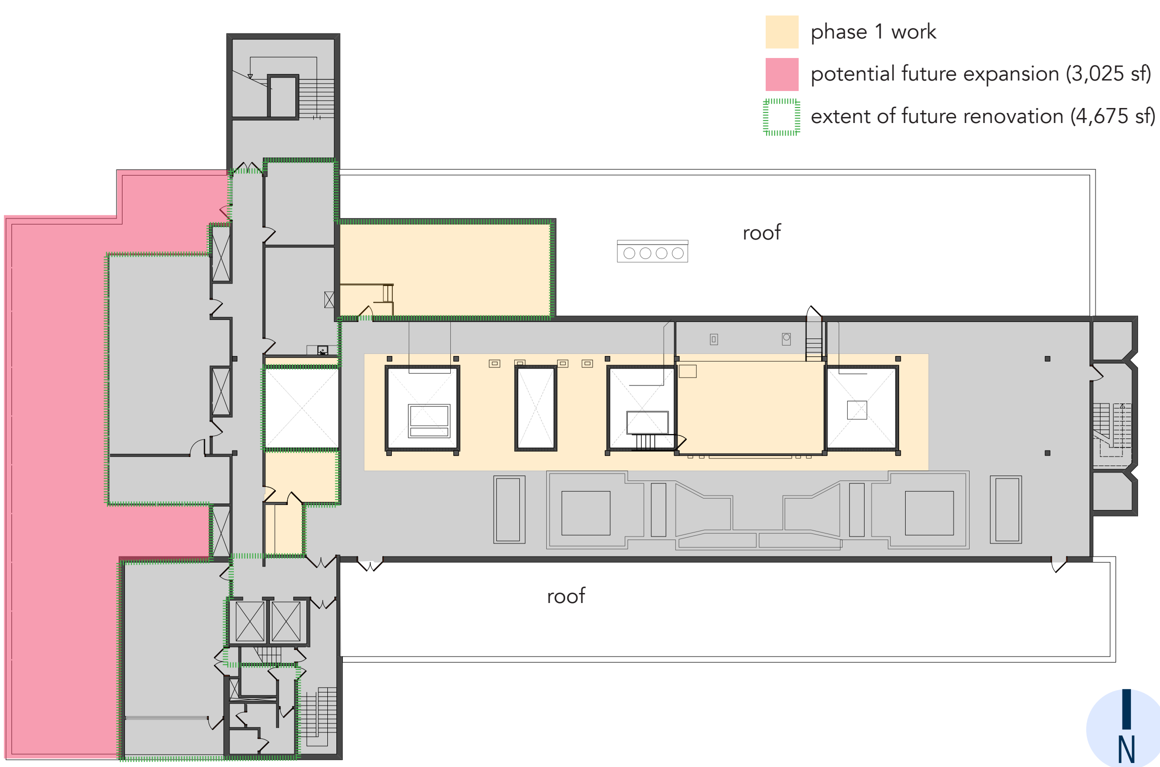
Although the findings from the Department Chair Interviews did not indicate the need for a significant amount of increased space over and above current provisions in the existing building, subsequent feedback indicated that future growth and expansion opportunities should be considered.

Increased Utilization

Currently, within the John R. Brodie Science Centre the utilization rate of classrooms and teachings spaces is not optimal. The $40M 'Re-Envision' Concept aims to increase utilization rates through the creation of more flexible and multi-use spaces that allow departments to have increased shared access. An additional recommendation for increasing classroom and teaching space utilization rates includes the future provision a centralized class booking system.

Expansion of Fifth Floor

There is the potential for modest growth to be accommodated within the existing John R. Brodie Science Centre's footprint through an expansion of the fifth floor. Currently, the fifth floor steps back from the building edge on the north, south and west sides. An increase of approximately 3,025sf of programmed area can be achieved by expanding the west side of the fifth floor, as shown in pink in the diagram below. The structural framing of the fifth floor is able to sustain this expansion, and the mechanical and electrical systems could be extended to suit. With this proposed expansion, it is anticipated that the balance of the fifth floor (as shown in green outline in the diagram below) would be renovated to suit its new intended use, for a total of 7,700sf combined addition and renovation scope.



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Fifth floor plan showing extent of potential future expansion

SCOPE	DESCRIPTION
Demolition	Demolition of existing interior spaces to facilitate revised layout (incl. interior partitions ceilings, finishes, etc.) Demolition of Exisitng Roofing membrane at 5th Floor Level. Demolition of sections of existing exterior North, South and West walls as required to accomodate new layout of interior space.
Concrete Work	Provide new topping at old roof area to accommodate new flooring and to provide transition tolerance for elevation discrepancies between existing interior and exterior spaces.
Masonry	Repurposing of existing masonry parapet to accept new curtainwall
Structural Steel	New Structural framework, joist package, reinforcing members to support floor compositiona at old roof location
Misc Metal	Roof deck, suplemental framing aw required for new curtainwall at perimter, new roof openings, etc.
Millwork	New Millowrk package including flexible partition and storage components, etc.
Roofing	Roofing assembly at new structure, including tie-ins at exisitng roof transitions
Aluminum and Glazing	New storefront glaing package at perimeter of new space
Doors and Hardware	Assumed nquantity of 20 new doors/frames/hdwe to facilitate layout and program of new space.
Interior Glazing	One thousand square feet of new interior galzing to allow for passive daylight exposure throughout the newly contemplate dspace.
Drywall	New framing/boarding /taping throughout to facilitate new layout of contempalted space. Includes drop ceilings and bulkheads at perimter to account for motorized daylight shading
Flooring	New Flooring throughout entirety of new space
Painting	New Painting throughout entirety of new space
Acoustic Treatments	Allowance for acoustically considerte construction specifically at newly created floor space to provide adequate sonic attentuation for the space below
WR Accessories	Allowance for accessories for a new Public Wasjroom and New UTR as required by compliance recommendations. Accessories include grab bars, TP dispensers, Paper Towel dispensers, etc.
Fire Protection	New branch lines and heads to accomodate new partition and ceiling layouts
Mechanical	Tie-in to existing system while providing new distribution for newly contemplated space.
Electrical	Tie-in to existing system while providing new distribution for newly contemplated space.
Temp Classrooms and Facilities	Two portables considerd for this protion of scope. The anitcpated site preparation and temporary strucutures and services allowance is reflected in this value

Scope and Cost of Fifth Floor Expansion

The proposed scope of work for a future fifth floor renovation is shown in the adjacent table. There would be demolition work required to accommodate a new layout; concrete and masonry work; new roofing, structural steel and miscellaneous metals; all new millwork, glazing, doors, walls, finishes and washrooms. The proposal ties into the existing mechanical and electrical systems, with new distribution to suit the new layouts. New fire protection branch lines and sprinkler heads would also be provided to suit the new wall and ceiling layout. Additionally, since this phase of work is assumed to be subsequent to the $40M 'Re-Envision' Concept phasing, an allowance for two portables as temporary space accommodation has been made.

Based on the scope described in the adjacent table, the estimated Class D cost is $2,509,678 plus GST. It is anticipated that this phase of work would have an eight month construction duration. This Class D estimate assumes current construction market values and does not include escalation. Refer to Appendix H for a breakdown of the Class D cost estimate.

>

Ground floor plan showing extent of potential new construction expansion with link to existing John R. Brodie Science Centre

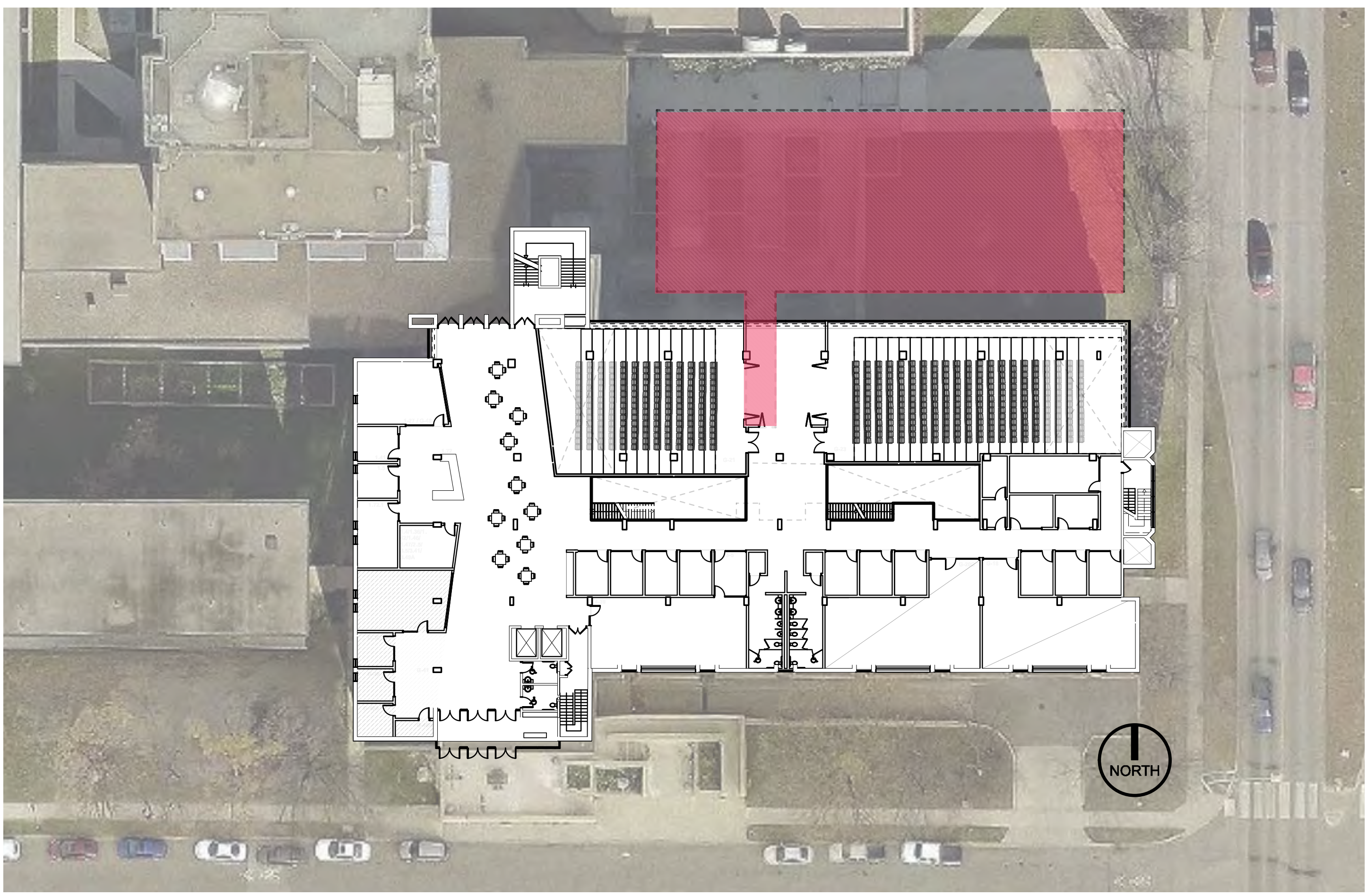
New Construction Addition

Two expansion development approaches were identified to address the future growth as the need arises within the Faculty of Science. The first approach identified the ability to expand 3,025sf on the existing fifth floor and the second, more comprehensive expansion approach creates the ability to add a standalone addition to the north of the John R. Brodie Science Centre. Currently, to the north of the building, there is an exterior tiered plaza with concrete planters. Access to the ground level entry of McMaster Hall is along the north edge of this plaza and needs to be maintained.

A new construction addition would accommodate increased space and programming over and above current provisions in the existing building. The addition could be considered either as a future phase 3, or if there was an increase to the existing $40M budget, a concurrent construction process during phase 1 and 2 of the 'Re-Envision' Concept scope of work.

It will be imperative to scan for underground services to ensure that, if services do exist in the plaza, either the addition is placed appropriately to avoid the services, or proper budgets are carried to address further potential unknowns.

The design of the ground and first floors of the 'Re-Envision' Concept facilitates a corridor link located between the Lecture Theatres, interconnecting the new addition and 'Re-Envision' Concept over two floor levels. For illustrative purposes, a four-storey building with 7,100sf per floor has been contemplated with office, teaching/classroom space and research laboratory function. The plan below shows the approximate new construction and link locations highlighted in pink.



potential future expansion with 7,100sf floor plate

SCOPE	DESCRIPTION
Demolition	Demolition of Existing Concrete Courtyard, selective demolition at existing north façade for link access
Concrete	Foundations for new facility (pile caps, grade beams, dampfroofing, etc.), Structural Slab for Ground Floor (Bsmt Level), concrete topping at Main, 2nd and 3rd Floors
Hollowcore	Supply and Installation of 10" Hollowcore at Main, 2nd and 3rd Floors
Masonry	Elevator Hoistway and two Stairwells, plus 2,000 SF of masonry veneer to provide an aesthetic contiguity with the Brodie Centre
Structural Steel Framing	Structural Steel framing package including Columns, Perimeter W-flange Beams, Delta Beams at interior areas, and joist package
Miscellaneous Metals	Stairs, landings and handrails at two Stairwells, Roof Deck and RTU reinforcing, bollards, roof access ladder, elevator pit ladder, etc.
Millwork	Millwork package that allows for fit-out of storage and moveable work stations for classrooms and labs, as well as office storage and shelving
Roofing	2-Ply Mod-Bit Roof
Skylights	Allowance for five 10'x10' skylights
Curtainwall	Curtainwall façade at all 4 elevations, including both elevations of the two story Link access
Doors Frames and Hardware	Allowance for 20 doorways on each floor
Interior Glazing	Allowance for 500 SF of interior glazing on each level
Drywall	Exterior Wall and insulation package plus Interior Framing and drywall/ceiling package to facilitate the layout on all 4 levels
Flooring	Flooring package that includes sheet goods in specialized areas (labs), cpt tile in classrooms and offices and vinyl tile in corridors at thoroughfares
Paint	Complete painting package throughout
Acoustic Treatments	Allowance for acoustic considerations at specialty areas and classrooms

Scope and Cost of New Construction Addition with Link

The proposed scope of work for a new construction addition with a link to the existing John R. Brodie Science Centre is shown in the adjacent table. There would be site demolition as well as some minor demolition work required to accommodate the link on the ground and first floors; new foundations and concrete work; masonry work with a new elevator hoistway, stairwells and exterior veneer; new roofing and tie-ins, structural steel and miscellaneous metals; all new millwork, interior glazing, doors, walls, finishes and washrooms. The scope includes a new curtain wall facade as well as an allowance for furniture, fixtures and equipment. The mechanical, electrical and fire protection systems would tie into the new systems in the John R. Brodie Science Centre. It is anticipated that there could be some stand-alone components but primarily the systems for the addition would be a subsidiary of the existing main system.

Based on the scope described in the adjacent table, the estimated Class D cost is $15,095,782 plus GST. It is anticipated that this phase of work would have an 16 month construction duration. This Class D estimate assumes current construction market values and does not include escalation. Refer to Appendix H for a breakdown of the Class D cost estimate.

Section 2.0 - Next Steps

The report herein, containing Preliminary Assessment and Conceptual Design Recommendations for the John R. Brodie Science Centre, details two fundamental approaches for the Faculty of Science and Brandon University: a $20M 'Refresh' and a $40M 'Re-Envision' of the existing building.

This report is intended for presentation to the Brandon University Board of Governors in March of 2019.

APPENDIX A

Existing Building Drawings

**Original drawings can be made available upon request

APPENDIX B

2006 Asbestos Building Materials Survey, by Pinchin Environmental

**Survey can be made available upon request

2016 Annual Asbestos-Containing Materials Inspection Report, by Tesseract Environmental Consulting Inc.

**Report can be made available upon request

APPENDIX C

Roof Condition Report

**Report can be made available upon request

APPENDIX D

Furniture & Equipment Inventory

Brandon University John R. Brodie Science Centre
Equipment Inventory

Nov. 19, 2018

Location		Existing Equipment / Item	Number	Estimated Date of Replacement	Estimated Cost to Replace	What equipment / item can be stored?	If stored, would assitance be required from manufacturer for storage?	If stored, are special conditions required for storage? (e.g., humidity)	If stored, could your program function? If so, for how long?	Does the room contain equipment / items that could be disposed of? If so, indicate whether defunct or functional (i.e., not used).
Applied Disaster and Emergency Studies										
G-38	Office									
G-39	Office									
G-40A	Office									
G-40	Meeting									
G-41	Reception									
	Storage									
	Sub Total									
Chemistry										
G-34	Chemistry Research									
2-11	Shared (Kathleen Nichol)									
4-11	Office									
4-12	Office									
4-13	Office									
4-14	Office									
4-15	Office									
4-16/4-17	Office									
4-18	Inorganic Chemistry Research									
4-19	Synthetic Organic Chem. Research - Hill Lab; only inventoried Charette equipment	Cell Harvester - Mark Berry's CFI	1	none	15,000 each	Yes	No	dry, room temp	Yes	Yes
4-20-1	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	Incubators, including 1 from Bill Paton's CFI ($20,000 value)	4	15 years	10000 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	Autoclave - Mark Berry's CFI	1	10 years	10,000 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	Power packs, including 1 from Cassone/LeMoine/Charette CFI	2	10 years	1,000 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	shaker	1	15 years	800 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	Western blot transfer apparatus - from Cassone/LeMoine/Charette CFI	1	10 years	4,000 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	Hybridization Oven - belongs to Faiz Ahmad	1	20 years	5,000 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	Spectrophotometer with computer - Mark Berry's CFI	1	10 years	40,000 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	Scale	1	10 years	2,000 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	Stir-plate - from Casseon/LeMoine/Charette CFI	1	20 years	800 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	UV crosslinking oven - from Cassone/LeMoine/Charette CFI	1	15 years	4,000 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	Water Bath - Mark Berry's CFI	1	5 years	2,000 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	Heating blocks	2	15 years	1,000 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	Microcentrifuges - from Cassone/LeMoine/Charette Cfi	2	15 years	2,000 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	Bench-top centrifuge - From Mark Berry's CFI	2	10 years	15,000 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	Computers	2	3 years	1,000 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	Vortexer - From Mark Berry's CFI	1	10 years	800 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	Blot scanner - belongs to Biochem teaching lab	1	10 years	5000 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	Dishwasher - from Mark Berry's CFI - needs distilled water	1	5 years	20,000 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	PCR Machine - from MB Agriculture donation	1	10 years	8,000 each	No	No	dry, room temp	No	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	Ultracentrifuge tube sealer	1	20 years	1,000 each	Yes	No	dry, room temp	Yes, for 6 months	No for these items
	Ribosome Assembly & Ribosomopathies CFI Lab - Charette lab	MilliQ Water purifyer - From Mark Berry's CFI - needs distilled water	1	5 years	5,000 each	No	No	dry, room temp	No	No for these items
4-20	Prep-Charette lab	Fridge - Mark Berry's CFI	1	in 10 years	5,000 each	No	No	dry, room temp	No	No for these items
	Prep-Charette lab	Freezer - Mark Berry's CFI	1	in 10 years	5,000 each	No	No	dry, room temp	No	No for these items
	Prep-Charette lab	Vortexers	1	in 15 years	800 each	No	No	dry, room temp	No	No for these items
	Prep-Charette lab	Rocker	1	in 15 years	800 each	No	No	dry, room temp	No	No for these items
4-20-2	Prep-Charette lab	Tissue Culture hood - From Mark Berry's CFI - needs isolated room	1	in 15 years	20,000 each	No	No	dry, room temp	No	No for these items
	Prep-Charette lab	Tissue Culture Incubator - From Mark Berry's CFI - needs isolated room, needs CO2 tank	1	in 15 years	5,000 each	No	No	dry, room temp	No	No for these items
4-21	Analytical Chem; Cell Signaling & Peoteomic Research									
4-22	Classroom									
4-23	Molecule-based Material Research CFI Lab									
4-24	General Chemistry Lab									
4-25	Dr. Peter Letkeman Lab for Analytical & Inoraganic Chem									
4-26	Room									
4-27	Room									
4-28	Dr. H.V. Kidd Chemistry Lab (Organic/Biochemistry) - only inventoried Biochem equipment	Large bench-top centrifuges	2	in 15 years	10,000 each	1 of the 2	No	dry, room temp	Yes, OK with 1 of 2	No for these items
	Dr. H.V. Kidd Chemistry Lab (Organic/Biochemistry) - only inventoried Biochem equipment	Microcentrifuges	4	in 15 years	2,000 each	none	No	dry, room temp	No	No for these items
	Dr. H.V. Kidd Chemistry Lab (Organic/Biochemistry) - only inventoried Biochem equipment	Vortexers	2	in 15 years	800 each	none	No	dry, room temp	No	No for these items
	Dr. H.V. Kidd Chemistry Lab (Organic/Biochemistry) - only inventoried Biochem equipment	Blenders	2	in 15 years	50 each	yes	No	dry, room temp	Yes, need in Jan/Feb	No for these items
	Dr. H.V. Kidd Chemistry Lab (Organic/Biochemistry) - only inventoried Biochem equipment	Micropipetters	20	in 10 yeast	300 each	none	No	dry, room temp	No	No for these items
4-29	Chemistry Club Room									
4-30	Room									
4-31	Dr.Bruce & Mrs.Jane Forrest Lab. For Physical Chemistry									
4-32	Physical Chemistry Research Lab									
4-33	Chemistry " machine shop" - only inventoried Charette equipment	Scintillation counter-radioactive, requires licence- from Mark Berry's CFI	1	none	40,000 each	yes	No	dry, room temp	Yes	Yes
4-34	Classroom (Chemistry)									
4-35	Dr.V.L. Lobodowsky Spectroscopy Lab - only inventoried Charette equipment	-80C Ultralow temperature freezer - Cassone/LeMoine/Charette CFI - requires 220 V, emergency power backup, and CO2 tank	1	in 15 years	20,000 each	no	No	dry, room temp	No	No for these items
	Dr.V.L. Lobodowsky Spectroscopy Lab - only inventoried Charette equipment	Ultra high speed floor model centrifuge - Cassone/LeMoine/Charette CFI - requires 220 V	1	in 20 years	30,000 each	yes	Yes	dry, room temp	Yes, for 6 months	No for these items
	Dr.V.L. Lobodowsky Spectroscopy Lab - only inventoried Charette equipment	Centrifuge rotors - Cassone/LeMoine/Charette CFI	2	in 2	15,000 each	yes	no	dry, room temp	Yes, for 6 months	No for these items
	Dr.V.L. Lobodowsky Spectroscopy Lab - only inventoried Charette equipment	Histology Tissue processor-Mark Berry's CFI	1	none	40000 each	yes	No	dry, room temp	Yes	Yes
4-36	Room									
4-37	Storage									
4-38	Storage									
4-39A	Shared									
	Sub Total									
Geography										
3-42	Geography Lecture Room B									
3-43	Health Geography Research Lab									
3-44	Center For Geomatics	geomatics workstations (21); digitizing table (1); flatbed scanner (1); SmartBoard		2019	25,000	digitizing table only	no	no		no
3-45	Storage				most can be stored	no	no	yes, indef	yes, some no longer used	
3-46	Plotters / Printers		2020	$15,000	none					

3-47	John Welsted Physical Geography Lab, Air Photo & Remote Sensing Lib.			mirror stereoscopes cost at least $1000 EACH					slide projector (in room; not used)	
4-4	Office	Handheld GPS equipment; Projector (for laptops); light table (integrated into desk)								
4-5	Office									
4-6	Office	computer, phone, 3 desks, 2 filing cabenets and books				none				
4-7	Office									
4-8	Office									
4-9	Office									
4-10	Office									
4-39A	Shared									
4-40	Geography Wet Laboratory									
4-41	Room									
4-42	Geography Equipment Maintenance & Preparation	primarily field equipment and supplies required for teaching and research (e.g UAVs, batteries, chargers, tools, total station, gps equipment, etc.)			$50,000	none				
4-43	Geography Research	Field equipment and suppies (4 automatic water samplers, shovels, cores, bags etc). Lab equipment and supplies (vacuum filtration setup, scale, filters glassware, wash bottles etc). Chest freezer. Dried soil and peat samples.			35,000	none				
4-44	Human Geography Research									
4-46	Physical Geography Research									
4-47	Geography Lecture Room									
4-48	Geography & Environmental Science Sudend Club (BUGS)									
5-8	Atmospheric Science, Geomorphology & Hydrology Laboratory	Sediment trap on sink (need access always, but use is intense but sporadic); drying oven (need access always, use is intense but sporadic); three rubbermaid (50 L) bins of teaching supplies need access for Fall terms; research equipment could be stored at my research site, if need be (not ideal)			10000	most of the glassware, stuff in draws etc. I would remove the stuff I would need on a term by term basis and condense it down to a few larger rubbermaid bins	no	no for most; >0 for some liquids	as long as I have my bins, I can go a year or so	
	Sub Total									
Geology										
G-15	Geology	Storage cabinets, shelving	assorted	2040	20,000	N				
		Seismology geophysical equipment	1	2040	40,000	Y			Y-2 years	
		JenaPol research petrographic microscope	1	2030	60,000	Y				
G-7	Rock Preparation Lab	Rock Crusher	1	2035	15,000	N				
		Rock Pulverizer	1	2035	12,000	N				
		14" Rock saw	1	2030	5,000	N				
		10" Rock saw	1	2030	3,500	Y				
		Seive shaker	1	2030	10,000	N				
		Mini jaw crusher	1	2035	12,000	N				
		10" slab saw	1	2025	8,000	N				
		Seive shaker	1	2030	10,000	Y				
		Wards diamond cut-off saw	1	2025	11,000	N				
		Wards diamond grinder	1	2025	8,000	N				
		12" lapping wheel	1	2025	10,000	N				
		Buehler 8" lapping wheels	2	2025	20,000	N				
2-4	Alexandre's Office	office printer	1	2025	500	N				
		microscope	2	2030	25,000	N				
		Magnetometers (geophysics)	3	2030	3,000	N				
		computer and two monitors	1	2025	3,000	N				
2-5	Shared (Copier/Suplies)									
2-6	Office	Computers, monitors, scanner, printer	1	2025	3,500	N				
2-7	Office	Computers, monitors, scanner, printer	1	2025	3,500	N				
2-8	Office	Computers, monitors, scanner, printer	1	2025	3,500	N				
2-9	Office	Computers, monitors, scanner, printer	1	2025	3,500	N				
		Reflected and transmitted microscope	1	2030	20,000	N				
2-10	Office	Computers, monitors, scanner, printer	1	2025	3,500	N				
2-13	Office									
2-23	Classroom: Physics classroom rarely used by Geology									
2-24	Research Lab	1 freezing/heating stage with Nikon microscope	1	2030	35,000	Y			1-Year	
		Research stereoscope	1	2030	5,000	N				
		Teaching stereoscope	1	2030	2,500	N				
2-25	Research Lab	Computer, monitor, printer	1	2022	2,500	N				
2-26	Research Lab									
2-27	Storage	Slide projectors	2	2026	1,400	Y			Y-1 year	
		Petrographic Microscopes transmitted/old leitz	18	N/A	N/A	Y			indefinitely	functional, but out of date
2-28	Research Lab	Stereomicroscope with imaging capacity	1	2025	21,000	N				
		regular steromicrocope	1	2025	4,000	N				
		Grinding machine for serial sectioning	1	2028	5,000	N				
		Ultrasound bath for sample cleaning	1	2025	900	N				
		Computer & monitor & Scanner	1	2020	3,000	N				
		photographying equipments (copystand etc)	1	2035	1,500	N				
		Seives for Sed & Strat lab	2 sets	2025	4,000	N				
2-29	Research/teaching Lab, Storage	Rotopols (lapper and polisher)	2	2025	46,000	N				
		Discoplan-TS (cutter and grinder)	1	2025	39,000	N				
		Citovac (impregnation chamber)	1	2025	7,500	N				
		Vacuum pump	1	2025	500	N				
		Fume hood	1	2025	5,000	N				
		Thermoline electric furnace	2	2025	20,000	Y			1-year	
		500 gram scale	1	2026	2,000	N				
		Hot plate, large, and stirret	2	2030	2,000	N				
		Jena Polarizing Microscope	1	2,025	7,000	N				
2-30	Classroom-Intro Geology, Historical									
2-31	Classroom-Structural, Petrology, Metamorphic									
2-42	Laboratory for Applied Research in Resource Geology	petrographic research microscopes and imaging	3	2030	140,000	N			N	
		computers	7	2022	14,000	N			N	
		Stereomicroscope and imaging	1	2030	35,000	N			N	
		Large portable Monitor, microscope, camera	1	2025	35,000	N				
		Small microfiche reader	1	2025	2,000	Y			Y	
		B&W Laser Printer	1	2020	700	Y				
		Colour inkjet printer	1	2020	500	Y				
		HP office jet pro-colour	1	2024	2,000	N				
		Large format 24" HP printer	1	2025	6,000	N				
2-43	Office	Computers, monitors, scanner, printer	1	2025	3,500	N				
2-44	Classroom-Mineralogy, Economic Geology, Tectonics, Geochemistry	Petrographic Microscopes reflected/transmited	19	2030	285,000	N			N	
		Overhead projector	1	2024	700	N			N	
2-45	Storage									
2-46	Brandon University Micro Analytical Facility	Scanning electron microscope IT500LV (present equivalent), back-scatter, secondary and cathodoluminescence detectors, cooling turbo pump	1	2025	335,000	N	yes	yes (low humidity)	no	
		EDS detector with software	1	2025	100,000	N	yes	yes (low humidity)	no	
		WDS detector with software	1	2025	130,000	N	yes	yes (low humidity)	no	
		Benchtop XRD	1	2030	50,000	N	no	yes (low humidity)	no	
		Denton Vacuum Sputter coater	1	2025	30,000	N	no	yes (low humidity)	no	
		Cathodoluminescence microscope	1	2030	30,000	Y	no	yes (low humidity)	yes	
		Microfiche and Microfiche reader	1	2030	50,000	N	no	yes (low humidity)	yes	
		Computers	4	2020	6,000	Y	no	yes (low humidity)	no	
		SEMPREP 2 sputter coater	1	2018	N/A	Y	no	no	yes	defunct
2-48	Classroom-Petroleum, Palentology, Sed-Strat	Nikon Petrograhic Microscopes, transmitted	24	2030	192,000	N				
2-48	Classroom-Petroleum, Palentology, Sed-Strat	Zoom Stereoscopes (Olympus, Nikon, Leitz-Leica)	27	2030	54,000	N				
2-48	Classroom-Petroleum, Palentology, Sed-Strat	Vickers petrographhic microscopes transmitted	6	N/A	N/A	Y				functional, dispose
2-49	Storage	lap tops	2	2022	3,000	N				
		digital projector	1	2026	700	N				
2-50	Student Lounge									

*Temporary bldg	Geology Core and geotechnical laboratories	10,000 lb load frame	1	2030	10,000	N			N	
		50 ton shop press	1	2040	2,000	N			N	
		Load Cell	1	2040	2,500	N			N	
		Atterbergs liquid limit machine	1	2040	600	Y			Y	
		Drop cone penetrometer	1	2035	2,500	N			N	
		Dynamic cone penetrometer	1	2030	3,500	N			N	
		Assorted CBR and other moulds	~12	2030	10,000	N			N	
		Gas compactor and accessories	1	2030	700	N			N	
		Electric cement/soil mixer	1	2030	600	N			N	
		Fine soils mixer KA	1	2030	1,000	N				
		High speed materials mixer	1	2030	500	N				
		Drying ovens	2	2025	5,000	N			N	
		Roll mill	1	2022	1,000	Y			Y	
		Seive shaker and seive set	1	2025	7,500	N			N	
		Electronic Scale 35 Kg	1	2030	18,000	N			N	
		Electronic Scale 2.1 Kg + 2 Kg calibration weight	1	2030	6,000	N			N	
		Stereomicroscope	1	2030	2,000	N			Y	
	Sub Total									
Mathematics and Computer Science										
1-4	Shared (Copier/Supplies)									
1-6	Office									
1-49		Computers	5		40,000					
1-52	Classroom									
1-73	Room									
1-74	Office									
1-75	Office									
1-76	Office									
1-77	Office									
1-78	Office									
1-79	Office									
1-80	Office/Storage									
1-81	Office									
2-11	Shared									
	Sub Total									
Physics and Astronomy										
2-4	Office									
2-5	Shared (Copier/Supplies)									
2-6	Office									
2-7	Office									
2-8	Office									
2-9	Office									
2-10	Office									
2-11	Shared									
2-12	Office									
2-14	Office									
2-15	Office									
2-17	Office									
2-18	Room									
2-19	NMR Lab	Liquid Nitrogen Dewer - purchased using Mark Berry's CFI Grant	1	2033	5,000	No	No	No	No	No
2-21	Research Office									
2-22	Research Office									
2-32	Classroom (Gas Supply)									
2-33	Computer Classroom									
2-34	Classroom									
2-35	Classroom									
2-36	Student Cubicles									
2-37	Student Lounge									
2-39	Radio Isotype storage									
	Storage									
	Sub Total									
Biology										
G-8	Biology									
G-9	Biology									
G-10	Biology									
G-10-2	Biology									
G-10-3	Biology									
G-10-4	Biology									
G-10-5	Biology									
G-10-6	Biology									
G-10-7	Biology	ventilated cage cabinet	1	2025	15,000	yes	no	no	yes - 6 months	no
G-10-8	Biology									
G-10-9	Biology									
G-10-10	Biology									
G-10-11	Biology									
G-10-12	Biology									
G-10-13	Biology									
G-10-14	Biology									
G-12	Biology									
G-13-1	Biology Office									
G-14	Biology	Astoria	2	2025	$50,000	Yes	No	Room Temp	12 months	No
		Muffle Furnace	Fisher	2025	$15,000	Yes	No	Room Temp	12 Months	No
		Varian	ICP	2025	$150,000	Yes	Yes	Not Sure	12 Months	No
		Fan Oven	Fisher	2025	$10,000	Yes	No	Room Temp	12 Months	No
		Shimadzu	VOC-TN	2025	$50,000	Yes	No	Room Temp	12 months	No
		Leco	Truspec TN	2025	$100,000	Yes	No	Room Temp	Indefinitely	Yes not used - maintence too expensive
		Olympus microscope suite (BX51 microscope & computer image station with fluorescence + MVX10 & computer image station with fluorescence)	1 of each	?	$300,000	no	yes	low humidity, no dust, above 0 degrees C	essential for research work	
G-14-1	Biology									
G-25	Biology Storage									
G-26	Chemistry Storage									
3-4	Office									
3-5	Office									
3-6	Office									
3-7	Office									
3-8/3-9/3-10	Office									
3-11	Office									
3-12/3-13	Office									
3-14	Office									
3-15	Office									
3-16	Office									
3-17	Office									
3-18	Classroom									
3-19	Research Lab	shaking incubator; 2D gel system; plate centrifuge; 3 chairs; 3 laptops;	1	2025	50,000	all	no	no	yes - 6 months	no
		consumables; 2 PCR machines; 1 microscope								
3-20	Research Lab Level 2	Nikon SMZ1500 and Eclipse microscope and software	2	2025	100,000	both	yes	yes	yes - 6 months	no
		Ultralow temperature freezer	1	2025	50,000	no	no	no	need this storage	no
		freezer	1	2025	20,000	no	no	no	need this storage	no
		class II biological safety cabinet	1	2020	15,000	yes	no	dust free	would require certification before use	no
		consumables storage	many	n/a	5,000	yes	no	no	yes - 6 months	no
		fume hood	1	2040	25,000	no	no	no	need access to a fume hood	no
3-21/3-22	Research Lab Level 2	Bioplex suspension array system with automated wash station	1	2025	200,000	possibly	yes	contains lasers	yes - 6 months; manufacturer install	no
		RotorGene 6000 qPCR system	1	2025	70,000	possibly	yes	contains lasers	yes - 6 months	no
		Molecular Devices plate reader system	1	2030	30,000	yes	no	no	yes - 6 months	no
		cold centrifuges	2	2025	30,000	yes	no	no	yes - 6 months	no
		mini-shaking incubator plus other small equipment	10	2025	30,000	yes	no	no	yes - 6 months	no
		Helios Gene gun system	1	2030	30,000	yes	no	no	yes - 6 months	no
		37C incubators	2	2025	30,000	yes	no	no	yes - 6 months	no
		fume hood	1	2040	25,000	no	no	no	require certification before use	no
		consumables and chemicals	many	n/a	30,000	yes	no	hazardous storage	yes - 6 months	no
		refrigerator	1	2025	10,000	yes	no	no	yes - 6 months	no
3-23	Research Lab									

3-24	Classroom									
3-24A	Research Lab	olympus BX43 microscope & computer imaging station; fieldwork equipment	1 of each	?	$25,000	none	no	low humidity, no dust, above 0 degrees C	essential for research work	
3-25		Olympus microscopes	9	bought in 2008$899	2018 quote $1209.60	yes	no	special packaging for protection	April to August only	no
		Nikon microscopes	5	bought in 2007 $970		yes	no	not high humidity or cold temperature	April to August only	no
		Nikon microscopes old	1	bought in 1990 $1070		yes	no	special packaging for protection	April to August only	no
		Nikon stereoscope new	2	bought in 2008 $1618	2018 quote Olympus $2097.80	yes	no	not high humidity or cold temperature	April to August only	no
		Nikon stereoscope old	2	bought in 1983 $1415		yes	no	special packaging for protection	April to August only	no
		Nikon diascopic microscope	1	bought in 2008 $2044		yes	no	not high humidity or cold temperature	April to August only	no
		Mandel pipettes (set of 3)	9	bought in 2015 $595/3		yes	no	special packaging for protection	April to August only	no
		Mandel pipettes 10	2	bought in 2015 $390/ea		yes	no	not high humidity or cold temperature	April to August only	no
		Projectors with amplifier	1		bought in 2009 $2500					
3-34A	Research Lab									
3-26	Zoology	Olympus microscopes	10	bought in 2008$899	2018 quote $1209.60	yes	no	special packaging for protection	April to August only	no
		Nikon microscopes	3	bought in 2007 $970		yes	no	not high humidity or cold temperature	April to August only	no
		Mandel pipettes (set of 3)	7	bought in 2015 $595/3		yes	no	special packaging for protection	April to August only	no
		Mandel pipettes 10	2	bought in 2015 $390/ea		yes	no	not high humidity or cold temperature	April to August only	no
3-27	Classroom Lab									
3-28	Classroom Lab	Laminar flow clean bench	1	5 years	$10-15,000	no	(manufacturer would need to disassemble)	(yes)	no	
		Tabletop incubator (VWR)	1	5+ years	$5,000	yes	no	no	no	
		floor model incubators (VWR)	2	5+ years	$10,000	yes	(for moving only)	no	no	
		microscopes (incl oil immersion and ocular micrometers)	25	3-5 years	$2000+ per	yes	no	no	no (a subset could be stored, but would require delicate scheduling with other courses)	
3-29	Supplies									
3-30	Classroom Lab									
3-31	Supplies									
3-32	Research Lab	Compound microscope	2		90,000	N	No assistance for any	No special conditions for any	My program requires all items except those markeed below	Nope!
		Dissecting microscope and fiber optic light source	2		35,000	N				
		Thermocycler	2		4,000	Y			X	
		Balance	2		5,000	N				
		Microwave	1		400	N				
		Waterbath	3		2,400	N				
		Thermo refrigerated CL3R Centrifuge and accessories	1		5,000	N				
		Thermo Forma orbital shaker and accessories	1		9,000	N				
		Upright freezer	2		2,000	N				
		Low temperature incubator	3 (2 located are in BB 3-27)		3,000	Y			X	
		Fast prep homogenizer	1		10,000	N				
		Micromax refrigerated microcentrifuge	1		12,000	N				
		Speedvac	1		8,000	N				
		Safe Air Biosafety Cabinet	1		12,000	N				
		Lyophilier, oil pump and cart	1 (now located in a storage/prep room)		30,000	N				
		Computers	3		8,000	N				
		Printer	1		400	N				
		Camera and imaging system	2		10,000	N				
3-34	Room									
3-35/3-36/3-37	Lab Equipment Storage	Frigidaire Freezer, upright	1		est. 1200		No	no	power	No
		Frigidaire Freezer, upright	1		est. 1201		No	no	power	No
		Frigidaire Freezer, upright	1		est. 1202		Yes	no	power	Yes, as long as needed
		Frigidaire Fridge	1		767.26 (2017)		No	no	power	No
		Kelvinator Freezer (old)	1		as above		Yes	no	power	Yes, as long as needed
		Ultra low temp freezer	1		10329.79 (2006)		No	Yes	Uninterruptal power	No
		Centrifuge, Eppendorf 5810R	1		7060.81 (2007)		No	Yes	power	No
		Centrifuge, Centra CL3R	1		as above		yes	Yes	power	Yes, another one is available
		VWR Digital platform shaker	1		4918.81 (2009)		yes	no	power	no
		VWR Digital incubator shaker	1		8329.19 (2009)		NO	Yes	power	No
		Flammable cabinet (30gal cap.)	1		1200.00 (2009)		no	no	yes, safety requirement	no, safety requirement
		Acid cabinet (4 gal cap.)	1		1000 (2009)		no	no	yes, safety requirement	no, safety requirement
3-38	Room									
3-39	Storage									
3-40	Storage/Prep									
3-41	Copier/Supplies									
3-48	Lounge									
5-6	Room									
5-6-1	Room									
5-7	Research Lab									
5-9	Botany Greenhouse									
5-10	Greenhouse prep									
	Sub Total									
Psychology										
1-4	Shared (Copier/Supplies)									
1-7	Office									
1-8	Office									
1-9	Office									
1-10	Office									
1-11	Office									
1-12	Office									
1-13	Office									
1-14	Office									
1-15	Office									
1-16	Office									
1-31	Training Room	2 Desktop computers								
1-35	Psychology Classroom									
1-43	Observation Rooms									
1-44	Observation Rooms									
1-45	Observation Rooms									
1-48	Classroom									
1-53	Psychology Classroom									
1-54	Psychology Classroom									
1-71	Observation Storage									
1-25	Storage	Desktop computer								
1-26	Storage									
1-26-1	Storage	Desktop computer								
1-27	Room	Desktop computer; printer								
1-28	WIC									
1-42	Printer Room (Shared with Math)	Printers	2							
1-30A	Sound booth									
1-55	Storage									
1-56	Study									
1-57	Study									
1-58	Study									

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1-59	Storage									
1-60	Study									
1-61	Study									
1-62	Room	Computers	2							
1-63/1-64	Storage									
1-68	Research Office	Desk, Chair, Bookshelf								
1-68-1	Office	Computer, Monitor, Photometer, Chinrest, Rtbox								
1-69	Office									
1-70	Office									
1-70A	Office									
	Sub Total									
IT										
G-18	IT Classroom	Computers	25		25,000					
G-20A	Office									
G-20A-1	Office									
G-20A-2	Office									
G-20C	Classroom	Computers	28		28,000					
G-20D	Office	Computers	7		7,000					
G-32	Office	Computers	10		10,000					
	Sub Total									
	Total									

Other Information — The Department of Geology has literally tons of rocks, fossils and other specimens that are used on a daily basis for lectures and laboratories.

It would not be possible to run the program without these materials. These materials are housed in many dozens of cabinets located throughout the Department.

* Temporary location for the lab. Needs to be moved to the new science building

APPENDIX E

Thermographic Scans, Photographs and Weather Data

Photograph #1:

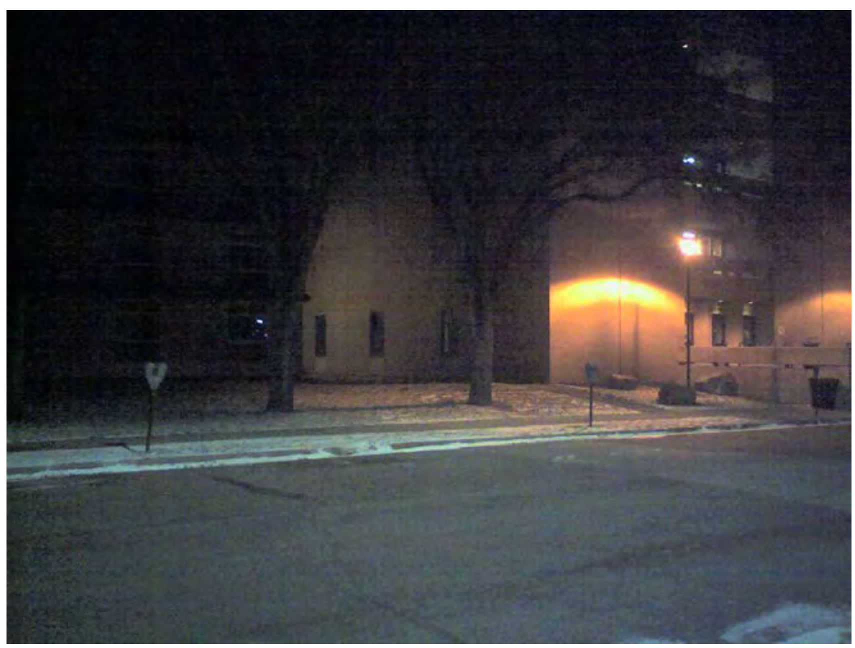
Overall view of south elevation. Note thermal bridging at floor slab band locations.

Photograph #2:

Photograph #3:

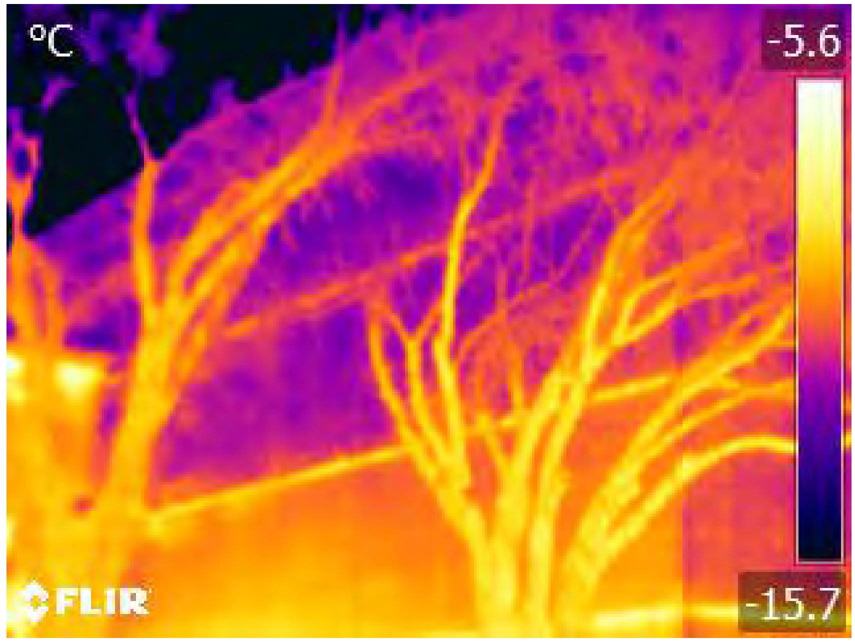
Detail view of southwest corner at grade.

Photograph #4:



Photograph #5:

Detail view of southwest corner at grade.



Photograph #6:

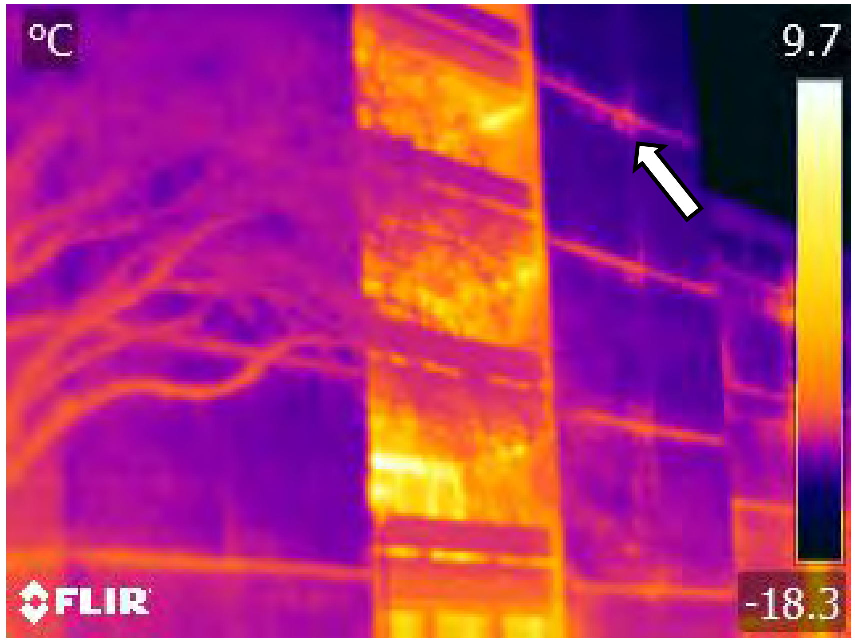
Photograph #7:

Detail view of southwest corner at grade.

Photograph #8:

Photograph #9:

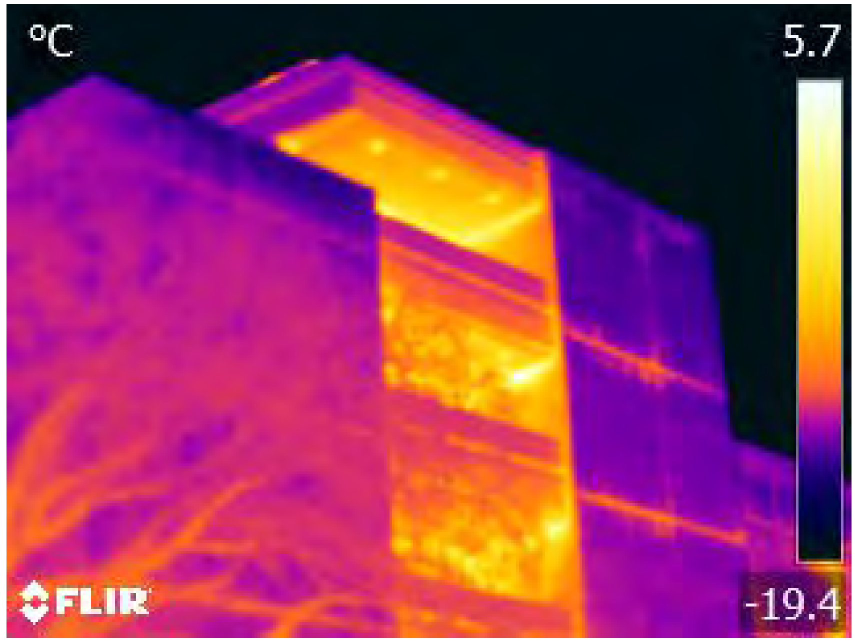
Detail view of south elevation. Note thermal bridging at shelf angles. Also note anomalies likely caused by air leakage.



Photograph #10:

Photograph #11:

Upper portion of south elevation.



Photograph #12:

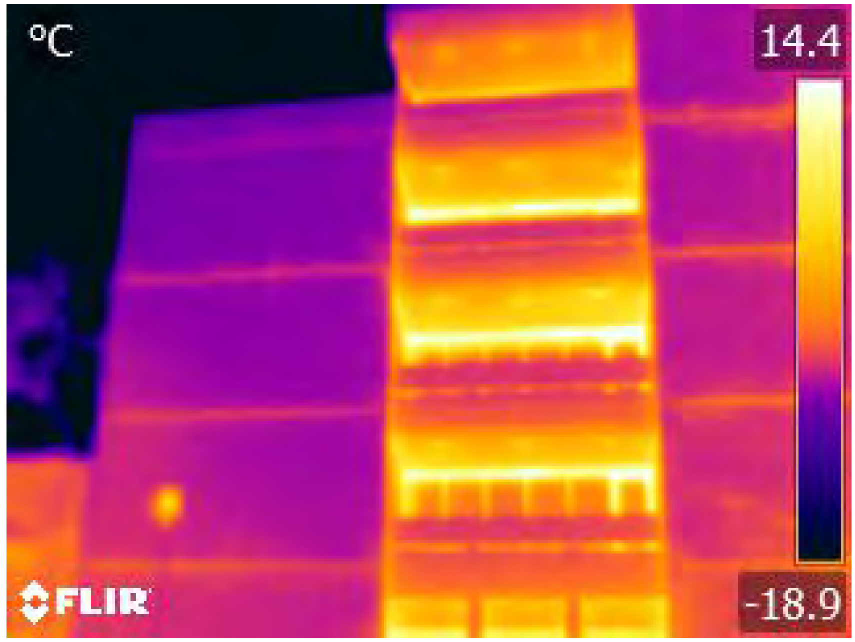
Photograph #13:

Detail view of south elevation at grade.

Photograph #14:

Photograph #15:

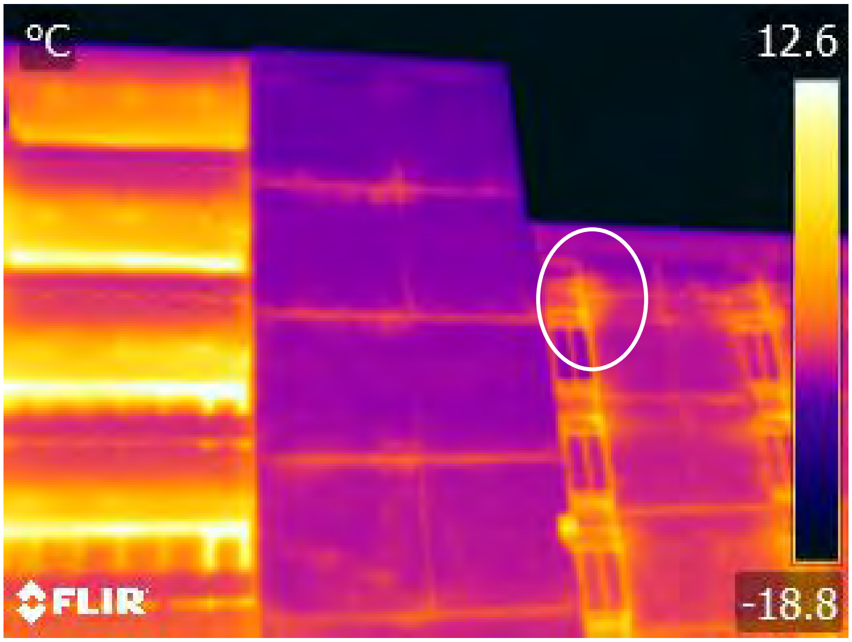
Partial west portion of south elevation.



Photograph #16:

Photograph #17:

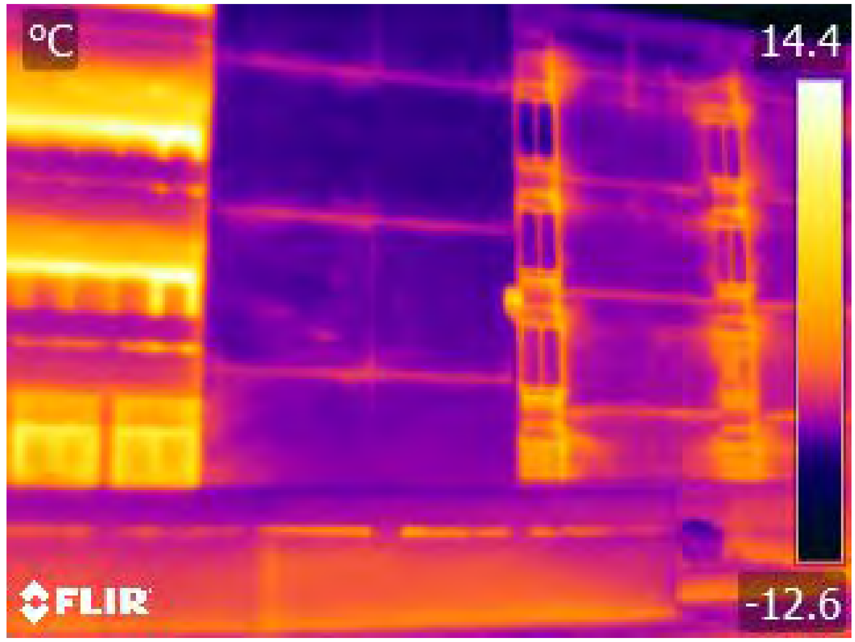
Upper portion of south elevation. Note thermal bridging at shelf angle/floor slab locations. Also note apparent air leakage at window corners.



Photograph #18:

Photograph #19:

Upper portion of south elevation. Note thermal bridging at shelf angle/floor slab locations. Also note apparent air leakage at window corners.



Photograph #20:

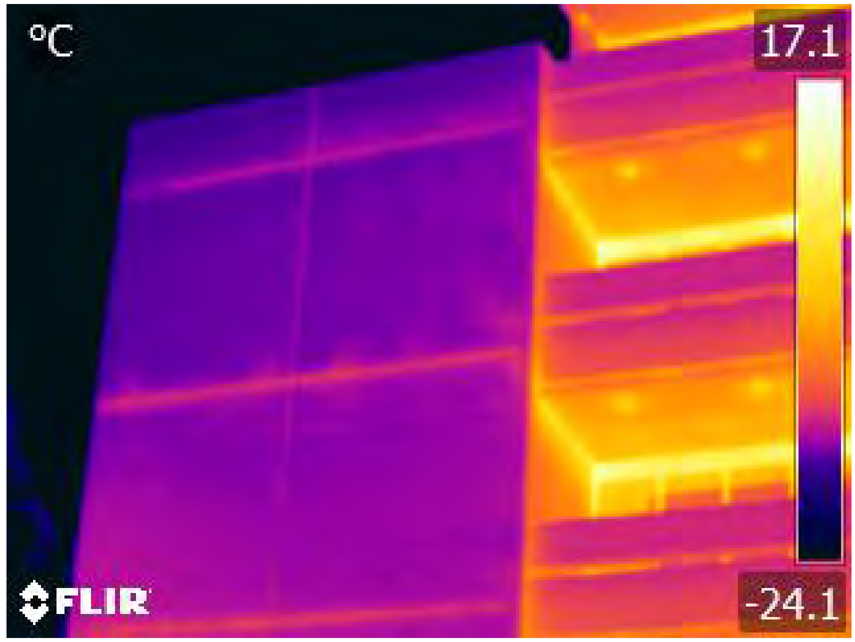
Photograph #21:

Overall south elevation.

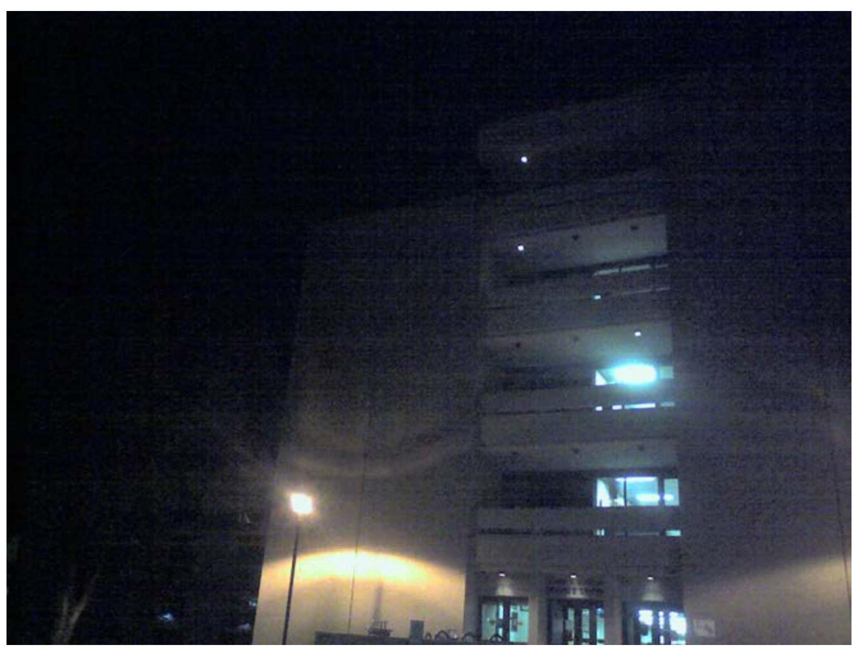
Photograph #22:

Photograph #23:

Detail view of west portion of south elevation. Note thermal bridging at floor slab locations.



Photograph #24:



Photograph #25:

Detail view of west portion of south elevation. Note thermal bridging at floor slab locations.

Photograph #26:

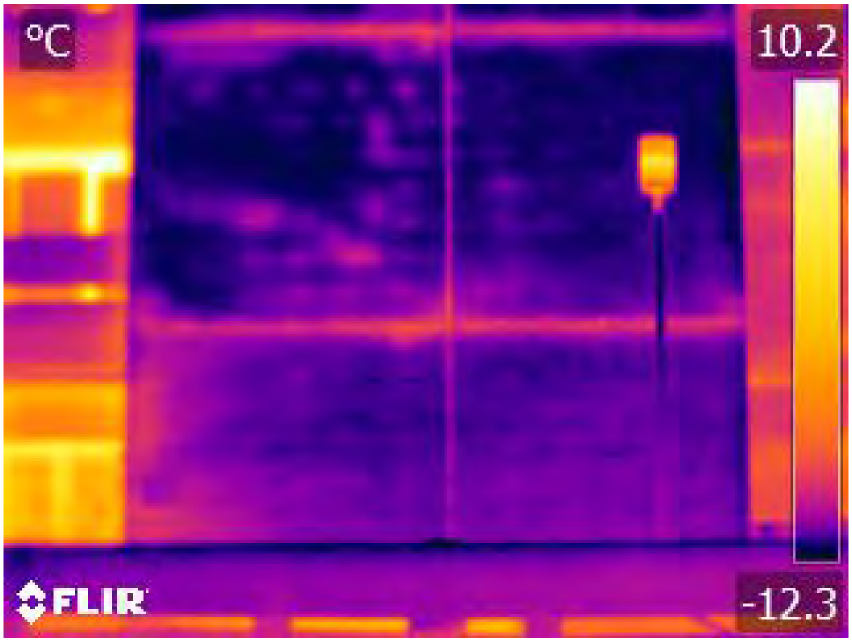
Photograph #27:

Detail view of west portion of south elevation. Note thermal bridging at floor slab locations.

Photograph #28:

Photograph #29:

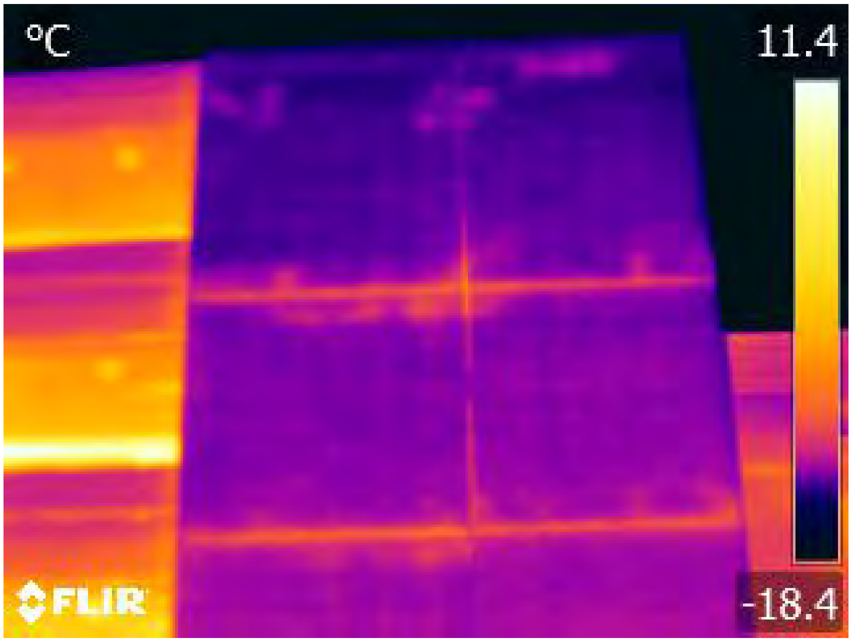
Detail view of south elevation near grade. Note thermal anomalies at second floor.



Photograph #30:

Photograph #31:

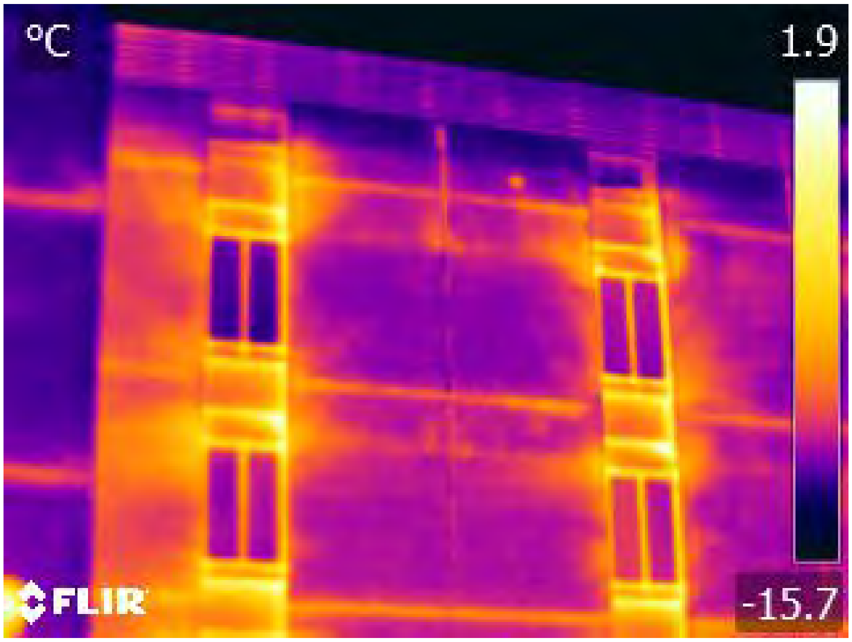
Detail view of south elevation near grade. Note several thermal anomalies.



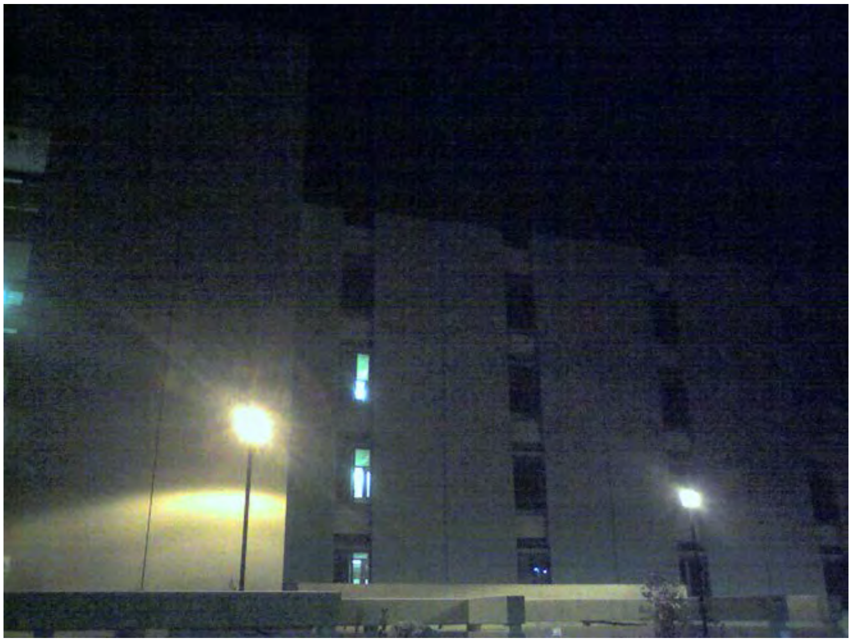
Photograph #32:

Photograph #33:

Detail view of south elevation showing thermal bridging at floor slab locations. Also note apparent air leakage at window jamb locations.

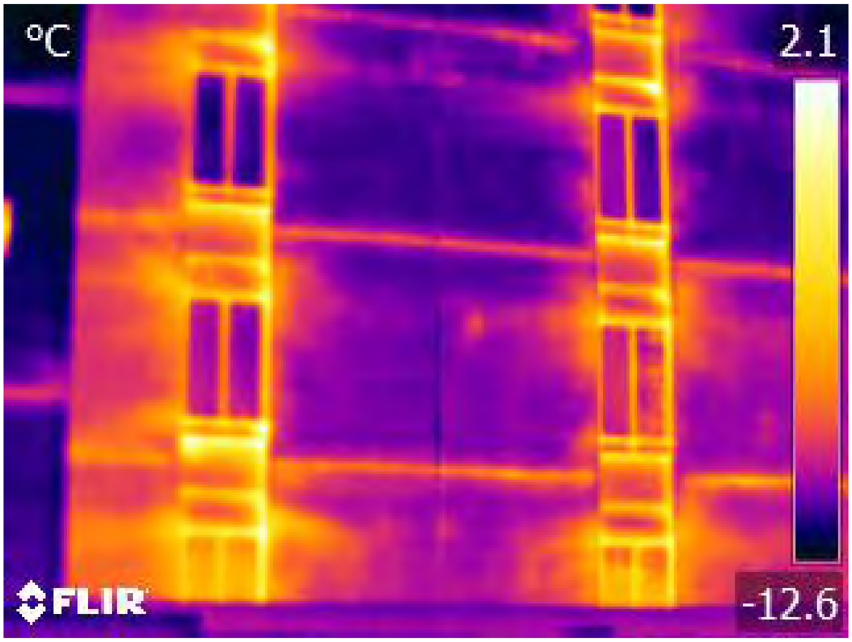


Photograph #34:



Photograph #35:

Detail view of south elevation showing thermal bridging at floor slab locations. Also note apparent air leakage at window jamb locations.



Photograph #36:

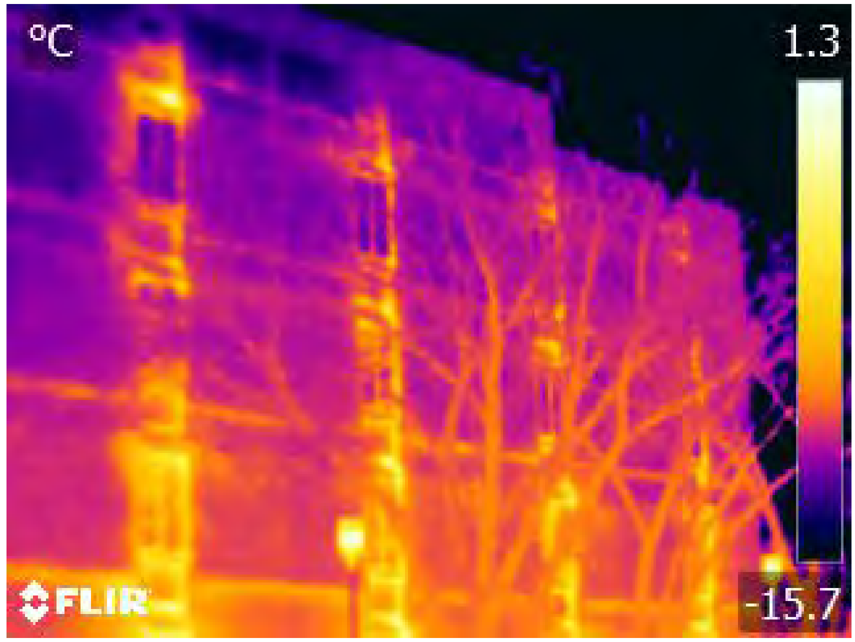
Photograph #37:

Partial south elevation near east end of building at grade.

Photograph #38:

Photograph #39:

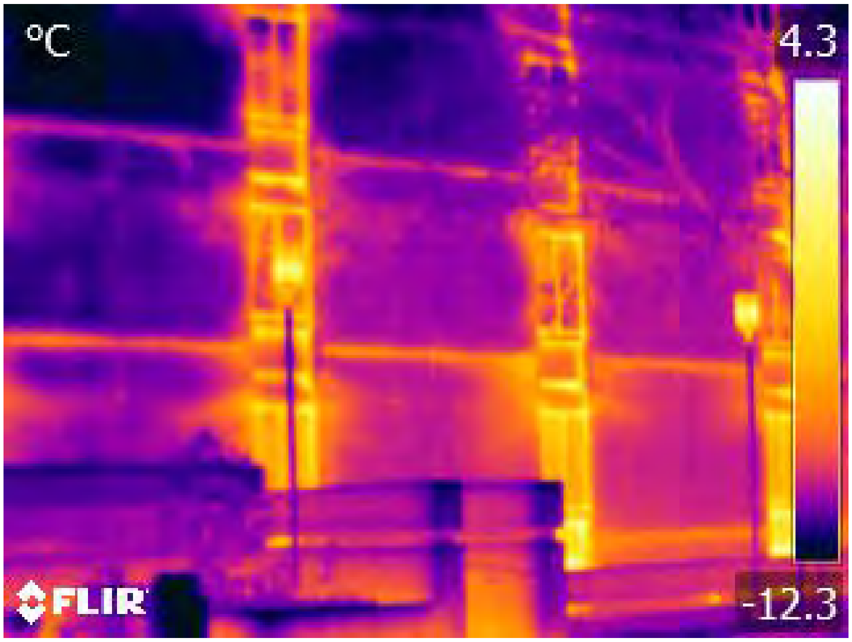
Partial south elevation near east end of building.



Photograph #40:

Photograph #41:

Partial south elevation near east end of building.



Photograph #42:

Photograph #43:

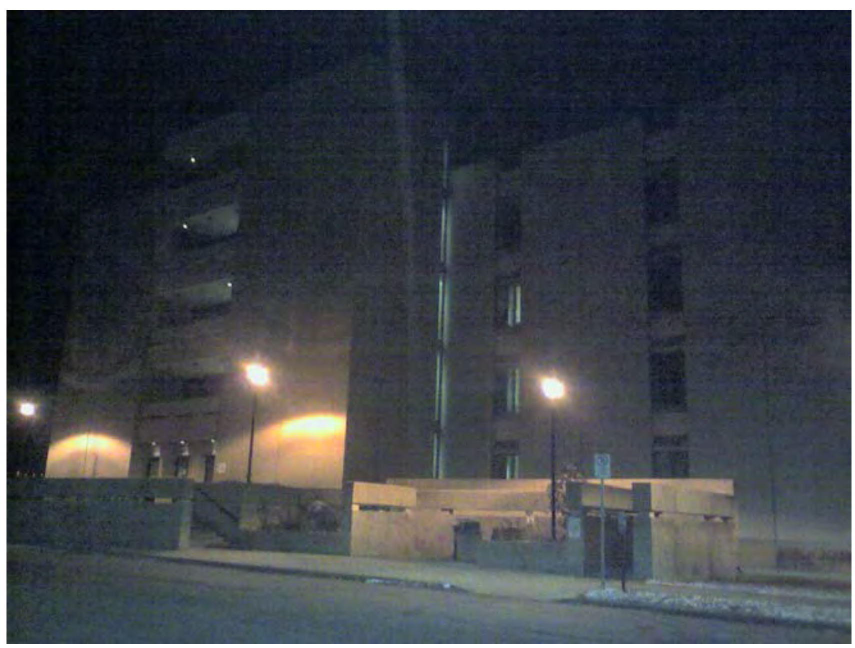
Detail view of south elevation showing thermal bridging at floor slab locations. Also note apparent air leakage at window jamb locations.

Photograph #44:

Photograph #45:

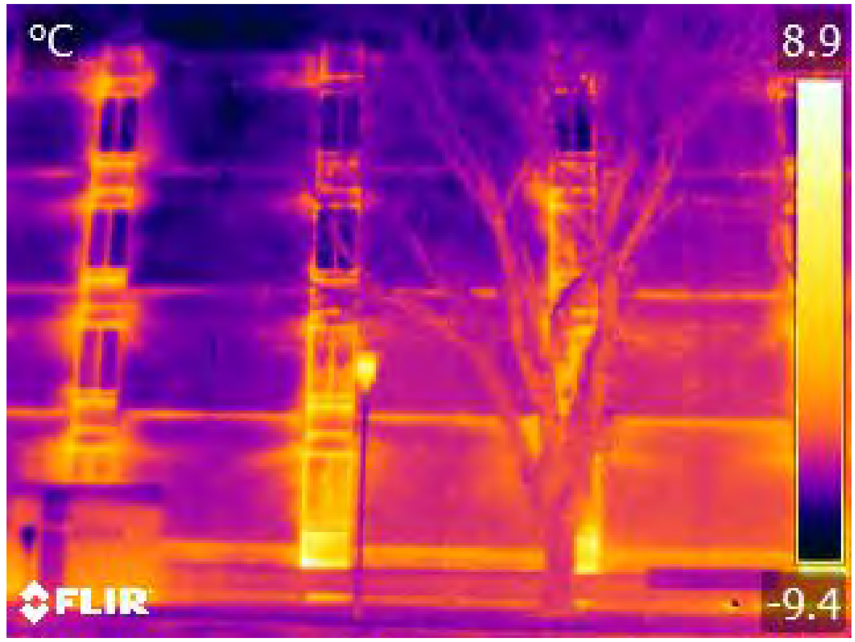
Partial south elevation.

Photograph #46:



Photograph #47:

Partial south elevation. Note apparent air leakage at most windows.



Photograph #48:

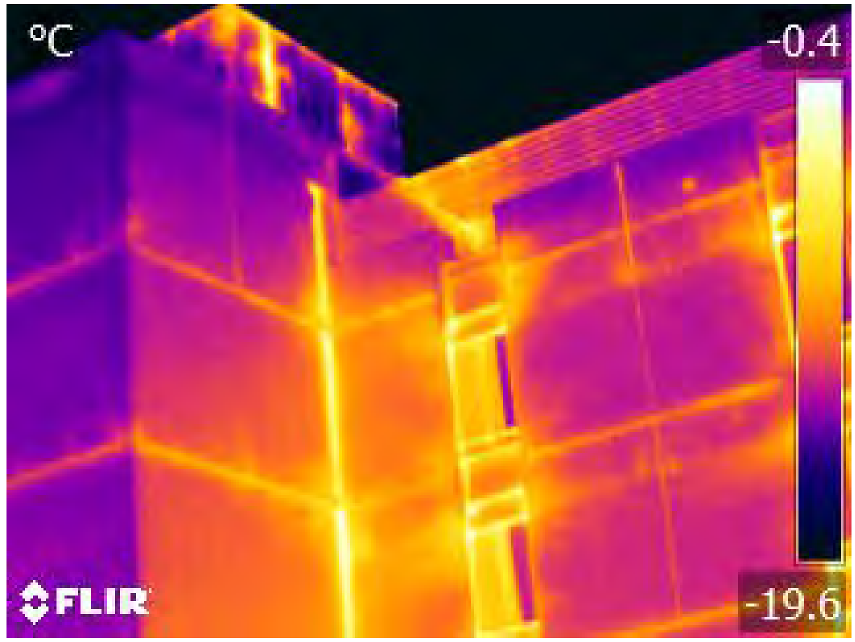
Photograph #49:

Partial south elevation at east end of building.

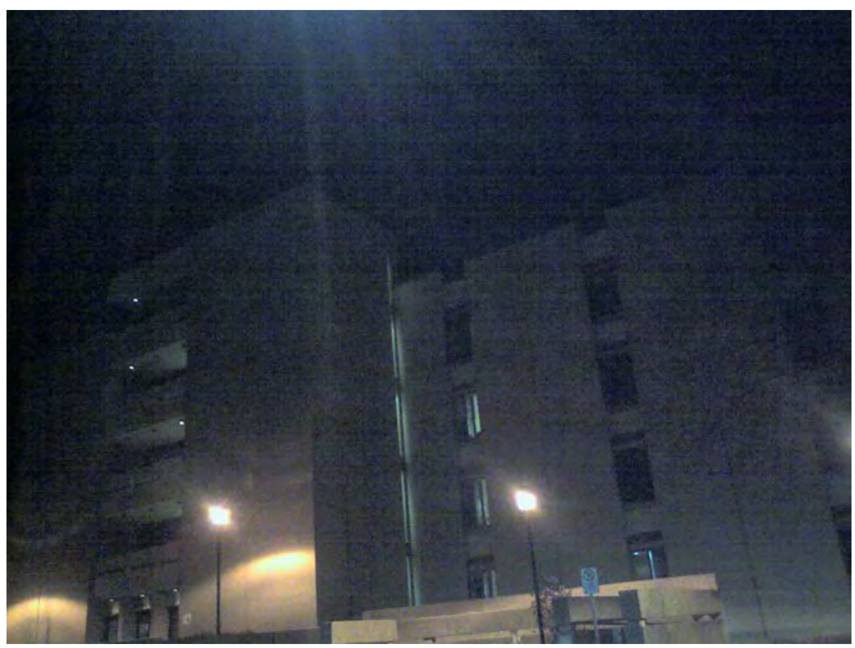
Photograph #50:

Photograph #51:

Detail view of south elevation.

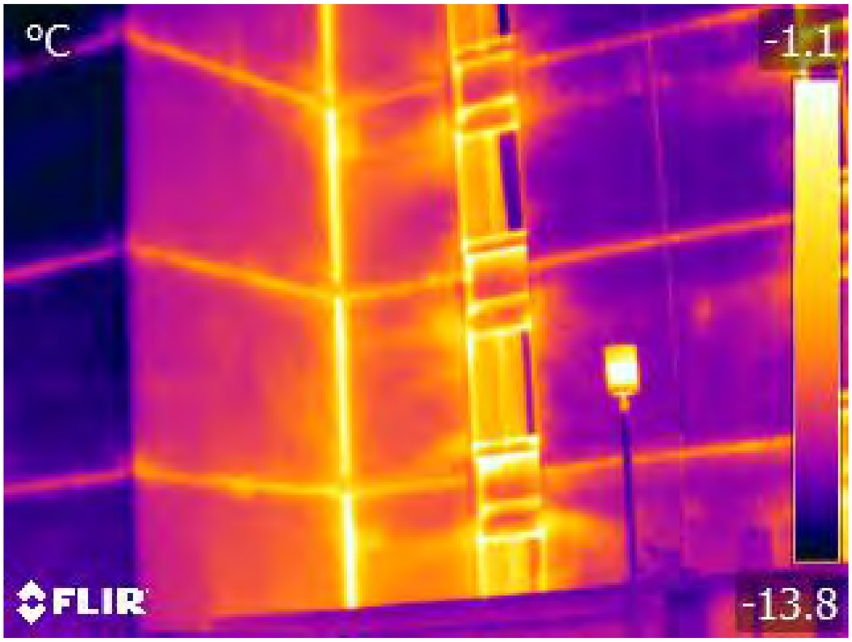


Photograph #52:



Photograph #53:

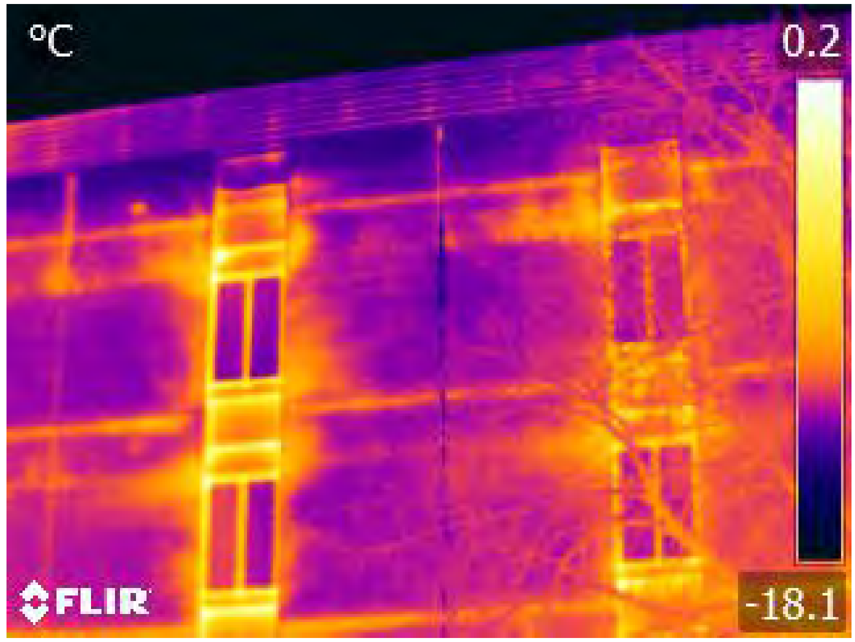
Detail view of south elevation near entrance. Note thermal bridging a floor slabs as well as air leakage at windows.



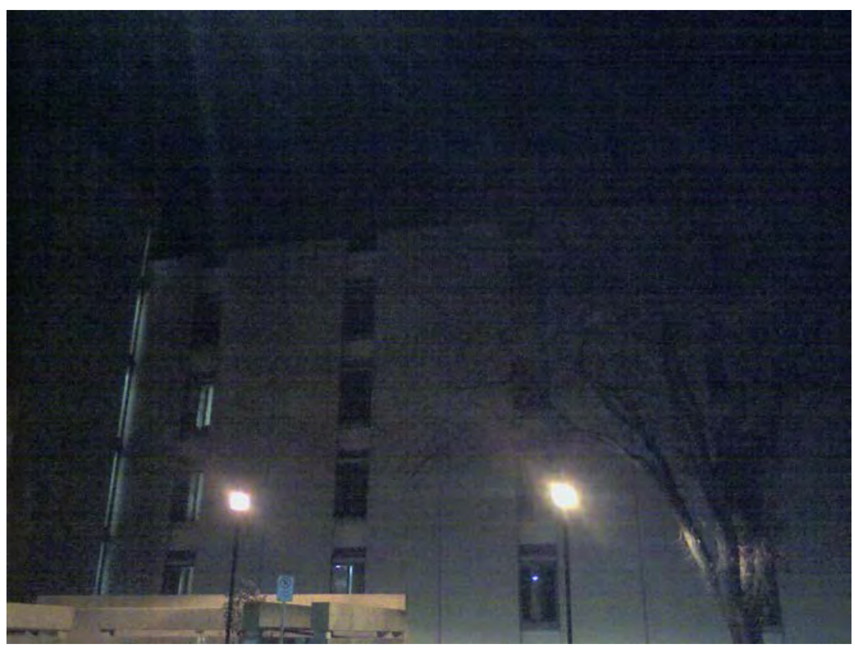
Photograph #54:

Photograph #55:

Detail view of south elevation. Note thermal bridging a floor slabs as well as air leakage at windows.



Photograph #56:



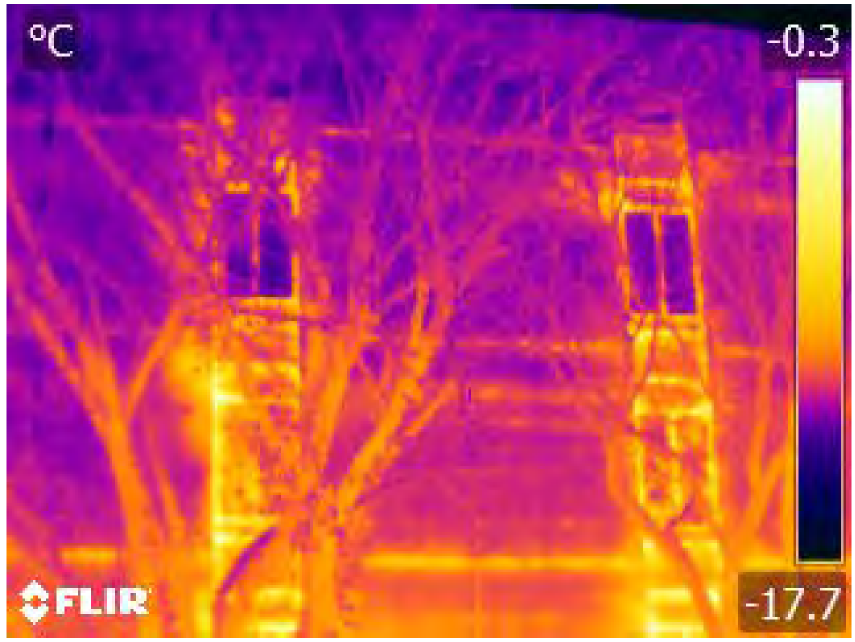
Photograph #57:

Detail view of south elevation. Note thermal bridging a floor slabs as well as air leakage at windows.

Photograph #58:

Photograph #59:

Detail view of south elevation. Note thermal bridging a floor slabs as well as air leakage at windows.



Photograph #60:

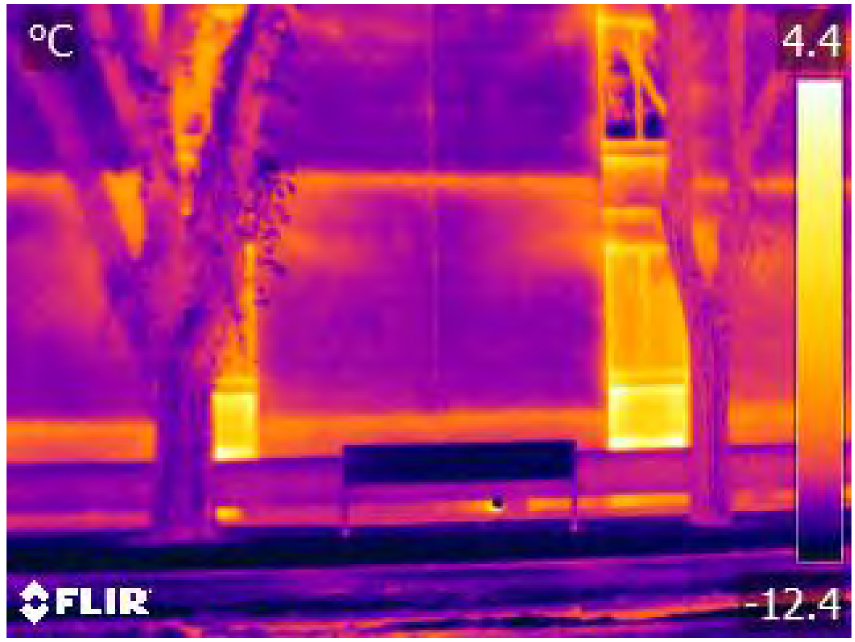
Photograph #61:

Detail view of south elevation. Note thermal bridging a floor slabs as well as air leakage at windows.

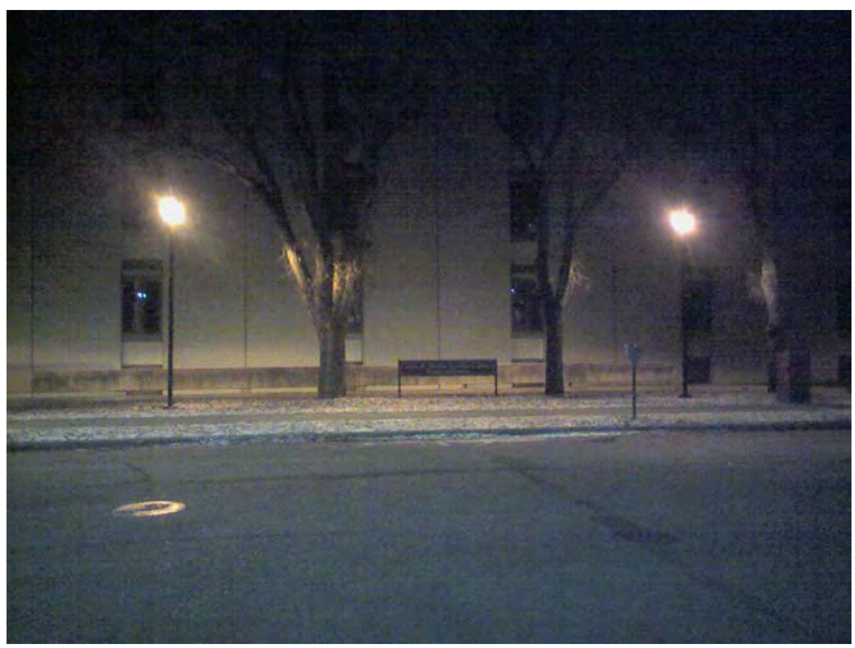
Photograph #62:

Photograph #63:

Detail view of south elevation. Note thermal bridging a floor slabs as well as air leakage at windows.

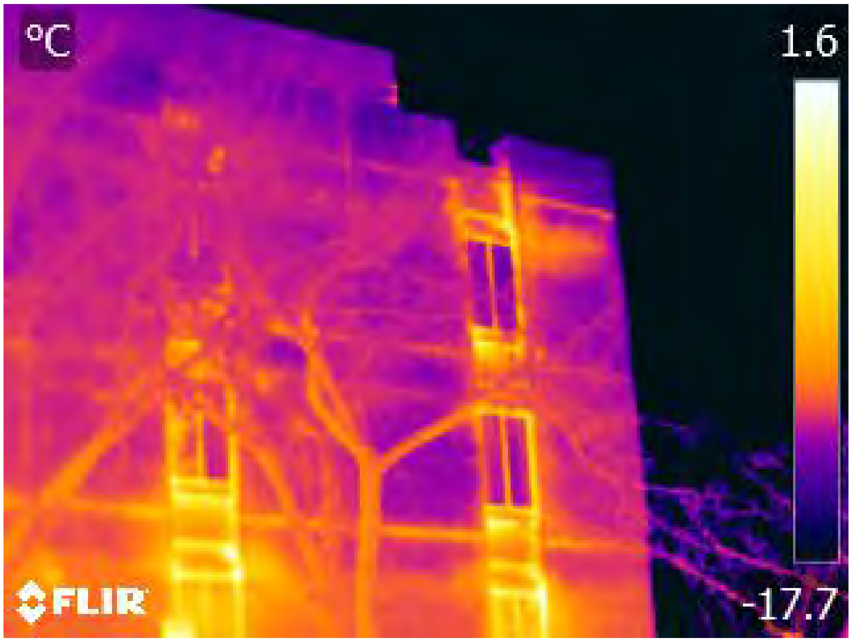


Photograph #64:



Photograph #65:

Detail view of east end of south elevation. Note thermal bridging a floor slabs as well as air leakage at windows.

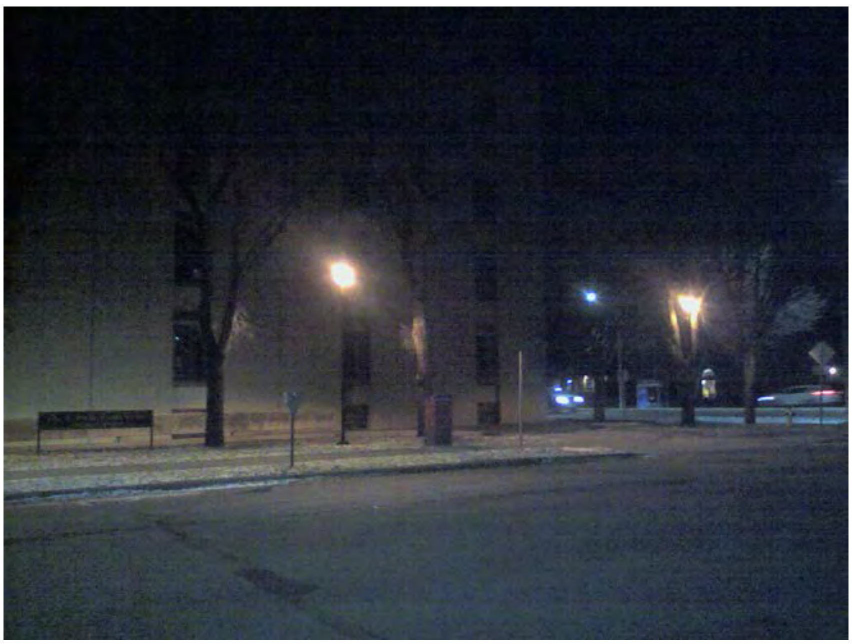


Photograph #66:

Photograph #67:

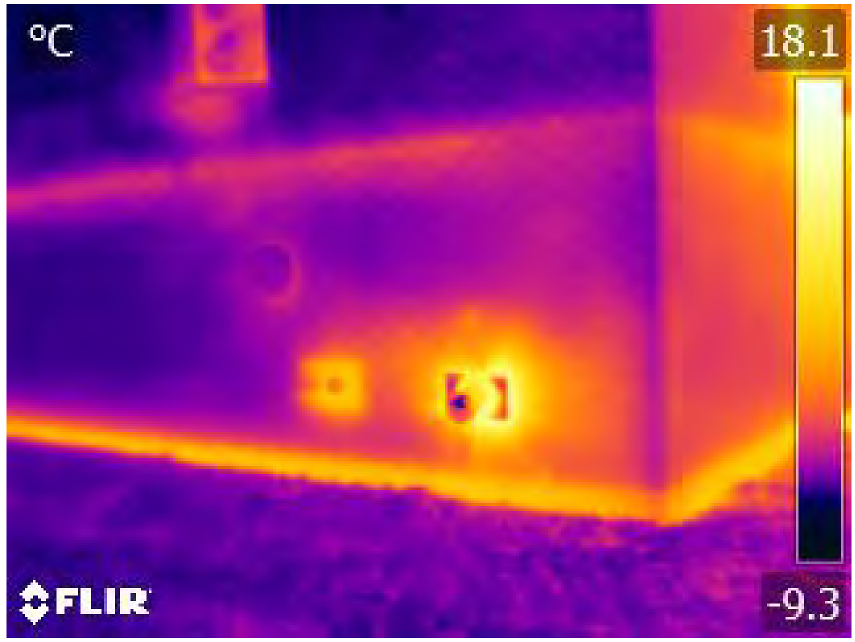
Detail view of east end of south elevation. Note thermal bridging a floor slabs as well as air leakage at windows.

Photograph #68:



Photograph #69:

Detail view of south elevation. Note thermal anomalies caused by air leakage at mechanical penetration and thermal bridging at masonry support and foundation wall.



Photograph #70:

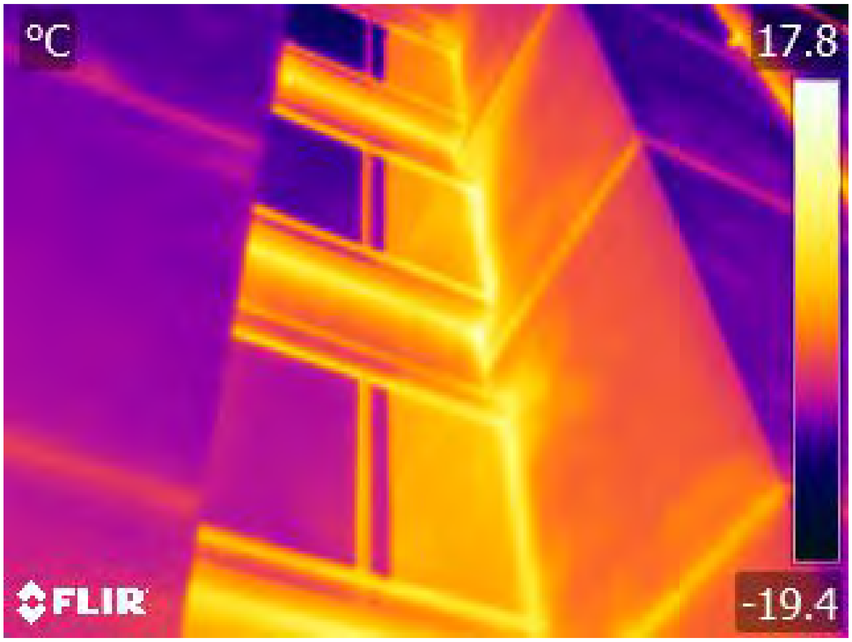
Photograph #71:

Detail view of south elevation. Note thermal anomalies caused by air leakage and thermal bridging.

Photograph #72:

Photograph #73:

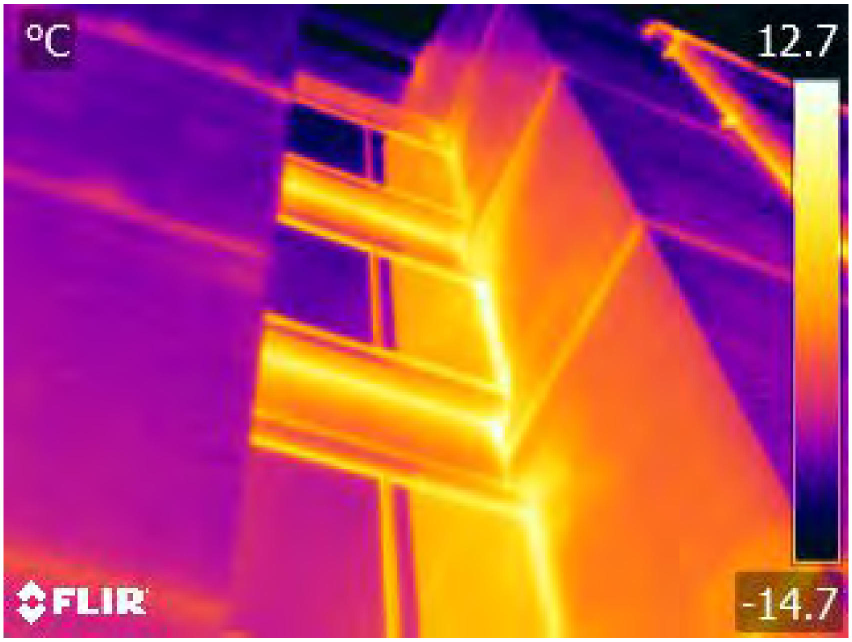
Detail view of south elevation. Note thermal anomalies caused by air leakage and thermal bridging.



Photograph #74:

Photograph #75:

Detail view of south elevation. Note thermal anomalies caused by air leakage and thermal bridging.

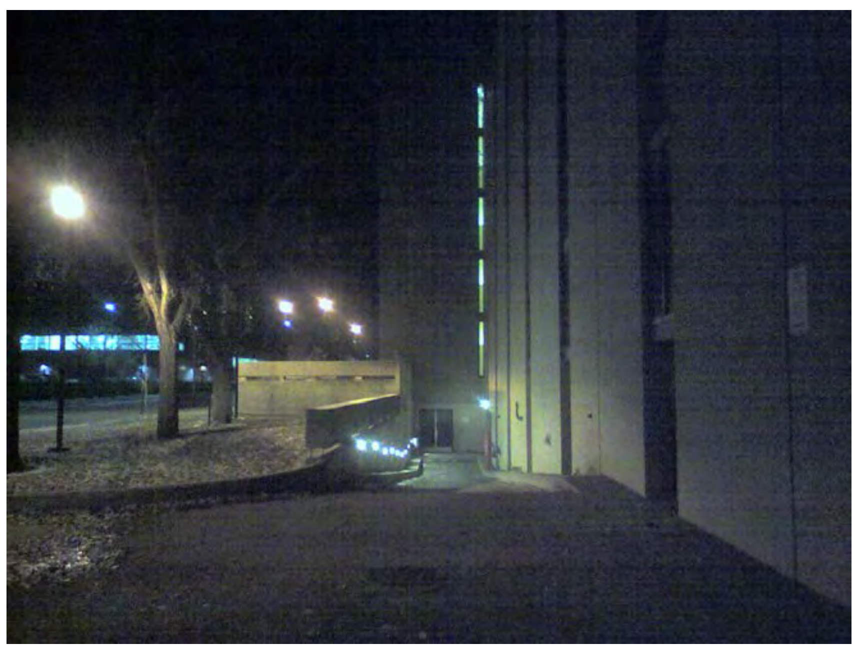


Photograph #76:

Photograph #77:

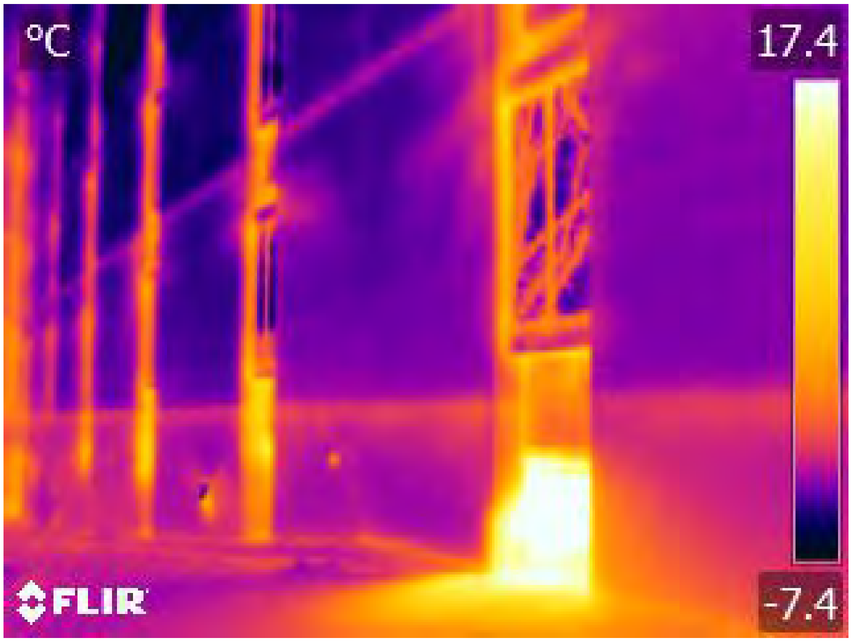
Detail view of south elevation. Note thermal anomalies caused by air leakage and thermal bridging.

Photograph #78:



Photograph #79:

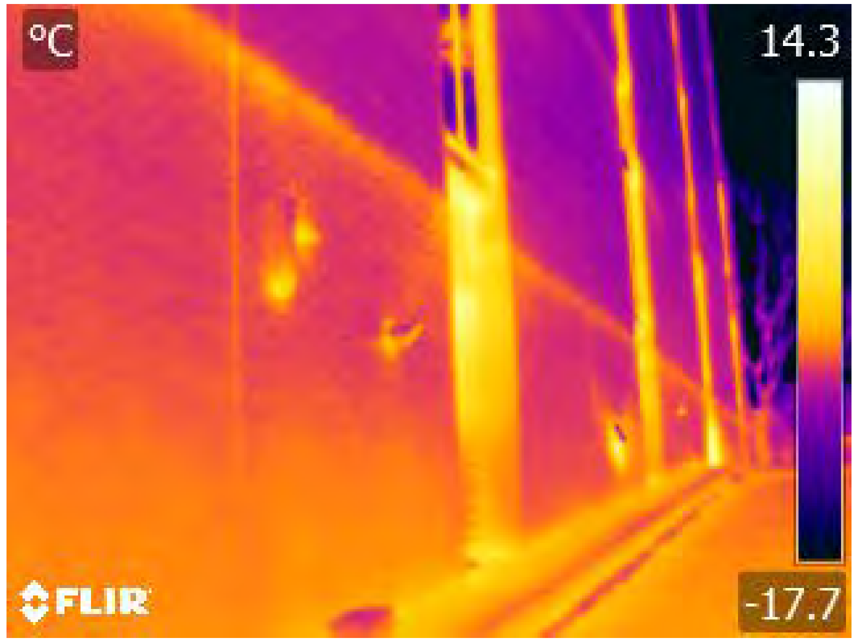
Detail view of south elevation. Note thermal anomalies caused by air leakage and thermal bridging.



Photograph #80:

Photograph #81:

Detail view of south elevation.



Photograph #82:

Photograph #83:

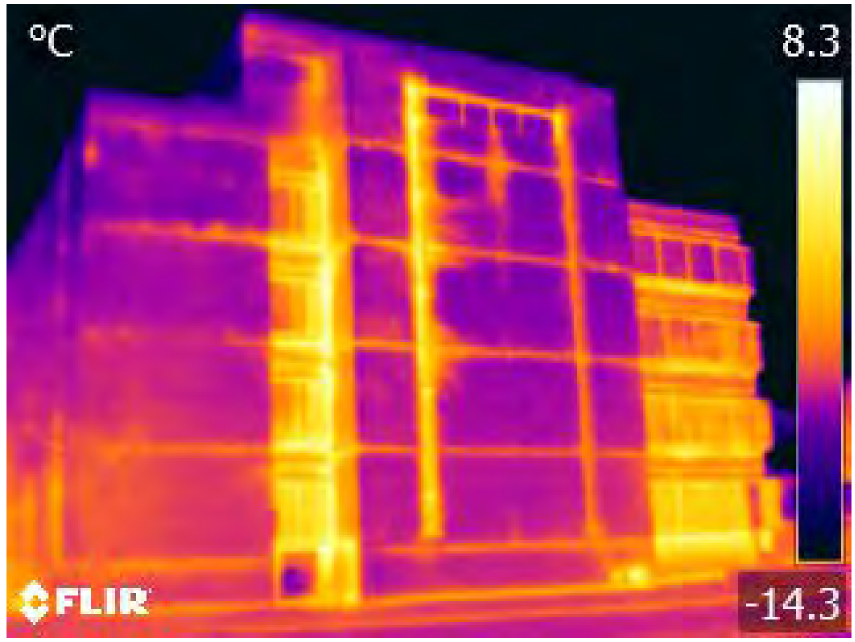
Detail view of south entrance doors. Note anomalies caused by air leakage and thermal bridging.

Photograph #84:

6.2 East Elevation

Photograph #85:

Overall east elevation showing thermal anomalies caused by air leakage and thermal bridging.



Photograph #86:

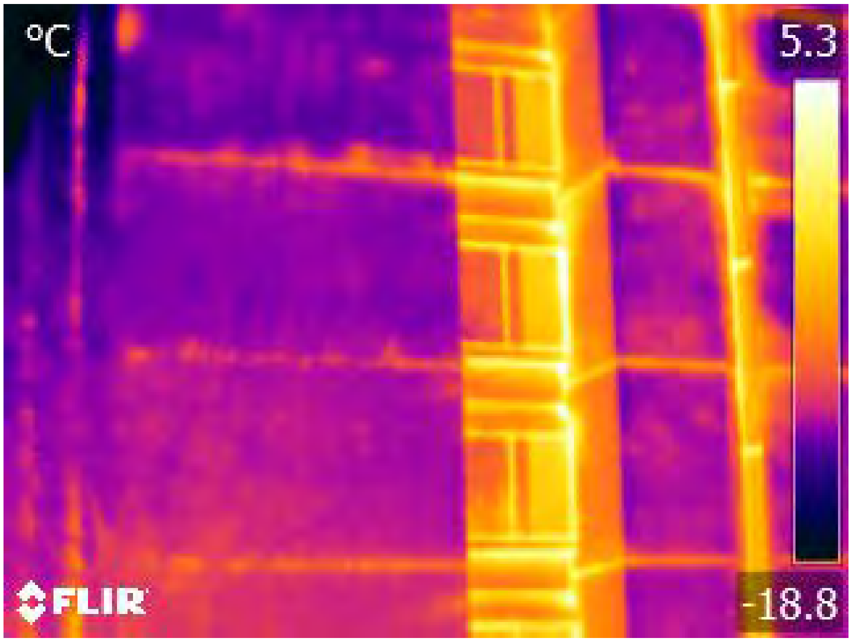
Photograph #87:

Detail view of upper portion of east elevation. Note thermal anomalies in opaque wall areas likely caused by discrete air leakage.

Photograph #88:

Photograph #89:

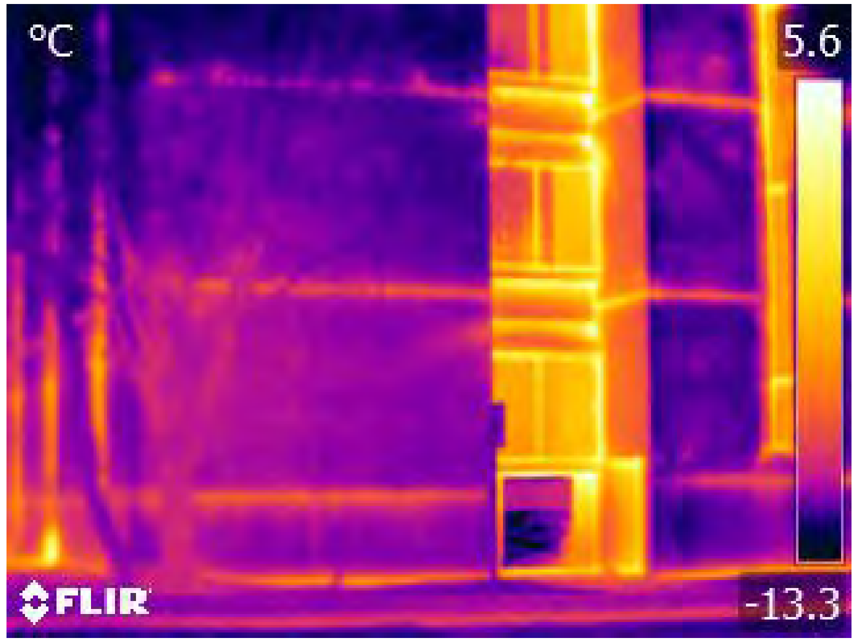
Detail view of upper portion of east elevation. Note thermal anomalies caused by air leakage and thermal bridging.



Photograph #90:

Photograph #91:

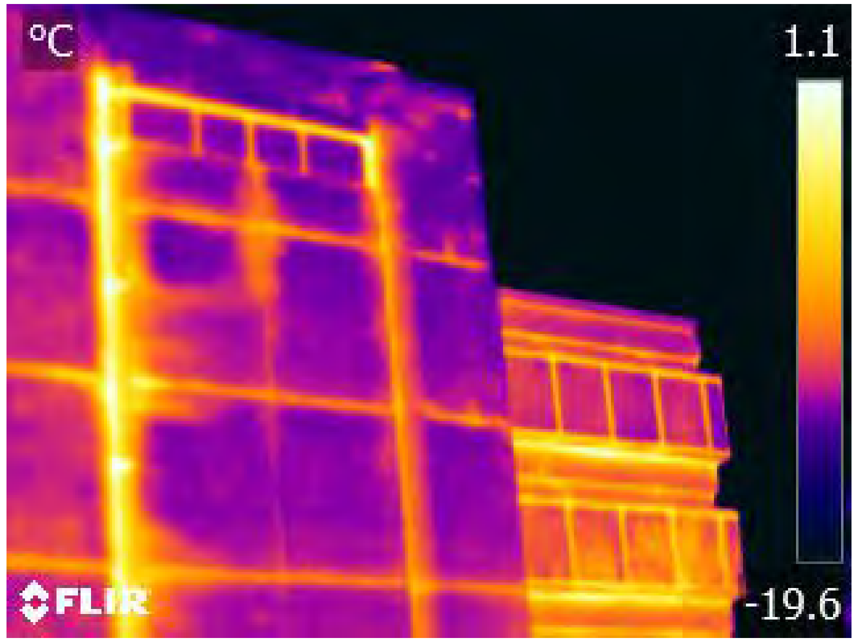
Detail view of upper portion of east elevation. Note thermal anomalies caused by air leakage and thermal bridging.



Photograph #92:

Photograph #93:

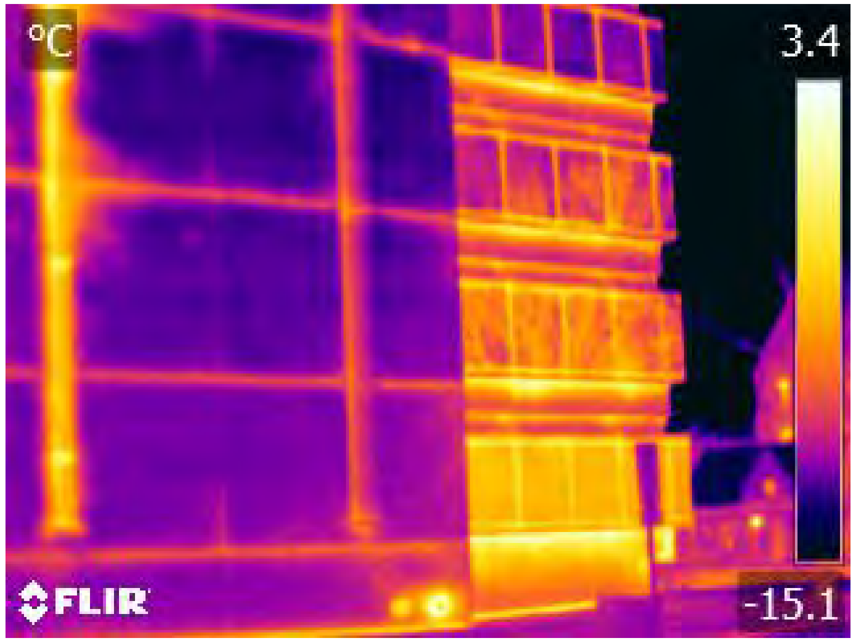
Detail view of upper portion of east elevation. Note thermal anomalies caused by air leakage and thermal bridging.



Photograph #94:

Photograph #95:

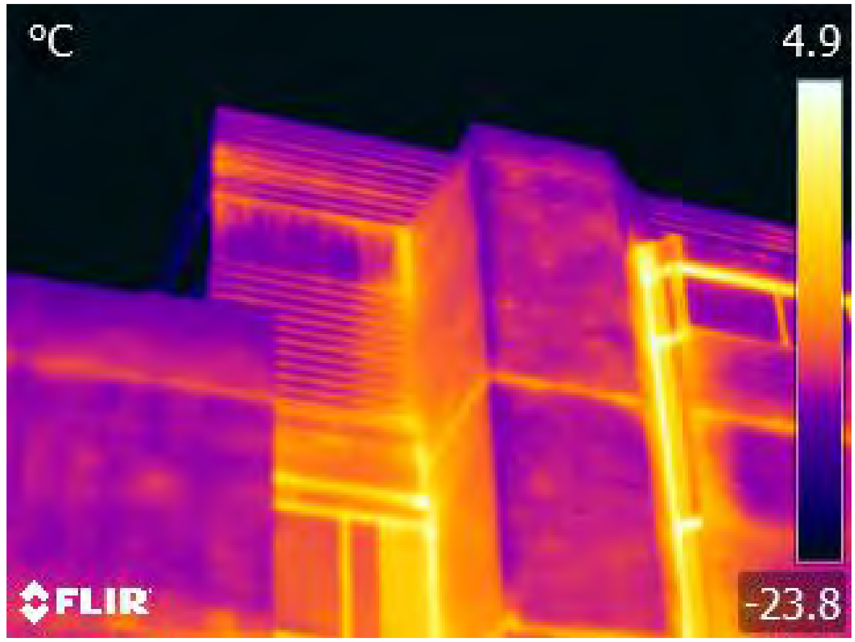
Detail view of east elevation at grade. Note thermal anomalies caused by air leakage and thermal bridging.



Photograph #96:

Photograph #97:

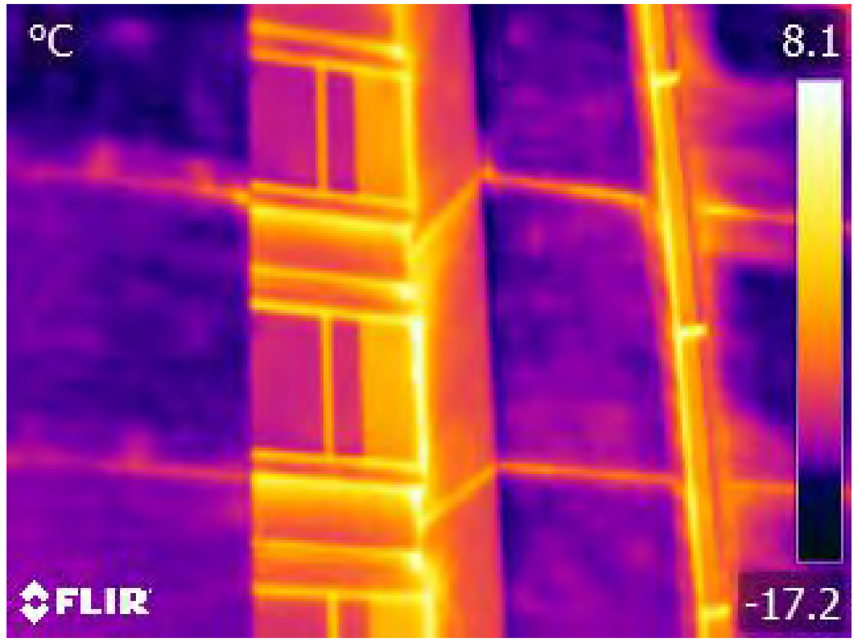
Detail view of upper portion of east elevation. Note thermal anomalies caused by air leakage and thermal bridging.



Photograph #98:

Photograph #99:

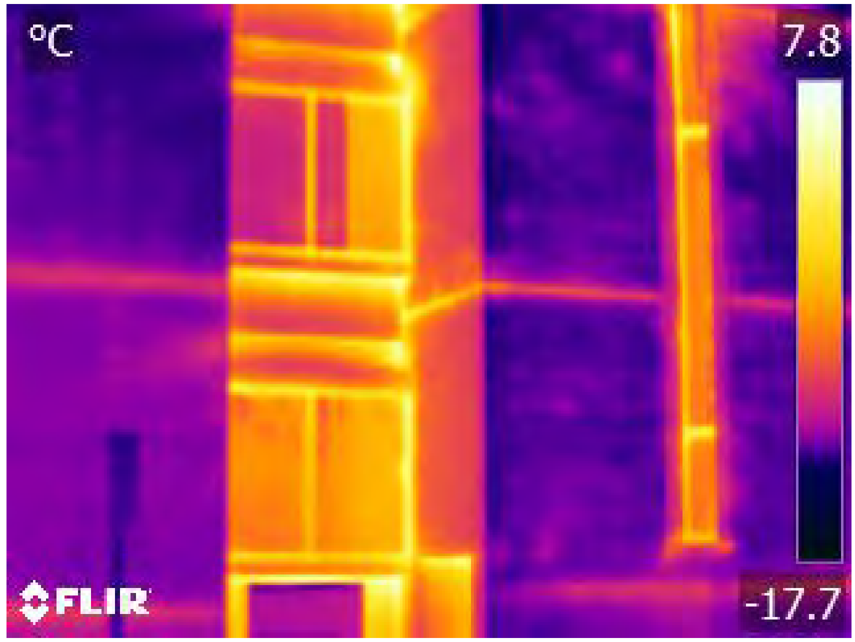
Detail view of east elevation. Note thermal anomalies caused by air leakage and thermal bridging.



Photograph #100:

Photograph #101:

Detail view of east elevation near grade. Note thermal anomalies caused by air leakage and thermal bridging.



Photograph #102:

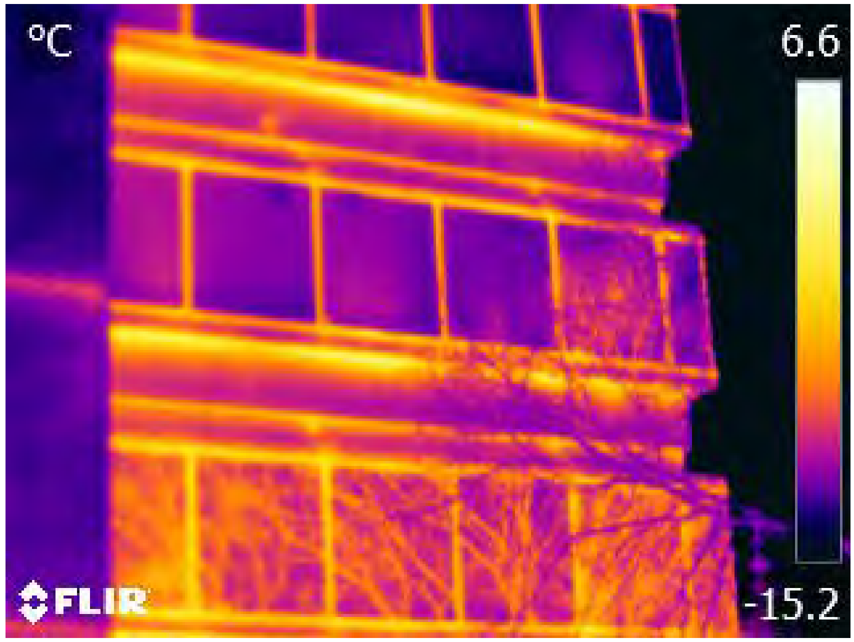
Photograph #103:

Detail view of upper portion of east elevation. Note thermal anomalies caused by air leakage at window framing.

Photograph #104:

Photograph #105:

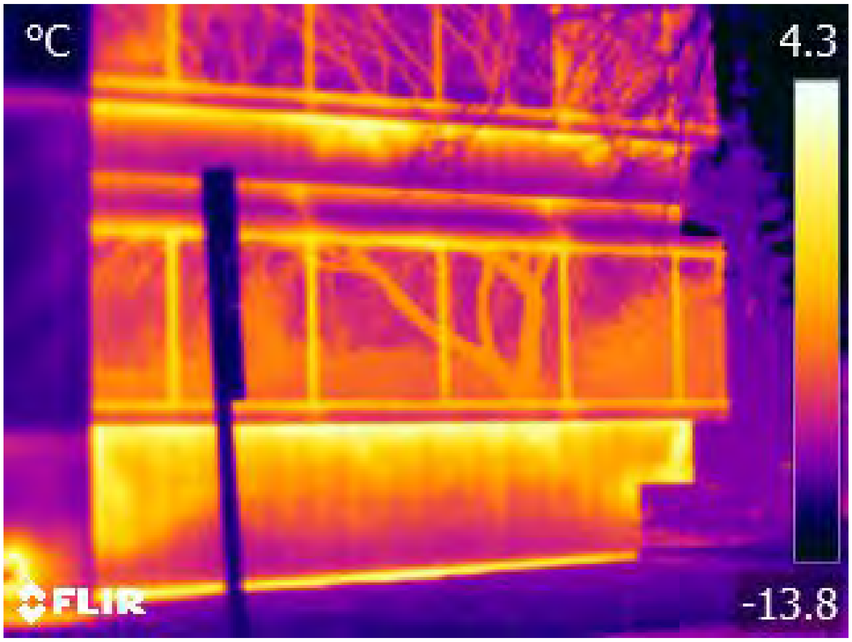
Detail view of east elevation. Note thermal anomalies caused by air leakage at window framing.



Photograph #106:

Photograph #107:

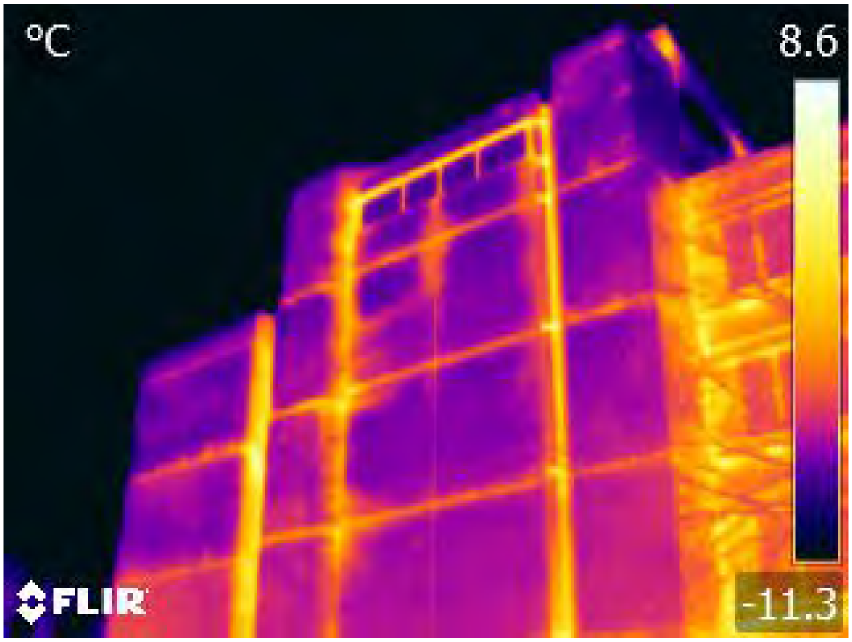
Detail view of east elevation at grade. Note thermal anomalies caused by air leakage at window framing.



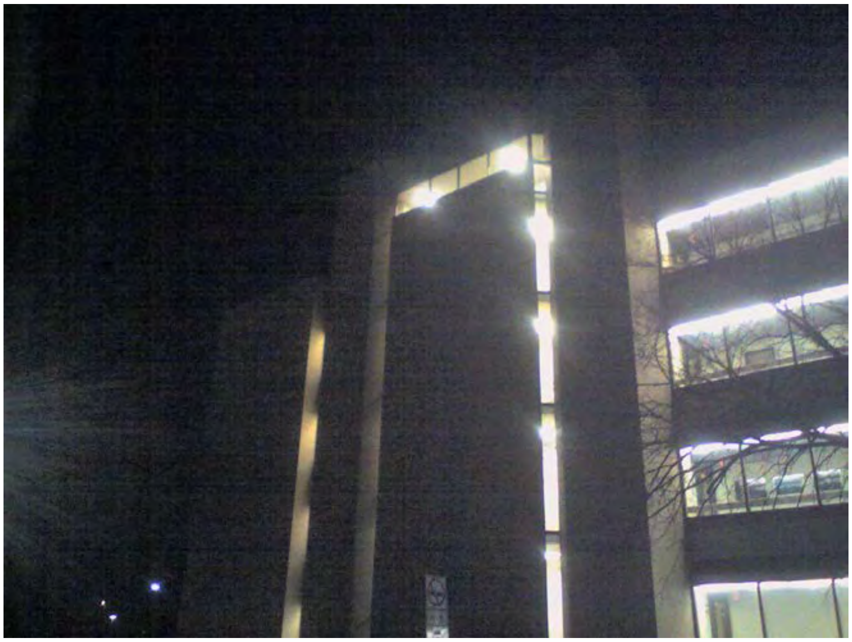
Photograph #108:

Photograph #109:

Detail view of upper portion of east elevation. Note thermal anomalies caused by air leakage at window framing.

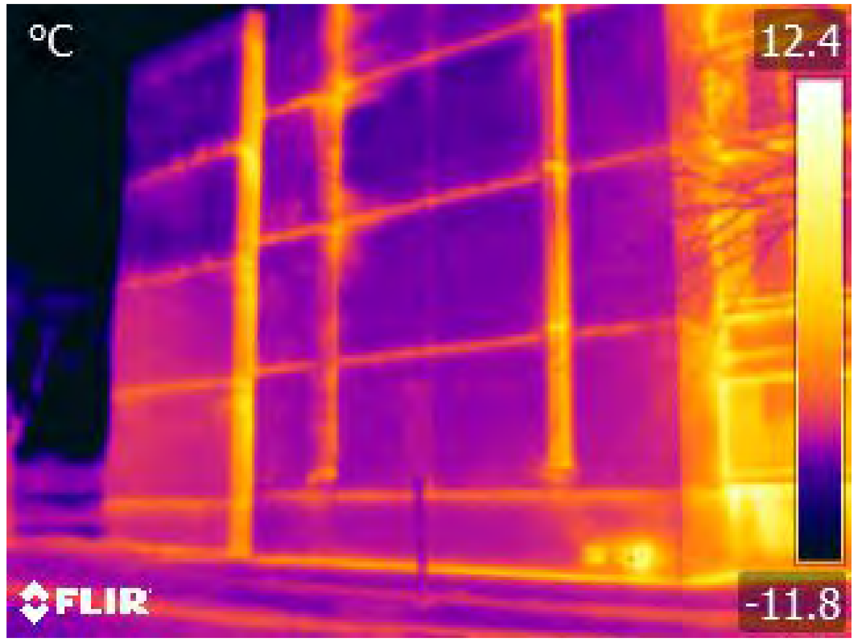


Photograph #110:



Photograph #111:

Detail view of east elevation at grade. Note thermal anomalies caused by air leakage at window framing.

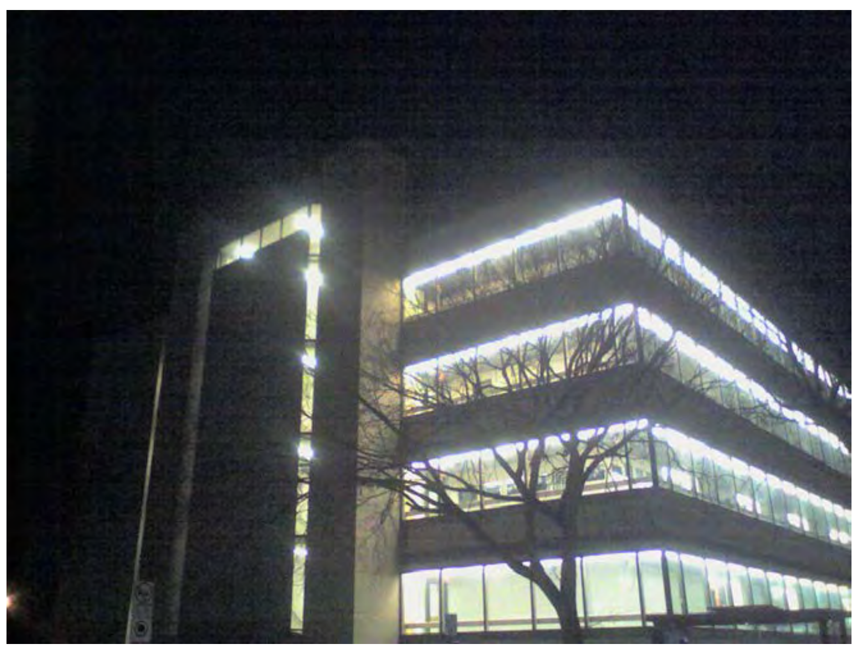


Photograph #112:

Photograph #113:

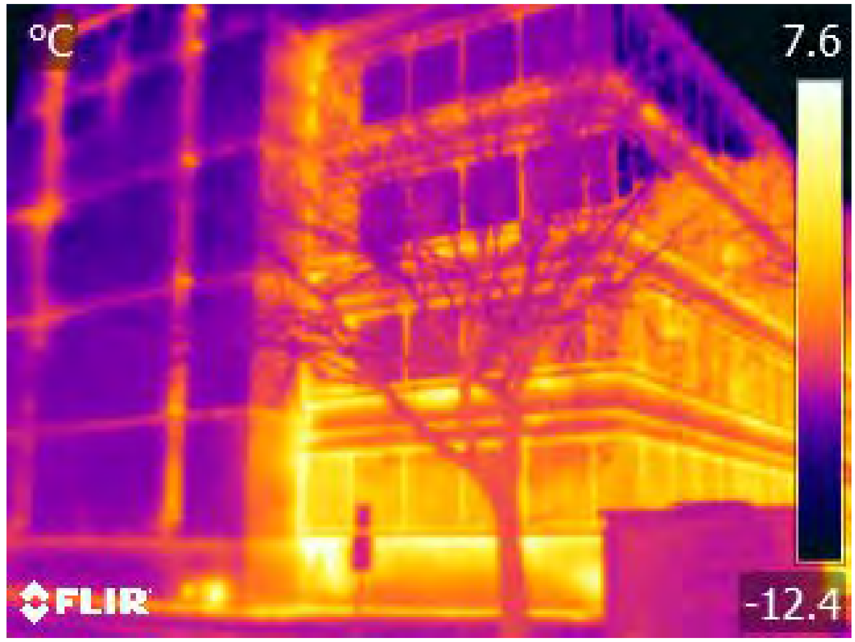
Overall view of east and partial north elevations showing numerous thermal anomalies.

Photograph #114:



Photograph #115:

Overall view of east and partial north elevations showing numerous thermal anomalies.

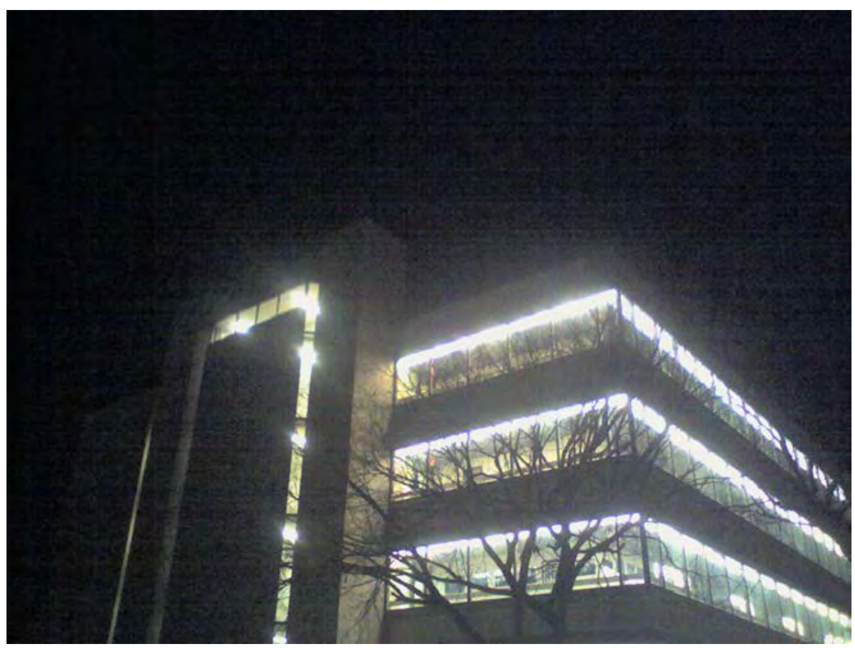


Photograph #116:

Photograph #117:

Overall view of east and partial north elevations showing numerous thermal anomalies.

Photograph #118:



Photograph #119:

Detail view of east elevation at grade. Note thermal anomalies caused by air leakage around windows.

Photograph #120:

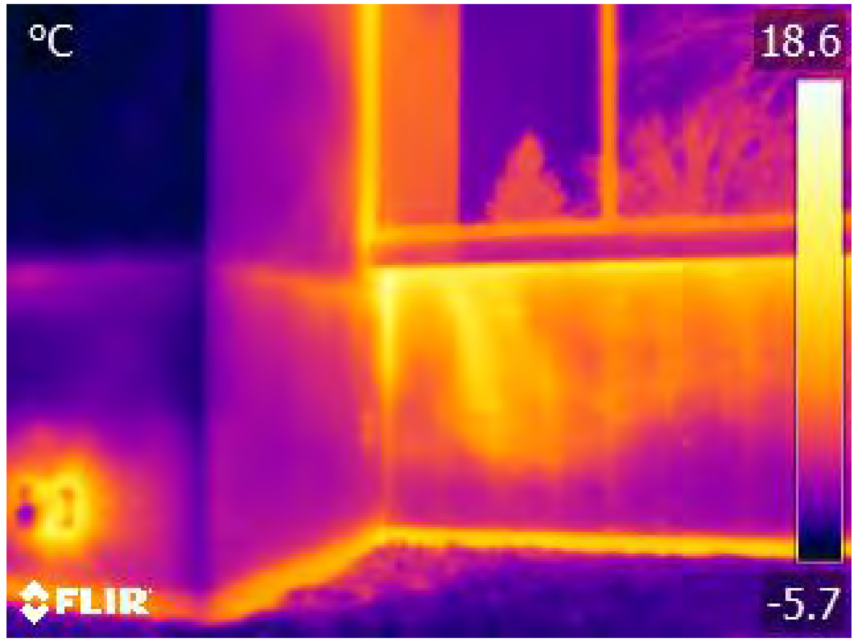
Photograph #121:

Detail view of east elevation. Note thermal anomalies caused by air leakage around and below the windows.

Photograph #122:

Photograph #123:

Detail view of east elevation. Note thermal anomalies caused by air leakage at window sill and mechanical penetration.

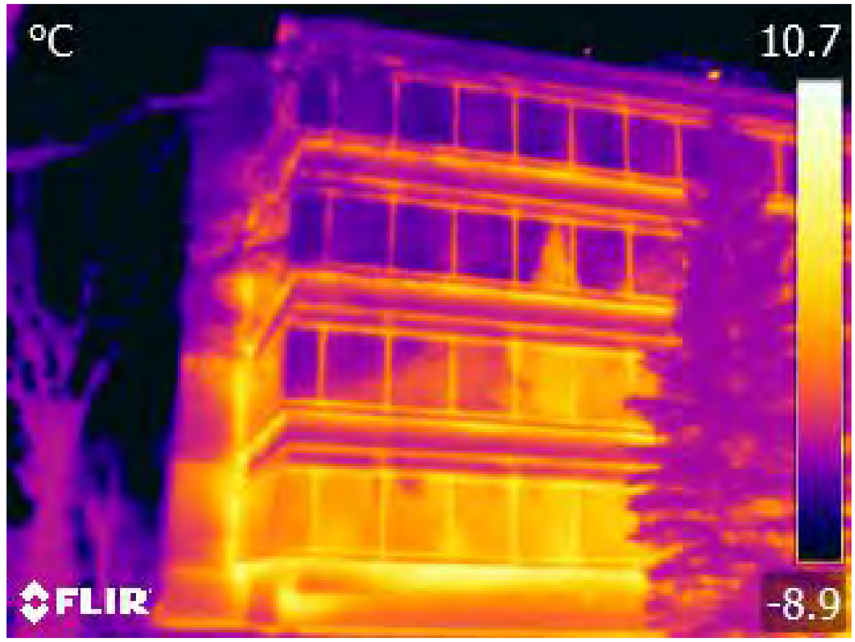


Photograph #124:

6.3 North Elevation

Photograph #125:

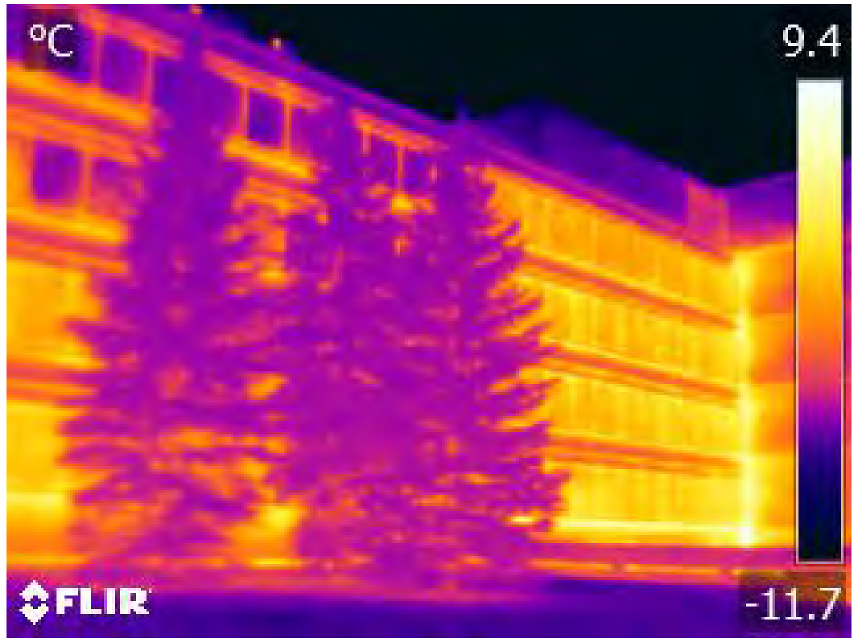
Partial east and north elevations. Note thermal anomalies around window framing caused by air leakage.



Photograph #126:

Photograph #127:

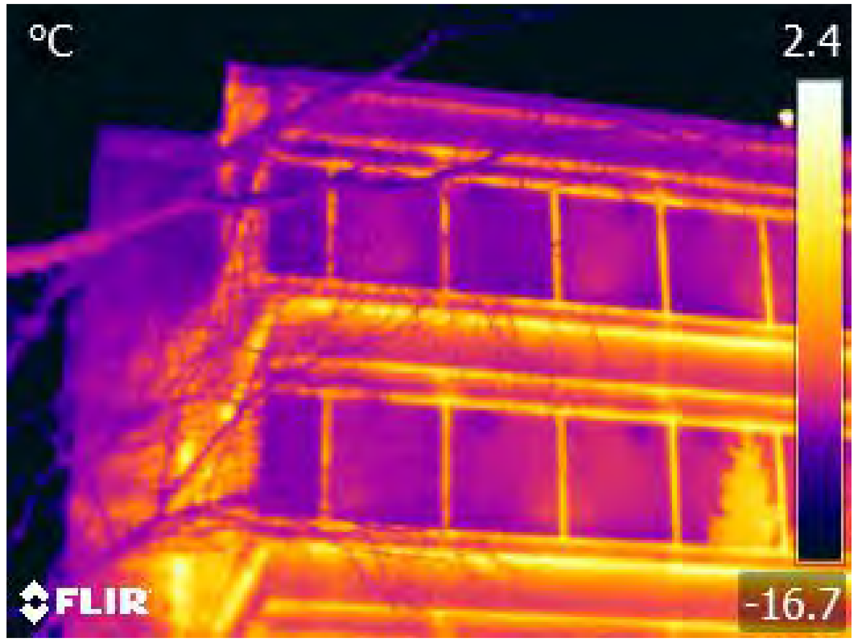
Overall north elevation.



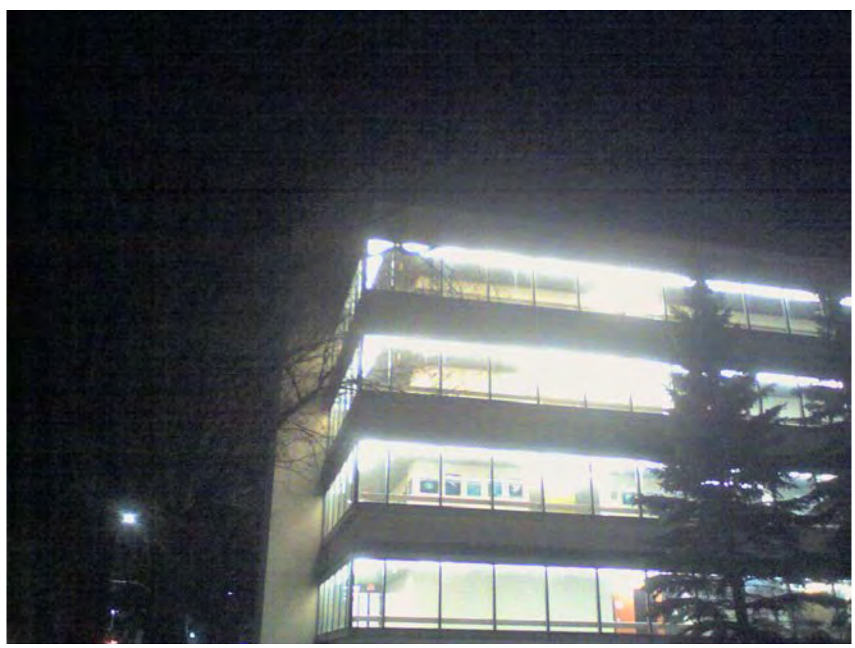
Photograph #128:

Photograph #129:

Detail view of north elevation at upper east end. Note thermal anomalies caused by air leakage at and around window framing.

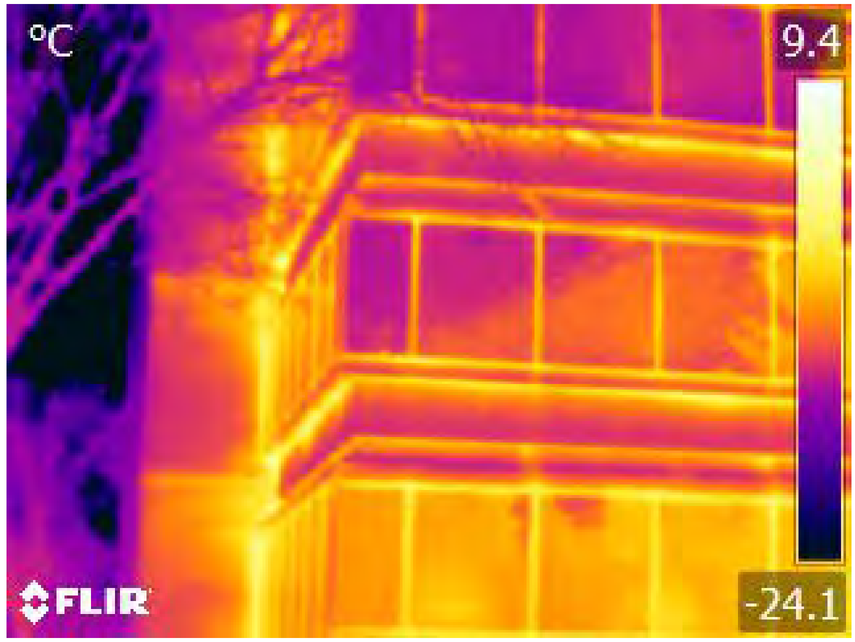


Photograph #130:



Photograph #131:

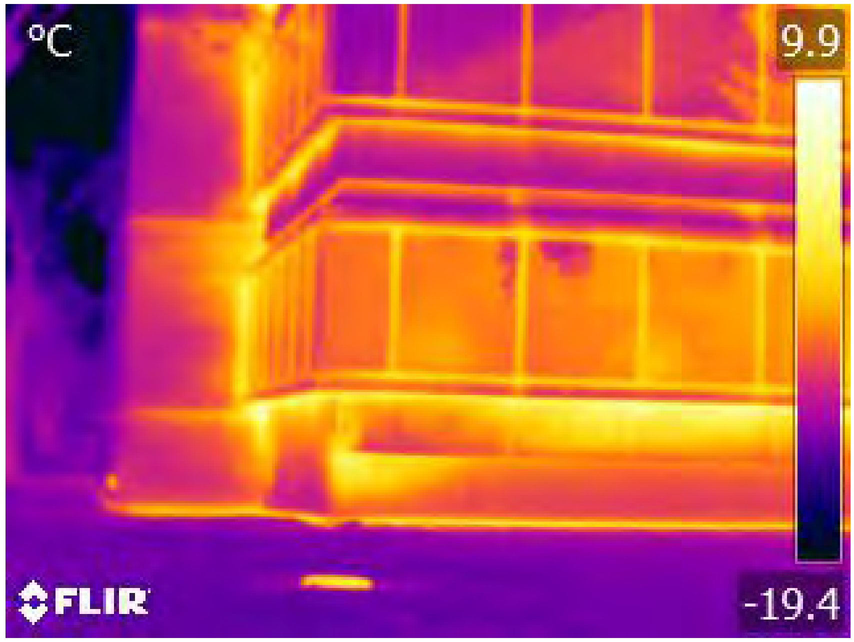
Detail view of north elevation at east end. Note thermal anomalies caused by air leakage at and around window framing.



Photograph #132:

Photograph #133:

Detail view of north elevation at east end near grade. Note thermal anomalies caused by air leakage at and around window framing.



Photograph #134:

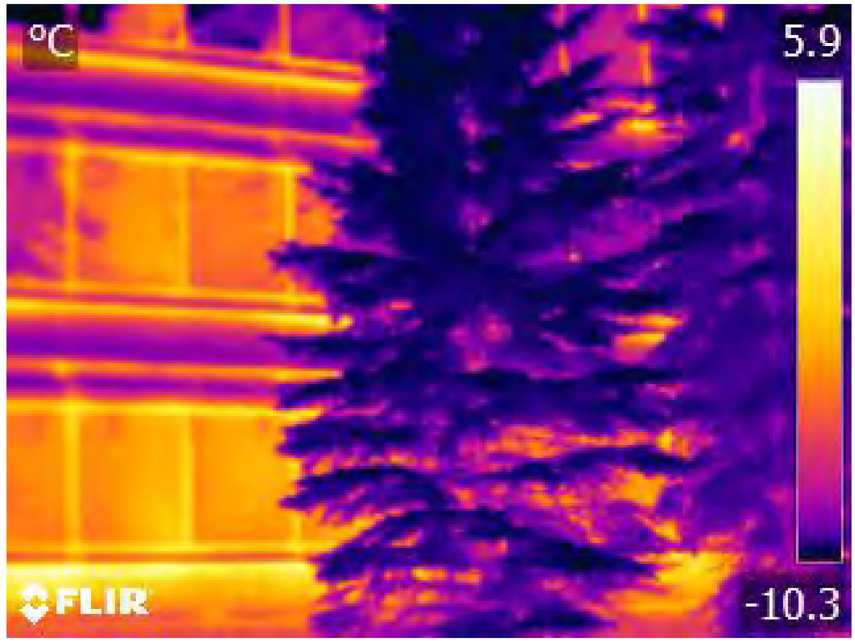
Photograph #135:

Detail view of north elevation. Note thermal anomalies caused by air leakage at and around window framing.

Photograph #136:

Photograph #137:

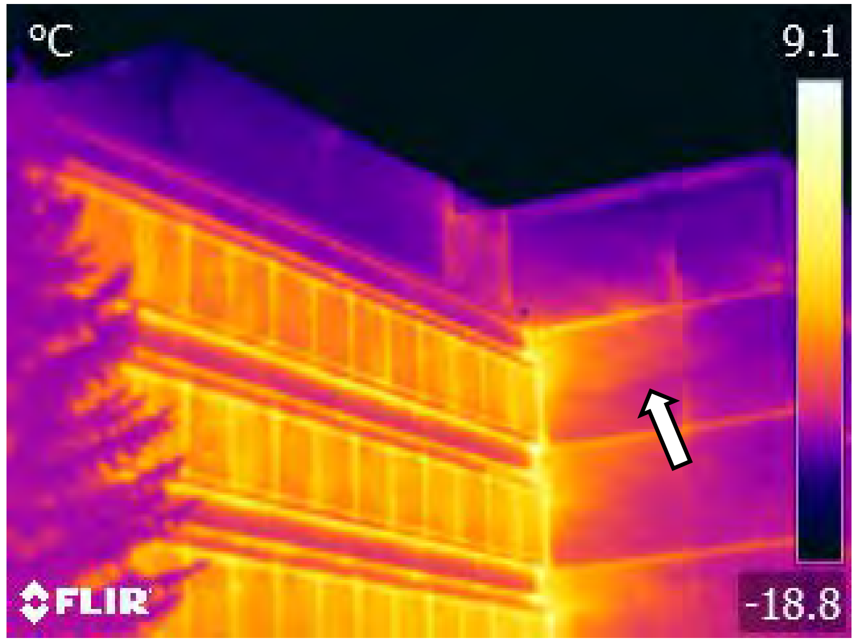
Detail view of north elevation. Note thermal anomalies caused by air leakage at and around window framing.



Photograph #138:

Photograph #139:

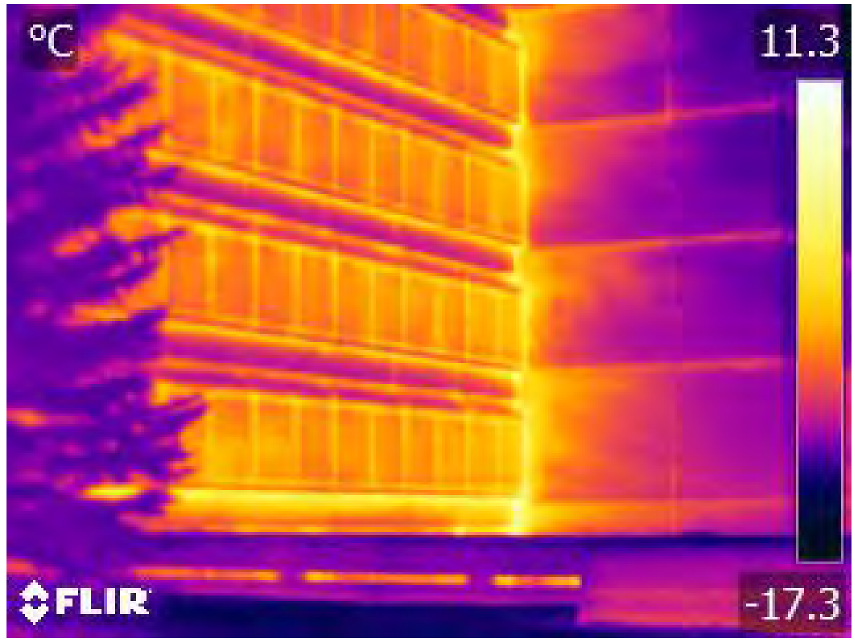
Detail view of north elevation at upper west end. Note thermal anomalies caused by air leakage at and around window framing.



Photograph #140:

Photograph #141:

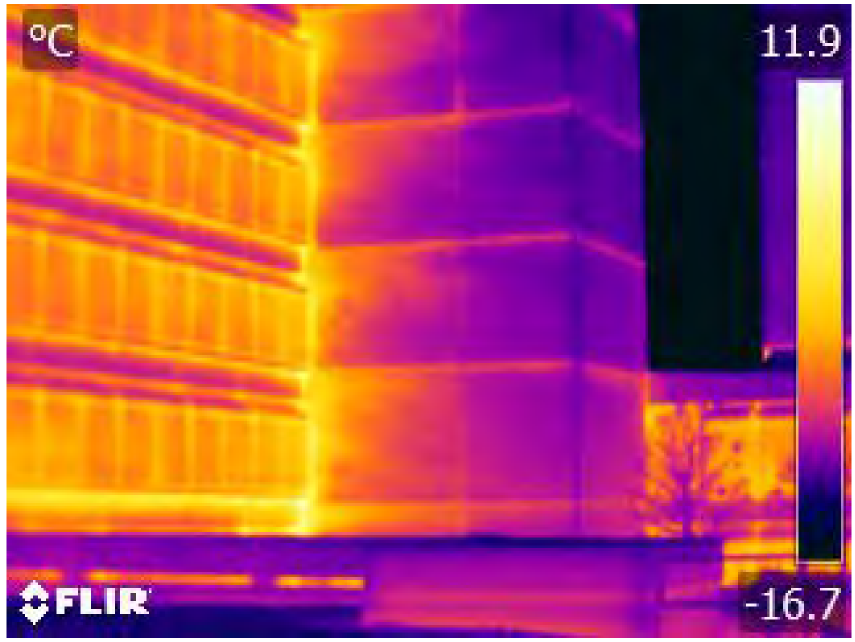
Detail view of north elevation at upper west end. Note thermal anomalies caused by air leakage at and around window framing.



Photograph #142:

Photograph #143:

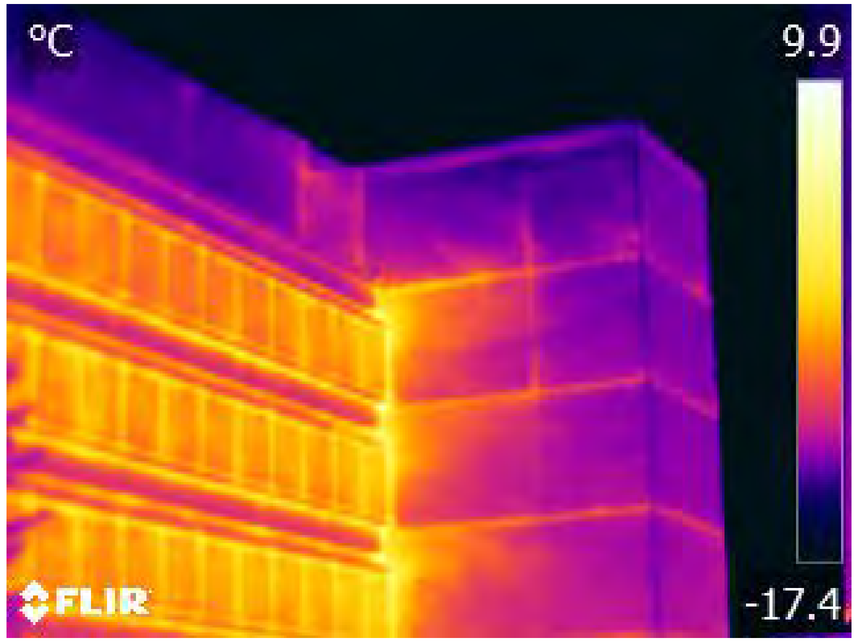
Detail view of north elevation at upper west end. Note thermal anomalies caused by air leakage at and around window framing.



Photograph #144:

Photograph #145:

Detail view of north elevation at upper west end. Note thermal anomalies caused by air leakage at and around window framing.



Photograph #146:

Photograph #147:

Detail view of north elevation. Note thermal anomalies caused by air leakage at and around window framing.

Photograph #148:

Photograph #149:

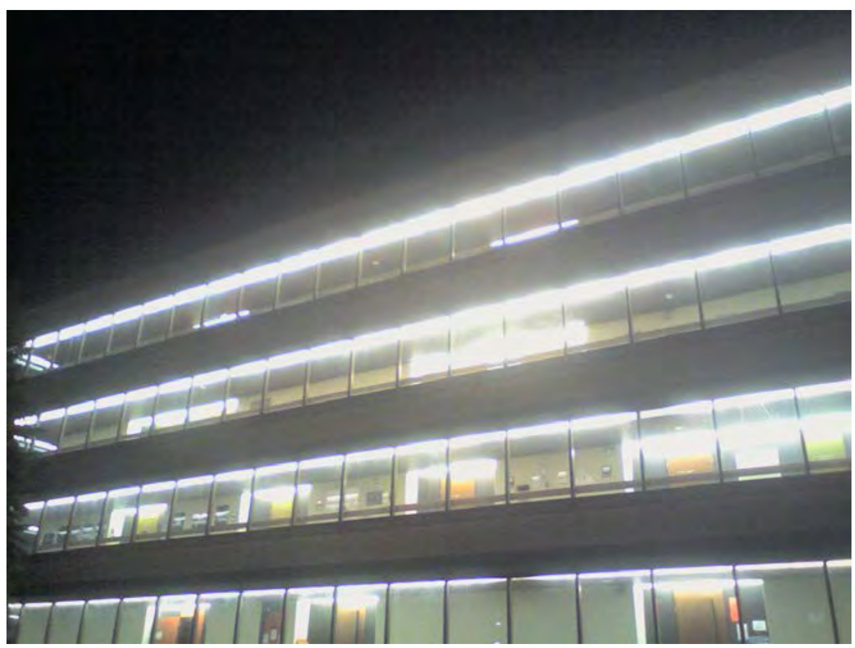
Detail view of north elevation. Note thermal anomalies caused by air leakage at and around window framing.

Photograph #150:

Photograph #151:

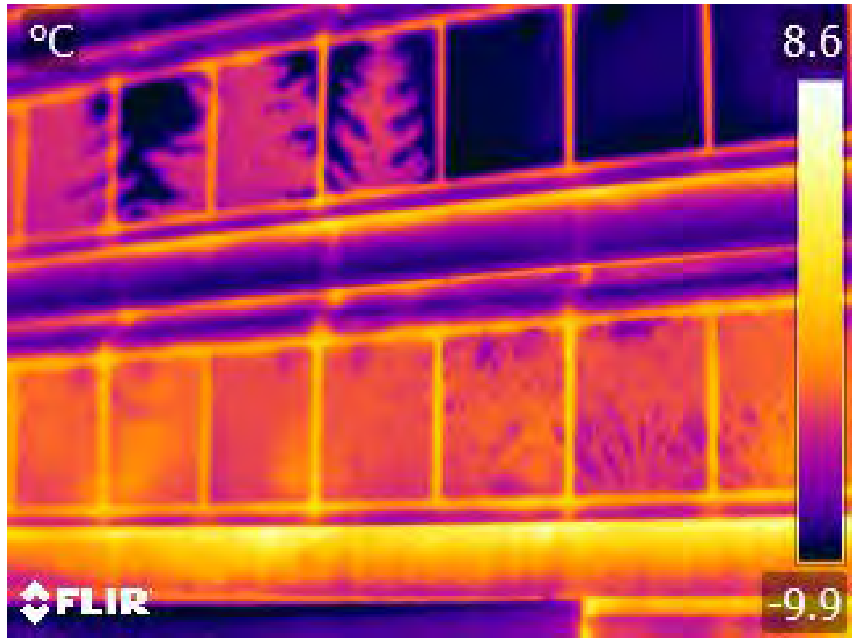
Detail view of north elevation. Note thermal anomalies caused by air leakage at and around window framing.

Photograph #152:



<u>Photograph #153:</u>

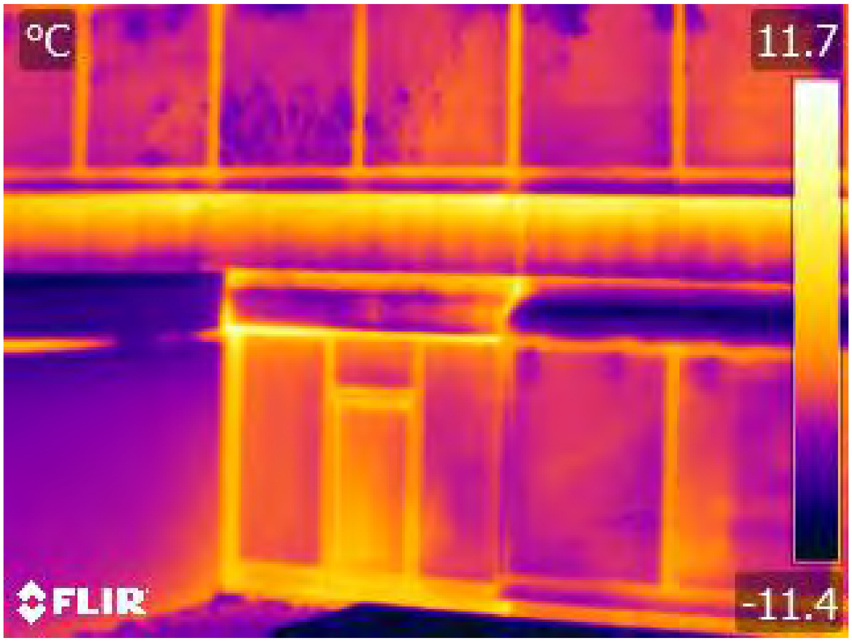
Detail view of north elevation. Note thermal anomalies caused by air leakage at and around window framing.



<u>Photograph #154:</u>

Photograph #155:

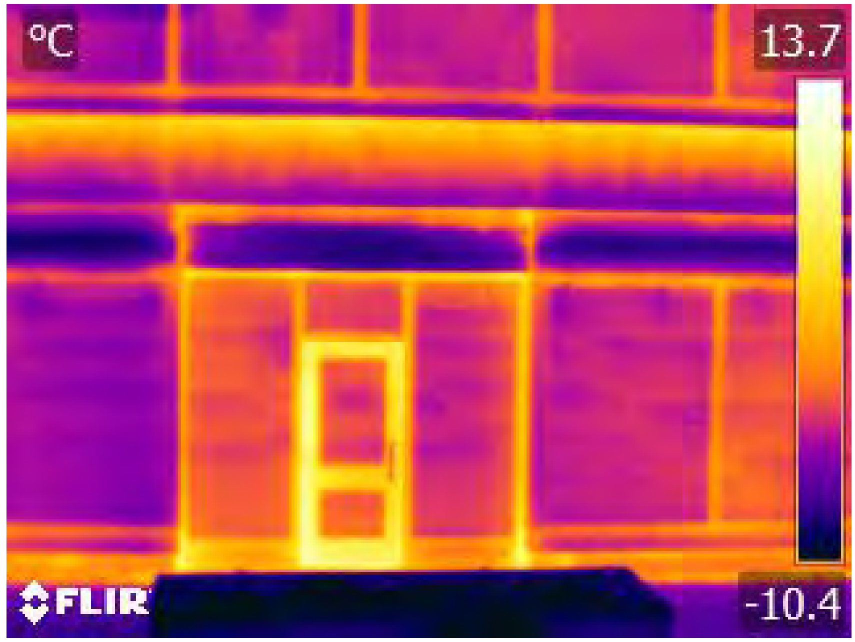
Detail view of north elevation.



Photograph #156:

Photograph #157:

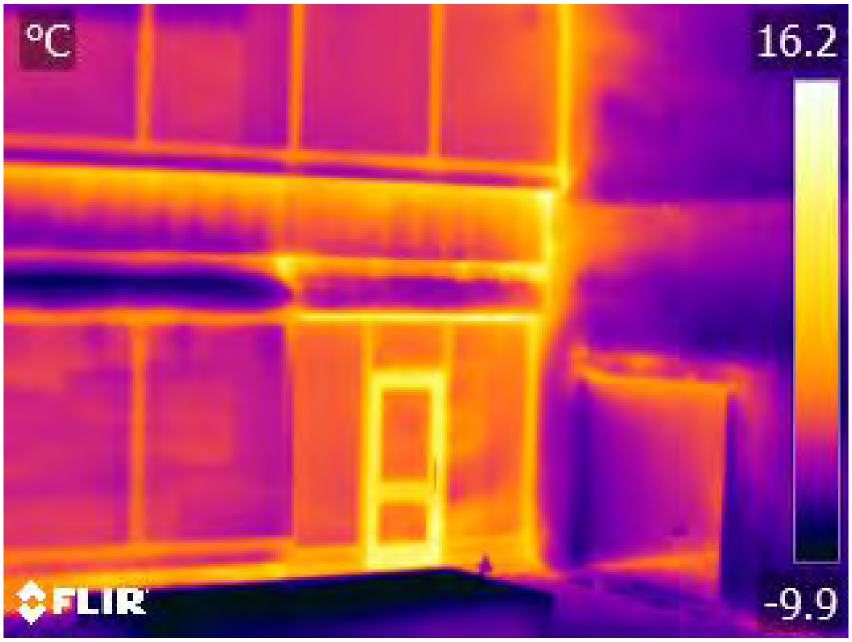
Detail view of north elevation.



Photograph #158:

Photograph #159:

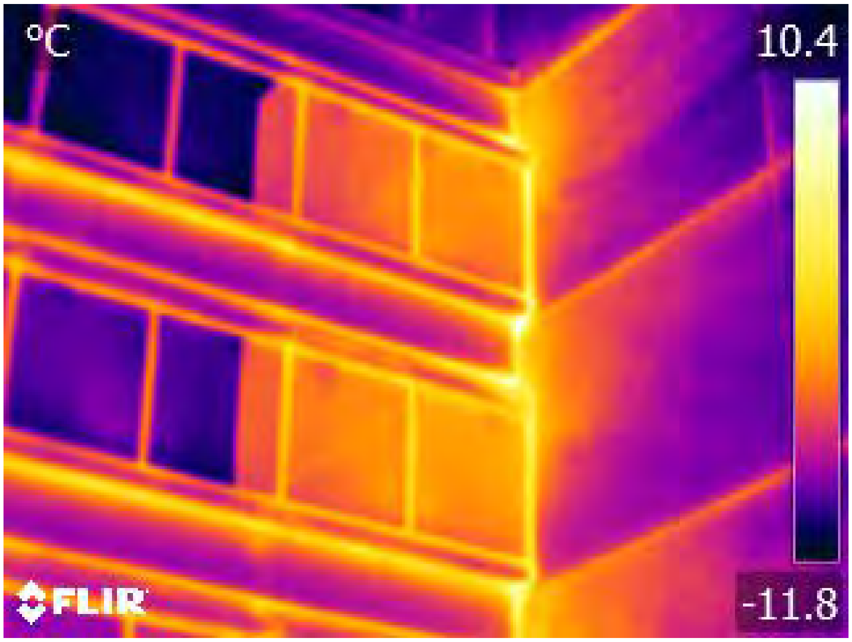
Detail view of north elevation. Note thermal anomalies caused by air leakage at and around window framing.



Photograph #160:

Photograph #161:

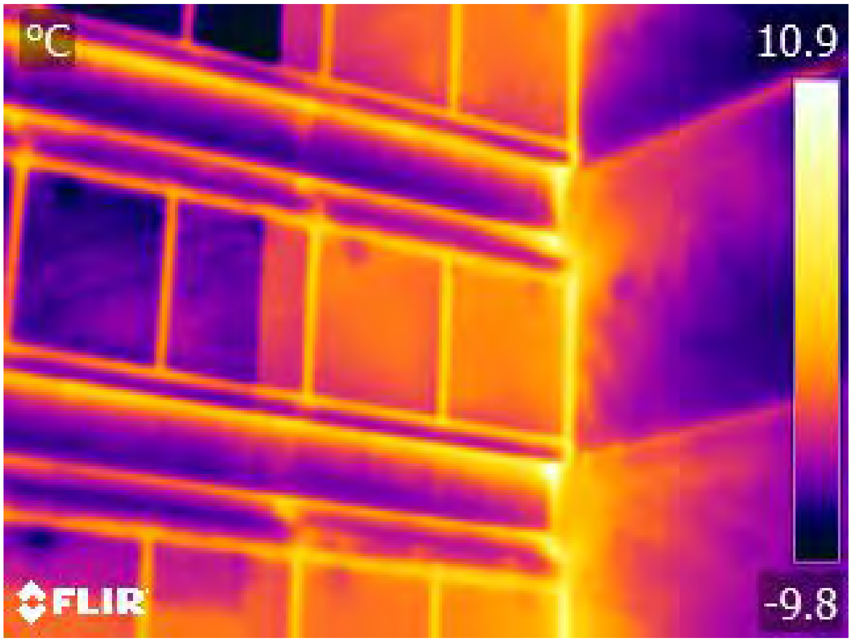
Detail view of north elevation. Note thermal anomalies caused by air leakage at and around window framing.



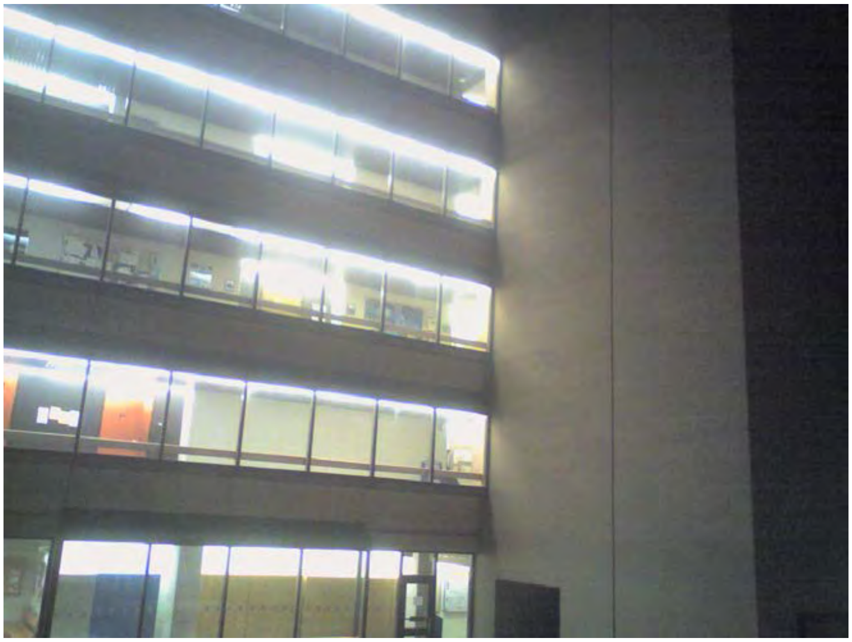
Photograph #162:

Photograph #163:

Detail view of north elevation. Note thermal anomalies caused by air leakage at and around window framing.

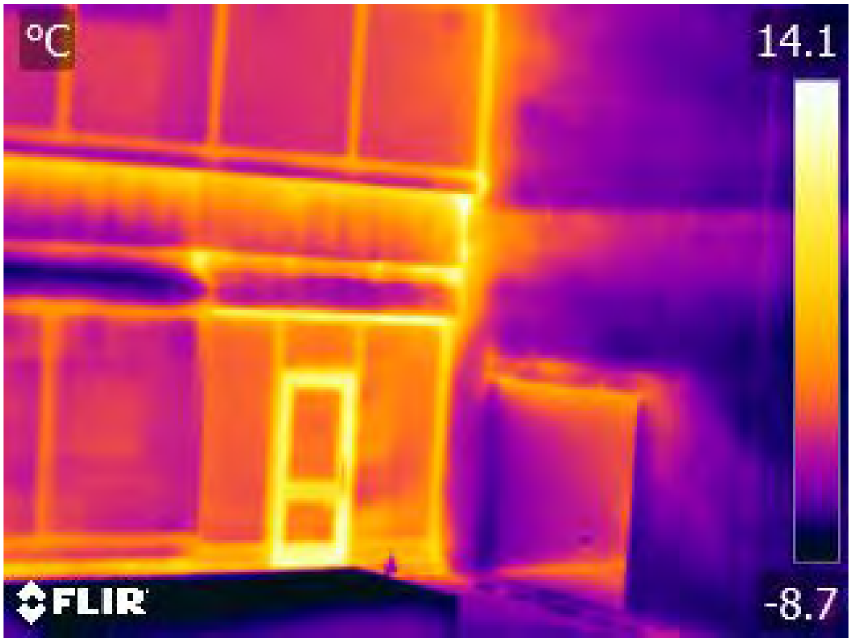


Photograph #164:



Photograph #165:

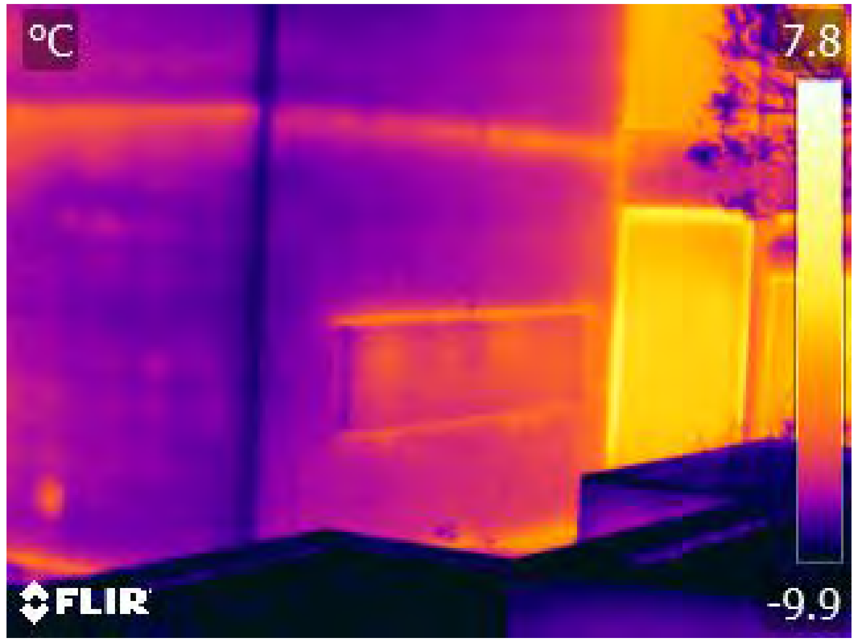
Detail view of north elevation. Note thermal anomalies caused by air leakage at and around window framing.



Photograph #166:

Photograph #167:

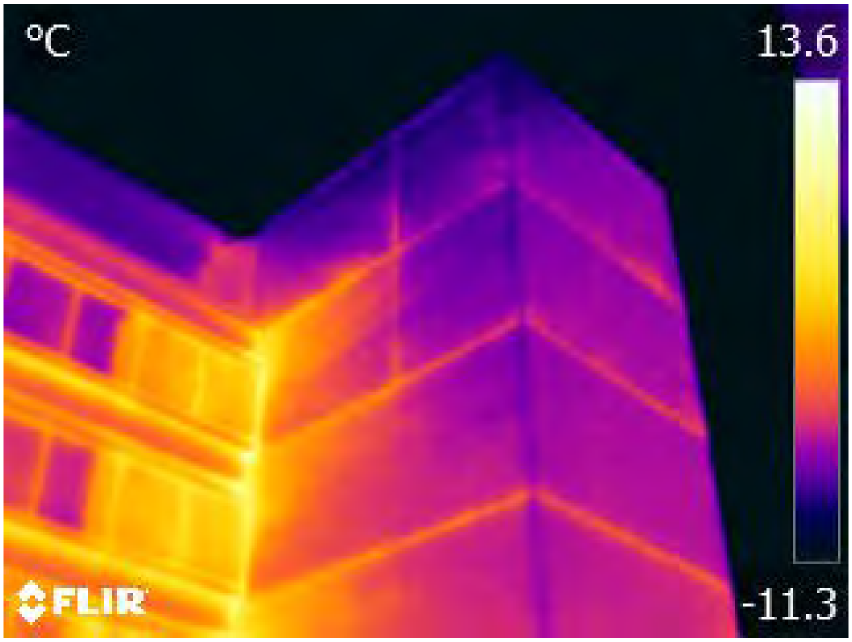
Detail view of north elevation.



Photograph #168:

Photograph #169:

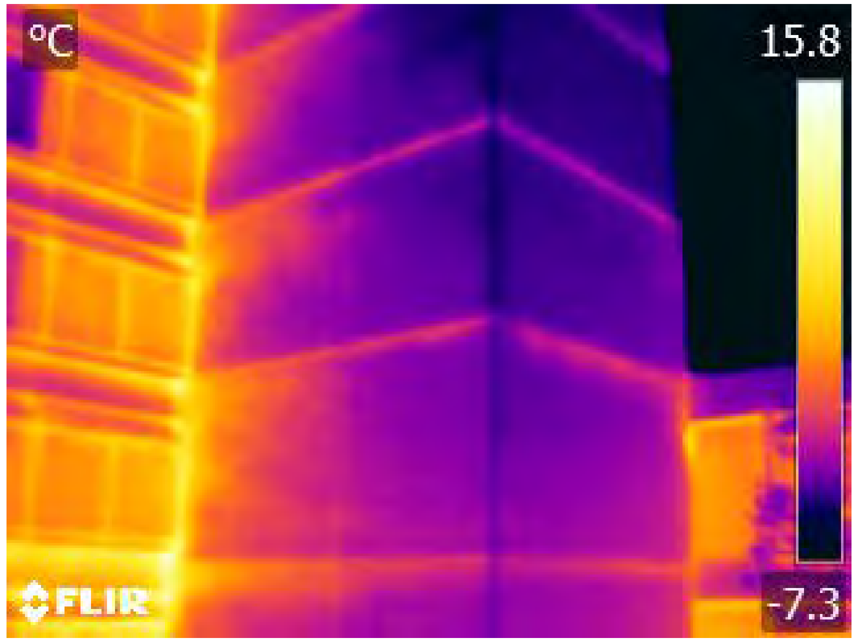
Detail view of north elevation. Note thermal anomalies caused by air leakage at and around window framing.



Photograph #170:

Photograph #171:

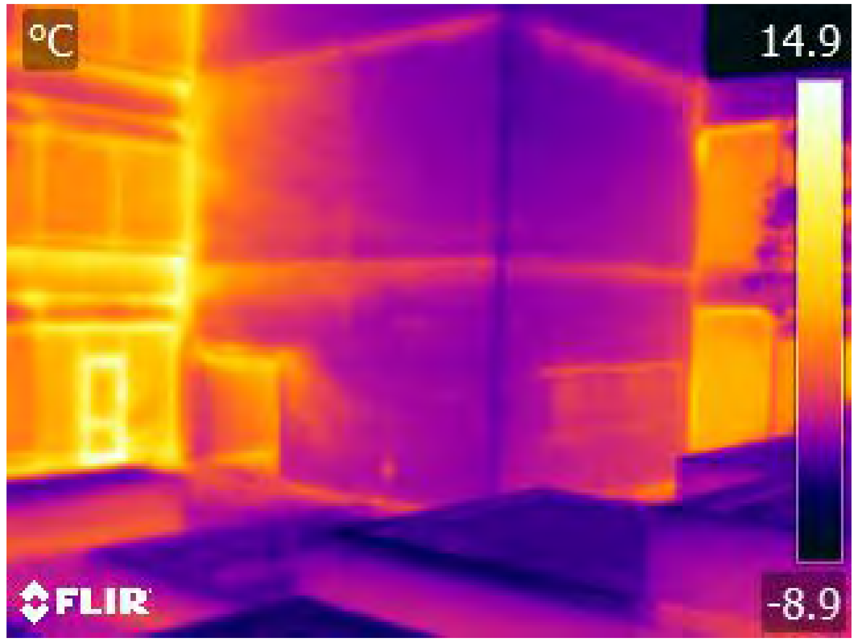
Detail view of north elevation. Note thermal anomalies caused by air leakage at and around window framing.



Photograph #172:

Photograph #173:

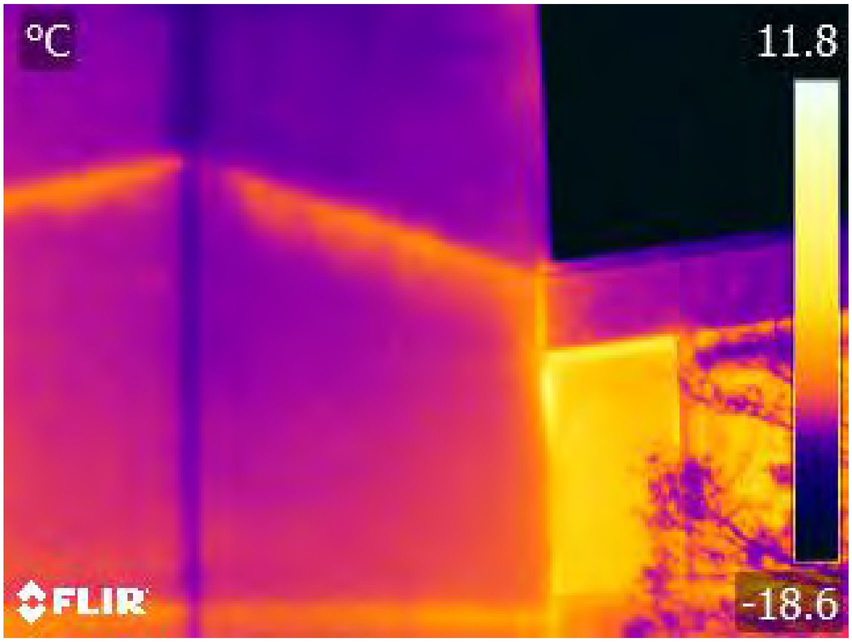
Detail view of north elevation. Note thermal anomalies caused by air leakage at and around window framing.



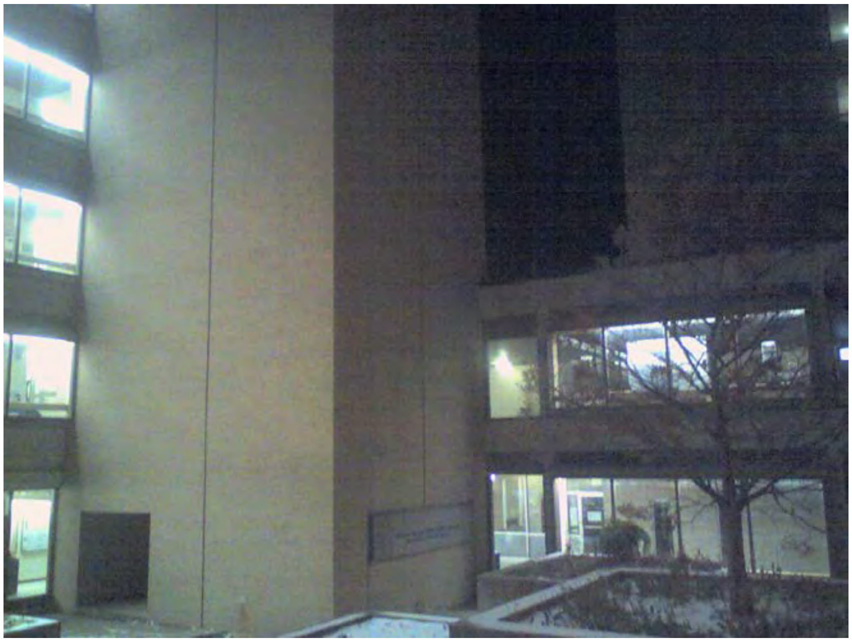
Photograph #174:

Photograph #175:

Detail view of north elevation. Note thermal anomalies caused by air leakage and thermal bridging.



Photograph #176:



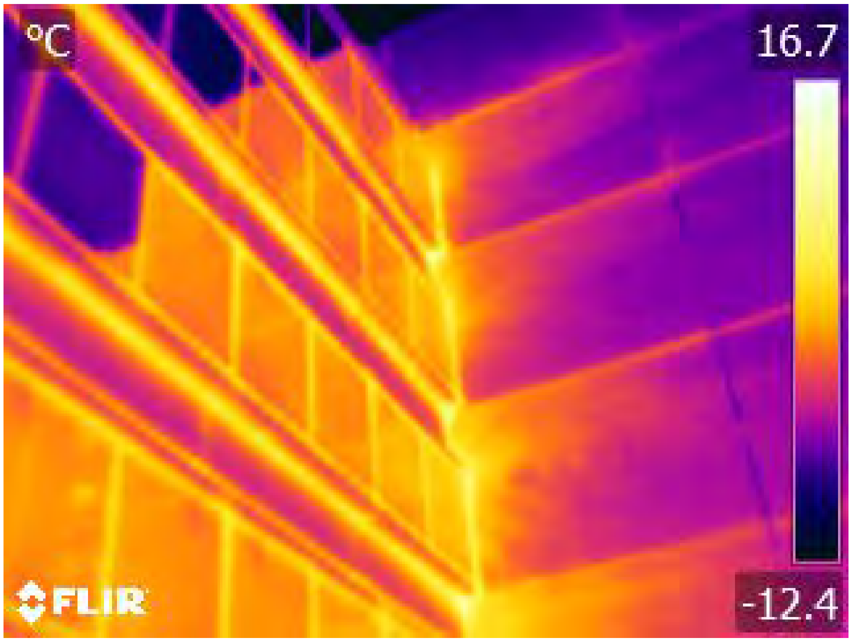
Photograph #177:

Detail view of north elevation. Note thermal anomalies caused by air leakage at and around window framing.

Photograph #178:

Photograph #179:

Detail view of north elevation. Note thermal anomalies caused by air leakage at and around window framing.

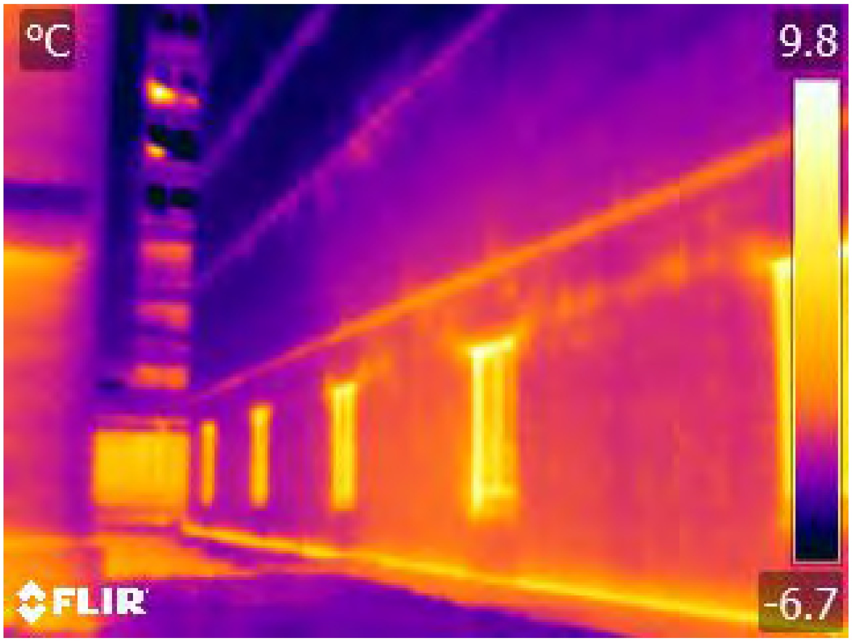


Photograph #180:

6.4 West Elevation

Photograph #181:

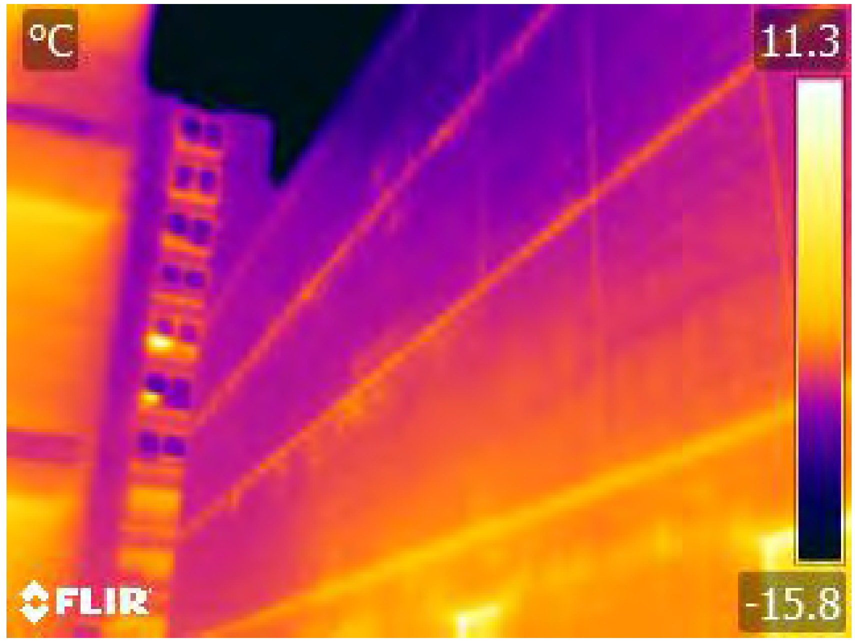
Partial west elevation. Note anomalies caused by air leakage and thermal bridging.



Photograph #182:

Photograph #183:

Partial west elevation. Note anomalies caused by air leakage and thermal bridging.



Photograph #184:

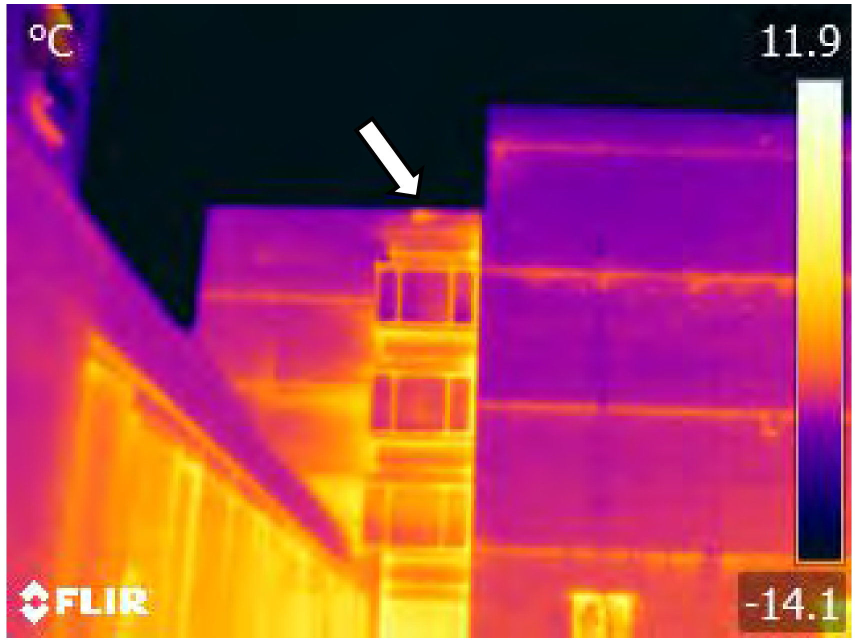
Photograph #185:

Partial west elevation. Note anomalies caused by air leakage and thermal bridging.

Photograph #186:

Photograph #187:

Partial west elevation. Note anomalies caused by air leakage and thermal bridging.



Photograph #188:

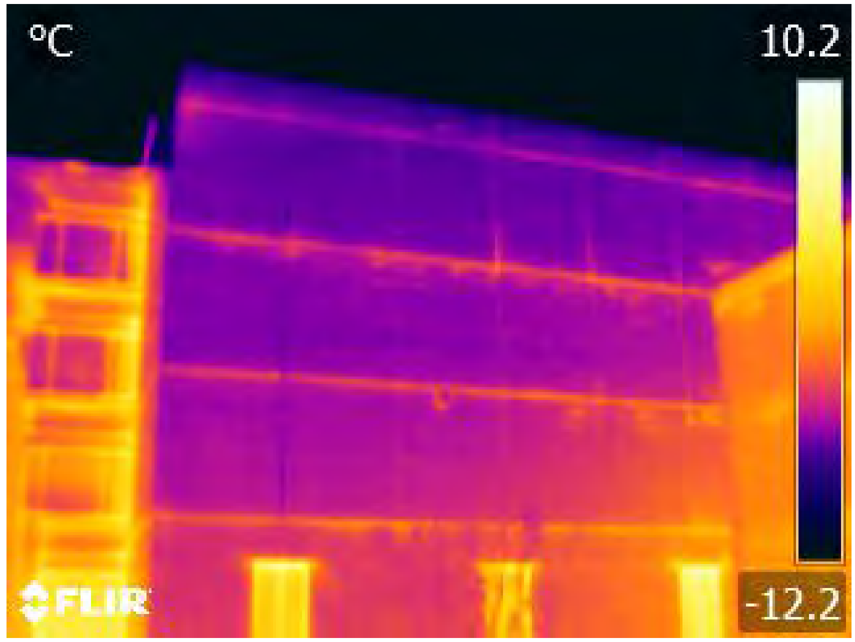
Photograph #189:

Partial west elevation. Note anomalies caused by air leakage and thermal bridging.

Photograph #190:

Photograph #191:

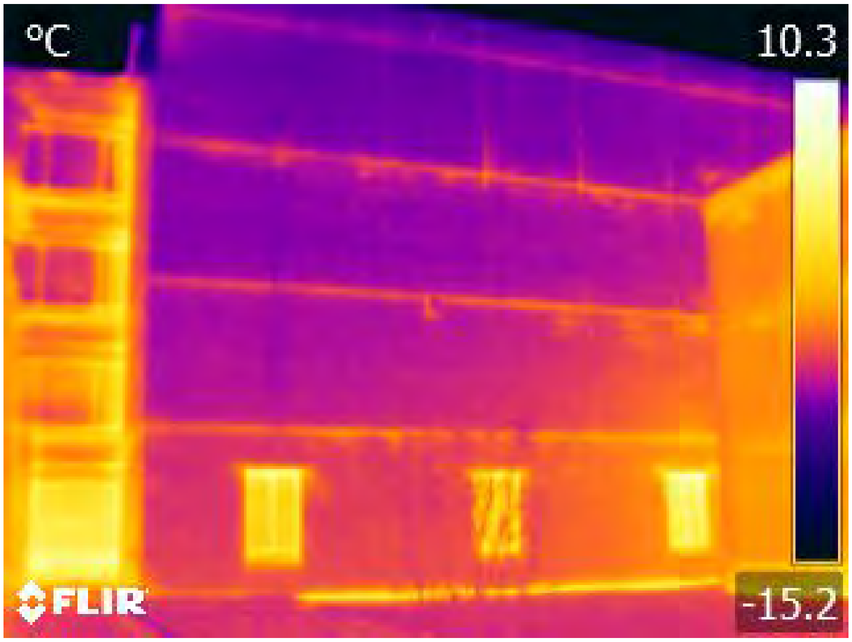
Partial west elevation. Note anomalies caused by air leakage and thermal bridging.



Photograph #192:

Photograph #193:

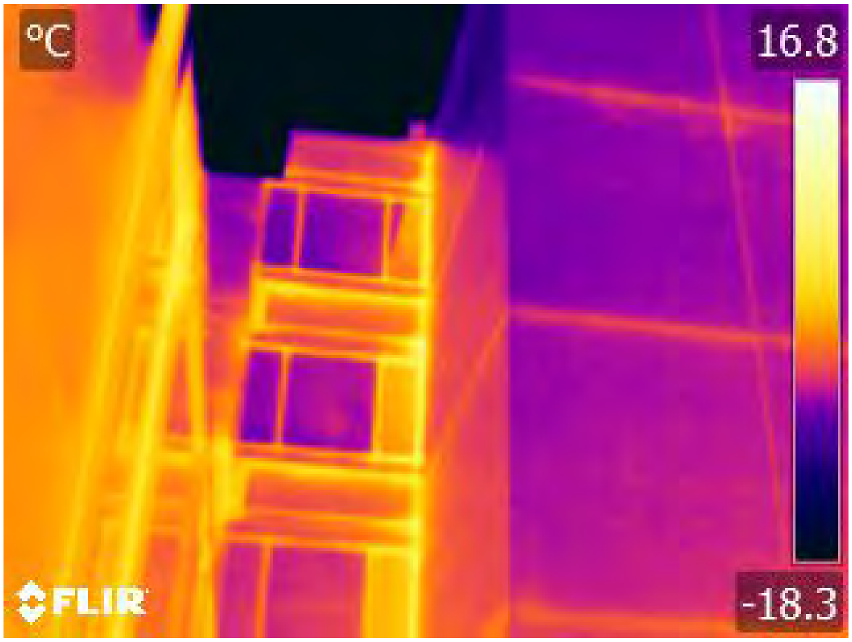
Partial west elevation. Note anomalies caused by air leakage and thermal bridging.



Photograph #194:

Photograph #195:

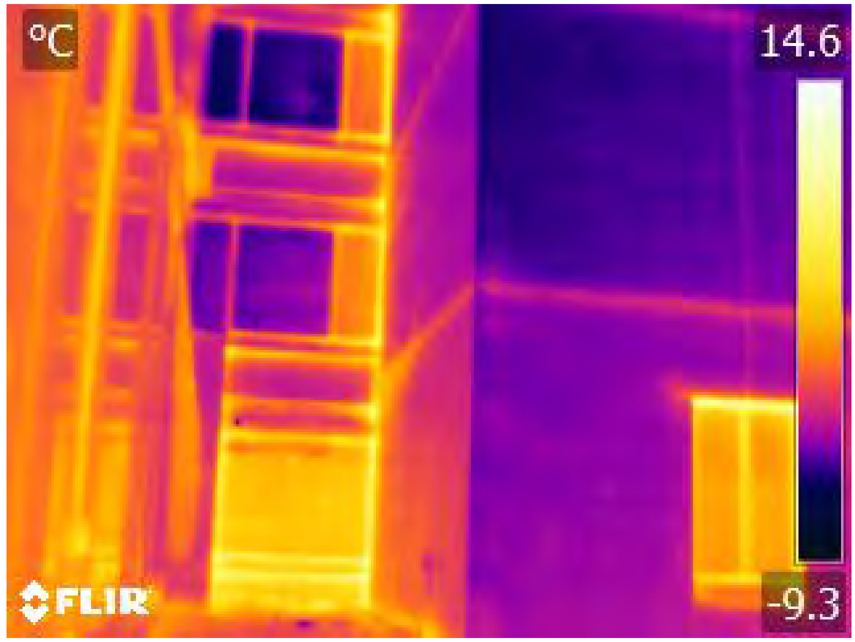
Partial west elevation. Note anomalies caused by air leakage and thermal bridging.



Photograph #196:

Photograph #197:

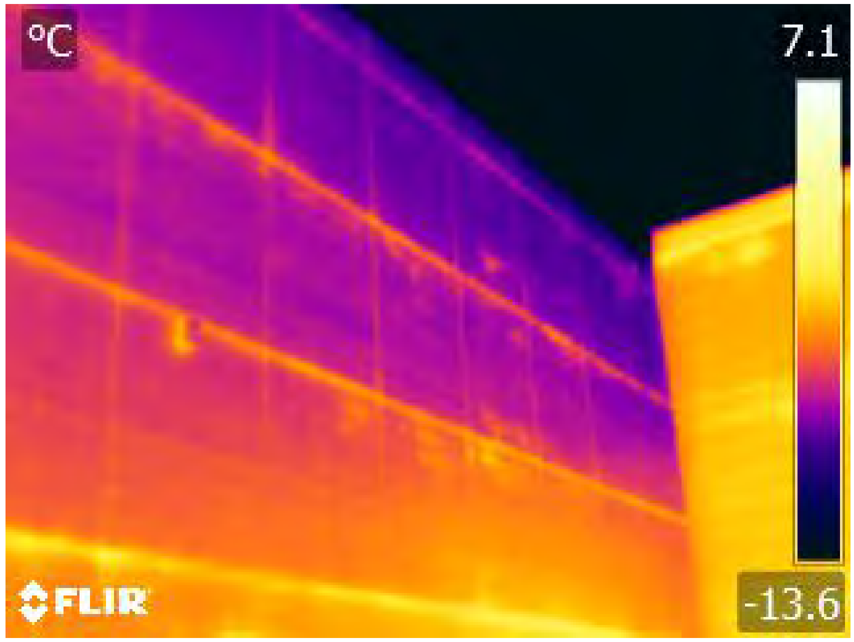
Partial west elevation. Note anomalies caused by air leakage and thermal bridging.



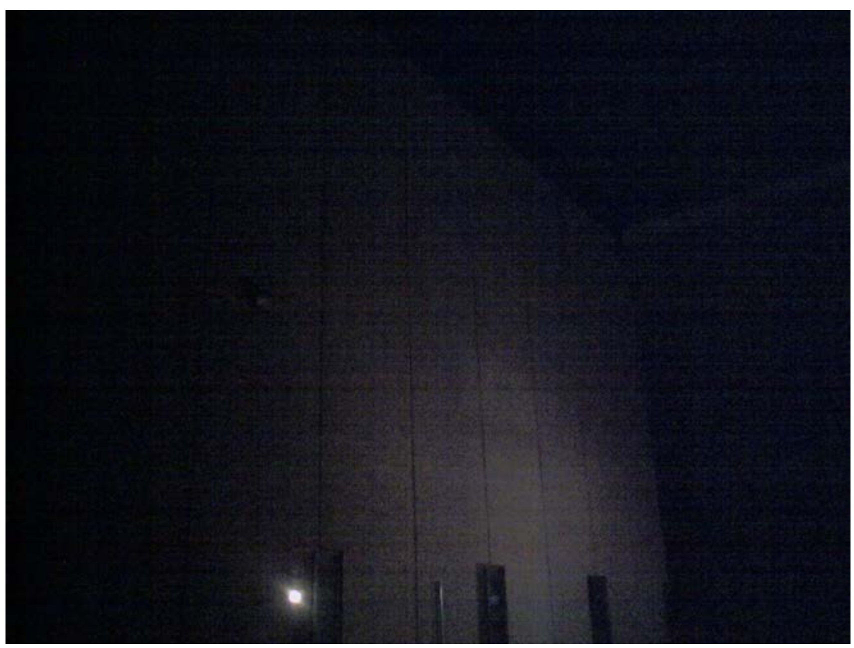
Photograph #198:

Photograph #199:

Partial west elevation. Note anomalies caused by air leakage and thermal bridging.

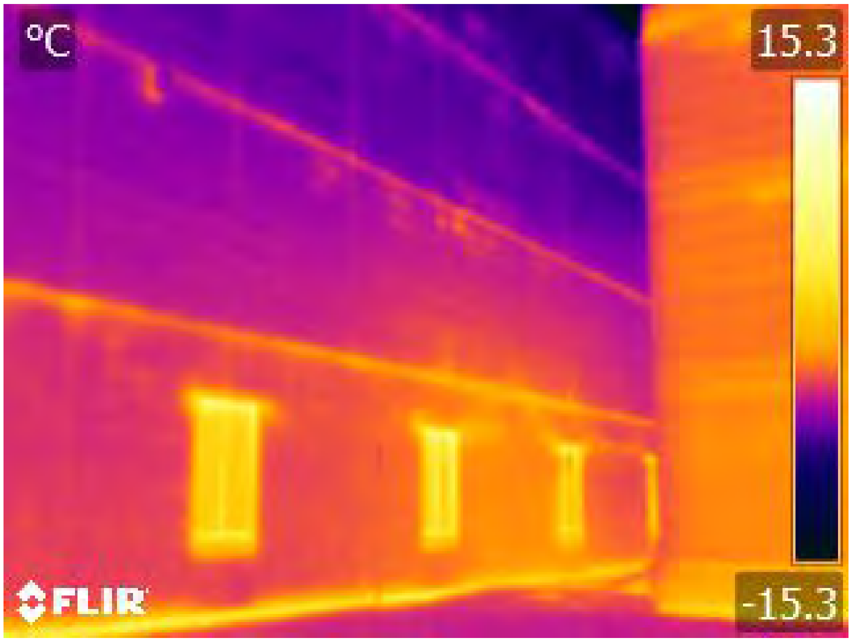


Photograph #200:



Photograph #201:

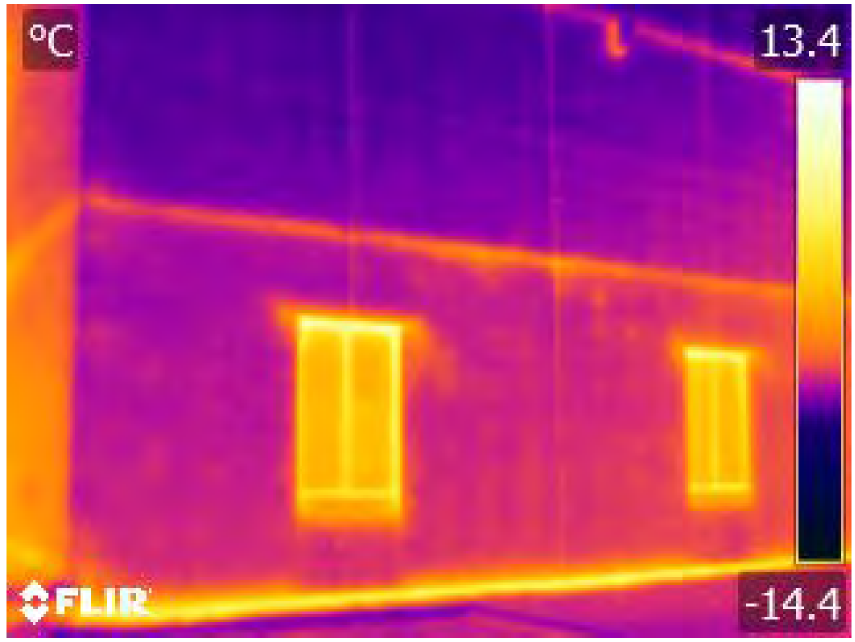
Partial west elevation. Note anomalies caused by air leakage and thermal bridging.



Photograph #202:

Photograph #203:

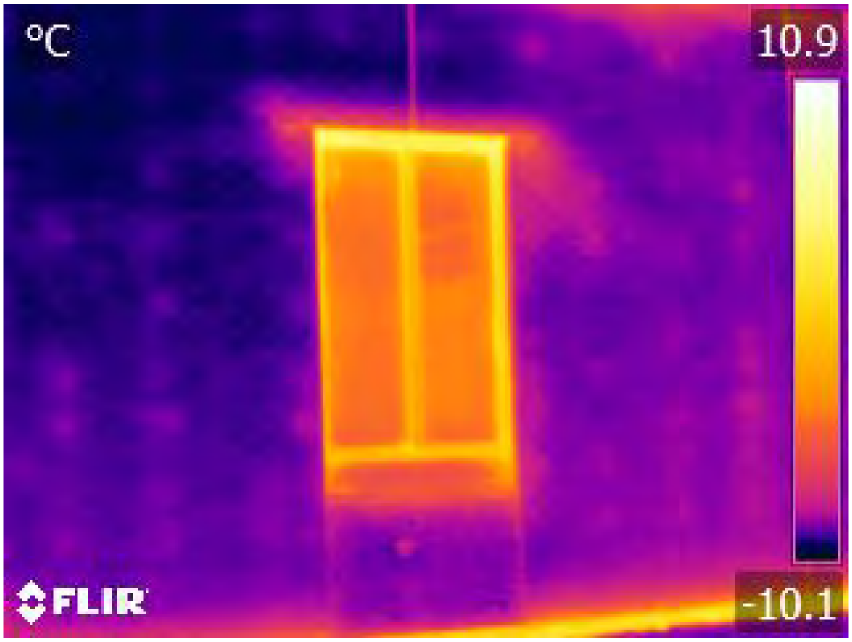
Partial west elevation. Note anomalies caused by air leakage and thermal bridging.



Photograph #204:

Photograph #205:

Partial west elevation. Note anomalies caused by air leakage and thermal bridging at window.



Photograph #206:

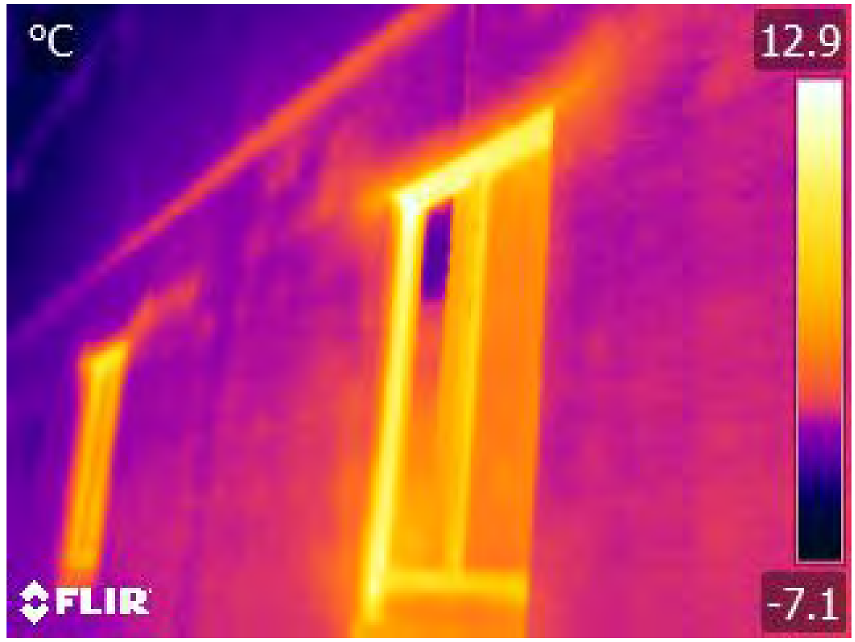
Photograph #207:

Partial west elevation. Note anomalies caused by thermal bridging at foundation wall.

Photograph #208:

Photograph #209:

Partial west elevation. Note anomalies caused by air leakage and thermal bridging.



Photograph #210:

Hourly Data Report for October 15, 2018

All times are specified in Local Standard Time (LST). Add 1 hour to adjust for Daylight Saving Time where and when it is observed.

BRANDON A
MANITOBA
Current Station Operator: NAVCAN

Latitude:	49°54'36.000" N
Longitude:	99°57'08.000" W
Elevation:	409.30 m
Climate ID:	5010481
WMO ID:	71140
TC ID:	YBR

TIME	Temp °C	Dew Point Temp °C	Rel Hum %	Wind Dir 10's deg	Wind Spd km/h	Visibility km	Stn Press kPa	Hmdx	Wind Chill	Weather
00:00	-11.4	-13.5	85	26	6	24.1	97.25		-15	Clear
01:00	-11.7	-13.8	85	26	8	24.1	97.20		-16	NA
02:00	-11.8	-13.6	87	26	10	24.1	97.14		-17	NA
03:00	-12.5	-14.2	87	23	8	24.1	97.04		-17	Clear
04:00	-12.6	-14.7	84	27	6	24.1	96.94		-17	NA

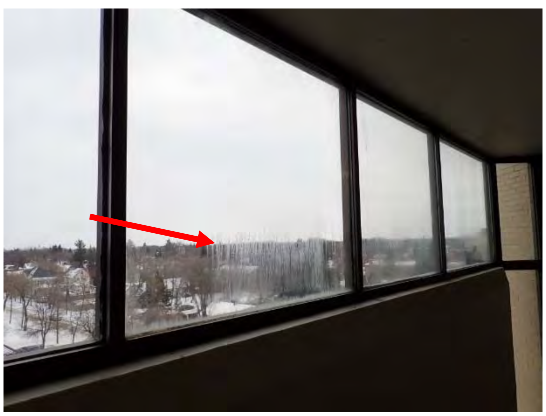
	Temp °C	Dew Point Temp °C	Rel Hum %	Wind Dir 10's deg	Wind Spd km/h	Visibility km	Stn Press kPa	Hmdx	Wind Chill	Weather
05:00	-9.1	-10.9	87	25	13	24.1	96.81		-15	NA
06:00	-10.0	-12.1	85	23	12	24.1	96.75		-16	Clear
07:00	-6.8	-9.2	83	23	20	24.1	96.58		-14	NA
08:00	-4.8	-8.1	78	24	17	24.1	96.45		-11	NA
09:00	-2.3	-6.4	74	24	18	24.1	96.30		-8	Mostly Cloudy
10:00	-0.8	-5.7	69	24	23	24.1	96.16		-7	NA
11:00	0.5	-4.7	68	26	23	24.1	96.10			NA
12:00	0.8	-2.6	78	23	23	24.1	96.00			Mostly Cloudy
13:00	4.2	-0.4	72	26	34	24.1	95.93			NA
14:00	6.5	0.9	67	27	32	24.1	95.84			NA
15:00	9.2	1.3	58	29	33	24.1	95.84			Mostly Cloudy
16:00	10.3	2.1	57	29	24	24.1	95.88			NA
17:00	9.9	1.9	57	31	20	24.1	95.90			NA
18:00	6.3	0.7	67	29	21	24.1	95.94			Mainly Clear
19:00	4.0	-0.6	72	28	18	24.1	95.97			NA
20:00	5.0	-0.3	68	26	22	24.1	96.00			NA
21:00	4.3	-0.4	71	28	23	24.1	96.05			Mainly Clear
22:00	4.2	-1.1	69	29	25	24.1	96.14			NA
23:00	1.2	-2.2	78	32	15	24.1	96.25			NA

APPENDIX F

Building Envelope Review Photographs

Photograph 1: Overview of curtain wall system along the north elevation.

Photograph 2: Showing typical office windows along the south elevation.



Photograph 3: Observed failed sealed glazing unit showing moisture and fogging between the glazing panes.

Photograph 4: Water streak marks along curtain wall mullion and stain marks on ceiling tiles (showing north elevation).

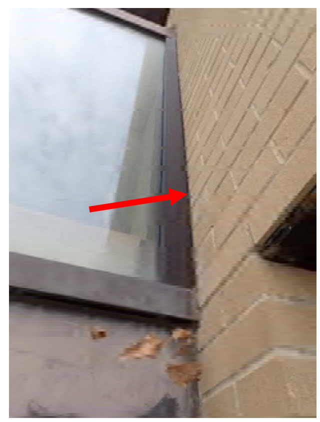
Photograph 5: Sealant applied at curtain wall mullion caps and sealed glazing unit interfaces (showing north elevation).

Photograph 6: Stains and deteriorated finish on the insulated metal panels. Note sealant applied at curtain wall mullion caps.

Photograph 7: Stains and deteriorated finish on the metal panels (east elevation windows).

Photograph 8: Silicone strip seal applied over the insulated metal panel joints and sealed to the panels with sealant.

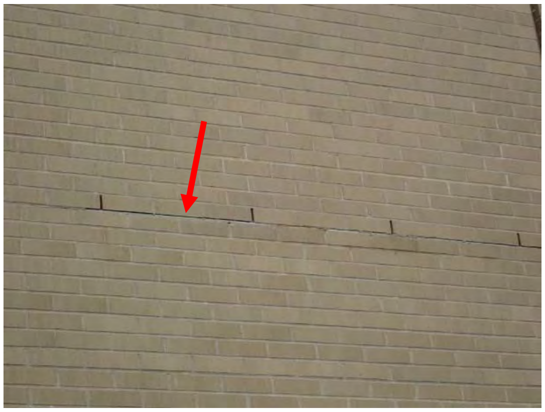
Photograph 9: Deteriorated sealant with gaps/voids at the rough opening



Photograph 10: No sealant along the exterior rough opening.

Photograph 11: Damaged stone dash finish was noted at isolated locations.

Photograph 12: Deterioration of mortar joints below the brick shelf angles at the floor line.



Photograph 13: Deteriorated mortar at the steel shelf angle showing the exposed edge of the angel and weep holes.

Photograph 14: Cracked and damaged bricks along exterior corner of the balcony side wall at the south elevation.

Photograph 15: Cracked and damaged bricks along exterior corner of the balcony side wall at the south elevation. Note different brick installed at this location.

Photograph 16: Typical vertical brick control joint with metal flashing.

Photograph 17: Dislodged metal flashing along roof parapet.

Photograph 18: Dislodged metal cap flashing along the roof parapet. Note missing metal flashing at brick control joint.

APPENDIX G

Structural, Mechanical & Electrical Concept Development

- Drawings and Basis of Design

1 FOUNDATION
S-1 3/32" = 1'-0"

#	REVISION	DATE	BY

WOLFROM ENGINEERING LTD
CONSULTING ENGINEERS
345 WARDLAW AVENUE
WINNIPEG,CANADA R3L 0L5
(204)452-0041 FAX:284-8680
E-Mail: info@wolfromeng.com

SEAL

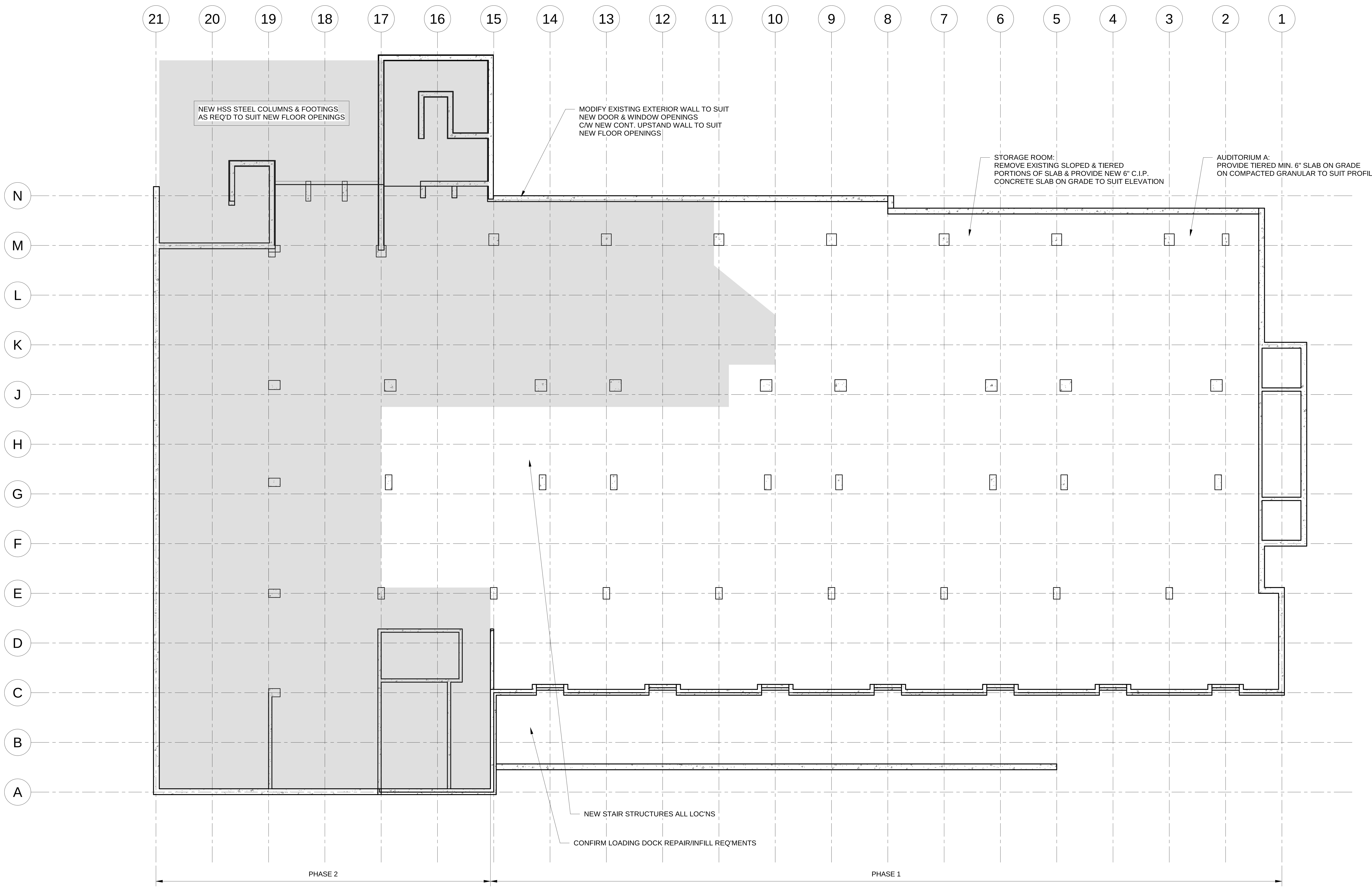
PRELIMINARY
NOT FOR CONSTRUCTION

JOB TITLE
BRANDON UNIVERSITY

270 - 18TH STREET
BRANDON, MB

DRAWING TITLE
FOUNDATION FRAMING PLAN

DRAWN BY	SCALE	DRAWING NO.
MNF	3/32" = 1'-0"	S-1
FILE NO.	DATE	REVISION NO.
W18139	NOV. 2018	



1 GROUND FLOOR
S-2 3/32" = 1'-0"

#	REVISION	DATE	BY

WOLFROM ENGINEERING LTD
CONSULTING ENGINEERS
345 WARDLAW AVENUE
WINNIPEG,CANADA R3L 0L5
(204)452-0041 FAX:284-8680
E-Mail: info@wolfromeng.com

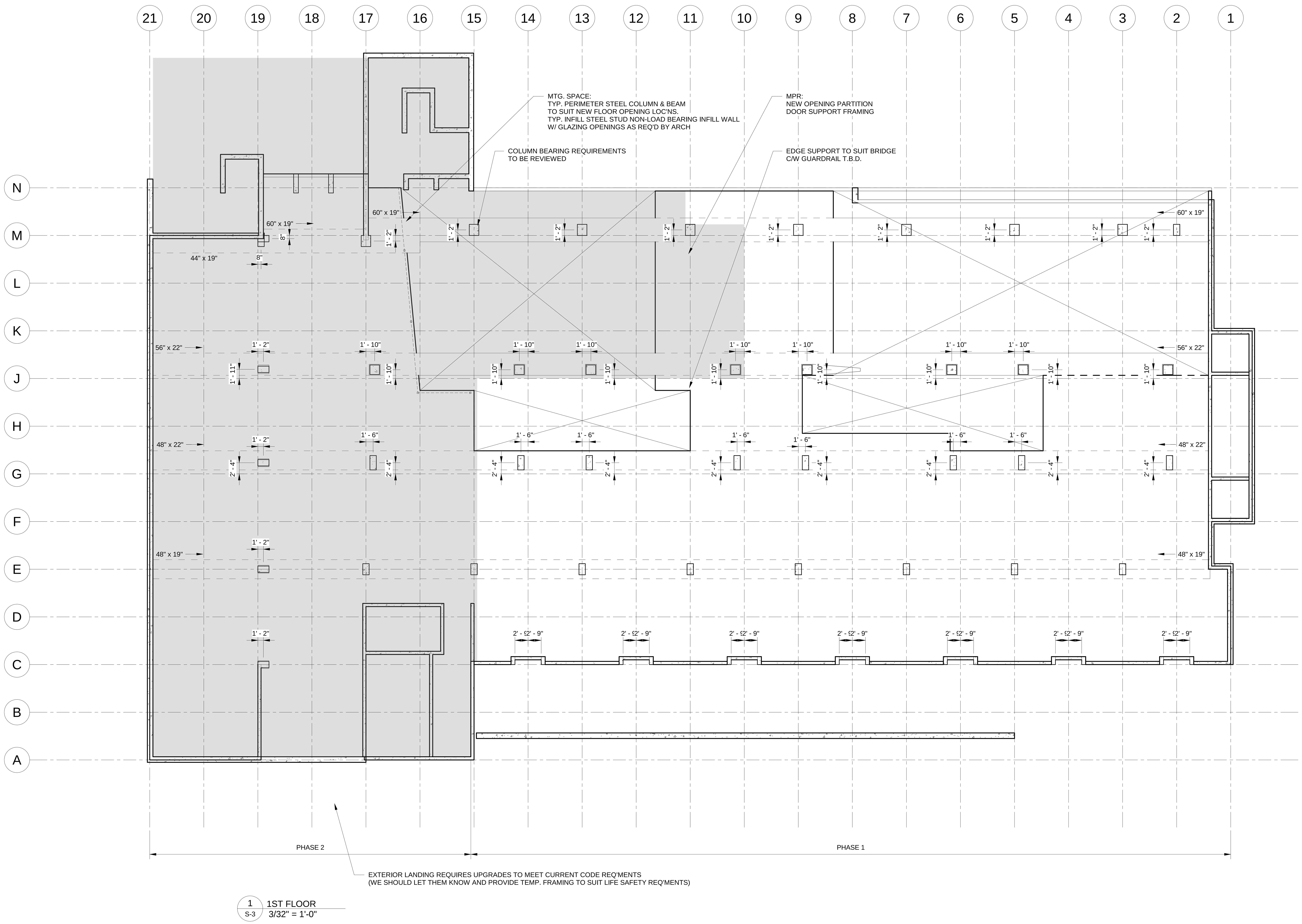
SEAL

PRELIMINARY
NOT FOR CONSTRUCTION

JOB TITLE
BRANDON UNIVERSITY
270 - 18TH STREET
BRANDON, MB

DRAWING TITLE
GROUND FLOOR FRAMING PLAN

DRAWN BY	SCALE	DRAWING NO.
	3/32" = 1'-0"	S-2
FILE NO. W18139	DATE NOV. 2018	REVISION NO.



1 S-3 1ST FLOOR
3/32" = 1'-0"

#	REVISION	DATE	BY

WOLFROM ENGINEERING LTD

CONSULTING ENGINEERS
345 WARDLAW AVENUE
WINNIPEG,CANADA R3L 0L5
(204)452-0041 FAX:284-8680
E-Mail: info@wolfromeng.com

SEAL

PRELIMINARY
NOT FOR CONSTRUCTION

JOB TITLE

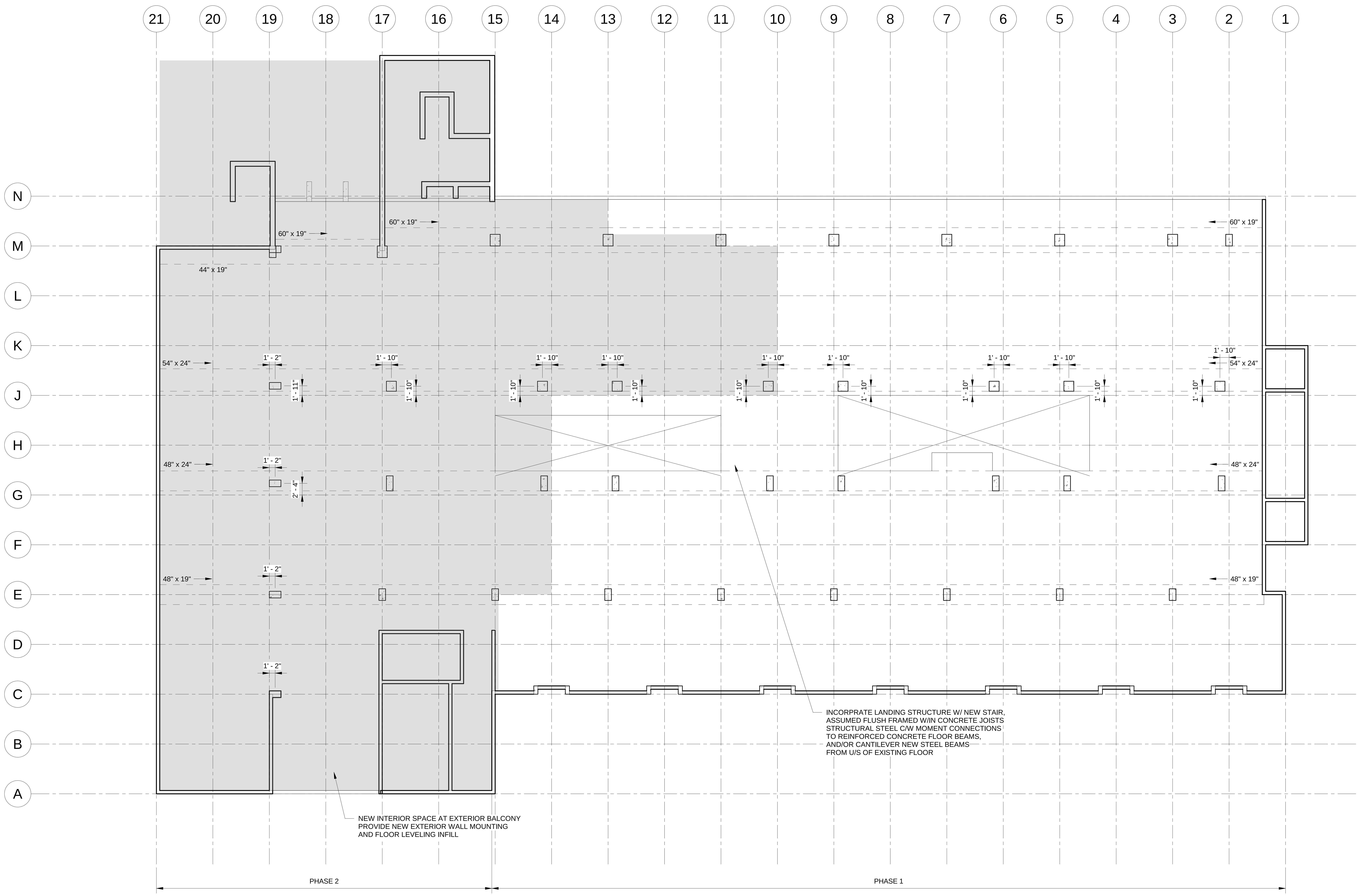
BRANDON UNIVERSITY

270 - 18TH STREET
BRANDON, MB

DRAWING TITLE

1ST FLOOR FRAMING PLAN

DRAWN BY	SCALE	DRAWING NO.
MNF	3/32" = 1'-0"	S-3
FILE NO.	DATE	REVISION NO.
W18139	NOV. 2018	



1
S-4
2ND FLOOR
3/32" = 1'-0"

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WOLFROM ENGINEERING LTD
CONSULTING ENGINEERS
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(204)452-0041 FAX:284-8680
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DRAWING TITLE
2ND FLOOR FRAMING PLAN

DRAWN BY	SCALE	DRAWING NO.
MNF	3/32" = 1'-0"	S-4
FILE NO.	DATE	REVISION NO.
W18139	NOV. 2018	

1 S-5 3RD FLOOR 3/32" = 1'-0"

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3RD FLOOR FRAMING PLAN

DRAWN BY	SCALE	DRAWING NO.
MNF	3/32" = 1'-0"	S-5
FILE NO. W18139	DATE NOV. 2018	REVISION NO.

1 4TH FLOOR
S-6 3/32" = 1'-0"

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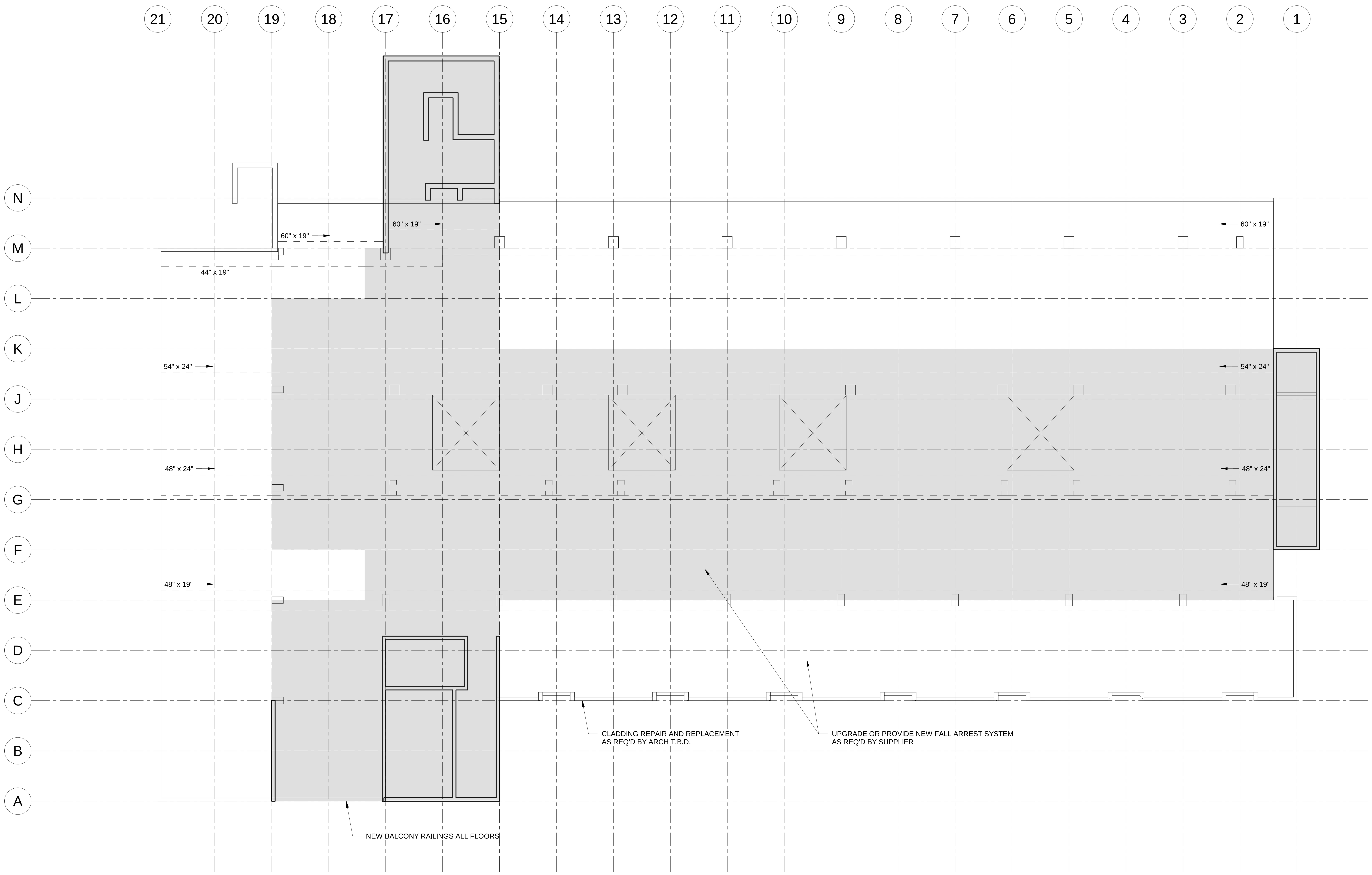
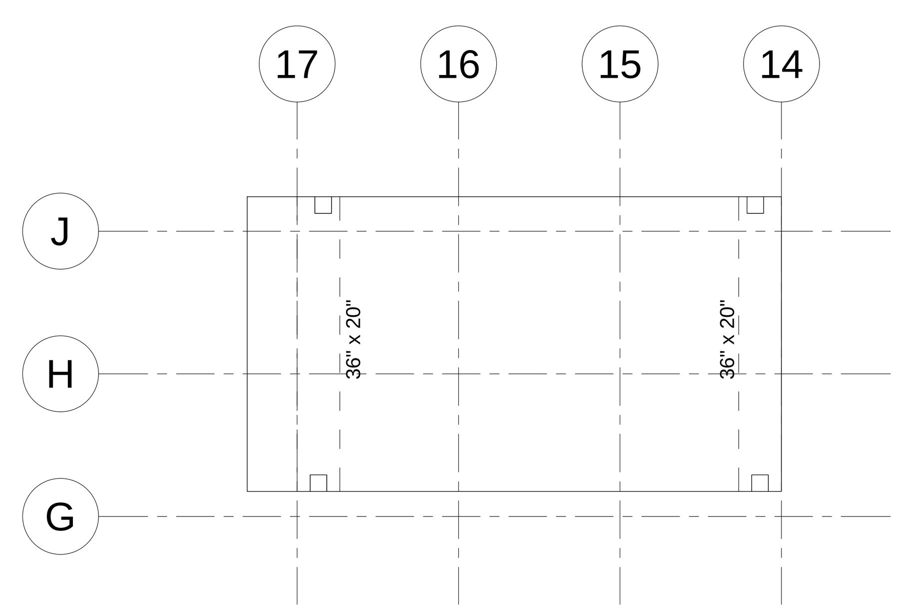
DRAWING TITLE
4TH FLOOR FRAMING PLAN

DRAWN BY: MNF	SCALE: 3/32" = 1'-0"	DRAWING NO.: S-6
FILE NO.: W18139	DATE: NOV. 2018	REVISION NO.



1 S-7 5TH FLOOR & ROOF
3/32" = 1'-0"



2 S-7 MEZZANINE FLOOR
3/32" = 1'-0"

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DRAWING TITLE

5TH FLOOR FRAMING
&
ROOF FRAMING PLAN

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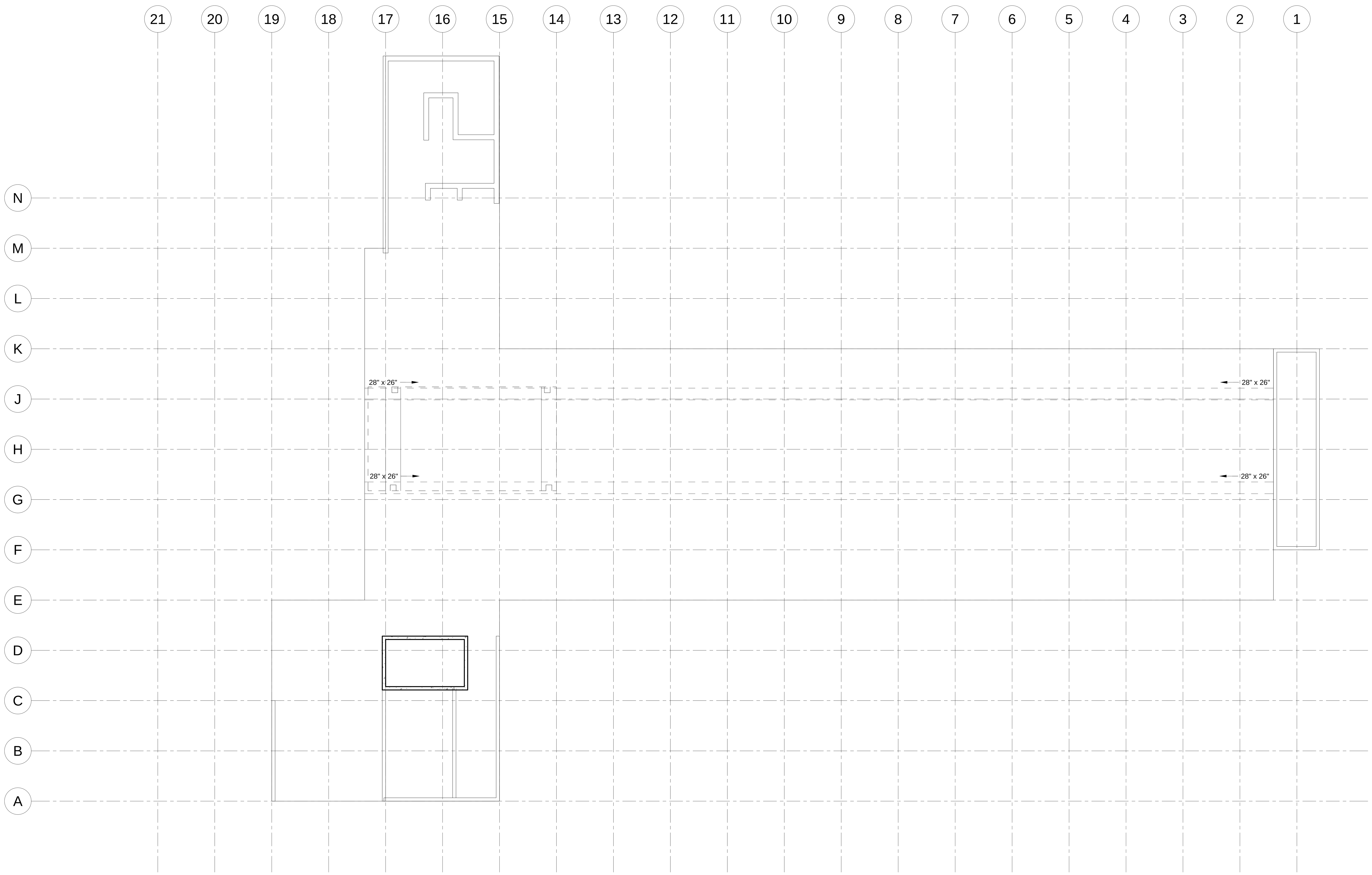
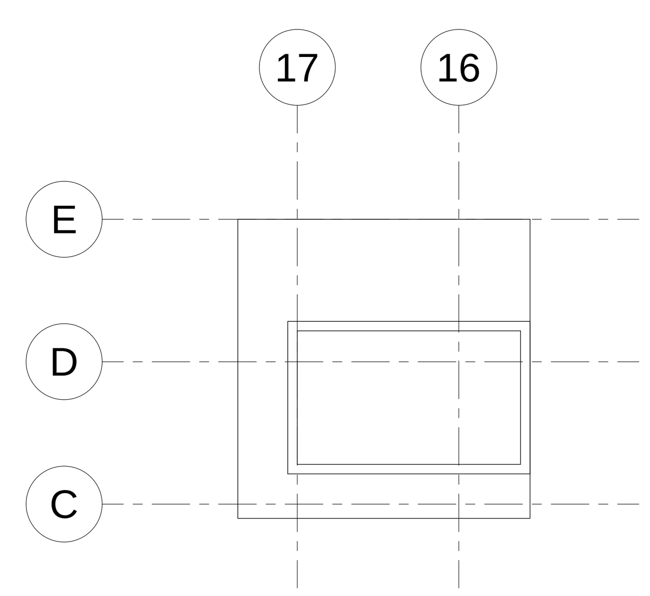
MNF	3/32" = 1'-0"	S-7
FILE NO. W18139	DATE NOV. 2018	REVISION NO.



1 S-8 PENTHOUSE ROOF
3/32" = 1'-0"



2 S-8 MACHINE ROOF
3/32" = 1'-0"

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JOB TITLE
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270 - 18TH STREET
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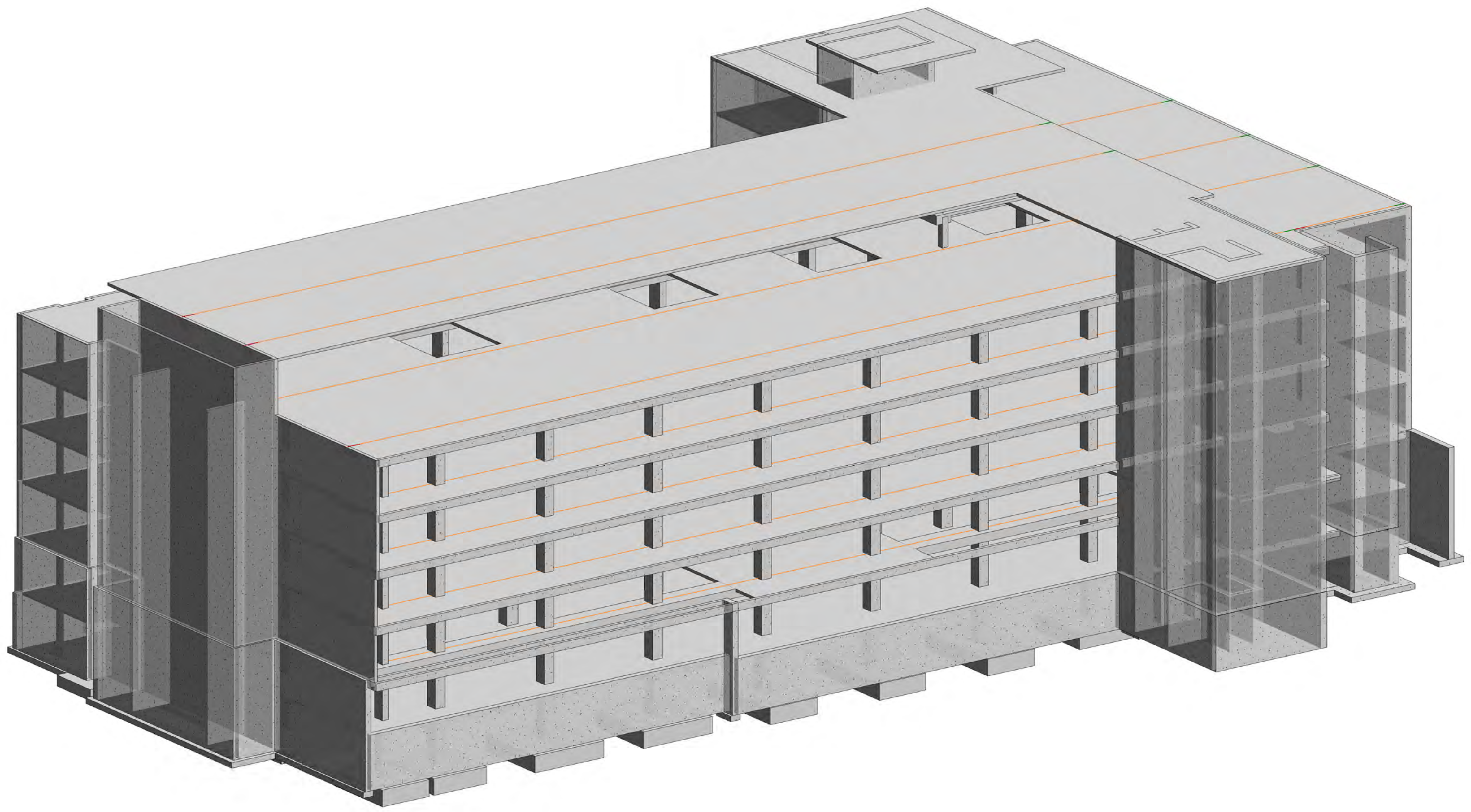
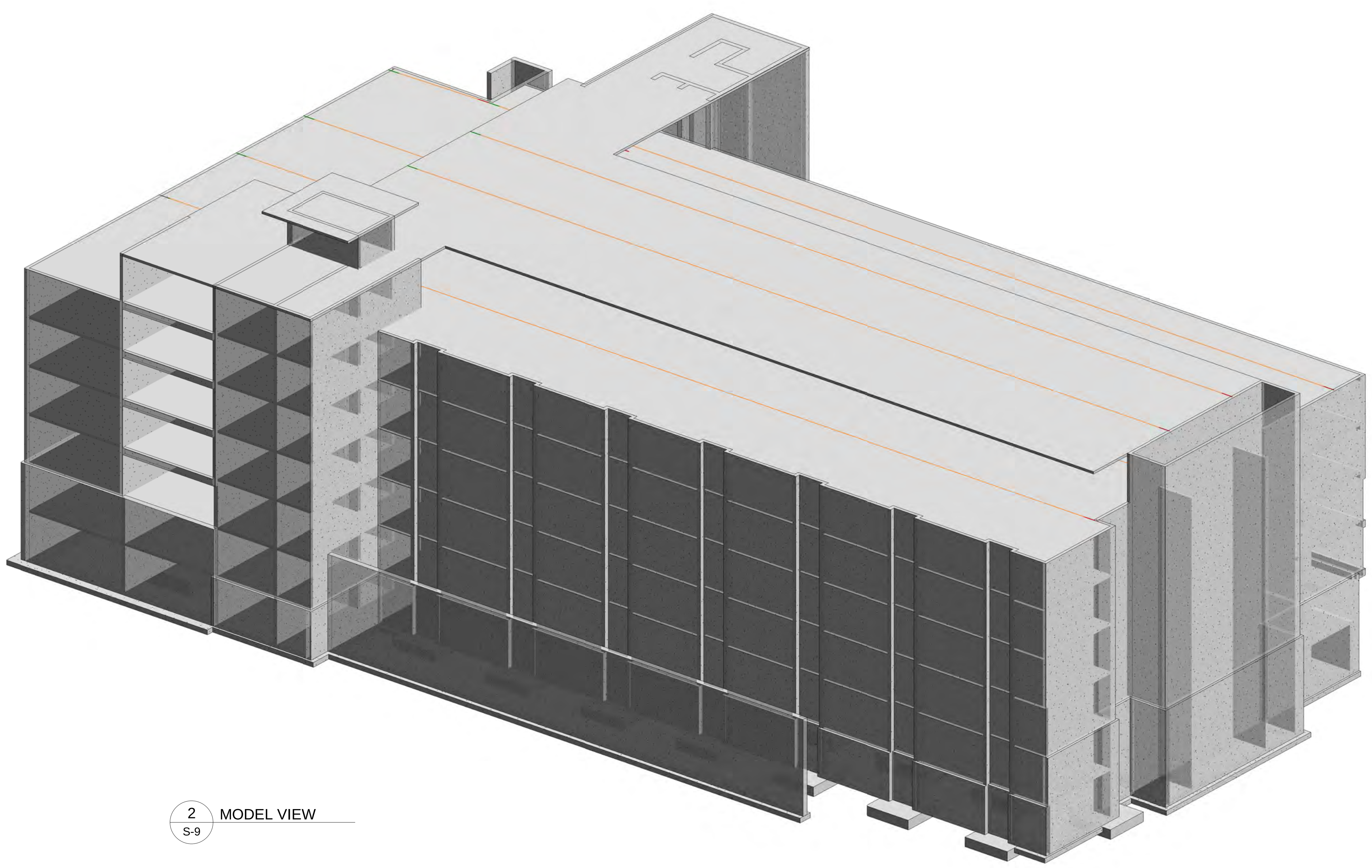
DRAWING TITLE
PENTHOUSE ROOF
FRAMING PLAN

DRAWN BY	SCALE	DRAWING NO.
Author	3/32" = 1'-0"	S-8
FILE NO.	DATE	REVISION NO.
W18139	NOV. 2018	



1 S-9 MODEL VIEW



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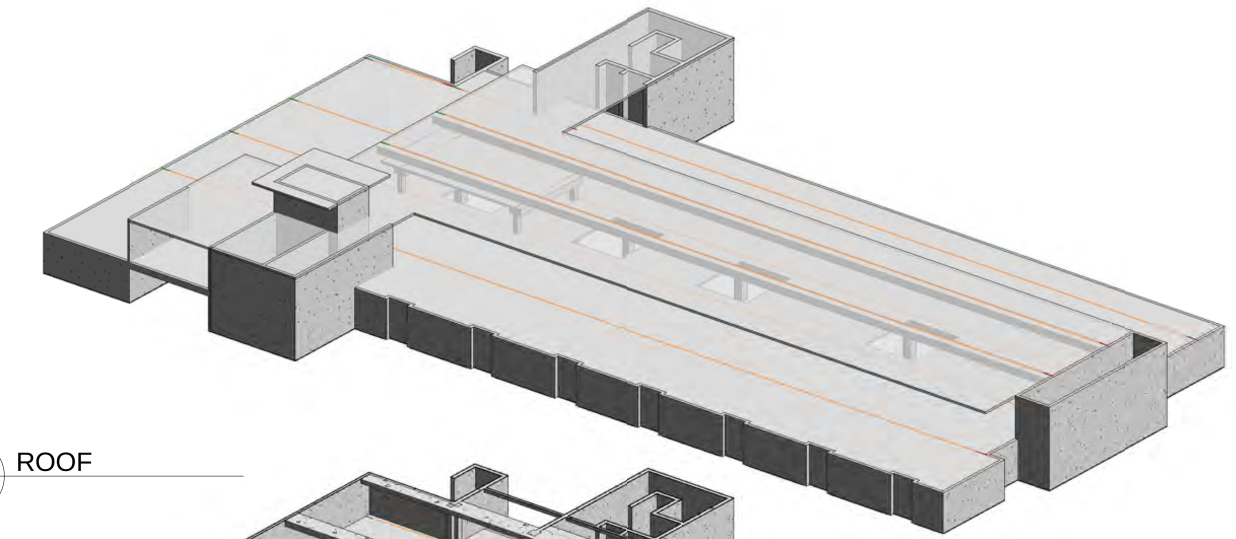
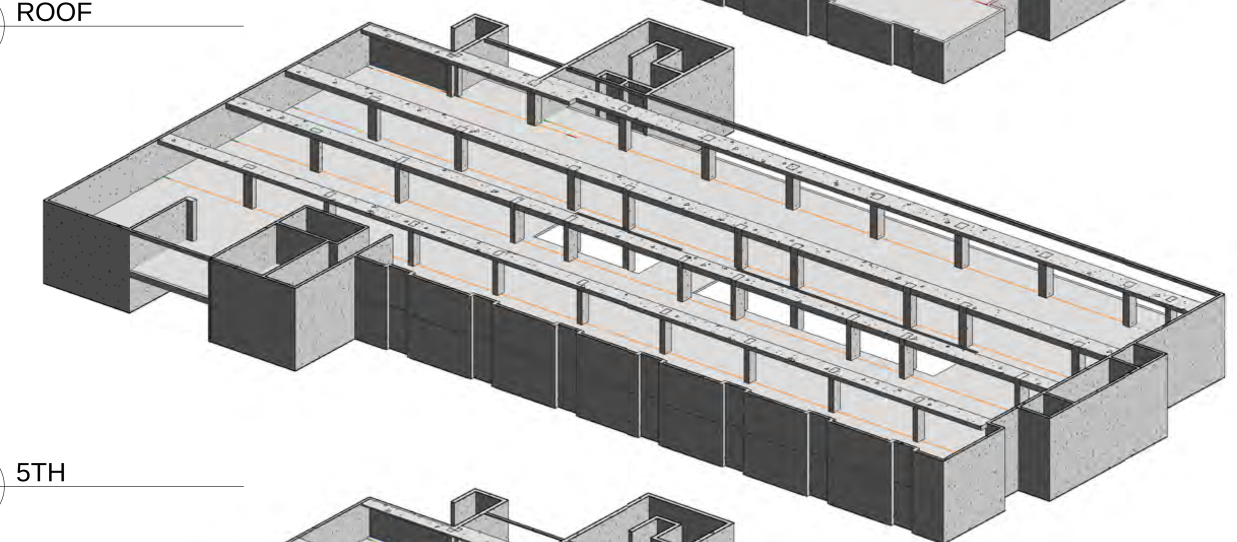
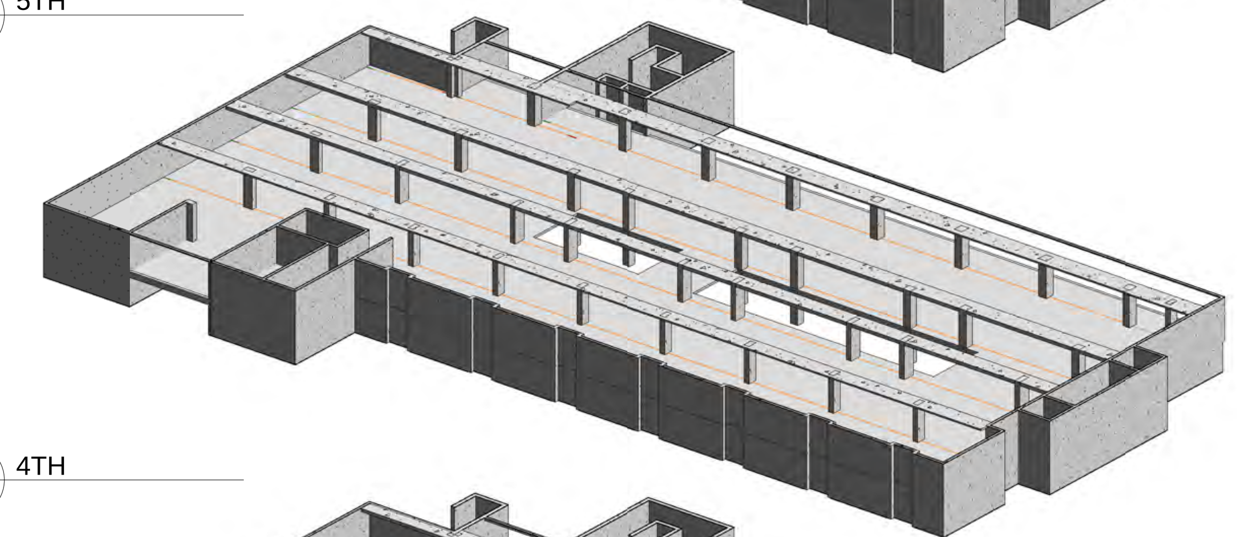


G S-9 ROOF



F S-9 5TH



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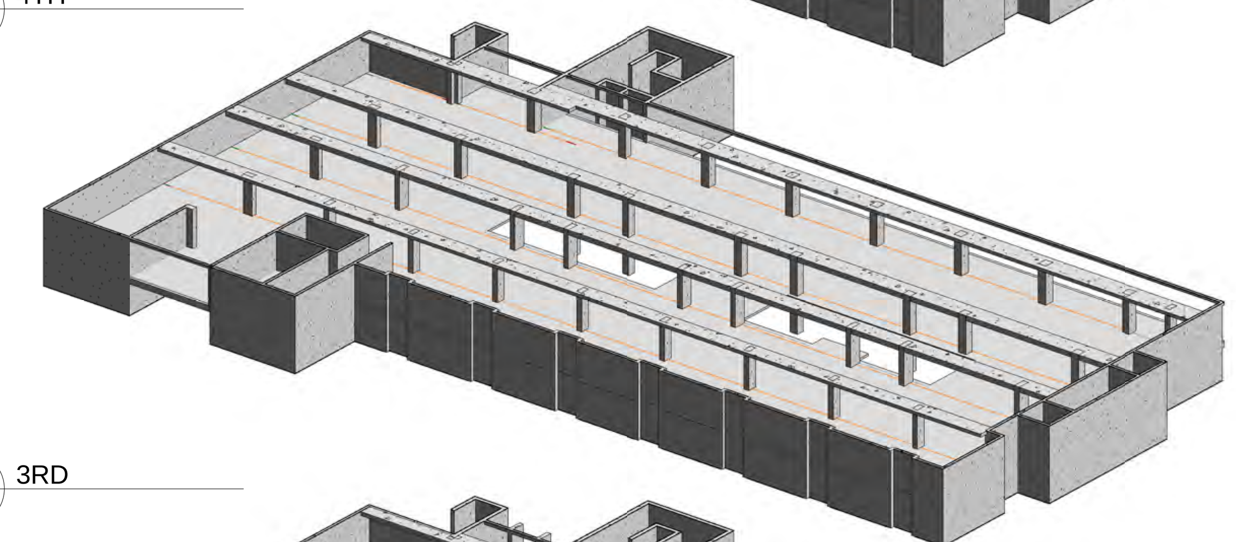

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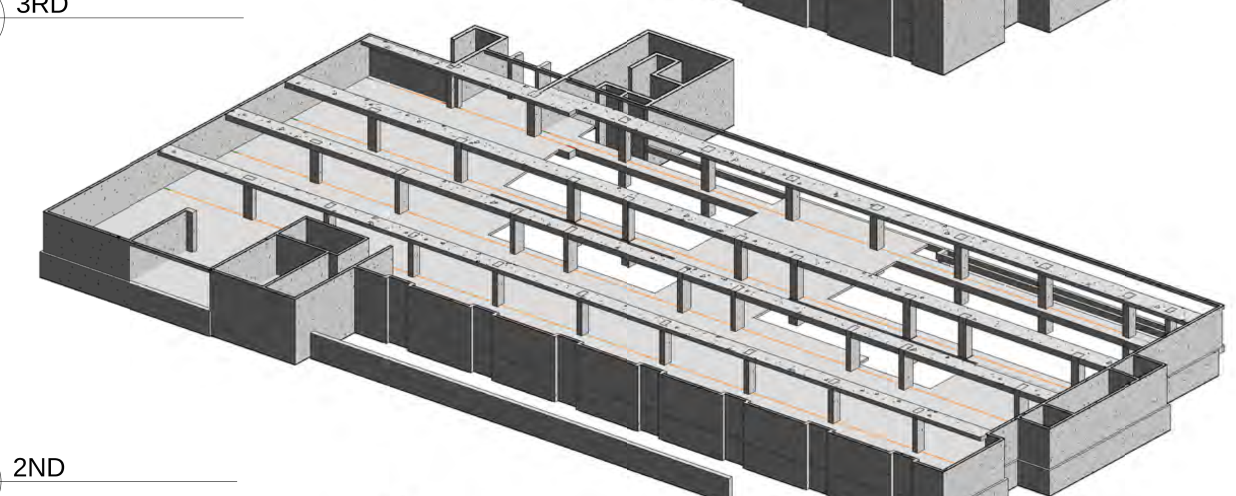
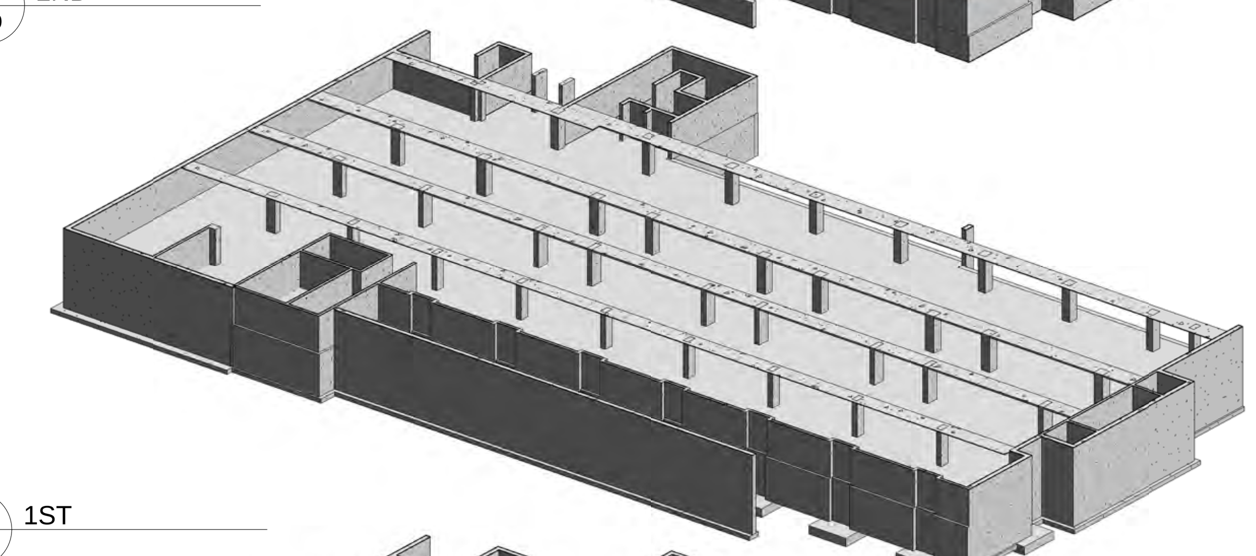


C S-9 2ND



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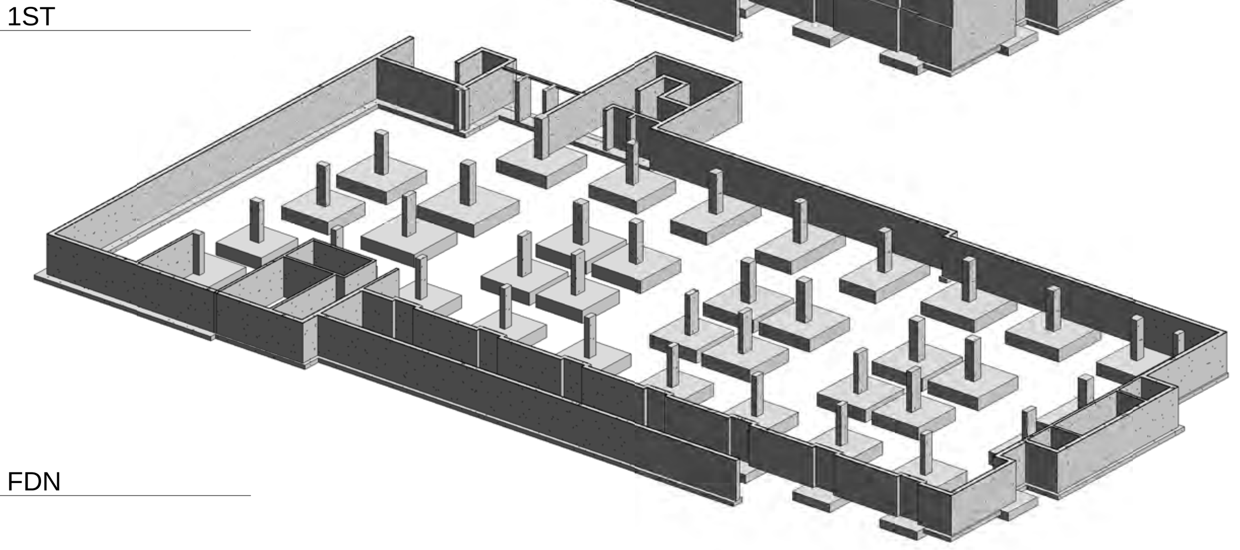

A S-9 FDN

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BRANDON UNIVERSITY

270 - 18TH STREET
BRANDON, MB

DRAWING TITLE

MODEL VIEWS

DRAWN BY	SCALE	DRAWING NO.
MNF		S-9
FILE NO.	DATE	REVISION NO.
W18139	NOV. 2018	

UNIVERSITY OF BRANDON
JOHN R. BRODIE CENTRE
PRELIMINARY BUILDING ASSESSMENT AND CONCEPTUAL DESIGN

November 23, 2018

Prairie Architects Inc.
101-139 Market Avenue
Winnipeg, MB R3B 0P5

SMS Project No.: 18-274-01

SMS ENGINEERING

MECHANICAL DESIGN BRIEF & OUTLINE SPECIFICATION

BRANDON UNIVERSITY
JOHN R. BRODIE CENTRE
PRELIMINARY BUILDING ASSESSMENT AND CONCEPTUAL DESIGN

SMS Engineering Ltd. Project No. 18-274-01

November 2018

General

1 This document is intended to provide a description of the proposed mechanical systems for the project and to be of sufficient detail to allow for review and agreement by all parties. It is understood that this document is to be used for the compilation of an opinion of probable cost. This document has been prepared using very preliminary information, with minimal client involvement. It is therefore subject to change.

2 The mechanical building systems will be designed to the following codes and standards.

- Manitoba Building Code
- Manitoba Fire Code
- Manitoba Plumbing Code
- Manitoba Energy Code for Buildings
- NFPA Standards
- SMACNA Standards
- Illuminating Engineering Society Standards
- ASHRAE Standards, including Standard 62 for Ventilation Rates
- Canadian Standards Association (CSA) Standards
- Requirements of Local Authorities Having Jurisdiction
- Manitoba Hydro Power Smart Programs
- Labs21 Sustainable Design Programming Checklist
- Canadian Council on Animal Care (CCAC) guidelines
- CCME Environmental Code of Practice

.3 All mechanical systems will be commissioned by an independent commissioning agency. The commissioning agency shall define the commissioning requirements for the project and manage the entire commissioning process.

.4 Refer to the Structural Outline Specification for seismic criteria. Install mechanical services to meet seismic criteria, in accordance with the National Building Code (Manitoba Amendment).

1 MECHANICAL

1.1 MECHANICAL SYSTEMS SUMMARY

1.1.1 Introduction

1.1.2 The existing Brandon University Brodie Centre will be renovated to suit the proposed programming of the space. The facility is approximately 137,000 ft^2 in area over five and one half floors. The major proposed components of the project are:

.1 Chemistry and Biology teaching labs,

.2 Chemistry and Biology research labs,

.3 Classrooms,

.4 Faculty offices,

.5 Atrium and Student Areas,

.6 Vivarium in the basement,

.7 Two lecture theatres.

1.1.3 The review process has set outlined a number of goals for the project. Some of the goals particularly relevant to the mechanical systems include:

.1 Energy efficiency, an energy use rate of approximately 200 $kWh/m^2/yr$,

.2 Reduced water use and water reuse,

.3 Best Practices building commissioning.

1.1.4 With the increasing global emphasis on green house gas (GHG) emission reductions, the project will be designed for a very low level of GHG emissions during operation.

1.2 CODES AND REGULATIONS

1.2.1 The mechanical building systems will be designed to the following codes and standards.

.1 Manitoba Building Code

.2 Manitoba Fire Code

.3 Manitoba Plumbing Code

.4 Manitoba Energy Code for Buildings

.5 NFPA Standards

.6 SMACNA Standards

.7 Illuminating Engineering Society Standards

.8 ASHRAE Standards, including Standard 62 for Ventilation Rates

.9 Canadian Standards Association (CSA) Standards

.10 Canadian Gas Association (CGA) Standards

.11 Requirements of Local Authorities Having Jurisdiction

.12 Manitoba Hydro Power Smart Programs

.13 Labs21 Sustainable Design Programming Checklist

.14 Canadian Council on Animal Care (CCAC) guidelines

.15 CCME Environmental Code of Practice

1.3 DESIGN CRITERIA

1.3.1 The mechanical systems will be designed to meet the following design criteria:

Winter ambient design	-35ºC
Summer ambient design	30ºC db, 20 ºC wb
Rainfall	28 mm in 15 minutes
Indoor winter room design	21ºC, 25% RH minimum
Indoor summer room design	24ºC, 50% RH maximum
Vivarium room design	as per CCAC Guidelines based on animal type 15 ACH
Teaching laboratory air change rate	6 ACH minimum when occupied 0 ACH when not occupied
Research laboratory air change rate	8 ACH minimum when occupied 4 ACH when not occupied

1.3.2 Acoustic Criteria

Offices	PNC 37
Classrooms	PNC 37
Laboratories	PNC 40
Corridors and common areas	PNC 45

1.4 ENERGY SOURCES AND UTILITIES

1.4.1 Electricity will be the prime energy source for the project as there is a very limited green house gas signature to the electrical energy. Natural gas will be provided for laboratory services if needed. Autoclaves and sterilizers on the project will be packaged units utilizing the existing central steam plant. Back up heating will also be provided by the campus steam plant.

1.5 GREEN LABORATORY

1.5.1 Consideration may be given towards the opportunities for a green laboratory. A green laboratory means that there will not be toxic pollutants discharged from the lab exhaust systems or the lab drainage systems. The pollutants would be dealt with on site, not discharged to the environment for others to deal with. A specific benefit of clean lab exhaust is the proximity of adjacent buildings to the site.

1.5.2 Some of the opportunities in the teaching labs include:

.1 Revising the experiments to eliminate toxic materials or to use less toxic materials,

.2 Use materials that can be effectively removed by scrubbers,

.3 Implement procedures where toxic materials are not discharged down the drain,

.4 Include the neutralization and disposal of toxic materials into the curriculum.

1.5.3 Some of the opportunities in the research labs include:

.1 Use less toxic materials and solvents,

.2 Use reduced quantities of toxic materials,

.3 Use systems to condense vapours coming off processes

.4 Use materials that can be effectively removed by scrubbers,

.5 Implement procedures where toxic materials are not discharged down the drain.

1.5.4 The exhaust air stream from the vivarium will be scrubbed to reduce the odor level.

1.6 HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS

Heating and Cooling Plant

1.6.1 Heating water and chilled water to heat and cool the project will be provided by a central heat recovery chiller. The existing chiller would be replaced by a modular system that has the ability to provide chilled water year-round, the system would use the rejected heat within the building. When the simultaneous heating and cooling loads are not present the system will either reject heat to the cooling tower, or use the central steam system to provide heat.

1.6.2 The heat recovery chiller plant is anticipated to consist of (27) twenty-seven 37-ton (130kW) water- to-water heat pumps complete with unit-mounted injection pumps for a total aggregate heat pump capacity of 1000 tons (3,393 kW).

1.6.3 Moderate temperature heating water (50°C) and chilled water (6.5°C) from the chiller plant will be distributed to the mechanical penthouse and throughout the building to the heating and cooling coils.

1.6.4 We will investigate the provision of chilled water to the labs to allow for condensing of vapors to reduce the emissions to the atmosphere and eliminate the wasting of potable water for this task.

1.6.5 The heat recovery chiller approach allows chilled water and heating water to be produced simultaneously in the winter to provide heat to the building and when used in the summer provides the heat required for reheating coils required for environmental control with the high air change rates of the labs.

Laboratory Supply Air System

1.6.6 Due to the phased construction approach, two air handling units located in the penthouse will provide ventilation air to the laboratory areas, the classrooms, offices and the atrium. A fan array in the air handling units will provide redundancy such that the loss of one or two fans will not impact the available air supply to the facility.

1.6.7 The air handling units will be custom air handling units and will consist of:

.1 Intake louvers and dampers,

.2 Pre filter at 35% efficiency,

.3 Preheat for low temperature operation

.4 Heat recovery wheel

.5 Mixing plenum with return air duct, damper, and silencer,

.6 High efficiency filters with prefilters

.7 Glycol heating coil

.8 Cooling coil

.9 Humidifier (ultrasonic or hydraulic compression)

.10 Supply air fans with isolation dampers (scroll or plug dependent on unit configuration)

.11 Supply air ductwork and silencers

1.6.8 The air handler will be configured to allow some return air back from cleaner areas back into the air stream to provide make-up air for the laboratory exhaust systems.

1.6.9 Based on the present facility configuration, the air handling unit will be selected based on 40,000 CFM (18.88 m^3/s). This would be reconfirmed once final exhaust systems have been determined.

1.6.10 The supply air fans will be provided with variable frequency drives so the fan speed will be adjusted to meet the needs of the building. At low air flow times, only one supply fan will operate. The filters and coils will be sized for 2 m/s air flow speed for low pressure drop. The sizing of the supply fans and the moderate air speed through the coils will allow for efficient, low energy operation and will also allow for some air flow increase in the future should the building use change.

1.6.11 Heat will be recovered from the laboratory exhaust air stream using an enthalpy heat wheel. The wheel will have 3 angstrom pore size media that has been shown to be very effective in minimizing any carry over from the exhaust to the intake air streams as there is a purge section. The heat wheel approach achieves higher heat recovery efficiencies that other types of heat recovery devices that are suitable for lab use.

1.6.12 A humidifier will use lab purified water for humidification to reduce maintenance. Both supply air and return air humidity sensors will be used to control the humidifier.

1.6.13 Acoustic silencers will be used on the supply and return air duct systems to provide the appropriate acoustic environment. All vibrating mechanical equipment will be provided with isolating vibration control.

Laboratory Exhaust System

1.6.14 The laboratory exhaust air from fume hoods and general laboratory exhaust will be gathered together in a common exhaust manifold system. This provides for significant dilution of any remaining contaminants. A Strobic type exhaust fan system will be provided with multiple exhaust fans including a redundant exhaust fan for reliability. The Strobic type system will draw air from the manifold exhaust through the heat recovery wheel and exhaust the air.

1.6.15 The Strobic type approach uses a high velocity discharge to induce additional air flow resulting in dilution of any remaining fumes and an increased discharge air volume with significant momentum for a high discharge air plume and significant additional dilution.

1.6.16 The laboratory exhaust system will be located above the mechanical penthouse at the opposite end from the air intake. The high plume exhaust air pattern will minimize the possibility of any exhaust air being re-entrained into the building air intake.

1.6.17 The exhaust from the vivarium will be carried up to the roof and the discharge outlet will be located adjacent to the laboratory exhaust plume so that vivarium exhaust air will join into the momentum of the larger laboratory exhaust air system the heat from this air stream will be recovered through the use of a glycol run-around system.

1.6.18 Each fume hood will be provided with a Phoenix type air flow control valve to allow on/off operation.. Where snorkel type exhaust units are called for, these will be connected to the exhaust header along with lab general exhaust through a Phoenix type air flow control valve.

Laboratory Ventilation System

1.6.19 The laboratory air supply systems are designed to meet base ventilation requirements due to:

.1 Laboratory air change requirements,

.2 Temperature control,

.3 Occupant ventilation requirements,

.4 Fume hood and other exhaust make up,

.5 Individual laboratory air flow/pressurization control,

.6 Air quality monitored in the lab.

1.6.20 A fancoil system will be incorporated to provide individual space conditioning. The fancoils will be 4-pipes (heating and cooling) to provide appropriate environmental conditions.

1.6.21 Room Data sheets for each space will be reviewed to provide the necessary services required in each laboratory.

1.6.22 The exhaust air volume for each laboratory will be monitored from the fume hoods and lab exhaust air systems with Phoenix type air flow control valves. Fast acting, electronic supply air flow control valves will provide the appropriate supply air volume to each room to maintain an air

1.6.23 flow deficit to maintain a slight negative pressure. Snorkel type local exhaust units will be provided as indicated on the room data sheets.

1.6.24 The air flow in the labs will be designed to minimize air motion at the fume hoods for protection of the users.

1.6.25 During unoccupied hours, the ventilation systems will be reduced in air volume or shut down as indicated below. Unoccupied hours will be determined by time of day schedule, occupancy sensors, and whether lights are on. Local over ride switches will be provided as well as indoor air quality sensors to monitor CO_2 and various volatile organic compounds and operate/alarm the ventilation system if there is a problem.

1.6.26 There are two laboratory types for both of the chemistry and biology labs – teaching labs and research labs.

Teaching Laboratories

1.6.27 The teaching labs operate on a specific schedule to suit class times. The labs are set up for specific experiments and class tasks. Chemicals are not left in the labs between classes. The lab support areas will house all of the chemicals in outside of class hours. The air system volumes will be reduced in volume to 1/3 of full volume or shut down entirely when unoccupied.

Research Laboratories

1.6.28 The research labs have a broad range of uses and do not operate on specific schedules. The air system volumes will be reduced to 4 air changes per hour or as dictated by fume hood use when unoccupied.

Flexibility and Adaptability

1.6.29 Discussions will be held with the University and design team to review the extent of flexibility and adaptability that should be built into the project. The proposed supply air system will provide some backup and expansion capabilities. The laboratory room data sheets should indicate future fume hood locations.

Classroom and Office Ventilation System

1.6.30 The classrooms and offices will be served by 4 pipe, ECM motor fan coil systems with ventilation air provided by the laboratory supply air system. One fan coil will serve the offices in each structural bay. Isolation dampers will be provided in the ventilation air duct to shut off the ventilation air when unoccupied.

1.6.31 The return air from the classrooms and offices will be transferred through the atrium for relief or return to the laboratory supply air unit.

Atrium Systems

1.6.32 The atrium provides a common connecting space between the laboratories, classrooms, offices and the student areas.

1.6.33 The atrium floor will have hydronic radiant heating and cooling piping for temperature control. Displacement ventilation air outlets will provide ventilation for the lower atrium areas.

1.6.34 Heated entry vestibules will minimize the problems with the opening doors in the winter.

1.6.35 *Vivarium Ventilation System (if required)*

1.6.36 The vivarium will be served by a dedicated, redundant supply air and exhaust air system providing individual temperature and humidity control to each animal holding and treatment room.

1.6.37 The location of the viviarium air handling unit remains to be determined. The supply air handling system will consist of:

.1 Intake louvers and dampers,

.2 Pre filter at 35% efficiency,

.3 Preheat for low temperature operation

.4 heat recovery module,

.5 High efficiency filters with prefilters

.6 Glycol Heating coil

.7 Cooling coil,

.8 Humidifier

.9 Fan array supply air fans with isolation dampers (scroll or plug depending on unit configuration)

.10 Supply air ductwork and silencers.

1.6.38 The heat recovery system will be used because of the high sensible and latent heat recovery efficiency.

1.6.39 The supply air duct to each room will be provided with a heating coil, cooling coil, and humidifier for individual control. All of these components will be located in service rooms so no equipment access will be required through access doors in the ceiling of the vivarium. The room conditions will be maintained in accordance with the Canadian Council on Animal Care.

1.6.40 Exhaust hoods will be provided in the clean up area.

1.6.41 The exhaust from the animal area will have dual redundant exhaust fans with isolation dampers for full backup. The exhaust will pass through a scrubber to reduce the odor level in the exhaust stream.

Equipment Room Cooling

1.6.42 Many laboratory equipment rooms will require additional cooling. Similarly building service rooms like transformer rooms, communications rooms and such will also require cooling.

1.6.43 Chilled water fan coil units will provide the cooling allowing the rejected heat from the heat recovery chiller to heat the building.

Washroom Exhaust

1.6.44 A dedicated exhaust system will be provided to exhaust the washrooms. Heat recovery will be implemented based on potential efficiency.

Emergency Generator

1.6.45 A fuel tank will be provided for the emergency generator and a pump and piping will serve the day tank and the generator. An engine exhaust pipe to the outdoors will be provided. Intake and exhaust ducting for the radiator with winter recirculation will be provided. Estimated tank capacity is 4,100 L. It is anticipated that a local storage tank will be located in the genset room with a transfer/fill tank located at grade complete with transfer pumps.

Emergency Power

1.6.46 Emergency power from the generator will be provided to the following mechanical services.

.1 Controls system,

.2 Sump pumps,

.3 Vivarium air handling systems,

.4 Fire pump,

.5 Smoke exhaust fans and pressurization fans,

Controls System

1.6.47 Integrated, interoperable systems tied into lighting control systems

Commissioning

1.6.48 Full commissioning of mech systems integrated into building systems is recommended.

1.7 PLUMBING SYSTEMS

Water

1.7.1 A second connection will be made to the City of Brandon water system with backflow protection. In the water service room, three way isolation will be provided to allow for interconnection of the two service connections. The potable water will be distributed in vertical shafts and horizontal branches throughout the building.

1.7.2 Low water use plumbing fixtures will be used and will consist of dual flush toilets, low water use flush valve urinals, low flow infra red, touchless faucets, and low flow showers.

Piping

1.7.3 All domestic piping will be Type L, third party certified copper, and insulated with fibreglass insulation complete with all service jacket. All sanitary mains will be cast iron or copper DWV.

<u>Laboratory Services</u>

1.7.4 Refer to the room data sheets for the specific needs of the laboratory areas. Hot and cold water service to the laboratory areas will have backflow preventors upon entering the lab area.

1.7.5 Eyewash stations with tempered water will be provided in the lab areas.

Typical lab sink with trim example – no aspirators

1.7.6 A central pure water system in the 2 to 5 meg ohm range will be provided with distribution pipes to the lab areas. Local water polishing units provided as lab equipment will provide higher purity water as needed. This pure water will also provide water to the humidification systems in the air handling units

1.7.7 Pure water will also be supplied to the vivarium for treatment and distribution as animal drinking water.

Sanitary

1.7.8 A 200 mm sanitary service connection will be provided to the City of Winnipeg system. The lab drainage system will connect to the main sanitary line leaving the building.

1.7.9 A dedicated lab drainage and vent system will be provided that connects to all of the lab drainage fixtures and will consist of acid resistant drainage and vent piping and local acid dilution tanks.

Gases and Laboratory Specialties

1.7.10 Natural gas service will be provided with a gas meter for the laboratory service. Natural gas will be distributed to the lab areas and benches as indicated on the room data sheets.

1.7.11 Special bottled gasses will be provided by the users as indicated on the room data sheets and piping will be provided in the benchwork to outlets.

1.7.12 Compressed air will be provided by a triplex, oil free compressor unit with refrigerated dryer and storage tank. The compressed air will be distributed throughout the laboratory areas as needed.

1.8 FIRE PROTECTION AND SMOKE CONTROL SYSTEMS

Sprinklers

1.8.1 The building will be fully sprinklered with wet systems in the occupied areas. A fire pump, standpipe system, and Siamese connection will be provided.

1.8.2 Close spaced sprinkler heads will be located along the atrium openings. Provisions for dry sprinklers in the atrium will be considered given the possibility of freeze ups should a fire incident occur in the wintertime and the atrium smoke exhaust is initiated.

Atrium Smoke Exhaust

1.8.3 The atrium will be provided with a two-staged smoke exhaust system, presently envisioned as four high-volume fans with operable panels or doors at low level for makeup air.

Pressurization Systems

1.8.4 Pressurization of vestibules will be provided by dedicated pressurization fans. Tempering of the makeup air will be provided as required.

2 PHASING

The renovation will be phased such that the ventilation system on the west side will remain to service the existing spaces. The east side will be provided with a new ventilation unit as described above, fancoils will be utilized within the east side of the building to provide conditioning to the individual zones. The existing chiller will be replaced with a heat pump unit during the first phase. The new light shafts and atrium spaces will be incorporated into the existing return air system and eventually retrofitted to suit the final configuration of the HVAC system. The building will have a new fire protection system incorporated through the phased approach. High quality water systems will be replaced during the first phase of the project.

3 GENERAL SPECIFICATIONS

3.1 INSULATION

3.1.1 The following piping will be insulated to the standards described in the Manitoba Energy Code for Buildings

.1 Hot water heating supply and return piping.

.2 Domestic cold, hot, and hot water recirculation water piping.

.3 Roof hoppers, vertical, and horizontal storm drains above grade.

.4 Vent piping for a developed length of 3 m (10 ft.) from roof terminals.

.5 Vent piping located in cold locations.

.6 Sump pump discharge lines that pass through ceiling spaces.

.7 Water meters.

.8 Run outs from mixing valves to shower heads.

3.1.2 The following ductwork will be insulated to the standards described in the Manitoba Energy Code for Buildings

.1 Supply ductwork on any air-conditioned systems.

.2 Outside air and mixed air ductwork or plenums.

.3 Exhaust ductwork back 2 m (6 ft.) from roof or wall.

.4 Acoustic insulation where required for sound considerations.

3.1.3 All piping will be identified and color-coded to assist in maintenance procedures.

4 GENERAL SPECIFICATIONS

4.1 SITE SERVICES

4.1.1 A second domestic and sprinkler water main will be connected to the local City of Brandon water main

4.2 PLUMBING

4.2.1 General

.1 Provisions will be made for barrier-free use conforming to the latest standards described in the Manitoba Building Code and National Building Code barrier-free requirements, including:

.1 offset traps

.2 blade handles

.3 fixture installation

.4 shower controls

.5 drinking fountains

.6 insulated traps and supply lines, where exposed

4.2.2 Plumbing Systems

.1 Sanitary drainage system will serve all plumbing fixtures, floor drains, and equipment and will connect to the building sanitary sewer. Aluminum or asbestos pipe will not be used.

.2 Domestic cold water, hot water, and hot water recirculation piping will be run to serve all equipment and fixtures as required, including interior and exterior hose bibbs. Piping will be third party certified Type-L hard copper with lead-free joints.

.3 Floor drains will be provided where required adjacent to equipment, in washrooms, vehicle parking areas and in wet mechanical rooms.

.4 Backflow preventers will be provided on water systems where required.

.5 Cold water hose bibbs, complete with backflow preventers will be provided at required locations.

.6 Gas cocks will be provided in each laboratory room. Master gas shut-off will be located within each laboratory complete with a gas monitor and alarm.

.7 In each of the teaching laboratory, student sink shut-offs will be provided in the instructor’s cabinet to allow isolation of hot and cold water at the students’ sinks.

.8 A vacuum-tube type solar water heating system will be provided with full capacity electric backup heaters.

Piping materials:

Natural gas:	Black steel
Laboratory vacuum:	Type L third party certified copper
High quality water:	304 Stainless Steel
Acid waste:	Glass/Silicate; fire-rated polypropylene (in specified areas)
Compressed Air:	Type L third party certified copper
Diesel fuel oil:	Black steel

4.2.3 Fixtures and Equipment

.1 Plumbing fixtures will be provided as shown on architectural floor plans.

.2 Where sinks are required within a fume hood, these are supplied by the hood manufacturer and piped up by Section 15300.

.3 In general, fixtures shall be as follows:

.1	Water Closets-	floor mounted, vitreous china, electronic flush valve, elongated bowl complete with open front seats. Barrier-free to be the same except with open front seat complete with cover.
.2	Urinals	wall hung; vitreous china, electronic flush valve.
.3	Lavatories	vanity; stainless steel, overflow, drain strainer, electronic automatic mixing faucet. Wall hung; vitreous china, overflow, concealed wall carrier, mixing faucet with blade handle.
.4	Sinks	stainless steel; with ledge back, hot and cold water two-handle mixing faucet.
.5	Drinking Fountians	wall mounted; stainless steel, refrigerated to suit standard and barrier-free requirements
.6	Service Sinks	floor-mounted complete with rim guards and wall mounted faucet

.7	Laboratory Sinks (Teaching Labx)	Instructor's sink; stainless steel; acid resistant with ledge back, hot and cold water gooseneck faucet with hose-end vacuum breaker. Student sinks; stainless steel; acid resistant with ledge back, hot and cold water gooseneck faucet with hose-end vacuum breaker
.8	Emergency Showers & Eyewash Station	individual pressure balancing mixing valves complete with vandalproof shower head or eye wash station

4.3 FIRE PROTECTION

4.3.1 Supervised, automatic, closed-head wet pipe sprinkler systems will be provided in all areas in accordance with the latest edition of the NFPA 13.

4.3.2 Spacing will be a maximum coverage of 21 m2 (225 ft2) per head.

4.3.3 Where a risk of mechanical damage may occur, sprinklers heads will be protected with approved guards.

4.3.4 Chrome plated heads and escutcheons will be provided in areas with finished ceilings.

4.3.5 Piping will be run exposed with upright heads in areas not having suspended ceilings and concealed with pendant heads in areas with suspended ceilings.

4.3.6 Sprinkler systems shall be zoned to accommodate facility functions and code standards.

4.3.7 System operating conditions will be electrically monitored to annunciate at the building fire alarm panel. Wiring and fire alarm panel to be furnished by Electrical.

4.3.8 All valves controlling water into the sprinkler systems will be electrically monitored to indicate abnormal condition at the fire alarm panel. Wiring and fire alarm panel to be furnished by Electrical.

4.3.9 Portable fire extinguishers will be provided under Architectural Divisions at locations in accordance with Manitoba Fire Code and local Fire Department.

4.3.10 A fire department Storz connection will be provided. Location shall be in accordance with the National Building Code and coordinated with the City of Brandon Fire Paramedic Service.

4.3.11 An electric powered fire pump is to be supplied to provide adequate flow and pressure to satisfy flow and pressure requirements of the system, including all standpipes. Fire pump and controller to be on emergency power. Fire pump to be located in the lower level of the building.

4.3.12 Sway bracing to be provided as per the requirements of the National Building Code.

4.4 LIQUID HEAT TRANSFER

4.4.1 Hydronic Systems

.1 Primary heating to be provided by heat recovery chiller.

.2 Supplementary building heating will be provided by glycol, generated from steam to liquid heat exchangers. Hot glycol distribution will be provided by a reverse-return system of insulated steel piping.

.3 Three (3) vertical-inline circulation pumps are provided to circulate heating fluid throughout the facility. Two pumps are duty service, one pump is standby.

.4 Three (3) vertical-inline chilled water circulation pumps are provided to circulate chilled water throughout the facility. Two pumps are duty service, one pump is standby.

.5 Two (2) vertical-inline condenser water pumps are provided to circulate condenser water from the chiller to the cooling tower. The pumps are duty/standby.

4.4.2 Chemical Treatment

.1 Chemical treatment of heat transfer systems will be provided by specialist contractor who will supply chemicals, accessories and conduct treatment analysis, supervise installation of equipment and provide initial start up of treatment procedures.

.2

.3 Follow up check on operating procedures, along with written reports will be provided by specialist contractor for first year of operation.

.4

4.4.3 Humidification Systems

.1 Humidification will be provided as required.

4.5 AIR DISTRIBUTION

4.5.1 General

.1 Temperature, humidification, filtration and ventilation rates of outdoor air will be provided to suit the requirements identified by ASHRAE Standard 62.

.2 Custom construction air handling units will be provided.

.3 Ventilation of washrooms, showers, change rooms, storage rooms, laboratories, etc. will be by means of ducted exhaust systems to fans located within building, with ductwork extending to outdoors. Heat will be recovered from the exhaust air for preheating of ventilation air where viable.

.4 Fire dampers will be provided as necessary where ducts and openings penetrate fire separations.

.5 Manufacturer-supplied vibration isolation will be provided at all fan equipment.

.6 Acoustic lining will be provided where required to meet NC noise level criteria.

4.6 CONTROLS

4.6.1 A DDC control system will be provided. Electric actuators will be provided for all motorized dampers and heating control valves.

4.6.2 Central monitoring console will be provided at a location identified by the Brandon University. The console will consist of the following components:

.1 Central processing unit including computer and associated peripherals.

.2 Color monitor with dynamic graphics capability.

.3 Alarm/report printer.

.4 Communications capability for remote monitoring of the facility from the Brandon University Maintenance Shop.

4.6.3 The central console will provide operating interaction with the DDC system, as well as monitoring all equipment connected to the DDC system and reporting all unusual events.

4.6.4 The DDC system of central console, coupled with remote equipment, will provide various energy management and control capabilities such as:

.1 Automatic starting and stopping of motors.

.2 Automatic adjustment of temperatures, pressures and humidity.

.3 Economizer control of air handling systems.

.4 Outdoor air quantity reset based on indoor air quality.

.5 Indoor/outdoor reset of hot water temperature.

.6 Automatic adjustment of air volumes on VAV systems

4.6.5 Generally the following components will be monitored with status and alarm points:

.1 air system filters

.2 heat exchangers

.3 heating pumps

.4 chilled water pumps

.5 condenser water pumps

.6 air handling units status

.7 return air CO_2 level

.8 low temperature alarms will be capable of being reported to the Brandon University Physical Plant Department.

4.6.6 All occupied spaces will have individual thermostatic temperature control. Day/night function temperature sensors/controllers with override switches will be provided.

4.7 HVAC TESTING & BALANCING

4.7.1 Testing and balancing of the mechanical heating, ventilation, and air conditioning systems will be provided to ensure environmental requirements have been met.

.1 All air and hydronic systems will be tested.

4.7.2 Preliminary test and balance reports will be provided for review.

4.7.3 Final reports will be provided to form part of the Operation and Maintenance manuals.

4.8 ACCEPTABLE PRODUCTS & MANUFACTURERS

4.8.1 Electric Motors

.1 G.E.; Siemens; Tamper; Reliance; Leland; Lincoln; U.S. Electric; Century; Baldor; WEG; Toshiba

4.8.2 Insulation

Pipe Insulation	Manville; Owens Corning; Knauf; Pabco; Fibreglas
External Duct Insulation	Manville; Fibreglas; Knauf
Fire Retardant Canvas	Fattal; Radley
Lagging Adhesive/Coating	Bakor; Childers; Fosters
Aluminum pipe jacket	Childers; Permaclad; Pabco
PVC pipe jacket	Sure-Fit

4.8.3 Vibration Control

Vibration Control Products*	Vibro-Acoustics; Airmaster; Vibron; Kinetics; SVC Ind.

4.8.4 Plumbing

Grooved copper piping	Gruvlok; Victaulic system*
Cast iron soil pipe	Bibby-Ste-Croix
Valves (gate & globe)*	Crane; Toyo; Kitz; Nibco
Valves (butterfly)*	Keystone; Center Line; Kurimoto; Victaulic; Gruvlok
Valves (ball)*	Toyo; Kitz; Nibco; Anvil
Check valves to 2" diam.*	
Horizontal piping	Crane; Toyo; Kitz; Nibco
Vertical piping	Val-Matic
Check valves 2 1/2" diam. & up*	
Horizontal piping	Check-Rite; Moyes & Groves
Vertical piping	Val-Matic; Durabla;Keystone-Prince
Hangers and Supports	Anvil; Crane; Myatt
Alignment Guides	Adsco; Flexon; Fulton; Yarway
Drainage specialties:* cleanouts, chair carriers, etc.)	Watts; Zurn; J.R. Smith; Mifab (floor drains, roof drains,
Stainless steel process drains*	Kusel
Dielectric	Watts
Shock absorbers*	Zurn; Watts; J.R. Smith; Mifab
Strainers*	Spirax-Sarco; Muessco; Toyo; Crane; Colton
Expansion joints*	Fulton; Flexonics; Hyspan; Flextech
Pressure gauges*	Ashcroft; Kunkle; Morrison; Winters; Marshalltown; Ametek; Trerice; Weiss
Thermo meters*	Ashcroft; Trerice; Taylor; Weiss; Marshalltown; Winters
Hose bibbs & compression stops*	Powers Crane; Brass Craft
Wall hydrants*	Zurn; Watts; J.R. Smith; Mifab
Wall hydrants*	Brass Craft; Crane
Gas cocks*	Toyo; Neuman-Milliken; Anvil
Gas regulators*	Fisher
Plumbing fixtures*	Crane; American-Standard; Kohler

Plumbing brass*	American Standard; Crane; Cambridge
Flush valves*	Crane; Teck; Sloan; Zurn
Stainless steel sinks*	American-Standard; K.I.L.; Briggs & Wessan; Kindred Industries; Architectural Metals Industries; Aristaline
Toilet seats*	Olsonite; Moldex; Centoco; Bemis
Hot water tank*	Leitch; Westeel-Rosco
Electric water heaters*	State; John Wood; A.O. Smith
Hot water recirc. pumps*	Armstrong; B & G; Grundfos
Laboratory supplies*	Cambridge
Air compressor*	Ingersoll-Rand; Gardner-Denver; DeVilbiss; Atlas Copco; Sullair
Air regulators*	DeVilbiss
Thermostatic mixing valves*	Symmons; Powers
Refrigerated drinking fountains*	Haws; Aquarius Elkay;
Backflow preventers*	Watts; Conbraco; Ames
Expansion tanks*	Amtrol; Expanflex; H & G
Eyewash*	Haws; Bradley; Guardian Equipment

4.8.5 Fire Protection

Automatic sprinkler	Reliable; Viking; Victaulic; equipment* Tyco Fire Products (Gem, Star, Central)
Gate valves*	Kennedy; McAvity; Mueller; Watts; Nibco
Ball Valves*	Milwaukee; Global
Check valves*	Crane; Check-Rite; Val-matic; Victaulic; Gruvlok
Butterfly valves*	Crane; Victaulic; Mueller; Watts; Gruvlok; Global; Nibco
Pressure gauges*	Dresser; Morrison; Marshalltown; H.O. Trerice; Ametek; Kunkle; Winters; Tyco
Fire pumps*	Peerless; Aurora; Armstrong; ITT; Darling
Jockey pumps*	Burks
Mechanical joints*	Victaulic; Gruvlok
Pre-action control valves*	Reliable; Griswold; Claval; Tyco Fire Products (Gem, Star, Central)
Backflow preventers*	Watts; Conbraco; Ames Valve monitor and
flow switches*	Potter; Tectra; Edson; Canswiss

.1 Liquid Heat Transfer

Welding fittings	Anvil; Crane; Tube Turn
Malleable iron fittings,	Crane; Gourd; Anvil; flange, flange gaskets International Malleable
Mechanical joints	Victaulic; Gruvlok
Pipe hangers	Anvil; Crane; Myatt
Floor plates	Crane
Gate, globe valves*	Crane; Toyo; Kitz; Nibco
Radiator valves*	Crane; Dahl; Toyo
Check valves (up to 2" diam.)	
Horizontal piping*	Crane; Toyo; Kitz; Nibco
Vertical piping*	Durabla; Nibco
Check valves (2-1/2" diam. & up)	
Horizontal piping*	Moyes & Groves; Chek-Rite; Keystone-Prince; Victaulic; Gruvlok
Vertical piping*	Val-Matic; Durabla; Victaulic; Gruvlok
Butterfly valves*	Keystone; Center Line; Nibco; Victaulic; Jenkins; Gruvlok
Ball Valves*	Toyo; Kitz; Nibco; Victaulic; Newman Hattersley; Jenkins; Anvil
Balancing valves (up to 2-1/2” dia. & up)*	Toyo; Kitz; Anvil; Newman Hattersley
Balancing valves* (2-1/2" dia. & up)*	Keystone; Center Line; Nibco; Victaulic; Jenkins; Gruvlok Circuit
balancing valves*	Armstrong; Tour & Andersson; Gruvlok
Triple duty valves*	Armstrong; B&G; Gruvlok; Victaulic
Suction guides*	Armstrong; B&G
Expansion joints*	Fulton; Flexonics; Hyspan
Alignment guides*	Adsco; Flexon; Fulton; Flexonics; Hyspan
Air vents*	Dole; Hoffman; Maid-O-Mist
Air purgers*	Hamlet & Garneau
Air separators*	Armstrong; B&G; Hamlet & Garneau
Strainers*	Spirax-Sarco; Mueller; Victaulic; Gruvlok; Colton
Thermometers*	Ashcroft; H.O. Trerice; Winters; Taylor; Weiss; Marshalltown
Pressure gauges*	Kunkle; Winters; Ametek; Ashcroft; Trerice; Weiss; Marshalltown
Water pressure reducing valves*	B & G; Braukmann

Expansion tanks*	Amtrol; Expanflex; Wessels; B & G; Taco; John Wood
Tank gauges*	Morrison
Relief valves (water)*	Conbraco; Spence; Farris
Wall fin, convectors*	Rosemex; Engineered Air; Rittling
Forced flow, unit heaters*	Rosemex; Engineered Air; McQuay
Radiant panels*	Airtex; Frenger; TWA; Rosemex
Specialty radiation*	Runtal; Hudevad
Fan coil units*	Carrier; McQuay; York
Plate heat exchangers*	Alfa-Laval; B & G; Armstrong
Vertical in-line pumps*	Armstrong; B & G
In-Line pumps*	Armstrong; B & G; Duro; Thrush
Flexible pipe connectors*	Flexonics; Hydro-Flex; United Flexible
Chemical treatment*	GE Betz
Fuel oil day tanks	Westeel; DTE; Roth
Fuel oil pumps*	Viking
Underfloor heating system	Heatlink; Rehau; Uponor
Glycol fill tank*	GE Betz; Hamlet & Garneau
Glycol fill pump*	Viking
Glycol holding tank*	Equinox
Glycol	Union Carbide; Dow
Welded pipe backing rings*	Robvon; Anvil
Vibration control*	Vibron; Vibro-Acoustic; Airmaster
Steam humidifier*	Armstrong; Dri-Steem; Nortec; Herrmidifier

.2 Air Distribution

Ducturns, damper hardware, fan connections*	Duro-Dyne
Duct Sealer	Duro-Dyne; 3M; Flexa-Duct; United; Bakelite
Fire Damper*	Controlled Air; Penn; Air Balance; C.A.A.; Hart & Cooley; Ruskin; Nailor; Cesco
Fire/smoke dampers*	Greenheck; Controlled Air; Prefco Lawson; Nailor; Taylor
Pitot tube enclosures*	Lawson Taylor
Manometers*	Dwyer
Filters*	A.A.F.; Camfill-Farr; Cambridge;
Continental; Airguard	
Louvres*	Airolite; Carnes; Penn; Air-O Vent; Canadian Advanced Air; H & C; Westvent; Ventex
Air supply units*	Haakon, McQuay; York
Tube / vane axial fans*	CML Northern Blower; Twin City; Barry Blower; Hartzell; Loren Cook; Greenheck
Belt driven vent fans*	CML Northern Blower; Loren Cook; Twin City; Barry Blower; Greenheck
Belt driven in-line fans*	Greenheck; Loren Cook
Roof exhausters*	Delhi; Airmaster; Torin; Greenheck; Penn; Philips-Lau; Airdex
Diffusers, registers	E.H. Price; Hart & Cooley; & grilles*; Titus; Carnes; Nailor
Acoustic duct insulation*	Manville; Fibreglas; Ultralite; Knauf
Variable volume air valves*	E.H. Price; Nailor; Titus; Hart & Cooley; Anemostat
Duct silencers*	Vibro-Acoustics; Commercial Acoustics; Vibron; Kinetics; E.H. Price
Vibration control*	Airmaster; Vibro-Acoustics; Vibron; Kinetics
Spiral ductwork*	AMS; Basar; United; Vent Air; Pellaers
Flexible ductwork*	Thermoflex
Backdraft damper*	Penn; Greenheck; Ventex

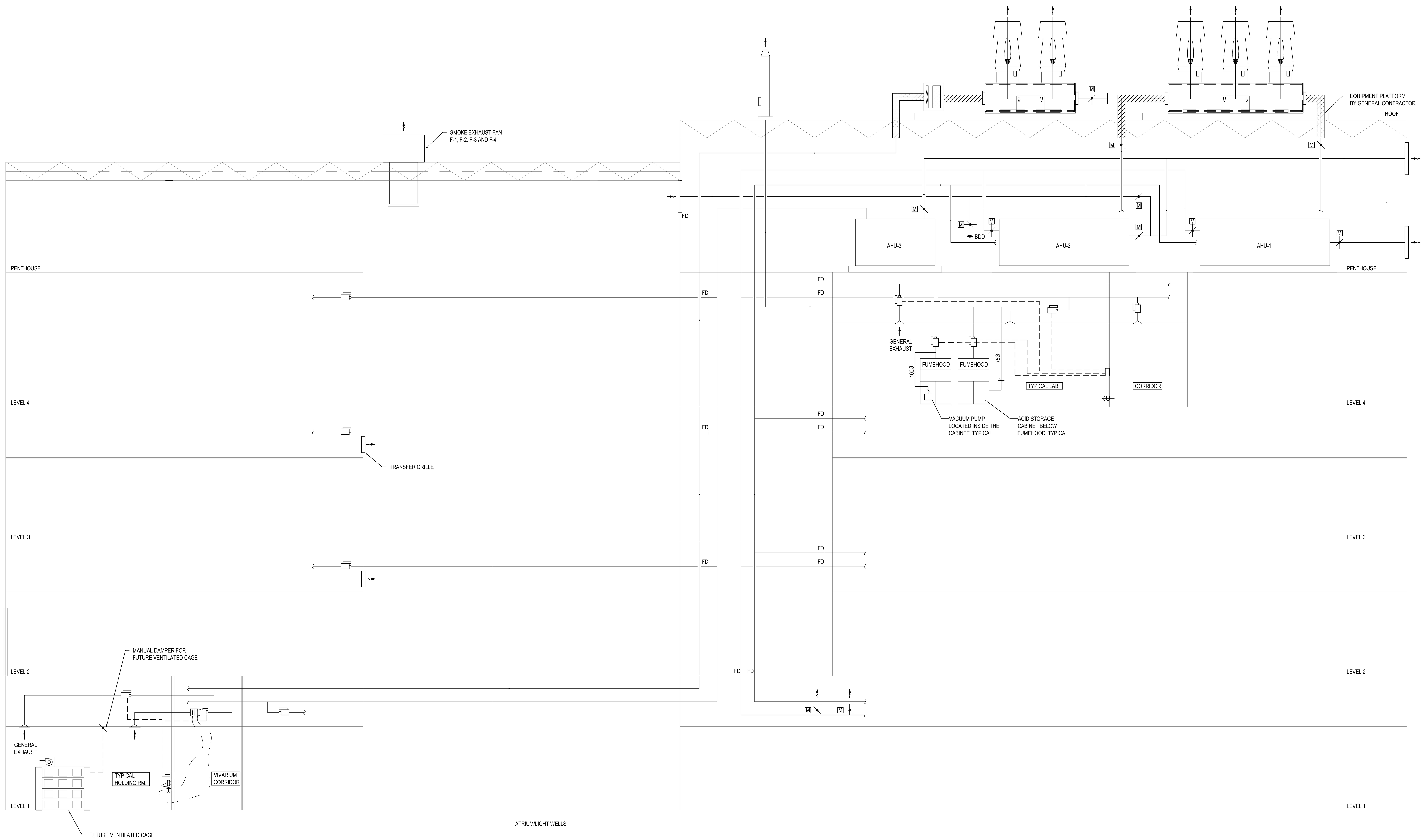
.3 Controls / Instrumentation

Temperature control system*	Automated Logic
Gas detection sensor*	Q.E.L.; M.S.A., Vulcain
I.A.Q. sensor*	Greystone
Air flow measuring stations*	Air Monitor; Ebtron

.4 HVAC Balancing & Testing

H.V.A.C. Balance & Testing Agency	Airdronics Inc.; AHS; Air Movement

END OF SECTION



1 VENTILATION SYSTEM SCHEMATIC
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ENGINEERS GEOSCIENTISTS MANITOBA
Certificate of Authorization
SMS Engineering Ltd.
No. 166

PRELIMINARY NOT FOR CONSTRUCTION

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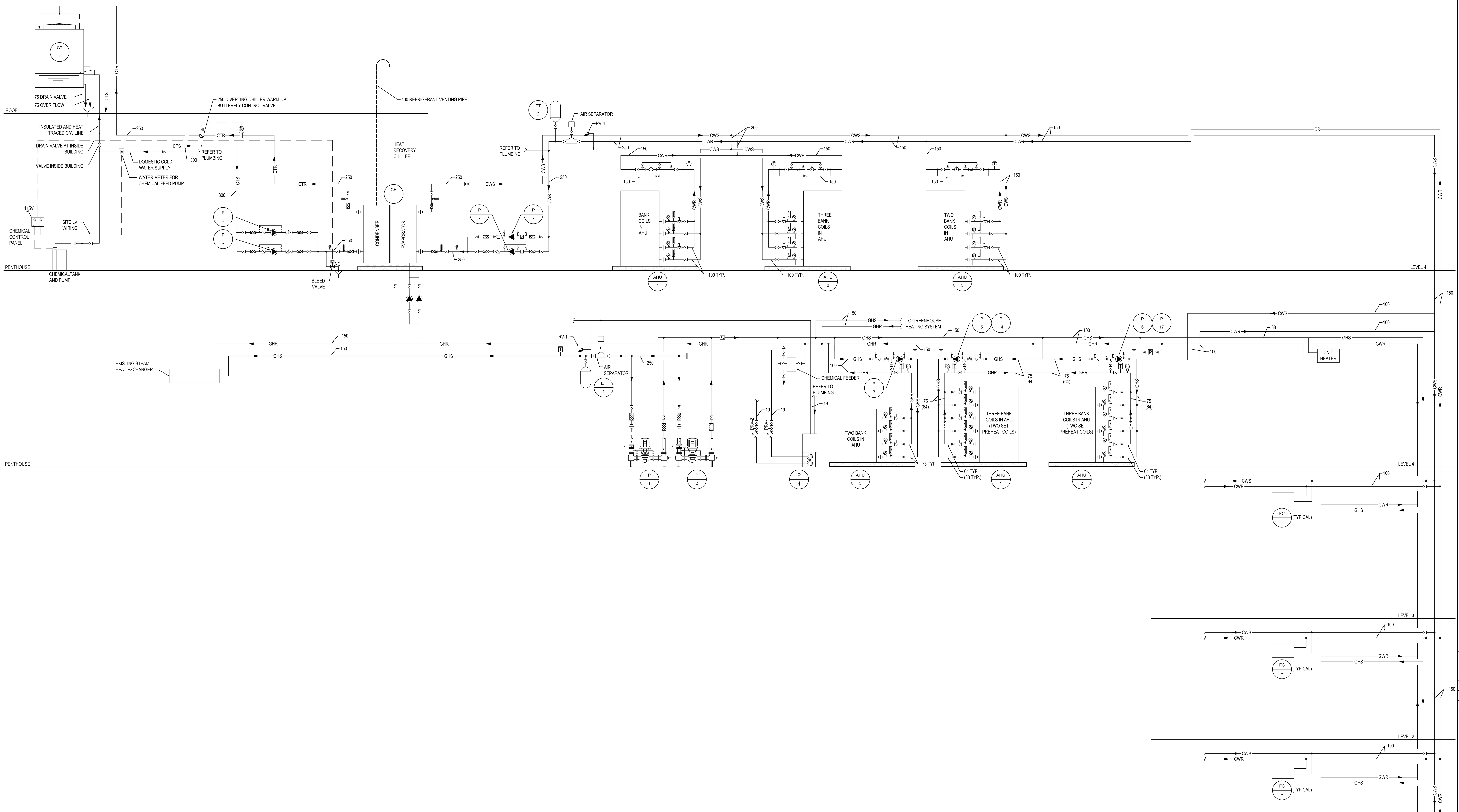
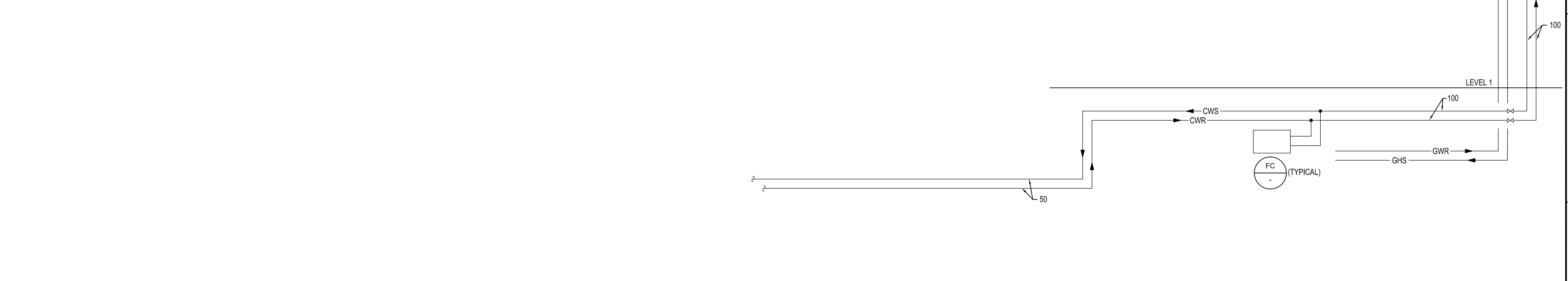
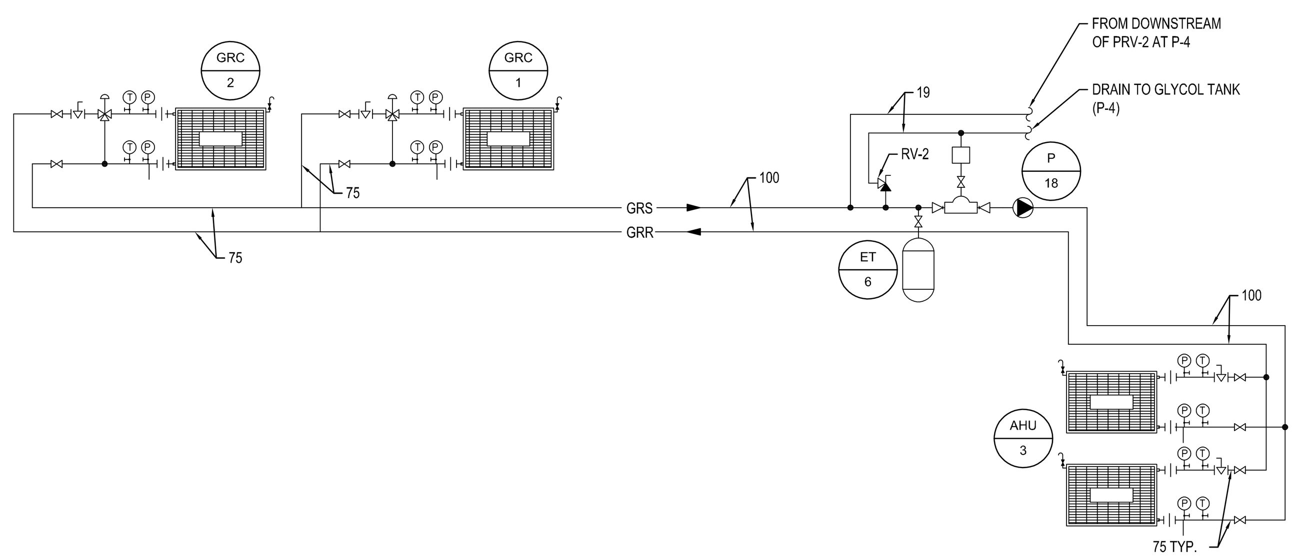
SMS ENGINEERING

Project Title
BRODIE SCIENCE CENTRE ASSESSMENT
-
WINNIPEG MANITOBA

Drawing Title
VENTILATION SYSTEM SCHEMATIC

Drawn By	Checked By	Approved By
RNS	VSW	-
Scale: AS SHOWN	Date: NOVEMBER 2018	Project No.: 18-274-01
Revision Number: 0	Drawing Number: M1	Sheet Order: 1 OF 2



2 / M2 GLYCOL HEAT RECLAIM SYSTEM PIPING SCHEMATIC
SCALE: N.T.S.

1 / M2 HYDRONIC PIPING SCHEMATIC
SCALE: N.T.S.

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Project Title
BRODIE SCIENCE CENTRE ASSESSMENT
-
BRANDON MANITOBA

Drawing Title
HYDRONIC PIPING SCHEMATIC

Drawn By	Checked By	Approved By
RNS	VSW	-
Scale: AS SHOWN	Date: NOVEMBER 2018	Project No.: 18-274-01
Revision Number: 0	Drawing Number: M2	Sheet Order: 2 OF 2

UNIVERSITY OF BRANDON
JOHN R. BRODIE CENTRE
PRELIMINARY BUILDING ASSESSMENT AND CONCEPTUAL DESIGN - ELECTRICAL

November 26, 2018

Prairie Architects Inc.
101-139 Market Avenue
Winnipeg, MB R3B 0P5

SMS Project No.: 18-274-01

1 ELECTRICAL

1.1 DESIGN SYNOPSIS

1.1.1 The electrical systems design is at the preliminary stage. This document is intended to describe proposed systems to develop a Class ‘D’ opinion of probable cost.

1.1.2 The electrical systems will be designed to be flexible and simple in their operation. This will result in a system which is reliable and straightforward to operate and maintain.

1.1.3 The design team will adopt a philosophy of integrated design which will lead to a building in which the building’s systems are optimized.

1.1.4 The lighting design will enhance the overall look of the interior spaces and exterior façade of the building. Illumination brilliance will be achieved through the use of various types of LED fixtures, to suit the environment.

1.1.5 The electrical design will be coordinated and integrated with the architectural, structural and mechanical designs to ensure the design intents of all disciplines are achieved.

1.1.6 Refer to attached preliminary Distribution Singe Line drawings E1 and E2 and Typical Voice Data Room Large Scale Plan ED-1 for reference.

1.1.7 Refer to mechanical drawings to confirm quantity of connection points and additional loads not yet indicated within the electrical package.

1.1.8 The electrical work will meet or exceed the minimum requirements of the latest applicable codes, rules and regulations including the following:

.1 Canadian Electrical Code

.2 Manitoba Fire Code

.3 Manitoba Building Code

.4 CSA Standards

.5 IEEE Standards

.6 Illuminating Engineering Society (IES) Standards

.7 ASHRAE Standards

.8 Governing Authority having jurisdiction

.9 Manitoba Energy Code for Buildings

.10 Universal Accessibility Guidelines

.11 All products will be CSA approved.

1.1.9 A digital customer metering system will be provided for all remote electrical distribution metering. The system will allow the building owners to meter power usage in all areas of the building. This will be achieved by metering CT's installed in the sub-breakers all connected to a master controller and required software.

1.1.10 A new 150kW/187.5kVA 347/600V 3ø 4W penthouse mounted standby emergency diesel generator will be provided for the facility. The generator will be equipped with an in-frame fuel day tank with 6 hour (at full load) fuel reserve.

1.1.11 Interior lighting will be an important aspect of the look, feel, and security of each area. The lighting will be designed in collaboration with the architectural and interior design team. Energy efficient lighting that features practicality, lamp efficacy, low energy use and long lamp life, all combined in decorative and pleasing enclosures will be utilized.

- .1 Light fixtures will be LED where available.
- .2 Colour changing fixtures will be used where required.
- .3 Vandal resistant fixtures will be provided in designated areas.
- .4 Exterior lighting will include decorative and expressive designs to highlight building outline, accentuate way finding and provide lighting of the exterior.
  - .1 Light source will be LED.
  - .2 Fixtures selection for exterior lighting shall mitigate exterior light pollution/trespass.
- .5 Lighting Control will be achieved by a programmable lighting control system will be used to control general exterior lighting, general interior space lighting and specific room lighting.

1.1.12 Receptacles & Power

- .1 Receptacles and power connections will be located in all areas as required to suit the room's intended purpose.
- .2 Receptacles and power connections for owner supplied equipment in labs or workshop areas will be provided to suit the equipment loads.
- .3 Mechanical equipment connections will be provided as required including motor control centres, CDP panels, starters, disconnects and interlocks.

1.1.13 Flush Floor Mounted Boxes

- .1 Flush floor mounted boxes will be provided in areas requiring power, data, or AV connections. The flush floor boxes to be low profile 4 gang galvanized steel box with Aluminum metal cover. Acceptable manufacturer is T&B Steel City 668-S Ultra Shallow Floor Boxes.

1.1.14 Systems

.1 Telecommunications and Data Cabling System pathways, Fire Alarm and Life Safety Systems, Card Access, Security and Closed Circuit Television System, Audiovisual as well as Paging Systems will be provided for the building and are further defined in the upcoming sections.

1.2 ELECTRICAL SERVICES TO THE BUILDING

1.2.1 Location of existing fibre optic backbone feeding the building to be confirmed and replaced if necessary to suit the renovation project.

1.2.2 Extend a 12 strand fibre optic cable from the main IT room (penthouse level) to each sub data room.

1.2.3 The main Telecommunications room will have plywood backboard on all walls up to the 2,440 mm height. All facility telephone and data feeds will originate from this room.

1.2.4 Coordinate with Cable TV utility supplier for cable TV service to the main telocomm room in the building and provide wiring from the demarcation point to all CATV outlets.

1.2.5 Electrical power outlets will be located on the exterior of the building by entrances, loading docks and other areas as required.

1.2.6 Site and Landscape lighting.

.1 The site lighting will consist of a combination of low pole mounted decorative LED fixtures, wall mounted LED security light fixtures, recessed and indirect canopy LED fixtures, decorative low level LED bollard fixtures (TBD) and LED landscape fixtures (TBD).

.2 Wall mounted LED fixtures will be provided around the perimeter of the building to allow for security and good illumination for the closed circuit television system.

.3 Lighting will be predominately powered at 120 volts controlled via the building lighting control system.

1.2.7 Power will be provided to exterior building signage at the main entrance as required.

1.2.8 Closed Circuit Television cameras (CCTV) will be located around the perimeter of the building. See CCTV section for equipment description.

1.3 NORMAL AND EMERGENCY/STANDBY POWER DISTRIBUTION

1.3.1 The existing 347/600V main distribution “Distribution Panel A” and 120/208V main distribution “Distribution Panel B” will be retrofitted. MCC-3 will remain for re-use. All other distribution equipment will be removed, and new equipment provided. At this preliminary stage it can be assumed that MCC-1 and MCC-2 will be replaced in a “like for like” manner.

Normal Power:

1.3.2 Multiple 120/208 volt, 3 phase, 4 wire, panels with molded case circuit breakers will be located on each level to feed all building loads. This will reduce voltage drop to acceptable levels and maintain the branch circuit wiring at # 10 AWG or less where possible (although larger sized wiring may be required to suit voltage drop requirements).

1.3.3 In consideration of the multi-use orientation of the facility, and due to the sensitivity of equipment installed within, Transient Voltage Surge Suppression will be installed on the 347/600 volt main distribution, 600V sub-distributions and on all the 120/208 volt main and sub-distributions.

1.3.4 Panel boards will be provided with lockable doors, 10% spare breakers and 15% space for future breakers.

1.3.5 Distribution busses to be copper and transformer windings will be Copper.

1.3.6 All wiring will be copper, and will be predominantly enclosed in a conduit raceway.

1.3.7 Electronic, networked metering will be provided at the following locations:

.1 Main distribution

.2 Generator distribution

.3 MCCs/mechanical CDPs

.4 All CDP sub-breakers.

1.3.8 Current transformers will be built-in the breakers feeding the above described loads.

.1 The metering breakers will be networked over Cat 6A cabling to a networked PC with metering software. The software will provide both tariff and electrical load (Amps, Voltage, kW, kWh) information.

.2 Typical manufacturers will be Eaton, Schneider Canada, Siemens Canada.

1.3.9 Refer to Drawing E1 Distribution Single line diagram for further details.

1.3.10 Emergency Power

.1 Emergency power will be provided by a 150kW/187.5 KVA 347/600V 3ø 4W diesel powered emergency generator. The generator will be mounted in the level G generator room.

.2 The generator will be provided with an in-frame ULC listed diesel fuel day tank with 6 hour capacity at generator full load. The day tank will be filled by a set of pumps and larger holding tank.

.3 The generator will power Emergency Main Distribution EMD-6A located inside the generator room and will have a spare 200A-3P breaker for future load bank testing.

.4 Refer to Drawing E2 Emergency Distribution Single line diagram for further details.

1.4 INTERIOR AND EXTERIOR LIGHTING CONCEPTS

1.4.1 All existing lighting (typically T8 fluorescent) will be removed and replaced with new energy efficient Light Emitting Diode (LED) lighting.

.1 High colour rendering (80 CRI or greater) fixtures will be selected

.2 Fixtures will be mercury free.

.3 Lamp colour will be determined based on colour and finishes of the architectural materials palette as well as the availability of daylight, to assure that the best possible colour rendering of the architectural materials and surfaces.

1.4.2 Driver selection will be carefully considered for all LED sources to provide the appropriate performance and efficiency.

1.4.3 In order to optimize energy conservation, an automated lighting control system will be provided.

1.4.4 All interior lighting will meet or exceed the requirements for lighting power density (LPD).

1.4.5 All exterior lighting will meet or exceed Dark Sky requirements and will be controlled with a combination of sensors and atomic time clock associated with the lighting control system.

1.4.6 Daylight harvesting will be utilized in areas where day light is present. Occupancy sensors to be used in designated areas (e.g. offices, classrooms, storage rooms, janitor rooms, etc.).

1.4.7 Light fixtures will be selected to be eligible for the Manitoba Hydro “Power Smart Rebate” program wherever possible. Where fixtures are not listed, special approval by Manitoba Hydro will be obtained by the supplier**.**

1.4.8 Interior Lighting General

.1 The proposed atrium with natural light will greatly increase daylight harvesting opportunities in the building. Daylight harvesting will be used in the atrium areas and in all spaces with natural light (along exterior walls).

.2 Approximately 20% of the light fixtures in corridors and large public areas will be designated as “night lights”. The lights will also be controlled by the lighting control system with an interface to the fire alarm to increase luminaire output to 100% in the event of a fire alarm.

.3 Lighting levels will be designed to the midrange of the Illumination Engineering Society (IES) recommended levels.

.4 Most lighting will be powered at 120.

.5 Interior light levels will be based on a combination of experience on past projects, and the established lighting design luminance level criteria of Industry Standards from the Illuminating Engineering Society Guidelines, 10th Edition. In addition, the power density allowance in the narrative may be exceeded in individual spaces, provided that the entire building / site meet ASHRAE 90.1-2010 and/or Manitoba Energy code requirements.

1.4.9 Exterior lighting general

.1 LED light fixtures with full cut-off and minimum efficacy of 100 plus lumens/watt will be utilized.

.2 Exterior light levels, where public will be traveling or present during the evening events, will be designed to IES recommended standards for night time outdoor lighting LZ2 (moderate ambient lighting) for safety and convenience.

.3 Exterior light levels will be based on a combination of experience on past projects, and the established lighting design luminance level criteria of Industry Standards from the Illuminating Engineering Society Guidelines, 10th Edition.

.4 Planter beds shall incorporate directional flood lights. Aiming and installation shall be coordinated with the Owner or Landscape designer.

1.4.10 Interior lighting

.1 Preliminary lighting approach:

Location	**Target Light Levels (Lux)**	**Description**
Offices	350-450 Lux	Direct Recessed or suspended direct/indirect lensed LED fixtures
Lobby / Reception Areas	250 Lux	Clusters of LED downlights, suspended clusters of various sizes of LED, wall mounted LED sconces and/or suspended pendants at the reception desks

Location	Target Light Levels (Lux)	Description
Presentation Space / Training Rooms/ Auditoriums	400-500 Lux general 600-750 Lux where required	Hospitality style lighting including recessed LED down lights and directional lights. Suspended or Recessed direct/indirect LED fixtures lenses for general lighting. Auditorium to include decorative wall sconces.
Fixed Workstation / Open Offices	350-450 Lux	Recessed or suspended direct/indirect LED lensed fixtures
Lunch Room	250-350 Lux	Recessed or suspended direct LED downlights & decorative pendants .
Classrooms / Lab's	400-500 Lux general	Direct Recessed or suspended direct LED lensed fixtures
Building Maintenance, storage areas, service rooms.	250-350 Lux	Suspended LED fixtures c/w acrylic lenses.

1.4.11 Light levels recommended in this narrative are to be used as a general guideline, and are based on a combination of experience on past projects, and the established lighting design illuminance level criteria of Industry Standards from the Illuminating Engineering Society Guidelines, 10th Edition. In addition, the power density allowance in the narrative may be exceeded in individual spaces, provided that the entire building / site exceed ASHRAE 90.1-2007 code requirements by 30 to 35%.

1.4.12 Lighting Controls

.1 The lighting control system will be based on an open source, intelligent, Digital Addressable Lighting, and network based lighting system that utilizes a combination of relay based switching, low voltage dimming (0-10v).

.2 Lighting control system will be designed based on a Fifth Light or Crestron lighting control system.

.3 Lighting devices that connect to the lighting control system will include dimmers, scene controllers, touch panels, photocells, occupancy sensors, astronomical time clock and day lighting sensors.

.4 The lighting control system will be able to seamlessly communicate between lighting panels and various system inputs and outputs.

.5 The system will be capable to incorporate controls for AV as well as motorized blinds where required.

.6 A easy to use master lighting control touch screen will be provided that will be used to program and control the entire facility.

.1 The master touch screen is intended to be portable and will be able to connect to the system either wirelessly or hard wired.

.2 The master touch screen will control all the lighting as well as have the capability to control the Audio, Visual and Blinds, and display Temperature, by interfacing with the BMS system in each room.

.3 Capability of connecting to Mobile Apps. Mobile Apps shall be limited access to main control.

.7 Provide touch panels for dedicated control for each space and are intended to control the lighting, Audio, Visual and Blinds. Temperature will be displayed, by interfacing with the BMS system.

.1 The small touch screens are intended to be wall mounted and will be able to connect to the system, either wirelessly or hard wired.

.8 Lighting control system will include a graphic user interface.

.9 Lighting control system will be programmed based upon the Owner’s requirements, and to maximize energy savings and maintain the ambient lighting in the space.

.10 Some area controllers, gateways and power packs will be installed in accessible ceiling spaces as required for smooth communications between the area and lighting control panel/s.

.11 The lighting control system will have an auxiliary connection to the fire alarm panel that will turn all the controlled lighting and emergency lighting in the entire facility to 100% in event of a fire alarm.

.12 Provide one smaller touch panel in each classroom, atrium and auditorium. Provide an additional four (10) panels for yet to be determined locations.

.13 Provide two master touch panels, location TBD.

.14 Provide a graphical software based interface in each panel. Provide custom programming and graphic package. Development of graphic to be completed with input from Owner and Consultant prior to initial programming of system.

.15 Alter and program final lighting levels and other control features during commissioning phase.

.16 Provide all necessary training.

1.4.13 Exit and Emergency Lighting

.1 Pictogram style green LED type exit lighting will be provided along all egress corridors and at all exit doors. Exit lights will be connected to the life safety emergency power system.

.2 Emergency lighting in the generator room will be supplemented with a battery bank, fed from a TVSS receptacle.

.3 Designated 120V light fixtures along egress paths and corridors will be connected to the emergency generator life safety distribution.

.4 Public area exit signs will be edge lit glass. Exit lights in the back-of house areas will be standard exit light fixtures.

.5 Battery powered DC emergency lighting will be provided in the generator room and areas where transfer switches are located. Additional remote emergency lighting will be provided in Electrical rooms and the Sprinkler room.

1.5 RECEPTACLES AND POWER OUTLETS

1.5.1 Receptacles and power outlets will be provided in keeping with the functional requirements of the space and specifically as follows:

1.5.2 Cubicle Offices – wired modular furniture connections for cubicles (2 workstations per circuit)

1.5.3 Single Person Offices – one quadplex and one duplex receptacles (2 offices per circuit).

1.5.4 Printing Areas – Copiers and printers will be connected to dedicated circuit.

1.5.5 Kitchenettes – Coffee stations, microwaves and fridges will be wired to dedicated circuits. Above counter 20A dedicated GFCI receptacles will be provided where required.

1.5.6 Classrooms– wall mounted, and flush floor mounted power and data outlets to suit the furniture layouts.

1.5.7 Labs:

.1 Legrand Wiremold DS400 series raceway over perimeter wall counters/casework.

.2 Casework mounted outlets for island type benches.

1.5.8 The following equipment will be wired:

.1 Electric Door operators and interior overhead doors

.2 Electric Hand dryers in washrooms

.3 Electric toilet flush valves and faucets

.4 Digital screens, projectors, electric screens

.5 Digital media and A/V equipment

.6 Overhead doors

.7 Dock levelers (if applicable)

.8 Elevators

.9 Shop equipment

1.5.9 Wiring will be copper type RW90, minimum #12 AWG, installed in EMT conduit inside building and rigid PVC conduit where underground.

1.5.10 Type “BX” cable will be used for drops from outlet boxes to individual lighting fixtures recessed in t-bar ceilings and for branch circuit wiring in steel stud partitions; all home runs to panels will be in conduit.

1.5.11 Heat trace for exterior rainwater leader drains will be wired.

1.6 GROUNDING AND BONDING

1.6.1 Grounding conductors to all distributions, transformers and panels will be provided.

1.6.2 Ground conductors will be provided in all conduit runs.

1.6.3 A telecoms grounding system will be provided, comprising a telecommunications main grounding busbar (TMGB) in the main data room and a telecommunications grounding bus bar (TGB) in each other data room. The telecommunications main grounding busbar (TMGB) and telecommunications grounding busbar (TGB) will be mounted on insulated bushings 100mm high. Install a #3/0 AWG insulated (FT4) grounding conductor from TMGB to each TGB in a radial configuration, following cabling pathways (mounted on cable tray) between data rooms. Connect to TGB ground bar. Use compression clamp at each ground bar to route on to next to allow removal of ground bar without affecting integrity of conductor. Install #3/0 AWG bonding conductor for telecommunications (BCT) from TMGB to service equipment (power) ground grid.

1.6.4 Bond metallic raceways in data rooms to associated TMGB/TGB using #6 AWG FT4 green insulated copper conductor.

1.6.5 For cables within data rooms having shield or metallic member, bond shield or metallic member to associated TMGB/TGB using #6 AWG FT4 green insulated copper conductor.

1.6.6 Bond equipment rack(s) located in data rooms to associated TMGB/TGB using #6 AWG FT4 green insulated copper conductor.

1.7 MECHANICAL EQUIPMENT

1.7.1 All mechanical equipment will be wired and connected. Review the mechanical sections for description as no connections are yet shown on the electrical plans.

1.7.2 Motor connections shall include manual starters, magnetic starters and soft starters (for motors greater than 15HP) installed in Motor Control Centres, interlock wiring and disconnect switches as required.

1.7.3 Wire and connect float switches, pressure switches, alternators, alarms, etc. for sump pumps, and circulation pumps.

1.7.4 Provide 120V power supply for all BMS control panels.

1.7.5 All equipment mounted on the exterior of the building shall be weatherproof.

1.7.6 Connections to include but not limited to the following:

.1 Mechanical room equipment: central heat recovery unit, boilers, chiller, pumps, fluid cooler

.2 Fan coil units, unit heaters

.3 Remote exhaust fans

.4 Split A/C system for the electrical and voice/data rooms

.5 Sump pumps

.6 Electric Hot Water Heaters

.7 Sprinkler system

1.8 VOICE AND DATA SYSTEMS

1.8.1 Vertically stacked voice/data riser rooms are proposed to be located coincident with the electrical riser rooms. Space for two racks (racks will be by others) will be accommodated in each riser room, offering space for network equipment as well as the potential for voice over IP phone protocol.

1.8.2 The voice/data pathway system will comprise of a cabling support infrastructure within the building consisting of:

.1 Telecomm outlets with cables pulled in to the stud space minimum 20 mm conduit to ceiling space and extended to the cable tray system. Provide nylon gromits in steel studs to protect cables.

.2 Use B-Line BB10 (or similar) wall plates in drywall partitions.

.3 “J” hooks as required,

.4 Cable trays provided in ceiling space to route cabling through all areas of the floor plate on each level. Cable tray to be interconnected to the main and sub-Telecomm rooms and remote Telecomm racks. Cable trays in exposed areas to be complete with solid bottom and with 2 adjustable partitions.

1.8.3 Provide remote Telecomm cabinets as required in the interstitial space and office/admin areas.

1.8.4 The main Telecomm room (Penthouse Level) is existing and will remain.

1.8.5 New secondary Telecomm rooms will be provided on each level (8' x 10' minimum size). Refer to attached sketch for preliminary layout.

1.8.6 Power receptacles will be provided near racks for connection to active rack mount equipment.

1.8.7 Voice/Data rooms will be located in the building to satisfy the 90m rule for CAT 6A cabling.

1.8.8 Remote Telecomm racks c/w fibre and copper patch panels will be provided complete with patch cords (within the data rooms) and power distribution units (power bars mounted in racks).

1.8.9 Bond cable tray using #6 AWG FT4 green insulated copper conductor (300 mm maximum) with cable tray ground clamps at each cable tray joint and maximum 3 m intervals.

1.8.10 Provide a single mode 12 strand fibre optic cable and 25 pair Cat 3 cable from Main Telecom Room to each secondary Telecom room (one on each floor).

1.8.11 Typically, provide 2-Cat 6A drops per data outlet:

1.8.12 In the following specific locations, provide the following:

.1 1 outlet per Office/cubicle

.2 6 outlets per Lab

.3 4 outlets per Classroom

1.8.13 Provide Wireless Access Points 'WAP' throughout the building. Provide 2 Cat 6A dropS for each Wireless Access Points 'WAP'.

1.8.14 Computer lab requirements to be established by the user groups.

1.8.15 Installation, labeling and technology to follow Brandon University standards.

1.8.16 Preferred Manufactuer: Belden bonded pair, Cat 6A.

1.9 FIRE ALARM SYSTEM

1.9.1 A single stage addressable fire alarm system will be provided and all devices will be connected as required.

1.9.2 The system notification devices shall include strobes and combination horn strobes.

1.9.3 A fire alarm shall cause the following functions to be activated automatically:

.1 Cause the fan shutdown relays to operate.

.2 Cause all door hold open devices to release.

.3 Cause coiling smoke shutters to close.

.4 Electric magnetic lock doors to release (if applicable).

.5 Cause an alarm to be transmitted to the Fire Department or Central Reporting Agency via an automatic voice dialer.

.6 Cause audible/visual signals (horn/strobes) to operate.

.7 Home elevators to main floor.

1.9.4 During an alarm the LED correlated with the zone (building area) in which the alarm occurred shall illuminate. The alarm LED shall remain illuminated until manual station or device that activated the alarm is reset.

1.9.5 Fire alarm control panel and dialer (dialer provided by monitoring agency) to be located in the Level 1 electrical room. Provide demarcation box for dialer wiring for use by Div. 26 and monitoring agency technician.

1.9.6 Provide 3 remote fire alarm annunciator panels at primary entrances to the building (locations TBD).

1.9.7 Pullstations shall be located at every “means of egress” door leaving a floor area or leading to the building exterior.

1.9.8 Automatic heat detectors (either fixed temperature or rate of rise units) shall be installed in mechanical rooms, generator room, elevator pits, etc.

1.9.9 Automatic smoke detectors will be installed in corridors, electrical rooms, data rooms, at the top of stairs, etc. Floor areas are sprinklered.

1.9.10 Early warning aspirating smoke detection (Vesda XAS) will be installed in elevator shafts at penthouse level and elevator machine room.

1.9.11 Monitoring of Carbon Dioxide detectors (supplied by Division 25) will be connected to the fire alarm panel.

1.9.12 Duct smoke detectors c/w addressable fire alarm relays (to shut-down mechanical equipment on fire alarm) will be provided as required by mechanical. Provide within major HVAC units serving more than one zone/floor..

1.9.13 Magnetic door hold open devices will be connected to the fire alarm system to ensure that doors release and close upon fire alarm system activation.

1.9.14 Alarm signal devices shall be horn/strobes, recessed or surface mounted depending on the area.

1.9.15 Provide connections to the sprinkler system. Refer to mechanical Narrative/Outline Specification for requirements and details.

1.9.16 Install all fire alarm system wiring in EMT conduit system; fire rated wiring shall be used where required by code.

1.9.17 The manufacturer will verify all fire alarm devices. Test reports shall be submitted to the authority having jurisdiction and be inserted in the maintenance manuals.

1.9.18 Provide monitoring modules at all CO detection panels (panels by Division 25) and interface with fire alarm system. Return trouble alarm.

1.9.19 Monitor modules are to be provided and installed at each sprinkler valve required to be monitored; water-flow switches, tamper switches, pressure switches, etc. Locations and quantities will be provided by Mechanical as the design progresses.

1.9.20 Door holders for the fire doors leading to the existing connected campus are to release upon activation of the Brodie building fire alarm system or fire alarm system for connected building. Provide fire alarm relays and interconnect both building fire alarm systems. Provide a trouble signal to/from each fire alarm system.

1.10 AUDIO VISUAL (AV) SYSTEM / PAGING AND SOUND SYSTEMS

1.10.1 At this preliminary stage the AV and paging systems are not yet defined. Requirements will be updated as the design progresses. Work under this contract will include all conduits, custom wall, ceiling and floor boxes, 120V wiring, Cat 6A wiring, pullstrings and related hardware.

1.10.2 All wiring in EMT conduit system or will be supported from the cable tray system.

1.10.3 The entire voice audio, lighting control, and video control system will be based on all encompassing Creston system.

1.11 SECURITY / CARD ACCESS / CLOSED CIRCUIT TV SYSTEM

1.11.1 Provide Kantech Card Access hardware in the building to communicate with the existing Kantech system on campus. Existing controllers can be salvaged for re-use, if possible. The system will consist of centrally located, multi door control panels, card readers, electric strikes (with infrared request to exit) operation on related internal doors and alarm functions.

1.11.2 The system controllers will be located in the Data Rooms.

1.11.3 Provide access control at all exterior doors and service rooms (IT rooms, mechanical rooms, electrical rooms, generator room, etc.). In addition allow for an additional 30 doors to be selected by Owner (e.g. Labs).

1.11.4 All wiring in EMT conduit system.

1.11.5 CAT 6A cabling from controllers will be routed back to data rooms and terminate on patch panels. Provide all necessary network interface switches.

1.11.6 Provide an IP Closed Circuit Television (CCTV) system in the building. The system will consist of interior and exterior digital color dome cameras, controller panels, browser based operating software.

1.11.7 Exterior cameras will be 360° colour cameras mounted in weatherproof dome enclosures. Interior cameras will be a combination of fixed mounted, PTZ and 360° dome cameras in semi-recessed enclosures.

1.11.8 The main entrance and loading dock cameras will be supervised with a camera linked to an intercom and door release controlled from reception or security desk (location TBD).

1.11.9 Devices will be IP based, CAT 6A cables will be routed in conduit and cable trays to the data rooms. CAT 6A cables will terminate on patch panels, which will be patched/connected to the LAN network.

1.12 CATV SYSTEM

1.12.1 CATV outlets will be provided at each TV/display monitor.

1.12.2 Distributed TV connectivity (coaxial cable and/or CAT 6A outlets) will be provided to suit A/V consultant requirements.

1.12.3 All wiring in EMT conduit system (minimum 25mm conduit) or will be supported from the conduit/cable tray system. Conduit and associated cabling to terminate at closest data room.

1.13 INTERCOM SYSTEM

1.13.1 Provide an intercom system in the building. The system will consist of slave intercom stations at the main entrance, link entrance doors and loading dock area complete with audio and integral camera. The master intercom station will be located at the security desk.

1.13.2 Devices are IP based, CAT 6A cables will be routed in conduit/cable trays to the data rooms. CAT 6A cables will terminate on patch panels, which will be patched/connected to the LAN network. The LAN network will interconnect the intercom system and will allow connectivity back to the security equipment.

1.14 POE CLOCK SYSTEMS

1.14.1 Provide a PoE synchronized clock system installed throughout the building. The system will consist of 12” digital wall mounted clocks located in all classrooms, labs, boardrooms, etc. 12” dual sided clocks ceiling mounted clocks will be provided in corridors.

1.14.2 Clock head end equipment will be located in data rooms. All clocks will be IP based, CAT 6A cables will be routed in conduit/cable trays to data rooms and will terminate on patch panels. The network will interconnect the clock system and will allow connectivity for configuration online.

1.14.3 Clocks to have the capability to be connected to the network wirelessly.

1.14.4 Provide one drop for a single clock and two for a dual clock.

1.15 GENERAL ITEMS TO BE PROVIDED

1.15.1 Operations and maintenance manuals for all electrical equipment and systems.

1.15.2 Digital-based as built, with record drawing information incorporated from the trades on-site drawings. These as-built will also reflect all approved change orders during construction.

1.15.3 Operations staff will be trained by both the Contractors' and Manufacturers' representatives on electrical equipment and systems operation and maintenance. Include for video records to be prepared for all training sessions.

1.15.4 The normal electrical system warranty will be 1 year.

1.15.5 Electrical panels will be tagged with a building wide naming system.

1.15.6 Provide a Short Circuit, Coordination and Arc Flash study on all panels in the building.

1.15.7 All wire will be in conduit, and will be copper, unless otherwise indicated.

1.15.8 Provide 1-2” conduit from each electrical panel in each electrical room to an accessible location in the corridor to allow ease of future circuit addition through congested corridors. Terminate conduit in a 6”x6” junction box, and label.

1.16 PHASING

1.16.1 The project will be executed in two main phases. Refer to Architectural for the Phase 1 and Phase 2 area of work for each floor. Some preliminary phasing considerations are as follows:

.1 During Phase 1, the emergency generator will remain in operation to serve the essential and life safety loads located within the occupied (Phase 2) portion of the building. A new emergency generator room and distribution will be provided during Phase 1 to enable the existing emergency power equipment to be removed during Phase 2.

.2 Existing Fire Alarm Control Panel is located within the Phase 2 floor area and will remain in operation until the completion of Phase 1. A new FACP and fire alarm devices will be provided within the Phase 1 area and the system extended to the Phase 2 area.

.3 Existing distributions A and B to be refurbished during Phase 1 in order to support the redesigned electrical distribution system.

.4 Motor Control Centres MCC- 1 and MCC-2 to be replaced during Phase 1 in order to support the new mechanical loads.

.5 The existing IT room in the penthouse is the main IT room for the campus and will remain in operation throughout the project.

2 ELECTRICAL OUTLINE SPECIFICATIONS

2.1 ELECTRICAL GENERAL REQUIREMENTS

2.1.1 All panels, motor disconnects, Motor Control Centres, ceiling junction boxes, and power outlets shall be identified with mechanically fastened lamacoid nameplates.

2.1.2 All outlet mounting heights will be to suit their intended purposes and coordinated with architectural and Owner details.

2.1.3 Fireproofing of electrical cables, conduits, trays, etc. passing through fire barriers shall conform to local codes and inspection authorities.

2.1.4 Upon completion of the project, demonstrate the operation of all equipment in the presence of the Owner, or his representative, and the Consultant. Obtain signed certification from the Owner and the Consultant that such equipment is fully operational and that all necessary operating instructions have been provided.

2.1.5 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components as specified in subsequent sections.

2.1.6 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

2.1.7 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

2.1.8 Maintain phase sequence and colour coding throughout.

2.1.9 Colour Code: To CSA C22.1.

2.1.10 Use colour coded wires in communication cables, matched throughout system. Colour coding used shall be documented by individual systems in Maintenance Manuals.

2.1.11 Insulated grounding conductors shall have a green finish and shall be used only as a grounding conductor. A ground shall be provided in all conduits.

2.1.12 Colour code conduits, boxes and metallic sheathed cable.

2.1.13 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15m intervals.

Colours: 25mm wide prime colour and 20mm wide auxiliary colour.

	Prime	Auxiliary
Up to 250V	Yellow	

Up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire alarm	Red	
Emergency Voice	Red	Blue
Security Systems	Red	Yellow
Control	Blue	

2.1.14 Other conduit systems as directed on site; all conduit systems shall be identified.

2.1.15 Colour outlet box covers to colour designated and show circuit numbers in black felt marker on inside of covers.

2.1.16 Provide operation and maintenance data for incorporation into operation and maintenance manuals specified.

2.1.17 Include in operations and maintenance data:

.1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension, and expansion of any portion or feature of the electrical installation.

.2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature alone is not acceptable.

.3 Wiring and schematic diagrams and performance curves.

.4 Names and addresses of local suppliers.

.5 Copy of reviewed shop drawings.

2.1.18 As work progresses, record on one (1) set of drawings, any changes to conduit layout as well as any approved changes and deviations from the original contract and/or working drawings, including outlets, equipment and panel locations. At completion of work, submit to the Consultant, at the contractor's costs, electronic CADD "Record Drawings”. The contract shall not be considered complete and no final payment shall be made until these drawings are accepted by the Consultant. (Provide separate drawings for each system so as not to "crowd" drawings).

2.1.19 Acceptable manufacturers of distribution equipment:

.1 Cutler-Hammer

.2 Schneider Electric

.3 Siemens Canada

2.2 CONDUITS, FITTINGS AND FASTENINGS

2.2.1 Electrical metallic tubing (EMT) conduits shall be used for all cable raceways with watertight fittings where exposed to sprinkler spray shall be installed for panel and branch circuit feeds.

2.2.2 All conduits will be recessed in office and public areas and exposed in electrical, mechanical and similar spaces. Conduits to be fastened with appropriate straps, beam clamps or U channel strut frame supports as required.

2.2.3 All conduit system junction boxes to be properly labeled to their specific system.

2.2.4 Minimum sizes – 19mm unless branch circuit from junction box, when 1/2” will be permitted.

2.3 WIRES AND CABLES

2.3.1 Conductors in conduits to be solid copper #10 AWG and smaller, and stranded #8 AWG and larger. Insulation cross link polyethylene RW-90 (RWU-90 underground) 90°C, minimum 600V as required.

2.3.2 Armoured cables to be solid copper #10 AWG and smaller, and stranded #8 AWG and larger. Insulation cross link polyethylene (XLPE) AC-90, 600V as required. Cables to be utilized for luminaire drop connections and receptacles in metal stud walls only.

2.3.3 Armoured cables (Teck) to be solid copper #10 AWG and smaller, and stranded #8 AWG and larger. Insulation cross link polyethylene (RW-90) 90°C, 1000V, FT4 flame rating as required. Cable to be utilized for large feeders and mechanical equipment connection for vibration isolation and weatherproofing as required (Watertight flex conduits can also be utilized).

2.3.4 Colour coded wires shall be as follows:

.1 Phase A - red Neutral - white

.2 Phase B - black Ground - green

.3 Phase C - blue Isolated Ground - green and orange trace

2.4 OUTLET BOXES AND FITTINGS

2.4.1 Size boxes in accordance with CSA C22.1.

2.4.2 Gang boxes where wiring devices are grouped.

2.4.3 Provide blank cover plates for boxes without wiring devices.

2.4.4 Combination boxes with barriers where outlets for more than one system are grouped.

2.4.5 In finished areas, blank cover plates, switch, convenience receptacle, and telephone outlet coverplates shall be stainless steel. In finished area ceilings, junction and pull boxes shall be solid covers, painted to match the finish of the adjacent surface.

2.4.6 In moist (e.g. vivarium) or dusty areas, gasketted watertight or dust-tight boxes and covers shall be provided.

2.4.7 102mm square or octagonal outlet boxes for lighting fixture outlets.

2.4.8 102mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster and tile walls.

2.4.9 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.4.10 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.4.11 Concrete tight electro-galvanized sheet steel floor boxes with gasket, floor plate, leveling screws, and adjustable finishing rings to suit floor finish with brass faceplate. Device mounting plates to accommodate short or long ear duplex receptacles.

2.4.12 Cast FS or FD feralloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle where exposed to moisture.

2.5 WIRING DEVICES

2.5.1 Switches to be toggle operated general purpose AC switches 15A 120V AC single pole, double pole, three-way and four-way switches as indicated, with the following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea molding.

.4 Suitable for back and side wiring.

.5 Colour to be coordinated with Architect.

.6 Fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.7 Switches of one manufacturer throughout project.

.8 Switches to be premium specification grade.

.9 Acceptable manufacturers: Hubbell, Leviton and Cooper.

2.5.2 Receptacles shall be as indicated below:

.1 Duplex receptacles, CSA type 5-15 R, 125V AC, 15A, U-ground, with following features:

.1 Nylon face, colour to be coordinated with Architect for normal power, red for emergency power.

.2 Suitable for #10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Double wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125V AC, 15A, U-ground with following features:

.1 Nylon face.

.2 Suitable for #10 AWG for back and side wiring.

.3 Receptacles of one manufacturer throughout project.

.4 Acceptable Manufacturers: Hubbell; Leviton; Cooper. Catalogue No. 5262 for all manufacturers

.5 USB receptacles in classrooms and public spaces.

2.5.3 Lighting Control:

.1 Occupancy sensors and line voltage switching in storage rooms, janitor rooms, etc.

.2 Low voltage lighting control for common areas and larger classrooms, auditoriums.

.3 Daylight harvesting in all areas with natural light.

.4 Line or low voltage (relay) switching via digital to analog converters and/or power packs.

.5 Dimming via dimming panels.

.6 Each lighting control panel shall be sprinkler proof or complete with drip shields.

.7 Provide a separate neutral wire for each dimmer circuit.

.8 Acceptable manufacturer’s: Cooper, Douglas, Crestron.

2.5.4 Cover Plates:

.1 Cover plates from one manufacturer throughout project.

.2 Stainless steel coverplates for wiring devices mounted in flush-mounted outlet boxes to be minimum plate thickness of 1.0mm.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Cast gasketed coverplates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.5 Weatherproof double lift spring-loaded cast aluminum coverplates, complete with gaskets for duplex receptacles in high moisture areas.

.6 Weatherproof plates complete with gaskets for single receptacles or switches as indicated.

2.6 MECHANICAL EQUIPMENT CONNECTIONS

2.6.1 Provide complete electrical power and control connections for mechanical equipment, except as noted herein.

2.6.2 Include motor starters, disconnects, conduit, wire, fittings, interlocks, outlet boxes, junction boxes, and all associated equipment required to provide power wiring for mechanical equipment, unless otherwise indicated.

2.6.3 Include pushbutton stations, motor protective switches, interlocks, conduit, wire, devices, and fittings required to provide control wiring for mechanical equipment except for temperature/humidity control systems.

2.6.4 Unless otherwise noted, motors and control devices shall be supplied by Div. 25. Motor horsepower ratings shall be as per Div. 25.

2.6.5 All equipment mounted on the exterior of the building shall be weatherproof.

2.6.6 Install power feeders, starters, disconnect switches and associated equipment and make connections to all mechanical equipment.

2.6.7 Install branch circuit wiring for mechanical systems control panels, time clocks and control transformers.

2.6.8 Install main power feeders to starter/control panels furnished by Div. 25. Install branch wiring from motors, electric coils, etc.

2.6.9 Install all electrical controls except low voltage temperature controls, unless otherwise noted herein. Controls which have both electrical and mechanical connections shall be installed by the trade supplying the control.

2.6.10 Wire and connect line voltage remote thermostats and P/E switches for force flows, prop fans, unit heaters, and small exhaust fans.

2.6.11 Wire and connect float switches, pressure switches, alternators, alarms, etc. for sump pumps, sewage pumps, hot water recalculating pumps, booster pumps, jockey pumps, and compressors.

2.6.12 Provide 120V power supply for all designated DDC control panels.

2.7 CABLE TELEVISION SERVICE

2.7.1 Co-ordination with Cable Television Service Provider:

.1 A new coaxial and/or fibre service cable will be provided to the building.

.2 Make all arrangements and co-ordinate with service provider to ensure availability to service when required.

.3 Pay all cost requirements associated with the CATV service(s).

2.8 GROUNDING - PRIMARY

2.8.1 Rod electrodes: copper clad steel, 19mm dia. by 3m long or as required.

2.8.2 Conductors: bare, stranded, tinned soft annealed copper wire, size No. 4/0 AWG for ground bus, electrode interconnections, metal structures, gradient control mats, transformers, switchgear, motors, ground connections.

2.9 RETROFIT OF EXISTING 5KV/347/600V 3Ø 4W SWITCHGEAR

2.9.1 Replace existing 5kV feeder from Dining Hall.

2.9.2 Hire and pay manufacturer to retrofit the existing main distribution switchgear, “Distribution A”.

.1 Enclosure:

.1 Add sprinkler drip hood and make any other required modifications to the existing enclosure to achieve sprinkler-proof construction.

.2 Provide new covers to suit new CDP sections, customer metering and surge suppression displays, selector switches, etc.

.2 Interior:

.1 Clean interior of all 4 sections.

.2 Clean all internal components including insulators, bus, frame louvers, etc.

.3 Modify framing/enclosure as required for installation of new CDP/Panelboard chassis.

2.9.3 Section 1 - Main 5kV Switch Section:

.1 Check condition of all components including insulators, switch mechanism, contacts, etc. and replace any components as required. Lubricate and exercise switch. Perform all electrical, visual and mechanical testing per ANSI/NETA MTS-2015.

2.9.4 Section 2 – Metering and Dry Type Transformer Section:

.1 Remove and replace all metering components. Refer to “Customer Metering Section” below for further information.

.2 Check condition of all components including cable/bus termination pads, insulators. Test transformer windings and perform insulation test on all phase to phase and phase to ground combinations. Replace any components as required. Perform all electrical, visual and mechanical testing per ANSI/NETA MTS-2015.

2.9.5 Section 3 – Air Circuit Breaker Section

.1 Clean, test and retrofit all (3) air circuit breakers with new LSIG electronic trip units.

2.9.6 Section 4 – Replace CDP chassis with new. Refer to Single Line Diagram E1.

.1 The relay shall be provided with contacts for remote indication. The breaker shall be equipped with in-built current sensors on each phase and neutral. Current sensors ampere tap setting shall be rated to match the frame size of the breaker. Shunt trip shall be direct acting solenoid type powered by the sensor/relay energy.

2.9.7 Grounding:

.1 Copper ground bus extending full width of cubicles and located at bottom.

.2 Lugs at each end sized for grounding cable.

2.9.8 Customer Metering Section:

.1 Microprocessor based, self-contained, door mounted device designed to both monitor and display the following electrical parameters:

.1 AC line current (each phase) +/- 1% accuracy.

.2 AC line to line voltage (all 3) +/- 1% accuracy.

.3 AC line to neutral voltage (all 3) +/- 1% accuracy.

.4 Watts +/- 2% accuracy.

.5 Vars +/- 2% accuracy.

.6 Power factor +/- 4% accuracy.

.7 Peak demand +/- 2% accuracy.

.8 Frequency +/- 5% accuracy.

.9 Watt hours +/- 2% accuracy.

.2 Voltage may be directly monitored on 3 phase AC lines within a range of 120 to 600V AC without external potential transformers.

.3 Current monitoring is through external current transformers. Current transformers to be dry type for indoor use with following characteristics:

.1 Nominal voltage class as indicated.

.2 Rated frequency: 60 Hz.

.3 Primary current rated to match ampere rating of main bus. Secondary rated at 5 Amps.

.4 Capability to detect user-chosen electrical parameters:

.1 Phase loss

.2 Phase unbalance

.3 Phase reversal

.4 Under-voltage

.5 Overvoltage

.5 Minimum switchgear and breaker interrupting rating to be as per drawings.

2.9.9 *NOTE: Retrofit of 120/208V Main Distribution (Distribution B) to be performed in the same manner as Distribution B. No air circuit breakers are provided in Distribution B. All CDP and panelboard sections to be replaced with new CDP/panelboard chassis in the existing enclosure.

2.10 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS)

2.10.1 Transient voltage surge suppression equipment will be located at main distribution, sub-distributions, etc. as required to protect Owner's equipment.

2.11 GROUNDING - SECONDARY

2.11.1 Grounding Equipment:

2.11.2 Grounding conductors, system, circuit and equipment, grounding to be bare stranded copper sized in accordance with the Canadian Electrical Code.

2.11.3 Clamps for grounding of conductor, size as required to electrically conductive ground grid as required.

2.11.4 Rod electrodes, galvanized steel 19mm dia. by 3m long.

2.11.5 System and circuit, equipment, grounding conductors, bare stranded copper, tinned, soft annealed, sized as indicated.

2.11.6 Insulated grounding conductors: Green, type RW-90.

2.11.7 Ground Bus: Copper, size 50mm by 6mm by 300mm long complete with insulated supports, fastenings, connectors.

.1 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.2 Grounding and bonding bushings.

.3 Protective type clamps.

.4 Bolted type conductor connectors.

.5 Thermit welded type conductor connectors.

.6 Bonding jumpers, straps.

.7 Pressure wire connectors.

2.11.8 Install complete permanent, continuous, system and circuit, equipment, grounding systems including g electrodes, conductors, connectors, accessories, as indicated, to conform to requirements of local authority having jurisdiction over installation.

2.11.9 Make buried connections, and connections to conductive water main, electrodes, using copper welding by Thermit process or Burndy "HYGround" compression conductors.

2.11.10 Install grounding connections to typical equipment included in, but not necessarily limited to following list; service equipment, transformers, frames of motors, motor control centres, starters, control panels, building steel work, generators, panels, outdoor lighting.

2.12 DRY-TYPE TRANSFORMERS

2.12.1 Dry-type transformers will be supplied to provide 120V and 208V power for receptacles, heat pumps, small mechanical fans, incandescent lighting and miscellaneous other equipment as required.

2.12.2 Transformers to be 600V delta primary / 120/208V, wye connected secondary, 60 Hz, copper windings, K13 rated, mounted in sprinklerproof enclosures (NEMA 3R).

2.12.3 Transformers to be floor mounted on 100mm concrete housekeeping pads.

2.13 PANELBOARDS

2.13.1 Panelboards: Product of one manufacturer.

2.13.2 250V branch circuit panelboards: Bus and breakers rated for 10 kA (symmetrical) interrupting capacity minimum or as indicated.

2.13.3 600V branch circuit panelboards: Bus and breakers rated for 35 kA (symmetrical) interrupting capacity minimum or as indicated.

2.13.4 Sequence phase bussing such that circuit breakers will be numbered in consecutive order, with each breaker identified by permanent number identification as to circuit number and phase.

2.13.5 Two keys for each panelboard. Key panelboards alike.

2.13.6 Aluminum bus with neutral of same ampere rating as mains.

2.13.7 Mains: Suitable for bolt-on 25mm wide breakers.

2.13.8 Trim and door finish: Baked grey enamel.

2.13.9 Lock-on devices for 5% of 15 to 30A breakers installed as indicated. Turn over unused lock-on devices to Owner.

2.13.10 Connect isolated ground bus in panelboards to main building ground with #2 AWG, green insulated ground wire, in conduit.

2.13.11 Wiring in panelboards shall be neat and set in as if laced. All neutral conductors shall be identified in the panel with their associated circuit numbers by means of Brady Markers.

2.13.12 All panelboards throughout the building shall be phased together such that the left-hand centre and right-hand panelboard busses represent phases A, B and C respectively. All indicating meters shall be identified to this sequence.

2.13.13 Enclosures to be sprinkler proof.

2.13.14 Panels will be c/w 10% spare breakers and 20% space for future breakers.

2.14 LIGHTING EQUIPMENT

2.14.1 LED fixtures shall have built in drivers with input voltage to match distribution system.

2.14.2 All LED drivers shall have a maximum THD of 20% and maximum in-rush of 3% with case temperature (Tc) or 90°C.

2.14.3 All LED fixtures shall be Design Lights Consortium (DLC) listed and Manitoba Hydro Power smart approved. Where approval is not in place, arrange and pay all costs for approval. Obtain approval and include as part of shop drawings.

2.15 POWER GENERATION DIESEL

2.15.1 Description of System:

- .1 Generating system consists of:
  - .1 Diesel engine
  - .2 Alternator
  - .3 Alternator control panel
  - .4 Battery charger and battery
  - .5 Automatic engine room ventilation system
  - .6 Fuel supply system
  - .7 Exhaust system
  - .8 Structural steel mounting base
  - .9 Automatic transfer equipment

.10 Manual bypass switches

.2 System designed to operate as emergency standby power source.

2.15.2 The diesel engine will be a four cycle, turbocharged and aftercooled engine with speed of 1800 rpm. The engine will be liquid cooled via a radiator as required.

2.15.3 The alternator will be 347/600V, 3 phase, 4 wire, 60 Hz at 8 P.F.

2.15.4 The emergency generator will be rated as per the drawings at 347/600 Volt, 3 phase, 4 wire, 60 Hz.

2.15.5 The automatic transfer switches c/w maintenance by-pass will signal the engine to start upon sensing normal power loss, and once engine is up to speed will transfer the emergency load to the generator.

2.16 FIRE ALARM SYSTEM

2.16.1 System Description:

.1 The electrical contractor shall supply, install, commission and verify a complete and operating addressable fire alarm system as herein specified and as shown on drawings.

.2 The system shall include, but not be limited to: control panels, input and control modules, alarm initiating and indicating peripheral devices, conduit, wire and accessories, etc. required to furnish a complete operational system. Provide 120V circuits for equipment as required.

.3 System Includes:

.1 Microprocessor based addressable control panel to carry out fire alarm and protection functions including receiving alarm signals, initiating general alarm, supervising system continuously, actuating zone annunciators, initiating trouble signals, performing fire control functions, etc.

.2 Annunciators.

.3 Trouble signal devices.

.4 Power supply facilities.

.5 Manual alarm stations.

.6 Automatic alarm initiating devices.

.7 Audible alarm signal devices.

.8 Visual alarm signal devices.

.9 End-of-line devices.

.10 Ancillary devices.

.11 Relays.

.12 Standby batteries.

.13 Auxiliary control.

.14 Intelligent environmental compensation. .

.15 The loading of device loops shall be based on approximately 80% load. Provide additional loops to comply with this loading where required or directed.

.16 The loading of horn/strobe circuits shall not exceed 75% circuit capacity. Provide additional circuits to comply with this loading where required or directed.

.4 The new fire alarm system shall be non-coded, single staged, zone annunciated, addressable, electrically supervised, and fully approved by the Underwriters Laboratories of Canada Inc. and the Provincial Fire Marshall.

2.16.2 Devices:

.1 Manual fire alarm station shall be cast aluminum addressable type with red enamel finish; pull-lever, open circuit type. Stations with plastic casings are not acceptable.

.2 Automatic thermal (heat) detectors shall be addressable type brushed aluminum finish; 57°C fixed temperature element with an 8°C per minute rate-of-rise element. Fixed temperature type heat detectors to operate at a rated temperature of 93°C.

.3 Smoke detectors shall be addressable type dual-chamber, photoelectric, 2-wire with white finish and twist-lock mounting base; adjustable sensitivity, built-in LED alarm indicating light.

.4 Duct mounted smoke detectors shall be dual chamber photoelectric type with sampling tubes and surface mounting housing and cover; adjustable sensitivity, built-in LED alarm indicating light; c/w 2 sets of style C auxiliary contacts.

.5 End-of-line resistors shall be mounted in a separate single gang recessed box at locations shown on the drawings, complete with a red coverplate.

.6 Magnetic door holders (120V AC) to be supplied and installed by Div. 8; door holders to be wired and connected by the electrical contractor.

.7 Fire alarm audible devices shall be recessed or surface mounted, combination horn/strobes or speaker/strobes depending on area of building.

.1 Strobes: shall be ULC listed and operate on supervised alarm circuits at 20 to 24V DC.

.2 Horn/Strobes: shall be ULC listed and operate on supervised alarm circuits.

.3 Provide red end of line plates with screw terminations as required for all signalling circuits as required.

2.16.3 Equipment and devices: ULC listed and labeled and supplied by single manufacturer.

.1 Manufacturer:

.1 Notifier by Vipond

.2 Johnson Controls (Simplex)

.3 Edwards

.4 Siemens

2.16.4 Verification Certificate:

.1 On completion of the testing, submit to the Consultant, a test report certified by both the manufacturer and the electrical subcontractor including:

.1 A copy of the inspecting technician's report showing location of each device and certifying the test results of each device.

.2 A certificate of verification confirming that the inspection has been completed and showing the conditions upon which such inspection and certification have been rendered.

.3 Proof of liability insurance for the inspection.

2.16.5 Warranty:

.1 Warranty all Equipment, Sensors, materials, peripherals, installation, workmanship, etc. for one (1) year from the date of final acceptance of the system.

.2 Provide all programming of system as directed during the warranty period at no cost to Owner.

2.17 CARD ACCESS & SECURITY SYSTEM

2.17.1 A card access and security system shall be provided to control 24 hour access to the facility for approved personnel.

2.17.2 Each entrance to the building shall be provided with a HID proximity card reader, and security system contacts.

2.17.3 The card access system shall have outputs to interface with the Owner’s network (for activation of a persons network connection).

2.17.4 Secure doors inside the facility will also have card readers.

2.17.5 All electric door hardware is supplied by other divisions.

2.17.6 Furnish and install all equipment, accessories, and materials in accordance with the specifications and drawings for Red River College access control and alarm monitoring system.

2.17.7 Manufactures:

.1 Access control hardware shall be manufactured by Kantech and be compatible with the existing access control system on campus.

2.18 CCTV SYSTEM

2.18.1 CCTV cameras will be located throughout the premises.

2.18.2 The CCTV System will consist generally of the following:

.1 POE switches to serve new POE cameras.

.2 Patch panels for POE cameras.

.3 Network video recorder.

.4 Fibre connections to the existing CCTV system.

2.18.3 The security video system shall be an IP network-based, fully distributed digital video system. The security video system will utilize local area networks (LAN) as a transmission medium for video, configuration, as well as storage of all data. The security video system shall provide full video control at the control posts, with additional full-selection capability at any point within the network from a workstation or a video console display. The security video system shall provide unlimited expansion capability for the addition or modification of video inputs.

2.18.4 The system equipment shall be manufactured by Panasonic Canada:

.1 Servo Electronics or

.2 Advance Electronics

2.18.5 Facilities And Functions

.1 This system shall provide visual observation, monitoring, recording, archiving etc. of all areas equipped with new cameras.

2.18.6 Video Management System Capabilites (Panasonic #wv-asm300):

.1 Supports 16:9 video stream and 16:9 HD monitor. Displays 16:9 and 4:3 videos from IP cameras on the same screen.

.2 H.264 recording data in the SD/SDHC/SDXC memory card can be downloaded.

.3 Convert file format from n3r (proprietary format) to MP4.

.4 Online management system enables easy use without dongle.

.5 Up to 100 recorders, 64 encoders and 256 directly connected cameras can be registered. Up to 6,400 cameras registered in the recorders and 256 cameras registered in the encoders are automatically registered in the WV-ASM200 (the number of the cameras depends on the recorder and encoder).

.6 Live images can be received directly from the camera/encoder or via the recorder enabling flexible network design.

.7 Multi-Monitor option enables simultaneous use of Operation Display (1 / 4 / 9 / 16 split), Live Display (1 / 4 / 9 / 16 split) and Map Display each on a dedicated monitor.
Single or two monitor operation is also available.
A total of 20 screens can be displayed with the simultaneous use of the Operation Display and the Live Display at a time.

.8 Provide WV-ASE202, maximum 64 screens in operation display.

.9 Up to 16x 30 ips/camera images can be displayed in H.264 1.5 Mbps mode (VGA : Normal quality mode) or MPEG-4 2 Mbps mode (VGA : Normal quality mode, QVGA : High quality mode, depending on the camera and camera setup).

.10 Up to 400 camera groups: Cameras and multiscreen mode for the Operation Display can be programmed and called up by manual or sequence operation.

.11 Image resolution dynamically changes depending on the screen mode:
VGA for Quad screen, QVGA for 16 split screen, enabling optimum network usage (depending on the camera model).

.12 Panasonic camera control: Pan/Tilt, Zoom, Focus, Brightness, Preset position call and program (up to 256), Auto mode, AUX 1 to 3, Click Centering, Wheel Zoom, Specified area zoom by mouse dragging (depending on the camera model)

.13 A camera, a group or a sequence can be called up on the Operation Display by their ID with the optional system controller WV-CU950. The camera displayed in the active window can be controlled by the system controller. Recorder playback operation can also be made by the system controller with Jog/Shuttle.

.14 Alarm notification: A pop-up alarm message is displayed.

.15 Individual alarm reset is possible.

.16 Operation Display, Live Display, and Map Display reacts correspondingly with the alarm.

.17 Displays the present alarm log in red.

.18 When an alarm occurs, the monitor changes into the map automatically showing where the alarm happened.

.19 Illustrated camera, alarm and recorder icons for intuitive operations

.20 Up to 64 camera icons can be freely positioned on a map with alarm status indicated by the color of the icons.

.21 Recorded images of up to 64 cameras (in case with WJ-ND400) can be downloaded by one operation. Downloaded images can be viewed by the viewer software (provided).

.22 Sophisticated user management: User authentication with time limited password, 5 user levels, User-Camera View/Control partitioning in conjunction with recorder's user management function, Up to 32 user registrations

.23 System logs can be saved in CSV format. Operation logs can automatically be erased when specified time has passed (31 / 92 / 184 / 366 days).

.24 Audio from a camera can be heard and the operator voice can be transmitted to the camera's audio output through the network (single channel at a time, full/half duplex depending on the camera).

.25 Video Analytic functions of the WJ-NT314 such as intruder detection and object abandonment/removal detection can be displayed.

.26 When used with WJ-ND400 series, WJ-HD716/616, WJ-NV200, VMD search can be operated.

.27 1-screen/4-screen PTZ compensation function (hereinafter compensation function) from the fish-eye images of the Panasonic Fisheye network cameras (WV-SF438 / WV-SF448 / WV-SW458)

.28 Supports 360-degree Network Microphone (WV-SMR10)

.29 Add Time line function

.30 Corresponding to the Active directory

.31 WV-CU950 Controller

2.18.7 Products:

.1 System Manager Panasonic i-Pro Management Software, WV-ASM3200

.2 Workstation (location TBD):

.1 The PC workstation shall use a graphical user interface (GUI) that is compatible with Microsoft® Windows and a keyboard/mouse for monitoring live and recorded video, virtual matrix functionality that allows operators to see and respond to any alarm from any device on the network, and direct any camera to any monitor on the network.

.2 The PC workstation shall allow administrators to configure devices, set up users, adjust network settings, and create recording schedules.

Permission to access these functions and all other system services can be configured to a fine level of detail. The PC workstation shall have advanced search capabilities, event logging, and alarm interface displays. The PC workstation shall export video and still images in multiple formats, including Pelco Native, QuickTime® MPEG-4, H.264, AVI, BMP, and JPG. A front panel USB port and DVD/CD-RW drive shall be included to make it capable of exporting video clips and still images to external media.

.3 High Performance Network Disk Recorder for Panasonic i-Pro Network Cameras:

.1 The WJ-NX400 recorder shall be capable of connecting to up to 64 network cameras without extra license fees and their images can be recorded simultaneously.

.4 Cameras:

.1 General

.1 All equipment and materials used shall be IP based, POE, standard components that are regularly manufactured and used in the manufacturer's system.

.2 All systems and components shall have been thoroughly tested and proven in actual use.

.3 All systems and components shall be provided with the availability of a toll-free (U.S. and Canada), 24-hour technical assistance program (TAP) from the manufacturer. The TAP shall allow for immediate technical assistance for either the dealer/installer or the end user at no charge for as long as the product is installed.

.4 All systems and components shall be provided with a one-day turnaround repair express and 24-hour parts replacement. The repair and parts express shall be guaranteed by the manufacturer on warranty and non-warranty items.

.5 Provide temporary cameras to match existing for the time period required to reinstall or repair the defective camera.

.6 Any camera which fails within 3 months of project substantial completion shall be replaced with a new camera.

.2 PTZ Progressive Scan Outdoor Day/Night Network Dome Camera:

.1 The unitized dome/camera assembly shall be a Panasonic Model WVX6531N or equivalent.

.3 Super Dynamic Megapixel Camera – 360 Degree:

.1 The digital signal processing (DSP) Megapixel Super Dynamic color MOS cameras shall be a Panasonic Model WVS4150. The camera shall incorporate a 1/3" progressive scan Megapixel Super Dynamic MOS, [3.1 Megapixel] pixels effective, with a microlens on each pixel for superior picture detail and clarity. The camera shall have a minimum illumination of 1.5 lx in color.

.5 POE Switches:

.1 POE Switches shall be provided by 28 23 00, switches shall be CISCO #ESW-540-24P/48P-K9 (24 or 48 port as required).

.6 POE/IP EXTENDER – FOR EXTERIOR CCTV CAMERAS if 90 m limit is exceeded.

2.18.8 Warranty:

.1 36 months for all equipment and components supplied under this section.

2.19 PA & INTERCOM SYSTEM

2.19.1 A master audio/video intercom system will be provided (location TBD).

2.19.2 Exterior intercoms located at the main entrances, walkway doors as well as the loading area will allow security to view and speak to delivery persons and allow entrance by de-activating the door lock momentarily.

2.19.3 The new IP based PA amplifier will interface with the facility's software. Provide a demonstration prior to shop drawings being submitted.

2.19.4 Supervised Network Paging System, including but not limited to:

.1 Supervised network amplifiers, back boxes, and all equipment, cabling and support required to interface the public address system.

.2 Supervised network system speakers, and ceiling mounted speakers, wall mounted horn.

.3 CAT 6A cabling to support the Public Address System.

2.20 POE CLOCK SYSTEMS

2.20.1 Description of System:

.1 Clock System – IP/POE

.1 A Primex clock system shall be provided.

.2 Supply, install, wire and connect a complete clock system as manufactured by Primex. Wiring to be CAT 6A/FT-6 data cable.

.3 Wall mounted single face analog clocks to be Primex, sweep second hand and high impact polycarbonate frame and lens.

.4 Exact location and mounting of all clocks shall be verified with Architect.

.5 POE clock system shall continually synchronize clocks throughout the facility, and shall be capable of clock readouts in multiple time zones where desired.

.6 The system shall synchronize all clocks to each other. The system shall utilize POE/Internet technology to provide atomic time. Clocks shall automatically adjust for Daylight Savings Time. Provide Primex time server in Owners server room.

.7 Analog Display Clocks shall be synchronized to within 10 milliseconds 6 times per day, and the system shall have an internal oscillator that maintains plus or minus one second per day between synchronizations, so that clock accuracy shall not exceed plus or minus 0.2 seconds.

.8 The system shall include an internal clock reference so that failure of the computer signal shall not cause the clocks to fail in indicating time.

.9 The system shall incorporate a "fail-safe" design so that failure of any component shall not cause failure of the system. Upon restoration of power or repair of failed component, the system shall resume normal operation without the need to reset the system or any component thereof.

.10 Clock locations shall be as indicated, and clocks shall be fully portable, capable of being relocated at any time.

2.20.2 Licensing

.1 Provide clock licence, Primex ONEVUE.

2.21 PANIC AND SAFETY SYSTEM

2.21.1 Supply, install and commission a complete and operating safety and panic alarm system:

.1 The system shall include, but not be limited to: control panels, push buttons, strobes, annunciators , network switches, conduit, wire and accessories, etc. required to furnish a complete and fully operational system. Provide 120V circuits and CAT 6A cabling for equipment as required.

2.21.2 Emergency telephones:

.1 Indoor VoIP Emergency Phones with Built- In Dialer and Digital Voice Announcer:

2.21.3 The Panic system equipment shall be manufactured by Sentrol:

.1 Panic switches: 3040 Series or approved equal.

2.22 MOTOR STARTERS

2.22.1 Single and three phase manual motor starters shall be breaker type, c/w overload heaters, manual reset, and trip indicating light. Starters in public areas shall be flush mounted type.

2.22.2 Three phase combination magnetic motor starters shall have MCP circuit breaker, solenoid operated contactor, rapid action type, overload protection for each phase, power and control termination. Each starter assembly to have its own control transformer, HOA selector switch, 2 NO and 2 NC auxiliary contacts and be EEMAC rated. Full size starters only will be provided.

2.22.3 Provide soft starters for all motors rated 20 hp and larger.

2.23 MOTOR CONTROL CENTRE

2.23.1 General Description:

.1 Compartmentalized vertical sections with common power bus bars.

.2 Floor mounting, free standing, enclosed dead front.

.3 Indoor CSA-1 gasketted enclosure with sprinkler drip hood.

.4 Accommodating combination starters, transformers, panels as indicated.

.5 Front or back to back mounting.

.6 Class I, Type B, 600V, 60 Hz, 3 phase, 3 wire, grounded.

.7 Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.

.8 Provision for future extension of both ends of motor control centre including bus bars without need for further drilling or cutting .

.9 MCCs to be 50 KAIC unless noted otherwise.

END OF SECTION

APPENDIX A – CONSTRUCTION DRAWINGS

ATTACHED DRAWINGS:

- ELECTRICAL DETAIL ED-1 – LEVELS G, 1-4 TYPICAL VOICE/DATA ROOM – LARGE SCALE
- E1 SINGLE LINE DIAGRAM – NORMAL POWER – CONSTRUCTION
- E2 SINGLE LINE DIAGRAM – EMERGENCY POWER - CONSTRUCTION

APPENDIX B – RECORD DRAWINGS WITH DEMOLITION NOTES

ATTACHED DRAWINGS:

- E1.03A BRODIE SCIENCE CENTRE SINGLE LINE DIAGRAM
- E1.03B BRODIE SCIENCE CENTRE SINGLE LINE DIAGRAM
- E1.03C BRODIE SCIENCE CENTRE SINGLE LINE DIAGRAM
- E1.03D BRODIE SCIENCE CENTRE SINGLE LINE DIAGRAM – EMERGENCY POWER

KEY NOTES

1. PROVIDE 100mm CONDUIT RISERS TO STACKED VOICE DATA ROOMS. COORDINATE/CONFIRM EXACT CONDUIT SIZES AND QUANTITIES. FIRE STOP PENETRATIONS SURROUNDING CONDUITS.

2. 1220mm (W) X 1220mm (H) X 20mm (D) PLYWOOD BACKBOARD PAINTED WITH FIRE RETARDANT PAINT FOR SERVICE PROVIDER(S) EQUIPMENT. PLYWOOD BACKBOARD TO BE MOUNTED AT 915mm ABOVE FINISHED FLOOR. COORDINATE HEIGHT OF DUPLEX RECEPTACLE (FOR SERVICE PROVIDER(S) EQUIPMENT) WITH SERVICE PROVIDER. PROVIDE A 1M COIL OF #6 AWG GREEN INSULATED COPPER GROUND WIRE CONNECTED TO THE TMGB.

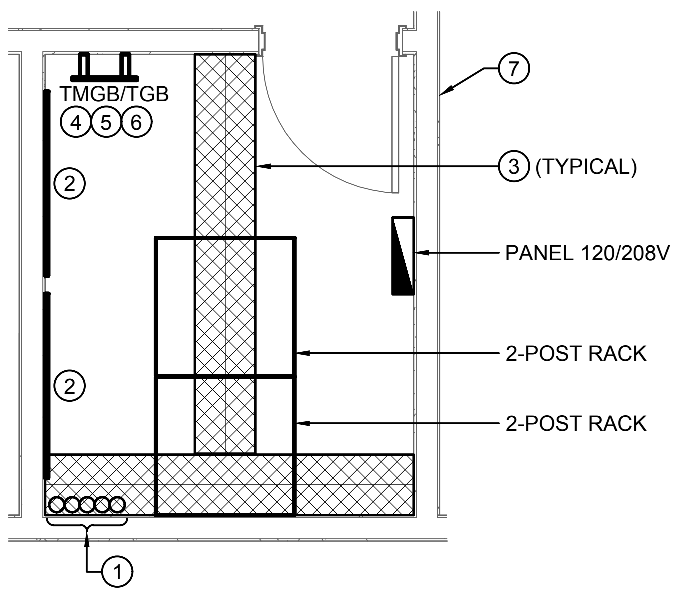
3. 400mm (WIDE) X 100mm (DEEP) CABLE TRAY LOCATED AT HIGH LEVEL. COORDINATE EXACT HEIGHT AND LOCATION WITH OWNER IT.

4. CONNECT TMGB/TGB USING #3/0 FT4 ON TRAY. CONNECT AT TMGB/TGB USING COMPRESSION CONNECTOR ON THE SIDE OF THE GROUND BAR.

5. 12" LONG TMGB/TGB ON INSULATED BUSHINGS.

6. CONNECT TMGB TO GROUND GRID WITH BCT (BONDING CONDUCTOR FOR TELECOMMUNICATIONS) USING COMPRESSION CONNECTORS AND #3/0 FT4 GROUND CABLE.

7. ORIENTATION OF THE ROOM TBD.



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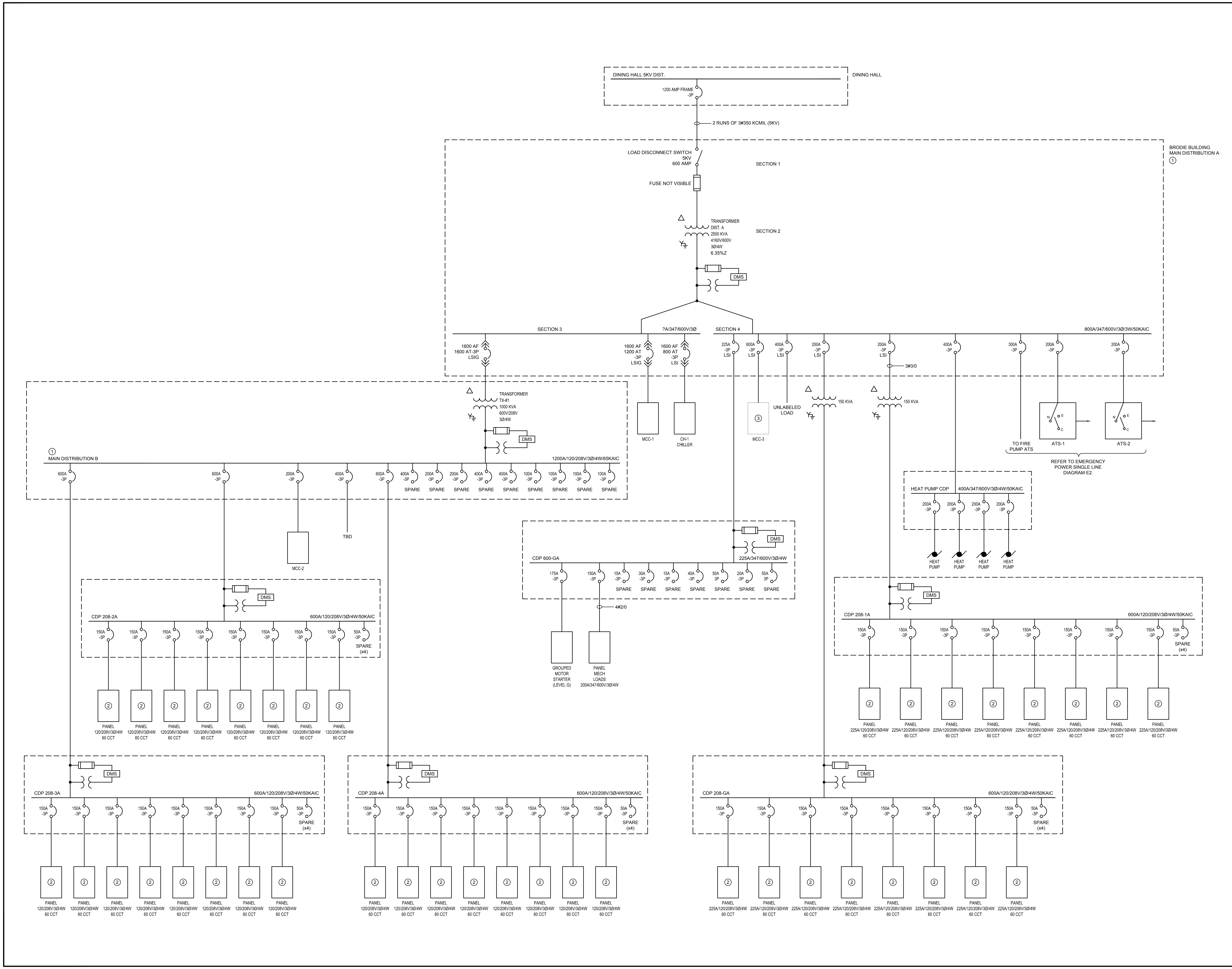
JOHN R BRODIE SCIENCE CENTRE PRELIMINARY BUILDING ASSESSMENT AND CONCEPTUAL DESIGN

BRANDON MANITOBA

LEVELS G, 1-4 TYPICAL
VOICE/DATA ROOM - LARGE SCALE

Drawn By	Approved By	Reference
JKC	VEK	
File No.	Date	Detail Sheet
18-274-01	NOV 2018	ED-1

FILE NAME AND PATH: G:\PROJECTS\2018\18 274 Brodie Science Centre Assessment\3.0 Cadd_Revit\3.4 Elec\18274_ED-1_m.dwg
LAYOUT: ED-1 LAST SAVED BY: jcruz DATE PLOTTED: Friday, November 23, 2018 8:19:17 AM



GENERAL NOTES

A. UNLESS OTHERWISE INDICATED ALL WIRING TO BE RW90 IN EMT CONDUIT.

B. PROVIDE SEPARATE BOND CONDUCTOR IN EACH CONDUIT RUN, SIZED TO CEC TABLE 16.

KEY NOTES

1. REFURBISH MAIN DISTRIBUTION A AND B. REFER TO OUTLINE SPECIFICATIONS.
2. PROVIDE 8 PANEL BOARDS ON EACH FLOOR. LOCATION TO BE DETERMINED.
3. EXISTING EQUIPMENT TO REMAIN. RE-FEED FROM NEW DISTRIBUTION. EXTEND WIRING/CONDUIT AS REQUIRED.

NO.	Description	BY	DD/MM/YY
0	ISSUED FOR COSTING	VEK	23/11/18

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Certificate of Authorization
SMS Engineering Ltd.
No. 166

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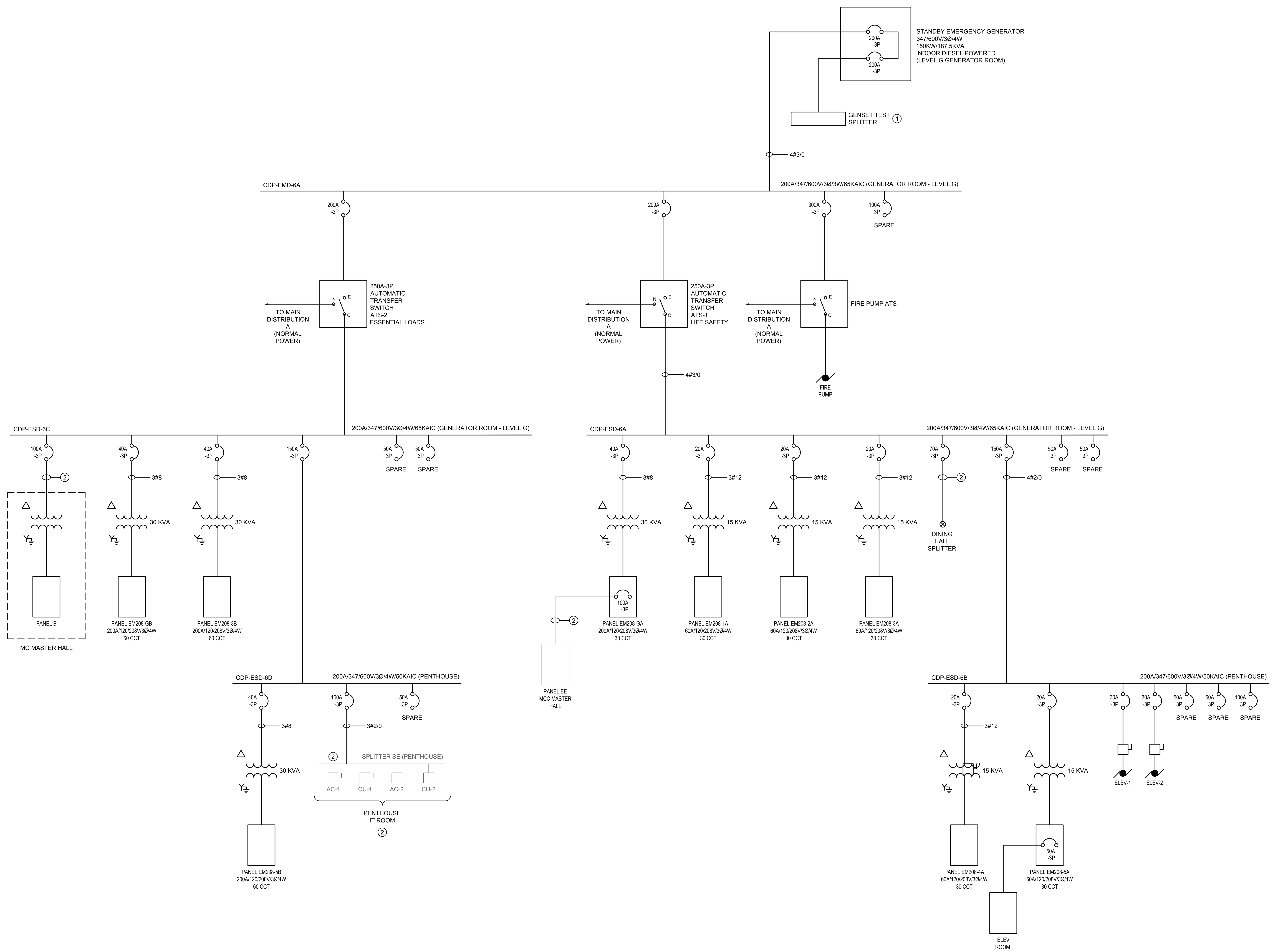
Project Title
JOHN R BRODIE SCIENCE CENTRE PRELIMINARY BUILDING ASSESSMENT AND CONCEPTUAL DESIGN

BRANDON MANITOBA

Drawing Title
SINGLE LINE DIAGRAM - NORMAL POWER - CONSTRUCTION

Drawn By	Checked By	Approved By
JKC	VEK	VEK
Scale: NTS	Date: NOVEMBER 2018	Project No.: 18-274-01
Revision Number: 0	Drawing Number: E1	Sheet Order: 1 OF 2

FILE NAME AND PATH: G:\PROJECTS\2018\18 274 Brodie Science Centre Assessment ... 18274_SLD_E1_m.dwg
LAYOUT: E1 DATE PLOTTED: Friday, November 23, 2018 ... LAST SAVED BY: jkvz



GENERAL NOTES

A. UNLESS OTHERWISE INDICATED ALL WIRING TO BE RW90 IN EMT CONDUIT.

B. PROVIDE SEPARATE BOND CONDUCTOR IN EACH CONDUIT RUN, SIZED TO CEC TABLE 16.

KEY NOTES

1. PROVIDE NEMA 4 400A/347/600V SPLITTER FOR TEMPORARY LOAD BANK CONNECTION, LOCATED AT LOADING DOCK.
2. CONNECT EXISTING FEEDER TO NEW DISTRIBUTION. EXTEND WIRING/CONDUIT AS REQUIRED.

NO.	Description	BY	DD/MM/YY
0	ISSUED FOR COSTING	VEK	23/11/18

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Project Title

JOHN R BRODIE SCIENCE CENTRE PRELIMINARY BUILDING ASSESSMENT AND CONCEPTUAL DESIGN

BRANDON MANITOBA

Drawing Title

SINGLE LINE DIAGRAM - EMERGENCY POWER - CONSTRUCTION

Drawn By	Checked By	Approved By
JKC	VEK	VEK
Scale: NTS	Date: NOVEMBER 2018	Project No.: 18-274-01
Revision Number: 0	Drawing Number: E2	Sheet Order: 2 OF 2

FILE NAME AND PATH: G:\PROJECTS\2018\18 274 Brodie Science Centre Assessment\3.0 Cadd_Revit\3.4 Elec\18274_SLD_E2_m.dwg
LAYOUT: E2 LAST SAVED BY: jcruz DATE PLOTTED: Friday, November 23, 2018 9:00:00 AM

APPENDIX H

Class D Cost Estimates

- $20M 'Refresh' Concept
- $40M 'Re-Envision' Concept
- Fifth Floor Expansion
- New 4-Storey Addition and Link

$20M 'Refresh' Concept
Class D Cost Estimate

Manshield CONSTRUCTION
BUILDING ON A SOLID FOUNDATION

Project:	Brodie Science Centre - Renovation	Conceptual Cost Modelling Budget - Optn A			
Owner:	Brandon University	GBA		135,000	SF
Architect:	Prairie Architect	Project Duration		18	Months
Location:	18th Street, Brandon MB				
Date:	03-Feb-19				
Div	Description	Qty	Unit	$/Unit	TOTAL
2	Demolition	135,000	SF	$9	$1,215,000
	Asbestos Abatement	135,000	SF	$16	$2,160,000
4	Masonry - Veneer/Façade Re-Pointing	135,000	LS	$2	$270,000
7	Thermal & Moisture Protection				
	Roofing - various penetrations,	8,000	SF	$15	$120,000
8	Doors & Windows				
	Curtainwall	24,000	SF	$18	$420,000
	Doors/Frames/Hdwe	55	EA	$1,500	$82,500
9	Finishes				
	Drywall	67,500	SF	$18	$1,215,000
	Flooring	15,000	SF	$9	$135,000
	Paint	80,000	SF	$2	$160,000
10	Specialties				
	WR Accessories				
	Public WR's	10	EA	$16,000	$160,000
	UTR's	8	EA	$8,000	$64,000
12	Furnishing, Fixture and Equipment (FFE)		Allowance		$1,000,000
	Lab Fit-Out Equipment	incl.			
13	Special Construction	1	SF		$0
14	Conveying Systems - Refurbishment		LS		$50,000
21	Fire Protection	135,000	SF	$1.50	$202,500
22 - 24	Mechanical	135,000	SF	$25	$3,375,000
26	Electrical	135,000	SF	$25	$3,375,000
	Total Work Division 2 - 16				**$14,004,000**
	CASH ALLOWANCES				
19	Concrete Testing		Allowance		$5,000
19	Roof Inspections		Allowance		$12,000
19	Building Envelope Inspections		Allowance		$20,000
19	Temp Classrooms and Facilities		Allowance		$307,200
19	Hazardous Material Assessments and Inspections		Allowance		$35,000
	Total Direct Costs				**$14,383,200**
	General Requirements	18	MO	$61,083	$1,099,494
	Sub-Total Project Costs				**$15,482,694**
	General Requirements 1				
006500	Builder's Risk Insurance	$0.00893	$/$100/mo		$15,891
006500	General Liability Insurance - CGL	$1.08	$/$1000		$17,430
006500	Wrap-up Insurance - Confirm Requirements	$0.87150	$/1000		$13,493
010950	Building Permit - (by owner)		$24.50/m2		$307,255
	Net Project Cost				**$15,836,762**
	CM Fee at 4%	4%			$633,470
006100	Performance Bond $3/1000	$3.00	$/1000		$49,411
		0.00%			
	Total Project Cost Not Including GST				**$16,519,643**
	Contingency	10.0%			$1,651,964
	Total Project Cost INCL contingency (no GST)				**$18,171,608**

$40M 'Re-Envision' Concept
Class D Cost Estimate

Manshield CONSTRUCTION
BUILDING ON A SOLID FOUNDATION

Project:	Brodie Science Centre - Renovation	Conceptual Cost Modelling Budget - Opt C			
Owner:	Brandon University	GBA		135,000	SF
Architect:	Prairie Architect	Project Duration		24	Months
Location:	18th Street, Brandon MB				
Date:	30-Jan-19				
Div	**Description**	**Qty**	**Unit**	**$/Unit**	**TOTAL**
2	Demolition	135,000	SF	$15	$2,025,000
	Asbestos Abatement	135,000	SF	$10	$1,350,000
3	Concrete Work		LS	$1.85	$250,000
4	Masonry - Veneer/Façade Re-Pointing		LS	$1.48	$200,000
5	Metals				
	Structural Reinforcing - floor openings	8,000	SF	$50.00	$400,000
	Misc Metals - partition reinforcing, skylights, etc.		LS		$240,000
	Stairs and Landings		LS		$420,000
6	Wood & Plastics				
	Millwork	135,000	SF	$11	$1,485,000
7	Thermal & Moisture Protection				
	Roofing - various penetrations,	8,000	SF	$6	$48,000
	Skylights	1,500	SF	$80	$120,000
8	Doors & Windows				
	Curtainwall	24,000	SF	$70	$1,680,000
	South Elevation - glazed cantilevered boxes	5	EA	$34,500	$172,500
	Doors/Frames/Hdwe	200	EA	$1,500	$300,000
	Interior Glazing - full height FireLite	8,460	SF	$300	$2,538,000
	Glazed Aluminum Railings	550	LF	$250	$137,500
9	Finishes				
	Drywall	135,000	SF	$18	$2,430,000
	Flooring	119,000	SF	$9	$1,071,000
	Paint	135,000	SF	$2	$270,000
10	Specialties				
	Lecture Hall Seating	489	EA	$400	$195,600
	Acoustic Treatments		LS		$120,000
	WR Accessories				
	Public WR's	10	EA	$16,000	$160,000
	UTR's	8	EA	$8,000	$64,000
	Folding Partitions	3	EA	$25,000	$75,000
12	Furnishing, Fixture and Equipment (FFE)		Allowance		$2,125,000
	Lab Fit-Out Equipment	incl.			
13	Special Construction	1	SF		$0
14	Conveying Systems - Refurbishment		LS		$50,000
21	Fire Protection	135,000	SF	$2.00	$270,000
22 - 24	Mechanical	135,000	SF	$36	$4,860,000
26	Electrical	135,000	SF	$38	$5,130,000
	Generator		LS		$250,000
	Total Work Division 2 - 16				**$28,436,600**
	CASH ALLOWANCES				
19	Concrete Testing		Allowance		$5,000
19	Roof Inspections		Allowance		$12,000
19	Building Envelope Inspections		Allowance		$20,000
19	Heating and Hoarding		Allowance		$350,000
19	Site Refurbishment		Allowance		$50,000
19	Firestopping Inspections		Allowance		$35,000
19	Exterior Entrance - Code Upgrade		Allowance		$160,000
19	Temp Classrooms and Facilities		Allowance		$553,200
19	Hazardous Material Assessments and Inspections		Allowance		$35,000
	Total Direct Costs				**$29,656,800**
	General Requirements	24	MO	$64,875	$1,557,000
	Sub-Total Project Costs				**$31,213,800**
	General Requirements 1				
006500	Builder's Risk Insurance	$0.00893	$/$100/mo		$32,037
006500	General Liability Insurance - CGL	$1.08	$/$1000		$35,139
006500	Wrap-up Insurance - Confirm Requirements	$0.87150	$/1000		$27,203
010950	Building Permit - (by owner)		$24.50/m2		$307,255
006300	Subtrades Security		$/M$		Not Included
015690	Warranty & Deficiency Repairs		Ls		$0
	Net Project Cost				**$31,615,433**
	CM Fee at 4%	4%			$1,264,617
006100	Performance Bond $3/1000	$3.00	$/1000		$98,640
		0.00%			
	Total Project Cost Not Including GST				**$32,978,691**
	Contingency	10.0%			$3,297,869
	Total Project Cost INCL contingency (plus GST)				**$36,276,560**

Fifth Floor Expansion
Class D Cost Estimate

Manshield CONSTRUCTION
BUILDING ON A SOLID FOUNDATION

Project:	Brodie Science Centre - Renovation	Future Growth - 5th Floor Expansion			
Owner:	Brandon University	GBA		7,700	SF
Architect:	Prairie Architect	Project Duration		8	Months
Location:	18th Street, Brandon MB				
Date:	8-Feb-19				

Div	Description	Qty	Unit	$/Unit	TOTAL
2	Demolition	7,700	SF	$12	$92,400
3	Concrete Work	4075	SF	$5.00	$20,375
4	Masonry	208	LF	$85.00	$17,680
5	Metals				
	Structural Steel	4,075	SF	$42.00	$171,150
	Misc Metals - Roof Deck, Reinforcing members, etc.		LS		$100,000
6	Wood & Plastics				
	Millwork	7,700	SF	$18	$138,600
7	Thermal & Moisture Protection				
	Roofing	4,075	SF	$26	$105,950
8	Doors & Windows				
	Aluminum and Glazing	3,100	SF	$60	$186,000
	Doors/Frames/Hdwe	20	EA	$1,500	$30,000
	Interior Glazing	1,000	SF	$50	$50,000
9	Finishes				
	Drywall	7,700	SF	$22	$169,400
	Flooring	7,700	SF	$9	$69,300
	Paint	7,700	SF	$3	$23,100
10	Specialties				
	Acoustic Treatments		LS		$20,000
	WR Accessories				
	Public WR's	1	EA	$2,000	$2,000
	UTR's	1	EA	$5,000	$5,000
12	Furnishing, Fixture and Equipment (FFE)		Allowance	5%	$103,007
	Lab Fit-Out Equipment	incl.			
13	Special Construction	1	SF		$0
21	Fire Protection	4,075	SF	$2.00	$8,150
22 - 24	Mechanical	4,075	SF	$21	$85,575
26	Electrical	4,075	SF	$25	$101,875
	Total Work Division 2 - 16				**$1,499,562**
	CASH ALLOWANCES				
19	Roof Inspections		Allowance		$12,000
19	Building Envelope Inspections		Allowance		$20,000
19	Heating, Hoarding and Enclosures		Allowance		$80,000
19	Site Refurbishment		Allowance		$10,000
19	Firestopping Inspections		Allowance		$10,000
19	Temp Classrooms and Facilities		Allowance		$166,400
	Total Direct Costs				**$1,797,962**
	General Requirements	8	MO	$45,649	$365,192
	Sub-Total Project Costs				**$2,163,154**
	General Requirements 1				
006500	Builder's Risk Insurance	$0.00893	$/$100/mo		$2,220
006500	General Liability Insurance - CGL	$1.08	$/$1000		$2,435
006500	Wrap-up Insurance - Confirm Requirements	$0.87150	$/1000		$1,885
010950	Building Permit - (by owner)		$24.50/m2		$17,518
006300	Subtrades Security		$/M$		Not Included
015690	Warranty & Deficiency Repairs		Ls		$0
	Net Project Cost				**$2,187,212**
	CM Fee at 4%	4%			$87,488
006100	Performance Bond $3/1000	$3.00	$/1000		$6,824
		0.00%			
	Total Project Cost Not Including GST				**$2,281,525**
	Contingency	10.0%			$228,153
	Total Project Cost INCL contingency (plus GST)				**$2,509,678**

New 4-Storey Addition and Link
Class D Cost Estimate

Project:	Brodie Science Centre - Renovation	Future Growth - 4 Story Addition			
Owner:	Brandon University	GBA		28,400	SF
Architect:	Prairie Architect	Footprint		7,100	SF
Location:	18th Street, Brandon MB	Duration		16	MONTHS
Date:	8-Feb-19				
Div	**Description**	**Qty**	**Unit**	**$/Unit**	**TOTAL**
2	Demolition	7,100	SF	$9	**$63,900**
3	Concrete				**$539,600**
	Foundations	7,100	SF	$35	$248,500
	Flatworks	28,400	SF	$10	$291,100
3	Hollowcore	21,300	SF	$12	$255,600
4	**Masonry**				**$277,000**
	Elevator Hoistway	28,400	SF	$3	$85,000
	Stairwells		LS		$120,000
	Façade Veneer	2,000	SF	$36	$72,000
5	**Metals**				**$1,312,100**
	Structural Steel Framing	28,400	SF	$36	$1,022,400
	Misc Metals				
	Stairs and Landings		LS		$240,000
	Roof Deck	7,100	SF	$3	$21,300
	RTU Reinforcing, Bollards, etc.	28,400		$1	$28,400
6	**Wood & Plastics**				
	Millwork	28,400	SF	$11	$312,400
7	Thermal & Moisture Protection				
	Roofing	7,100	SF	$21	$149,100
	Skylights	500	SF	$80	$40,000
8	Doors & Windows				
	Curtainwall	18,630	SF	$75	$1,397,250
	Doors/Frames/Hdwe	80	EA	$1,500	$120,000
	Interior Glazing	2,000	SF	$50	$100,000
9	Finishes				
	Drywall	28,400	SF	$21	$596,400
	Flooring	28,400	SF	$9	$255,600
	Paint	28,400	SF	$2	$56,800
10	Specialties				
	Acoustic Treatments		LS		$120,000
	WR Accessories				
	Public WR's	8	EA	$16,000	$128,000
	UTR's	4	EA	$8,000	$32,000
	Folding Partitions	2	EA	$25,000	$50,000
12	Furnishing, Fixture and Equipment (FFE)		Allowance		$1,100,000
	Lab Fit-Out Equipment	incl.			
13	Special Construction	1	SF		$0
14	Conveying Systems - 4-Stop Elevator (Eco Drive)		LS		$125,000
21	Fire Protection	28,400	SF	$4	$113,600
20	Mechanical	28,400	SF	$30	$852,000
26	Electrical	28,400	SF	$30	$852,000
32	Piling		LS		$116,600
	Shoring	2,350	SF	$600	$1,410,000
	Excavation	800	M3	$25	$20,000
	Total Work Division 2 - 16				**$11,607,050**
	CASH ALLOWANCES				
19	Concrete Testing		Allowance		$15,000
19	Roof Inspections		Allowance		$12,000
19	Building Envelope Inspections		Allowance		$20,000
19	Temporary Walkways		Allowance		$50,000
19	Heating, Hoarding, Temporary Enclosures		Allowance		$180,000
19	Site Refurbishment		Allowance		$60,000
	Access Roads and Crane Pad		Allowance		$50,000
19	Firestopping Inspections		Allowance		$20,000
	Total Direct Costs				**$12,014,050**
	General Requirements	16	MO	$64,875	$1,038,000
	Sub-Total Project Costs				**$13,052,050**
	General Requirements 1				
006500	Builder's Risk Insurance	$0.00893	$/$100/mo		$13,396
006500	General Liability Insurance - CGL	$1.08	$/$1000		$14,693
006500	Wrap-up Insurance - Confirm Requirements	$0.87150	$/1000		$11,375
010950	Building Permit - (by owner)		$24.50/m2		$64,631
006300	Subtrades Security		$/M$		Not Included
015690	Warranty & Deficiency Repairs		Ls		$0
	Net Project Cost				**$13,156,145**
	CM Fee at 4%	4%			$526,246
006100	Performance Bond $3/1000	$3.00	$/1000		$41,047
		0.00%			
	Total Project Cost Not Including GST				**$13,723,438**